GEOLOGY OF THE SITE

Geologically, the site is in a glacial outwash deposit. The outwash deposit consists of water-laid, well-sorted gravel and sand horizontally layered deposited by affrading streams of melt water poured from a glacier. The bridge abutments consist of the embankment fill that was placed during the construction of the existing I-75.

EXPLORATION

Six exploration borings were made for the bridge foundation investigation using a truck-mounted boring rig. Standard penetration methods (ASTM D-1586) were used at maximum depth intervals of five feet. The field exploration work was performed on June 28, June 29, July 8, July 9, and July 12, 2004.

INVESTIGATIONAL FINDINGS AND OBSERVATIONS

The subgrade soil consists of embankment fill, undocumented and uncontrolled fill for the flood dike, brown or gray silt and clay (A-6a), brown gravel with sand (A-1-b), brown coarse and fine sand, greenish-gray silty clay (A-6b), gray gravel (A-1-a), greenish-gray silt and clay, greenish-gray sandy silt (A-4a), and brown or gray gravel with sand and silt (A-2-4). The asphalt pavement at the bridge abutments is about six inches thick. The concrete base beneath the asphalt pavement at the bridge abutments is between 6 and 12 inches thick.

Groundwater was observed in Borings 4, 5, 8, and 9 at elevations of 717.0 to 749.6 feet during the boring operations. Borings 6 and 7 were performed in the middle of the Great Miami River; the river water was above the bottom of the riverbed. Bedrock was not encountered to an elevation of 690 feet.

SYMBOLS OF ROCK TYPES

- COAL
- FIRE CLAY OR UNDERCLAY
- WEATHERED MUDSTONE
- MUDSTONE
- WEATHERED SHALE
- SHALE
- WEATHERED CLAY–SHALE
- CLAY–SHALE
- BOULDERS OR COBBLES
- WEATHERED SILTSTONE
- SILTSTONE
- WEATHERED SANDSTONE
- SANDSTONE
- LEACHED DOLOMITE
- DOLOMITE
- LEACHED LIMESTONE
- LIMESTONE

PARTICLE SIZE DEFINITIONS

	11.8"	3"	0.1"		0.02"	0.003"	0.0002"
Boulders	Cobbles	Gravel	Coarse Sand		Fine Sand	Silt	Clay
			No. 10 SIEVE		No. 40 SIEVE	No. 200 SIEVE	

LEGEND

- AUGER BORING LOCATION
- TR — TOP OF ROCK
- W — INDICATES FREE WATER ELEVATION
- INDICATES STATIC WATER ELEVATION
- HORIZONTAL BAR ON BORING INDICATES THE DEPTH THE SAMPLE WAS TAKEN - PROFILE VIEW
- X/Y/Z — FIGURES BESIDE THE BORING IN PROFILE INDICATE THE NUMBER OF BLOWS FOR STANDARD PENETRATION TEST
  - X = NUMBER OF BLOWS FOR FIRST 6"
  - Y = NUMBER OF BLOWS FOR SECOND 6"
  - Z = NUMBER OF BLOWS FOR THIRD 6"

GENERAL INFORMATION

DRIVE SAMPLES

Drive sample borings are made by means of a mechanically-powered, rotary-type drill rig employing a 2" O.D., 1-1/2" I.D., split-spoon sampler, at continuous, 2-1/2 to 5-foot depth intervals driven by means of a 140-pound hammer with a free fall of 30 inches. The number of blows required to drive the sampler three 6-inch increments is considered the standard penetration test.

SAMPLING AND TESTING

The boring log sheets show a graphic plot of the information obtained, including depth and elevation of the sample, type of sample, number of blows for the standard penetration test in three 6-inch increments, and a sample description based on laboratory test results, utilizing the ODOT classification system.

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DRAWN	REVIEWED	DATE	PROJECT NO.
HGW	RJYT	rev. 12-04	131651

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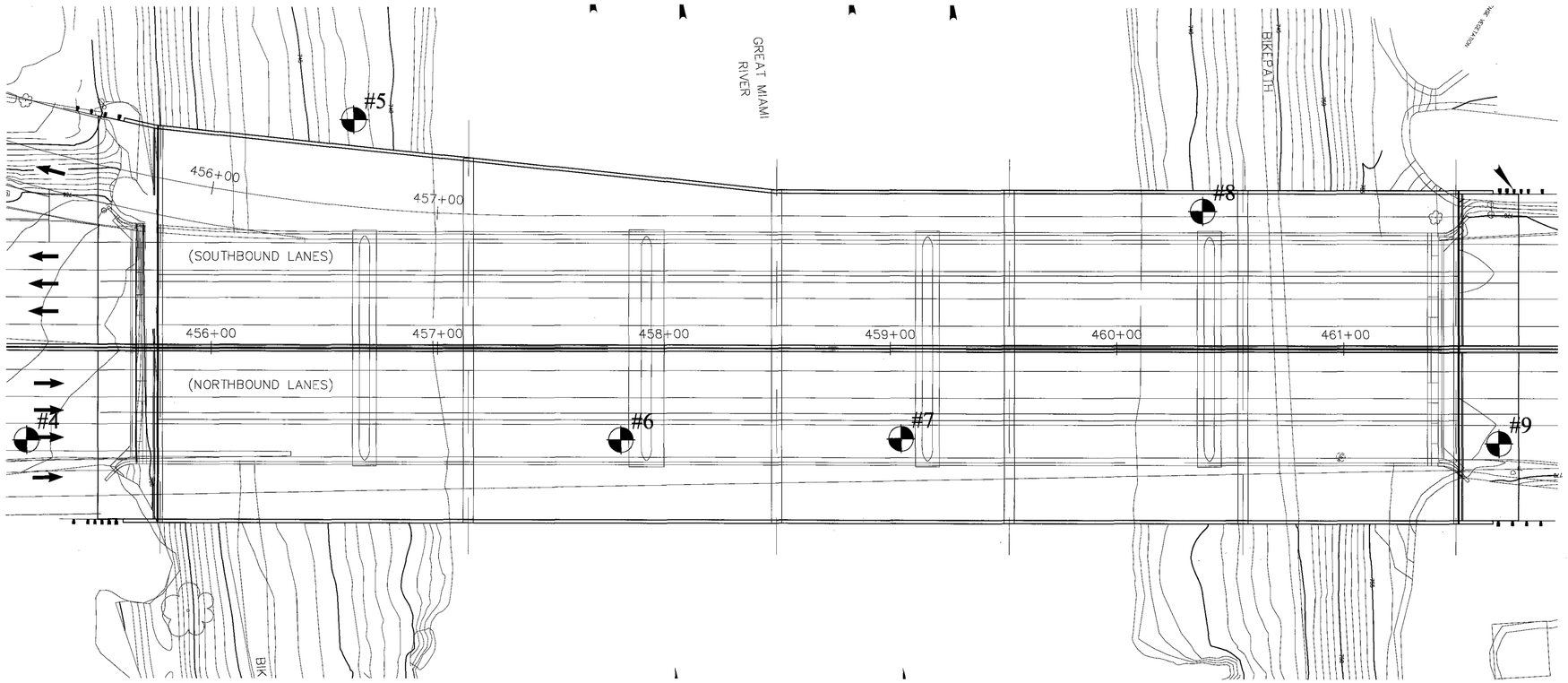
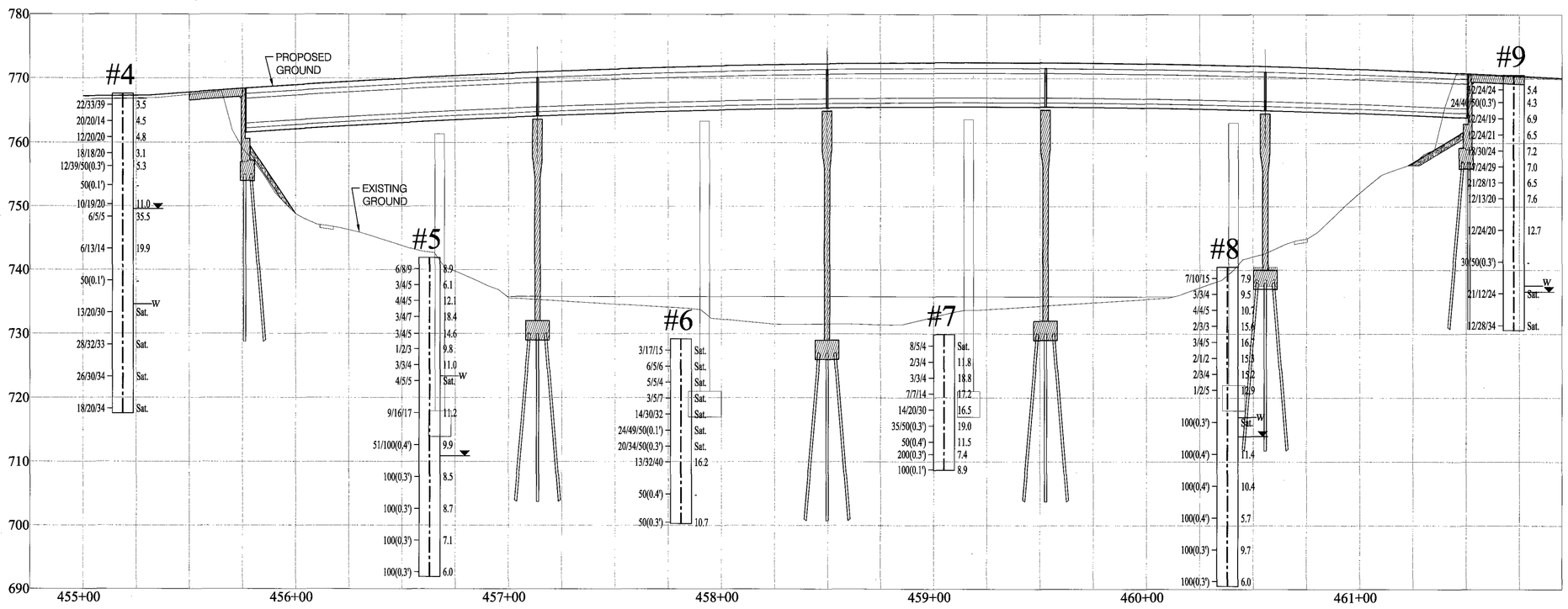
STRUCTURE FOUNDATION INVESTIGATION
I-75 BRIDGE OVER GREAT MIAMI RIVER

MOT I-75-14.60





HORIZONTAL SCALE IN FEET

DRAWN	REVIEWED	DATE	PROJECT NO.
HGW	RJYT	rev. 12-04	131651

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STRUCTURE FOUNDATION INVESTIGATION
I-75 BRIDGE OVER GREAT MIAMI RIVER

MOT I-75-14.60

Date Started 7/8/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 749.6
Date Completed 7/8/04 Casing: Length Dia.

Boring No. 4 Station & Offset Sta. 455+18.71; 41.22' Rt. Surface Elev. (ft) 767.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
767.6	0														
767.1					(FILL) ASPHALT pavement (6")										
766.6					(FILL)CONCRETE pavement (6")										
	2	22/33/39			(FILL) Brown coarse and fine SAND, some gravel	1A								3.5	Visual
	4	20/20/14			(FILL) Brown coarse and fine SAND, some gravel	2A								4.5	Visual
	6	12/20/20			(FILL) Brown coarse and fine SAND, some gravel	3A								4.8	Visual
	8	18/18/20			(FILL) Brown coarse and fine SAND, some gravel	4A								3.1	Visual
	10	12/39/50(0.3')			(FILL) Brown coarse and fine SAND, some gravel	5A								5.3	Visual
	12														
	14	50(0.1')			(FILL) Brown coarse and fine SAND, some gravel	6A									Visual
751.6	16														
		10/19/20			(FILL) Dark brown coarse SAND, some gravel, some silt, trace glass	7A								11.0	Visual
	▽ 18														
		6/5/5			(FILL) Dark brown coarse SAND, some gravel, some silt, trace glass	8A								35.5	Visual
	20														
	22														
744.6															
	24	6/13/14			(ORIGINAL) Brown SILT and CLAY, trace gravel	9A								19.9	Visual
	26														
	28														
		50(0.1')			Brown SILT and CLAY, trace gravel	10A								-	Visual
	30														
	32														
734.6															
	34	13/20/30			Brown GRAVEL with sand, trace cobbles	11A								Sat.	Visual
	36														
	38														
		28/32/33			Brown GRAVEL with sand, trace cobbles	12A	28.7	21.5	37.3	8.9	3.6	NonPlastic		Sat.	A-1-b(0)
	40														
	42														
	44	26/30/34			Brown GRAVEL with sand, trace cobbles	13A								Sat.	Visual
	46														
	48														
		18/20/34			Brown GRAVEL with sand, trace cobbles	14A								Sat.	Visual
717.6	50														

Bottom of Boring at 50.0'

Date Started 6/29/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 723.4
Date Completed 6/29/04 Casing: Length Dia.

Boring No. 5 Station & Offset Sta. 456+62.95; 57.34' Lt. Surface Elev. (ft) 741.9

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
741.9	0														
741.3					(FILL) TOPSOIL (7")										
	2	6/8/9			(FILL) Brown SANDY SILT, some gravel	1A								8.9	Visual
738.4	4	3/4/5			(FILL) Brown GRAVEL with sand, silt and clay	2A								6.1	Visual
	6	4/4/5			(FILL) Brown GRAVEL with sand, silt and clay	3A								12.1	Visual
	8	3/4/7			(FILL) Brown GRAVEL with sand, silt and clay	4A								18.4	Visual
732.4	10														
	12	3/4/5			(FILL) Gray SANDY SILT, little gravel	5A								14.6	Visual
	14	1/2/3			(FILL) Gray SANDY SILT, little gravel	6A	25.8	14.4	19.2	23.7	16.9	20	8	9.8	A-4a(1)
	16	3/3/4			(FILL) Gray SANDY SILT, little gravel	7A								11.0	Visual
723.4	▽ 18	4/4/5			(ORIGINAL) Brown coarse and fine SAND, little gravel	8A								Sat.	Visual
	20														
	22														
718.9															
	24	9/16/17			Greenish gray SILTY CLAY, some gravel	9A								11.2	Visual
	26														
	28														
		51/100(0.4')			Greenish gray SILTY CLAY, some gravel	10A	23.6	7.1	4.5	27.6	37.2	36	17	9.9	A-6b(9)
	30														
	32														
	34	100(0.3')			Greenish gray SILTY CLAY, some gravel	11A								8.5	Visual
	36														
	38														
		100(0.3')			Greenish gray SILTY CLAY, some gravel	12A								8.7	Visual
	40														
	42														
	44	100(0.3')			Greenish gray SILTY CLAY, some gravel	13A								7.1	Visual
	46														
	48														
		100(0.3')			Greenish gray SILTY CLAY, some gravel	14A								6.0	Visual
691.9	50														

Bottom of Boring at 50.0'

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PROJECT NO. 131651
DATE rev. 12-04
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CLIENT TRANSYSTEMS CORPORATION

STRUCTURE FOUNDATION INVESTIGATION
I-75 BRIDGE OVER GREAT MIAMI RIVER

MOT I-75-14.60

Date Started 7/8/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 749.6

Date Completed 7/8/04 Casing: Length Dia.

Boring No. 4 Station & Offset Sta. 455+18.71; 41.22' Rt. Surface Elev. (ft) 767.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
767.6	0														
767.1					(FILL) ASPHALT pavement (6")										
766.6	2	22/33/39			(FILL)CONCRETE pavement (6") (FILL) Brown coarse and fine SAND, some gravel	1A								3.5	Visual
	4	20/20/14			(FILL) Brown coarse and fine SAND, some gravel	2A								4.5	Visual
	6	12/20/20			(FILL) Brown coarse and fine SAND, some gravel	3A								4.8	Visual
	8	18/18/20			(FILL) Brown coarse and fine SAND, some gravel	4A								3.1	Visual
	10	12/39/50(0.3')			(FILL) Brown coarse and fine SAND, some gravel	5A								5.3	Visual
	12														
	14	50(0.1')			(FILL) Brown coarse and fine SAND, some gravel	6A									Visual
751.6	16														
		10/19/20			(FILL) Dark brown coarse SAND, some gravel, some silt, trace glass	7A								11.0	Visual
	▼ 18														
		6/5/5			(FILL) Dark brown coarse SAND, some gravel, some silt, trace glass	8A								35.5	Visual
	20														
	22														
744.6															
	24	6/13/14			(ORIGINAL) Brown SILT and CLAY, trace gravel	9A								19.9	Visual
	26														
	28														
		50(0.1')			Brown SILT and CLAY, trace gravel	10A								-	Visual
	30														
	32														
734.6															
	34	13/20/30			Brown GRAVEL with sand, trace cobbles	11A								Sat.	Visual
	36														
	38														
		28/32/33			Brown GRAVEL with sand, trace cobbles	12A	28.7	21.5	37.3	8.9	3.6	NonPlastic		Sat.	A-1-b(0)
	40														
	42														
	44	26/30/34			Brown GRAVEL with sand, trace cobbles	13A								Sat.	Visual
	46														
	48														
		18/20/34			Brown GRAVEL with sand, trace cobbles	14A								Sat.	Visual
717.6	50														

Bottom of Boring at 50.0'

Date Started 6/29/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 723.4

Date Completed 6/29/04 Casing: Length Dia.

Boring No. 5 Station & Offset Sta. 456+62.95; 57.34' Lt. Surface Elev. (ft) 741.9

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
741.9	0														
741.3					(FILL) TOPSOIL (7")										
	2	6/8/9			(FILL) Brown SANDY SILT, some gravel	1A								8.9	Visual
738.4	4	3/4/5			(FILL) Brown GRAVEL with sand, silt and clay	2A								6.1	Visual
	6	4/4/5			(FILL) Brown GRAVEL with sand, silt and clay	3A								12.1	Visual
	8	3/4/7			(FILL) Brown GRAVEL with sand, silt and clay	4A								18.4	Visual
732.4	10														
	12	3/4/5			(FILL) Gray SANDY SILT, little gravel	5A								14.6	Visual
	14	1/2/3			(FILL) Gray SANDY SILT, little gravel	6A	25.8	14.4	19.2	23.7	16.9	20	8	9.8	A-4a(1)
	16	3/3/4			(FILL) Gray SANDY SILT, little gravel	7A								11.0	Visual
723.4	18	4/5/5			(ORIGINAL) Brown coarse and fine SAND, little gravel	8A								Sat.	Visual
	20														
	22														
718.9	24	9/16/17			Greenish gray SILTY CLAY, some gravel	9A								11.2	Visual
	26														
	28	51/100(0.4')			Greenish gray SILTY CLAY, some gravel	10A	23.6	7.1	4.5	27.6	37.2	36	17	9.9	A-6b(9)
	30														
	32														
	34	100(0.3')			Greenish gray SILTY CLAY, some gravel	11A								8.5	Visual
	36														
	38	100(0.3')			Greenish gray SILTY CLAY, some gravel	12A								8.7	Visual
	40														
	42														
	44	100(0.3')			Greenish gray SILTY CLAY, some gravel	13A								7.1	Visual
	46														
	48	100(0.3')			Greenish gray SILTY CLAY, some gravel	14A								6.0	Visual
691.9	50														

Bottom of Boring at 50.0'

Date Started 7/9/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) River Surface
Date Completed 7/9/04 Casing: Length Dia.

Boring No. 6 Station & Offset Sta. 457+80.95; 40.79' Rt. Surface Elev. (ft) 729.2'

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
729.2	0														
	2	3/17/15			Brown coarse SAND, little gravel	1A								Sat.	Visual
725.7	4	6/5/6			Gray GRAVEL, some sand	2A	57.6	31.4	6.1	2.7	2.2	NonPlastic		Sat.	A-1-a(0)
	6	5/5/4			Gray GRAVEL, some sand	3A								Sat.	Visual
	8	3/5/7			Gray GRAVEL, some sand	4A								Sat.	Visual
	10	14/30/32			Gray GRAVEL, some sand	5A								Sat.	Visual
	12	24/49/50(0.1')			Gray GRAVEL, some sand	6A								Sat.	Visual
	14	20/34/50(0.3')			Gray GRAVEL, some sand	7A								Sat.	Visual
711.7	16	13/32/40			Brown SILT and CLAY, little gravel	8A	11.5	8.7	12.5	38.9	28.4	28	11	16.2	A-6a(7)
	18														
	20														
705.2	22	50(0.4')			Greenish gray SILT and CLAY, trace gravel	9A								-	Visual
	24														
	26														
700.3	28	50(0.3')			Greenish gray SILT and CLAY, trace gravel (Auger refusal at 28.9')	10A								10.7	Visual

Bottom of Boring at 28.9'

Date Started 7/14/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) River Surface
Date Completed 7/14/04 Casing: Length Dia.

Boring No. 7 Station & Offset Sta. 459+04.90; 40.08' Rt. Surface Elev. (ft) 729.9'

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
729.9	0														
	2	8/5/4			Brown and gray SAND, some clay	1A								Sat.	Visual
725.9	4	2/3/4			Gray SANDY SILT, trace gravel	2A								11.8	Visual
724.9	6	3/3/4			Gray SILT and CLAY, trace gravel	3A	13.5	11.1	11.3	25.1	39.0	28	11	18.8	A-6a(6)
	8	7/7/14			Gray SILT and CLAY, trace gravel	4A								17.2	Visual
	10	14/20/30			Gray SILT and CLAY, trace gravel	5A								16.5	Visual
	12	35/50(0.3')			Gray SILT and CLAY, trace gravel	6A								19.0	Visual
714.9	14	50(0.4')			Greenish gray SANDY SILT, trace gravel	7A								11.5	Visual
	16	200(0.3')			Greenish gray SANDY SILT, trace gravel	8A	33.2	6.1	9.9	29.7	21.1	26	10	7.4	A-4a(3)
	18														
	20														
708.7		100(0.1')			Greenish gray SANDY SILT, trace gravel (Auger refusal at 21.2')	9A								8.9	Visual

Bottom of Boring at 21.2'

Date Started 6/28/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 717.0
Date Completed 6/28/04 Casing: Length Dia.

Boring No. 8 Station & Offset Sta. 460+37.90; 60.28' Lt. Surface Elev. (ft) 740.5

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
740.5	0														
740.0					(FILL) TOPSOIL (6")										
	2	7/10/15			(FILL) Brown SANDY SILT, little gravel	1A								7.9	Visual
	4	3/3/4			(FILL) Brown SANDY SILT, little gravel	2A	32.3	14.6	16.8	19.7	16.6	23	10	9.5	A-4a(0)
	6	4/4/5			(FILL) Brown SANDY SILT, little gravel	3A								10.7	Visual
	8	2/3/3			(FILL) Brown SANDY SILT, little gravel	4A								15.6	Visual
731.0	10	3/4/5			(ORIGINAL) Greenish gray and brown SILT and CLAY, trace gravel	5A	8.2	7.5	10.0	32.1	42.2	30	13	16.7	A-6a(9)
	12	2/1/2			Greenish gray and brown SILT and CLAY, trace gravel	6A								15.3	Visual
	14	2/3/4			Greenish gray and brown SILT and CLAY, trace gravel	7A								15.2	Visual
	16	1/2/5			Greenish gray and brown SILT and CLAY, trace gravel	8A								12.9	Visual
	18														
	20														
717.0	22	100(0.3')			Gray GRAVEL with sand and silt	9A								Sat.	Visual
	24														
	26														
712.0	28	100(0.4')			Greenish gray SANDY SILT, little gravel	10A	14.6	5.1	3.8	33.4	43.1	23	8	11.4	A-4a(8)
	30														
	32	100(0.4')			Greenish gray SANDY SILT, little gravel	11A								10.4	Visual
	34														
	36	100(0.4')			Greenish gray SANDY SILT, little gravel	12A								5.7	Visual
	38														
	40	100(0.3')			Greenish gray SANDY SILT, little gravel	13A								9.7	Visual
	42														
	44	100(.3')			Greenish gray SANDY SILT, little gravel	14A								6.0	Visual
	46														
	48														
690.5	50														

Bottom of Boring at 50.0'

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BOWSER MORNER®

DRAWN	REVIEWED	DATE	PROJECT NO.
HGW	RJYT	rev. 12-04	131651

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STRUCTURE FOUNDATION INVESTIGATION
I-75 BRIDGE OVER GREAT MIAMI RIVER

MOT I-75-14.60

Date Started 7/9/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) River Surface

Date Completed 7/9/04 Casing: Length Dia.

Boring No. 6 Station & Offset Sta. 457+80.95; 40.79' Rt. Surface Elev. (ft) 729.2'

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
729.2	0														
	2	3/17/15			Brown coarse SAND, little gravel	1A								Sat.	Visual
725.7	4	6/5/6			Gray GRAVEL, some sand	2A	57.6	31.4	6.1	2.7	2.2	NonPlastic		Sat.	A-1-a(0)
	6	5/5/4			Gray GRAVEL, some sand	3A								Sat.	Visual
	8	3/5/7			Gray GRAVEL, some sand	4A								Sat.	Visual
	10	14/30/32			Gray GRAVEL, some sand	5A								Sat.	Visual
	12	24/49/50(0.1')			Gray GRAVEL, some sand	6A								Sat.	Visual
	14	20/34/50(0.3')			Gray GRAVEL, some sand	7A								Sat.	Visual
711.7	16	13/32/40			Brown SILT and CLAY, little gravel	8A	11.5	8.7	12.5	38.9	28.4	28	11	16.2	A-6a(7)
	18														
	20														
	22														
705.2	24	50(0.4')			Greenish gray SILT and CLAY, trace gravel	9A								-	Visual
	26														
	28														
700.3		50(0.3')			Greenish gray SILT and CLAY, trace gravel (Auger refusal at 28.9')	10A								10.7	Visual

Bottom of Boring at 28.9'

Date Started 7/14/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) River Surface

Date Completed 7/14/04 Casing: Length Dia.

Boring No. 7 Station & Offset Sta. 459+04.90; 40.08' Rt. Surface Elev. (ft) 729.9'

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
729.9	0														
	2	8/5/4			Brown and gray SAND, some clay	1A								Sat.	Visual
725.9															
	4	2/3/4			Gray SANDY SILT, trace gravel	2A								11.8	Visual
724.9															
	6	3/3/4			Gray SILT and CLAY, trace gravel	3A	13.5	11.1	11.3	25.1	39.0	28	11	18.8	A-6a(6)
	8	7/7/14			Gray SILT and CLAY, trace gravel	4A								17.2	Visual
	10														
	12	14/20/30			Gray SILT and CLAY, trace gravel	5A								16.5	Visual
	14	35/50(0.3')			Gray SILT and CLAY, trace gravel	6A								19.0	Visual
714.9															
	16	50(0.4')			Greenish gray SANDY SILT, trace gravel	7A								11.5	Visual
	18	200(0.3')			Greenish gray SANDY SILT, trace gravel	8A	33.2	6.1	9.9	29.7	21.1	26	10	7.4	A-4a(3)
	20														
708.7		100(0.1')			Greenish gray SANDY SILT, trace gravel (Auger refusal at 21.2')	9A								8.9	Visual

Bottom of Boring at 21.2'

Date Started 6/28/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 717.0

Date Completed 6/28/04 Casing: Length Dia.

Boring No. 8 Station & Offset Sta. 460+37.90; 60.28' Lt. Surface Elev. (ft) 740.5

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
740.5	0														
740.0					(FILL) TOPSOIL (6")										
	2	7/10/15			(FILL) Brown SANDY SILT, little gravel	1A								7.9	Visual
	4	3/3/4			(FILL) Brown SANDY SILT, little gravel	2A	32.3	14.6	16.8	19.7	16.6	23	10	9.5	A-4a(0)
	6	4/4/5			(FILL) Brown SANDY SILT, little gravel	3A								10.7	Visual
	8	2/3/3			(FILL) Brown SANDY SILT, little gravel	4A								15.6	Visual
731.0	10														
	12	3/4/5			(ORIGINAL) Greenish gray and brown SILT and CLAY, trace gravel	5A	8.2	7.5	10.0	32.1	42.2	30	13	16.7	A-6a(9)
	14	2/1/2			Greenish gray and brown SILT and CLAY, trace gravel	6A								15.3	Visual
	16	2/3/4			Greenish gray and brown SILT and CLAY, trace gravel	7A								15.2	Visual
	18	1/2/5			Greenish gray and brown SILT and CLAY, trace gravel	8A								12.9	Visual
	20														
	22														
717.0 ▽	24	100(0.3')			Gray GRAVEL with sand and silt	9A								Sat.	Visual
	26														
712.0	28	100(0.4')			Greenish gray SANDY SILT, little gravel	10A	14.6	5.1	3.8	33.4	43.1	23	8	11.4	A-4a(8)
	30														
	32														
	34	100(0.4')			Greenish gray SANDY SILT, little gravel	11A								10.4	Visual
	36														
	38	100(0.4')			Greenish gray SANDY SILT, little gravel	12A								5.7	Visual
	40														
	42														
	44	100(0.3')			Greenish gray SANDY SILT, little gravel	13A								9.7	Visual
	46														
	48	100(.3')			Greenish gray SANDY SILT, little gravel	14A								6.0	Visual
690.5	50														

Bottom of Boring at 50.0'

Date Started 7/12/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 737.6
Date Completed 7/12/04 Casing: Length Dia.

Boring No. 9 Station & Offset Sta. 461+72.30; 42.06' Rt, Surface Elev. (ft) 770.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
770.6	0														
770.1					(FILL) ASPHALT pavement (6")										
769.1					(FILL) CONCRETE pavement (12")										
	2	12/24/24			(FILL) Brown GRAVEL with sand and silt	1A	50.8	24.2	9.4	8.6	7.0	23	8	5.4	A-2-4(0)
	4	24/40/50(0.3')			(FILL) Brown GRAVEL with sand and silt	2A								4.3	Visual
	6	12/24/19			(FILL) Brown GRAVEL with sand and silt	3A								6.9	Visual
	8	12/24/21			(FILL) Brown GRAVEL with sand and silt	4A								6.5	Visual
	10	18/30/24			(FILL) Brown GRAVEL with sand and silt	5A								7.2	Visual
	12	17/24/29			(FILL) Brown GRAVEL with sand and silt	6A								7.0	Visual
	14	21/28/13			(FILL) Brown GRAVEL with sand and silt	7A								6.5	Visual
	16	12/13/20			(FILL) Brown GRAVEL with sand and silt	8A								7.6	Visual
	18														
	20														
	22	12/24/20			(FILL) Brown GRAVEL with sand and silt	9A								12.7	Visual
	24														
	26														
	28	30/50(0.3')			(FILL) Brown GRAVEL with sand and silt	10A								-	Visual
	30														
	32														
737.6 ▽	34	21/12/24			(ORIGINAL) Brown GRAVEL with sand and silt	11A	62.4	14.8	7.5	9.6	5.7	26	10	Sat.	A-2-4(0)
	36														
	38	12/28/34			Brown GRAVEL with sand and silt	12A								Sat.	
730.6	40														

Bottom of Boring at 40.0'

BOWSER MORNER
DAYTON, OHIO
TOLEDO, OHIO
LEXINGTON, KY

PROJECT NO. 131651
DATE rev 12-04
REVIEWED RJYT
DRAWN HGW
CLIENT TRANSYSTEMS CORPORATION

STRUCTURE FOUNDATION INVESTIGATION
I-75 BRIDGE OVER GREAT MIAMI RIVER

MOT I-75-14.60

GENERAL INFORMATION

INTRODUCTION

This study includes the roadway improvement of a section of I-75 between Stations 433+00 and 463+00, the entrance and exit ramps, and a section of Stanley Avenue between Stations 0+00 and 14+00.

GEOLOGY OF THE SITE

Geologically, the site is in a glacial outwash deposit. The outwash deposit consists of water-laid, well-sorted gravel, and sand horizontally layered deposited by aggrading streams of melt water poured from a glacier. The existing roadways and the ramps are on the embankment fill that was placed during the construction of the I-75 and Stanley Avenue ramps.

EXPLORATION

Eight exploration borings were made using a truck-mounted boring rig. Standard penetration methods (ASTM D-1586) were used at maximum depth intervals of five feet. The field exploration work was performed on June 29, July 8, July 12, and July 13, 2004.

INVESTIGATIONAL FINDINGS AND OBSERVATIONS

The I-75 roadway in this area is over more than 10 feet of embankment fill. The embankment fill consists of 6 inches of asphalt pavement, 6 to 18 inches of concrete base, black or gray coarse and fine sand (A-3a), black fine sand, brown gravel with sand (A-1-b), brown gravel (A-1-a), and brown gravel with sand and silt (A-2-4). The subgrade soil along the ramp to Stanley Avenue consists of embankment fill; topsoil; dark brown sandy silt; brown silt and clay (A-6a); and brown gravel with sand, silt and clay (A-2-6). The subgrade soil along Stanley Avenue consists of undocumented fill, dark brown and gray silt and clay (A-6a), brown silty clay (A-6b), and brown sand.

Groundwater was observed only in Borings 11, 12, and 14 at elevations of 733.8 to 736.4 feet during the boring operations. Groundwater was not encountered in the remaining borings. Bedrock was not encountered in these borings.

LEGEND FOR PROJECT AVERAGE RESULTS OF TESTS

DESCRIPTION	AASHTO CLASS	OHIO CLASS	% AGG.	% C,S	% F.S.	% SILT	% CLAY	LIQUID LIMIT	PLASTICITY INDEX	WATER CONTENT	SAMPLES TESTED
GRAVEL	A-1-a(0)	A-1-a(0)	56.9	21.6	9.7	8.8	3.0	5	0.3	3.7	3
GRAVEL WITH SAND	A-1-b(0)	A-1-b(0)	50.6	20.1	14.3	15.0		10	1	9.7	3
FINE SAND	A-3(0)	A-3(0)	38.4	22.0	26.0	13.6		NON-PLASTIC		10.1	3
COARSE AND FINE SAND		A-3a(0)	20.4	12.6	46.4	13.8	6.8	NON-PLASTIC		10.5	2
GRAVEL WITH SAND AND SILT	A-2-4(0)	A-2-4(0)	41.0	26.6	12.3	12.7	7.4	25	8	16.0	2
GRAVEL WITH SAND, SILT AND CLAY	A-2-6(0)	A-2-6(0)	63.6	12.4	6.7	13.0	4.3	31	14	4.9	1
SANDY SILT	VISUAL CLASSIFICATION										
SILT AND CLAY	A-6(5)	A-6a(5)	11.0	14.6	28.0	28.4	18.0	32	13	17.4	3
SILTY CLAY	A-6(10)	A-6b(10)	0.4	2.5	23.6	41.1	32.4	39	16	25.7	1
SOD and/or TOPSOIL	VISUAL CLASSIFICATION										
ASPHALT	VISUAL CLASSIFICATION										
CONCRETE	VISUAL CLASSIFICATION										

W — FREE WATER

STATIC WATER LEVEL

INDICATES BORING LOCATION

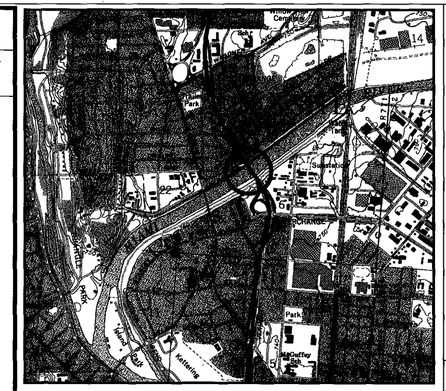
DRIVE SAMPLE AND/OR CORE BORING PLOTTED TO VERTICAL SCALE ONLY

WATER CONTENT NEARLY EQUAL TO OR GREATER THAN LIQUID LIMIT

INDICATES A NON PLASTIC MATERIAL WITH A HIGH WATER CONTENT

NUMBER OF BLOWS FOR "STANDARD PENETRATION" TEST
X=NUMBER OF BLOWS FOR FIRST 150 mm
Y=NUMBER OF BLOWS FOR SECOND 150 mm
Z=NUMBER OF BLOWS FOR THIRD 150 mm

NOTE: FIGURES BESIDE BORINGS INDICATE WATER CONTENT IN PERCENT. e.g. 15



VICINITY MAP

PROJECT INDEX

STATIONS FROM	TO	SOIL PROFILE SHEET
433+00 (INTERSTATE 75)	463+00	2 & 3
0+00 (STANLEY AVENUE)	14+00	4
448+00 (RAMP N-6)	454+00	4
440+00 (RAMP N-6A)	449+00	4
446+00 (RAMP N-7)	453+00	4

SUMMARY OF SOIL TEST DATA

Boring Number	Station & Offset	Depth From	Depth To	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	% W.C.	ODOT Class
1	433+57.92; 43.76' Rt.	1.0	2.5	22.7	16.9	37.9	14.3	8.2	NonPlastic		9.2	A-3a(0)
		3.5	5.0	18.1	8.3	54.9	13.2	5.5	NonPlastic		11.7	A-3a(0)
		5.5	7.0	(FILL) Dense black fine sand, little gravel							6.0	Visual
		8.5	10.0	(FILL) Gray coarse and fine sand, little gravel, trace clay							11.0	Visual
2	438+45.11; 61.22' Lt.	2.0	3.5	45.9	17.9	14.9	15.0	6.3	31	4	11.6	A-1-b(0)
		4.5	6.0	(FILL) Brown gravel with sand							30.1	Visual
		6.5	8.0	(FILL) Brown gravel with sand							29.8	Visual
		8.5	10.0	(FILL) Brown gravel with sand							28.3	Visual
3	451+20.07; 43.34' Rt.	1.0	2.5	57.2	22.4	9.9	7.4	3.1	NonPlastic		3.0	A-1-a(0)
		3.5	5.0	58.2	20.3	9.1	9.2	3.2	NonPlastic		3.2	A-1-a(0)
		6.0	7.5	(FILL) Brown gravel, some sand							3.1	Visual
		8.5	10.0	(FILL) Brown gravel, some sand							5.9	Visual
3A	447+39.18; 15.43' Rt.	1.0	3.0	37.7	25.6	20.9	12.1	3.7	NonPlastic		9.0	A-1-b(0)
		3.0	5.0	25.5	22.8	43.6	7.5	0.6	NonPlastic		12.7	A-3(0)
4	455+18.71; 41.22' Rt.	1.0	2.5	(FILL) Brown coarse and fine sand, some gravel							3.5	Visual
		3.5	5.0	(FILL) Brown coarse and fine sand, some gravel							4.5	Visual
		6.0	7.5	(FILL) Brown coarse and fine sand, some gravel							4.8	Visual
		8.5	10.0	(FILL) Brown coarse and fine sand, some gravel							3.1	Visual
4A	454+42.05; 109.26' Rt.	1.0	2.5	(FILL) Brown silt and clay, little gravel							13.9	Visual
		3.5	5.0	(FILL) Brown sandy silt, little gravel, trace glass							17.2	Visual
		6.0	7.5	45.0	18.6	16.3	20.1		NonPlastic		13.7	A-3(0)
		8.5	10.0	44.7	24.7	18.1	12.5		NonPlastic		3.8	A-3(0)
		11.0	12.5	Brown coarse and fine sand, some gravel							4.3	Visual
		13.5	15.0	Brown gravel with sand							8.3	Visual
		16.0	17.5	Brown gravel with sand							7.5	Visual
		18.5	20.0	Brown gravel with sand							8.6	Visual
		23.5	25.0	Brown gravel with sand							7.1	Visual
4B	452+65.66; 108.20' Rt.	1.0	2.5	(FILL) Brown coarse sand, little gravel, trace silt, trace ash, trace glass							12.4	Visual
		3.5	5.0	(FILL) Dark brown silty and clay, trace gravel, trace wood							14.5	Visual
		6.0	7.5	(FILL) Dark brown silty and clay, trace gravel, trace wood							10.3	Visual
		8.5	10.0	Brown gravel with sand, trace silt and clay							8.4	Visual
		11.0	12.5	Brown gravel with sand, trace silt and clay							9.6	Visual
		13.5	15.0	68.2	16.8	7.0	8.0		NonPlastic		8.5	A-1-b(0)
		16.0	17.5	Brown fine sand, little gravel, trace silt							14.4	Visual
		18.5	20.0	48.5	20.7	17.0	13.8		NonPlastic		11.0	A-1-b(0)
		23.5	25.0	Brown gravel with sand							8.3	Visual
		28.5	30.0	Brown gravel with sand							7.3	Visual
10	462+68.65; 47.70' Rt.	1.0	2.5	32.3	33.9	13.4	11.3	9.1	21	7	4.7	A-2-4(0)
		3.5	5.0	(FILL) Brown gravel with sand and silt							3.4	Visual
		5.5	7.0	(FILL) Brown gravel with sand and silt							3.2	Visual
		8.5	10.0	(FILL) Brown gravel with sand and silt							4.7	Visual
10A	462+00.93; 105.69' Rt.	1.0	2.5	Brown silty clay, trace gravel							19.8	Visual
		3.5	5.0	64.1	16.4	6.5	13.0		Non Plastic		5.1	A-1-a(0)
		6.0	7.5	Brown gravel with sand, trace silt							5.1	Visual
		8.5	10.0	Brown gravel with sand, trace silt							5.9	Visual
		11.0	12.5	61.0	16.8	11.6	10.6		Non Plastic		4.9	A-1-a(0)
		13.5	15.0	Brown gravel with sand, trace silt							6.6	Visual
		16.0	17.5	Brown gravel with sand, trace silt							6.0	Visual
		18.5	20.0	Brown gravel with sand, trace silt							8.8	Visual
		23.5	25.0	Greenish-gray sandy silt, trace gravel							12.3	Visual
11	13+04.86; 37.0' Lt.	1.5	3.0	(FILL) Dark brown and gray silt and clay, little gravel, with organic odor							13.6	Visual
		3.5	5.0	(FILL)3.2	18.6	31.4	29.5	17.3	33	13	16.0	A-6a(4)
		5.5	7.0	Brown silty clay, trace gravel							27.1	Visual
		8.5	10.0	Brown sand, some silt, little gravel							Sat.	Visual
12	8+54.68; 36.05' Rt.	0.5	2.0	(FILL) Brown sand, some silt, trace gravel							5.2	Visual
		2.5	4.0	(FILL) Brown silt and clay							21.2	Visual
		5.5	7.0	0.4	2.5	23.6	41.1	32.4	39	16	25.7	A-6b(10)
		8.5	10.0	Brown sand, little silt, little gravel							Sat.	Visual
13	448+72.61; 8.19' Lt.	0.5	2.0	(FILL) Brown sand, some gravel, little silt							4.3	Visual
		2.5	4.0	29.1	14.4	20.0	21.7	14.8	30	11	14.9	A-6a(1)
		5.5	7.0	Dark brown sandy silt, trace gravel							13.9	Visual
		8.5	10.0	0.6	10.7	32.6	33.9	22.2	34	15	21.2	A-6a(6)
13A	444+34.14; 3.80 Rt.	1.0	3.0	55.3	22.1	10.1	9.8	2.7	16	1	4.9	A-1-a(0)
		3.0	5.0	49.7	19.3	11.3	14.0	5.7	28	8	11.3	A-2-4(0)
14	452+35.33; 0.66' Rt.	0.5	2.0	Brown gravel with sand, silt and clay							10.0	Visual
		2.5	4.0	63.6	12.4	6.7	13.0	4.3	31	14	4.9	A-2-6(0)
		4.5	6.0	Brown gravel with sand, silt and clay							4.9	Visual
		8.5	10.0	Brown gravel with sand, silt and clay							Sat.	Visual

BOWSER MORNER® DAYTON, OHIO LEXINGTON, KY

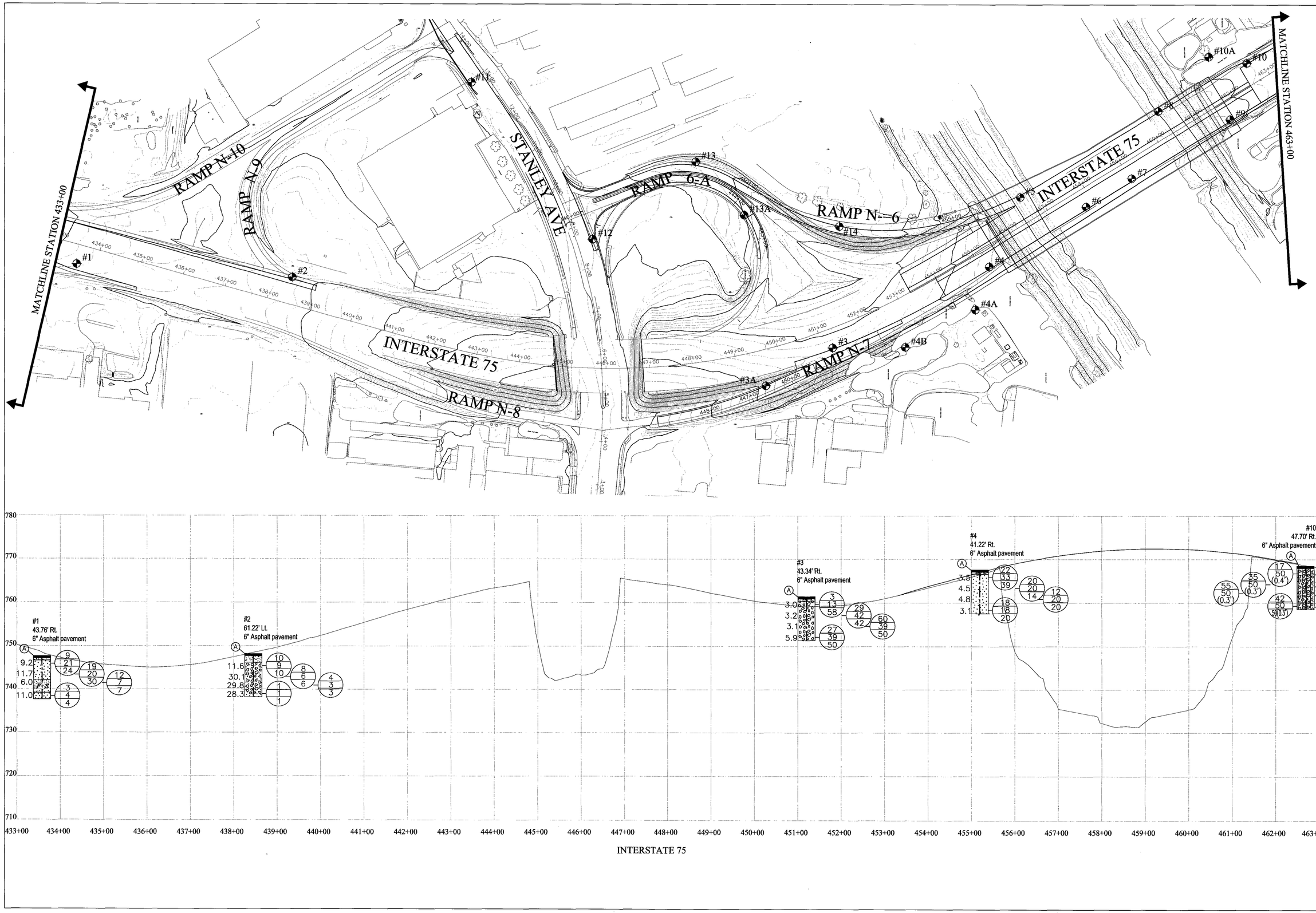
DRAWN HGW | REVIEWED RJYT | DATE rev 05-05 | PROJECT NO. 131651

CLIENT TRANSYSTEMS CORPORATION

SOIL PROFILE

I-75 BRIDGE OVER GREAT MIAMI RIVER

MOT I-75-14.60


MATCHLINE STATION 433+00
MATCHLINE STATION 463+00
RAMP N-10
RAMP N-9
STANLEY AVE
RAMP 6-A
RAMP N-=6
INTERSTATE 75
RAMP N-8
RAMP N-7
#1
#2
#3
#3A
#4
#4A
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#7
#8
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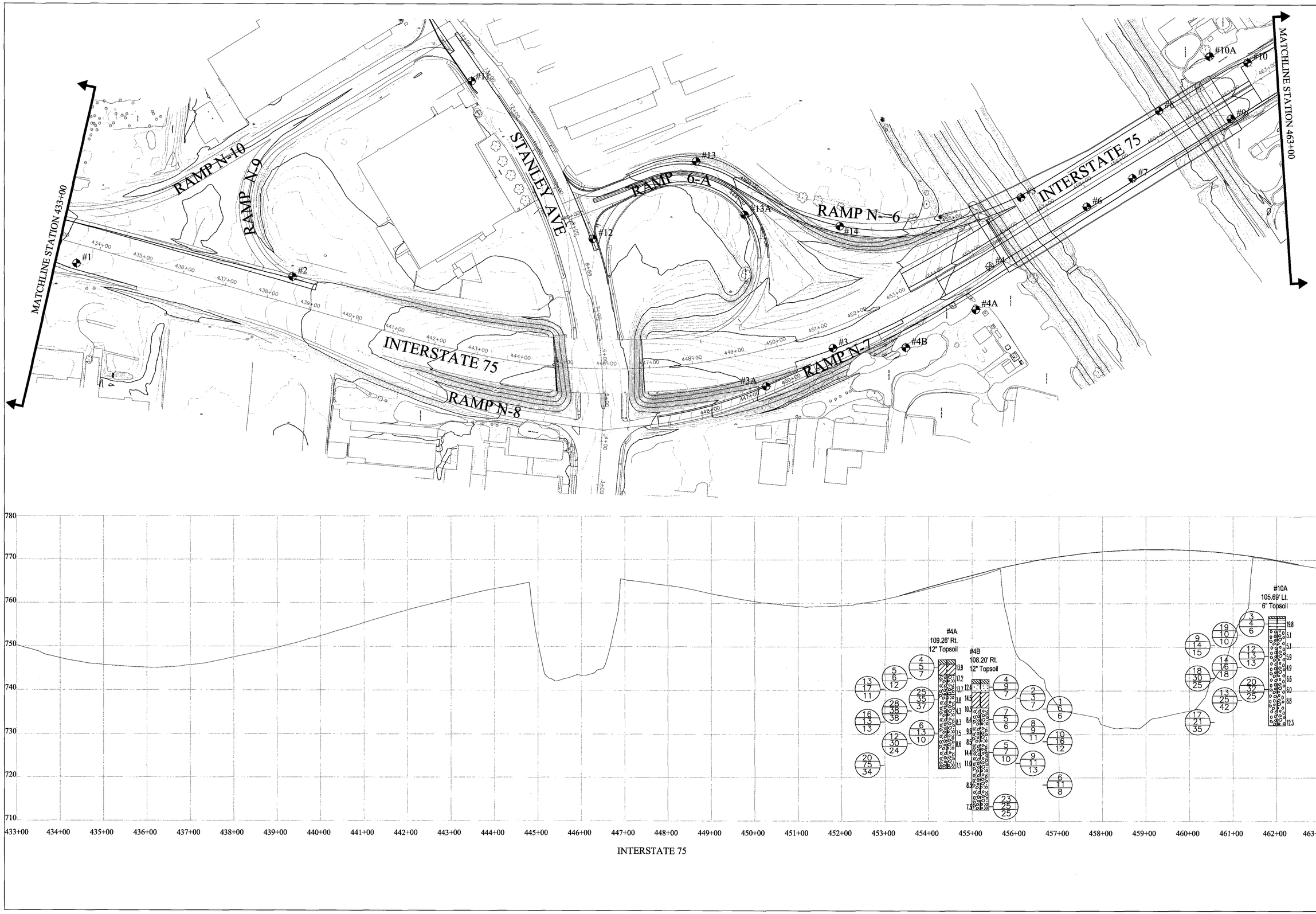
#10A
#11
#12
#13
#13A
#14
#1
43.76' Rt.
6" Asphalt pavement
#2
61.22' Lt.
6" Asphalt pavement
#3
43.34' Rt.
6" Asphalt pavement
#4
41.22' Rt.
6" Asphalt pavement
#10
47.70' Rt.
6" Asphalt pavement
INTERSTATE 75
DRAWN HGW
REVIEWED RJYT
DATE REV. 05-05
PROJECT NO. 131651
CLIENT TRANSYSTEMS CORPORATION
SOIL PROFILE - INTERSTATE 75
STA. 433+00 TO STA. 463+00
MOT I-75-14.60
2 / 4



SOIL PROFILE – INTERSTATE 75
STA. 433+00 TO STA. 463+00

MOT I-75-14.60

DRAWN	REVIEWED	DATE	PROJECT NO.
HGW	RJYT	REV. 05-05	131651

CLIENT
TRANSYSTEMS CORPORATION

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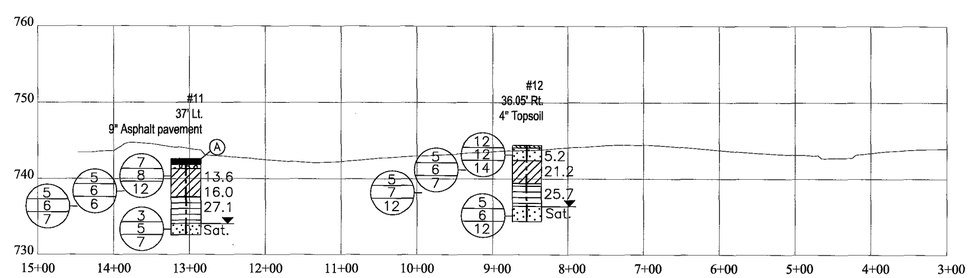
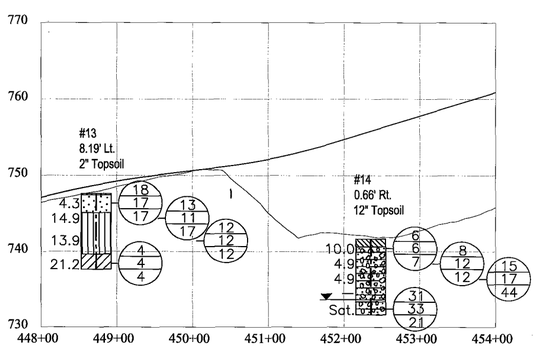


STANLEY AVENUE



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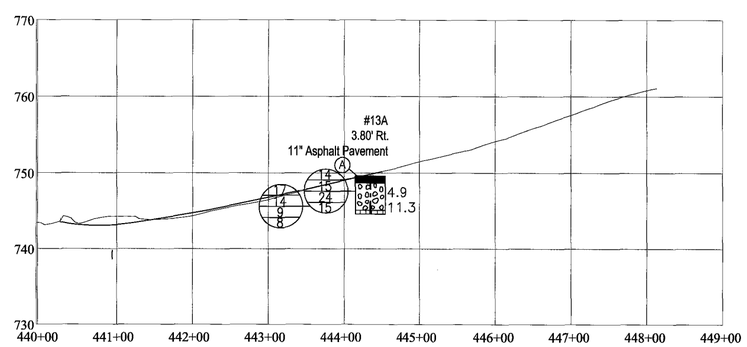

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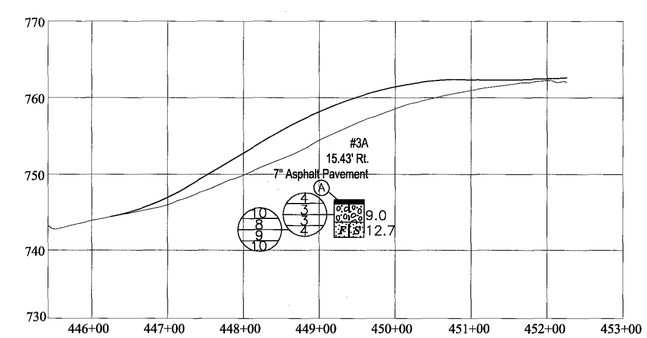

RAMP N-7

DRAWN	REVIEWED	DATE	PROJECT NO.
HGW	RJYT	rev. 05-05	131651

CLIENT
TRANSYSTEMS CORPORATION

SOIL PROFILE – STANLEY AVENUE RAMPS N-6, N-6A, AND N-7

MOT I-75-14.60

4 / 4

TE-26
Rev. 11-83

#18235

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

2004 Year	Job No. PID 23828	County	Montgomery
	Changes	Bridge No.	MOT-75-1523 L/R
		Section	MOT-75-14.60
		Location	(over) under Great Miami River

File No. DRS

CONSULTANT PROJECT

Name of Consultant TranSystems

Name of Drilling Contractor Bowser Morner

Contents of File Reports (including roadway and retaining walls)
Review Comments / Correspondence
Soil Sheets

Date of Report _____ No. of Tracings _____

Date Received _____ Filed with Year _____

Remarks _____

DOT-1346

Inter-office communication

To: Gene Geiger, Administrator,
Office of Geotechnical Engineering

Date: July 8, 2005

From: Paul R. Nartker, P.E., P.S., Acting Production Engineer
By: Scott C. Boyer, P.E.

Subject: MOT-75-14.60 PID 23828 Geotechnical Soil Study

As requested an e-mail from SteveTaliaferro, P.E. dated 7/6/05, please find attached Geotechnical Soil Study from Subconsultant Bowser-Morner dated June 2, 2005 for your file.

A copy has also been sent to the Office of Structural Engineering along with Stage 3 and Retaining Wall plans for review and comment.

Please direct comments to Scott C. Boyer, P.E., (937) 497-6807.

RECEIVED
JUL 2005

PRN/SCB

c: Boyer
Dharma
File

TRANSYSTEMS CORPORATION

July 07, 2005

Mr. Scott C. Boyer, PE
District Contract Manger
District 7 - Production
Ohio Department of Transportation
1001, St. Mary's Avenue
Sidney, Ohio 45365

SUBJECT: Bowser Morner Geotechnical Report, June 2, 2005
MOT-75-14.60
PID#23828

Dear Mr. Boyer:

As per your request, enclosed please find four (4) copies of the "Soil Study Retaining Walls, Report 131651-0605-152" prepared by Bowser Morner for the subject project. This report is referenced in the June 14, 2005 addendum that was submitted along with the retaining wall detailed plan sheets.

If you have any questions or require more information on this matter, please do not hesitate to call.

Sincerely,

TranSystems Corporation

Asvin Mandadi

Asvin Mandadi, P.E.
Project Manager

Enclosure as noted.

Cc: File

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JUL 8 2005
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DISTRICT 7 - BY: SCB

5747 Perimeter Drive, Suite 240 • Dublin, Oh 43017 • Phone: (614) 336-8480 • Fax: (614) 336-8540

Inter-office communication

To: Gene Geiger, Administrator,
Office of Geotechnical Engineering

Date: July 1, 2005

From: Paul R. Nartker, P.E., P.S., Acting Production Engineer
By: Scott C. Boyer, P.E.

Subject: MOT-75-14.60 PID 23828 Retaining Wall Plans - Stage 3

Please find attached Retaining Wall Plans - Stage 3, letter of transmittal from the consultant and Addendum to Bowser-Morner Report for Retaining Walls. Please review and provide comments on or before July 15, 2005. Also a copy is being sent to Michelle Porr of D-7 for review.

Please direct comments to Scott C. Boyer, P.E., (937) 497-6807.

PRN/SCB

c: Boyer
File

TRANSYSTEMS CORPORATION

June 29, 2005

Mr. Scott C. Boyer, PE
District Contract Manger
District 7 - Production
Ohio Department of Transportation
1001, St. Mary's Avenue
Sidney, Ohio 45365

SUBJECT: Retaining Wall Plans – Stage III
MOT-75-14.60
PID#23828

Dear Mr. Boyer:

Enclosed, please find the following:

1. Eighteen (18) copies (11 x 17) of the revised Stage III plan sheets 1, 8, 78, 79, 92, & 93 that now incorporate the work for the proposed retaining walls mentioned below
2. Eighteen (18) copies (11 x 17) of new plans sheets 254A-254L for the two proposed Retaining Walls
3. "Addendum to Bowser Morner Report 131651-0606-152" dated June 14, 2005, discussing the subsurface investigation for the Retaining Walls.
4. One set of full size (22 x 34) Mylars of the Soil Profile sheets
5. Stage I review disposition letter for Retaining Walls
6. Revised Engineer's construction cost estimate

This submittal should complete the Stage III plan submission.

If you have any questions or require more information on this matter, please do not hesitate to call.

Sincerely,

TranSystems Corporation

Asvin Mandadi

Asvin Mandadi, P.E.
Project Manager - Highway

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JUN 30 2005
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DISTRICT 7 - BY:

Enclosure as noted.
Cc: File

5747 Perimeter Drive, Suite 240 • Dublin, Oh 43017 • Phone: (614) 336-8480 • Fax: (614) 336-8540

Inter-office communication

To: Gene Geiger, Administrator,
Office of Geotechnical Engineering

Date: June 27, 2005

From: Paul R. Nartker, P.E., P.S., Acting Production Engineer
By: Scott C. Boyer, P.E.

Subject: MOT-75-14.60 PID 23828 Stage 3 Plans

Please find attached Stage 3 Plans; the letter of transmittal from the consultant on subject project was previously conveyed electronically this morning for your review. Please review and provide comments on or before July 8, 2005.

Please direct comments to Scott C. Boyer, P.E., (937) 497-6807.

RECEIVED
JUN 2005

PRN/SCB

c: Boyer
File

RETAINING WALL STAGE 1 REVIEW DISPOSITION LETTER

Discussed herein is the resolution to ODOT review comments as they pertain to Structure MOT-75-1523 L/R. The numbers given under each heading correlate to the comment numbers outlined in the review letter.

ODOT REVIEW COMMENTS *(Refer to ODOT December 27, 2004 letter)*

Walls

1. MSE walls and CIP walls were investigated. Associated costs and details were provided for each. Which wall types are you recommending and why?

   Resolution: The retaining wall soil investigations were part of a contract modification that was authorized after the TS&L submittal. Therefore, our TS&L did not recommend an alternative since we were awaiting the results of the soil investigation. Included in this submittal you will find the retaining wall subsurface investigation report. In summary, three major items had a major impact on the recommended alternative that was carried into final plans. The first item was the introduction of the bridge taper of the northbound bridge which has eliminated the need for the northeast retaining wall. Therefore the total retaining wall square foot area was reduced greatly. The second item is due to the soil investigation analysis results associated with the slope stability analysis. That analysis indicated that the MSE wall will have a minimum factor of safety of 1.13 which is below the required 1.30 outlined in the Bridge Design Manual. The third item is related to the use of spread footing which will require that footing elevations be lowered 10 feet below the elevation shown on the TS&L therefore making that alternative to be more unpractical and costly.
   Based on the findings of those 3 items, we have designed the retaining walls to be supported on HP steel piles.

2. If MSE walls are carried forward to final design, the MSE wall detail shown on sheet 10/11 will need to be modified. A suggested detail is available from the Office of Structural Engineering.

   Resolution: MSE walls were not carried to final design, therefore the comment does not apply.

Retaining Wall Details - Sheets 10 & 11 of 11:

Comment 1: Missing R/W and slope indicator lines
Resolution: The above lines were inadvertently turned off.

Comment 1: Need to show settlement and bearing capacity calculations and global stability analysis.
Resolution: We agree, see resolution to item 1 shown above under walls.

Comment 2: Verify Boring Location
Resolution: Additional borings were obtained for the retaining wall and they are shown accordingly on the Retaining Walls- General Plan & Elevation sheets.

Addendum to Bowser-Morner Report 131651-0605-152 for
Retaining Walls, Bridge Replacement Project
Bridge No. MOT I-75-14.60, Over Great Miami River
Dayton, Montgomery County, Ohio

For

TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Report No. 131651-0605-163

June 14, 2005

BOWSER MORNER®

BOWSER-MORNER

4518 Taylorsville Road • P.O. Box 51 • Dayton, Ohio 45401 • 937/236-8805

ENGINEERING REPORT

REPORT TO: TranSystems Corporation
5747 Perimeter Drive
Suite 540
Dublin, Ohio 43017

Attn: Mr. Nabil Farah

REPORT DATE: June 14, 2005

REPORT NO: 131651-0605-163

REPORT ON: Addendum to Bowser-Morner Report 131651-0605-152 for Retaining Walls, Bridge Replacement Project, Bridge No. MOT I-75-14.60, Over Great Miami River, Dayton, Montgomery County, Ohio

Two retaining walls will be constructed, one on the northwest corner and one on the southeast corner of the I-75 bridge over the Great Miami River, as part of the reconstruction of the five-span bridge, Bridge No. MOT I-75-14.60. The bridge is north of Stanley Street, in Dayton, Montgomery County, Ohio. This report presents our recommendations of driven H-piles to support the proposed retaining walls.

Mr. Nabil Farah of TranSystems Corporation informed us in an email on June 10, 2005, that the cast-in-place retaining walls will be supported on driven piles. This report is an addendum to Bowser-Morner Report 131651-0605-152 for the above-referenced bridge replacement project dated June 2, 2005. That soil study report discusses the soil conditions for the retaining walls for the bridge replacement project, Bridge No. I-75-14.60 over Great Miami River in Dayton, Montgomery County, Ohio.

The embankment fill and the weak soil in the vicinity of Borings 4A and 4B (southeast corner), and 10A (northwest corner) extending to depths of 3 to 11 feet, are unreliable to support the retaining walls. We understand that the retaining wall foundations can be supported on driven steel H-piles. Based on the results of standard penetration tests with "N" values greater than 30 blows per foot, driving points are recommended to be welded onto the tips of the H-piles to facilitate the driving of the piles and to protect the tips of the piles.

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Based on the results of the standard penetration tests (SPT) and the soil information from the borings made for this study, a computer program, *Driven v1.2* by the Federal Highway Administration, was used to determine the required penetration depths to reach the allowable capacity for the piles. We assume that the same type of soil formation will be encountered below a depth of 50 feet at each boring. The design capacities for driven HP piles, a 10x42 with a capacity of 55 tons and a 12x53 with a capacity of 70 tons, are tabulated in *ODOT Bridge Design Manual.* The driven piles will be a combination of end-bearing and side-friction piles. The computer output files are included in the attached Appendix.

The minimum embedment lengths for the HP 10x42 piles in the vicinity of Borings 4B and 10A, with a factor of safety of two, are summarized in Table 1.

Table 1. Minimum Lengths* of H-Piles (HP 10×42)

Pile Location	Elevation at the Bottom of the Proposed Pile Cap (ft)	Min. Length of Pile (ft)	Pile Tip Elevation (ft)
Boring 4B	739.6	50	689.6
Boring 10A	754.1	40	714.1

* The minimum lengths do not include the required length of the pile to be connected to the pile cap nor the scouring depth.

For each pile in the pile group to have the full design capacity, each pile should be installed at least four feet away from the adjacent piles, measured from center-to-center of the piles. If the piles will be installed less than four feet from an adjacent pile, the pile group-efficiency coefficient should be applied in the design.

The minimum embedment lengths for the HP 12x53 piles in the vicinity of Borings 4B and 10A, with a factor of safety of two, are summarized in Table 2.

Table 2. Minimum Lengths* of H-Piles (HP 12×53)

Pile Location	Elevation at the Bottom of the Proposed Pile Cap (ft)	Min. Length of Pile (ft)	Pile Tip Elevation (ft)
Boring 4B	739.6	49	690.6
Boring 10A	754.1	40	714.1

* The minimum lengths do not include the required length of the pile to be connected to the pile cap nor the scouring depth.

Based on an anticipated pile load at the retaining walls of 100 kips per pile, the minimum embedment lengths for the HP 10x42 and HP 12x53 piles in the vicinity of Borings 4B and 10A, are summarized in Table 3.

Table 3. Minimum Lengths* of H-Piles (100 kips)

Pile Location	Pile	Elevation at the Bottom of the Proposed Pile Cap (ft)	Min. Length of Pile (ft)	Pile Tip Elevation (ft)
Boring 4B	HP 10x42	739.6	39	700.6
	HP 12x53	754.1	39	715.1
Boring 10A	HP 10x42	739.6	30	709.6
	HP 12x53	754.1	22	732.1

* The minimum lengths do not include the required length of the pile to be connected to the pile cap nor the scouring depth.

Free groundwater was observed in Borings 4B and 10A at depths of 4.5 to 13 feet below the existing grade. The groundwater should not be a problem for the installation of driven H-piles.

We recommend that a dynamic analyzer be used during the installation of the driven piles to verify the capacity of the piles. Alternatively, static pile-load tests can be performed to determine the actual loading-bearing capacity of the piles.

If you have any questions, please give us a call.

Respectfully submitted,

BOWSER-MORNER ASSOCIATES, INC.

Christopher R. Ryan, M.S., E.I.T.
Geotechnical Engineer

STATE OF OHIO
RICHARD J. Y. TSENG
E-63351
REGISTERED PROFESSIONAL ENGINEER

Richard J.Y. Tseng, Ph.D., P.E.
Vice President
Chief Geotechnical Engineer

CRR/RJYT/kmw
6-Addressee
2-File

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DRIVEN 1.2

*6/14/05 addendum

GENERAL PROJECT INFORMATION

Filename: E:\2005EN~1\CLIENTS\S-T~1\TRANSY~1\HPILE\4B.DVN
Project Name: Retaining Wall - South
Project Date: 06/13/2005
Project Client: TranSystems Corp.
Computed By: CRR
Project Manager:

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 3.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	5.00 ft
	- Driving/Restrike	5.00 ft
	- Ultimate:	5.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil: (Downdrag Condition)	6.50 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	2.50 ft	0.00%	110.00 pcf	36.0/36.0	Nordlund
2	Cohesive	4.00 ft	0.00%	120.00 pcf	500.00 psf	T-79 Steel
3	Cohesionless	23.50 ft	0.00%	130.00 pcf	34.7/34.7	Nordlund
4	Cohesive	20.00 ft	0.00%	130.00 pcf	4000.00 psf	T-80 Sand

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	410.00 psf	4.72 Kips
6.51 ft	Cohesionless	661.74 psf	25.45	N/A	4.74 Kips
15.51 ft	Cohesionless	965.94 psf	25.45	N/A	16.80 Kips
24.51 ft	Cohesionless	1270.14 psf	25.45	N/A	36.45 Kips
29.99 ft	Cohesionless	1455.36 psf	25.45	N/A	52.13 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	52.30 Kips
39.01 ft	Cohesive	N/A	N/A	3926.85 psf	168.77 Kips
48.01 ft	Cohesive	N/A	N/A	2895.23 psf	224.02 Kips
49.99 ft	Cohesive	N/A	N/A	2724.96 psf	231.69 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	78.15	13.21 Kips	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	78.15	13.21 Kips	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
6.49 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
6.51 ft	Cohesionless	662.08 psf	61.57	8.42 Kips	2.37 Kips
15.51 ft	Cohesionless	1270.48 psf	61.57	8.42 Kips	4.55 Kips
24.51 ft	Cohesionless	1878.88 psf	61.57	8.42 Kips	6.61 Kips
29.99 ft	Cohesionless	2249.32 psf	61.57	8.42 Kips	7.85 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
49.99 ft	Cohesive	N/A	N/A	N/A	3.10 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.39 Kips	0.39 Kips
6.49 ft	4.72 Kips	0.39 Kips	5.10 Kips
6.51 ft	4.74 Kips	2.37 Kips	7.11 Kips
15.51 ft	16.80 Kips	4.55 Kips	21.34 Kips
24.51 ft	36.45 Kips	6.61 Kips	43.06 Kips
29.99 ft	52.13 Kips	7.85 Kips	59.98 Kips
30.01 ft	52.30 Kips	3.10 Kips	55.40 Kips
39.01 ft	168.77 Kips	3.10 Kips	171.87 Kips
48.01 ft	224.02 Kips	3.10 Kips	227.12 Kips
49.99 ft	231.69 Kips	3.10 Kips	234.79 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	410.00 psf	4.72 Kips
6.51 ft	Cohesionless	661.74 psf	25.45	N/A	4.74 Kips
15.51 ft	Cohesionless	965.94 psf	25.45	N/A	16.80 Kips
24.51 ft	Cohesionless	1270.14 psf	25.45	N/A	36.45 Kips
29.99 ft	Cohesionless	1455.36 psf	25.45	N/A	52.13 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	52.30 Kips
39.01 ft	Cohesive	N/A	N/A	3926.85 psf	168.77 Kips
48.01 ft	Cohesive	N/A	N/A	2895.23 psf	224.02 Kips
49.99 ft	Cohesive	N/A	N/A	2724.96 psf	231.69 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	78.15	13.21 Kips	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	78.15	13.21 Kips	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
6.49 ft	Cohesive	N/A	N/A	N/A	0.39 Kips
6.51 ft	Cohesionless	662.08 psf	61.57	8.42 Kips	2.37 Kips
15.51 ft	Cohesionless	1270.48 psf	61.57	8.42 Kips	4.55 Kips
24.51 ft	Cohesionless	1878.88 psf	61.57	8.42 Kips	6.61 Kips
29.99 ft	Cohesionless	2249.32 psf	61.57	8.42 Kips	7.85 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
49.99 ft	Cohesive	N/A	N/A	N/A	3.10 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.39 Kips	0.39 Kips
6.49 ft	4.72 Kips	0.39 Kips	5.10 Kips
6.51 ft	4.74 Kips	2.37 Kips	7.11 Kips
15.51 ft	16.80 Kips	4.55 Kips	21.34 Kips
24.51 ft	36.45 Kips	6.61 Kips	43.06 Kips
29.99 ft	52.13 Kips	7.85 Kips	59.98 Kips
30.01 ft	52.30 Kips	3.10 Kips	55.40 Kips
39.01 ft	168.77 Kips	3.10 Kips	171.87 Kips
48.01 ft	224.02 Kips	3.10 Kips	227.12 Kips
49.99 ft	231.69 Kips	3.10 Kips	234.79 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	410.00 psf	-4.72 Kips
6.49 ft	Cohesionless	410.00 psf	0.00	N/A	-4.72 Kips
6.50 ft	Cohesionless	410.00 psf	0.00	N/A	-4.73 Kips
6.51 ft	Cohesionless	661.74 psf	25.45	N/A	-4.72 Kips
15.51 ft	Cohesionless	965.94 psf	25.45	N/A	7.34 Kips
24.51 ft	Cohesionless	1270.14 psf	25.45	N/A	26.99 Kips
29.99 ft	Cohesionless	1455.36 psf	25.45	N/A	42.67 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	42.84 Kips
39.01 ft	Cohesive	N/A	N/A	3926.85 psf	159.31 Kips
48.01 ft	Cohesive	N/A	N/A	2895.23 psf	214.56 Kips
49.99 ft	Cohesive	N/A	N/A	2724.96 psf	222.23 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
6.50 ft	Cohesionless	661.40 psf	0.00	0.39 Kips	0.39 Kips
6.51 ft	Cohesionless	662.08 psf	61.57	8.42 Kips	2.37 Kips
15.51 ft	Cohesionless	1270.48 psf	61.57	8.42 Kips	4.55 Kips
24.51 ft	Cohesionless	1878.88 psf	61.57	8.42 Kips	6.61 Kips
29.99 ft	Cohesionless	2249.32 psf	61.57	8.42 Kips	7.85 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
49.99 ft	Cohesive	N/A	N/A	N/A	3.10 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.49 ft	-4.72 Kips	0.00 Kips	-4.72 Kips
6.49 ft	-4.72 Kips	0.00 Kips	-4.72 Kips
6.50 ft	-4.73 Kips	0.39 Kips	-4.34 Kips
6.51 ft	-4.72 Kips	2.37 Kips	-2.35 Kips
15.51 ft	7.34 Kips	4.55 Kips	11.88 Kips
24.51 ft	26.99 Kips	6.61 Kips	33.60 Kips
29.99 ft	42.67 Kips	7.85 Kips	50.52 Kips
30.01 ft	42.84 Kips	3.10 Kips	45.94 Kips
39.01 ft	159.31 Kips	3.10 Kips	162.41 Kips
48.01 ft	214.56 Kips	3.10 Kips	217.66 Kips
49.99 ft	222.23 Kips	3.10 Kips	225.33 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: E:\2005EN~1\CLIENTS\S-T~1\TRANSY~1\HPILE\4B.DVN
Project Name: Retaining Wall - South Project Date: 06/13/2005
Project Client: TranSystems Corp.
Computed By: CRR
Project Manager:

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 3.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	5.00 ft
	- Driving/Restrike	5.00 ft
	- Ultimate:	5.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil: (Downdrag Condition)	6.50 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	2.50 ft	0.00%	110.00 pcf	36.0/36.0	Nordlund
2	Cohesive	4.00 ft	0.00%	120.00 pcf	500.00 psf	T-79 Steel
3	Cohesionless	23.50 ft	0.00%	130.00 pcf	34.7/34.7	Nordlund
4	Cohesive	20.00 ft	0.00%	130.00 pcf	4000.00 psf	T-80 Sand

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	410.00 psf	5.68 Kips
6.51 ft	Cohesionless	661.74 psf	26.14	N/A	5.71 Kips
15.51 ft	Cohesionless	965.94 psf	26.14	N/A	21.12 Kips
24.51 ft	Cohesionless	1270.14 psf	26.14	N/A	46.24 Kips
29.99 ft	Cohesionless	1455.36 psf	26.14	N/A	66.29 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	66.49 Kips
39.01 ft	Cohesive	N/A	N/A	4000.00 psf	209.44 Kips
48.01 ft	Cohesive	N/A	N/A	3205.73 psf	295.59 Kips
49.99 ft	Cohesive	N/A	N/A	3008.47 psf	305.13 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	78.15	16.51 Kips	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	78.15	16.51 Kips	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
6.49 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
6.51 ft	Cohesionless	662.08 psf	61.57	10.52 Kips	2.96 Kips
15.51 ft	Cohesionless	1270.48 psf	61.57	10.52 Kips	5.68 Kips
24.51 ft	Cohesionless	1878.88 psf	61.57	10.52 Kips	8.34 Kips
29.99 ft	Cohesionless	2249.32 psf	61.57	10.52 Kips	9.88 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
49.99 ft	Cohesive	N/A	N/A	N/A	3.88 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.48 Kips	0.48 Kips
6.49 ft	5.68 Kips	0.48 Kips	6.17 Kips
6.51 ft	5.71 Kips	2.96 Kips	8.67 Kips
15.51 ft	21.12 Kips	5.68 Kips	26.81 Kips
24.51 ft	46.24 Kips	8.34 Kips	54.58 Kips
29.99 ft	66.29 Kips	9.88 Kips	76.17 Kips
30.01 ft	66.49 Kips	3.88 Kips	70.37 Kips
39.01 ft	209.44 Kips	3.88 Kips	213.32 Kips
48.01 ft	295.59 Kips	3.88 Kips	299.46 Kips
49.99 ft	305.13 Kips	3.88 Kips	309.01 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	410.00 psf	5.68 Kips
6.51 ft	Cohesionless	661.74 psf	26.14	N/A	5.71 Kips
15.51 ft	Cohesionless	965.94 psf	26.14	N/A	21.12 Kips
24.51 ft	Cohesionless	1270.14 psf	26.14	N/A	46.24 Kips
29.99 ft	Cohesionless	1455.36 psf	26.14	N/A	66.29 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	66.49 Kips
39.01 ft	Cohesive	N/A	N/A	4000.00 psf	209.44 Kips
48.01 ft	Cohesive	N/A	N/A	3205.73 psf	295.59 Kips
49.99 ft	Cohesive	N/A	N/A	3008.47 psf	305.13 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	78.15	16.51 Kips	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	78.15	16.51 Kips	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
6.49 ft	Cohesive	N/A	N/A	N/A	0.48 Kips
6.51 ft	Cohesionless	662.08 psf	61.57	10.52 Kips	2.96 Kips
15.51 ft	Cohesionless	1270.48 psf	61.57	10.52 Kips	5.68 Kips
24.51 ft	Cohesionless	1878.88 psf	61.57	10.52 Kips	8.34 Kips
29.99 ft	Cohesionless	2249.32 psf	61.57	10.52 Kips	9.88 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
49.99 ft	Cohesive	N/A	N/A	N/A	3.88 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.48 Kips	0.48 Kips
6.49 ft	5.68 Kips	0.48 Kips	6.17 Kips
6.51 ft	5.71 Kips	2.96 Kips	8.67 Kips
15.51 ft	21.12 Kips	5.68 Kips	26.81 Kips
24.51 ft	46.24 Kips	8.34 Kips	54.58 Kips
29.99 ft	66.29 Kips	9.88 Kips	76.17 Kips
30.01 ft	66.49 Kips	3.88 Kips	70.37 Kips
39.01 ft	209.44 Kips	3.88 Kips	213.32 Kips
48.01 ft	295.59 Kips	3.88 Kips	299.46 Kips
49.99 ft	305.13 Kips	3.88 Kips	309.01 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	410.00 psf	-5.68 Kips
6.49 ft	Cohesionless	410.00 psf	0.00	N/A	-5.68 Kips
6.50 ft	Cohesionless	410.00 psf	0.00	N/A	-5.70 Kips
6.51 ft	Cohesionless	661.74 psf	26.14	N/A	-5.69 Kips
15.51 ft	Cohesionless	965.94 psf	26.14	N/A	9.73 Kips
24.51 ft	Cohesionless	1270.14 psf	26.14	N/A	34.85 Kips
29.99 ft	Cohesionless	1455.36 psf	26.14	N/A	54.90 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	55.09 Kips
39.01 ft	Cohesive	N/A	N/A	4000.00 psf	198.04 Kips
48.01 ft	Cohesive	N/A	N/A	3205.73 psf	284.19 Kips
49.99 ft	Cohesive	N/A	N/A	3008.47 psf	293.74 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
2.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
2.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.00 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
6.49 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
6.50 ft	Cohesionless	661.40 psf	0.00	0.48 Kips	0.48 Kips
6.51 ft	Cohesionless	662.08 psf	61.57	10.52 Kips	2.96 Kips
15.51 ft	Cohesionless	1270.48 psf	61.57	10.52 Kips	5.68 Kips
24.51 ft	Cohesionless	1878.88 psf	61.57	10.52 Kips	8.34 Kips
29.99 ft	Cohesionless	2249.32 psf	61.57	10.52 Kips	9.88 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
49.99 ft	Cohesive	N/A	N/A	N/A	3.88 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.49 ft	-5.68 Kips	0.00 Kips	-5.68 Kips
6.49 ft	-5.68 Kips	0.00 Kips	-5.68 Kips
6.50 ft	-5.70 Kips	0.48 Kips	-5.21 Kips
6.51 ft	-5.69 Kips	2.96 Kips	-2.72 Kips
15.51 ft	9.73 Kips	5.68 Kips	15.41 Kips
24.51 ft	34.85 Kips	8.34 Kips	43.18 Kips
29.99 ft	54.90 Kips	9.88 Kips	64.77 Kips
30.01 ft	55.09 Kips	3.88 Kips	58.97 Kips
39.01 ft	198.04 Kips	3.88 Kips	201.92 Kips
48.01 ft	284.19 Kips	3.88 Kips	288.07 Kips
49.99 ft	293.74 Kips	3.88 Kips	297.61 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: E:\2005EN~1\CLIENTS\S-T~1\TRANSY~1\HPILE\10A.DVN
Project Name: Retaining Wall - North Project Date: 06/13/2005
Project Client: Transystems Corp.
Computed By: CRR
Project Manager:

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 3.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	13.00 ft
	- Driving/Restrike	13.00 ft
	- Ultimate:	13.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil: (Downdrag Condition)	3.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	3.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesionless	27.00 ft	0.00%	130.00 pcf	40.6/40.6	Nordlund
3	Cohesive	27.00 ft	0.00%	130.00 pcf	4000.00 psf	T-80 Sand

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	800.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesionless	375.65 psf	29.73	N/A	0.01 Kips
12.01 ft	Cohesionless	960.65 psf	29.73	N/A	19.58 Kips
12.99 ft	Cohesionless	1024.35 psf	29.73	N/A	23.15 Kips
13.01 ft	Cohesionless	1675.34 psf	29.73	N/A	23.23 Kips
22.01 ft	Cohesionless	1979.54 psf	29.73	N/A	63.54 Kips
29.99 ft	Cohesionless	2249.26 psf	29.73	N/A	109.65 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	109.85 Kips
39.01 ft	Cohesive	N/A	N/A	3926.85 psf	226.33 Kips
48.01 ft	Cohesive	N/A	N/A	2895.23 psf	281.57 Kips
56.99 ft	Cohesive	N/A	N/A	2122.99 psf	298.57 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	375.00 psf	0.00	0.77 Kips	0.77 Kips
3.01 ft	Cohesionless	376.30 psf	183.37	40.08 Kips	4.50 Kips
12.01 ft	Cohesionless	1546.30 psf	183.37	40.08 Kips	18.48 Kips
12.99 ft	Cohesionless	1673.70 psf	183.37	40.08 Kips	20.00 Kips
13.01 ft	Cohesionless	1675.68 psf	183.37	40.08 Kips	20.02 Kips
22.01 ft	Cohesionless	2284.08 psf	183.37	40.08 Kips	27.29 Kips
29.99 ft	Cohesionless	2823.52 psf	183.37	40.08 Kips	33.74 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
56.99 ft	Cohesive	N/A	N/A	N/A	3.10 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.77 Kips	0.77 Kips
3.01 ft	0.01 Kips	4.50 Kips	4.50 Kips
12.01 ft	19.58 Kips	18.48 Kips	38.06 Kips
12.99 ft	23.15 Kips	20.00 Kips	43.15 Kips
13.01 ft	23.23 Kips	20.02 Kips	43.25 Kips
22.01 ft	63.54 Kips	27.29 Kips	90.83 Kips
29.99 ft	109.65 Kips	33.74 Kips	143.39 Kips
30.01 ft	109.85 Kips	3.10 Kips	112.95 Kips
39.01 ft	226.33 Kips	3.10 Kips	229.43 Kips
48.01 ft	281.57 Kips	3.10 Kips	284.67 Kips
56.99 ft	298.57 Kips	3.10 Kips	301.67 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	800.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesionless	375.65 psf	29.73	N/A	0.01 Kips
12.01 ft	Cohesionless	960.65 psf	29.73	N/A	19.58 Kips
12.99 ft	Cohesionless	1024.35 psf	29.73	N/A	23.15 Kips
13.01 ft	Cohesionless	1675.34 psf	29.73	N/A	23.23 Kips
22.01 ft	Cohesionless	1979.54 psf	29.73	N/A	63.54 Kips
29.99 ft	Cohesionless	2249.26 psf	29.73	N/A	109.65 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	109.85 Kips
39.01 ft	Cohesive	N/A	N/A	3926.85 psf	226.33 Kips
48.01 ft	Cohesive	N/A	N/A	2895.23 psf	281.57 Kips
56.99 ft	Cohesive	N/A	N/A	2122.99 psf	298.57 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	375.00 psf	0.00	0.77 Kips	0.77 Kips
3.01 ft	Cohesionless	376.30 psf	183.37	40.08 Kips	4.50 Kips
12.01 ft	Cohesionless	1546.30 psf	183.37	40.08 Kips	18.48 Kips
12.99 ft	Cohesionless	1673.70 psf	183.37	40.08 Kips	20.00 Kips
13.01 ft	Cohesionless	1675.68 psf	183.37	40.08 Kips	20.02 Kips
22.01 ft	Cohesionless	2284.08 psf	183.37	40.08 Kips	27.29 Kips
29.99 ft	Cohesionless	2823.52 psf	183.37	40.08 Kips	33.74 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
56.99 ft	Cohesive	N/A	N/A	N/A	3.10 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.77 Kips	0.77 Kips
3.01 ft	0.01 Kips	4.50 Kips	4.50 Kips
12.01 ft	19.58 Kips	18.48 Kips	38.06 Kips
12.99 ft	23.15 Kips	20.00 Kips	43.15 Kips
13.01 ft	23.23 Kips	20.02 Kips	43.25 Kips
22.01 ft	63.54 Kips	27.29 Kips	90.83 Kips
29.99 ft	109.65 Kips	33.74 Kips	143.39 Kips
30.01 ft	109.85 Kips	3.10 Kips	112.95 Kips
39.01 ft	226.33 Kips	3.10 Kips	229.43 Kips
48.01 ft	281.57 Kips	3.10 Kips	284.67 Kips
56.99 ft	298.57 Kips	3.10 Kips	301.67 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	800.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesionless	375.65 psf	29.73	N/A	0.01 Kips
12.01 ft	Cohesionless	960.65 psf	29.73	N/A	19.58 Kips
12.99 ft	Cohesionless	1024.35 psf	29.73	N/A	23.15 Kips
13.01 ft	Cohesionless	1675.34 psf	29.73	N/A	23.23 Kips
22.01 ft	Cohesionless	1979.54 psf	29.73	N/A	63.54 Kips
29.99 ft	Cohesionless	2249.26 psf	29.73	N/A	109.65 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	109.85 Kips
39.01 ft	Cohesive	N/A	N/A	3926.85 psf	226.33 Kips
48.01 ft	Cohesive	N/A	N/A	2895.23 psf	281.57 Kips
56.99 ft	Cohesive	N/A	N/A	2122.99 psf	298.57 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	375.00 psf	0.00	0.77 Kips	0.77 Kips
3.01 ft	Cohesionless	376.30 psf	183.37	40.08 Kips	4.50 Kips
12.01 ft	Cohesionless	1546.30 psf	183.37	40.08 Kips	18.48 Kips
12.99 ft	Cohesionless	1673.70 psf	183.37	40.08 Kips	20.00 Kips
13.01 ft	Cohesionless	1675.68 psf	183.37	40.08 Kips	20.02 Kips
22.01 ft	Cohesionless	2284.08 psf	183.37	40.08 Kips	27.29 Kips
29.99 ft	Cohesionless	2823.52 psf	183.37	40.08 Kips	33.74 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.10 Kips
56.99 ft	Cohesive	N/A	N/A	N/A	3.10 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.77 Kips	0.77 Kips
3.01 ft	0.01 Kips	4.50 Kips	4.50 Kips
12.01 ft	19.58 Kips	18.48 Kips	38.06 Kips
12.99 ft	23.15 Kips	20.00 Kips	43.15 Kips
13.01 ft	23.23 Kips	20.02 Kips	43.25 Kips
22.01 ft	63.54 Kips	27.29 Kips	90.83 Kips
29.99 ft	109.65 Kips	33.74 Kips	143.39 Kips
30.01 ft	109.85 Kips	3.10 Kips	112.95 Kips
39.01 ft	226.33 Kips	3.10 Kips	229.43 Kips
48.01 ft	281.57 Kips	3.10 Kips	284.67 Kips
56.99 ft	298.57 Kips	3.10 Kips	301.67 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: E:\2005EN~1\CLIENTS\S-T~1\TRANSY~1\HPILE\10A.DVN
Project Name: Retaining Wall - North Project Date: 06/13/2005
Project Client: Transystems Corp.
Computed By: CRR
Project Manager:

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 3.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	13.00 ft
	- Driving/Restrike	13.00 ft
	- Ultimate:	13.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil: (Downdrag Condition)	3.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	3.00 ft	0.00%	125.00 pcf	1000.00 psf	T-79 Steel
2	Cohesionless	27.00 ft	0.00%	130.00 pcf	40.6/40.6	Nordlund
3	Cohesive	27.00 ft	0.00%	130.00 pcf	4000.00 psf	T-80 Sand

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	800.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesionless	375.65 psf	30.54	N/A	0.01 Kips
12.01 ft	Cohesionless	960.65 psf	30.54	N/A	25.37 Kips
12.99 ft	Cohesionless	1024.35 psf	30.54	N/A	30.00 Kips
13.01 ft	Cohesionless	1675.34 psf	30.54	N/A	30.10 Kips
22.01 ft	Cohesionless	1979.54 psf	30.54	N/A	82.33 Kips
29.99 ft	Cohesionless	2249.26 psf	30.54	N/A	142.07 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	142.31 Kips
39.01 ft	Cohesive	N/A	N/A	4000.00 psf	285.26 Kips
48.01 ft	Cohesive	N/A	N/A	3205.73 psf	371.41 Kips
56.99 ft	Cohesive	N/A	N/A	2502.60 psf	410.37 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	375.00 psf	0.00	0.97 Kips	0.97 Kips
3.01 ft	Cohesionless	376.30 psf	183.37	50.10 Kips	5.62 Kips
12.01 ft	Cohesionless	1546.30 psf	183.37	50.10 Kips	23.09 Kips
12.99 ft	Cohesionless	1673.70 psf	183.37	50.10 Kips	25.00 Kips
13.01 ft	Cohesionless	1675.68 psf	183.37	50.10 Kips	25.03 Kips
22.01 ft	Cohesionless	2284.08 psf	183.37	50.10 Kips	34.11 Kips
29.99 ft	Cohesionless	2823.52 psf	183.37	50.10 Kips	42.17 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
56.99 ft	Cohesive	N/A	N/A	N/A	3.88 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.97 Kips	0.97 Kips
3.01 ft	0.01 Kips	5.62 Kips	5.63 Kips
12.01 ft	25.37 Kips	23.09 Kips	48.47 Kips
12.99 ft	30.00 Kips	25.00 Kips	55.00 Kips
13.01 ft	30.10 Kips	25.03 Kips	55.12 Kips
22.01 ft	82.33 Kips	34.11 Kips	116.44 Kips
29.99 ft	142.07 Kips	42.17 Kips	184.24 Kips
30.01 ft	142.31 Kips	3.88 Kips	146.19 Kips
39.01 ft	285.26 Kips	3.88 Kips	289.14 Kips
48.01 ft	371.41 Kips	3.88 Kips	375.29 Kips
56.99 ft	410.37 Kips	3.88 Kips	414.24 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	800.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesionless	375.65 psf	30.54	N/A	0.01 Kips
12.01 ft	Cohesionless	960.65 psf	30.54	N/A	25.37 Kips
12.99 ft	Cohesionless	1024.35 psf	30.54	N/A	30.00 Kips
13.01 ft	Cohesionless	1675.34 psf	30.54	N/A	30.10 Kips
22.01 ft	Cohesionless	1979.54 psf	30.54	N/A	82.33 Kips
29.99 ft	Cohesionless	2249.26 psf	30.54	N/A	142.07 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	142.31 Kips
39.01 ft	Cohesive	N/A	N/A	4000.00 psf	285.26 Kips
48.01 ft	Cohesive	N/A	N/A	3205.73 psf	371.41 Kips
56.99 ft	Cohesive	N/A	N/A	2502.60 psf	410.37 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	375.00 psf	0.00	0.97 Kips	0.97 Kips
3.01 ft	Cohesionless	376.30 psf	183.37	50.10 Kips	5.62 Kips
12.01 ft	Cohesionless	1546.30 psf	183.37	50.10 Kips	23.09 Kips
12.99 ft	Cohesionless	1673.70 psf	183.37	50.10 Kips	25.00 Kips
13.01 ft	Cohesionless	1675.68 psf	183.37	50.10 Kips	25.03 Kips
22.01 ft	Cohesionless	2284.08 psf	183.37	50.10 Kips	34.11 Kips
29.99 ft	Cohesionless	2823.52 psf	183.37	50.10 Kips	42.17 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
56.99 ft	Cohesive	N/A	N/A	N/A	3.88 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.97 Kips	0.97 Kips
3.01 ft	0.01 Kips	5.62 Kips	5.63 Kips
12.01 ft	25.37 Kips	23.09 Kips	48.47 Kips
12.99 ft	30.00 Kips	25.00 Kips	55.00 Kips
13.01 ft	30.10 Kips	25.03 Kips	55.12 Kips
22.01 ft	82.33 Kips	34.11 Kips	116.44 Kips
29.99 ft	142.07 Kips	42.17 Kips	184.24 Kips
30.01 ft	142.31 Kips	3.88 Kips	146.19 Kips
39.01 ft	285.26 Kips	3.88 Kips	289.14 Kips
48.01 ft	371.41 Kips	3.88 Kips	375.29 Kips
56.99 ft	410.37 Kips	3.88 Kips	414.24 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	800.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesionless	375.65 psf	30.54	N/A	0.01 Kips
12.01 ft	Cohesionless	960.65 psf	30.54	N/A	25.37 Kips
12.99 ft	Cohesionless	1024.35 psf	30.54	N/A	30.00 Kips
13.01 ft	Cohesionless	1675.34 psf	30.54	N/A	30.10 Kips
22.01 ft	Cohesionless	1979.54 psf	30.54	N/A	82.33 Kips
29.99 ft	Cohesionless	2249.26 psf	30.54	N/A	142.07 Kips
30.01 ft	Cohesive	N/A	N/A	4000.00 psf	142.31 Kips
39.01 ft	Cohesive	N/A	N/A	4000.00 psf	285.26 Kips
48.01 ft	Cohesive	N/A	N/A	3205.73 psf	371.41 Kips
56.99 ft	Cohesive	N/A	N/A	2502.60 psf	410.37 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	375.00 psf	0.00	0.97 Kips	0.97 Kips
3.01 ft	Cohesionless	376.30 psf	183.37	50.10 Kips	5.62 Kips
12.01 ft	Cohesionless	1546.30 psf	183.37	50.10 Kips	23.09 Kips
12.99 ft	Cohesionless	1673.70 psf	183.37	50.10 Kips	25.00 Kips
13.01 ft	Cohesionless	1675.68 psf	183.37	50.10 Kips	25.03 Kips
22.01 ft	Cohesionless	2284.08 psf	183.37	50.10 Kips	34.11 Kips
29.99 ft	Cohesionless	2823.52 psf	183.37	50.10 Kips	42.17 Kips
30.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
39.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
48.01 ft	Cohesive	N/A	N/A	N/A	3.88 Kips
56.99 ft	Cohesive	N/A	N/A	N/A	3.88 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.97 Kips	0.97 Kips
3.01 ft	0.01 Kips	5.62 Kips	5.63 Kips
12.01 ft	25.37 Kips	23.09 Kips	48.47 Kips
12.99 ft	30.00 Kips	25.00 Kips	55.00 Kips
13.01 ft	30.10 Kips	25.03 Kips	55.12 Kips
22.01 ft	82.33 Kips	34.11 Kips	116.44 Kips
29.99 ft	142.07 Kips	42.17 Kips	184.24 Kips
30.01 ft	142.31 Kips	3.88 Kips	146.19 Kips
39.01 ft	285.26 Kips	3.88 Kips	289.14 Kips
48.01 ft	371.41 Kips	3.88 Kips	375.29 Kips
56.99 ft	410.37 Kips	3.88 Kips	414.24 Kips

Soil Study for Retaining Walls, Bridge Replacement Project
Bridge No. MOT I-75-14.60, Over Great Miami River
Dayton, Montgomery County, Ohio

For

TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Report No. 131651-0605-152

June 2, 2005

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June 2, 2005

TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Attention: Mr. Asvin Mandadi

Re: Report No. 131651-0605-152; Soil Study for Retaining Walls, Bridge Replacement Project, Bridge No. MOT I-75-14.60, Over Great Miami River, Dayton, Montgomery County, Ohio

Dear Mr. Mandadi:

Bowser-Morner is pleased to submit our report of the soil study for the above-referenced project. This report is a second addendum to Bowser-Morner Report 131651-1104-268 for the above-referenced bridge replacement project dated November 15, 2004. The first addendum was discussed in Bowser-Morner Report No. 131651-0105-002 dated January 7, 2005. The purposes of this study are to determine the physical characteristics of the soil strata and allowable bearing capacity for two proposed retaining walls and to present our computation of lateral loads on proposed drilled piers as requested by the structural engineer. This report is prepared in accordance with *Specifications for Subsurface Investigations* by the Ohio Department of Transportation dated October 3, 1996.

The samples collected that were not used to perform the laboratory tests will be kept in our laboratory for 30 days unless you advise us otherwise. If you have any questions, or if we can help you in any way on this project or future work, please call us.

Sincerely,

BOWSER-MORNER ASSOCIATES, INC.

Chris R. Ryan, M.S., E.I.T.
Geotechnical Engineer

STATE OF OHIO
RICHARD J. Y. TSENG
43351
REGISTERED
PROFESSIONAL ENGINEER

Richard J. Y. Tseng, Ph.D., P.E.
Vice President
Chief Geotechnical Engineer

CRR/RJYT/kmw
6-Client
2-File

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1.0 INTRODUCTION

This report is a second addendum to Bowser-Morner Report 131651-1104-268 for a bridge replacement project, Bridge No. MOT I-75-14.60, I-75 over the Great Miami River. That report was dated November 15, 2004. Two retaining walls will be constructed on this site as part of the reconstruction of the five-span bridge, MOT I-75-14.60, along I-75 over the Great Miami River, north of Stanley Street, in Dayton, Montgomery County, Ohio.

The first addendum was discussed in Bowser-Morner Report No. 131651-0105-002 dated January 7, 2005 to reply to comments from ODOT in their "red flag" review. A site plan with all of the borings made for the study is shown on the prints in Section III of this report. Our findings on the soil conditions and groundwater levels with respect to the potential construction problems, and recommendations for the allowable bearing capacity for the construction of the proposed retaining walls are given in this report. Two additional pavement borings were included in this report as a part of the tasks to be done for the responses to the ODOT review comments as indicated in our first addendum.

Authorization to proceed with this soil study was given on April 13, 2005 in an e-mail from Mr. Asvin Mandadi with TranSystems Corporation. The work was to proceed in accordance with our proposal and agreement, Quotation No. 04-2771-189 dated December 20, 2004.

2.0 WORK PERFORMED

2.1 FIELD WORK

Five soil borings were made at the locations specified by Mr. Asvin Mandadi with TranSystems Corporation as shown on the prints included in Section IV. Three of the borings were performed in the proposed retaining wall areas and two additional borings were performed in the proposed ramp areas. The boring logs are included in Section IV. The borings were made with a boring rig mounted on an all-terrain vehicle (ATV) using hollow-stem augers and standard penetration resistance methods. The standard

penetration tests were performed in accordance with ASTM D1586, which includes a 140-pound hammer, 30-inch drops, and two-inch-O.D. split-spoon samplers driven at maximum depth intervals of five feet or at major changes in stratum, whichever occurred first. The disturbed split-spoon samples were visually classified, logged, sealed in moisture-proof jars, and taken to the Bowser-Morner laboratory for study. The depths where these "A"-type split-spoon samples were collected are noted on the corresponding boring logs.

2.2 LABORATORY WORK

Four Unified Soil Classification, AASHTO, and ODOT soil classification tests were performed in accordance with ASTM D422, D2216, D2487, D4318, and D3282. The purpose of this type of test is to determine parameters that aid in the evaluation of the general behavior of the soils.

Six sieve-analysis tests were performed in accordance with ASTM D422 and D2216. The purpose of this type of test is to determine parameters that aid in the evaluation of the general behavior of the soils. In addition, 32 moisture content determinations were made in accordance with ASTM D2216. The moisture contents ranged from 4.9% to 19.8% for the embankment fill layer, and from 3.8% to saturated for the brown gravel with sand. The results of the laboratory tests are summarized in Table 2-1 and included in Section IV of this report.

TABLE 2-1. Summary of Laboratory Test Results

Boring No.	Depth (ft.)	Moisture Content (%)	% Gravel	% Sand	% Silt	% Clay	Atterberg Limits LL	PL	PI
3A	1.0 – 3.0	9.0	37.7	46.5	12.1	3.7	Non-Plastic		
	3.0 – 5.0	12.7	25.5	66.4	7.5	0.6	Non-Plastic		
4A	1.0 – 2.5	13.9							
	3.5 – 5.0	17.2							
	6.0 – 7.5	13.7	45.0	34.9	20.1		Visual	Non- Plastic	
	8.5 – 10.0	3.8	44.7	42.8	12.5		Visual	Non- Plastic	
	11.0 – 12.5	4.3							
	13.5 – 15.0	8.3							
	16.0 – 17.5	7.5							
	18.5 – 20.0	8.6							
	23.5 – 25.0	7.1							

TABLE 2-1. Summary of Laboratory Test Results

Boring No.	Depth (ft.)	Moisture Content (%)	% Gravel	% Sand	% Silt	% Clay	Atterberg Limits LL	PL	PI
4B	1.0 – 2.5	12.4							
	3.5 – 5.0	14.5							
	6.0 – 7.5	10.3							
	8.5 – 10.0	8.4							
	11.0 – 12.5	9.6							
	13.5 – 15.0	8.5	68.2	23.8	8.0		Visual	Non-	Plastic
	16.0 – 17.5	14.4							
	18.5 – 20.0	11.0	48.5	37.7	13.8		Visual	Non-	Plastic
	23.5 – 25.0	8.3							
	28.5 – 30.0	7.3							
10A	1.0 – 2.5	19.8							
	3.5 – 5.0	5.1	64.1	22.9	13.0		Visual	Non-	Plastic
	6.0 – 7.5	5.1							
	8.5 – 10.0	5.9							
	11.0 – 12.5	4.9	61.0	28.4	10.6		Visual	Non-	Plastic
	13.5 – 15.0	6.6							
	16.0 – 17.5	6.0							
	18.5 – 20.0	8.8							
	23.5 – 25.0	12.3							
13A	1.0 – 3.0	4.9	55.3	32.2	9.8	2.7	16	15	1
	3.0 – 5.0	11.3	49.7	30.6	14.0	5.7	28	20	8

3.0 SOIL AND GROUNDWATER CONDITIONS

3.1 RETAINING WALL SITES

Borings 4A, 4B, and 10A were made at the toe of the embankments in the proposed retaining wall sites. Based on information from these borings, the subgrade soil conditions are described in descending order below:

- Three to eight feet of embankment fill consisting of topsoil, brown silty clay, brown and dark brown coarse sand, brown and dark brown silt and clay, and brown sandy silt.
- Below the fill layer, medium-dense-to-very-dense brown gravel with sand extending to the bottoms of these borings at depths of 25 to 30 feet.

3.2 RAMPS

Borings 3A and 13A were make-up borings in the proposed locations for Ramps N-7 and 6-A, respectively. Based on the information from these borings, the subgrade soil conditions are described below:

- Embankment fill consisting of seven to 11 inches of asphalt pavement, brown gravel with sand, brown fine sand, and brown sandy silt extending to the bottoms of these boring at depths of 5 feet.

Free groundwater was encountered in Borings 4A, 4B, 10A, and 13A during the advancement of the borings at the depths and elevations summarized in Table 3-1. Free groundwater was not encountered in Boring 3A.

TABLE 3-1. Summary of Groundwater Observations

Boring No.	Depth Groundwater First Observed (ft)		Groundwater Observations at Completion of Boring	
	Depth	Elevation	Depth	Elevation
4A	13.0	734.1	12.0	735.1
4B	8.0	734.6	5.0	737.6
10A	13.0	744.1	13.0	744.1
13A	3.0	746.6	2.8	746.8

Free groundwater is defined as water that seeps into an open borehole before it is backfilled. Groundwater observations were made during the boring operations by noting the depth of water on the boring tools and in the open boreholes following withdrawal of the boring augers. However, it should be noted that short-term water level readings are not necessarily a reliable indication of the groundwater level and that significant fluctuations may occur due to variations in rainfall, the river water levels, and other factors. For specific questions on the soil conditions, please refer to the individual boring logs in Section III.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 PROJECT DESCRIPTION

Two retaining walls will be constructed, one on the northwest corner and one on the southeast corner of the I-75 bridge over the Great Miami River, as part of the reconstruction of the five-span bridge, Bridge No. MOT I-75-14.60. The bridge is north of Stanley Street, in Dayton, Montgomery County, Ohio. No specific wall design or loading information was provided for this report.

Based on the requests from Mr. Nabil Farah, P.E., the Bridge Group Manager with TranSystems Corporation in an e-mail dated April 15, 2005, this report presents the results of the computations with an "L-Pile" computer program on the deflections of the 60-inch-diameter drilled piers. We understand that the 60-inch-diameter, drilled piers are recommended as the foundations to support the center bridge piers for the design of the proposed bridge. The design loads for Bridge Piers No. 2 and No. 4 are tabulated in Table 4-1 as provided by Mr. Jonathan Hren, P.E. with TranSystems Corporation.

Table 4-1. Design Loads for 60-Inch-Dia. Piers

Bridge Pier No.	Maximum Axial Load (Kips)	Maximum Moment (Kips-ft)	Maximum Lateral Load at Top (Kips)
2	1060	410	26
4	1035	1110	39

After the completion of our initial soil study, we learned that Ramps 6A and N-7 will be reconstructed. As noted in our responses to the ODOT "Red Flag" review included in Addendum No. 1, additional borings were needed to comply with the requirements in ODOT specifications. Two additional borings, one on each ramp, were made; information on these borings is included in this report. The boring locations and the soil profiles for each of these pavement borings are included in Section IV, both in the sections for the boring log sheets and in the prints. We understand that the final pavement sections have been selected for the project. As a result no further discussions of these pavement borings are included in the following sections.

The following recommendations are based on this information. If the above statements are incorrect or changes are made, Bowser-Morner should be notified so that the new data can be reviewed and additional recommendations and services can be given if required to meet the needs of your project.

4.2 RETAINING WALL DESIGN RECOMMENDATIONS

4.2.1 FOUNDATION SUBGRADE PREPARATION

The proposed retaining wall areas are covered by a layer of embankment fill that extends to the approximate depths and elevations outlined in Table 4-2.

Table 4-2. Depths to Bottoms of Unreliable Soils

Boring No.	Depth to Bottom of Unreliable Soil (ft)	Elevation at Bottom of Unreliable Soil (ft)	Topsoil, Fill, and/or Weak Soil
4A	8.0	739.1	Fill
4B	6.5	736.1	Fill
10A	3.0	754.1	Fill

The embankment fill within the shallow depths and with low "N" values may be unreliable to support the retaining walls. Within the construction limits, the dry unit weight of the embankment fill should be verified. Unless the embankment fill has been compacted to the required density indicated in ODOT specifications, the weak embankment fill should be removed to the depths and elevations outlined in Table 4-1 and replaced with compacted backfill. The excavation within the construction limits should extend to suitable soils. The retaining wall foundations can be supported on the original soil at the depths and elevations outlined in Table 4-2 or on the newly compacted backfill.

To remove the unreliable soil and the weak soil layers, the base of the excavation should extend one lateral foot for every foot of excavation below the bottom of the retaining wall foundations or below the bottom of the backfill for the construction of MSE walls. A maximum allowable side slope of 1 (horizontal) to 1 (vertical) should be maintained in the excavations for stability and for the safety of workers.

After the fill material has been removed from the retaining wall area, the top foot of the exposed ground surface at the bottoms of the excavations should be compacted to 95% of the maximum dry unit weight as defined by the standard Proctor test (AASHTO T-99) before any new fill or foundation is placed. Any soft soil pockets should be undercut and replaced with compacted fill. Horizontal benches should be provided on the face of the existing embankment. The newly placed fill should be compacted in horizontal eight-inch-thick lifts and should be keyed into the existing embankment with horizontal benches.

After the bottom of the excavation has been compacted, structural fill can be placed to bring the bottom of the excavation to the desired grade if needed. Structural fill should be placed in accordance with specifications outlined in ODOT construction specifications for the construction of embankments. The soil removed from this site that is free of organic or objectionable materials as defined by a field technician who is qualified in soil material identification and compaction procedures can be reused as fill. Objectionable or undesirable soils are defined as those materials that cannot meet design placement specifications or materials that will deteriorate with time.

Based on the results of the standard penetration tests ("N" values) in Borings 4A and 4B, the retaining wall to be placed on the original soil at the depths and elevations outlined in Table 4-2 should be designed based on an allowable bearing capacity of 2,500 pounds per square foot (psf).

If a higher bearing capacity of 4,000 psf is required for the retaining wall design, the excavations to remove the weak soil layer should extend to or below the depths and elevations outlined in Table 4-3.

Table 4-3. Depths to Bottoms of Unreliable or Weak Soils

Boring No.	Depth to Bottom of Unreliable Soil (ft)	Elevation at Bottom of Unreliable Soil (ft)	Topsoil, Fill, and/or Weak Soil
4A	8.0	739.1	Fill
4B	11.0	731.6	Fill and Weak Soil
10A	3.0	754.1	Fill

The excavations can extend to the bearing strata at the depths and elevations outlined in Table 4-3. The retaining wall foundations or the MSE walls can be supported on the original soil layer. Alternatively, the weak soil layer can be removed and replaced with compacted backfill in accordance with the recommendations included in ODOT specifications. The foundations and/or MSE walls can be supported on the newly compacted backfill. Based on the "N" values indicated in Boring 10A, the allowable bearing capacity for the wall to be constructed at the northwest corner can be increased to 6,000 psf for the excavation to extend to the depths and elevations outlined in Table 4-3.

For the allowable bearing capacity recommended above, the total settlement of the foundation is estimated to be about 1.0 inch.

If an allowable bearing capacity for the MSE wall design is greater than 4,000 psf, the MSE-type retaining wall will not be suitable in the vicinity of Borings 4A and 4B. A cast-in-place concrete wall supported on a system of drilled piers or driven piles can be installed to support the foundations for the proposed cast-in-place concrete retaining walls. The bottoms of the piers or driven piles should extend below the depths and elevations outlined in Table 4-4 and supported on the brown gravel layer.

Table 4-4. Depths to Bearing Stratum

Boring No.	Depth to Bearing Stratum (ft)	Elevation of Bearing Stratum (ft)
4A	8.0	739.1
4B	28.0	714.6
10A	11.0	746.1

For the installation of drilled piers, temporary steel casings will be required to keep the shafts from caving in. After the concrete has been placed, the casings can be removed and reused.

The bottoms of the drilled piers that extend below the depths and elevations outlined in Table 4-4 can be designed with an allowable end-bearing capacity of 10,000 psf. The allowable side-friction capacities of 200 psf in the vicinity of Borings 4B, and 500 psf in the vicinity of Borings 4A and 10A can be assigned to the parts of the piers in contact with the original soils below the depths and elevations outlined in Table 4-3.

If the determination of the allowable capacity of driven piles is needed, we will be glad to provide the capacity based on the results of the driven-pile computer program provided by ODOT. We believe that driven concrete piles may not be able to penetrate the brown gravel layer with "N" values greater than 30 as indicated in the borings made for this study. If a driven H-steel pile will be used, driven shoes should be welded onto the tips of the piles to protect the piles and penetrate the dense gravel layer. The determination of the driven-pile capacity should be determined with a dynamic pile analyzer during the installation of the driven piles.

The piers or driven piles should be installed at least three diameters away from adjacent piers to account for the full capacity. Otherwise, the pile-group effect should be applied to determine the capacity of the group.

To determine the actual allowable capacity of the drill piers, we recommend that static pile load tests be performed to verify the allowable drilled-pier capacity.

The allowable bearing capacity recommended above can be increased by a factor of one-third when designing for live loads such as wind or earthquake loading. When determining the geometric size (the "footprint") of the footing foundation, the total system loads applied to the tops of the foundations should be considered in the bearing pressure calculations.

The bearing capacity recommended above for spread footing foundations supported on structural fill applies to well-graded granular soils, low-to-medium plastic clays, clayey sands, and some silty sands that are placed and compacted in accordance with the recommendations given in this report. However, uniformly graded or gap-graded granular soils (GP or SP), silts (ML), silty fine sands (SM), and high plasticity clays (CH) will be difficult to place and compact, and may result in a reduced bearing capacity. If these soils will be used as backfill, Bowser-Morner should be notified before the soils are placed so that the proposed placement methods and bearing capacity recommendations can be reviewed.

The bearing capacity of a soil is not a unique physical property of the soil. Instead, it depends explicitly on several factors including the footing type, size, and shape; the depth of embedment; the eccentricity and inclination of the applied load; the footing base inclination; the stiffness of the footing; the proximity of the footing to open cuts or slopes; the relative distance between the bottom of the footing and the water table; and the allowable amounts of settlement. The recommended allowable bearing capacity is based on the foundation design parameters given above and the assumptions that the applied load is vertical with no eccentricity, the base is horizontal and level, the footing is rigid, the footing is not close to an open cut or slope, and the water table is below the bottom of footing. If the actual conditions vary from the parameters and assumptions stated above, Bowser-Morner should be notified so that the new information can be reviewed and additional recommendations and services can be given to meet the needs of your project.

The bottoms of the cast-in-place, retaining-wall footing foundations should be placed at least 36 inches below the final adjacent grades to protect against frost penetration and heaving. Foundations supported on soil settle as the result of externally applied loads. While the foundations should be expected to settle, the amount of settlement should be within the tolerable limits for the structure.

4.2.2 LATERAL EARTH PRESSURE FOR RETAINING WALL

With the retaining wall to be backfilled with free-draining granular backfill and with the water in the granular fill to be drained through the weep holes on the wall or through an underdrain system behind the wall, an "at-rest," lateral earth-pressure coefficient "k_a" of 0.35 should be used to determine the lateral earth pressure against the retaining walls. The strength parameter "ϕ" of 30 degree and a unit weight of 130 pounds per cubic foot have been assigned to the granular backfill. A lateral soil pressure of 45 pounds per square foot per foot depth can be used in the design of the retaining walls. If water will be allowed to accumulate behind the basement walls, a static water pressure of 62.4 psf per foot depth should be added onto the design lateral pressure against the retaining walls.

4.3 RETAINING WALL EXCAVATIONS

During the excavations to prepare the subgrade for the retaining walls, the subsurface conditions should be verified. Changes in subsurface conditions other than what are shown on the boring logs warrant additional subsurface investigation before the foundations are constructed.

The excavations should be observed to ensure that the loose, soft, or otherwise undesirable materials are removed and that the wall foundations or the reinforced backfill behind the walls will be supported directly on an acceptable surface. At the time of this observation, it may be necessary to use a hand penetration device in the base of the foundation excavation to ensure that the soils immediately below the foundation base are satisfactorily prepared to support the foundations. Please note that such shallow observations do not replace an adequate deep-boring program and structural fill compaction QA/QC records. The overall performance of the foundations is governed by the soils below the bottom of the footing foundation.

If pockets of soft, loose, or otherwise unsuitable materials are encountered in the footing excavations and it is inconvenient to lower the footings, the proposed footing elevations may be reestablished by backfilling after the undesirable materials have been removed. The excavation under each footing should extend to suitable soils, and the base of the excavation should extend one lateral foot for every foot of excavation below the bottom of the foundation or the reinforced backfill zones. The entire excavation should then be refilled with well-compacted, engineered fill. Special care should be taken to remove the sloughed, loose, or soft materials near the base of the excavation slopes. Extra care should also be taken to tie-in the compacted fill with the excavation slopes, with benches as necessary, to ensure that no pockets of loose or soft materials are left along the excavation slopes below the foundation bearing level. The contractor should maintain temporary cut slopes in accordance with the current OSHA regulations governing trenching and slope stability.

Soils exposed at the bases of satisfactory foundation excavations should be protected against any detrimental change in condition such as from construction

disturbances, rain, and freezing. Surface runoff should be drained away from the excavation and not allowed to pond. If possible, foundation concrete should be placed the same day the excavation is made. If this is not practical, the foundation excavations should be adequately protected. Also, for this reason, proper drainage should be maintained after construction. It must be emphasized that all excavations must conform to all state, federal, and local regulations relative to slope geometry.

4.4 SLOPE STABILITY ANALYSIS

The slope stability analyses were performed using the computer program STABL6H. This program was developed at Purdue University in cooperation with the Federal Highway Administration. The program is capable of determining the factor of safety for potential failure surfaces of given configurations and includes a search routine that locates the surface that gives a minimum factor of safety. The Simplified Bishop method was used for circular failure surfaces (rotational stability analysis). The program uses a limited equilibrium procedure applied to the method of slices. A plotting subroutine provides graphical representation of the analyzed slope sections, including pertinent analysis information such as the most-critical failure surfaces and the factors of safety for these most-critical surfaces.

Based on the cross-sections at Stations 454+00 on the east side of the north bound lane and at Station 461+77 on the west side of the south bound lane, the analyses were performed. Since the final design of the MSE walls was not available, we assume that the width of the reinforced soil fill behind the wall is 0.7 times of the height of the wall. The heights of the retaining wall sections are about 13.7 feet at Station 454+00 and about 12.7 feet at Station 461+77.

Based on the available data and our experience with similar materials, the input parameters for the subgrade materials were selected for use in the slope stability analyses. Table 4-5 summarizes the strength parameters used for the analyses. The angle of friction was estimated based on correlations with the standard penetration test (SPT) results indicated in the soil borings made for this study. We assume that an MSE wall system will be selected for this project. The retaining walls with reinforced metal strips

are considered as the reinforced fill sections in our analyses. The internal stability of the wall system, the sliding and over-turning considerations, and the pull-out requirements of the metal strips will be performed by the supplier and are beyond the scopes of this study.

TABLE 4-5. Strength Parameters for Slope Stability Analyses

Material	Dry Unit Weight (pcf)	Effective Strength ϕ' (°)	Cohesion C' (psf)
Reinforced Fill	125	0	8000
Embankment Fill	125	28	0
Gravel with Sand	130	36	0
Live Load Surcharge	130	0	0

The slope stability analyses were performed under static conditions using the effective strength parameters. The live loading is based on HS-25 loading conditions. The live load was converted into soil surcharge load placed over the top of the embankment. The strength parameters for the surcharge were assigned as "0" values.

4.4.1 RESULTS OF SLOPE STABILITY ANALYSES

The results of the slope stability analyses for the retaining walls are summarized in Table 4-6. The computer printouts are included in Section II of this report.

TABLE 4-6. Results of Slope Stability Analyses

Cross-Section at Station	Height of Retaining Wall (ft)	Minimum Factor of Safety
454+00	13.7	1.13
454+00	15.7	1.20
461+77.19	12.3	1.42

Based on an exposed wall height of 13.7 feet with the bottom of the wall at an elevation of 748.6 feet, the minimum factor of safety is 1.13 at Station 454+00. The failure envelope cut through the bottom of the reinforced soil fill section. To increase the minimum factor of safety, the bottom of the reinforce soil section extended two feet below the bottom of the exposed wall section provided by the client. The minimum factor of safety, with the bottom of the wall extending to an elevation of 746.6 feet,

increases to 1.20. The minimum factor of safety for the retaining wall at Station 461+77.19 is 1.42.

For the installation of a cast-in-place concrete retaining wall, the wall will be supported on drilled piers or on driven steel H-piles. The design loading will be supported on a system of piers or pile foundations. The drilled piers or the driven steel H-piles will provide additional resistance against the sliding failure. The slope stability analyses for the cast-in-place retaining wall are beyond the scope of this study.

4.5 CONSTRUCTION DEWATERING

At the time of our study, free groundwater was encountered in Borings 4A, 4B, 10A, and 13A at depths of 2.8 to 13.0 feet below the existing grade as outlined in Table 3-1. Borings 4A, 4B, and 10A were made on the retaining wall sites, and Boring 13A was made in the ramp area. Free groundwater was not encountered in Boring 3A.

Since groundwater was encountered below the anticipated footing depth in the vicinity of Borings 4A, 4B, and 10A, we do not anticipate that significant groundwater seepage will be encountered in shallow foundation excavations. However, in the vicinity of Boring 13A, the ODOT standard transverse underdrains should be installed to channel the ground water to the shoulders of the embankment.

Temporary steel casings should be used during the drilled-pier installations. It may not be possible to lower the groundwater in the casings because the drilled piers will be installed into the sand and gravel layer at the bottom of the river. A tremie method of placing the concrete should be used.

The groundwater level will change with the season. Typically, groundwater levels are highest during winter and spring, and lower in summer and early fall.

4.6 SUMMARY OF L-PILE ANALYSIS

The analyses of the lateral movement and the determination of the embedment lengths of 60-inch-diameter drilled piers were performed using the L-pile computer program. The two loading conditions given were considered to perform the analyses.

The loading conditions for Piers 2 and 4 are tabulated in Table 4-1 in Section 4.1. For your convenience, the loading conditions are identified as Case I and Case II in Table 4-7.

TABLE 4-7. Loading Conditions

Loading Condition	Vertical Load (kips)	Moment (kips-ft)	Horizontal Load (kips)
Case I	1060	410	26
Case II	1035	1110	39

The subgrade information is included in Borings 5, 6, and 7 for the center bridge piers included in our previous study. The results of the L-pile analyses for the drilled piers are summarized in Table 4-8.

TABLE 4-8. L-Pile Test Results

Boring No.	Loading Condition	Minimum Length (ft.)	Lateral Deflection at Top of Piers (inches)	Max Moment (in-kips)	Depth* of Max Moment (ft)
5	Case I	37	0.12	6,800	10
5	Case II	40	0.26	15,600	10
6	Case I	33	0.057	6,800	10
6	Case II	34	0.136	15,600	7
7	Case I	30	0.036	6,200	8 to 9
7	Case II	35	0.092	14,500	5

*Depth below the top of the creek bed.

The results of the computer print out from L-Pile analyses and our assumptions of the subgrade soil conditions are included in Section III of this report.

5.0 CLOSURE

5.1 BASIS OF RECOMMENDATIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface

conditions. Data used during this exploration included, but were not necessarily limited to:

- Five additional exploratory borings performed for two retaining wall sites and along two ramps during this study.
- Bowser-Morner Report No. 131651-1104-268 dated November 15, 2004.
- Bowser-Morner Report No. 131651-0105-002 dated January 7, 2005.
- Observations of the project site by our staff.
- The survey results provided by TranSystems Corporation.
- The loading conditions for the drilled piers provided by TranSystems Corporation.
- The results of the laboratory soil tests.
- The site plan profile sheets provided by TranSystems Corporation.
- Limited interaction with Mr. Asvin Mandadi, Mr. Nabil Farah, and Mr. Jonathan Hren of TranSystems Corporation.
- Published soil or geologic data of this area.

In the event that changes in the project characteristics are planned, or if additional information or differences from the conditions anticipated in this report become apparent, Bowser-Morner should be notified so that the conclusions and recommendations contained in this report can be reviewed and, if necessary, modified or verified in writing.

5.2 LIMITATIONS AND ADDITIONAL SERVICES

The subsurface conditions discussed in this report and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by designers, or that the construction process has altered the soil conditions. As variations in the soil profile are encountered, additional subsurface sampling and testing may be necessary to provide data required to reevaluate the recommendations of this report. Consequently, after submission of this report, it is recommended that Bowser-Morner be authorized to perform additional services to work with the designer(s) to minimize errors and omissions regarding the interpretation and implementation of this report.

Before construction begins, we recommend that Bowser-Morner:

- Work with the designers to implement the recommended geotechnical design parameters into plans and specifications.
- Consult with the design team regarding interpretation of this report.
- Establish criteria for the construction observation and testing for the soil conditions encountered at this site.
- Review final plans and specifications pertaining to geotechnical aspects of design.

During construction, we recommend that Bowser-Morner:

- Observe the construction, particularly the site preparation, fill placement, and foundation excavation or installation.
- Perform in-place density testing of all compacted fill.
- Perform materials testing of soil and other materials as required.
- Consult with the design team to make design changes in the event that differing subsurface conditions are encountered.

If Bowser-Morner is not retained for these services, we shall assume no responsibility for construction compliance with the design concepts, specifications or recommendations.

5.3 WARRANTY

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, express or implied, is made.

The scope of this study did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, within or beyond the site studied. Any statements in the report or on the boring logs regarding odors, staining of soils or other unusual items or conditions observed are strictly for the information of our client.

To evaluate the site for possible environmental liabilities, we recommend an environmental assessment, consisting of a detailed site reconnaissance, a record review, and report of findings. Additional subsurface drilling and sampling, including groundwater sampling, may be required. Bowser-Morner can provide this service and would be pleased to provide a cost proposal to perform such a study, if requested.

This report has been prepared for the exclusive use of TranSystems Corporation for specific application to the proposed retaining walls and the design of drilled piers for bridge replacement project over Great Miami River, north of Stanley Avenue, in Dayton, Montgomery County, Ohio. Specific design and construction recommendations have been provided in the various sections of the report. The report shall therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. Bowser-Morner is not responsible for the independent conclusions, opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.

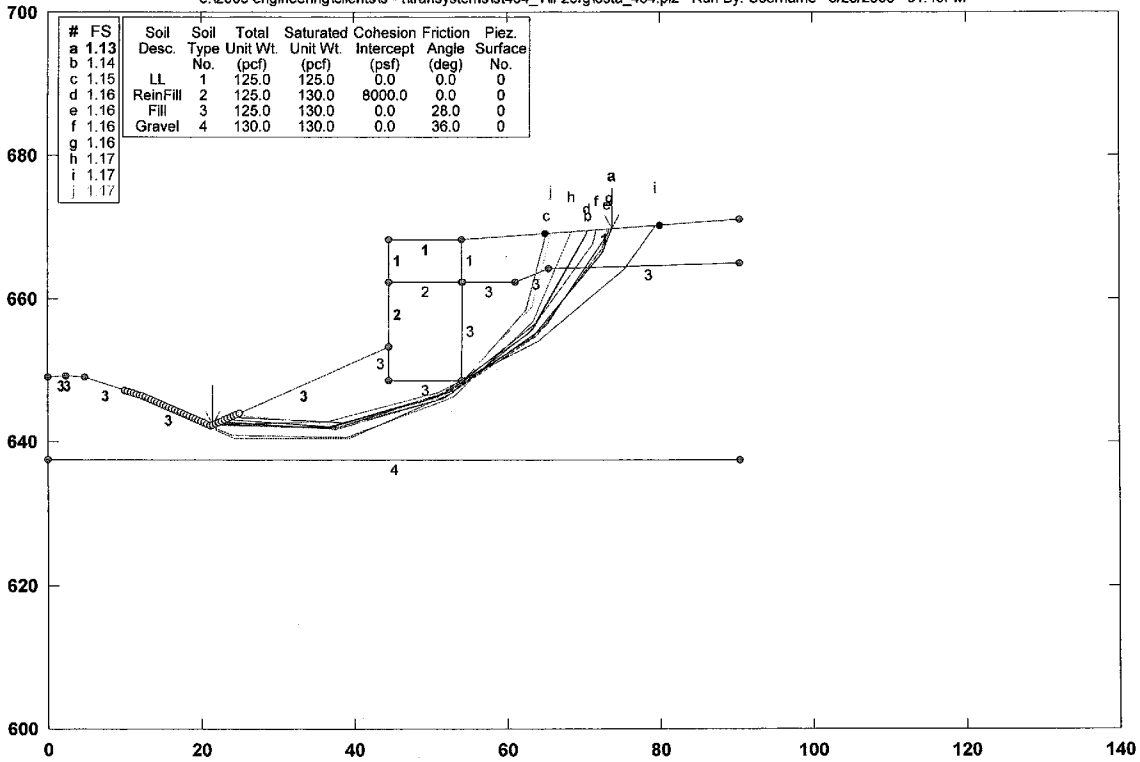
SECTION II

SLOPE STABILITY ANALYSES

BOWSER MORNER®

Transystems - 13.71ft - Retaining Wall Station 454+00

e:\2005 engineering\clients\s - t\transystems\st454_1\ll-2org\3sta_454.pl2 Run By: Username 5/25/2005 01:40PM



STABL6H FSmin=1.13

Safety Factors Are Calculated By The Modified Bishop Method

BOWSER MORNER®

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                    ** STABL6H  **
                         by
                   Purdue University
            --Slope Stability Analysis--
        Simplified Janbu, Simplified Bishop
           or Spencer`s Method of Slices
Run Date:                    5/25/2005
Time of Run:                 01:40PM
Run By:                      Username
Input Data Filename:         E:3sta_454.in
Output Filename:             E:3sta_454.OUT
Plotted Output Filename:     E:3sta_454.PLT
PROBLEM DESCRIPTION   Transystems - 13.71ft - Retaining Wall
                      Station 454+00
BOUNDARY COORDINATES
     Note: User origin value specified.
     Add 0.00 to X-values and 600.00 to Y-values listed.

    9 Top   Boundaries
   18 Total Boundaries
```

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	49.02	2.40	49.30	3
2	2.40	49.30	4.80	49.00	3
3	4.80	49.00	12.40	46.36	3
4	12.40	46.36	21.30	42.22	3
5	21.30	42.22	44.52	53.32	3
6	44.52	53.32	44.53	62.32	2
7	44.53	62.32	44.54	68.32	1
8	44.54	68.32	54.13	68.32	1
9	54.13	68.32	90.46	71.03	1
10	44.53	62.32	54.13	62.32	2
11	54.13	62.32	54.14	68.32	1
12	44.52	53.32	44.53	48.61	3
13	44.53	48.61	54.14	48.61	3
14	54.14	48.61	54.15	62.32	3
15	54.15	62.32	61.03	62.32	3
16	61.03	62.32	65.42	64.24	3
17	65.42	64.24	90.46	65.03	3
18	.00	37.50	90.46	37.50	4

```
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
```

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	.0	.0	.00	.0	0
2	125.0	130.0	8000.0	.0	.00	.0	0
3	125.0	130.0	.0	28.0	.00	.0	0
4	130.0	130.0	.0	36.0	.00	.0	0

```
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1600 Trial Surfaces Have Been Generated.
  40 Surfaces Initiate From Each Of 40 Points Equally Spaced
Along The Ground Surface Between  X =  10.00 ft.
                                  and  X =  25.00 ft.
Each Surface Terminates Between   X =  65.00 ft.
                                  and  X =  80.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =   .00 ft.
15.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Examined.  They Are Ordered - Most Critical
      First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Failure Surface Specified By  6 Coordinate Points
        Point       X-Surf       Y-Surf
         No.         (ft)         (ft)
```

```
     1          21.54        42.33
     2          36.53        41.96
     3          50.93        46.19
     4          63.34        54.61
     5          72.58        66.43
     6          73.82        69.79
Circle Center At X =   30.2 ; Y =   90.0  and Radius,   48.5
      ***     1.132   ***
Failure Surface Specified By  5 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
     1         23.08        43.07
     2         38.05        42.10
     3         52.29        46.81
     4         63.74        56.50
     5         70.62        69.55
Circle Center At X =   33.0 ; Y =   81.2  and Radius,   39.4
      ***     1.140   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
     1         10.77        46.93
     2         24.33        40.51
     3         39.33        40.49
     4         52.90        46.88
     5         62.44        58.46
     6         65.15        69.14
Circle Center At X =   31.9 ; Y =   73.9  and Radius,   34.3
      ***     1.151   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
     1         22.69        42.89
     2         37.64        41.65
     3         51.94        46.17
     4         63.46        55.78
     5         70.48        69.03
     6         70.53        69.54
Circle Center At X =   33.3 ; Y =   80.2  and Radius,   38.8
      ***     1.158   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
     1         22.31        42.70
     2         37.28        41.85
     3         51.69        46.04
     4         63.87        54.79
     5         72.44        67.10
     6         73.17        69.74
Circle Center At X =   32.3 ; Y =   85.9  and Radius,   44.4
      ***     1.163   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
     1         21.54        42.33
     2         36.53        41.81
     3         50.85        46.28
     4         62.88        55.24
     5         71.26        67.68
     6         71.77        69.64
Circle Center At X =   30.6 ; Y =   86.0  and Radius,   44.6
      ***     1.163   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
     1         23.85        43.44
     2         38.83        42.71
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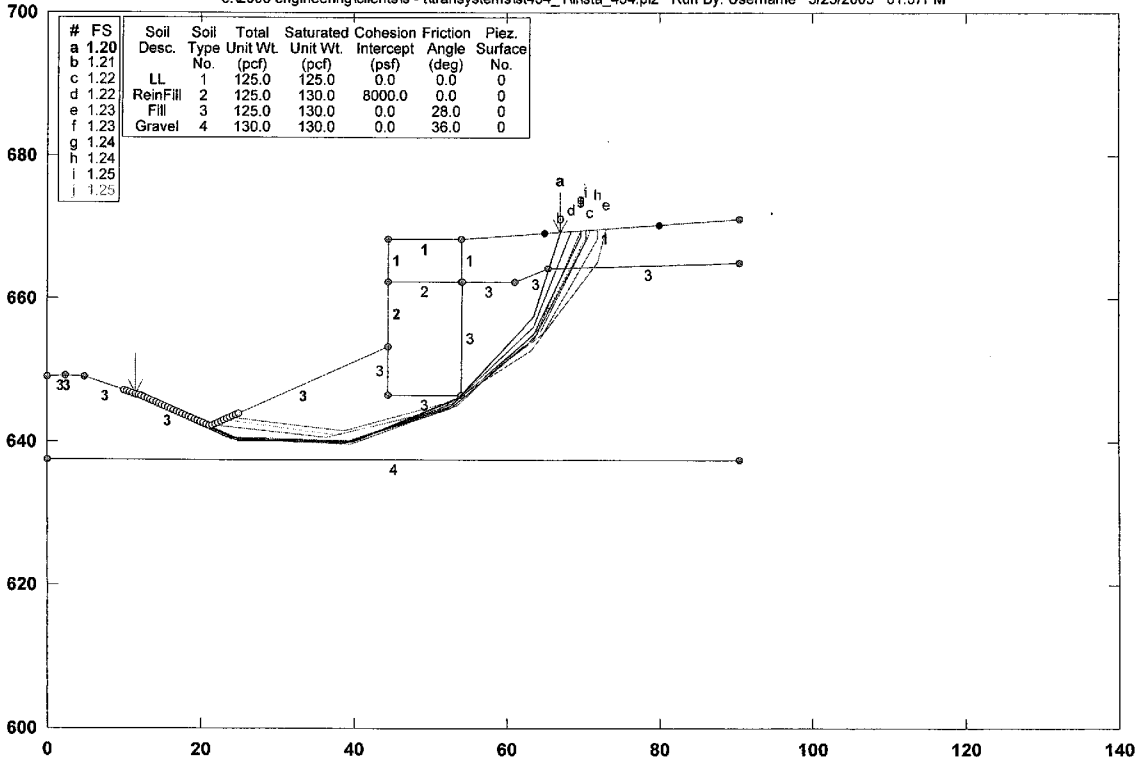
    3          53.15        47.16
    4          65.09        56.24
    5          73.20        68.86
    6          73.41        69.76
Circle Center At X =   33.4 ; Y =   85.5  and Radius,   43.2
      ***      1.164   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          10.39        47.06
    2          24.06        40.90
    3          39.06        40.62
    4          52.96        46.25
    5          63.52        56.91
    6          68.46        69.39
Circle Center At X =   32.3 ; Y =   77.4  and Radius,   37.4
      ***      1.165   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          21.54        42.33
    2          36.53        42.85
    3          50.99        46.83
    4          64.14        54.05
    5          75.25        64.13
    6          79.41        70.21
Circle Center At X =   26.8 ; Y =  106.3  and Radius,   64.2
      ***      1.168   ***
Failure Surface Specified By  5 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          24.62        43.81
    2          39.53        42.17
    3          53.49        47.64
    4          63.32        58.97
    5          65.73        69.19
Circle Center At X =   35.4 ; Y =   73.3  and Radius,   31.4
      ***      1.168   ***
```

Transystems - 15.71ft - Retaining Wall Station 454+00

e:\2005 engineering\clients\s - t\transystems\st454_1\ll\sta_454.pl2 Run By: Username 5/25/2005 01:37PM



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
LL	1	125.0	125.0	0.0	0.0	0
ReinFill	2	125.0	130.0	8000.0	0.0	0
Fill	3	125.0	130.0	0.0	28.0	0
Gravel	4	130.0	130.0	0.0	36.0	0

STABL6H FSmin=1.20

Safety Factors Are Calculated By The Modified Bishop Method

BOWSER MORNER®

COMMITTED TO EXCELLENCE SINCE 1911

** STABL6H **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 5/25/2005
Time of Run: 01:37PM
Run By: Username
Input Data Filename: E:sta_454.in
Output Filename: E:sta_454.OUT
Plotted Output Filename: E:sta_454.PLT
PROBLEM DESCRIPTION Transystems - 15.71ft - Retaining Wall
Station 454+00

BOUNDARY COORDINATES
Note: User origin value specified.
Add 0.00 to X-values and 600.00 to Y-values listed.

9 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	49.02	2.40	49.30	3
2	2.40	49.30	4.80	49.00	3
3	4.80	49.00	12.40	46.36	3
4	12.40	46.36	21.30	42.22	3
5	21.30	42.22	44.52	53.32	3
6	44.52	53.32	44.53	62.32	2
7	44.53	62.32	44.54	68.32	1
8	44.54	68.32	54.13	68.32	1
9	54.13	68.32	90.46	71.03	1
10	44.53	62.32	54.13	62.32	2
11	54.13	62.32	54.14	68.32	1
12	44.52	53.32	44.53	46.61	3
13	44.53	46.61	54.14	46.61	3
14	54.14	46.61	54.15	62.32	3
15	54.15	62.32	61.03	62.32	3
16	61.03	62.32	65.42	64.24	3
17	65.42	64.24	90.46	65.03	3
18	.00	37.50	90.46	37.50	4

ISOTROPIC SOIL PARAMETERS
4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	.0	.0	.00	.0	0
2	125.0	130.0	8000.0	.0	.00	.0	0
3	125.0	130.0	.0	28.0	.00	.0	0
4	130.0	130.0	.0	36.0	.00	.0	0

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1600 Trial Surfaces Have Been Generated.
40 Surfaces Initiate From Each Of 40 Points Equally Spaced
Along The Ground Surface Between X = 10.00 ft.
and X = 25.00 ft.
Each Surface Terminates Between X = 65.00 ft.
and X = 80.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = .00 ft.
15.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

```
    1          11.54        46.66
    2          25.07        40.18
    3          40.07        39.99
    4          53.75        46.12
    5          63.59        57.45
    6          67.01        69.28
Circle Center At X =   33.0 ; Y =   74.1  and Radius,   34.8
     ***     1.204   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          11.54        46.66
    2          25.10        40.24
    3          40.10        40.09
    4          53.78        46.23
    5          63.63        57.55
    6          67.06        69.28
Circle Center At X =   32.9 ; Y =   74.3  and Radius,   35.0
     ***     1.206   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          10.77        46.93
    2          24.41        40.69
    3          39.40        40.13
    4          53.47        45.32
    5          64.50        55.49
    6          70.81        69.10
    7          70.83        69.57
Circle Center At X =   33.3 ; Y =   78.2  and Radius,   38.6
     ***     1.218   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          10.77        46.93
    2          24.25        40.36
    3          39.24        39.82
    4          53.16        45.42
    5          63.61        56.17
    6          68.48        69.39
Circle Center At X =   33.0 ; Y =   75.4  and Radius,   36.2
     ***     1.221   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          21.54        42.33
    2          36.45        40.67
    3          50.99        44.34
    4          63.32        52.88
    5          71.87        65.21
    6          73.01        69.73
Circle Center At X =   33.6 ; Y =   82.6  and Radius,   42.1
     ***     1.227   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          11.15        46.79
    2          24.68        40.31
    3          39.67        39.76
    4          53.63        45.23
    5          64.26        55.82
    6          69.65        69.48
Circle Center At X =   33.5 ; Y =   76.0  and Radius,   36.8
     ***     1.234   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
```

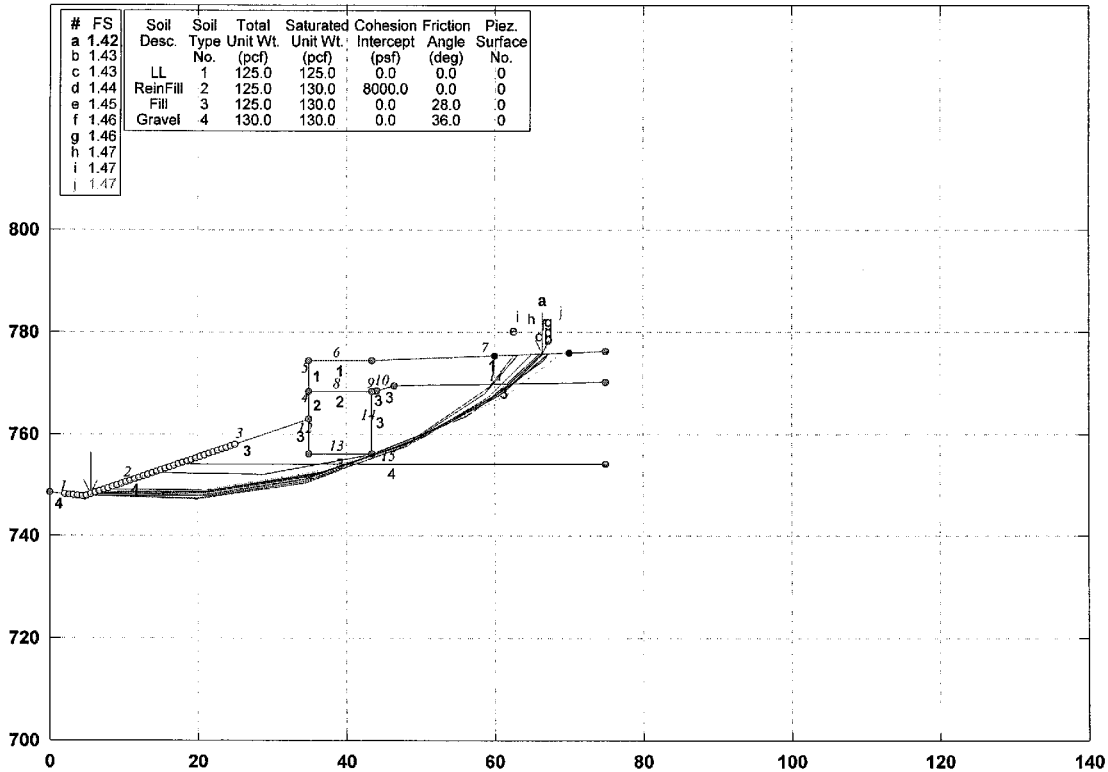
```
    1          10.00        47.19
    2          23.46        40.57
    3          38.44        39.74
    4          52.55        44.82
    5          63.55        55.02
    6          69.68        68.71
    7          69.70        69.48
Circle Center At X =   33.0 ; Y =   76.9  and Radius,   37.6
      ***      1.235   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          23.85        43.44
    2          38.73        41.60
    3          53.15        45.73
    4          64.81        55.17
    5          71.84        68.42
    6          71.94        69.65
Circle Center At X =   35.8 ; Y =   79.1  and Radius,   37.6
      ***      1.240   ***
Failure Surface Specified By  7 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          10.00        47.19
    2          23.47        40.60
    3          38.45        39.70
    4          52.62        44.62
    5          63.81        54.61
    6          70.29        68.13
    7          70.37        69.53
Circle Center At X =   33.2 ; Y =   77.6  and Radius,   38.3
      ***      1.245   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          23.08        43.07
    2          37.91        40.87
    3          52.33        45.00
    4          63.75        54.73
    5          70.12        68.31
    6          70.14        69.51
Circle Center At X =   35.6 ; Y =   76.2  and Radius,   35.4
      ***      1.246   ***
```

Transystems - 12.3 ft - Retaining Wall Station 461+77.19

e:\2005 engineering\clients\s - t\transystems\st461+77.19\sta_461_.pl2 Run By: Username 5/25/2005 02:09PM

#	FS
a	1.42
b	1.43
c	1.43
d	1.44
e	1.45
f	1.46
g	1.46
h	1.47
i	1.47
j	1.47

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
LL	1	125.0	125.0	0.0	0.0	0
ReinFill	2	125.0	130.0	8000.0	0.0	0
Fill	3	125.0	130.0	0.0	28.0	0
Gravel	4	130.0	130.0	0.0	36.0	0



STABL6H FSmin=1.42

Safety Factors Are Calculated By The Modified Bishop Method

BOWSER MORNER®

COMMITTED TO EXCELLENCE SINCE 1911

```
                    ** STABL6H  **
                         by
                  Purdue University
            --Slope Stability Analysis--
        Simplified Janbu, Simplified Bishop
           or Spencer`s Method of Slices
Run Date:                    5/25/2005
Time of Run:                 02:09PM
Run By:                      Username
Input Data Filename:         E:sta_461_.in
Output Filename:             E:sta_461_.OUT
Plotted Output Filename:     E:sta_461_.PLT
PROBLEM DESCRIPTION   Transystems - 12.3 ft - Retaining Wall
                      Station 461+77.19
BOUNDARY COORDINATES
     Note: User origin value specified.
     Add 0.00 to X-values and 700.00 to Y-values listed.

    7 Top   Boundaries
   15 Total Boundaries
Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
    1          .00      48.60       4.64      47.80        4
    2         4.64      47.80      17.20      54.10        4
    3        17.20      54.10      34.84      62.95        3
    4        34.84      62.95      34.85      68.37        2
    5        34.85      68.37      34.86      74.37        1
    6        34.86      74.37      43.45      74.37        1
    7        43.45      74.37      74.90      76.19        1
    8        34.84      68.37      43.45      68.37        2
    9        43.45      68.37      44.06      68.58        3
   10        44.06      68.58      46.47      69.56        3
   11        46.47      69.56      74.90      70.19        3
   12        34.84      62.95      34.85      56.07        3
   13        34.85      56.07      43.45      56.07        3
   14        43.45      56.07      43.46      68.37        3
   15        17.20      54.10      74.90      54.10        4
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt.  Intercept  Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)      (psf)    (deg)   Param.    (psf)    No.
  1   125.0    125.0        .0       .0     .00        .0      0
  2   125.0    130.0     8000.0      .0     .00        .0      0
  3   125.0    130.0        .0     28.0     .00        .0      0
  4   130.0    130.0        .0     36.0     .00        .0      0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
1600 Trial Surfaces Have Been Generated.
  40 Surfaces Initiate From Each Of 40 Points Equally Spaced
Along The Ground Surface Between  X =   2.00 ft.
                              and  X =  25.00 ft.
Each Surface Terminates Between   X =  60.00 ft.
                              and  X =  70.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =    .00 ft.
15.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Examined.  They Are Ordered - Most Critical
      First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Failure Surface Specified By  6 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1         5.54       48.25
          2        20.54       48.40
          3        35.13       51.87
```

```
    4          48.60        58.48
    5          60.27        67.90
    6          66.43        75.70
Circle Center At X =   12.4 ; Y =  115.3  and Radius,   67.4
      ***      1.420   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           5.54        48.25
    2          20.54        48.42
    3          35.14        51.84
    4          48.67        58.32
    5          60.47        67.58
    6          67.18        75.74
Circle Center At X =   12.2 ; Y =  116.9  and Radius,   69.0
      ***      1.431   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           4.95        47.96
    2          19.95        47.92
    3          34.56        51.30
    4          48.02        57.93
    5          59.62        67.44
    6          65.92        75.67
Circle Center At X =   12.6 ; Y =  112.9  and Radius,   65.4
      ***      1.432   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           6.13        48.55
    2          21.13        48.73
    3          35.73        52.16
    4          49.23        58.70
    5          60.99        68.01
    6          67.27        75.75
Circle Center At X =   12.8 ; Y =  116.8  and Radius,   68.5
      ***      1.437   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           6.13        48.55
    2          21.12        47.91
    3          35.70        51.42
    4          48.76        58.79
    5          59.30        69.47
    6          62.59        75.48
Circle Center At X =   15.9 ; Y =  101.8  and Radius,   54.1
      ***      1.447   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           7.31        49.14
    2          22.31        49.13
    3          36.90        52.62
    4          50.28        59.40
    5          61.71        69.10
    6          66.55        75.71
Circle Center At X =   14.8 ; Y =  112.7  and Radius,   64.0
      ***      1.456   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1          13.80        52.39
    2          28.79        52.11
    3          43.30        55.94
    4          56.20        63.58
```

```
    5          66.53        74.46
    6          67.21        75.74
Circle Center At X =   22.3 ; Y =  106.1  and Radius,   54.4
     ***      1.457   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           4.95        47.96
    2          19.94        47.47
    3          34.58        50.73
    4          47.96        57.52
    5          59.23        67.42
    6          64.81        75.61
Circle Center At X =   14.4 ; Y =  107.1  and Radius,   59.9
     ***      1.465   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           4.95        47.96
    2          19.93        47.21
    3          34.56        50.50
    4          47.78        57.60
    5          58.60        67.99
    6          63.05        75.50
Circle Center At X =   15.2 ; Y =  102.4  and Radius,   55.4
     ***      1.465   ***
Failure Surface Specified By  6 Coordinate Points
  Point       X-Surf       Y-Surf
   No.         (ft)         (ft)
    1           6.13        48.55
    2          21.12        49.09
    3          35.71        52.57
    4          49.33        58.85
    5          61.46        67.68
    6          68.97        75.85
Circle Center At X =   10.9 ; Y =  124.4  and Radius,   76.0
     ***      1.469   ***
         Y            A     X     I     S            F     T
           .00     16.76     33.52     50.29     67.05     83.81
X       .00 +---------+---------+---------*+---------+---------+
            -                              .
            -                              *
            -                              6.
            -                               ..
            -                        ...     7.
      16.76 +                        ....     *
            -                         ....81....
            -                          ....4.....
            -                           ..........
            -                            ....7....
            -                      ................
A     33.52 +                       ........83.*... *  *  *
            -                        ........1......
            -                          ..............
            -                          .......7......
            -                         .........*...... *  *
            -                        ...........81.....*
X     50.29 +                        .. ........4......
            -                            ...............
            -                              .........7.....
            -                              ...........35....
            -                               ..........21...5
            -                                   ...........8
I     67.05 +                                     ........71
            -                                        .......0
            -                                 *          *  *
S     83.81 +
```

```
     100.57 +
F    117.33 +
T    134.10 +
```

SECTION III

RESULT OF L-PILE ANALYSES

BOWSER MORNER®

BOWSER MORNER®

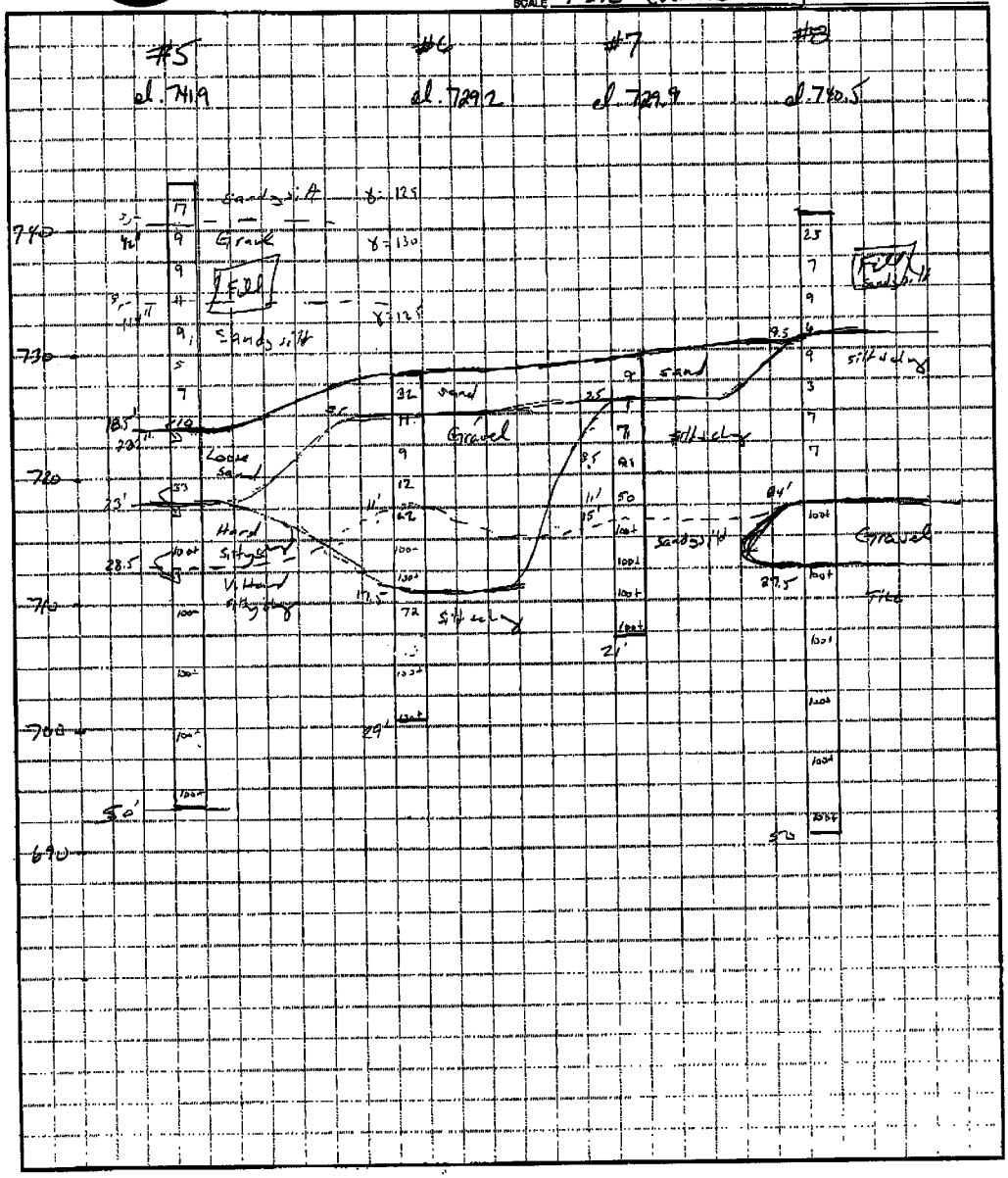
JOB 13160 1

SHEET NO. 1 OF

CALCULATED BY TAC DATE 5-4-05

CHECKED BY DATE

SCALE 1" = 10' (vertical scale)



BOWSER MORNER®

JOB 15100

SHEET NO. 2 OF

CALCULATED BY TAK DATE 5-4-05

CHECKED BY DATE

SCALE

Pile $\phi = 60''$

$$I = \frac{\pi D^4}{64} = \frac{\pi (60)^4}{64}$$

$$\boxed{I = 636{,}173 \text{ in}^4}$$

$$A = \frac{\pi D^2}{4} = \frac{\pi (60)^2}{4} = 2827 \text{ in}^2$$

$$\boxed{A = 2827 \text{ in}^2}$$

Modulus of Elasticity = 3.75×10^6 psi

LOADING CONDITIONS

Cyclic Loading due to live loads

Case I (pier #2): Axial load = 1060 kips
M = 410 k-ft = 4920 k-in
lateral load = 216 K

Case II (pier 4): Axial load = 1035 K
M = 1110 k-ft = 13,320 k-in
lateral load = 39 K

BOWSER MORNER®

JOB 131651
SHEET NO. 3 OF
CALCULATED BY TAC DATE 5-4-05
CHECKED BY DATE
SCALE

Pile top is "0"
Pile tip is 78" below ground surface

Boring #5

-78" 0

Fill Sandy silt $\gamma = 125$ pcf $= 0.072$ pci
$C_u = 500$ psf $= 3.5$ psi

-36" 3.5' (42")

Fill Gravel $N = 10$ Say $\phi = 28°$
$\gamma = 130 = 0.075$ pci

36" 9.5' (114")

Fill Sandy silt same as above

144" 18.5' (222")

Loose Sand $\phi = 28°$
$\gamma = 125 = 0.072$

198" 23' (276")

Clay $C_u = 3000 = 21$ psi
$\gamma = 135 = 0.078$

204" 26.5' (312")

Clay $C_u = 7000 = 49$ psi
$\gamma = 0.078$

522" 50' (600")

Boring #7

-78" 0

Loose Sand $N = 9$ $\phi = 28$ $\gamma = 0.072$

-36" 3.5' (42")

Clay $C_u = 1000$ $\gamma = 0.075$

24" 8.5' (102")

Clay $C_u = 2000$ $\gamma = 0.075$

54" 11' (132")

Clay $C_u = 3000$ $\gamma = 0.078$

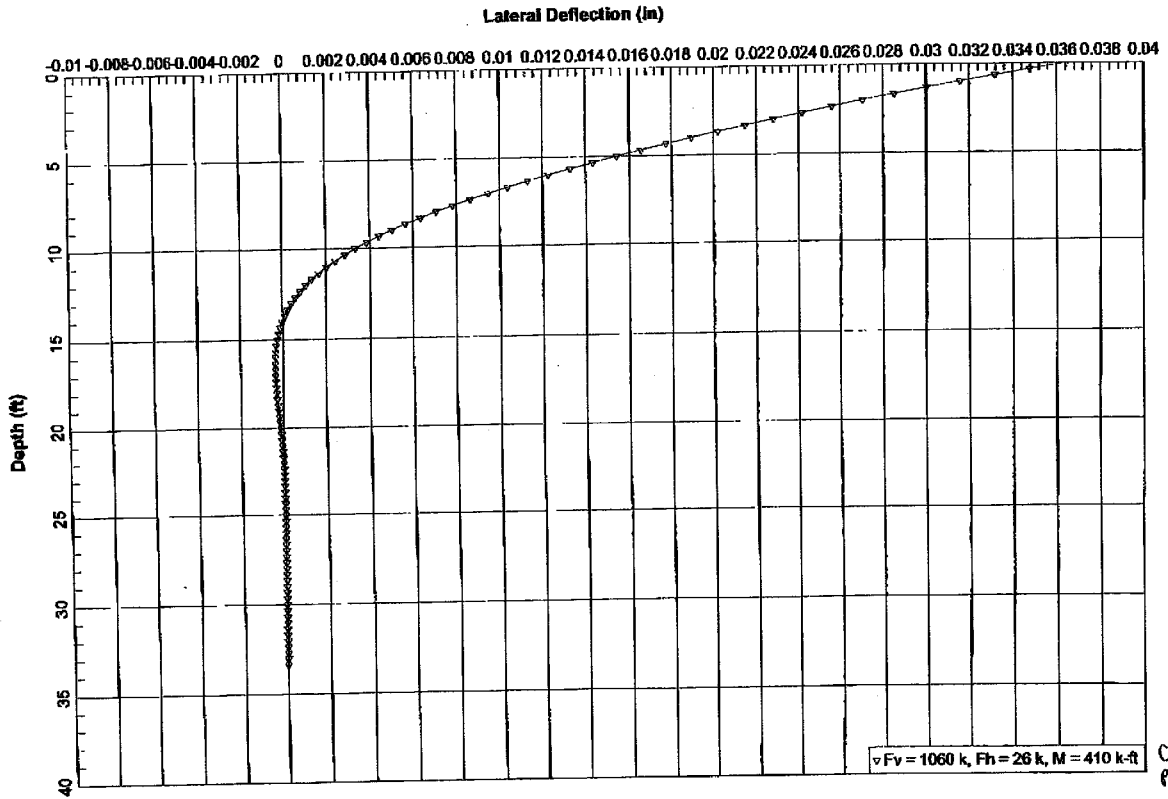
102" 15' (180")

Clay $C_u = 7000$ $\gamma = 0.078$

174" 21' (252")

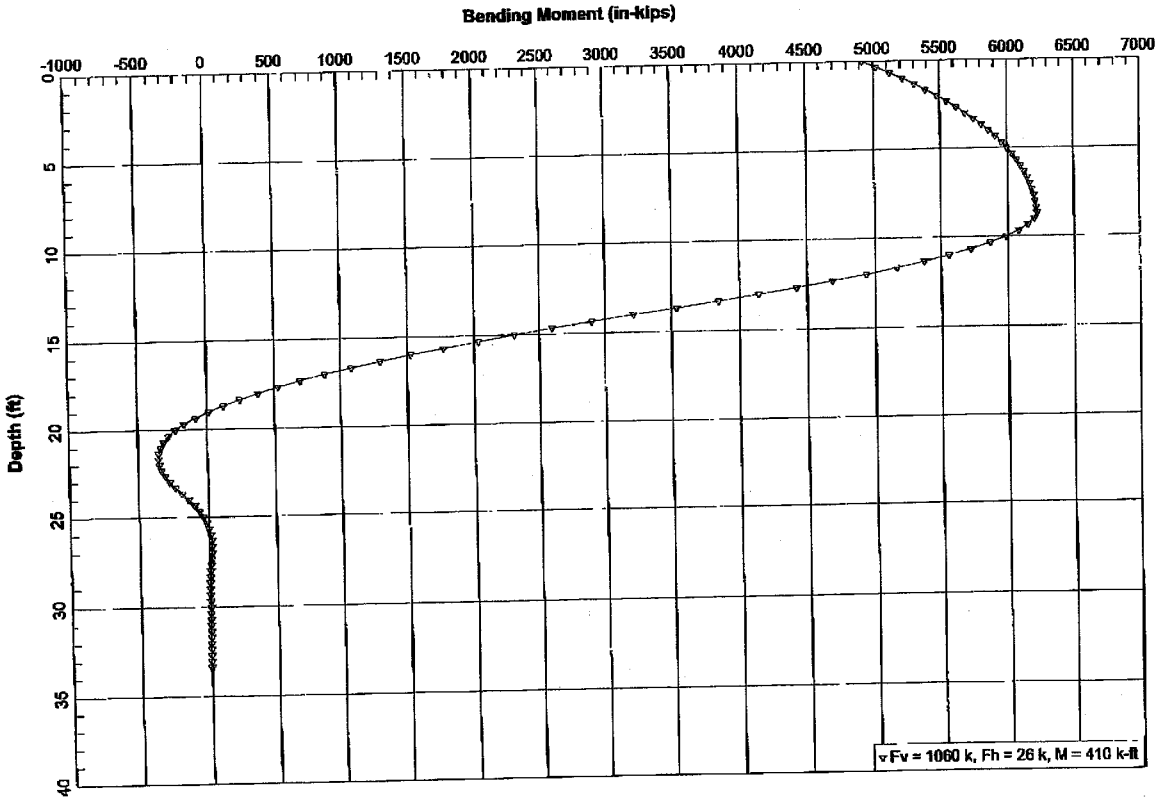
Assume material below this depth is all 100+ blows Clay.

L_{min} = 20'

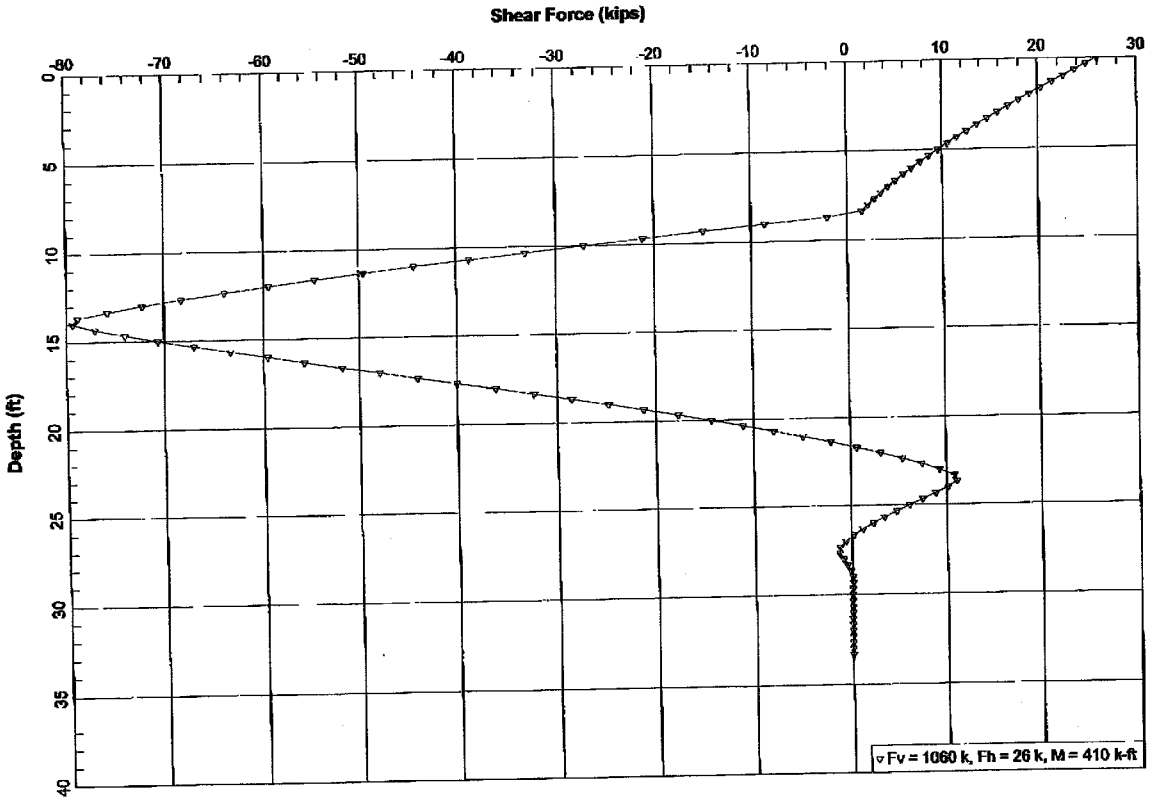


Core I
pier 2

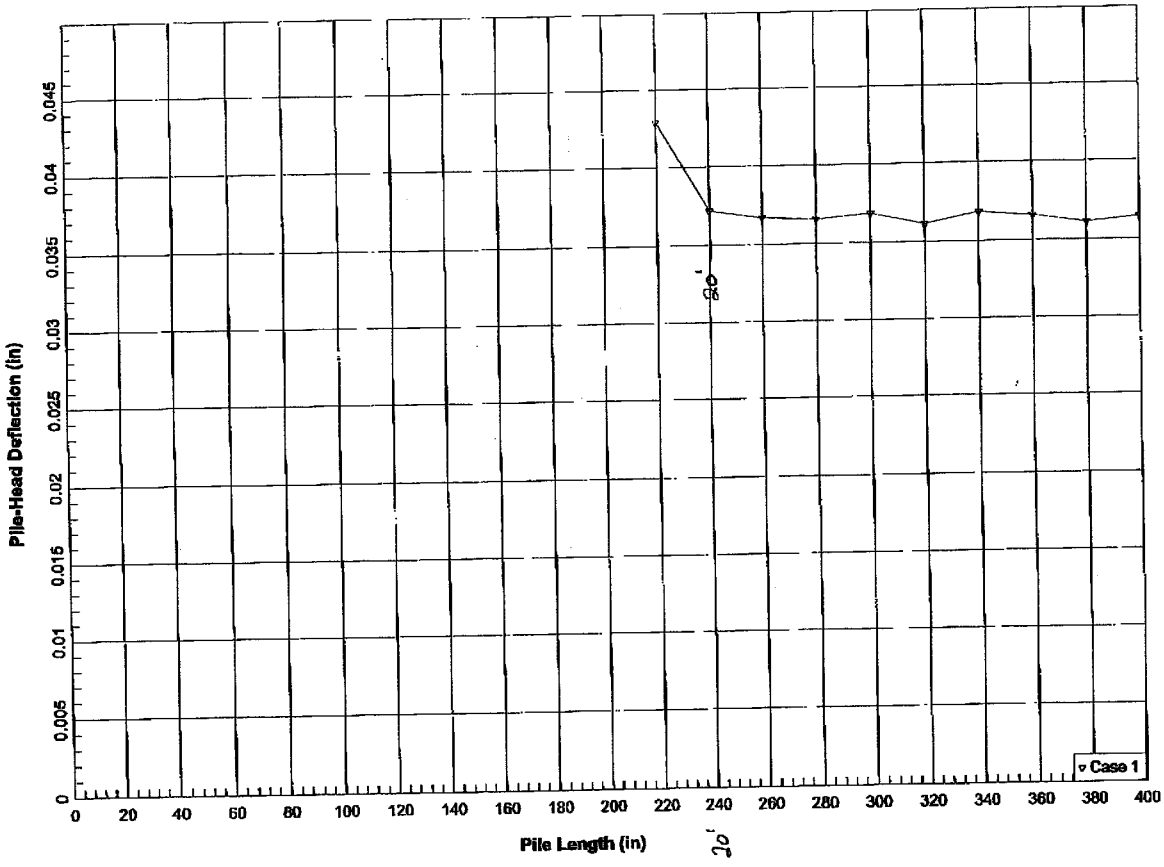
Based on Boring 7



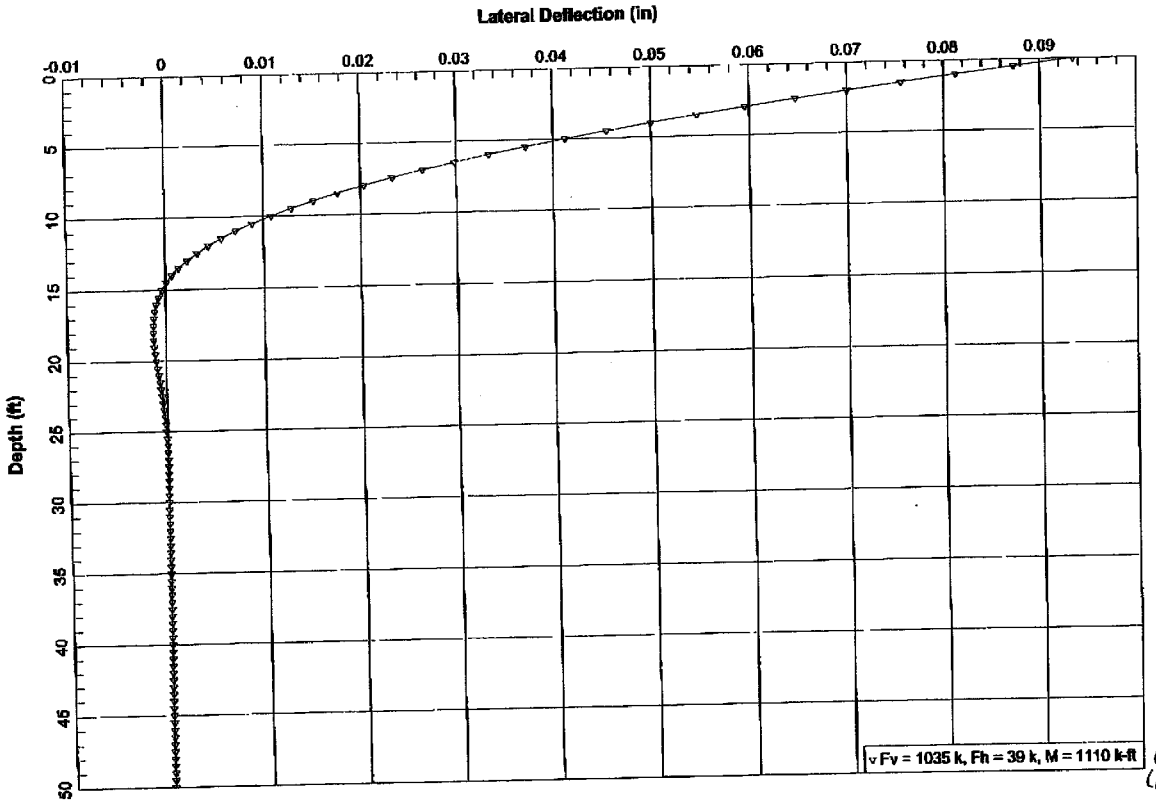
Based on Boring 7



Based on Boring 7

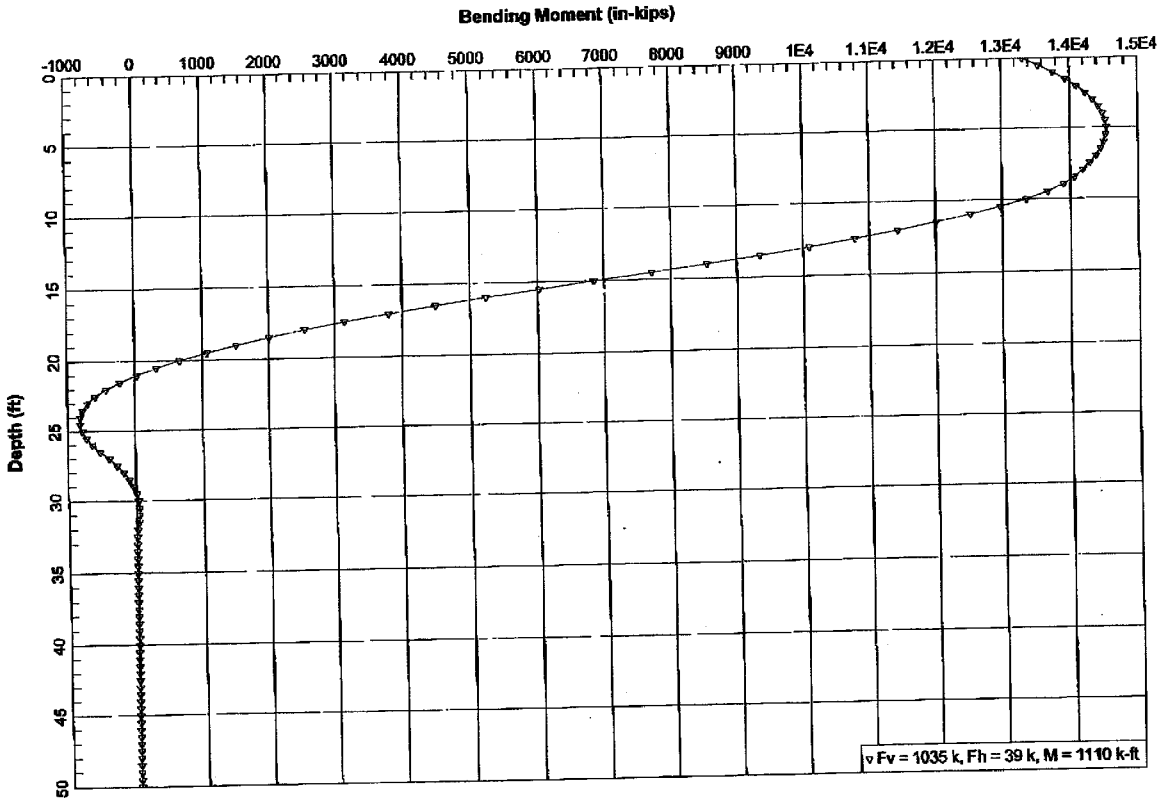

Pile-Head Deflection (in)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
Pile Length (in)
Case 1

Lmin = 23'

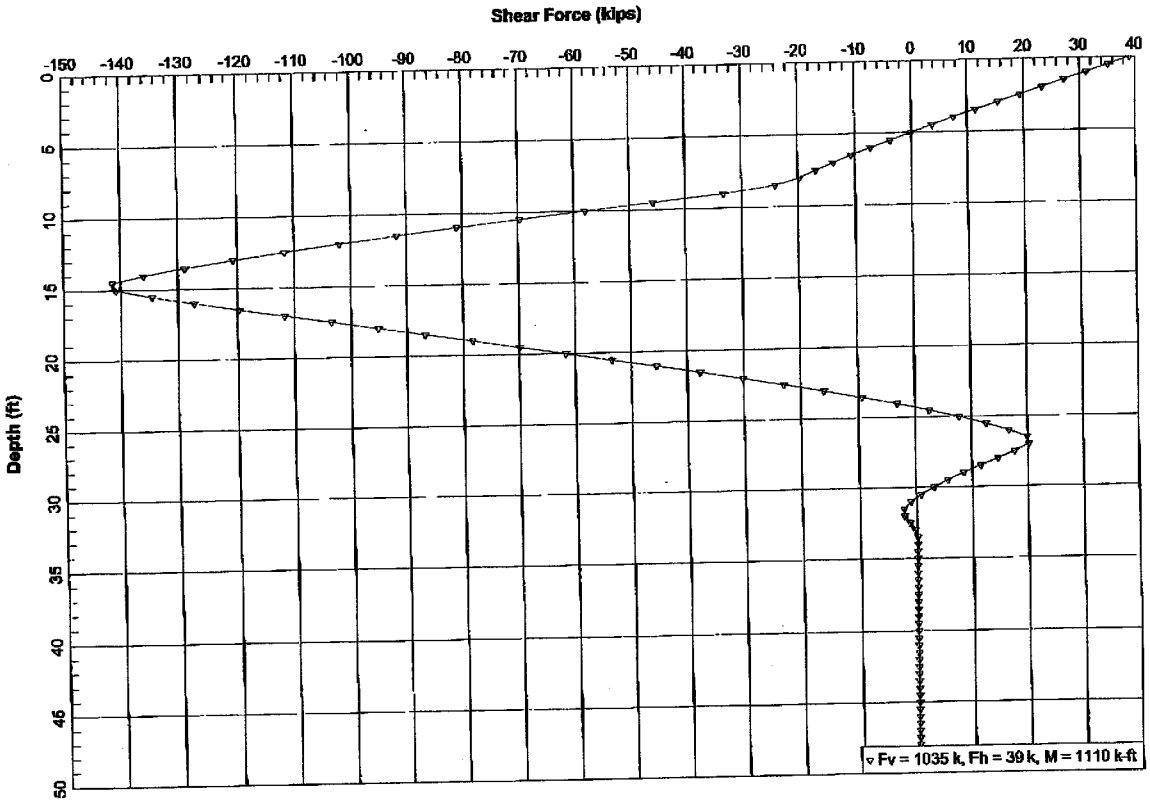


Case II (pier 4)

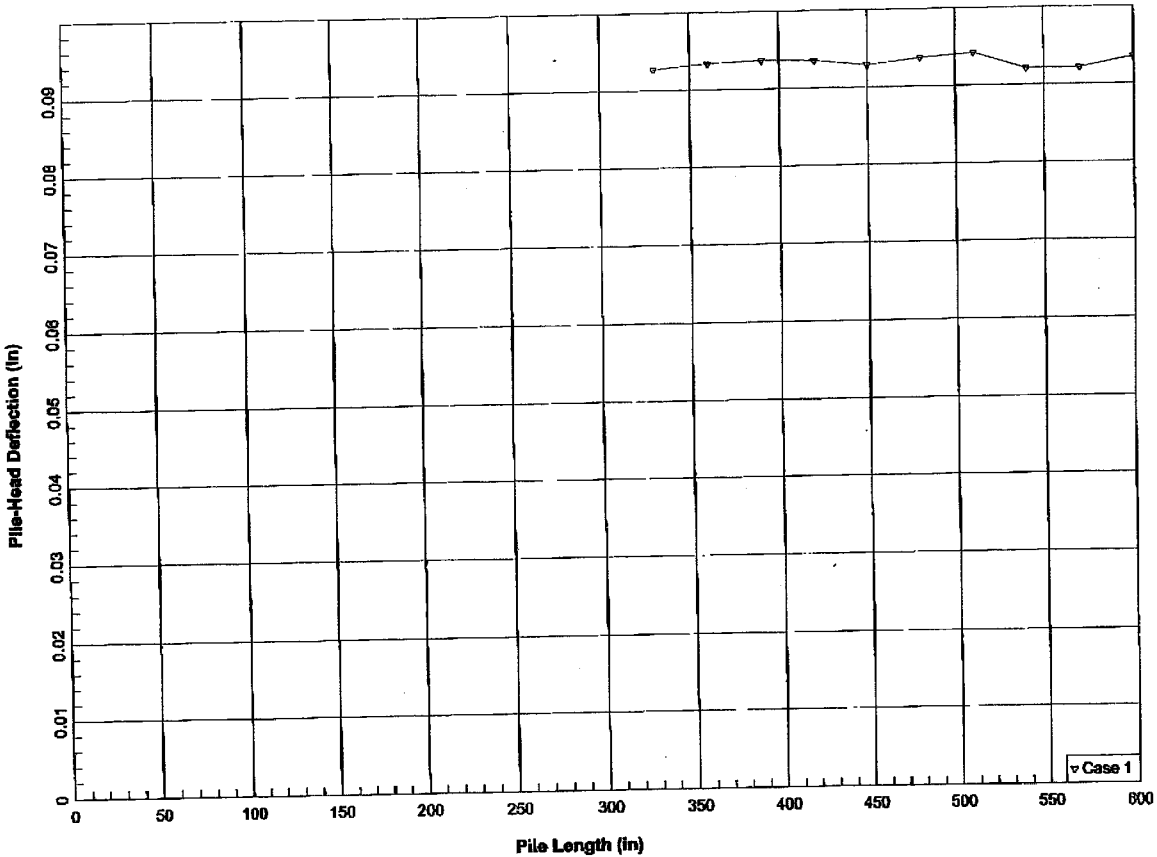
Based on Boring 7

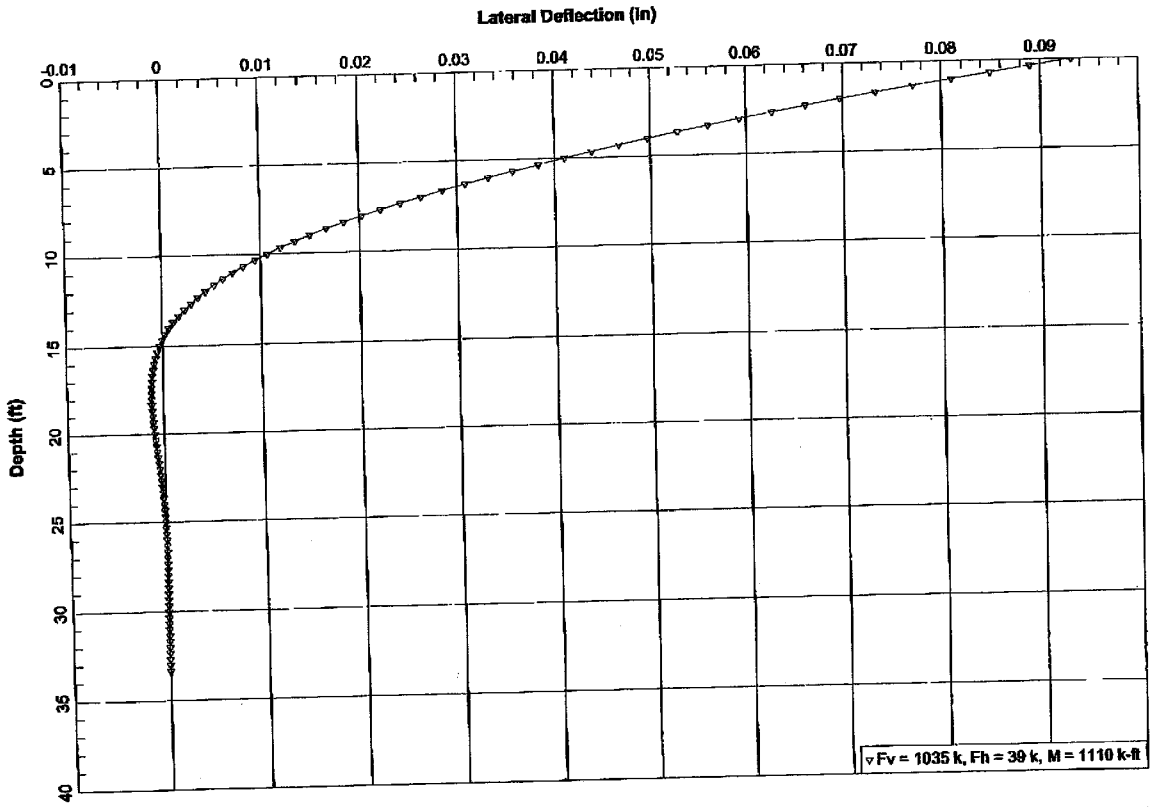


Based on Boring 7

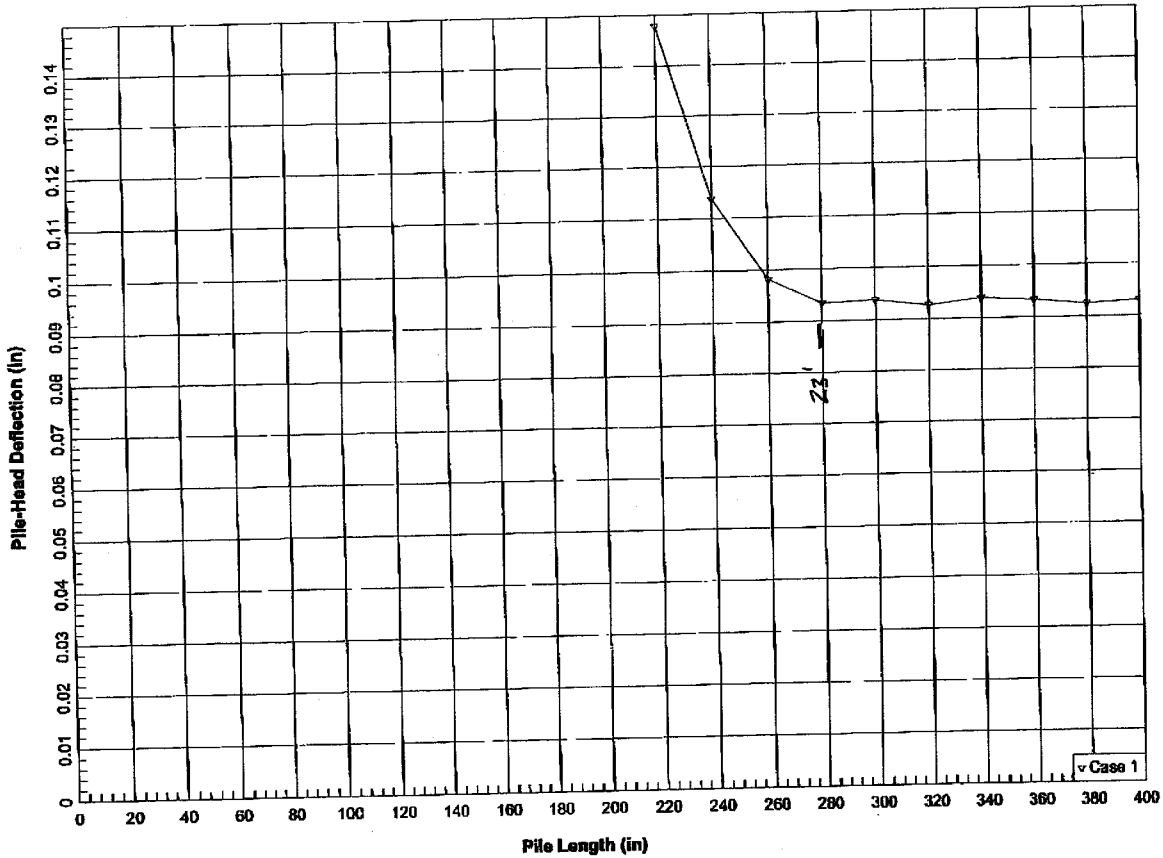


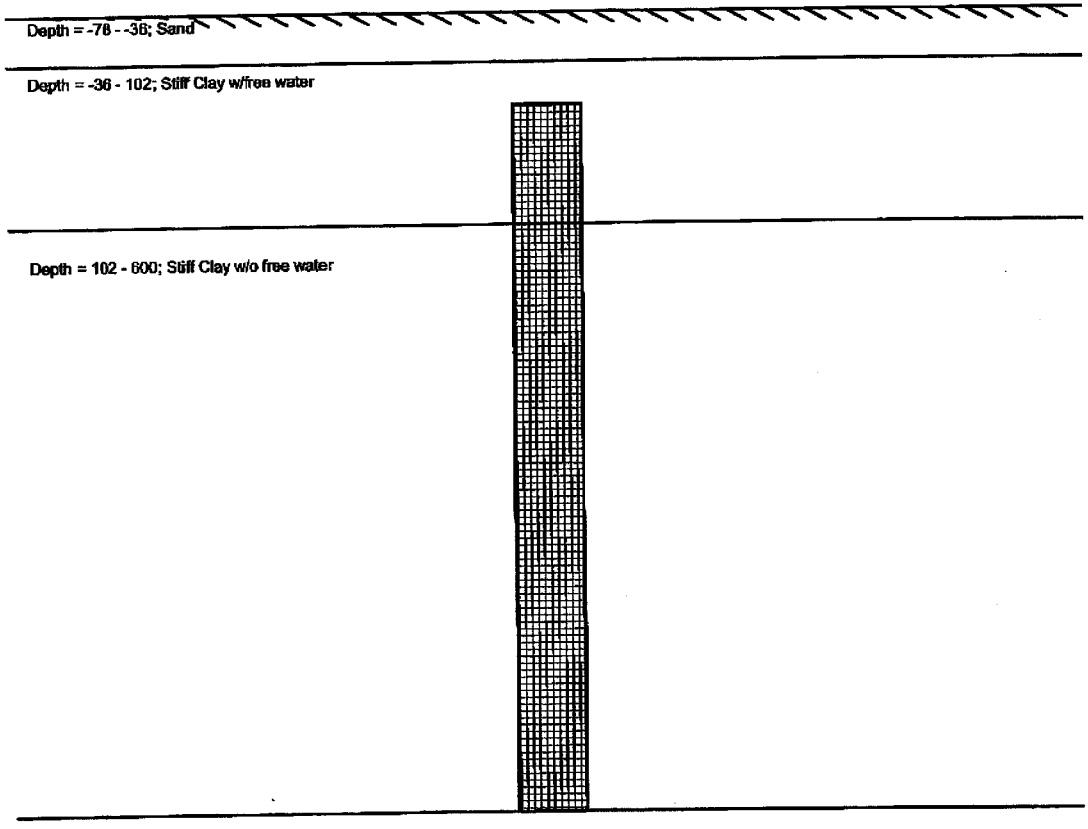
Based on Boring 7


Pile-Head Deflection (in)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0
50
100
150
200
250
300
350
400
450
500
550
600
Pile Length (in)
Case 1

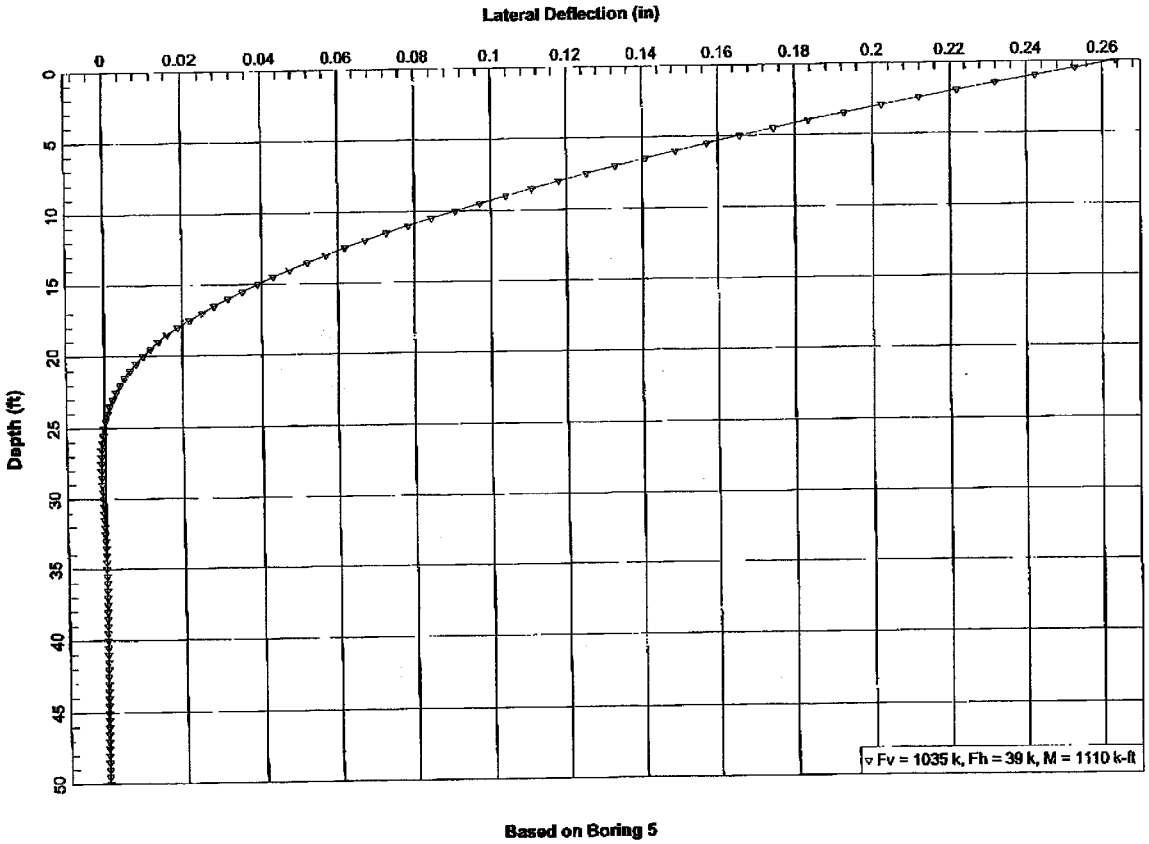


Based on Boring 7 - Length = 400 in.

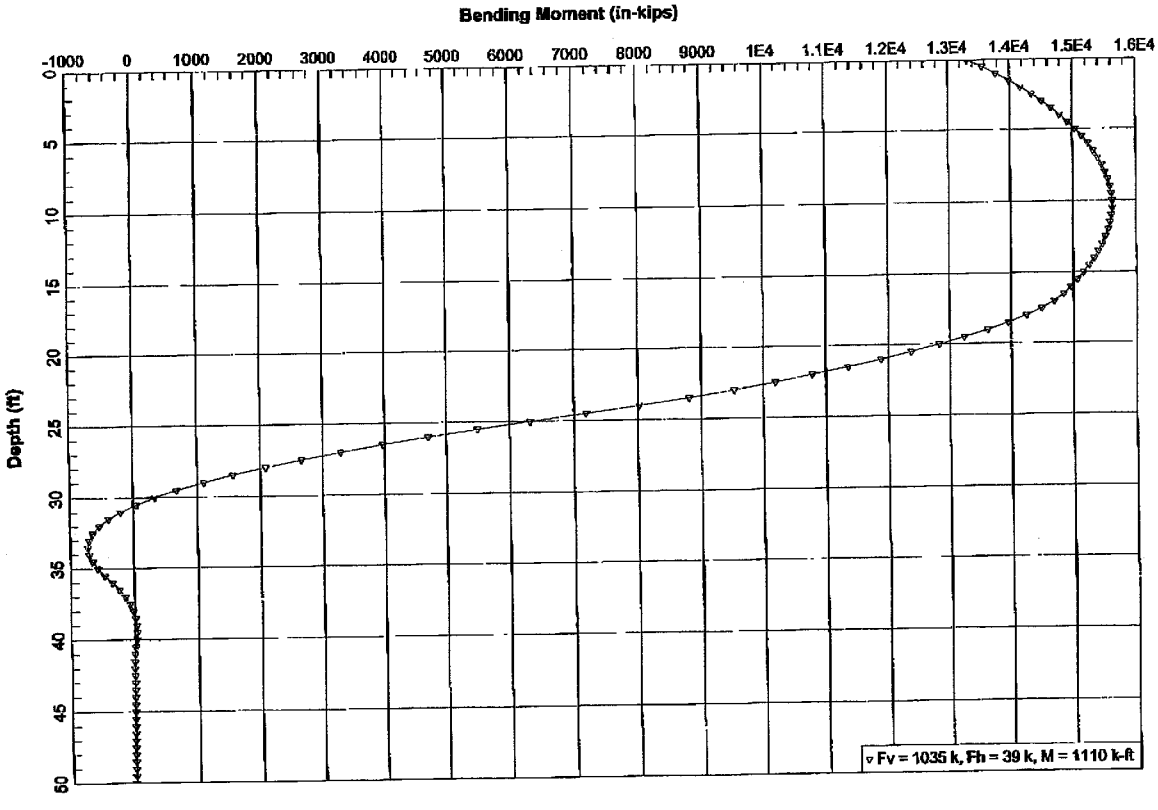

Pile-Head Deflection (in)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
Pile Length (in)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
Case 1
23'


Depth = -78 - -36; Sand
Depth = -36 - 102; Stiff Clay w/free water
Depth = 102 - 600; Stiff Clay w/o free water

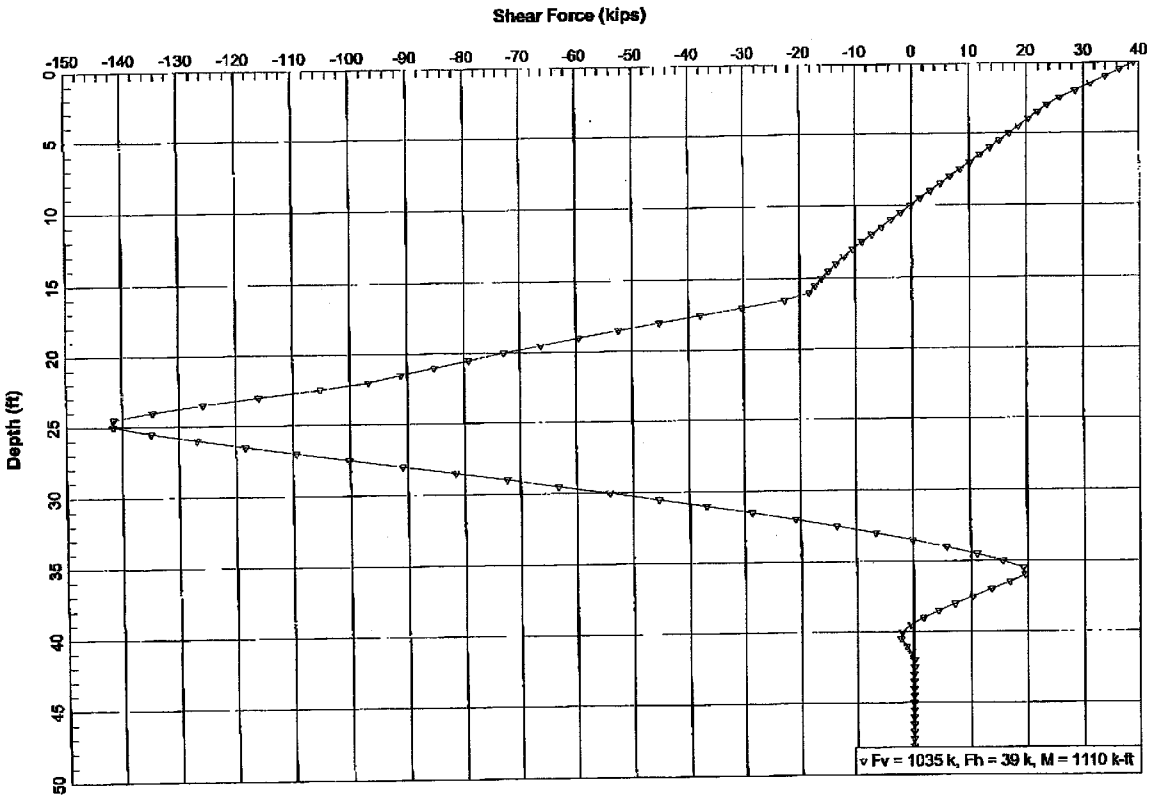
$L_{min} = 33'$



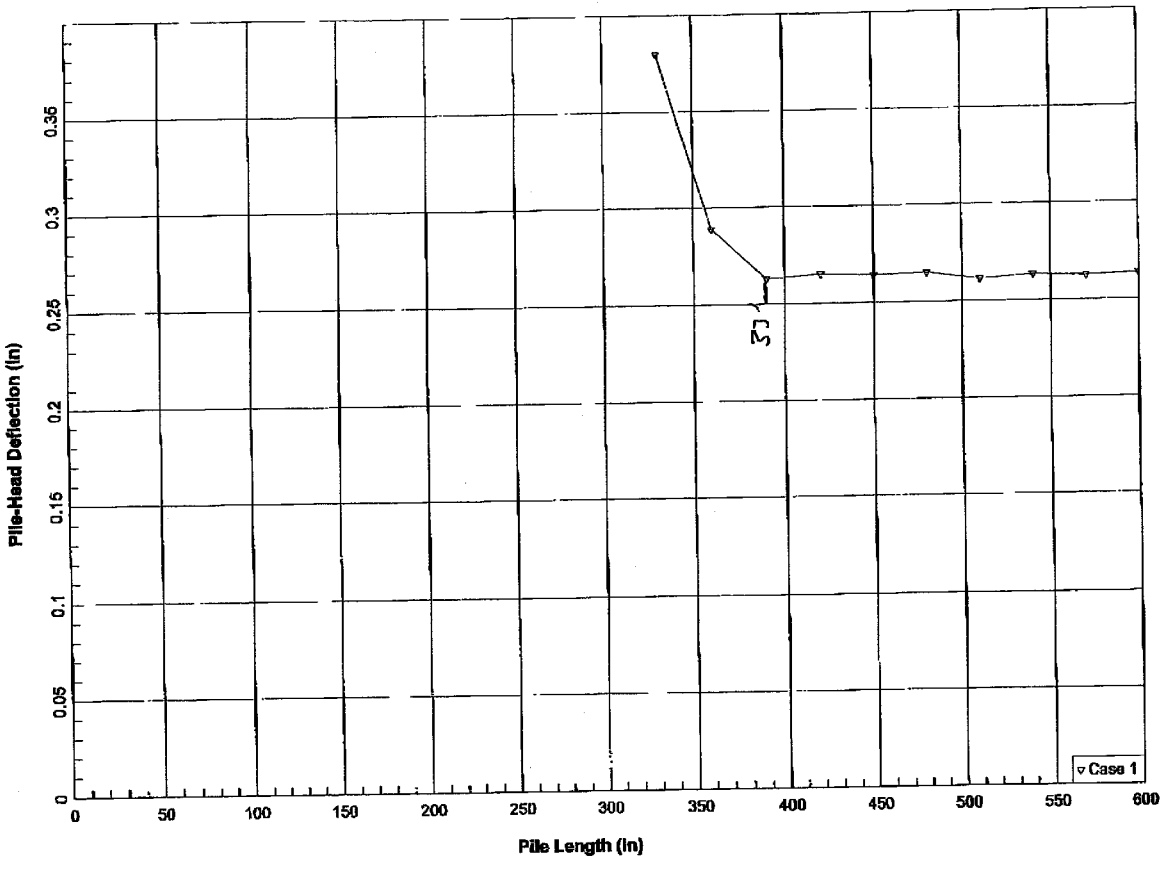
Case II
pier 4



Based on Boring 5

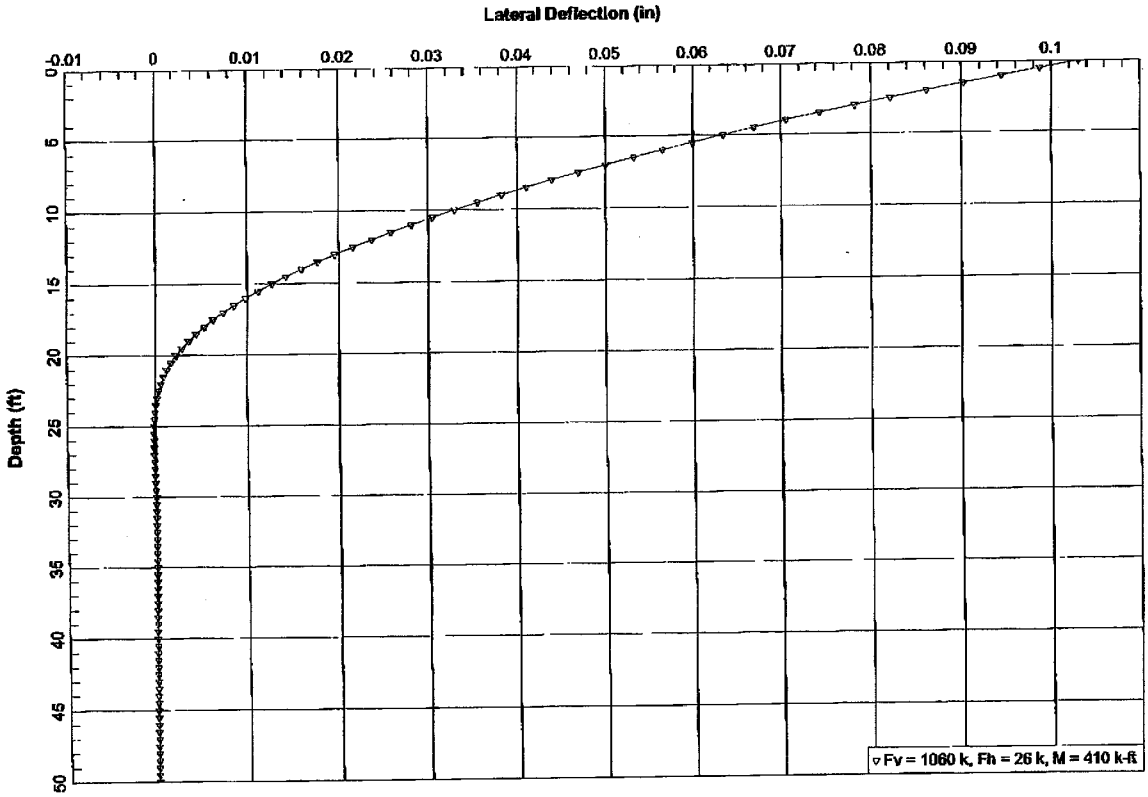


Based on Boring 5


Pile-Head Deflection (in)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Pile Length (in)
0
50
100
150
200
250
300
350
400
450
500
550
600
Case 1

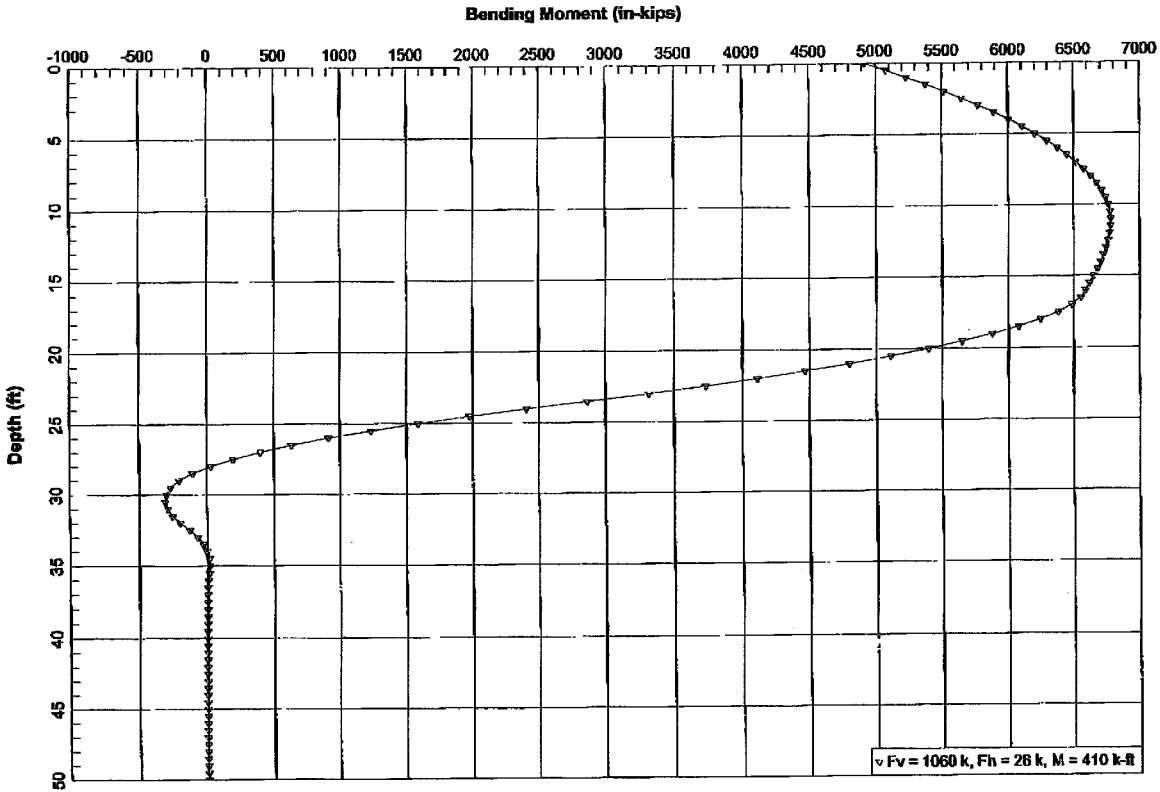
Depth = -78 - -36; Soft Clay	
Depth = -36 - 36; Sand	
Depth = 36 - 144; Soft Clay	
Depth = 144 - 198; Sand	
Depth = 198 - 264; Stiff Clay w/o free water	
Depth = 264 - 600; Stiff Clay w/o free water	

30'

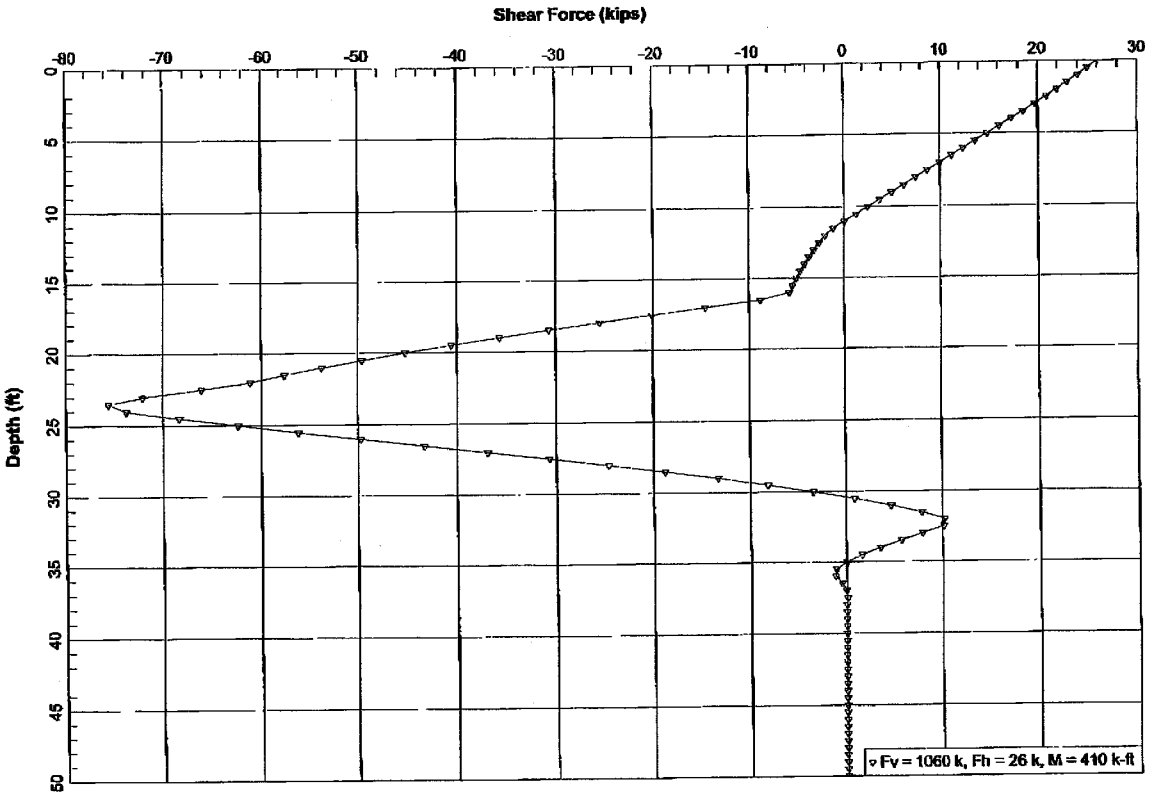


Case I
pier 2

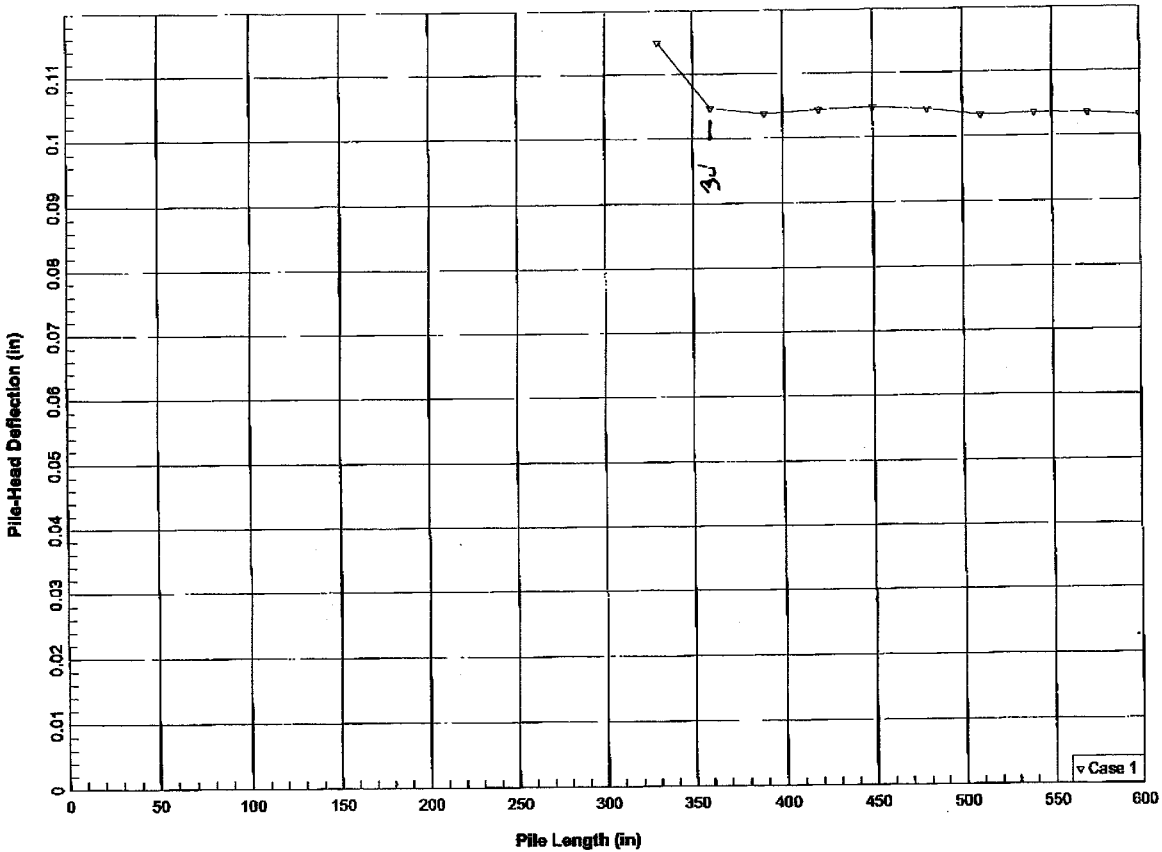
Based on Boring 5



Based on Boring 5

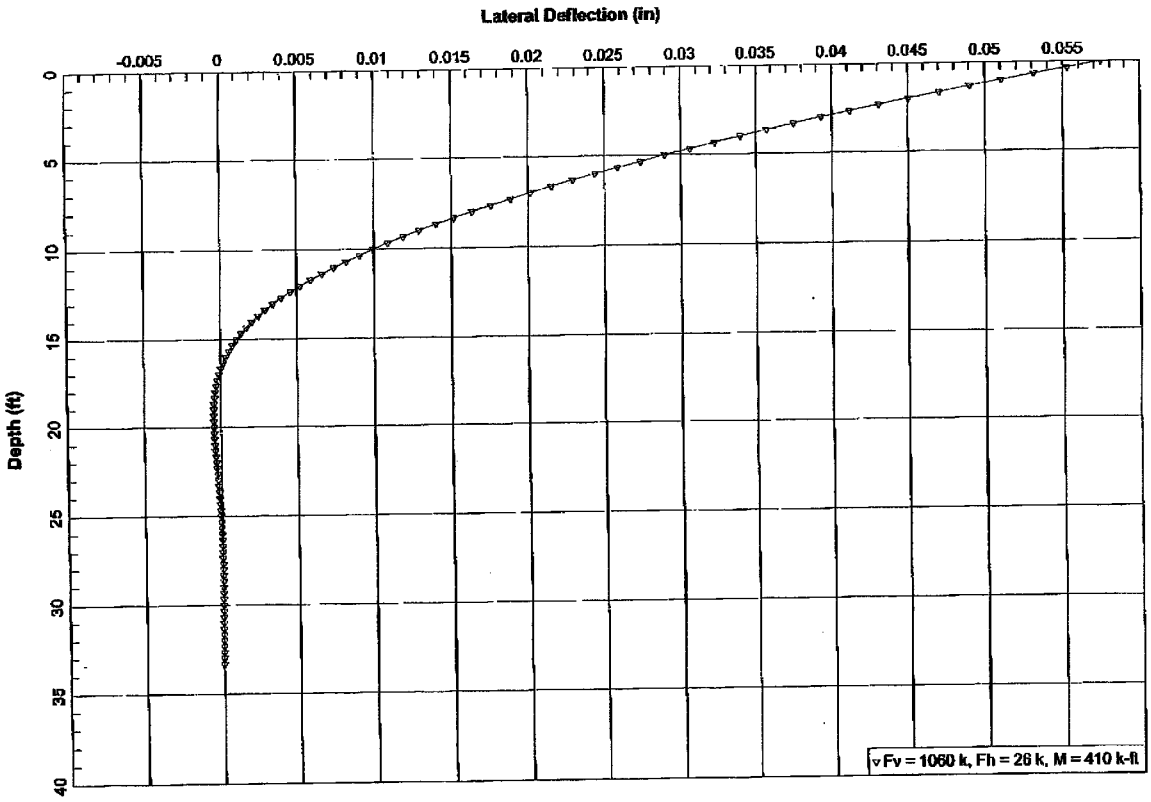


Based on Boring 5


Pile-Head Deflection (in)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
Pile Length (in)
0
50
100
150
200
250
300
350
400
450
500
550
600
Case 1
3"

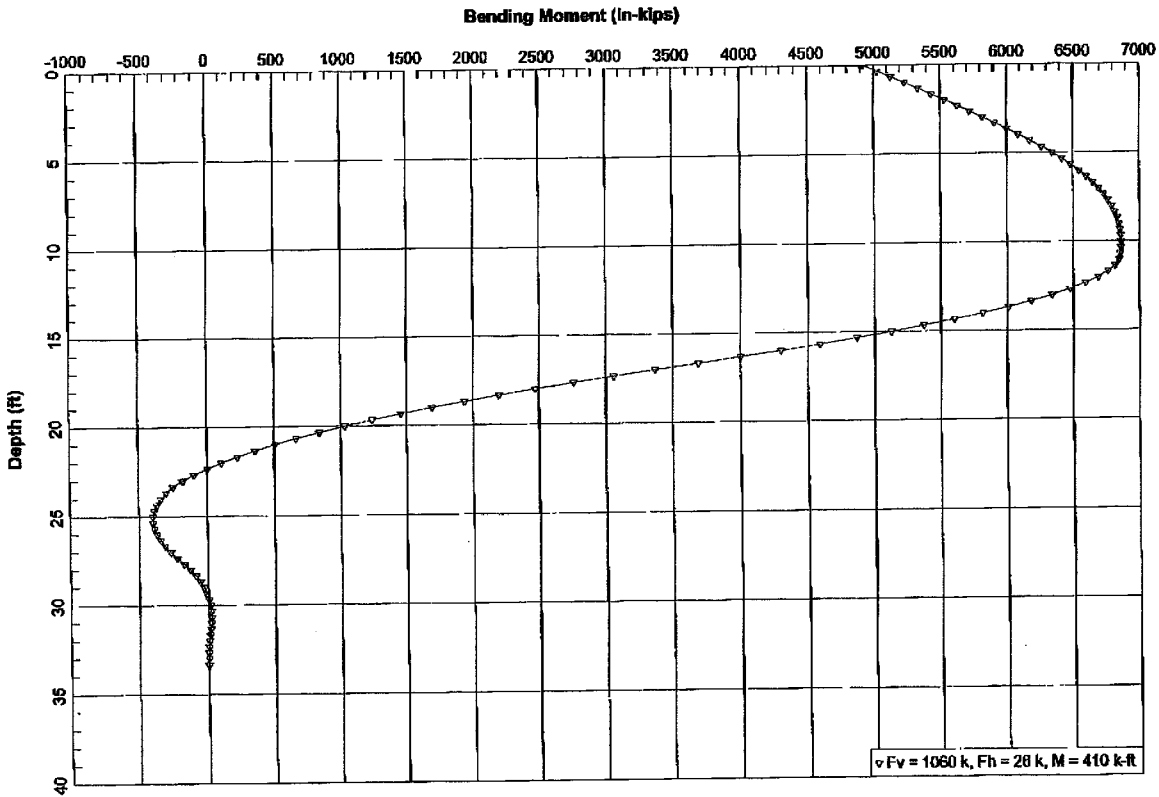
Depth = -78 - -36; Soft Clay	
Depth = -36 - 36; Sand	
Depth = 36 - 144; Soft Clay	
Depth = 144 - 198; Sand	
Depth = 198 - 264; Stiff Clay w/o free water	
Depth = 264 - 600; Stiff Clay w/o free water	

$L_{min} = 25'$

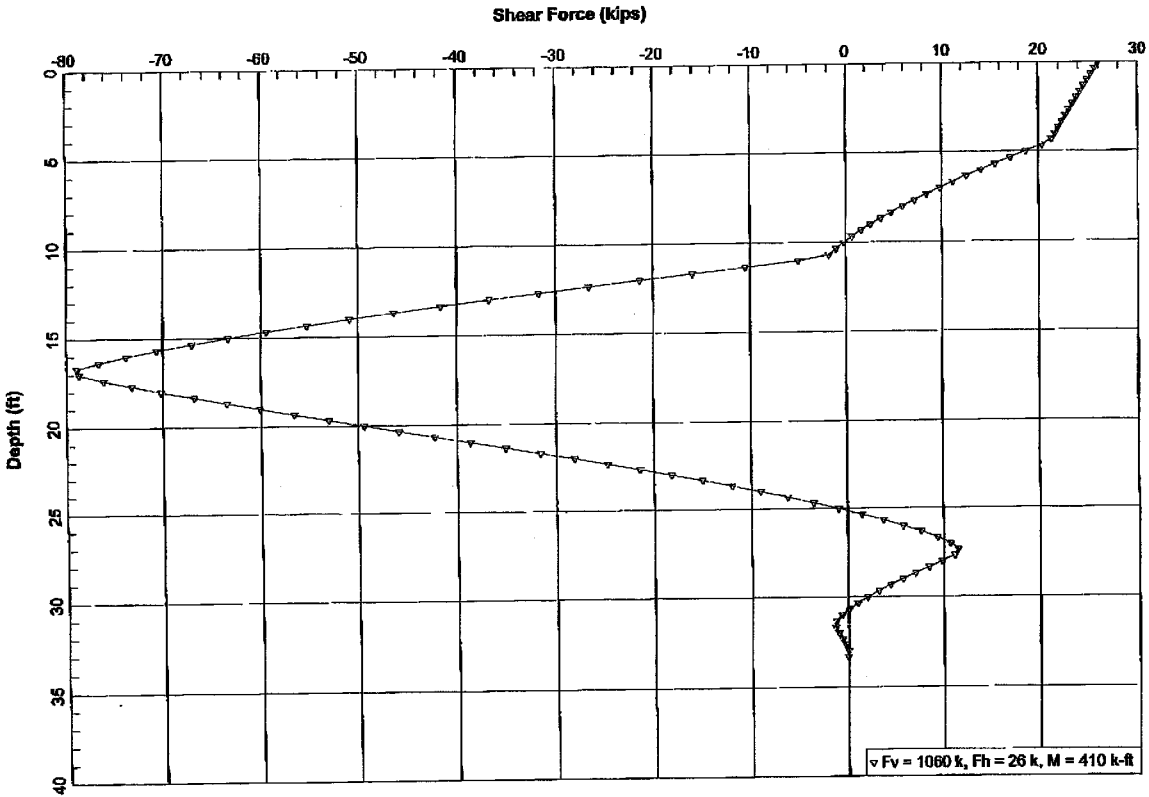


Case I
pier 2

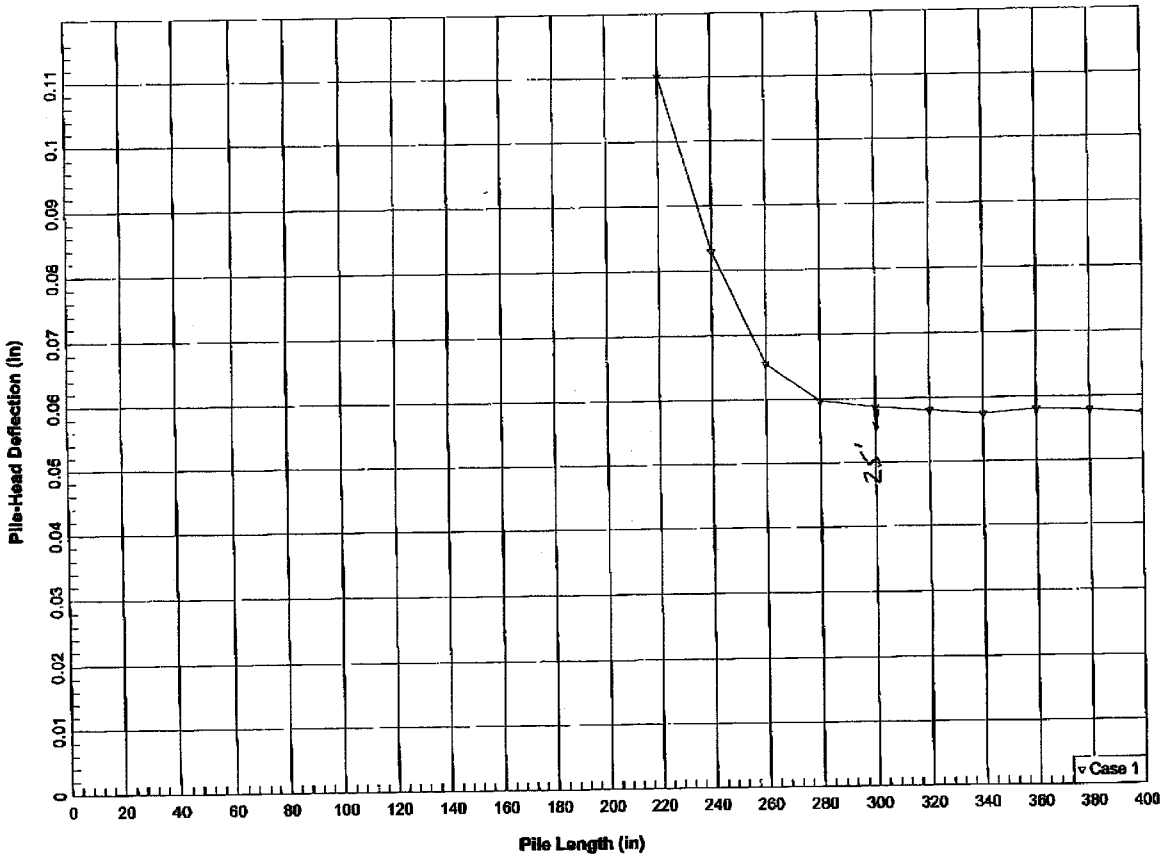
Based on Boring 6



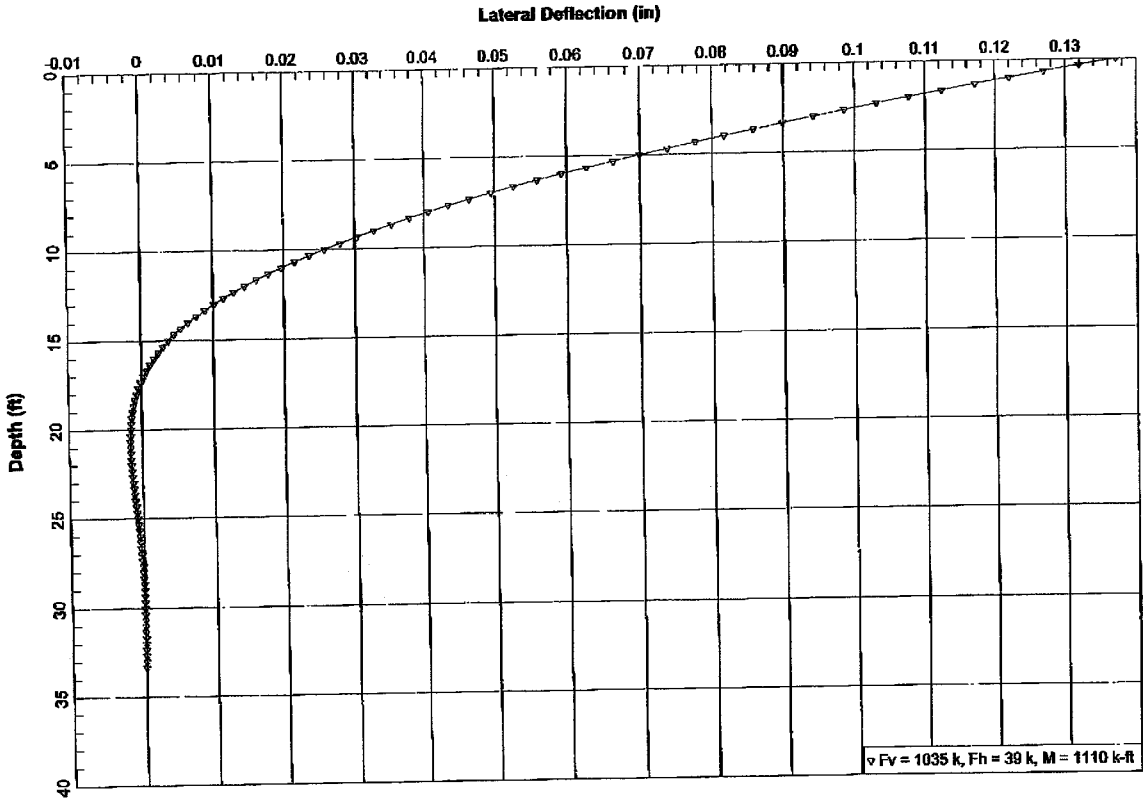
Based on Boring 6



Based on Boring 6

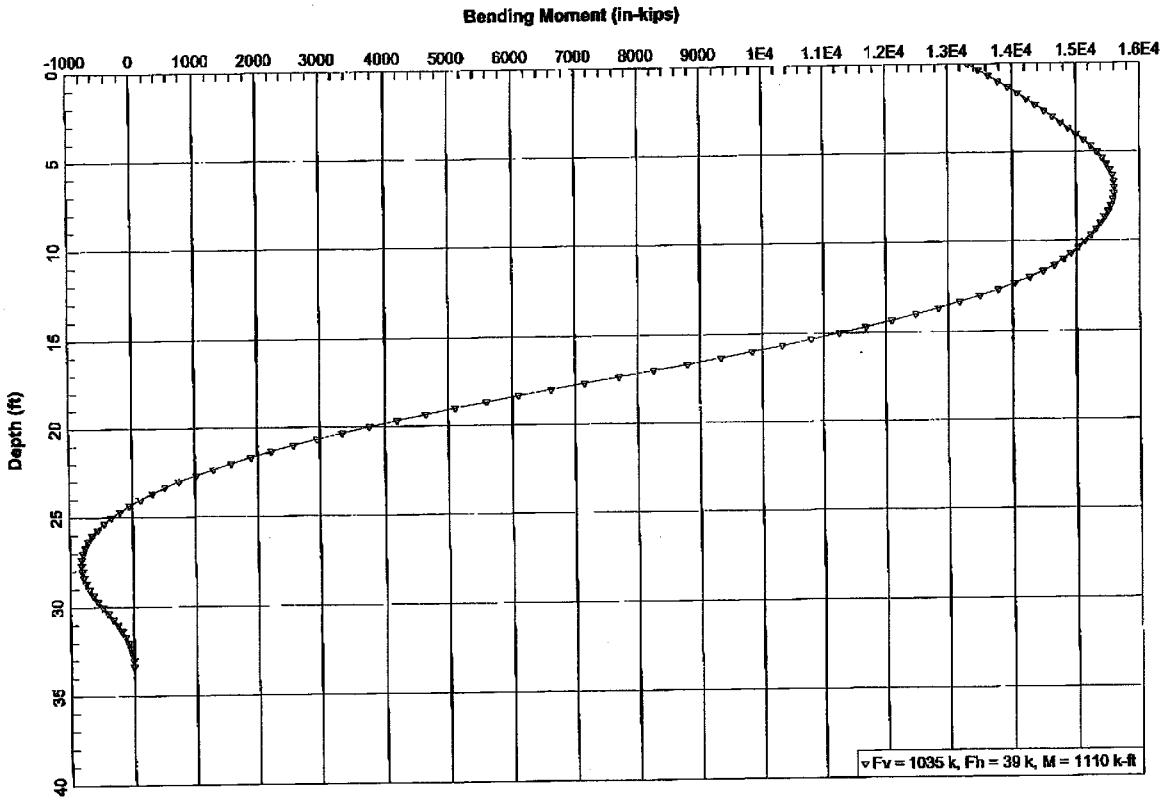

Pile-Head Deflection (in)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
Pile Length (in)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
Case 1
25'

$L_{min} = 27'$

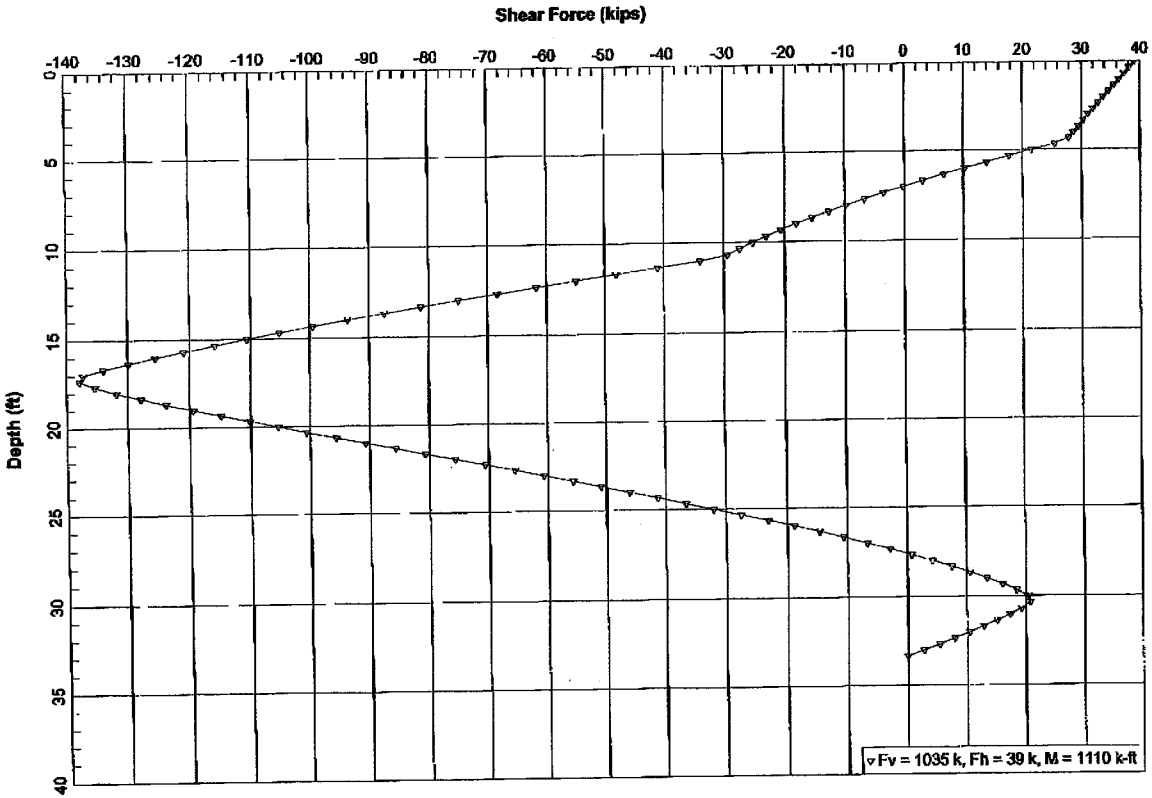


Case II
pier 4

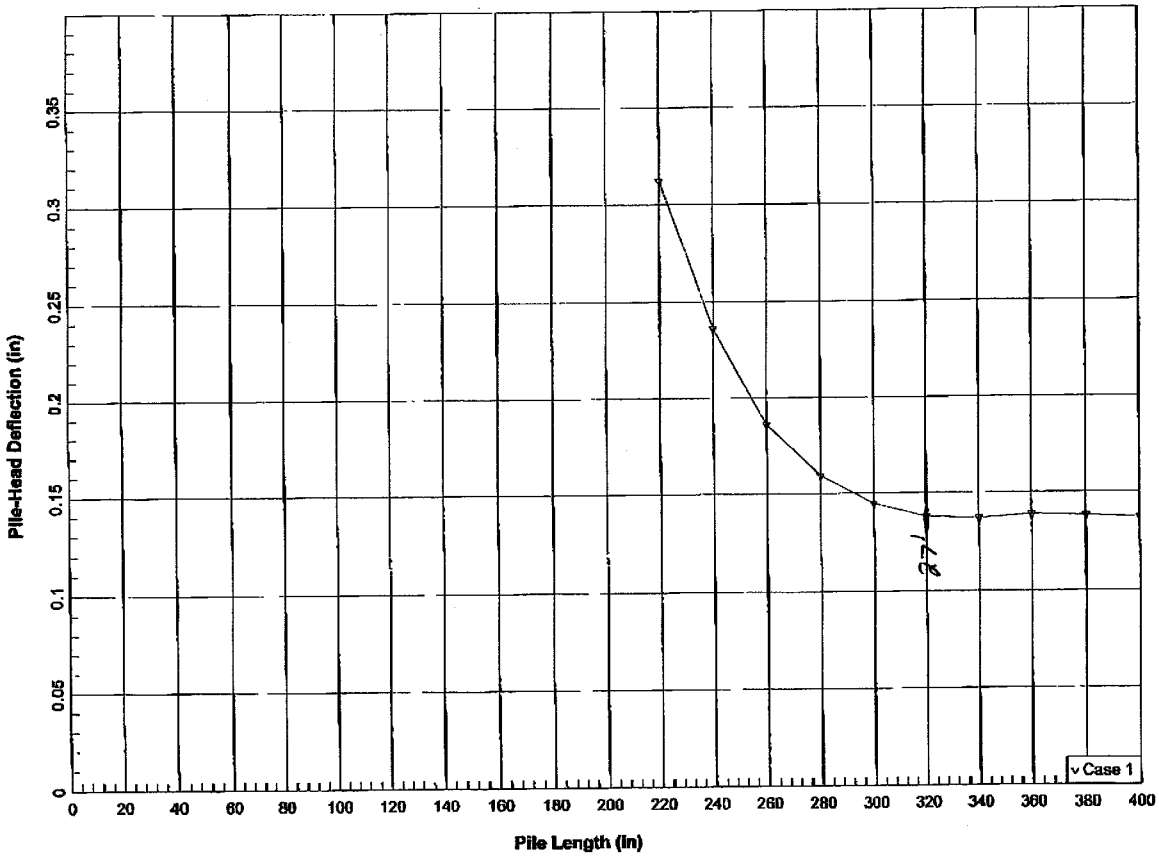
Based on Boring 6



Based on Boring 6



Based on Boring 6


Pile-Head Deflection (in)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Pile Length (in)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
Case 1
.178

Depth = -78 - 54; Sand

Depth = 54 - 132; Sand

Depth = 132 - 600; Stiff Clay w/o free water

Bowser-Morner, Inc.

Job Number: 131651

Date Started 5/3/05 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) None

Date Completed 5/3/05 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Retaining Wall for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 3A

Sheet 1 of 1 Station & Offset Sta. 447+39.18 (Ramp N-7); 15.43' Lt. Surface Elev. (ft) 746.7

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
746.7	0														
746.0					(FILL) ASPHALT Pavement (7")										
	2	4/3/3/4			(FILL) Loose brown GRAVEL with sand, little silt, trace clay - moist	1A	37.7	25.6	20.9	12.1	3.7	Non Plastic		9.0	A-1-b (0)
743.7															
	4	10/8/9/10			(FILL) Medium dense brown fine SAND, some gravel, trace silt, trace clay - moist	2A	25.5	22.8	43.6	7.5	0.6	Non Plastic		12.7	A-3 (0)
741.7															

Bottom of Boring at 5.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 5/3/05 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 735.1

Date Completed 5/3/05 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Retaining Wall for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 4A

Sheet 1 of 1 Station & Offset Sta. 454+42.05 (I-75); 109.26' Rt. Surface Elev. (ft) 747.1

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
747.1	0														
746.1					(FILL) TOPSOIL (12")										
		4/5/7			(FILL) Stiff brown SILT and CLAY, little gravel - moist	1A								13.9	
743.6															
		5/6/12			(FILL) Medium dense dark brown GRAVEL with sand, trace silt, trace glass - moist	2A								17.2	
	5														
		13/17/11				3A	45.0	18.6	16.3	20.1		Non Plastic		13.7	A-1-b (0)
739.1															
		25/35/37			(ORIGINAL) Very dense brown GRAVEL with sand, some gravel - moist	4A	44.7	24.7	18.1	12.5		Non Plastic		3.8	A-1-b (0)
	10														
		28/38/38				5A								4.3	
		16/13/13			(Becomes medium dense at 13.0')	6A								8.3	
	15														
		6/13/10				7A								7.5	
		12/30/24				8A								8.6	
	20														
		20/25/34				9A								7.1	
722.1	25														

Bottom of Boring at 25.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 5/3/05 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 737.6

Client: TranSystems Corporation

Date Completed 5/3/05 Casing: Length Dia.

Project Description: Soil Study for Retaining Wall for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 4B

Sheet 1 of 1 Station & Offset Sta. 452+65.66 (I-75); 108.20' Rt. Surface Elev. (ft) 742.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
742.6	0														
741.6					(FILL) TOPSOIL (12")										
	2	4/9/7			(FILL) Medium dense brown coarse SAND, little gravel, trace silt, trace ash, trace glass - moist	1A								12.4	
739.6															
	4	2/3/2			(FILL) Medium stiff dark brown SILT and CLAY, trace gravel, trace wood - moist	2A								14.5	
	6														
736.1		1/6/6				3A								10.3	
	8				(ORIGINAL) Medium dense brown GRAVEL with SAND, trace silt and clay - moist										
	10	7/5/6			(Becomes wet at 8.5')	4A								8.4	
	12	8/9/11				5A								9.6	
	14	10/16/12				6A	68.2	16.8	7.0	8.0		Non Plastic		8.5	A-1-b (0)
	16	5/7/10				7A								14.4	
	18														
	20	9/11/13				8A	48.5	20.7	17.0	13.8		Non Plastic		11.0	
	22														
	24	6/11/8				9A								8.3	
	26														
	28														
712.6	30	23/25/25			(Becomes dense at 28.5')	10A								7.3	

Bottom of Boring at 30.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 5/3/05 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 744.1

Client: TranSystems Corporation

Date Completed 5/3/05 Casing: Length Dia.

Project Description: Soil Study for Retaining Wall for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 10A

Sheet 1 of 1 Station & Offset Sta. 462+00.93 (I-75); 105.69' Rt. Surface Elev. (ft) 757.1

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
757.1	0														
756.6					(FILL) TOPSOIL (6")										
		3/4/6			(FILL) Stiff brown silty CLAY, trace gravel - moist	1A								19.8	
754.1															
		19/10/10			(ORIGINAL) Medium dense brown GRAVEL, trace sand, trace silt - moist	2A	64.1	16.4	6.5	13.0		Non Plastic		5.1	A-1-a(0)
	5														
		9/14/15				3A								5.1	
		12/13/13				4A								5.9	
	10														
		14/16/18			(Becomes dense at 11.0')	5A	61.0	16.8	11.6	10.6		Non Plastic		4.9	
		18/30/25			(Becomes very dense and wet at 13.5')	6A								6.6	
	15														
		20/32/25				7A								6.0	
		13/25/42				8A								8.8	
	20														
		17/21/35				9A								12.3	
732.1	25														

Bottom of Boring at 25.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 5/3/05 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 746.8

Client: TranSystems Corporation

Date Completed 5/3/05 Casing: Length Dia.

Project Description: Soil Study for Retaining Wall for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 13A

Sheet 1 of 1 Station & Offset Sta. 444+34.14 (Ramp N-6A); 3.80 Rt. Surface Elev. (ft) 749.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
749.6	0														
748.7					(FILL) ASPHALT (11")										
	2	14/15/24/15			(FILL) Dense brown GRAVEL, some sand, trace silt and clay - moist	1A	55.3	22.1	10.1	9.8	2.7	16	1	4.9	A-1-a (0)
	4	17/14/9/8			(Becomes medium dense and wet at 3.0')	2A	49.7	19.3	11.3	14.0	5.7	28	8	11.3	A-2-4 (0)
745.1															
744.6					(FILL) Very stiff brown sandy SILT, trace gravel - moist										

Bottom of Boring at 5.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Addendum to Bowser-Morner Report 131651-1104-268
for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge
Over Great Miami River, Dayton, Montgomery County, Ohio

For

TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Report No. 131651-0105-002

January 7, 2005

BOWSER MORNER®

BOWSER-MORNER

4518 Taylorsville Road • P.O. Box 51 • Dayton, Ohio 45401 • 937/236-8805

ENGINEERING REPORT

REPORT TO: TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Attn: Mr. Asvin Mandadi, P.E.

REPORT DATE: January 7, 2005

REPORT NO: 131651-0105-002

REPORT ON: Addendum to Bowser-Morner Report 131651-1104-268 for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

RESPONSE TO ODOT GEOTECHNICAL REVIEW COMMENTS

This report presents our response to review comments made by ODOT's Office of Geotechnical Engineering dated December 7, 2004 concerning Bowser-Morner Report No. 131651-1104-268 dated November 15, 2004. That soil-study report discusses the soil conditions for the bridge replacement project, Bridge No. I-75-14.60 over Great Miami River in Dayton, Montgomery County, Ohio.

Reconnaissance and Planning Checklist

Question 1: We followed the "Planning and Reconnaissance" section of ODOT's "*Specifications for Subsurface Investigations*" and GB1 to prepare our proposal and perform our study.

Borings 1, 2, and 3 were made for the pavement design. However, since the widening of these sections of the pavement may include the construction of additional embankment sections over the sides of the existing embankment, 10-foot-deep borings were made to provide additional data for design considerations for the construction of embankment fill on the sides of the embankment.

Also, based on the information provided by TranSystems Corporation during our planning and reconnaissance period, Boring 1 was made on the east side of the northbound lane while Boring 2 was made on the west side of the southbound lane. Each

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widening section of the project is less than 400 feet long. Borings 1 and 2 were not intended for a continuous section of the roadway-widening project. It is our understanding that the length of each section of the widening project has been increased to meet the line-and-grade design requirements. The extensions of these widening sections were made after the field exploration had been performed.

The construction of the retaining walls was determined by TranSystems Corporation to meet the required line-and-grade after our field exploration was completed. The design and study of the retaining-wall foundations were not included in our initial scope of work. We understand that a modification of our scope of work will be filed with ODOT District 7 with additional borings to be made for the retaining wall. No borings were planned or made for the design of the retaining walls as presented in our soil-study report as submitted on November 15, 2004.

Ramps N-6a and N-7 were not included in our scope of study in the initial planning and reconnaissance. We understand that additional borings will be made under the proposed modification to be submitted to District 7.

Questions 2, 3, 4, 7, 8, 10, and 11: We have the past construction plans provided by TranSystems Corporation, as given by District 7. The existing bridge piers are supported on spread-footing foundations. The bottoms of the foundations are at elevations between 718 and 719 feet. During a conversation, Mr. Scott Boyer, P.E. with District 7 said that no further data, soil profile sheets, or construction diaries are available. We also contacted Mr. Gary Ketron, who worked on this bridge project and retiring from ODOT District 8. Mr. Ketron said that the past project construction diaries were destroyed within seven years after the bridge was completed. Other people with knowledge of the project during the original construction have retired.

During the planning and reconnaissance, TranSystems Corporation asked us to determine the depth to bedrock to design the spread-footing foundations for the replacement bridge structure. As a result of our years of experience with the soil and geologic formation in the downtown Dayton area, we know that bedrock is more than 100 feet below the existing grade. We also reviewed the "Groundwater Resource Map for

Montgomery County, Ohio," "Glacial Map of Ohio," and "Geologic Map of Ohio" by ODNR. The bedrock topographic is included in a map for the groundwater resources in the Dayton area. The bedrock in one of the wells near the project site is about 110 feet below grade.

The bridge site is in a thick, glacial outwash deposit. The initial design plan for the improvement of the bridge and the section of the I-75 project was provided to us by TranSystems on an aerial photograph. The site is not in the "Known and Probable Karsi in Ohio." The site is in an urban developed area with flood dikes on both sides of the Great Miami River. Consequently, wetlands will not be a concern. The flood control and maintenance of the flood dikes are the responsibilities of The Miami Conservancy District. We worked closely with the district in our planning and boring operations in the flood plain of the river.

We contacted ODOT District 7's Montgomery County Garage, which provided assistance in traffic control for us to proceed with our study. They also provided information regarding access to and the locations of the pump stations owned by the Montgomery Sanitary Department. The pump stations are on the south bank of the Great Miami River and on the sides of the south bridge abutment.

The site is relatively flat with the exception of the embankments constructed by ODOT for I-75. Consequently, the potential for landslides on this site is not a concern. Both sides of the riverbanks have flood dikes that are well maintained by The Miami Conservancy. Based on our study and experience, no lakebed sediments, organic soil, or peat deposits are in the vicinity of this site.

Embankments Checklist

Questions 27, 28, and 29: Any fill placed over the face of the existing embankments or slope should be placed and compacted in horizontal lifts, and keyed into the slope or embankments with horizontal benches. We understand that the general notes and details will be included in the design drawings to be prepared by TranSystems Corporation. Retaining walls will be constructed on the northwest, northeast, and

southeast sides of the bridge abutments. Study of the retaining walls is beyond the scope of this phase of our project. We understand that the study of the retaining-wall foundations will be included in the modification phase of the study.

Subgrade Checklist

Question 1: Based on the requirements, two samples within five feet of the proposed subgrade should be tested for the full soil classification. The number of classification tests performed did not meet the requirements. Three additional classification tests were performed and included in the revised sheets included with this submission. The laboratory test results for the additional three samples, 1-2A, 3-2A, and 13-2A, are included in the attached appendix. In Borings 2, 10, 12, and 13, Samples 2-2A, 10-2A, 12-1A, 12-2A, and 13-2A did not have enough recovered soil for the classification tests to be performed. Consequently, the classification tests for these samples could not be performed.

Question 4 and 4a: Based on our review of the soil data indicated in Borings 1, 2, 3, 4, 10, 11, 12, 13, and 14 for pavement design, the subgrade soil consists of existing subgrade prepared or constructed by ODOT during the construction of I-75, the ramps, and the street. No weak soil will have to be removed or treated in accordance with GB-1, with the exception of the topsoil. The average SPT values are between 16 and 30 within the top five feet of subgrade soil. Topsoil was encountered in the vicinity of Borings 12, 13, and 14. New embankment will have to be constructed in the vicinity of Borings 13 and 14 for Ramp 6N. Consequently, the topsoil will have to be removed for the ramp construction. The exposed subgrade soil can be recompacted to receive the new fill.

Question 6: The quantity of proof rolling will be included in the Stage II submission by TranSystems Corporation, including the construction of the ramp embankments.

Question 7: Based on the soil conditions indicated in Borings 1, 2, 3, 4, 10, 11, 12, 13, and 14, the subgrade soil along the main line of I-75 and Ramp 6N consists of granular embankment fill (A-3a, A-1-b, and A-1-a types of soil) placed during the

construction of I-75. The subgrade soil along Stanley Avenue consists of A-6a and A-6b types of soil. None of the ODOT GB-1 requirements was ignored intentionally. The sampling plan and the number of laboratory tests were planned in accordance with the ODOT GB-1 requirements. Inadvertently, not enough soil classification tests were performed during our study, due in large part to not having the required quantities of recovered soil samples to perform the tests.

The granular type of subgrade compacted to the required density will have a higher California Bearing Ratio (CBR) value. A CBR value of 10 was assigned to the design of the pavement along the main line. However, an A-6 type of soil was encountered along Stanley Avenue. If a silty and clayey soil (A-4, A-6, or A-7 types of soil) will be used for constructing Ramp 6N, and any other embankments for the additional lane widening, a lower CBR value of 4 should be assigned to the design of the pavement along the ramp and along Stanley Avenue. If a granular soil will be used in the construction of the proposed ramp embankment, a CBR value of 10 can be used in the design of the ramp pavement.

Retaining Wall Checklist

The retaining wall design and study are beyond the scope of this phase of our study. We understand that the study will be included in the next phase of submission for "Modification of the Study" by TranSystems Corporation.

Submission Requirements Checklist

Notes for Stage 1: The revised Sheet 3/3 is included. The text has been enlarged to the text size of 0.125 inch to meet the requirements.

An additional sheet for Ramp N6 has been prepared and submitted for your review. The profile and boring location plan sheet for Ramp N6 has been separated from the main line of I-75.

For your convenience, the soil profile for the top five feet of Boring 4 is included on the pavement design sheet.

STAGE 1 PLANS AND BRIDGE PRELIMINARY DESIGN REPORT

Our responses to the comments for the preliminary structure submittal for Comments 1 and 3 follow.

Calculations For H-Pile Length

The recommendations on the required lengths of the H-piles were presented in Bowser-Morner Report No. 131651-1104-268 dated November 15, 2004

As indicated in Bowser-Morner Report No. 131651-1104-268, the cutoff lengths of the H-piles were determined using a computer program, *Driven v1.2* by the Federal Highway Administration. The pile-cap elevations for the bridge abutments and center piers were shown on the plan and profile sheets provided by TranSystems Corporation. We understand that the scouring depth is 15 feet, as provided by TranSystems Corporation. This projected scouring depth was used in our analyses to determine the required pile length for center piers. The cutoff lengths of the HP 14×73 piles were selected based on a design load of 95 tons with a factor of safety of 2. The computations are based on the soil information and the results of the standard penetration tests (SPT) from the six borings made for this study (Borings 4 through 9). The soil parameters used in the calculations are discussed in the following paragraphs. The center piers are numbered from the south to north directions.

South Abutment

Boring 4 was made in the south abutment location. Based on the information indicated in Boring 4, the soil parameters are presented in Table 1.

Table 1. Soil Profile at South Abutment

Layer	Type	Thickness	Unit Weight	Friction Angle	Cohesion	Adhesion
1	Cohesionless	23 ft	120 pcf	28°	--	--
2	Cohesive	10 ft	130 pcf	--	2500 psf	--
3	Cohesionless	20 ft	130 pcf	38°	--	--

First Pier

Boring 5 was made at the first pier location (from south to north). Based on the information indicated in Boring 5, the soil parameters are presented in Table 2.

Table 2. Soil Profile at First Pier

Layer	Type	Thickness	Unit Weight	Friction Angle	Cohesion	Adhesion
1	Cohesive	23 ft	100 pcf	--	450 psf	--
2	Cohesive	5.5 ft	135 pcf	--	--	1600 psf
3	Cohesive	19.5 ft	135 pcf	--	--	3500 psf

Second Pier

Boring 6 was made in the second pier location. Based on the soil data indicated in Boring 6, the soil parameters are presented in Table 3.

Table 3. Soil Profile at Second Pier

Layer	Type	Thickness	Unit Weight	Friction Angle	Cohesion	Adhesion
1	Cohesionless	11 ft	100 pcf	25°	--	--
2	Cohesionless	6.5 ft	125 pcf	35°	--	--
3	Cohesive	29.5 ft	125 pcf	--	--	2750 psf

Third Pier

Boring 7 was made in the third pier location, from south to north. Based on the information indicated in this boring, the soil parameters are presented in Table 4.

Table 4. Soil Profile at Third Pier

Layer	Type	Thickness	Unit Weight	Friction Angle	Cohesion	Adhesion
1	Cohesive	11 ft	100 pcf	--	400	--
2	Cohesive	2.5 ft	125 pcf	--	--	2000 psf
3	Cohesive	22.5 ft	125 pcf	--	--	4000 psf

Fourth Pier

Boring 8 was made in the fourth pier location, from south to north. Based on the information indicated in this boring, the soil parameters are presented in Table 5.

Table 5. Soil Profile at Fourth Pier

Layer	Type	Thickness	Unit Weight	Friction Angle	Cohesion	Adhesion
1	Cohesive	23.5 ft	100 pcf	--	200	--
2	Cohesionless	5 ft	125 pcf	36°	--	--
3	Cohesive	20.5 ft	125 pcf	--	--	3500 psf

North Abutment

Boring 9 was made in the north abutment location. Based on the information indicated in this boring, the soil parameters are presented in Table 6.

Table 6. Soil Profile at North Abutment

Layer	Type	Thickness	Unit Weight	Friction Angle	Cohesion	Adhesion
1	Cohesionless	33 ft	125 pcf	34°	--	--
2	Cohesionless	21 ft	125 pcf	35°	--	--

The computer printouts for the determinations of the pile lengths by *Driven v1.2* were included in the appendix of this report. The summary of the output results was presented in Table 4-2 of Bowser-Morner Report No. 131651-1104-268 dated November 15, 2004.

Comment No. 1 recommendations for drilled pier installation

We understand that drilled piers can be an alternative method for the proposed bridge foundations. Based on the soil conditions indicated in six borings made for this study, the bottoms of the drilled piers should extend below the depths and elevations outlined in Table 7.

Table 7. Depths to Top of Bearing Stratum

Pier Location	Boring No.	Depth to Bearing Strata (ft)	Elevation of Bearing Strata (ft)
South Abutment	4	28.5	739.1
First Pier (From South to North)	5	28.5	713.4
Second Pier (From South to North)	6	11.0	718.2
Third Pier (From South to North)	7	11.0	718.9
Fourth Pier (From South to North)	8	23.5	717.0
North Abutment	9	32.0	738.6

The drilled piers that extend below the depths and elevations outlined in Table 7 can be designed with an allowable end-bearing capacity of 12,000 psf. An allowable side-friction capacity of 1,500 psf can be assigned to the parts of the piers below the depths and elevations outlined in Table 7 and below the maximum possible scouring depths. No side-friction capacity should be assigned to the parts of the piers above the depths and elevations outlined in Table 7 and within the potential scouring depth.

Boring 9 was made in the north abutment area. The piers for the north abutment will be installed in the embankment fill. Based on the SPT results indicated in Boring 9, the parts of the drilled piers in contact with the existing fill layer and below the maximum potential scouring depth but above a depth of 32 feet below the existing grade can be designed with an allowable end side-friction capacity of 800 psf.

Steel casings should be provided during the pier installations to keep the shafts from caving in. The drilled piers will be installed in the middle of the Great Miami River. Water will be encountered in the casings during the pier installation. If water in the casings cannot be lowered, the concrete should be placed using the tremie method. A short section of casing will have to be installed within top five feet of each pier to extend above the river water level and allow the concrete placement.

Comment No. 3 minimum pile or pier length

The driven piles or the drilled piers should be extended below the maximum potential scouring depth plus the required embedded lengths to provide the design side friction capacities. For the installation of driven piles, the upper section of the pile can be installed in the pre-augered hole to extend through the auger refusal section of the subgrade soil. A rock core barrel or the rock bits may have to be used to break up the boulders and/or to penetrate through the hard till layers.

The driven piles should maintain at least 3-diameter from any adjacent piles in order to account for the full single pile design capacity. The drilled piers should maintain at least 8-diameter from the adjacent piers to account of the full single pier design capacity. Otherwise, the group pile or pier efficiency coefficient should be applied to determine the pile or the pier group capacity.

If you have any questions, please contact us.

Respectfully submitted,

BOWSER-MORNER ASSOCIATES, INC.

Jimmy Zhong, M.S., P.E.
Geotechnical Engineer

Richard J. Y. Tseng, Ph.D., P.E.
Vice President
Chief Geotechnical Engineer

JZ/RJYT/kmw
6-Addressee
2-File

BOWSER MORNER®

DRIVEN 1.2

* From 1/7/05 addendum

GENERAL PROJECT INFORMATION

Boring Location 4

Filename: C:\PROGRA~1\DRIVEN\TRANSY~1\TRANS4.DVN
Project Name: I-75 Bridge MOT I-75-14.60
Project Date: 11/12/2004
Project Client: TranSystems Corp.
Computed By: Jimmy Zhong
Project Manager: RJYT

(For South Abutment)

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 13.60 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	18.00 ft
	- Driving/Restrike	18.00 ft
	- Ultimate:	18.00 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	23.00 ft	0.00%	120.00 pcf	28.0/28.0	Nordlund
2	Cohesive	10.00 ft	0.00%	130.00 pcf	2500.00 psf	T-79 Steel
3	Cohesionless	20.00 ft	0.00%	130.00 pcf	38.0/38.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.60 ft	Cohesionless	1632.00 psf	22.00	N/A	0.00 Kips
17.99 ft	Cohesionless	1895.40 psf	22.00	N/A	11.41 Kips
18.01 ft	Cohesionless	2160.29 psf	22.00	N/A	11.47 Kips
22.99 ft	Cohesionless	2303.71 psf	22.00	N/A	27.21 Kips
23.01 ft	Cohesive	N/A	N/A	1156.31 psf	27.30 Kips
32.01 ft	Cohesive	N/A	N/A	1285.89 psf	81.69 Kips
32.99 ft	Cohesive	N/A	N/A	1300.00 psf	88.28 Kips
33.01 ft	Cohesionless	3124.34 psf	29.86	N/A	88.45 Kips
42.01 ft	Cohesionless	3428.54 psf	29.86	N/A	194.52 Kips
51.01 ft	Cohesionless	3732.74 psf	29.86	N/A	319.41 Kips
52.99 ft	Cohesionless	3799.66 psf	29.86	N/A	349.41 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	22.80	1.98 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	22.80	1.98 Kips	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	22.80	1.98 Kips	0.00 Kips
13.60 ft	Cohesionless	1632.00 psf	22.80	1.98 Kips	1.98 Kips
17.99 ft	Cohesionless	2158.80 psf	22.80	1.98 Kips	1.98 Kips
18.01 ft	Cohesionless	2160.58 psf	22.80	1.98 Kips	1.98 Kips
22.99 ft	Cohesionless	2447.42 psf	22.80	1.98 Kips	1.98 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
32.99 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
33.01 ft	Cohesionless	3124.68 psf	110.40	39.92 Kips	37.01 Kips
42.01 ft	Cohesionless	3733.08 psf	110.40	39.92 Kips	39.92 Kips
51.01 ft	Cohesionless	4341.48 psf	110.40	39.92 Kips	39.92 Kips
52.99 ft	Cohesionless	4475.32 psf	110.40	39.92 Kips	39.92 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.60 ft	0.00 Kips	1.98 Kips	1.98 Kips
17.99 ft	11.41 Kips	1.98 Kips	13.39 Kips
18.01 ft	11.47 Kips	1.98 Kips	13.45 Kips
22.99 ft	27.21 Kips	1.98 Kips	29.19 Kips
23.01 ft	27.30 Kips	3.34 Kips	30.65 Kips
32.01 ft	81.69 Kips	3.34 Kips	85.04 Kips
32.99 ft	88.28 Kips	3.34 Kips	91.62 Kips
33.01 ft	88.45 Kips	37.01 Kips	125.46 Kips
42.01 ft	194.52 Kips	39.92 Kips	234.44 Kips
51.01 ft	319.41 Kips	39.92 Kips	359.33 Kips
52.99 ft	349.41 Kips	39.92 Kips	389.33 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.60 ft	Cohesionless	1632.00 psf	22.00	N/A	0.00 Kips
17.99 ft	Cohesionless	1895.40 psf	22.00	N/A	11.41 Kips
18.01 ft	Cohesionless	2160.29 psf	22.00	N/A	11.47 Kips
22.99 ft	Cohesionless	2303.71 psf	22.00	N/A	27.21 Kips
23.01 ft	Cohesive	N/A	N/A	1156.31 psf	27.30 Kips
32.01 ft	Cohesive	N/A	N/A	1285.89 psf	81.69 Kips
32.99 ft	Cohesive	N/A	N/A	1300.00 psf	88.28 Kips
33.01 ft	Cohesionless	3124.34 psf	29.86	N/A	88.45 Kips
42.01 ft	Cohesionless	3428.54 psf	29.86	N/A	194.52 Kips
51.01 ft	Cohesionless	3732.74 psf	29.86	N/A	319.41 Kips
52.99 ft	Cohesionless	3799.66 psf	29.86	N/A	349.41 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	22.80	1.98 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	22.80	1.98 Kips	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	22.80	1.98 Kips	0.00 Kips
13.60 ft	Cohesionless	1632.00 psf	22.80	1.98 Kips	1.98 Kips
17.99 ft	Cohesionless	2158.80 psf	22.80	1.98 Kips	1.98 Kips
18.01 ft	Cohesionless	2160.58 psf	22.80	1.98 Kips	1.98 Kips
22.99 ft	Cohesionless	2447.42 psf	22.80	1.98 Kips	1.98 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
32.99 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
33.01 ft	Cohesionless	3124.68 psf	110.40	39.92 Kips	37.01 Kips
42.01 ft	Cohesionless	3733.08 psf	110.40	39.92 Kips	39.92 Kips
51.01 ft	Cohesionless	4341.48 psf	110.40	39.92 Kips	39.92 Kips
52.99 ft	Cohesionless	4475.32 psf	110.40	39.92 Kips	39.92 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.60 ft	0.00 Kips	1.98 Kips	1.98 Kips
17.99 ft	11.41 Kips	1.98 Kips	13.39 Kips
18.01 ft	11.47 Kips	1.98 Kips	13.45 Kips
22.99 ft	27.21 Kips	1.98 Kips	29.19 Kips
23.01 ft	27.30 Kips	3.34 Kips	30.65 Kips
32.01 ft	81.69 Kips	3.34 Kips	85.04 Kips
32.99 ft	88.28 Kips	3.34 Kips	91.62 Kips
33.01 ft	88.45 Kips	37.01 Kips	125.46 Kips
42.01 ft	194.52 Kips	39.92 Kips	234.44 Kips
51.01 ft	319.41 Kips	39.92 Kips	359.33 Kips
52.99 ft	349.41 Kips	39.92 Kips	389.33 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
13.60 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
15.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
17.99 ft	Cohesionless	1979.40 psf	22.00	N/A	8.12 Kips
18.01 ft	Cohesionless	2160.29 psf	22.00	N/A	8.18 Kips
22.99 ft	Cohesionless	2303.71 psf	22.00	N/A	23.92 Kips
23.01 ft	Cohesive	N/A	N/A	1156.31 psf	24.01 Kips
32.01 ft	Cohesive	N/A	N/A	1285.89 psf	78.40 Kips
32.99 ft	Cohesive	N/A	N/A	1300.00 psf	84.98 Kips
33.01 ft	Cohesionless	3124.34 psf	29.86	N/A	85.16 Kips
42.01 ft	Cohesionless	3428.54 psf	29.86	N/A	191.22 Kips
51.01 ft	Cohesionless	3732.74 psf	29.86	N/A	316.11 Kips
52.99 ft	Cohesionless	3799.66 psf	29.86	N/A	346.12 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
13.59 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
13.60 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
15.00 ft	Cohesionless	1800.00 psf	22.80	1.98 Kips	1.98 Kips
17.99 ft	Cohesionless	2158.80 psf	22.80	1.98 Kips	1.98 Kips
18.01 ft	Cohesionless	2160.58 psf	22.80	1.98 Kips	1.98 Kips
22.99 ft	Cohesionless	2447.42 psf	22.80	1.98 Kips	1.98 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
32.99 ft	Cohesive	N/A	N/A	N/A	3.34 Kips
33.01 ft	Cohesionless	3124.68 psf	110.40	39.92 Kips	37.01 Kips
42.01 ft	Cohesionless	3733.08 psf	110.40	39.92 Kips	39.92 Kips
51.01 ft	Cohesionless	4341.48 psf	110.40	39.92 Kips	39.92 Kips
52.99 ft	Cohesionless	4475.32 psf	110.40	39.92 Kips	39.92 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.60 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.00 ft	0.00 Kips	1.98 Kips	1.98 Kips
17.99 ft	8.12 Kips	1.98 Kips	10.10 Kips
18.01 ft	8.18 Kips	1.98 Kips	10.16 Kips
22.99 ft	23.92 Kips	1.98 Kips	25.90 Kips
23.01 ft	24.01 Kips	3.34 Kips	27.35 Kips
32.01 ft	78.40 Kips	3.34 Kips	81.74 Kips
32.99 ft	84.98 Kips	3.34 Kips	88.32 Kips
33.01 ft	85.16 Kips	37.01 Kips	122.17 Kips
42.01 ft	191.22 Kips	39.92 Kips	231.14 Kips
51.01 ft	316.11 Kips	39.92 Kips	356.03 Kips
52.99 ft	346.12 Kips	39.92 Kips	386.03 Kips ←

53 ft − 13.6' = 39.4'

use 40 feet HP 14×73

386 kips = 193 tons

use SF=2,

say 95 tons

design capacity = 193/2 = 96.5 tons

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\TRANSY~1\TRANS5.DVN
Project Name: I-75 Bridge MOT I-75-14.60 Project Date: 11/12/2004
Project Client: TranSystems Corp.
Computed By: Jimmy Zhong
Project Manager: RJYT

Boring Location 5

PILE INFORMATION

For First Pier (South to North)

Pile Type: H Pile - HP14X73
Top of Pile: 13.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	18.50 ft
	- Driving/Restrike	18.50 ft
	- Ultimate:	18.50 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	23.00 ft	0.00%	100.00 pcf	450.00 psf	T-80 Clay
2	Cohesive	5.50 ft	0.00%	135.00 pcf	3200.00 psf	User Def.
3	Cohesive	19.50 ft	0.00%	135.00 pcf	7000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	239.40 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	239.40 psf	5.64 Kips
22.99 ft	Cohesive	N/A	N/A	239.40 psf	11.24 Kips
23.01 ft	Cohesive	N/A	N/A	1600.00 psf	11.32 Kips
28.49 ft	Cohesive	N/A	N/A	1600.00 psf	52.53 Kips
28.51 ft	Cohesive	N/A	N/A	3500.00 psf	52.77 Kips
37.51 ft	Cohesive	N/A	N/A	3500.00 psf	200.79 Kips
46.51 ft	Cohesive	N/A	N/A	3500.00 psf	348.81 Kips
47.99 ft	Cohesive	N/A	N/A	3500.00 psf	373.16 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
22.99 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	4.28 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	4.28 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
46.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
47.99 ft	Cohesive	N/A	N/A	N/A	9.36 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
12.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.00 ft	0.00 Kips	0.60 Kips	0.60 Kips
18.01 ft	5.64 Kips	0.60 Kips	6.24 Kips
22.99 ft	11.24 Kips	0.60 Kips	11.84 Kips
23.01 ft	11.32 Kips	4.28 Kips	15.60 Kips
28.49 ft	52.53 Kips	4.28 Kips	56.81 Kips
28.51 ft	52.77 Kips	9.36 Kips	62.13 Kips
37.51 ft	200.79 Kips	9.36 Kips	210.15 Kips
46.51 ft	348.81 Kips	9.36 Kips	358.18 Kips
47.99 ft	373.16 Kips	9.36 Kips	382.52 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	239.40 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	239.40 psf	5.64 Kips
22.99 ft	Cohesive	N/A	N/A	239.40 psf	11.24 Kips
23.01 ft	Cohesive	N/A	N/A	1600.00 psf	11.32 Kips
28.49 ft	Cohesive	N/A	N/A	1600.00 psf	52.53 Kips
28.51 ft	Cohesive	N/A	N/A	3500.00 psf	52.77 Kips
37.51 ft	Cohesive	N/A	N/A	3500.00 psf	200.79 Kips
46.51 ft	Cohesive	N/A	N/A	3500.00 psf	348.81 Kips
47.99 ft	Cohesive	N/A	N/A	3500.00 psf	373.16 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
22.99 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	4.28 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	4.28 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
46.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
47.99 ft	Cohesive	N/A	N/A	N/A	9.36 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
12.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.00 ft	0.00 Kips	0.60 Kips	0.60 Kips
18.01 ft	5.64 Kips	0.60 Kips	6.24 Kips
22.99 ft	11.24 Kips	0.60 Kips	11.84 Kips
23.01 ft	11.32 Kips	4.28 Kips	15.60 Kips
28.49 ft	52.53 Kips	4.28 Kips	56.81 Kips
28.51 ft	52.77 Kips	9.36 Kips	62.13 Kips
37.51 ft	200.79 Kips	9.36 Kips	210.15 Kips
46.51 ft	348.81 Kips	9.36 Kips	358.18 Kips
47.99 ft	373.16 Kips	9.36 Kips	382.52 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	239.40 psf	3.39 Kips
22.99 ft	Cohesive	N/A	N/A	239.40 psf	8.99 Kips
23.01 ft	Cohesive	N/A	N/A	1600.00 psf	9.08 Kips
28.49 ft	Cohesive	N/A	N/A	1600.00 psf	50.28 Kips
28.51 ft	Cohesive	N/A	N/A	3500.00 psf	50.52 Kips
37.51 ft	Cohesive	N/A	N/A	3500.00 psf	198.54 Kips
46.51 ft	Cohesive	N/A	N/A	3500.00 psf	346.56 Kips
47.99 ft	Cohesive	N/A	N/A	3500.00 psf	370.91 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
22.99 ft	Cohesive	N/A	N/A	N/A	0.60 Kips
23.01 ft	Cohesive	N/A	N/A	N/A	4.28 Kips
28.49 ft	Cohesive	N/A	N/A	N/A	4.28 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
46.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
47.99 ft	Cohesive	N/A	N/A	N/A	9.36 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
12.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.00 ft	0.00 Kips	0.60 Kips	0.60 Kips
18.01 ft	3.39 Kips	0.60 Kips	3.99 Kips
22.99 ft	8.99 Kips	0.60 Kips	9.59 Kips
23.01 ft	9.08 Kips	4.28 Kips	13.36 Kips
28.49 ft	50.28 Kips	4.28 Kips	54.56 Kips
28.51 ft	50.52 Kips	9.36 Kips	59.88 Kips
37.51 ft	198.54 Kips	9.36 Kips	207.90 Kips
46.51 ft	346.56 Kips	9.36 Kips	355.93 Kips
47.99 ft	370.91 Kips	9.36 Kips	380.27 Kips ←

48 ft − 13 ft = 35 ft

use 35 ft HP 14X73

380 kips = 190 tons

use sf = 2,

design capacity = 190/2 = 95 tons

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Boring Location 6

Filename: C:\PROGRA~1\DRIVEN\TRANSY~1\TRANS6.DVN
Project Name: I-75 Bridge MOT I-75-14.60 Project Date: 11/12/2004
Project Client: TranSystems Corp.
Computed By: Jimmy Zhong
Project Manager: RJYT

For second pier (south to North)

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 3.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	11.00 ft	0.00%	100.00 pcf	25.0/25.0	Nordlund
2	Cohesionless	6.50 ft	0.00%	125.00 pcf	35.0/35.0	Nordlund
3	Cohesive	29.50 ft	0.00%	125.00 pcf	5500.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	112.80 psf	19.65	N/A	0.00 Kips
9.01 ft	Cohesionless	225.79 psf	19.65	N/A	1.48 Kips
10.99 ft	Cohesionless	263.01 psf	19.65	N/A	2.29 Kips
11.01 ft	Cohesionless	413.91 psf	27.51	N/A	2.30 Kips
17.49 ft	Cohesionless	616.74 psf	27.51	N/A	12.13 Kips
17.51 ft	Cohesive	N/A	N/A	2750.00 psf	12.28 Kips
26.51 ft	Cohesive	N/A	N/A	2750.00 psf	128.58 Kips
35.51 ft	Cohesive	N/A	N/A	2750.00 psf	244.89 Kips
44.51 ft	Cohesive	N/A	N/A	2750.00 psf	361.19 Kips
46.99 ft	Cohesive	N/A	N/A	2750.00 psf	393.24 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	15.00	1.98 Kips	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	15.00	1.98 Kips	0.00 Kips
3.00 ft	Cohesionless	112.80 psf	15.00	1.98 Kips	0.12 Kips
9.01 ft	Cohesionless	338.78 psf	15.00	1.98 Kips	0.35 Kips
10.99 ft	Cohesionless	413.22 psf	15.00	1.98 Kips	0.43 Kips
11.01 ft	Cohesionless	414.23 psf	64.00	15.99 Kips	2.68 Kips
17.49 ft	Cohesionless	819.87 psf	64.00	15.99 Kips	5.30 Kips
17.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
26.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
35.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
44.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
46.99 ft	Cohesive	N/A	N/A	N/A	7.36 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.12 Kips	0.12 Kips
9.01 ft	1.48 Kips	0.35 Kips	1.83 Kips
10.99 ft	2.29 Kips	0.43 Kips	2.72 Kips
11.01 ft	2.30 Kips	2.68 Kips	4.98 Kips
17.49 ft	12.13 Kips	5.30 Kips	17.43 Kips
17.51 ft	12.28 Kips	7.36 Kips	19.64 Kips
26.51 ft	128.58 Kips	7.36 Kips	135.94 Kips
35.51 ft	244.89 Kips	7.36 Kips	252.24 Kips
44.51 ft	361.19 Kips	7.36 Kips	368.55 Kips
46.99 ft	393.24 Kips	7.36 Kips	400.60 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	112.80 psf	19.65	N/A	0.00 Kips
9.01 ft	Cohesionless	225.79 psf	19.65	N/A	1.48 Kips
10.99 ft	Cohesionless	263.01 psf	19.65	N/A	2.29 Kips
11.01 ft	Cohesionless	413.91 psf	27.51	N/A	2.30 Kips
17.49 ft	Cohesionless	616.74 psf	27.51	N/A	12.13 Kips
17.51 ft	Cohesive	N/A	N/A	2750.00 psf	12.28 Kips
26.51 ft	Cohesive	N/A	N/A	2750.00 psf	128.58 Kips
35.51 ft	Cohesive	N/A	N/A	2750.00 psf	244.89 Kips
44.51 ft	Cohesive	N/A	N/A	2750.00 psf	361.19 Kips
46.99 ft	Cohesive	N/A	N/A	2750.00 psf	393.24 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	15.00	1.98 Kips	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	15.00	1.98 Kips	0.00 Kips
3.00 ft	Cohesionless	112.80 psf	15.00	1.98 Kips	0.12 Kips
9.01 ft	Cohesionless	338.78 psf	15.00	1.98 Kips	0.35 Kips
10.99 ft	Cohesionless	413.22 psf	15.00	1.98 Kips	0.43 Kips
11.01 ft	Cohesionless	414.23 psf	64.00	15.99 Kips	2.68 Kips
17.49 ft	Cohesionless	819.87 psf	64.00	15.99 Kips	5.30 Kips
17.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
26.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
35.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
44.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
46.99 ft	Cohesive	N/A	N/A	N/A	7.36 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.12 Kips	0.12 Kips
9.01 ft	1.48 Kips	0.35 Kips	1.83 Kips
10.99 ft	2.29 Kips	0.43 Kips	2.72 Kips
11.01 ft	2.30 Kips	2.68 Kips	4.98 Kips
17.49 ft	12.13 Kips	5.30 Kips	17.43 Kips
17.51 ft	12.28 Kips	7.36 Kips	19.64 Kips
26.51 ft	128.58 Kips	7.36 Kips	135.94 Kips
35.51 ft	244.89 Kips	7.36 Kips	252.24 Kips
44.51 ft	361.19 Kips	7.36 Kips	368.55 Kips
46.99 ft	393.24 Kips	7.36 Kips	400.60 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
11.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
15.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
17.49 ft	Cohesionless	741.94 psf	27.51	N/A	4.54 Kips
17.51 ft	Cohesive	N/A	N/A	2750.00 psf	4.69 Kips
26.51 ft	Cohesive	N/A	N/A	2750.00 psf	121.00 Kips
35.51 ft	Cohesive	N/A	N/A	2750.00 psf	237.30 Kips
44.51 ft	Cohesive	N/A	N/A	2750.00 psf	353.60 Kips
46.99 ft	Cohesive	N/A	N/A	2750.00 psf	385.65 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.00 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
11.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
15.00 ft	Cohesionless	664.00 psf	64.00	15.99 Kips	4.29 Kips
17.49 ft	Cohesionless	819.87 psf	64.00	15.99 Kips	5.30 Kips
17.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
26.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
35.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
44.51 ft	Cohesive	N/A	N/A	N/A	7.36 Kips
46.99 ft	Cohesive	N/A	N/A	N/A	7.36 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.00 ft	0.00 Kips	4.29 Kips	4.29 Kips
17.49 ft	4.54 Kips	5.30 Kips	9.84 Kips
17.51 ft	4.69 Kips	7.36 Kips	12.05 Kips
26.51 ft	121.00 Kips	7.36 Kips	128.35 Kips
35.51 ft	237.30 Kips	7.36 Kips	244.66 Kips
44.51 ft	353.60 Kips	7.36 Kips	360.96 Kips
46.99 ft	385.65 Kips	7.36 Kips	393.01 Kips

> 380 kips
OK.

47' − 3' = 44'

use 44' HP 14×73

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Boring Location 7

Filename: C:\PROGRA~1\DRIVEN\TRANSY~1\TRANS7.DVN
Project Name: I-75 Bridge MOT I-75-14.60 Project Date: 11/12/2004
Project Client: TranSystems Corp.
Computed By: Jimmy Zhong
Project Manager: RJYT

For third pier (south to north)

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 1.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	11.00 ft	0.00%	100.00 pcf	400.00 psf	T-80 Clay
2	Cohesive	2.50 ft	0.00%	125.00 pcf	4000.00 psf	User Def.
3	Cohesive	22.50 ft	0.00%	125.00 pcf	8000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	212.80 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	212.80 psf	8.01 Kips
10.99 ft	Cohesive	N/A	N/A	212.80 psf	9.99 Kips
11.01 ft	Cohesive	N/A	N/A	2000.00 psf	10.09 Kips
13.49 ft	Cohesive	N/A	N/A	2000.00 psf	33.40 Kips
13.51 ft	Cohesive	N/A	N/A	4000.00 psf	33.68 Kips
22.51 ft	Cohesive	N/A	N/A	4000.00 psf	202.85 Kips
31.51 ft	Cohesive	N/A	N/A	4000.00 psf	372.02 Kips
35.99 ft	Cohesive	N/A	N/A	4000.00 psf	456.23 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	N/A	0.54 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.54 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.54 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
13.49 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
13.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
22.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
31.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
35.99 ft	Cohesive	N/A	N/A	N/A	10.70 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
0.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.00 ft	0.00 Kips	0.54 Kips	0.54 Kips
9.01 ft	8.01 Kips	0.54 Kips	8.54 Kips
10.99 ft	9.99 Kips	0.54 Kips	10.52 Kips
11.01 ft	10.09 Kips	5.35 Kips	15.44 Kips
13.49 ft	33.40 Kips	5.35 Kips	38.75 Kips
13.51 ft	33.68 Kips	10.70 Kips	44.38 Kips
22.51 ft	202.85 Kips	10.70 Kips	213.55 Kips
31.51 ft	372.02 Kips	10.70 Kips	382.72 Kips
35.99 ft	456.23 Kips	10.70 Kips	466.93 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	212.80 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	212.80 psf	8.01 Kips
10.99 ft	Cohesive	N/A	N/A	212.80 psf	9.99 Kips
11.01 ft	Cohesive	N/A	N/A	2000.00 psf	10.09 Kips
13.49 ft	Cohesive	N/A	N/A	2000.00 psf	33.40 Kips
13.51 ft	Cohesive	N/A	N/A	4000.00 psf	33.68 Kips
22.51 ft	Cohesive	N/A	N/A	4000.00 psf	202.85 Kips
31.51 ft	Cohesive	N/A	N/A	4000.00 psf	372.02 Kips
35.99 ft	Cohesive	N/A	N/A	4000.00 psf	456.23 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	N/A	0.54 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.54 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.54 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
13.49 ft	Cohesive	N/A	N/A	N/A	5.35 Kips
13.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
22.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
31.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
35.99 ft	Cohesive	N/A	N/A	N/A	10.70 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
0.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.00 ft	0.00 Kips	0.54 Kips	0.54 Kips
9.01 ft	8.01 Kips	0.54 Kips	8.54 Kips
10.99 ft	9.99 Kips	0.54 Kips	10.52 Kips
11.01 ft	10.09 Kips	5.35 Kips	15.44 Kips
13.49 ft	33.40 Kips	5.35 Kips	38.75 Kips
13.51 ft	33.68 Kips	10.70 Kips	44.38 Kips
22.51 ft	202.85 Kips	10.70 Kips	213.55 Kips
31.51 ft	372.02 Kips	10.70 Kips	382.72 Kips
35.99 ft	456.23 Kips	10.70 Kips	466.93 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.51 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
22.51 ft	Cohesive	N/A	N/A	4000.00 psf	141.16 Kips
31.51 ft	Cohesive	N/A	N/A	4000.00 psf	310.33 Kips
35.99 ft	Cohesive	N/A	N/A	4000.00 psf	394.54 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
0.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
1.00 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
11.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.51 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
22.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
31.51 ft	Cohesive	N/A	N/A	N/A	10.70 Kips
35.99 ft	Cohesive	N/A	N/A	N/A	10.70 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
0.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
1.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.00 ft	0.00 Kips	10.70 Kips	10.70 Kips
22.51 ft	141.16 Kips	10.70 Kips	151.86 Kips
31.51 ft	310.33 Kips	10.70 Kips	321.03 Kips
35.99 ft	394.54 Kips	10.70 Kips	405.24 Kips

> 380 kips

OK.

36'-1' = 35'

Use 35 ft HP 14x73

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Boring Location 8

Filename: C:\PROGRA~1\DRIVEN\TRANSY~1\TRANS8.DVN
Project Name: I-75 Bridge MOT I-75-14.60 Project Date: 11/12/2004
Project Client: TranSystems Corp.
Computed By: Jimmy Zhong
Project Manager: RJYT

For fourth pier (south to north)

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 3.50 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	23.50 ft
	- Driving/Restrike	23.50 ft
	- Ultimate:	23.50 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	23.50 ft	0.00%	100.00 pcf	200.00 psf	T-80 Clay
2	Cohesionless	5.00 ft	0.00%	125.00 pcf	36.0/36.0	Nordlund
3	Cohesive	20.50 ft	0.00%	125.00 pcf	7000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.50 ft	Cohesive	N/A	N/A	106.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	106.40 psf	2.75 Kips
18.01 ft	Cohesive	N/A	N/A	118.26 psf	8.06 Kips
23.49 ft	Cohesive	N/A	N/A	145.86 psf	13.70 Kips
23.51 ft	Cohesionless	2350.31 psf	28.29	N/A	13.78 Kips
28.49 ft	Cohesionless	2506.19 psf	28.29	N/A	48.43 Kips
28.51 ft	Cohesive	N/A	N/A	3500.00 psf	48.67 Kips
37.51 ft	Cohesive	N/A	N/A	3500.00 psf	196.69 Kips
46.51 ft	Cohesive	N/A	N/A	3500.00 psf	344.71 Kips
48.99 ft	Cohesive	N/A	N/A	3500.00 psf	385.50 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.50 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
23.49 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
23.51 ft	Cohesionless	2350.63 psf	77.60	22.53 Kips	18.79 Kips
28.49 ft	Cohesionless	2662.37 psf	77.60	22.53 Kips	21.25 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
46.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
48.99 ft	Cohesive	N/A	N/A	N/A	9.36 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.50 ft	0.00 Kips	0.27 Kips	0.27 Kips
9.01 ft	2.75 Kips	0.27 Kips	3.02 Kips
18.01 ft	8.06 Kips	0.27 Kips	8.33 Kips
23.49 ft	13.70 Kips	0.27 Kips	13.97 Kips
23.51 ft	13.78 Kips	18.79 Kips	32.57 Kips
28.49 ft	48.43 Kips	21.25 Kips	69.68 Kips
28.51 ft	48.67 Kips	9.36 Kips	58.03 Kips
37.51 ft	196.69 Kips	9.36 Kips	206.05 Kips
46.51 ft	344.71 Kips	9.36 Kips	354.08 Kips
48.99 ft	385.50 Kips	9.36 Kips	394.86 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.50 ft	Cohesive	N/A	N/A	106.40 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	106.40 psf	2.75 Kips
18.01 ft	Cohesive	N/A	N/A	118.26 psf	8.06 Kips
23.49 ft	Cohesive	N/A	N/A	145.86 psf	13.70 Kips
23.51 ft	Cohesionless	2350.31 psf	28.29	N/A	13.78 Kips
28.49 ft	Cohesionless	2506.19 psf	28.29	N/A	48.43 Kips
28.51 ft	Cohesive	N/A	N/A	3500.00 psf	48.67 Kips
37.51 ft	Cohesive	N/A	N/A	3500.00 psf	196.69 Kips
46.51 ft	Cohesive	N/A	N/A	3500.00 psf	344.71 Kips
48.99 ft	Cohesive	N/A	N/A	3500.00 psf	385.50 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.50 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
23.49 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
23.51 ft	Cohesionless	2350.63 psf	77.60	22.53 Kips	18.79 Kips
28.49 ft	Cohesionless	2662.37 psf	77.60	22.53 Kips	21.25 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
46.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
48.99 ft	Cohesive	N/A	N/A	N/A	9.36 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.50 ft	0.00 Kips	0.27 Kips	0.27 Kips
9.01 ft	2.75 Kips	0.27 Kips	3.02 Kips
18.01 ft	8.06 Kips	0.27 Kips	8.33 Kips
23.49 ft	13.70 Kips	0.27 Kips	13.97 Kips
23.51 ft	13.78 Kips	18.79 Kips	32.57 Kips
28.49 ft	48.43 Kips	21.25 Kips	69.68 Kips
28.51 ft	48.67 Kips	9.36 Kips	58.03 Kips
37.51 ft	196.69 Kips	9.36 Kips	206.05 Kips
46.51 ft	344.71 Kips	9.36 Kips	354.08 Kips
48.99 ft	385.50 Kips	9.36 Kips	394.86 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.50 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	118.26 psf	1.67 Kips
23.49 ft	Cohesive	N/A	N/A	145.86 psf	5.82 Kips
23.51 ft	Cohesionless	2350.31 psf	28.29	N/A	5.89 Kips
28.49 ft	Cohesionless	2506.19 psf	28.29	N/A	40.54 Kips
28.51 ft	Cohesive	N/A	N/A	3500.00 psf	40.78 Kips
37.51 ft	Cohesive	N/A	N/A	3500.00 psf	188.80 Kips
46.51 ft	Cohesive	N/A	N/A	3500.00 psf	336.83 Kips
48.99 ft	Cohesive	N/A	N/A	3500.00 psf	377.62 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.50 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
15.00 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
23.49 ft	Cohesive	N/A	N/A	N/A	0.27 Kips
23.51 ft	Cohesionless	2350.63 psf	77.60	22.53 Kips	18.79 Kips
28.49 ft	Cohesionless	2662.37 psf	77.60	22.53 Kips	21.29 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
46.51 ft	Cohesive	N/A	N/A	N/A	9.36 Kips
48.99 ft	Cohesive	N/A	N/A	N/A	9.36 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.50 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.00 ft	0.00 Kips	0.27 Kips	0.27 Kips
18.01 ft	1.67 Kips	0.27 Kips	1.94 Kips
23.49 ft	5.82 Kips	0.27 Kips	6.09 Kips
23.51 ft	5.89 Kips	18.79 Kips	24.69 Kips
28.49 ft	40.54 Kips	21.29 Kips	61.83 Kips
28.51 ft	40.78 Kips	9.36 Kips	50.14 Kips
37.51 ft	188.80 Kips	9.36 Kips	198.17 Kips
46.51 ft	336.83 Kips	9.36 Kips	346.19 Kips
48.99 ft	377.62 Kips	9.36 Kips	386.98 Kips

> 380 kips

ok.

49 ft − 3.5 ft = 45.5 ft

use 46 ft HP 14x73

DRIVEN 1.2

Boring Location 9

GENERAL PROJECT INFORMATION

For North Abutment

Filename: C:\PROGRA~1\DRIVEN\TRANSY~1\TRANS9.DVN
Project Name: I-75 Bridge MOT I-75-14.60 Project Date: 11/12/2004
Project Client: TranSystems Corp.
Computed By: Jimmy Zhong
Project Manager: RJYT

PILE INFORMATION

Pile Type: H Pile - HP14X73
Top of Pile: 14.60 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	33.00 ft
	- Driving/Restrike	33.00 ft
	- Ultimate:	33.00 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	33.00 ft	0.00%	125.00 pcf	34.0/34.0	Nordlund
2	Cohesionless	21.00 ft	0.00%	125.00 pcf	35.0/35.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.60 ft	Cohesionless	1825.00 psf	26.72	N/A	0.00 Kips
18.01 ft	Cohesionless	2038.12 psf	26.72	N/A	15.80 Kips
27.01 ft	Cohesionless	2600.62 psf	26.72	N/A	73.36 Kips
32.99 ft	Cohesionless	2974.38 psf	26.72	N/A	124.33 Kips
33.01 ft	Cohesionless	4125.31 psf	27.51	N/A	124.52 Kips
42.01 ft	Cohesionless	4407.01 psf	27.51	N/A	222.04 Kips
51.01 ft	Cohesionless	4688.71 psf	27.51	N/A	332.02 Kips
53.99 ft	Cohesionless	4781.99 psf	27.51	N/A	371.19 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	55.60	10.93 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	55.60	10.93 Kips	0.00 Kips
14.59 ft	Cohesionless	0.00 psf	55.60	10.93 Kips	0.00 Kips
14.60 ft	Cohesionless	1825.00 psf	55.60	10.93 Kips	9.99 Kips
18.01 ft	Cohesionless	2251.25 psf	55.60	10.93 Kips	10.93 Kips
27.01 ft	Cohesionless	3376.25 psf	55.60	10.93 Kips	10.93 Kips
32.99 ft	Cohesionless	4123.75 psf	55.60	10.93 Kips	10.93 Kips
33.01 ft	Cohesionless	4125.63 psf	64.00	15.99 Kips	15.99 Kips
42.01 ft	Cohesionless	4689.03 psf	64.00	15.99 Kips	15.99 Kips
51.01 ft	Cohesionless	5252.43 psf	64.00	15.99 Kips	15.99 Kips
53.99 ft	Cohesionless	5438.97 psf	64.00	15.99 Kips	15.99 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.60 ft	0.00 Kips	9.99 Kips	9.99 Kips
18.01 ft	15.80 Kips	10.93 Kips	26.72 Kips
27.01 ft	73.36 Kips	10.93 Kips	84.28 Kips
32.99 ft	124.33 Kips	10.93 Kips	135.25 Kips
33.01 ft	124.52 Kips	15.99 Kips	140.51 Kips
42.01 ft	222.04 Kips	15.99 Kips	238.03 Kips
51.01 ft	332.02 Kips	15.99 Kips	348.01 Kips
53.99 ft	371.19 Kips	15.99 Kips	387.18 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.60 ft	Cohesionless	1825.00 psf	26.72	N/A	0.00 Kips
18.01 ft	Cohesionless	2038.12 psf	26.72	N/A	15.80 Kips
27.01 ft	Cohesionless	2600.62 psf	26.72	N/A	73.36 Kips
32.99 ft	Cohesionless	2974.38 psf	26.72	N/A	124.33 Kips
33.01 ft	Cohesionless	4125.31 psf	27.51	N/A	124.52 Kips
42.01 ft	Cohesionless	4407.01 psf	27.51	N/A	222.04 Kips
51.01 ft	Cohesionless	4688.71 psf	27.51	N/A	332.02 Kips
53.99 ft	Cohesionless	4781.99 psf	27.51	N/A	371.19 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	55.60	10.93 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	55.60	10.93 Kips	0.00 Kips
14.59 ft	Cohesionless	0.00 psf	55.60	10.93 Kips	0.00 Kips
14.60 ft	Cohesionless	1825.00 psf	55.60	10.93 Kips	9.99 Kips
18.01 ft	Cohesionless	2251.25 psf	55.60	10.93 Kips	10.93 Kips
27.01 ft	Cohesionless	3376.25 psf	55.60	10.93 Kips	10.93 Kips
32.99 ft	Cohesionless	4123.75 psf	55.60	10.93 Kips	10.93 Kips
33.01 ft	Cohesionless	4125.63 psf	64.00	15.99 Kips	15.99 Kips
42.01 ft	Cohesionless	4689.03 psf	64.00	15.99 Kips	15.99 Kips
51.01 ft	Cohesionless	5252.43 psf	64.00	15.99 Kips	15.99 Kips
53.99 ft	Cohesionless	5438.97 psf	64.00	15.99 Kips	15.99 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.60 ft	0.00 Kips	9.99 Kips	9.99 Kips
18.01 ft	15.80 Kips	10.93 Kips	26.72 Kips
27.01 ft	73.36 Kips	10.93 Kips	84.28 Kips
32.99 ft	124.33 Kips	10.93 Kips	135.25 Kips
33.01 ft	124.52 Kips	15.99 Kips	140.51 Kips
42.01 ft	222.04 Kips	15.99 Kips	238.03 Kips
51.01 ft	332.02 Kips	15.99 Kips	348.01 Kips
53.99 ft	371.19 Kips	15.99 Kips	387.18 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.59 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.60 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
15.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.01 ft	Cohesionless	2063.13 psf	26.72	N/A	14.12 Kips
27.01 ft	Cohesionless	2625.63 psf	26.72	N/A	71.68 Kips
32.99 ft	Cohesionless	2999.38 psf	26.72	N/A	122.65 Kips
33.01 ft	Cohesionless	4125.31 psf	27.51	N/A	122.84 Kips
42.01 ft	Cohesionless	4407.01 psf	27.51	N/A	220.36 Kips
51.01 ft	Cohesionless	4688.71 psf	27.51	N/A	330.34 Kips
53.99 ft	Cohesionless	4781.99 psf	27.51	N/A	369.50 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.59 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.60 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
15.00 ft	Cohesionless	1875.00 psf	55.60	10.93 Kips	10.27 Kips
18.01 ft	Cohesionless	2251.25 psf	55.60	10.93 Kips	10.93 Kips
27.01 ft	Cohesionless	3376.25 psf	55.60	10.93 Kips	10.93 Kips
32.99 ft	Cohesionless	4123.75 psf	55.60	10.93 Kips	10.93 Kips
33.01 ft	Cohesionless	4125.63 psf	64.00	15.99 Kips	15.99 Kips
42.01 ft	Cohesionless	4689.03 psf	64.00	15.99 Kips	15.99 Kips
51.01 ft	Cohesionless	5252.43 psf	64.00	15.99 Kips	15.99 Kips
53.99 ft	Cohesionless	5438.97 psf	64.00	15.99 Kips	15.99 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.59 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.60 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.00 ft	0.00 Kips	10.27 Kips	10.27 Kips
18.01 ft	14.12 Kips	10.93 Kips	25.04 Kips
27.01 ft	71.68 Kips	10.93 Kips	82.60 Kips
32.99 ft	122.65 Kips	10.93 Kips	133.57 Kips
33.01 ft	122.84 Kips	15.99 Kips	138.83 Kips
42.01 ft	220.36 Kips	15.99 Kips	236.35 Kips
51.01 ft	330.34 Kips	15.99 Kips	346.33 Kips
53.99 ft	369.50 Kips	15.99 Kips	385.49 Kips > 380 kips

54 ft - 14.6 ft = 39.4 ft

Use 40 ft HP 14 x 73

TRANSYSTEMS CORPORATION

January 01, 2005

Mr. Scott C. Boyer, PE
District Contract Manger
District 7 - Production
Ohio Department of Transportation
1001, St. Mary's Avenue
Sidney, Ohio 45365

RECEIVED
FEB 3 2005
PRODUCTION
DISTRICT 7 - BY:

SUBJECT: Geotechnical Addendum
MOT-75-14.60
PID#23828

Dear Mr. Boyer:

Enclosed, please find four (4) copies of the "Addendum to Bowser Morner Report 131651-1104-268". This report addresses all the Geotechnical comments we received from ODOT in the letter dated December 7, 2004.

We would like to bring to your attention the section "Subgrade Checklist, Question 7" in the above mentioned report. The comments on CBR values for pavement design are addressed in this section. Richard Tseng of Bowser Morner and I talked over the different recommendations for CBR value for Mainline pavement, and for Ramp and Stanley Avenue pavement. A CBR value of 10 is still being recommended for the mainline pavement and shoulders accounting for the in-situ embankment fill material. We have a clear direction from the department on the design for the mainline pavement and shoulders from the letter dated December 17, 2004. However, specific pavement recommendation for the Ramps and Stanley Avenue were pending due to the lack of a clear recommendation on the CBR value. Bowser Morner recommends a CBR value of 4 for both the Ramp and Stanley Avenue pavement. Please review the enclosed soils report and provide us with a pavement buildup for the Ramps and Stanley Avenue.

Pursuant to Stage I structures comments from ODOT in the letter dated December 27, 2004 we looked at tapering the bridge in the northbound direction and have determined that we can proceed with the tapered design without affecting the recommended Maintenance of Traffic (MOT) alternative. Making this change will reduce superstructure and substructure costs, and eliminate the need for 184-feet of retaining wall at the north east corner of the bridge. As far as we know, there are no other limiting factors that preclude us from proceeding with the taper on the bridge in the northbound direction. We also would like to proceed with preparing MOT plans for Stage II, and would like the department's concurrence with out recommendation for part width construction.

5747 Perimeter Drive, Suite 240 • Dublin, OH 43017 • Phone: (614) 336-8480 • Fax: (614) 336-8540

If you have any questions or require more information on this matter, please do not hesitate to call.

Sincerely,

TranSystems Corporation

Asvin Mandadi

Asvin Mandadi, P.E.
Senior Roadway Engineer

Enclosure as noted.

Cc: Richard Tseng, Bowser Morner
File

Soil Study for Bridge Replacement Project,
MOT I-75-14.60, I-75 Bridge Over the Great Miami River,
Dayton, Montgomery County, Ohio

For

TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Report No. 131651-1104-268

November 15, 2004

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November 15, 2004

TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, Ohio 43017

Attention: Mr. Asvin Mandadi

Re: Report No. 131651-1104-268; Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Dear Mr. Mandadi:

Bowser-Morner is pleased to submit our report of the soil study for the above-referenced project. The purpose of the study is to determine the physical characteristics of the soil strata and allowable bearing capacity for the proposed bridge and to determine the soil conditions and the subgrade resilient modulus to be used by others to perform pavement design. This report is prepared in accordance with *Specifications for Subsurface Investigations* by the Ohio Department of Transportation dated October 3, 1996.

The samples collected that were not used to perform the laboratory tests will be kept in our laboratory for 30 days unless you advise us otherwise. If you have any questions or if we can help you in any way on this project or future work, please call us.

Sincerely,
BOWSER-MORNER ASSOCIATES, INC.

Jimmy Zhong

Jimmy Zhong, M.S., E.I.T.
Geotechnical Engineer

Richard J.Y. Tseng, Ph.D., P.E.
Vice President
Chief Geotechnical Engineer

STATE OF OHIO
RICHARD J. Y. TSENG
43351
REGISTERED PROFESSIONAL ENGINEER

JZ/RJYT/kmw
5-Client
2-File

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1.0 INTRODUCTION

A five-span bridge, MOT I-75-14.60, along I-75 over the Great Miami River, north of Stanley Avenue, in Dayton, Montgomery County, Ohio will be replaced. A site plan is shown on the prints in Section II of this report. Our findings on the soil conditions and groundwater levels with respect to the potential construction problems, and recommendations for the allowable bearing capacity for the construction of the proposed bridge are given in the report.

Authorization to proceed with this soil study was given by TranSystems Corporation on June 15, 2004. The work was to proceed in accordance with our proposal and agreement, Quotation No. 04-2771-027 dated March 1, 2004.

The draft soil boring logs were faxed to Mr. Asvin Mandadi and Mr. Rick Rockich of TranSystems Corporation on July 29, 2004. The preliminary recommendations for the pile lengths for the bridge foundations were faxed to Mr. Nabil Farah and Mr. Asvin Mandadi of TranSystems Corporation on November 12, 2004.

2.0 WORK PERFORMED

2.1 FIELD WORK

Fourteen soil borings were made at the locations shown on the prints included in Section II. Six of these borings were performed for the proposed bridge foundations and eight of these borings were made for the proposed pavement. The boring logs are included in Section II. The borings were made with a truck-mounted boring rig using hollow-stem augers and standard penetration resistance methods. The standard penetration tests were performed in accordance with ASTM D1586, which includes a 140-pound hammer, 30-inch drops, and two-inch-O.D. split-spoon samplers driven at maximum depth intervals of five feet or at major changes in stratum, whichever occurred first. The disturbed split-spoon samples were visually classified, logged, sealed in moisture-proof jars, and taken to the Bowser-Morner laboratory for study. The depths

where these "A"-type split-spoon samples were collected are noted on the corresponding boring logs.

2.2 LABORATORY WORK

Twenty Unified Soil Classification, AASHTO, and ODOT soil classification tests were performed in accordance with ASTM D422, D2216, D2487, D4318, and D3282 and with ODOT specifications. The purpose of this type of test is to determine parameters that aid in the evaluation of the general behavior of the soils. The results of the soil classification tests are summarized in Table 2-1 and included in Section II of this report.

TABLE 2-1. Summary of Laboratory Test Results

Boring No.	Depth (ft.)	Moisture Content (%)	% Gravel	% Sand	% Silt	% Clay	Atterberg Limits LL	PL	PI	ODOT Classification
1	1.0 – 2.5	9.2	22.7	54.8	14.3	8.2	Non-Plastic			A-3a (0)
2	1.0 – 2.5	11.6	45.9	32.8	15.0	6.3	31	27	4	A-1-b (0)
3	1.0 – 2.5	3.0	57.2	32.3	7.4	3.1	Non-Plastic			A-1-a (0)
4	38.5 – 40.0	10.9	28.7	58.8	8.9	3.6	Non-Plastic			A-1-b (0)
5	13.5 – 15.0	9.8	25.8	33.6	23.7	16.9	20	12	8	A-4a (1)
	28.5 – 30.0	9.9	23.6	11.6	27.6	37.2	36	19	17	A-6b (9)
6	3.5 – 5.0	Saturated	57.6	37.5	2.7	2.2	Non-Plastic			A-1-a (0)
	18.5 – 20.0	16.2	11.5	21.2	38.9	28.4	28	17	11	A-6a (7)
7	6.0 – 7.5	18.8	13.5	22.4	25.1	39.0	28	17	11	A-6a (6)
	18.5 – 18.9	7.4	33.2	16.0	29.7	21.1	26	16	10	A-4a (3)
8	3.5 – 5.0	9.5	32.3	31.4	19.7	16.6	23	13	10	A-4a (0)
	11.0 – 12.5	16.7	8.2	17.5	32.1	42.2	30	17	13	A-6a (9)
	28.5 – 30.0	11.4	14.6	8.9	33.4	43.1	23	15	8	A-4a (8)
9	1.5 – 3.0	5.4	50.8	33.6	8.6	7.0	23	15	8	A-2-4 (0)
	33.5 – 35.0	8.0	62.4	22.3	9.6	5.7	26	16	10	A-2-4 (0)
10	1.0 – 2.5	4.7	32.3	47.3	11.3	9.1	21	14	7	A-2-4 (0)
11	3.5 – 5.0	16.0	3.2	50.0	29.5	17.3	33	20	13	A-6a (4)
12	5.5 – 7.0	25.7	0.4	26.1	41.1	32.4	39	23	16	A-6b (10)
13	8.5 – 10.0	21.2	0.6	43.3	33.9	22.2	34	19	15	A-6a (6)
14	2.5 – 4.0	4.9	63.6	19.1	13.0	4.3	31	17	14	A-2-6 (0)

In addition, 118 moisture-content determinations were made in accordance with ASTM D2216. The results of the moisture content tests are included in Section II of this report.

3.0 SOIL AND GROUNDWATER CONDITIONS

3.1 BRIDGE ABUTMENTS

Boring 4 was made in the south bridge abutment area while Boring 9 was made in the north bridge abutment area. Borings 5, 6, 7, and 8 were made for the center piers. Based on the information from Borings 4 and 9, the subgrade soil conditions at the bridge abutments are described in descending order below:

- 23 to 33 feet of embankment fill consisting of asphalt pavement, concrete base, brown coarse and fine sand, and brown gravel with sand and silt.
- In Boring 4 and below the fill layer, 10 feet of very-stiff-to-hard brown silt and clay.
- In Boring 4 and below the brown silt and clay layer, and in Boring 9 and below the fill layer, dense-to-very-dense brown gravel with sand extending to the bottoms of these borings at depths of 40 to 50 feet.

3.2 CENTER PIERS

Borings 6 and 7 were made in the middle of the Great Miami River while Borings 5 and 8 were made at the shorelines over the flood dikes. Based on the information from these borings, the subgrade soil conditions are described in descending order below:

- In Borings 5 and 8, 9.5 to 18.5 feet of undocumented and uncontrolled fill, which is the embankment fill for the flood dikes.
- In Boring 5 and below the fill layer, and in the vicinity of Borings 6 and 7, three to 4.5 feet of loose-to-dense brown sand.
- In Boring 6 and below the brown sand layer, 14 feet of loose-to-very-dense gray gravel.
- In Borings 5 and 7 and below the brown sand layer, in Boring 6 and below the gray gravel layer, and in Boring 8 and below the fill layer, soft-to-hard, gray or brown silty clay, or silt and clay, or sandy silt extending to the bottoms of these borings at depths of 21.2 to 50 feet.
- In Boring 8, five feet of very dense, gray gravel with sand and silt were embedded in the greenish-gray and brown, silty clay layer at a depth of 23.5 feet.

- Auger refusal occurred at the bottoms of Borings 7 and 6 at depths of 21.2 and 28.9 feet, respectively.

3.3 SHOULDERS OF I-75 HIGHWAY

Borings 1, 2, 3, and 10 were made along the shoulders of I-75. Based on the information from these borings, the areas are covered with more than 10 feet of embankment fill, which is described in descending order below:

- Six inches of asphalt pavement.
- In Borings 1, 2, and 3, and below the asphalt pavement layer, 6 to 18 inches of concrete base.
- In Boring 1 and below the concrete base, loose-to-dense, black or gray coarse and fine sand extending to the bottom of the boring at a depth of 10 feet.
- In Borings 2 and 3, and below the concrete base, and in Boring 10 and below the asphalt pavement, very-loose-to-very-dense brown gravel with sand extending to the bottoms of these borings at a depth of 10 feet.

3.4 RAMP TO STANLEY AVENUE

Borings 13 and 14 were made along the proposed ramp from southbound I-75 to Stanley Avenue. Based on information from these borings, the subgrade soil conditions are described in descending order below:

- In Boring 13, 2.5 feet of embankment fill consisting of topsoil and brown sand.
- In Boring 14, 12 inches of topsoil.
- In Boring 13 and below the fill layer, medium-stiff-to-very-stiff, dark brown or brown sandy silt, and silt and clay extending to the bottom of this boring at a depth of 10 feet.
- In Boring 14 and below the topsoil layer, medium-dense-to-very-dense brown gravel with sand, silt, and clay extending to the bottom of this boring at a depth of 10 feet.

3.5 STANLEY AVENUE

Borings 11 and 12 were made on the shoulders of Stanley Avenue. Based on the information from these borings, the subgrade soil conditions are described in descending order below:

- Five feet of undocumented fill consisting of asphalt pavement; gravel base; topsoil; brown sand; dark brown and gray sandy silt; and brown or gray silt and clay.
- Below the fill layer, 3 to 3.5 feet of stiff-to-very-stiff, brown silty clay.
- Below the brown, silty clay layer, medium-dense brown sand extending to the bottoms of these borings at a depth of 10 feet.

3.6 GROUNDWATER LEVELS

Free groundwater was encountered only in Borings 4 through 9, 11, 12, and 14 during the advancement of the borings. Borings 6 and 7 were performed in the middle of the Great Miami River; the river water was above the bottom of the river. Free groundwater was not encountered in the remaining borings. The groundwater depths and elevations are summarized in Table 3-1. The ground-surface elevations at the boring locations are provided by TranSystems Corporation.

TABLE 3-1. Summary of Groundwater Observations

Boring No.	Depth Groundwater First Observed (ft)		Groundwater Observations at Completion of Boring (ft)	
	Depth	Elevation	Depth	Elevation
4	33.0	734.6	18.0	749.6
5	18.5	723.4	31.0	710.9
6	River Water Level above the Top of the Boring			
7	River Water Level above the Top of the Boring			
8	23.5	717.0	26.5	714.0
9	33.0	737.6	34.0	736.6
11	8.5	734.1	8.5	734.1
12	8.0	736.4	8.0	736.4
14	8.0	733.8	8.0	733.8

Free groundwater is defined as water that seeps into an open borehole before it is backfilled. Groundwater observations were made during the boring operations by noting the depth of water on the boring tools and in the open boreholes following withdrawal of the boring augers. However, it should be noted that short-term water level readings are not necessarily a reliable indication of the groundwater level and that significant fluctuations may occur due to variations in rainfall and other factors. For specific questions on the soil conditions, please refer to the individual boring logs in Section II.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 PROJECT DESCRIPTION

A five-span bridge, MOT I-75-14.60, along I-75 over the Great Miami River, north of Stanley Avenue, in Dayton, Montgomery County, Ohio will be replaced. A site plan is included in Section II of this report. A section of I-75 between Stations 427+00 and 469+00, and the ramp from southbound I-75 to Stanley Avenue will be improved. A section of Stanley Avenue between Stations 7+00 and 16+00 will also be improved. No loading information for the bridge design was provided for this report.

The following recommendations are based on this information. If the above statements are incorrect or changes are made, Bowser-Morner should be notified so that the new data can be reviewed and additional recommendations and services can be given if required to meet the needs of your project.

4.2 FOUNDATION RECOMMENDATIONS

Boring 4 was made at the south abutment, Boring 9 was made at the north abutment, and Borings 5 through 8 were made in the center pier locations. From south to north, Boring 5 was made for the first south pier over the flood dike, Boring 6 was made for the second center pier in the river, Boring 7 was made for the third center pier in the river, and Boring 8 was made for the fourth pier over the flood dike.

Based on the information from these borings, the two abutment locations of the bridge are covered with 23 to 33 feet of embankment fill. The first and fourth pier

locations are covered with 23 to 23.5 feet of undocumented and uncontrolled fill, the flood dike embankment, and weak soil. The second and third pier locations are covered with 11 feet of weak soil, which is the alluvial deposit by the river water. The fill and/or the weak soil extend to the approximate depths and elevations outlined in Table 4-1.

Table 4-1. Depths to Bottoms of Fill and Weak Soil Layer

Boring No.	Depth to Bottom of Fill and Weak Soil Layer (ft)	Elevation at Bottom of Fill and Weak Soil Layer (ft)	Fill and/or Weak Soil
4	23.0	744.6	Fill
5	23.0	718.9	Fill and Weak Soil
6	11.0	718.2	Weak Soil
7	11.0	718.9	Weak Soil
8	23.5	717.0	Fill and Weak Soil
9	33.0	737.6	Fill

The existing fill at the bridge abutments, in the vicinity of Borings 4 and 9, is embankment fill placed during the construction of the existing I-75 bridge. Based on the results of the standard penetration tests (SPT), the embankment fill at the bridge abutments appears to have been compacted. Below the embankment fill layer, very-stiff-to-hard brown silt and clay, and dense-to-very-dense brown gravel with sand extended to the bottoms of the borings.

In the center pier area, in the vicinity of Borings 5, 6, 7, and 8, the undocumented and uncontrolled fill and weak soil outlined in Table 4-1 are unreliable to support the bridge foundations. Below the unreliable soil layer, very dense gray gravel and hard gray or brown silty clay, or silt and clay, or sandy silt extended to the bottoms of the borings.

Based on the soil information from Borings 4 through 9, the bearing stratum below the fill and weak soil layer outlined in Table 4-1 has a SPT "N" value ranging from 27 to 200 blows per foot. It will be very difficult for driven pipe piles filled with concrete to penetrate this hard layer. The steel pipe piles will be crushed during the pile driving unless the pipe pile walls will be thickened to accept the hard driving of the pile hammer.

Driven steel H-piles can be installed on this site to support the proposed bridge foundations. Driving points should be welded onto the tips of the H-piles to protect the tips of the piles. We understand that HP 14×73 piles will be installed on this site and that each pile will have a design load of 95 tons. Based on the profile sheet provided by TranSystems Corporation, the bottoms of the proposed pile caps at the bridge abutments and center piers are presented in Table 4-2. We understand that the local scouring depth at the bridge abutments and center piers will be about 15 feet. A computer program, *Driven v1.2* by the Federal Highway Administration, was used to determine the required cutoff lengths of the H-piles. The output results of the computer program are summarized in Table 4-2. The computations are based on the soil information and the results of the standard penetration tests (SPT) from the six borings made in the bridge area.

Table 4-2. Cutoff Lengths* of H-Piles (HP 14×73)

Pile Location	Elevation at the Bottom of the Proposed Pile Cap (ft)	Cutoff Length of Pile (ft)	Pile Tip Elevation (ft)
South Abutment	754	40	714
First Pier (From South to North)	729	35	694
Second Pier (From South to North)	726	44	682
Third Pier (From South to North)	729	35	694
Fourth Pier (From South to North)	737	46	691
North Abutment	756	40	716

* The pile cutoff length does not include the required length of the pile to be connected to the pile cap.

The cutoff lengths of the HP 14×73 piles were determined based on a design load of 95 tons for each pile and were designed with a factor of safety of 2. For a pile group, at least four feet measured from center-to-center of the piles should be maintained between the piles to provide the full capacity of each pile. If the piles will be closer than four feet, the pile-group efficiency coefficient should be applied in the design.

We recommend that a dynamic analyzer be used during the installation of the driven piles to verify the capacity of the piles. Alternatively, static pile-load tests can be performed to determine the actual load-bearing capacity of the piles.

Free groundwater was observed at depths of 18 to 34 feet in Borings 4, 5, 8, and 9 during the boring operations as outlined in Table 3-1. Borings 6 and 7 were performed in the middle of the Great Miami River; the river water was above the bottom of the river. Groundwater should not be a problem for the installation of driven H-piles. However, it must be noted that the driven H-piles will be installed close to the existing bridge foundations. The vibrations from driving the piles may disturb the existing bridge foundations and superstructures. The amount of vibration waves propagated to the existing structures should be measured with monitoring equipment during the pile installations. While the monitoring work is beyond the scope of this study, we will be glad to perform the monitoring during the pile installations as a separate study at your request.

4.3 SOIL DATA FOR SCOUR ANALYSIS

Based on the results of the laboratory soil-classification tests performed for this study, the D_{50} particle sizes of the soils under the riverbed in the middle of the Great Miami River are tabulated in Table 4-3. The scour analyses are beyond the scope of this study.

Table 4-3. D_{50} Particle Sizes

Boring No.	Sample No.	Depth Interval (ft)	D_{50} (mm)
6	2A	3.5 – 5.0	2.76
7	3A	6.0 – 7.5	0.0122

4.4 SITE CLASSIFICATION FOR SEISMIC DESIGN

Based on the results of the standard penetration tests (SPT) in Borings 4 through 9 made in the bridge area, the average "N" value is approximately 44 to 55 blows per foot for the soil layer within 21 to 50 feet of the existing grade. The bottoms of the borings are in the very dense, brown gravel with sand, or in the hard gray silt and clay layer with blow counts ranging from 50 to 100. We believe the average "N" value for the soil layer within 100 feet of the existing grade will be greater than 50. It is our opinion that the site will be classified as a "C" type in accordance with the 2002 *Ohio Building Code*.

4.5 PAVEMENT RECOMMENDATIONS

4.5.1 SUBGRADE SOIL CONDITIONS AND PREPARATIONS

A section of I-75 between Stations 427+00 and 469+00, and the ramp from southbound I-75 to Stanley Avenue will be improved. The improvement of a section of Stanley Avenue between Stations 7+00 and 16+00 will also be part of this project. Borings 1, 2, 3, and 10 were made along the shoulders of the I-75 roadway, Borings 13 and 14 were made in the proposed ramp area, and Borings 11 and 12 were made along the shoulders of Stanley Avenue.

Based on the soil information from Borings 1, 2, 3, and 10, the shoulders of the I-75 roadway in the project area is covered with six inches of asphalt pavement. Six to 18 inches of concrete pavement were encountered in Borings 1, 2, and 3 below the asphalt pavement layer. The existing pavement was supported on more than 10 feet of embankment fill, which was placed during the construction of I-75. Loose fill was encountered in Borings 1 and 2 at depths of 6 to 10 feet below the existing grade. With the widening of the I-75 roadway in the vicinity of Borings 1 and 2, the embankment will have to be widened for the extra lanes. The loose fill encountered in the embankment fill should be removed and replaced with newly compacted backfill. The fill should be placed in eight-inch-thick lifts and compacted to the required ODOT specifications (ODOT Item 203.07).

Based on the soil information from Borings 13 and 14, the proposed ramp area is covered with 1 to 2.5 feet of topsoil or embankment fill over brown gravel with sand, brown sandy silt, and brown silt and clay. The topsoil and any organic soil in the proposed ramp area should be removed. Weak soil was encountered in Boring 13 at a depth of 8 feet. If the existing ramp in the vicinity of Boring 13 will be widened and the weak soil is encountered, the weak soil should be removed and replaced with newly compacted backfill. The fill should be placed in eight-inch-thick lifts and compacted to the required ODOT specifications (ODOT Item 203.07).

Based on the soil information from Borings 11 and 12, the shoulders of Stanley Avenue are covered with five feet of undocumented and uncontrolled fill over brown silty clay and brown sand. If the street in the vicinity of Borings 11 and 12 will be widened, the top foot of the undocumented and uncontrolled fill should be recompacted to achieve the required dry unit weight per ODOT specifications. However, if soft soil is encountered, the soft and weak soil should be removed and replaced with compacted backfill. The backfill should be placed in eight-inch-thick lifts and compacted to the required ODOT specifications (ODOT Item 203.07).

Silty or clayey soil at subgrade depth will tend to degrade quickly under construction traffic when wet. Degradation of the wet subgrade soils will result in a reduced support value. For this reason, all of the exposed subgrade should be graded to drain and should be protected against any detrimental change in condition such as from disturbances, rain, and freezing. The ground surface on both sides of the roadway should slope away from the pavement so that surface runoff is not allowed to pond next to the pavement. Adequate drainage should be provided at the site to avoid an increase in moisture content of the subgrade soils during and after construction.

4.5.2 RECOMMENDATIONS ON SUBGRADE SOIL SUPPORT VALUE

Based on the results of the laboratory tests, the subgrade soils along the shoulders of I-75 can be classified as A-1-a, A-1-b, A-3a, and A-2-4 types in accordance with the ODOT Soil Classification System. With this type of subgrade soil compacted to the required ODOT specifications (ODOT Item 203.07), a California Bearing Ratio (CBR) value of 10 can be assigned for the pavement design. A resilient modulus M_R of 12,000 psi can be used for the asphalt pavement design.

Based on the results of the laboratory tests, the subgrade soils along the proposed ramp from southbound I-75 to Stanley Avenue can be classified as A-2-6 and A-6a types in accordance with the ODOT Soil Classification System. With this type of subgrade soil compacted to the required ODOT specifications (ODOT Item 203.07), a California Bearing Ratio (CBR) value of 4 can be assigned for the pavement design. A resilient modulus M_R of 4,800 psi can be used for asphalt pavement design.

Based on the results of the laboratory tests, the subgrade soils along the shoulders of Stanley Avenue can be classified as A-6a and A-6b types in accordance with the ODOT Soil Classification System. With this type of subgrade soil compacted to the required ODOT specifications (ODOT Item 203.07), a California Bearing Ratio (CBR) value of 4 can be assigned for the pavement design. A resilient modulus M_R of 4,800 psi can be used for asphalt pavement design.

5.0 CLOSURE

5.1 BASIS OF RECOMMENDATIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions. Data used during this exploration included, but were not necessarily limited to:

- Fourteen exploratory borings performed during this study.
- Observations of the project site by our staff.
- The results of the laboratory soil tests.
- The site plan and profile sheets provided by TranSystems Corporation.
- The stations and offsets of the borings and the boring surface elevations provided by TranSystems Corporation.
- Limited interaction with Mr. Asvin Mandadi, Mr. Rick Rockich, and Mr. Nabil Farah of TranSystems Corporation.
- Published soil or geologic data of this area.

In the event that changes in the project characteristics are planned, or if additional information or differences from the conditions anticipated in this report become apparent, Bowser-Morner should be notified so that the conclusions and recommendations contained in this report can be reviewed and, if necessary, modified or verified in writing.

5.2 LIMITATIONS AND ADDITIONAL SERVICES

The subsurface conditions discussed in this report and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by designers, or that the construction process has altered the soil conditions. As variations in the soil profile are encountered, additional subsurface sampling and testing may be necessary to provide data required to reevaluate the recommendations of this report. Consequently, after submission of this report, it is recommended that Bowser-Morner be authorized to perform additional services to work with the designer(s) to minimize errors and omissions regarding the interpretation and implementation of this report.

Before construction begins, we recommend that Bowser-Morner:

- Work with the designers to implement the recommended geotechnical design parameters into plans and specifications.
- Consult with the design team regarding interpretation of this report.
- Establish criteria for the construction observation and testing for the soil conditions encountered at this site.
- Review final plans and specifications pertaining to geotechnical aspects of design.

During construction, we recommend that Bowser-Morner:

- Observe the construction, particularly the site preparation, fill placement, and pile installation.
- Perform in-place density testing of all compacted fill.
- Perform materials testing of soil and other materials as required.
- Consult with the design team to make design changes in the event that differing subsurface conditions are encountered.

If Bowser-Morner is not retained for these services, we shall assume no responsibility for construction compliance with the design concepts, specifications or recommendations.

5.3 WARRANTY

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, express or implied, is made.

The scope of this study did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, within or beyond the site studied. Any statements in the report or on the boring logs regarding odors, staining of soils or other unusual items or conditions observed are strictly for the information of our client.

To evaluate the site for possible environmental liabilities, we recommend an environmental assessment, consisting of a detailed site reconnaissance, a record review, and report of findings. Additional subsurface drilling and sampling, including groundwater sampling, may be required. Bowser-Morner can provide this service and would be pleased to provide a cost proposal to perform such a study, if requested.

This report has been prepared for the exclusive use of TranSystems Corporation for specific application to the I-75 bridge replacement project over the Great Miami River (MOT I-75-14.60) in Dayton, Montgomery County, Ohio (see the site plan shown on the prints in Section II of this report). Specific design and construction recommendations have been provided in the various sections of the report. The report shall therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. Bowser-Morner is not responsible for the independent conclusions, opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.

Bowser-Morner, Inc.

Job Number: 131651
Client: TranSystems Corporation
Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Date Started 7/12/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) None
Date Completed 7/12/04 Casing: Length Dia.
Boring No. 1
Sheet 1 of 1 Station & Offset Sta. 433+57.92; 43.76' Rt. Surface Elev. (ft) 747.7

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
747.7	0														
~~747.2~~					(FILL) ASPHALT pavement (6")										
~~746.7~~	2	9/21/24			(FILL) CONCRETE pavement (6") (FILL) Dense black coarse and fine SAND, some gravel, trace cinders, trace silt - damp	1A	22.7	16.9	37.9	14.3	8.2	NonPlastic		9.2	A-3a(0)
	4	19/20/30				2A								11.7	
742.2	6	12/7/7			(FILL) Medium dense black fine SAND, little gravel - damp	3A								6.0	
739.2	8	3/4/4			(FILL) Loose gray coarse and fine SAND, little gravel, trace clay - moist	4A								11.0	
737.7	10														

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/13/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) None

Client: TranSystems Corporation

Date Completed 7/13/04 Casing: Length Dia.

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 2

Sheet 1 of 1 Station & Offset Sta. 438+45.11; 61.22' Lt. Surface Elev. (ft) 748.2

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
748.2	0														
747.7					(FILL) ASPHALT pavement (6")										
746.2	2				(FILL) CONCRETE pavement (18")										
		10/9/10			(FILL) Medium dense brown GRAVEL with sand - moist (Trace concrete at 2.0')	1A	45.9	17.9	14.9	15.0	6.3	31	4	11.6	A-1-b(0)
	4														
		8/6/6				2A								30.1	
	6														
		4/3/3			(Becomes loose with trace glass at 6.5')	3A								29.8	
	8														
		1/1/1			(Becomes very loose with trace glass and trace cinders at 8.5')	4A								28.3	
738.2	10														

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651
Client: TranSystems Corporation
Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Date Started 7/8/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) None
Date Completed 7/8/04 Casing: Length Dia.
Boring No. 3
Sheet 1 of 1 Station & Offset Sta. 451+20.07; 43.34' Rt. Surface Elev. (ft) 761.4

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
761.4	0														
760.9					(FILL) ASPHALT pavement (6")										
760.4					(FILL) CONCRETE pavement (6")										
	2	3/13/58			(FILL) Very dense brown GRAVEL, some sand - damp	1A	57.2	22.4	9.9	7.4	3.1	NonPlastic		3.0	A-1-a(0)
	4	29/42/42				2A								3.2	
	6	60/39/50			(Trace silt at 6.0')	3A								3.1	
	8	27/39/50				4A								5.9	
751.4	10														

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/8/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 749.6

Date Completed 7/8/04 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 4

Sheet 1 of 2 Station & Offset Sta. 455+18.71; 41.22' Rt. Surface Elev. (ft) 767.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
767.6	0														
767.1					(FILL) ASPHALT pavement (6")										
766.6					(FILL)CONCRETE pavement (6")										
	2	22/33/39			(FILL) Very dense brown coarse and fine SAND, some gravel - damp	1A								3.5	
	4	20/20/14			(Becomes dense at 3.5')	2A								4.5	
	6	12/20/20				3A								4.8	
	8	18/18/20				4A								3.1	
	10	12/39/50(0.3')			(Becomes very dense at 10.5')	5A								5.3	
	12														
	14	50(0.1')				6A								-	
751.6	16														
	18	10/19/20			(FILL) Dense dark brown coarse SAND, some gravel, some silt, trace glass - moist	7A								11.0	
	20	6/5/5			(Becomes loose with some black ash at 18.5')	8A								35.5	
	22														
744.6															
	24	6/13/14			(ORIGINAL) Very stiff brown SILT and CLAY, trace gravel - moist	9A								19.9	
	26														
	28														
	30	50(0.1')			(Becomes hard with cobble encountered at 28.5')	10A								-	
	32														
734.6															
	34	13/20/30			Dense brown GRAVEL with sand, trace cobbles - wet	11A								Sat.	

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Boring No. 4

Sheet 2 of 2 Station & Offset Sta. 455+18.71; 41.22' Rt. Surface Elev. (ft) 767.6 Job Number: 131651

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
732.6															
	36														
	38														
		28/32/33			(Becomes very dense at 38.5')	12A	28.7	21.5	37.3	8.9	3.6	NonPlastic		Sat.	A-1-b(0)
	40														
	42														
	44	26/30/34				13A								Sat.	
	46														
	48														
		18/20/34				14A								Sat.	
717.6	50														

Bottom of Boring at 50.0'

Bowser-Morner, Inc.

Job Number: 131651

Date Started 6/29/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 723.4

Date Completed 6/29/04 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 5

Sheet 1 of 2 Station & Offset Sta. 456+62.95; 57.34' Lt. Surface Elev. (ft) 741.9

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
741.9	0														
741.3					(FILL) TOPSOIL (7")										
	2	6/8/9			(FILL) Very stiff brown SANDY SILT, some gravel - moist	1A								8.9	
738.4	4	3/4/5			(FILL) Loose brown GRAVEL with sand, silt and clay - moist	2A								6.1	
	6	4/4/5				3A								12.1	
	8	3/4/7				4A								18.4	
732.4	10				(FILL) Stiff gray SANDY SILT, little gravel - moist										
	12	3/4/5				5A								14.6	
	14	1/2/3			(Becomes medium stiff at 13.5')	6A	25.8	14.4	19.2	23.7	16.9	20	8	9.8	A-4a(1)
	16	3/3/4				7A								11.0	
723.4 ▽	18														
	20	4/5/5			(ORIGINAL) Loose brown coarse and fine SAND, little grave - wet	8A								Sat.	
	22														
718.9															
	24	9/16/17			Hard greenish gray SILTY CLAY, some gravel - moist	9A								11.2	
	26														
	28	51/100(0.4')			(Becomes damp at 28.5')	10A	23.6	7.1	4.5	27.6	37.2	36	17	9.9	A-6b(9)
	30														
	32														
	34	100(0.3')				11A								8.5	

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Boring No. 5

Sheet 2 of 2 Station & Offset Sta. 456+62.95; 57.34' Lt. Surface Elev. (ft) 741.9 Job Number: 131651

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
706.9															
	36														
	38														
	40	100(0.3')				12A								8.7	
	42														
	44	100(0.3')			(Becomes wet with trace cobbles at 43.5')	13A								7.1	
	46														
	48														
691.9	50	100(0.3')			(Becomes moist at 48.5')	14A								6.0	

Bottom of Boring at 50.0'

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/9/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) River Surface Client: TranSystems Corporation

Date Completed 7/9/04 Casing: Length Dia. Project Description: Soil Study for Bridge Replacement

Boring No. 6 Project, MOT I-75-14.60, I-75 Bridge Over Great Miami

Sheet 1 of 1 Station & Offset Sta. 457+80.95; 40.79' Rt. Surface Elev. (ft) 729.2 River, Dayton, Montgomery County, Ohio

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
729.2	0														
	2	3/17/15			Dense brown coarse SAND, little gravel - wet	1A								Sat.	
725.7	4	6/5/6			Medium dense gray GRAVEL, some sand - wet	2A	57.6	31.4	6.1	2.7	2.2	NonPlastic		Sat.	A-1-a(0)
	6	5/5/4			(Becomes loose at 6.0')	3A								Sat.	
	8	3/5/7			(Becomes medium dense with trace silt at 8.5')	4A								Sat.	
	10	14/30/32			(Becomes very dense at 11.0')	5A								Sat.	
	12	24/49/50(0.2')				6A								Sat.	
	14	20/34/50(0.3')				7A								Sat.	
711.7	16														
	18	13/32/40			Hard brown SILT and CLAY, little gravel - moist	8A	11.5	8.7	12.5	38.9	28.4	28	11	16.2	A-6a(7)
	20														
	22														
705.2	24	50(0.4')				9A								-	
	26				Hard greenish gray SILT and CLAY, trace gravel - moist										
	28														
700.3		50(0.3')			(Becomes wet with trace cobbles at 28.5') (Auger refusal at 28.9')	10A								10.7	

Bottom of Boring at 28.9'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/14/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) River Surface Client: TranSystems Corporation

Date Completed 7/14/04 Casing: Length Dia. Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 7

Sheet 1 of 1 Station & Offset Sta. 459+04.90; 40.08' Rt. Surface Elev. (ft) 729.9

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
729.9	0														
	2	8/5/4			Loose brown and gray SAND, some clay - wet	1A								Sat.	
726.9															
	4	2/3/4			Medium stiff gray SANDY SILT, trace gravel - wet	2A								11.8	
724.9															
	6	3/3/4			Medium stiff gray SILT and CLAY, trace gravel - wet	3A	13.5	11.1	11.3	25.1	39.0	28	11	18.8	A-6a(6)
	8	7/7/14			(Becomes very stiff at 8.5')	4A								17.2	
	10														
	12	14/20/30			(Becomes hard at 11.0')	5A								16.5	
	14	35/50(0.3')				6A								19.0	
714.9															
	16	50(0.4')			Hard greenish gray SANDY SILT, trace gravel - moist	7A								11.5	
	18	200(0.3')				8A	33.2	6.1	9.9	29.7	21.1	26	10	7.4	A-4a(3)
	20														
708.7		100(0.1')			(Auger refusal at 21.2')	9A								8.9	

Bottom of Boring at 21.2'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 6/28/04 | Sampler: Type Split Spoon | Dia. 1-3/8" | Water Elev. (ft) 717.0

Date Completed 6/28/04 | Casing: Length | Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 8

Sheet 1 of 2 | Station & Offset Sta. 460+37.90; 60.28' Lt. | Surface Elev. (ft) 740.5

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
740.5	0														
740.0					(FILL) TOPSOIL (6")										
	2	7/10/15			(FILL) Very stiff brown SANDY SILT, little gravel - moist	1A								7.9	
	4	3/3/4			(Becomes medium stiff with trace organic material and trace plastics at 3.5')	2A	32.3	14.6	16.8	19.7	16.6	23	10	9.5	A-4a(0)
	6	4/4/5				3A								10.7	
	8	2/3/3				4A								15.6	
731.0	10				(ORIGINAL) Medium stiff greenish gray and brown SILT and CLAY, trace gravel - moist										
	12	3/4/5				5A	8.2	7.5	10.0	32.1	42.2	30	13	16.7	A-6a(9)
	14	2/1/2			(Becomes soft with trace organic material at 13.5')	6A								15.3	
	16	2/3/4			(Becomes medium stiff at 16.0')	7A								15.2	
	18	1/2/5				8A								12.9	
	20														
	22														
717.0 ▽	24	100(0.3')			Very dense gray GRAVEL with sand and silt - wet	9A								Sat.	
	26														
712.0	28	100(0.4')			Hard greenish gray SANDY SILT, little gravel - moist	10A	14.6	5.1	3.8	33.4	43.1	23	8	11.4	A-4a(8)
	30														
	32														
	34	100(0.4')				11A								10.4	

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Boring No. 8

Sheet 2 of 2 Station & Offset Sta. 460+37.90; 60.28' Lt. Surface Elev. (ft) 740.5 Job Number: 131651

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
705.5															
	36														
	38														
		100(0.4')				12A								5.7	
	40														
	42														
	44	100(0.3')				13A								9.7	
	46														
	48														
		100(0.3')				14A								6.0	
690.5	50														

Bottom of Boring at 50.0'

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/12/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 737.6

Date Completed 7/12/04 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 9

Sheet 1 of 2 Station & Offset Sta. 461+72.30; 42.06' Rt. Surface Elev. (ft) 770.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
770.6	0				(FILL) ASPHALT pavement (6")										
~~770.1~~ 769.1					(FILL) CONCRETE pavement (12")										
	2	12/24/24			(FILL) Dense brown GRAVEL with sand and silt - damp	1A	50.8	24.2	9.4	8.6	7.0	23	8	5.4	A-2-4(0)
	4	24/40/50(0.3')			(Becomes very dense at 3.5')	2A								4.3	
	6	12/24/19			(Becomes dense at 6.0')	3A								6.9	
	8	12/24/21			(Trace cobbles at 8.5')	4A								6.5	
	10	18/30/24			(Becomes very dense at 11.0')	5A								7.2	
	12	17/24/29			(Trace cobbles at 13.5')	6A								7.0	
	14	21/28/13			(Becomes dense at 16.0')	7A								6.5	
	16	12/13/20			(Trace red bricks and trace cinders at 18.5')	8A								7.6	
	18	12/24/20			(Some clay at 23.5')	9A								12.7	
	20	30/50(0.3')			(Becomes very dense at 28.5')	10A								-	
	22														
	24														
	26														
	28														
	30														
	32														
737.6 ▼	34	21/12/24			(ORIGINAL) Dense brown GRAVEL with sand and silt - wet	11A	62.4	14.8	7.5	9.6	5.7	26	10	Sat.	A-2-4(0)

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Boring No. 9

Sheet 2 of 2 Station & Offset Sta. 461+72.30; 42.06' Rt, Surface Elev. (ft) 770.6 Job Number: 131651

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics								ODOT Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
735.6															
	36														
	38														
730.6	40	12/28/34			(Becomes very dense at 38.5')	12A								Sat.	

Bottom of Boring at 40.0'

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/13/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) None

Client: TranSystems Corporation

Date Completed 7/13/04 Casing: Length Dia.

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 10

Sheet 1 of 1 Station & Offset Sta. 462+68.65; 47.70' Rt. Surface Elev. (ft) 768.5

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
768.5	0														
768.0					(FILL) ASPHALT pavement (6")										
	2	17/50(0.4')			(FILL) Very dense brown GRAVEL with sand and silt - moist	1A	32.3	33.9	13.4	11.3	9.1	21	7	4.7	A-2-4(0)
	4	35/50(0.3')				2A								3.4	
	6	55/50(0.3')				3A								3.2	
	8	42/50/50(0.3')				4A								4.7	
758.6															

Bottom of Boring at 9.9'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/13/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 734.1

Date Completed 7/13/04 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 11

Sheet 1 of 1 Station & Offset Sta. 13+04.86; 37' Lt. Surface Elev. (ft) 742.6

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
742.6	0														
741.9					(FILL) ASPHALT pavement (9")										
741.3					(FILL) GRAVEL base (7")										
	2	7/8/12			(FILL) Very stiff dark brown and gray SILT and CLAY, little gravel, trace organic odor - moist	1A								13.6	
	4	5/6/6			(Becomes stiff at 3.5')	2A	3.2	18.6	31.4	29.5	17.3	33	13	16.0	A-6a(4)
737.6															
	6	5/6/7			(ORIGINAL) Stiff brown SILTY CLAY, trace gravel - moist	3A								27.1	
	8														
734.1		3/5/7			Medium dense brown SAND, some silt, little gravel - wet	4A								Sat.	
732.6	10														

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651

Date Started 7/13/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 736.4

Date Completed 7/13/04 Casing: Length Dia.

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Boring No. 12

Sheet 1 of 1 Station & Offset Sta. 8+54.68; 36.05' Rt. Surface Elev. (ft) 744.4

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
744.4	0														
744.1		12/12/14			(FILL) TOPSOIL (4")										
742.4	2				(FILL) Medium dense brown SAND, some silt, trace gravel - damp	1A								5.2	
	4	5/6/7			(FILL) Stiff brown SILT and CLAY - moist	2A								21.2	
739.4															
	6	5/7/12			(ORIGINAL) Very stiff brown SILTY CLAY, trace gravel - moist	3A	0.4	2.5	23.6	41.1	32.4	39	16	25.7	A-6b(10)
736.4 ▽	8														
734.4	10	5/6/12			Medium dense brown SAND, little silt, little gravel - wet	4A								Sat.	

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Job Number: 131651
Client: TranSystems Corporation
Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Date Started 7/13/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) None
Date Completed 7/13/04 Casing: Length Dia.
Boring No. 13
Sheet 1 of 1 Station & Offset Sta. 448+72.61; 8.19' Lt. Surface Elev. (ft) 747.8

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
747.8	0														
747.6		18/17/17			(FILL) TOPSOIL (2")										
	2				(FILL) Dense brown SAND, some gravel, little silt - damp	1A								4.3	
745.3		13/11/17			(ORIGINAL) Very stiff dark brown SANDY SILT, trace gravel - damp	2A								14.9	
	4														
	6	12/12/12				3A								13.9	
739.8	8														
737.8	10	4/4/4			Medium stiff brown SILT and CLAY, trace sand - moist	4A	0.6	10.7	32.6	33.9	22.2	34	15	21.2	A-6a(6)

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

Bowser-Morner, Inc.

Date Started 6/29/04 Sampler: Type Split Spoon Dia. 1-3/8" Water Elev. (ft) 733.8

Date Completed 6/29/04 Casing: Length Dia.

Boring No. 14

Sheet 1 of 1 Station & Offset Sta. 452+35.33; 0.66' Rt. Surface Elev. (ft) 741.8

Job Number: 131651

Client: TranSystems Corporation

Project Description: Soil Study for Bridge Replacement Project, MOT I-75-14.60, I-75 Bridge Over Great Miami River, Dayton, Montgomery County, Ohio

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics % Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	ODOT Class
741.8	0														
740.8		6/6/7			TOPSOIL (12")	1A								10.0	
	2				Medium dense brown GRAVEL with sand, silt and clay - moist (Some clay at 1.0')										
	4	8/12/12				2A	63.6	12.4	6.7	13.0	4.3	31	14	4.9	A-2-6(0)
	6	15/17/44			(Becomes very dense at 4.5')	3A								4.9	
	▽ 8														
731.8	10	31/33/21				4A								Sat.	

Bottom of Boring at 10.0'

Particle Sizes: Agg => 2.00mm, Coarse Sand = 2.00-0.42mm, Fine Sand = 0.42-0.074mm, Silt = 0.074-0.005mm, Clay =< 0.005mm.

MOT-75-14.60

PID NO. 23828

MOT-75-1523 L/R

IR-75 OVER THE GREAT MIAMI RIVER

BRIDGE PRELIMINARY DESIGN REPORT

PREPARED FOR:

Ohio Department of Transportation
District 7
1001 St. Mary's Avenue
Sidney, Ohio 45365

NOVEMBER 12, 2004

TRANSYSTEMS CORPORATION

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APPENDIX A
- Preliminary Probable Construction Cost

APPENDIX B
- Site Plan - Sheet 1 of 11
- Phase Construction Details - Sheets 2 & 3 of 11
- Transverse Section - Sheets 4 & 5 of 11
- Substructure Details - Sheets 6,7 & 8 of 11
- Supplemental Site Plan – Sheet 9 of 11
- Retaining Wall Details – Sheets 10 & 11 of 11

APPENDIX C
- Pier Alternatives Cost Comparison
- Retaining Walls Cost Comparison

APPENDIX D
- Preliminary Abutments Pile Loads
- Preliminary Piers Pile Loads
- Preliminary Retaining Wall Foundation Loads

PROPOSED BRIDGE NARRATIVE

1. Introduction

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation for the design of the Northbound and Southbound IR-75 over The Great Miami River. As requested by the Scope of Services, the Bridge Type Study report was submitted August 7, 2004. The purpose of the report was to investigate various span arrangements and superstructure and substructure types in order to determine the most appropriate and economical structure type that will meet the project requirements. ODOT has chosen to pursue Alternative C-2 which consists of an all new structure consisting of Prestressed Concrete I-Beams supported on new substructures. This TS&L submittal represents the recommended alternative C-2 modified as necessary to accommodate the limited sight distance requirement for the ramp and for the part width construction of the structure.

2. Subsurface Conditions and Foundation Recommendation:

Bowser Morner performed the subsurface exploration for the proposed bridges and prepared the Preliminary Bridge Foundation Recommendations. The Soils Report is attached. Two different foundation options were investigated in their report: Steel H-piles and drilled shafts.

In summary, five test borings were drilled and advanced to depths of 30 feet to 50 feet below the existing ground surface. The borings did not encounter any bedrock. The soil sampled at the pier footing plan elevation consisted of very dense granular and hard silt clay materials. Standard penetration Test (SPT)-blow counts were basically indicating refusal at the elevation of the bottom of the existing pier footings.

Based on the preliminary pile loads design calculation shown in Appendix D, HP14x73 piles with a maximum design load of 95 tons generated from a combination of side friction and end bearing are required to accommodate the preliminary design loads for this structure. The existing bridge abutments are founded on HP 12X53 piles while the existing piers are founded on spread footings.

As an alternative, we also recommend that drilled shafts be considered for the piers in the river. The method of construction of the substructures in the river has not been determined; therefore the drilled shaft alternative could be a viable solution pending on the need to use cofferdams for the pier excavations in conjunction with a causeway.

3. Proposed Structure

General: As a result of the preliminary roadway alignment and the existing Structure Analysis, the bridge width shown in the plans is required to accommodate the entrance and exit ramps for the Northbound and Southbound structures.

Alignment & Profile: The proposed structure's horizontal geometry is tangent for the entire length of the proposed structure except for the base line of the ramps. The profile of the structure is comprised of a 692' vertical curve that projects over the entire length of the bridge.

Transverse Section: The transverse section for the recommended proposed structure can be found in Appendix B. The proposed IR-75 Structure consists of two unsymmetrical decks separated by a 2" open longitudinal joint. The proposed Southbound I-75 bridge transverse section is composed of three 12-foot lanes and inside shoulder of 8'-7 1/8" and outside shoulder that varies from 10'-0" minimum to 25'-0" maximum to accommodate the limited sight distance required for the ramp. With a 1'-6" outside deflector parapet and a 1'-3 7/8" inside median barrier, the Southbound Bridge out to out deck width varies from 69'-6"minimum to 97'-6" maximum. The proposed Northbound IR-75 bridge transverse section consists of three 12-foot lanes plus the Ramp entrance ramp that varies from a minimum of 7'-2 ½" to a maximum of 19'-2 ½", an inside shoulder of 8'-7 1/8", and an outside shoulder that varies from 10'-10"minimum to 22'-4" maximum. The cross slopes of each structure are shown on the plans and they consist of a normal crown for the Northbound Structure and a normal crown that transitions to a superelevation slope in order to accommodate the exit ramp for the Southbound Structure.

Span Layout: We have modified the span layout that was shown in the Structure Analysis Report for Alternate C-2 to the span layout shown on the TS&L plans. This modification was necessary to accommodate the requirement to provide a minimum of 21'-0" offset to the barrier for the limited sight distance for the ramp alignment. Since the superstructure type of prestressed concrete I-beams would only allow the beam for a varying deck width to end at a pier location, the piers were moved as necessary to accommodate this requirement. The proposed pier piles clear the existing pier footings. The removal of the some of the existing bridge abutment piles might become necessary to accommodate the new abutment pile locations.

Substructure Layout: The entire substructure units were set to be perpendicular to the centerline of IR-75. The preliminary Pile loads for the substructure units are shown in Appendix D. Due to the overall length of the piers; an alternate pier type was also investigated and is shown on the substructure plan sheets. This pier type is presented in order to aesthetically enhance the appearance of the structure in lieu of solid wall type piers. A cost comparison for both piers was prepared and it is shown in Appendix C.

Retaining Walls: Retaining walls are proposed at the approaches in order to alleviate encroachments on the existing pump stations and right-of-way limits. The Locations are as follows:

- Rear Abutment – Northbound Structure from Station 453+50 to end of wingwall.
- Forward Abutment – Northbound Structure from end of wingwall to Station 463+50.
- Forward Abutment –Southbound Structure from end of wingwall to Station 463+28.

The wall quantity area for the project is approximately 7300 square feet. According to the Bridge Design Manual the use of proprietary retaining walls is to be considered when the wall quantity for the project exceeds 5000 square feet. The preliminary retaining wall plans are shown in Appendix B and they include a cast-in-place reinforced concrete type wall and an alternate MSE type wall. A cost comparison between both alternatives was prepared and it is shown in Appendix C.

Preliminary Abutment Pile Loads

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION
Calculations for: *MOT-75-14.60*
Job No.: *P403040066*

Made By *NFF* Date *11/4/2004*
Checked Date

ABUTMENT CALCULATIONS

HORIZONTAL DIMENSIONS (feet)

Toe	2	seat	1
Stem Width	4.1	seat	1.33
Heel	0.5	Bckwll Width	1.75
Ftg. Width	6.6	Skew Angle	90
Beam Spacing	8 Normal		

VERTICAL DIMENSIONS (feet)

backwall Ht.	7.86		
Stem Ht.	3.34	Earth Front Ht.	2.25
Footing depth	3.25		
Total Ht.	14.45		

MATERIAL (kcf)

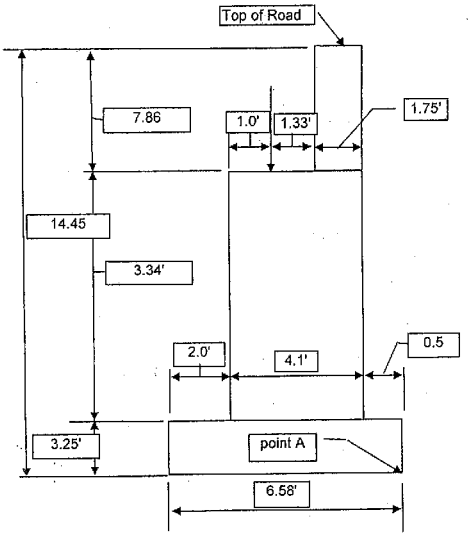
Soil Unit Weight	0.12	Concrete Unit weight	0.15
Lateral Soil Pressui	0.04		

REACTION LOADS (kips/Girder)

DL	153
LL	55

Sum Moments about Point "A". Counter-Clockwise is positive

item	height	Width	Unit wt.	P (kips)	Arm (ft.)	Moment('k)
Concrete						
Backwall	7.86	1.75	0.15	2.06	1.375	2.8
Stem	3.34	4.1	0.15	2.05	2.55	5.2
Footing	3.25	6.6	0.15	3.22	3.3	10.6
Earth Load						
Vertical Front	2.25	2	0.12	0.54	5.6	3.0
Vertical Back	11.2	0.5	0.12	0.67	0.25	0.2
Horizontal	14.45			4.18	4.82	20.1
CASE 1 DL+Earth				*8.55*	*4.91*	*42.0*
Superstructure loads						
Super DL		8.00		19.13	3.58	68.5
CASE 2 DL+Super DL+Earth				*27.67*	*3.992*	*110.5*
Super LL		8.00		6.88	3.58	24.6
CASE 3 DL+Super DL+LL+Earth				*34.55*	*3.910*	*135.08*



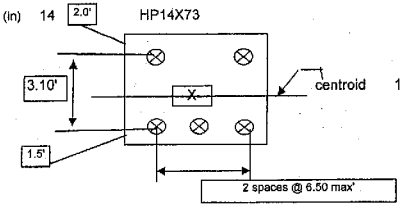
TRANSYSTEMS CORPORATION
Calculations for: *MOT-75-14.60*
Job No.: *P403040066*

Made By *NFF* Date *11/4/2004*
Checked Date

Pile Foundation: PILE CAPACITY(KIPS) 190 Pile Diam. (in) 14 2.0" HP14X73

Pile spacing ~~arome 4.2.5A = 3PILE DIAMETER~~

	No. of Piles	Y-Space	X-Space
Front row	2	0	6.5
2nd row	0	0	
3rd row	0	0	
back row	1	3.1	



centroid 1.033333 from front

Section Modulus (about X) centroid

	A	Y	AY	I +AY^2
	2	1.033333	2.07	2.14
	0	0	0	0
	0	0	0	0
	1	2.066667	2.07	4.27
TOTAL	3		4.13	6.41

Front Pile Load = P/A+Pe/SM front
Back Pile Load = P/A+Pe/SM back

SM *front* = 6.20

SM *back* = 3.1

PILE LOAD	P	A	e	P/A	Pe/SM	Total (K/ft)	Total per Abut Length (kips)	Pile Capacity (kips)	
Case 1: DL+Earth									
Front Piles	8.55	3	0.85	2.85	1.17	4.02	52.22	190	ok!
Back Piles	8.55	3	0.85	2.85	2.34	0.51	6.67	190	ok!
Case 2: DL+Super DL+Earth									
Front Piles	27.67	3	-0.07	9.22	-0.33	8.89	115.58	190	ok!
Back Piles	27.67	3	-0.07	9.22	-0.67	9.89	128.57	190	ok!
CASE 3 DL+Super DL+LL+Earth									
Front Piles	34.55	3	-0.16	11.52	-0.87	10.64	138.36	190	ok!
Back Piles	34.55	3	-0.16	11.52	-1.75	13.26	172.40	190	ok!

PILES HP 14x73 - 95 TONS MAX DESIGN LOAD
@ 6.50' c/c PILE.

Preliminary Piers Pile Loads

TRANSYSTEMS CORPORATION

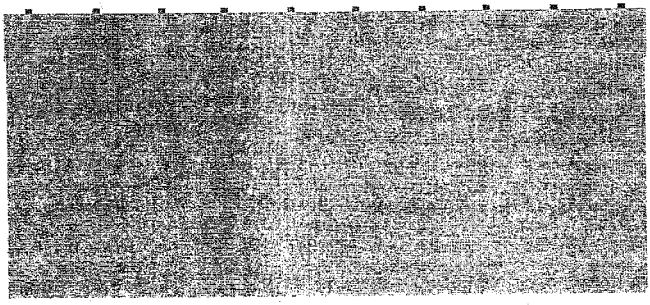
PROJECT: MOT-75-14.60 SOLID WALL

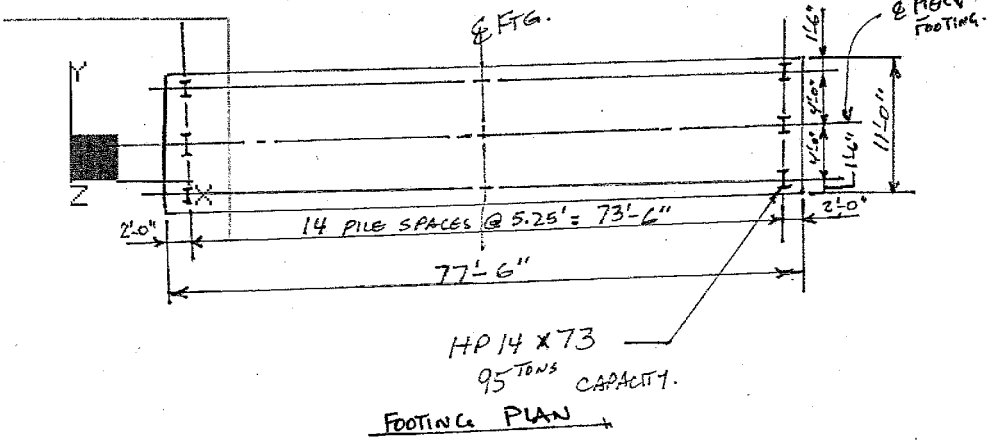
PROJECT DATA
==========

Project : MOT-75-14.60 SOLID WALL
User Job No.: P403040066
State : OHIO State Job No. : 23828
Comments : SOLID WALL DESIGN

PROJECT: MOT-75-14.60 SOLID WALL

FULL IMAGE:

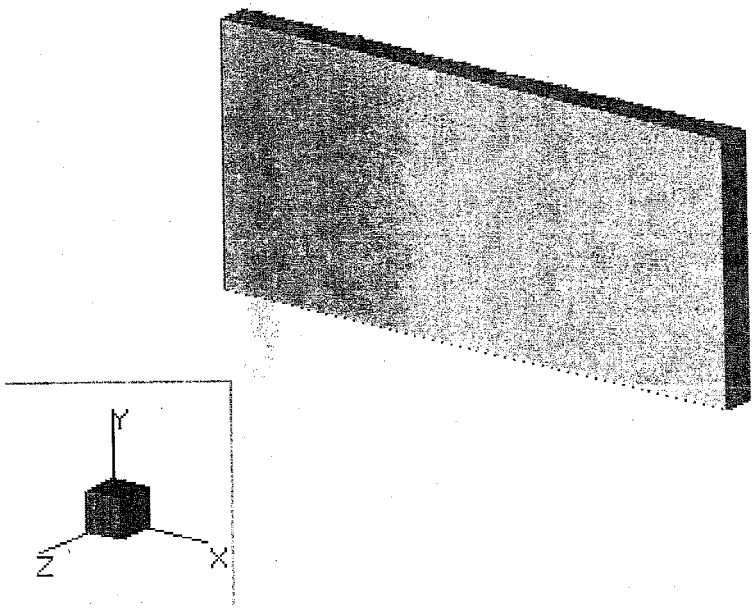




FOOTING PLAN

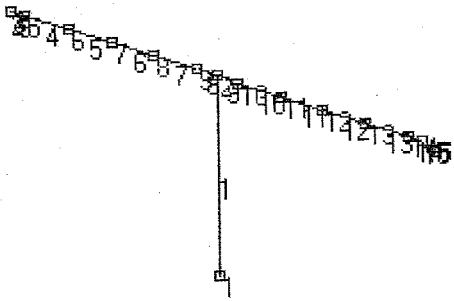
PROJECT: MOT-75-14.60 SOLID WALL

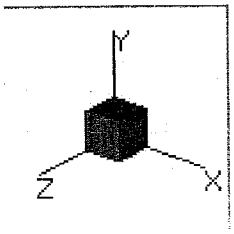
FULL IMAGE:



PROJECT: MOT-75-14.60 SOLID WALL

STRUCTURE MODEL:





PROJECT: MOT-75-14.60 SOLID WALL

PIER GEOMETRY

Pier Type: Hammer Head

Length(X) = 77.50 ft Height max(Y) = 6.00 ft Height min(Y) = 6.00 ft
Bottom length(X) = 77.25 ft Depth(Z) = 4.50 ft Skew angle = 0.00 Reduction of I = 1.000

Column Shape: Rectangular Non Tapered
Bottom width(X) = 77.25 ft Top width(X) = 77.25 ft Depth(Z) = 4.50 ft Height(Y) = 29.00 ft

STRUCTURE MODEL

FRAME Model:

	Member	Node	Hinge	Check Pt Dist(ft)	Memb length(ft)
Column No. 1					
	1	1	-	0.00	
		2	-	32.00	32.00
Cap					
	2	3	-	0.00	
		4	-	0.13	0.13
	3	4	-	0.13	
		5	-	2.75	2.63
	4	5	-	2.75	
		6	-	10.75	8.00
	5	6	-	10.75	
		7	-	18.75	8.00
	6	7	-	18.75	
		8	-	26.75	8.00
	7	8	-	26.75	
		9	-	34.75	8.00
	8	9	-	34.75	
		2	-	38.75	4.00
	9	2	-	38.75	
		10	-	42.75	4.00
	10	10	-	42.75	
		11	-	50.75	8.00
	11	11	-	50.75	
		12	-	58.75	8.00
	12	12	-	58.75	
		13	-	66.75	8.00
	13	13	-	66.75	
		14	-	74.75	8.00
	14	14	-	74.75	
		15	-	77.38	2.63
	15	15	-	77.38	
		16	-	77.50	0.13

Node coordinates:

Number	X(ft)	Y(ft)	Node type
1	38.75	0.00	fixed at ground
2	38.75	32.00	column-cap
3	0.00	32.00	
4	0.13	32.00	
5	2.75	32.00	bearing

PROJECT: MOT-75-14.60 SOLID WALL

6	10.75	32.00	bearing
7	18.75	32.00	bearing
8	26.75	32.00	bearing
9	34.75	32.00	bearing
10	42.75	32.00	bearing
11	50.75	32.00	bearing
12	58.75	32.00	bearing
13	66.75	32.00	bearing
14	74.75	32.00	bearing
15	77.38	32.00	
16	77.50	32.00	

SUPERSTRUCTURE INFO

Total number of spans: 2 Span number rear to current pier: 1
Number of traffic lanes: 3

Beam: height = 72.00 in section area = 956.00 in^2
Barrier height = 42.00 in Depth of slab = 10.50 in

Span	Forward	Rear
Overall width	77.50 ft	77.50 ft
Curbs width	74.50 ft	74.50 ft
Span Length	136.00 ft	136.00 ft

BEARING POINTS

Number of bearing lines: 2

First bearing line Eccentricity = 1.21 ft

Point	Distance ft
1	2.75
2	10.75
3	18.75
4	26.75
5	34.75
6	42.75
7	50.75
8	58.75
9	66.75
10	74.75

Second bearing line Eccentricity = -1.21 ft

Point	Distance ft
1	2.75
2	10.75
3	18.75
4	26.75
5	34.75
6	42.75
7	50.75
8	58.75
9	66.75
10	74.75

PROJECT: MOT-75-14.60 SOLID WALL

MATERIAL PROPERTIES

	Cap	Column	Footing
Concrete Type	normal	normal	normal
Concrete Strength (psi)	4000.00	4000.00	4000.00
Concrete Density (lb/ft3)	150.00	150.00	150.00
Concrete Modulus Ec (ksi)	3834.30	3834.30	3834.30
Steel Strength Fy (ksi)	60.00	60.00	60.00

DESIGN PARAMETERS

AASHTO STANDARD Code

Strength Reduction factors for reinf. concrete:

Flexure and tension	0.90
Shear and torsion (normal)	0.85
(lightweight)	0.85
Axial compression (ties)	0.70
Axial compression (spiral)	0.75

Multi presence factors for live load:

1 Lane	1.00
2 Lanes	1.00
3 Lanes	0.90
more than 3 Lanes	0.75

	Crack control factor kip/ft	Min clear cover in	Impact factors (auto calculation)
Cap	170.00	2.00	1.19
Column	170.00	2.00	1.19
Footing	130.00	3.00	1.00

Degree of fixity in foundations for Moment Magnify Method: R = 5.00

PROJECT: MOT-75-14.60 SOLID WALL

LOADS
=====

Load Cases: 4

Loadcase ID: D1 Name:
Multiplier = 1.000

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	Y	-165.70
1	2	Y	-165.70
1	3	Y	-165.70
1	4	Y	-165.70
1	5	Y	-165.70
1	6	Y	-165.70
1	7	Y	-165.70
1	8	Y	-165.70
1	9	Y	-165.70
1	10	Y	-165.70
2	1	Y	-153.00
2	2	Y	-153.00
2	3	Y	-153.00
2	4	Y	-153.00
2	5	Y	-153.00
2	6	Y	-153.00
2	7	Y	-153.00
2	8	Y	-153.00
2	9	Y	-153.00
2	10	Y	-153.00

Auto generation details:

Generated Dead Load

Slab weight	=	150.00	pcf	Girder weight =	150.00	pcf
Wearing weight	=	8460.00	plf	Barrier load =	2556.00	plf

Loadcase ID: W1 Name: Angle: 0
Multiplier = 1.000

Cap loads:
Force(X) = 1.080 kip Arm = 0.00 ft

Column loads:

Col #	Type	Dir	Mag1	y1/L	Mag2	y2/L
1	UDL	X	0.180 k/ft	0.00	----	0.91

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	X	3.53
1	1	Y	104.58
1	1	Z	0.00
1	2	X	3.53
1	2	Y	0.00

PROJECT: MOT-75-14.60 SOLID WALL

1	2	Z	0.00
1	3	X	3.53
1	3	Y	0.00
1	3	Z	0.00
1	4	X	3.53
1	4	Y	0.00
1	4	Z	0.00
1	5	X	3.53
1	5	Y	0.00
1	5	Z	0.00
1	6	X	3.53
1	6	Y	0.00
1	6	Z	0.00
1	7	X	3.53
1	7	Y	0.00
1	7	Z	0.00
1	8	X	3.53
1	8	Y	0.00
1	8	Z	0.00
1	9	X	3.53
1	9	Y	0.00
1	9	Z	0.00
1	10	X	3.53
1	10	Y	-104.58
1	10	Z	0.00
2	1	X	3.53
2	1	Y	104.58
2	1	Z	0.00
2	2	X	3.53
2	2	Y	0.00
2	2	Z	0.00
2	3	X	3.53
2	3	Y	0.00
2	3	Z	0.00
2	4	X	3.53
2	4	Y	0.00
2	4	Z	0.00
2	5	X	3.53
2	5	Y	0.00
2	5	Z	0.00
2	6	X	3.53
2	6	Y	0.00
2	6	Z	0.00
2	7	X	3.53
2	7	Y	0.00
2	7	Z	0.00
2	8	X	3.53
2	8	Y	0.00
2	8	Z	0.00
2	9	X	3.53
2	9	Y	0.00
2	9	Z	0.00
2	10	X	3.53
2	10	Y	-104.58
2	10	Z	0.00

Auto generation details:
Generated Wind Load on Structure
Angle of wind = 0.00 deg Elevation above which wind load acts = 0.00 ft
Default wind pressure
Wind pressure for superstructure: Wind pressure for substructure:

PROJECT: MOT-75-14.60 SOLID WALL

Transverse	50.000 psf	Cap	40.000 psf
Longitudinal	0.000 psf	Column	40.000 psf
Overturning	20.000 psf		

Loadcase ID: WL1 Name: Angle: 0
Multiplier = 1.000

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	X	0.68
1	1	Y	1.22
1	1	Z	0.00
1	2	X	0.68
1	2	Y	0.00
1	2	Z	0.00
1	3	X	0.68
1	3	Y	0.00
1	3	Z	0.00
1	4	X	0.68
1	4	Y	0.00
1	4	Z	0.00
1	5	X	0.68
1	5	Y	0.00
1	5	Z	0.00
1	6	X	0.68
1	6	Y	0.00
1	6	Z	0.00
1	7	X	0.68
1	7	Y	0.00
1	7	Z	0.00
1	8	X	0.68
1	8	Y	0.00
1	8	Z	0.00
1	9	X	0.68
1	9	Y	0.00
1	9	Z	0.00
1	10	X	0.68
1	10	Y	-1.22
1	10	Z	0.00
2	1	X	0.68
2	1	Y	1.22
2	1	Z	0.00
2	2	X	0.68
2	2	Y	0.00
2	2	Z	0.00
2	3	X	0.68
2	3	Y	0.00
2	3	Z	0.00
2	4	X	0.68
2	4	Y	0.00
2	4	Z	0.00
2	5	X	0.68
2	5	Y	0.00
2	5	Z	0.00
2	6	X	0.68
2	6	Y	0.00
2	6	Z	0.00
2	7	X	0.68
2	7	Y	0.00

PROJECT: MOT-75-14.60 SOLID WALL

2	7	Z	0.00
2	8	X	0.68
2	8	Y	0.00
2	8	Z	0.00
2	9	X	0.68
2	9	Y	0.00
2	9	Z	0.00
2	10	X	0.68
2	10	Y	-1.22
2	10	Z	0.00

Auto generation details:
Generated Wind Load on Live Load
Angle of wind = 0.00 deg Live load length = 136.00 ft

Loadcase ID: (L+In)1 Name:
Multiplier = 1.000

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	Y	-85.20
1	2	Y	-85.20
1	3	Y	-85.20
1	4	Y	-85.20
1	5	Y	-85.20
1	6	Y	-85.20
1	7	Y	-85.20
1	8	Y	-85.20
1	9	Y	-85.20
1	10	Y	-85.20
2	1	Y	-82.00
2	2	Y	-82.00
2	3	Y	-82.00
2	4	Y	-82.00
2	5	Y	-82.00
2	6	Y	-82.00
2	7	Y	-82.00
2	8	Y	-82.00
2	9	Y	-82.00
2	10	Y	-85.20

Selected load groups:

SERVICE GROUP I
SERVICE GROUP II
SERVICE GROUP III
SERVICE GROUP IV
SERVICE GROUP V

PROJECT: MOT-75-14.60 SOLID WALL

ISOLATED FOOTING DESIGN

Code: AASHTO STANDARD - Service Load Design
Units: US

Geometry:
=========
Name : PILECAP
Shape : Rectangular, Type : Pile/Shaft Cap

Bf(X) = 77.50 ft, Hf(Z) = 11.00 ft, Thickness(Y) = 48.00 in

Start at X = -38.75 ft from centerline of column.
Columns located on the footing:
Column No. 1 at x = 0.00 ft, Rectangular 927.00 in x 54.00 in

Ag = 852.50 ft^2, Ix = 480.00 ft^2, Iz = 23152.50 ft^2

Surcharge = 0.00 ksf

Piles: H-Steel Size: 14.00 in Capacity: 190.00 kips

Design Parameters:
==========
f'c = 4000.00 psi fy = 60000.00 psi
Ec = 3834.3 ksi Es = 29000.0 ksi
Crack control factor z = 130.00 kips/in
Concrete Type : Normal Weight.

Pile Reactions, Service (Without the reduction of overstress allowance):
==========

Pile	Loc(X) ft	X in	Z in	Column Loads comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Pile Reac. kips
1	-36.75	24.0	0.0	5	1.250	-6844.68	188.25	5827.78	172.72 < 190^k OK
				2	1.250	-5169.48	153.45	-17639.60	98.24
2	-31.50	87.0	0.0	5	1.250	-6844.68	188.25	5827.78	171.40
				2	1.250	-5169.48	153.45	-17639.60	102.24
3	-26.25	150.0	0.0	5	1.250	-6844.68	188.25	5827.78	170.08
				2	1.250	-5169.48	153.45	-17639.60	106.24
4	-21.00	213.0	0.0	5	1.250	-6844.68	188.25	5827.78	168.76
				2	1.250	-5169.48	153.45	-17639.60	110.24
5	-15.75	276.0	0.0	5	1.250	-6844.68	188.25	5827.78	167.44
				2	1.250	-5169.48	153.45	-17639.60	114.24
6	-10.50	339.0	0.0	5	1.250	-6844.68	188.25	5827.78	166.11
				2	1.250	-5169.48	153.45	-17639.60	118.24
7	-5.25	402.0	0.0	5	1.250	-6844.68	188.25	5827.78	164.79
				2	1.250	-5169.48	153.45	-17639.60	122.24
8	0.00	465.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.47
				2	1.250	-5169.48	153.45	-17639.60	126.24
9	5.25	528.0	0.0	4	1.250	-6844.68	188.25	-6058.18	164.84
				3	1.250	-5169.48	153.45	17639.60	122.24
10	10.50	591.0	0.0	4	1.250	-6844.68	188.25	-6058.18	166.22
				3	1.250	-5169.48	153.45	17639.60	118.24
11	15.75	654.0	0.0	4	1.250	-6844.68	188.25	-6058.18	167.59
				3	1.250	-5169.48	153.45	17639.60	114.24
12	21.00	717.0	0.0	4	1.250	-6844.68	188.25	-6058.18	168.97
				3	1.250	-5169.48	153.45	17639.60	110.24

PROJECT: MOT-75-14.60 SOLID WALL

13	26.25	780.0	0.0	4	1.250	-6844.68	188.25	-6058.18	170.34	
				3	1.250	-5169.48	153.45	17639.60	106.24	
14	31.50	843.0	0.0	4	1.250	-6844.68	188.25	-6058.18	171.71	
				3	1.250	-5169.48	153.45	17639.60	102.24	
15	36.75	906.0	0.0	4	1.250	-6844.68	188.25	-6058.18	173.09	< 190K
				3	1.250	-5169.48	153.45	17639.60	98.24	
16	-36.75	24.0	-48.0	5	1.250	-6844.68	188.25	5827.78	171.15	
				2	1.250	-5169.48	153.45	-17639.60	96.97	
17	-31.50	87.0	-48.0	5	1.250	-6844.68	188.25	5827.78	169.83	
				2	1.250	-5169.48	153.45	-17639.60	100.97	
18	-26.25	150.0	-48.0	5	1.250	-6844.68	188.25	5827.78	168.51	
				2	1.250	-5169.48	153.45	-17639.60	104.97	
19	-21.00	213.0	-48.0	5	1.250	-6844.68	188.25	5827.78	167.19	
				2	1.250	-5169.48	153.45	-17639.60	108.97	
20	-15.75	276.0	-48.0	5	1.250	-6844.68	188.25	5827.78	165.87	
				2	1.250	-5169.48	153.45	-17639.60	112.97	
21	-10.50	339.0	-48.0	5	1.250	-6844.68	188.25	5827.78	164.54	
				2	1.250	-5169.48	153.45	-17639.60	116.97	
22	-5.25	402.0	-48.0	5	1.250	-6844.68	188.25	5827.78	163.22	
				2	1.250	-5169.48	153.45	-17639.60	120.97	
23	0.00	465.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.90	
				2	1.250	-5169.48	153.45	-17639.60	124.97	
24	5.25	528.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	163.28	
				3	1.250	-5169.48	153.45	17639.60	120.97	
25	10.50	591.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	164.65	
				3	1.250	-5169.48	153.45	17639.60	116.97	
26	15.75	654.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	166.02	
				3	1.250	-5169.48	153.45	17639.60	112.97	
27	21.00	717.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	167.40	
				3	1.250	-5169.48	153.45	17639.60	108.97	
28	26.25	780.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	168.77	
				3	1.250	-5169.48	153.45	17639.60	104.97	
29	31.50	843.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	170.14	
				3	1.250	-5169.48	153.45	17639.60	100.97	
30	36.75	906.0	-48.0	4	1.250	-6844.68	188.25	-6058.18	171.52	
				3	1.250	-5169.48	153.45	17639.60	96.97	
31	-36.75	24.0	48.0	5	1.250	-6844.68	188.25	5827.78	174.29	< 190K
				2	1.250	-5169.48	153.45	-17639.60	99.52	
32	-31.50	87.0	48.0	5	1.250	-6844.68	188.25	5827.78	172.97	
				2	1.250	-5169.48	153.45	-17639.60	103.52	
33	-26.25	150.0	48.0	5	1.250	-6844.68	188.25	5827.78	171.65	
				2	1.250	-5169.48	153.45	-17639.60	107.52	
34	-21.00	213.0	48.0	5	1.250	-6844.68	188.25	5827.78	170.33	
				2	1.250	-5169.48	153.45	-17639.60	111.52	
35	-15.75	276.0	48.0	5	1.250	-6844.68	188.25	5827.78	169.00	
				2	1.250	-5169.48	153.45	-17639.60	115.52	
36	-10.50	339.0	48.0	5	1.250	-6844.68	188.25	5827.78	167.68	
				2	1.250	-5169.48	153.45	-17639.60	119.52	
37	-5.25	402.0	48.0	5	1.250	-6844.68	188.25	5827.78	166.36	
				2	1.250	-5169.48	153.45	-17639.60	123.52	
38	0.00	465.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.04	
				2	1.250	-5169.48	153.45	-17639.60	127.52	
39	5.25	528.0	48.0	4	1.250	-6844.68	188.25	-6058.18	166.41	
				3	1.250	-5169.48	153.45	17639.60	123.52	
40	10.50	591.0	48.0	4	1.250	-6844.68	188.25	-6058.18	167.79	
				3	1.250	-5169.48	153.45	17639.60	119.52	
41	15.75	654.0	48.0	4	1.250	-6844.68	188.25	-6058.18	169.16	
				3	1.250	-5169.48	153.45	17639.60	115.52	
42	21.00	717.0	48.0	4	1.250	-6844.68	188.25	-6058.18	170.53	
				3	1.250	-5169.48	153.45	17639.60	111.52	
43	26.25	780.0	48.0	4	1.250	-6844.68	188.25	-6058.18	171.91	

PROJECT: MOT-75-14.60 SOLID WALL

				3	1.250	-5169.48	153.45	17639.60	107.52	
44	31.50	843.0	48.0	4	1.250	-6844.68	188.25	-6058.18	173.28	
				3	1.250	-5169.48	153.45	17639.60	103.52	
45	36.75	906.0	48.0	4	1.250	-6844.68	188.25	-6058.18	174.66	< 190k
				3	1.250	-5169.48	153.45	17639.60	99.52	

Pile Reactions, Service (After the reduction of overstress allowance):

Pile	Loc(X) ft	X in	Z in	Column Loads comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Pile Reac. kips	
1	-36.75	24.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.29	< 190k
				7	1.400	-5169.48	153.45	-17639.60	70.17	
2	-31.50	87.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.31	
				7	1.400	-5169.48	153.45	-17639.60	73.03	
3	-26.25	150.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.34	
				7	1.400	-5169.48	153.45	-17639.60	75.89	
4	-21.00	213.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.37	
				7	1.400	-5169.48	153.45	-17639.60	78.75	
5	-15.75	276.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.39	
				7	1.400	-5169.48	153.45	-17639.60	81.60	
6	-10.50	339.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.42	
				7	1.400	-5169.48	153.45	-17639.60	84.46	
7	-5.25	402.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.44	
				7	1.400	-5169.48	153.45	-17639.60	87.32	
8	0.00	465.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.47	
				7	1.400	-5169.48	153.45	-17639.60	90.17	
9	5.25	528.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.50	
				8	1.400	-5169.48	153.45	17639.60	87.32	
10	10.50	591.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.52	
				8	1.400	-5169.48	153.45	17639.60	84.46	
11	15.75	654.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.55	
				8	1.400	-5169.48	153.45	17639.60	81.60	
12	21.00	717.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.58	
				8	1.400	-5169.48	153.45	17639.60	78.75	
13	26.25	780.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.60	
				8	1.400	-5169.48	153.45	17639.60	75.89	
14	31.50	843.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.63	
				8	1.400	-5169.48	153.45	17639.60	73.03	
15	36.75	906.0	0.0	1	1.000	-6844.68	188.25	-115.20	163.65	< 190k
				8	1.400	-5169.48	153.45	17639.60	70.17	
16	-36.75	24.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.72	
				7	1.400	-5169.48	153.45	-17639.60	69.26	
17	-31.50	87.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.75	
				7	1.400	-5169.48	153.45	-17639.60	72.12	
18	-26.25	150.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.77	
				7	1.400	-5169.48	153.45	-17639.60	74.98	
19	-21.00	213.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.80	
				7	1.400	-5169.48	153.45	-17639.60	77.83	
20	-15.75	276.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.82	
				7	1.400	-5169.48	153.45	-17639.60	80.69	
21	-10.50	339.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.85	
				7	1.400	-5169.48	153.45	-17639.60	83.55	
22	-5.25	402.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.88	
				7	1.400	-5169.48	153.45	-17639.60	86.40	
23	0.00	465.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.90	
				7	1.400	-5169.48	153.45	-17639.60	89.26	
24	5.25	528.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.93	

PROJECT: MOT-75-14.60 SOLID WALL

				8	1.400	-5169.48	153.45	17639.60	86.40	
25	10.50	591.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.95	
				8	1.400	-5169.48	153.45	17639.60	83.55	
26	15.75	654.0	-48.0	1	1.000	-6844.68	188.25	-115.20	161.98	
				8	1.400	-5169.48	153.45	17639.60	80.69	
27	21.00	717.0	-48.0	1	1.000	-6844.68	188.25	-115.20	162.01	
				8	1.400	-5169.48	153.45	17639.60	77.83	
28	26.25	780.0	-48.0	1	1.000	-6844.68	188.25	-115.20	162.03	
				8	1.400	-5169.48	153.45	17639.60	74.98	
29	31.50	843.0	-48.0	1	1.000	-6844.68	188.25	-115.20	162.06	
				8	1.400	-5169.48	153.45	17639.60	72.12	
30	36.75	906.0	-48.0	1	1.000	-6844.68	188.25	-115.20	162.08	
				8	1.400	-5169.48	153.45	17639.60	69.26	
31	-36.75	24.0	48.0	1	1.000	-6844.68	188.25	-115.20	164.86	<190k
				7	1.400	-5169.48	153.45	-17639.60	71.09	
32	-31.50	87.0	48.0	1	1.000	-6844.68	188.25	-115.20	164.88	
				7	1.400	-5169.48	153.45	-17639.60	73.95	
33	-26.25	150.0	48.0	1	1.000	-6844.68	188.25	-115.20	164.91	
				7	1.400	-5169.48	153.45	-17639.60	76.80	
34	-21.00	213.0	48.0	1	1.000	-6844.68	188.25	-115.20	164.93	
				7	1.400	-5169.48	153.45	-17639.60	79.66	
35	-15.75	276.0	48.0	1	1.000	-6844.68	188.25	-115.20	164.96	
				7	1.400	-5169.48	153.45	-17639.60	82.52	
36	-10.50	339.0	48.0	1	1.000	-6844.68	188.25	-115.20	164.99	
				7	1.400	-5169.48	153.45	-17639.60	85.37	
37	-5.25	402.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.01	
				7	1.400	-5169.48	153.45	-17639.60	88.23	
38	0.00	465.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.04	
				7	1.400	-5169.48	153.45	-17639.60	91.09	
39	5.25	528.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.07	
				8	1.400	-5169.48	153.45	17639.60	88.23	
40	10.50	591.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.09	
				8	1.400	-5169.48	153.45	17639.60	85.37	
41	15.75	654.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.12	
				8	1.400	-5169.48	153.45	17639.60	82.52	
42	21.00	717.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.14	
				8	1.400	-5169.48	153.45	17639.60	79.66	
43	26.25	780.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.17	
				8	1.400	-5169.48	153.45	17639.60	76.80	
44	31.50	843.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.20	
				8	1.400	-5169.48	153.45	17639.60	73.95	
45	36.75	906.0	48.0	1	1.000	-6844.68	188.25	-115.20	165.22	<190k
				8	1.400	-5169.48	153.45	17639.60	71.09	

Note:

Only max. force in piles is considered for design.
Pile coordinates X and Z are from the most left edge of the footing.

Max. Pile Reaction Used in Design: (without selfweight and surcharge)
==========

Working Stress pile reaction = 153.86 kips

Reinforcement Schedule:
==========:

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Dir	Quantity	Size	Bar dist. in	As total in^2	Spacing in	Hook
Z	52	# 10	5.14	66.04	18.09	None

Flexure:
========

Dir	Loc ft	d in	Mmax kft	Comb	Asb_req in^2	Asb_prv in^2	Asb_eff in^2	Ast_req in^2	Ast_prv in^2	Ast_eff in^2
X	-38.63	45.00	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00
X	38.63	45.00	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00
Z	-2.25	42.86	4038.7	1	65.86	66.04 *	53.44 *	0.00	0.00	0.00
Z	2.25	42.86	4038.7	1	65.86	66.04 *	53.44 *	0.00	0.00	0.00

Note:
* The provided reinforcement is not adequate, either less than required or larger than maximum allowed.
** Required spacing of bars violated.

One Way Shear:
==========

Col	Dir	Dist ft	Comb	d in	V kips	Vc kips
1	X	-42.38	----	------	Outside of Footing	
	X	42.38	----	------	Outside of Footing	
	Z	-5.82	----	------	Outside of Footing	
	Z	5.82	----	------	Outside of Footing	

Note:
* Shear resistance is less than applied shear force.
You may increase the footing depth or provide stirrups.

Two Way Shear:
==========

#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips
Columns:						
1	------	------	---	No Two Way Shear		
Piles - max:						
2	18.95	22.46	1	45.00	153.9	1110.0
Piles - min:						
16	8.24	16.91	1	45.00	153.9	482.4

Note:
* Shear resistance is less than applied punching force.

PROJECT: MOT -75-14.60

PROJECT DATA
==========

Project : MOT -75-14.60
User Job No.: P4030066
State : OHIO State Job No. : 23828
Comments : PRELIMINARY DESIGN - AESTHETIC PIER WALL

SHEET 2 OF 12

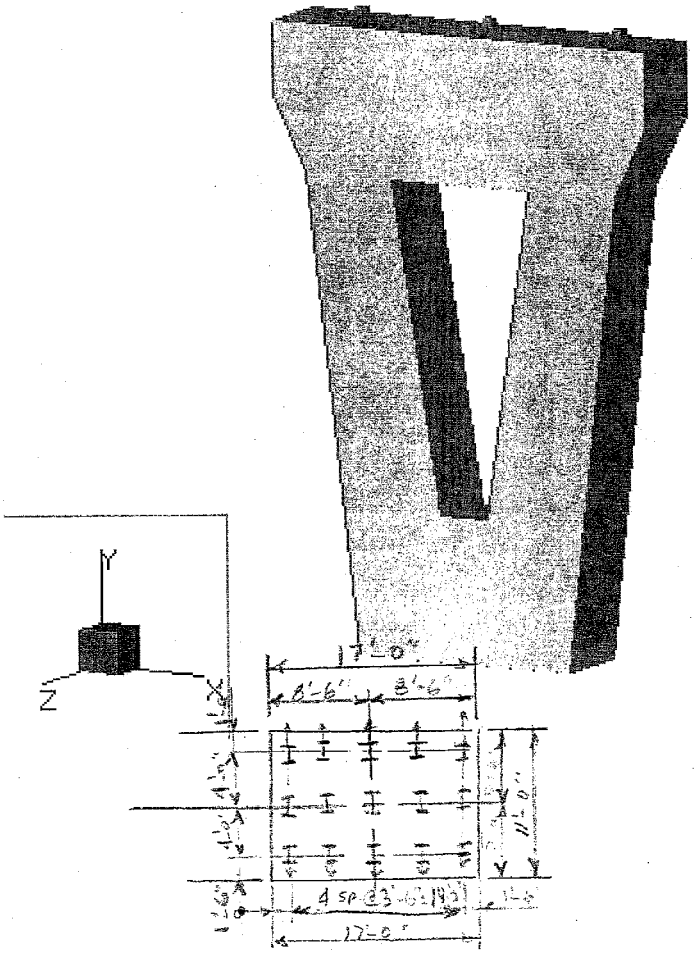
TranSystems Corporation
55 Public Square, Suite 1650
PHONE: 216-861-1780
Cleveland, OH 44113

SHEET 1 OF 1
JOB NO. P4030066
BY NFF DATE Oct/29/2004
CKD. DATE

PROGRAM: RC-PIER® v1.5.0 LEAP Software Inc., Tampa, Florida
PHONE : TOLL-FREE 1-800-451-5327 TAMPA AREA: 813-985-9170

PROJECT: MOT -75-14.60

FULL IMAGE:



SHEET 3 OF 12

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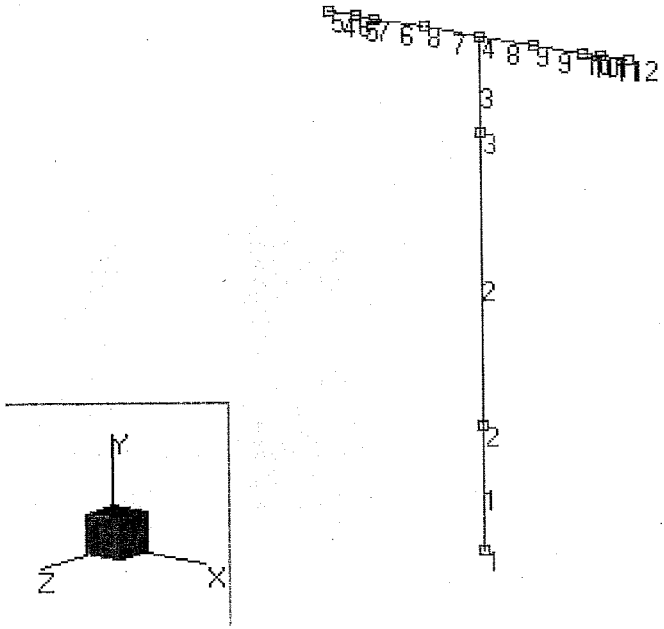
Footing Plan

PROJECT: MOT -75-14.60

STRUCTURE MODEL:



PROJECT: MOT -75-14.60

PIER GEOMETRY

Pier Type: Hammer Head

Length(X) = 23.00 ft Height max(Y) = 8.00 ft Height min(Y) = 4.00 ft
Bottom length(X) = 19.00 ft Depth(Z) = 4.50 ft Skew angle = 0.00 Reduction of I = 1.000
Opening parameters:
a1(X) = 8.50 ft a2(X) = 3.00 ft b1(Y) = 8.00 ft b2(Y) = 18.16 ft

Column Shape: Rectangular with Tapered Width (X dir)
Bottom width(X) = 13.00 ft Top width(X) = 19.00 ft Depth(Z) = 4.50 ft Height(Y) = 26.00 ft

STRUCTURE MODEL

FRAME Model:

	Member	Node	Hinge	Check Pt Dist(ft)	Memb length(ft)
Column No. 1					
	1	1	-	0.00	
		2	-	7.84	7.84
	2	2	-	7.84	
		3	-	26.00	18.16
	3	3	-	26.00	
		4	-	32.00	6.00
Cap					
	4	5	-	0.00	
		6	-	2.00	2.00
	5	6	-	2.00	
		7	-	3.50	1.50
	6	7	-	3.50	
		8	-	7.25	3.75
	7	8	-	7.25	
		4	-	11.50	4.25
	8	4	-	11.50	
		9	-	15.75	4.25
	9	9	-	15.75	
		10	-	19.50	3.75
	10	10	-	19.50	
		11	-	21.00	1.50
	11	11	-	21.00	
		12	-	23.00	2.00

Node coordinates:

Number	X(ft)	Y(ft)	Node type
1	11.50	0.00	fixed at ground
2	11.50	7.84	
3	11.50	26.00	
4	11.50	32.00	column-cap bearing
5	0.00	32.00	
6	2.00	32.00	
7	3.50	32.00	bearing
8	7.25	32.00	
9	15.75	32.00	
10	19.50	32.00	bearing
11	21.00	32.00	

PROJECT: MOT -75-14.60

12	23.00	32.00

SUPERSTRUCTURE INFO
==========

Total number of spans: 2 Span number rear to current pier: 1
Number of traffic lanes: 1

Beam: height = 72.00 in section area = 956.00 in^2
Barrier height = 42.00 in Depth of slab = 10.50 in

Span	Forward	Rear
Overall width	21.75 ft	21.75 ft
Curbs width	18.50 ft	18.50 ft
Span Length	136.00 ft	136.00 ft

BEARING POINTS
==========

Number of bearing lines: 2

First bearing line Eccentricity = 1.21 ft

Point	Distance ft
1	3.50
2	11.50
3	19.50

Second bearing line Eccentricity = -1.21 ft

Point	Distance ft
1	3.50
2	11.50
3	19.50

MATERIAL PROPERTIES
==========

	Cap	Column	Footing
Concrete Type	normal	normal	normal
Concrete Strength (psi)	4000.00	4000.00	4000.00
Concrete Density (lb/ft3)	150.00	150.00	150.00
Concrete Modulus Ec (ksi)	3834.30	3834.30	3834.30
Steel Strength Fy (ksi)	60.00	60.00	60.00

SHEET 6 OF 12

PROJECT: MOT -75-14.60

LOADS
=====

Load Cases: 4

Loadcase ID: D1 Name:
Multiplier = 1.000

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	Y	-184.60
1	2	Y	-203.72
1	3	Y	-184.60
2	1	Y	-184.60
2	2	Y	-203.72
2	3	Y	-184.60

Auto generation details:

Generated Dead Load
Slab weight = 150.00 pcf Girder weight = 150.00 pcf
Wearing weight = 1305.00 plf Barrier load = 1278.00 plf

Loadcase ID: W1 Name: Angle: 0
Multiplier = 1.000

Cap loads:
Force(X) = 1.440 kip Arm = 0.00 ft

Column loads:

Col #	Type	Dir	Mag1	y1/L	Mag2	y2/L
1	UDL	X	0.180 k/ft	0.00	----	0.00

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	X	11.76
1	1	Y	21.49
1	1	Z	0.00
1	2	X	11.76
1	2	Y	0.00
1	2	Z	0.00
1	3	X	11.76
1	3	Y	-21.49
1	3	Z	0.00
2	1	X	11.76
2	1	Y	21.49
2	1	Z	0.00
2	2	X	11.76
2	2	Y	0.00
2	2	Z	0.00
2	3	X	11.76
2	3	Y	-21.49
2	3	Z	0.00

SHEET 7 OF 12

PROJECT: MOT -75-14.60

Auto generation details:
Generated Wind Load on Structure
Angle of wind = 0.00 deg Elevation above which wind load acts = 0.00 ft
Default wind pressure

Wind pressure for superstructure:		Wind pressure for substructure:	
Transverse	50.000 psf	Cap	40.000 psf
Longitudinal	0.000 psf	Column	40.000 psf
Overturning	20.000 psf		

Loadcase ID: WL1 Name: Angle: 0
Multiplier = 1.000

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	X	2.27
1	1	Y	5.47
1	1	Z	0.00
1	2	X	2.27
1	2	Y	0.00
1	2	Z	0.00
1	3	X	2.27
1	3	Y	-5.47
1	3	Z	0.00
2	1	X	2.27
2	1	Y	5.47
2	1	Z	0.00
2	2	X	2.27
2	2	Y	0.00
2	2	Z	0.00
2	3	X	2.27
2	3	Y	-5.47
2	3	Z	0.00

Auto generation details:
Generated Wind Load on Live Load
Angle of wind = 0.00 deg Live load length = 136.00 ft

Loadcase ID: (L+In)1 Name:
Multiplier = 1.000

Bearing loads:

Line #	Bearing #	Dir.	Load, kip
1	1	Y	-165.70
1	2	Y	-165.70
1	3	Y	-165.70
2	1	Y	-153.00
2	2	Y	-153.00
2	3	Y	-153.00

Selected load groups:

SERVICE GROUP I
SERVICE GROUP II
SERVICE GROUP III
SERVICE GROUP IV
SERVICE GROUP V

SHEET 8 OF 12

PROJECT: MOT -75-14.60

LOAD COMBINATIONS - AASHTO STANDARD

```
Comb #     1  (SER GP I    ) = 1.00 (  1.00 D1 + 1.00 (L+In)1 )
Comb #     2  (SER GP II   ) = 1.00 (  1.00 D1 + 1.00 W1 )
Comb #     3  (SER GP II   ) = 1.00 (  1.00 D1 - 1.00 W1 )
Comb #     4  (SER GP III  ) = 1.00 (  1.00 D1 + 1.00 (L+In)1 + 0.30 W1 + 1.00 WL1 )
Comb #     5  (SER GP III  ) = 1.00 (  1.00 D1 + 1.00 (L+In)1 - 0.30 W1 - 1.00 WL1 )
Comb #     6  (SER GP IV   ) = 1.00 (  1.00 D1 + 1.00 (L+In)1 )
Comb #     7  (SER GP V    ) = 1.00 (  1.00 D1 + 1.00 W1 )
Comb #     8  (SER GP V    ) = 1.00 (  1.00 D1 - 1.00 W1 )
```

Load Combinations for Columns are the same

PROJECT: MOT -75-14.60

ISOLATED FOOTING DESIGN

Code: AASHTO STANDARD - Service Load Design
Units: US

Geometry:
==========
Name : PILECAP
Shape : Rectangular, Type : Pile/Shaft Cap

Bf(X) = 17.00 ft, Hf(Z) = 11.00 ft, Thickness(Y) = 48.00 in

Start at X = -8.50 ft from centerline of column.
Columns located on the footing:
Column No. 1 at x = 0.00 ft, Rectangular 156.00 in x 54.00 in

Ag = 187.00 ft^2, Ix = 160.00 ft^2, Iz = 367.50 ft^2

Surcharge = 0.00 ksf

Piles: H-Steel Size: 14.00 in Capacity: 190.00 kips

Design Parameters:
==========
f'c = 4000.00 psi fy = 60000.00 psi
Ec = 3834.3 ksi Es = 29000.0 ksi
Crack control factor z = 130.00 kips/in
Concrete Type : Normal Weight.

Pile Reactions, Service (Without the reduction of overstress allowance):
==========

Pile	Loc(X) ft	X in	Z in	comb	Ovs	Column Loads P, kips	Mxx, kft	Mzz, kft	Pile Reac. kips
1	-7.00	18.0	-48.0	5	1.250	-2448.88	46.04	1577.23	199.63
				2	1.250	-1492.78	0.00	-3132.44	47.33
2	-3.50	60.0	-48.0	5	1.250	-2448.88	46.04	1577.23	184.61
				2	1.250	-1492.78	0.00	-3132.44	77.17
3	0.00	102.0	-48.0	1	1.000	-2448.88	46.04	-0.00	169.59
				2	1.250	-1492.78	0.00	-3132.44	107.00
4	3.50	144.0	-48.0	4	1.250	-2448.88	46.04	-1577.23	184.61
				3	1.250	-1492.78	0.00	3132.44	77.17
5	7.00	186.0	-48.0	4	1.250	-2448.88	46.04	-1577.23	199.63
				3	1.250	-1492.78	0.00	3132.44	47.33
6	-7.00	18.0	0.0	5	1.250	-2448.88	46.04	1577.23	200.78
				2	1.250	-1492.78	0.00	-3132.44	47.33
7	-3.50	60.0	0.0	5	1.250	-2448.88	46.04	1577.23	185.76
				2	1.250	-1492.78	0.00	-3132.44	77.17
8	0.00	102.0	0.0	1	1.000	-2448.88	46.04	-0.00	170.74
				2	1.250	-1492.78	0.00	-3132.44	107.00
9	3.50	144.0	0.0	4	1.250	-2448.88	46.04	-1577.23	185.76
				3	1.250	-1492.78	0.00	3132.44	77.17
10	7.00	186.0	0.0	4	1.250	-2448.88	46.04	-1577.23	200.78
				3	1.250	-1492.78	0.00	3132.44	47.33
11	-7.00	18.0	48.0	5	1.250	-2448.88	46.04	1577.23	201.93
				2	1.250	-1492.78	0.00	-3132.44	47.33
12	-3.50	60.0	48.0	5	1.250	-2448.88	46.04	1577.23	186.91
				2	1.250	-1492.78	0.00	-3132.44	77.17

PROJECT: MOT -75-14.60

13	0.00	102.0	48.0	1	1.000	-2448.88	46.04	-0.00	171.89
				2	1.250	-1492.78	0.00	-3132.44	107.00
14	3.50	144.0	48.0	4	1.250	-2448.88	46.04	-1577.23	186.91
				3	1.250	-1492.78	0.00	3132.44	77.17
15	7.00	186.0	48.0	4	1.250	-2448.88	46.04	-1577.23	201.93
				3	1.250	-1492.78	0.00	3132.44	47.33

Pile Reactions, Service (After the reduction of overstress allowance):

Pile	Loc(X) ft	X in	Z in	Column Loads comb	Ovs	P, kips	Mxx, kft	Mzz, kft	Pile Reac. kips
1	-7.00	18.0	-48.0	1	1.000	-2448.88	46.04	-0.00	169.59 < 190k
				7	1.400	-1492.78	0.00	-3132.44	33.81
2	-3.50	60.0	-48.0	1	1.000	-2448.88	46.04	-0.00	169.59
				7	1.400	-1492.78	0.00	-3132.44	55.12
3	0.00	102.0	-48.0	1	1.000	-2448.88	46.04	-0.00	169.59
				7	1.400	-1492.78	0.00	-3132.44	76.43
4	3.50	144.0	-48.0	1	1.000	-2448.88	46.04	-0.00	169.59
				8	1.400	-1492.78	0.00	3132.44	55.12
5	7.00	186.0	-48.0	1	1.000	-2448.88	46.04	-0.00	169.59
				8	1.400	-1492.78	0.00	3132.44	33.81
6	-7.00	18.0	0.0	1	1.000	-2448.88	46.04	-0.00	170.74 < 190k
				7	1.400	-1492.78	0.00	-3132.44	33.81
7	-3.50	60.0	0.0	1	1.000	-2448.88	46.04	-0.00	170.74
				7	1.400	-1492.78	0.00	-3132.44	55.12
8	0.00	102.0	0.0	1	1.000	-2448.88	46.04	-0.00	170.74
				7	1.400	-1492.78	0.00	-3132.44	76.43
9	3.50	144.0	0.0	1	1.000	-2448.88	46.04	-0.00	170.74
				8	1.400	-1492.78	0.00	3132.44	55.12
10	7.00	186.0	0.0	1	1.000	-2448.88	46.04	-0.00	170.74
				8	1.400	-1492.78	0.00	3132.44	33.81
11	-7.00	18.0	48.0	1	1.000	-2448.88	46.04	-0.00	171.89
				7	1.400	-1492.78	0.00	-3132.44	33.81
12	-3.50	60.0	48.0	1	1.000	-2448.88	46.04	-0.00	171.89
				7	1.400	-1492.78	0.00	-3132.44	55.12
13	0.00	102.0	48.0	1	1.000	-2448.88	46.04	-0.00	171.89
				7	1.400	-1492.78	0.00	-3132.44	76.43
14	3.50	144.0	48.0	1	1.000	-2448.88	46.04	-0.00	171.89
				8	1.400	-1492.78	0.00	3132.44	55.12
15	7.00	186.0	48.0	1	1.000	-2448.88	46.04	-0.00	171.89 < 190k
				8	1.400	-1492.78	0.00	3132.44	33.81

Note:

Only max. force in piles is considered for design.
Pile coordinates X and Z are from the most left edge of the footing.

Max. Pile Reaction Used in Design: (without selfweight and surcharge)

Working Stress pile reaction = 164.41 kips

Reinforcement Schedule:

PROJECT: MOT -75-14.60

==========:

Dir	Quantity	Size	Bar dist. in	As total in^2	Spacing in	Hook
X	4	# 10	3.63	5.08	41.58	None
Z	19	# 10	5.14	24.13	10.93	None

Flexure:
========

Dir	Loc ft	d in	Mmax kft	Comb	Asb_req in^2	Asb_prv in^2	Asb_eff in^2	Ast_req in^2	Ast_prv in^2	Ast_eff in^2
X	-6.50	44.37	246.6	1	3.82	5.08 *	2.53 *	0.00	0.00	0.00
X	6.50	44.37	246.6	1	3.82	5.08 *	2.53 *	0.00	0.00	0.00
Z	-2.25	42.86	1438.6	1	23.77	24.13 *	19.53 *	0.00	0.00	0.00
Z	2.25	42.86	1438.6	1	23.77	24.13 *	19.53 *	0.00	0.00	0.00

Note:
* The provided reinforcement is not adequate, either less than required or larger than maximum allowed.
** Required spacing of bars violated.

One Way Shear:
==========

Col	Dir	Dist ft	Comb	d in	V kips	Vc kips
1	X	-10.20	----	------	Outside of Footing	
	X	10.20	----	------	Outside of Footing	
	Z	-5.82	----	------	Outside of Footing	
	Z	5.82	----	------	Outside of Footing	

Note:
* Shear resistance is less than applied shear force.
You may increase the footing depth or provide stirrups.

Two Way Shear:
==========

#	Bo ft	Ao ft^2	Comb	Avg. d in	V kips	Vc kips
Columns:						
1	------	------	---	No Two Way Shear		
Piles - max:						
7	19.20	23.05	1	45.00	164.4	1144.3
Piles - min:						
1	7.80	15.21	1	45.00	164.4	464.8

Preliminary Retaining Walls Foundation Load

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

MOT-78-
RETAINING WALL AT REAR ABUTMENT

MADE BY: N. . 1/9/2004

	thickness	length
Toe	2	1.5
Heel	2	6.25
Stem	1.25	11.6

soil	0.12
equiv fl	0.04
fric fact	0.35

key depth	1.5
bot flg dp	3.5
flg width	[illegible]

fc (psi)	4000
fy (psi)	60000
n	17.64706

Vertical Forces

		Xa	Ma
Conc. Stem	w1	2.151563	2.125	4.57207
Conc. Flg.	w2	2.7	4.5	12.15
Soil wt. Back	w3	8.325	5.875	48.90938
Soil wt. Front	w4	0.36	0.75	0.27
		13.53656		65.90145

Horizontal Forces

Hor. Soil	Ph	3.4322	4.366667	14.98727
2' LL Surch.	HLL	1.048	6.55	6.8644
		4.4802		21.85167

3	0.11
4	0.2
5	0.31
6	0.44
7	0.6
8	0.79
9	1
10	1.27
11	1.56

2' - LL Surcharge 0.08

General

Overturning (FS)	3.015853	OK
Sliding (FS)	1.484375	FAIL
Soil Pressure		
X	3.254133	OK
Middl 3rd	3	
Range	6	
Sigma "A"	-2.753304	< 3.0 KSF
Sigma "B"	-0.254821	OK

1.50 OK

Stem

Ph (k)	4.535685	Mcr	213.4537	X(ABV FT)	5
M (k-ft)	16.78203	1.2Mcr	256.1445	Mu (k-in)	37.13675
d	12.605			d	12.67
bar (area)	0.79	As (sq in)	[illegible]	bar (area)	0.88
Vu (k)	5.3361			Ru (psi)	19.27833
Mu (k-in)	223.7605			p(req'd)	0.000322
Vc (k)	19.13304	OK		As (sq in)	[illegible]
Ru (psi)	117.359				
p(req'd)	0.001991				

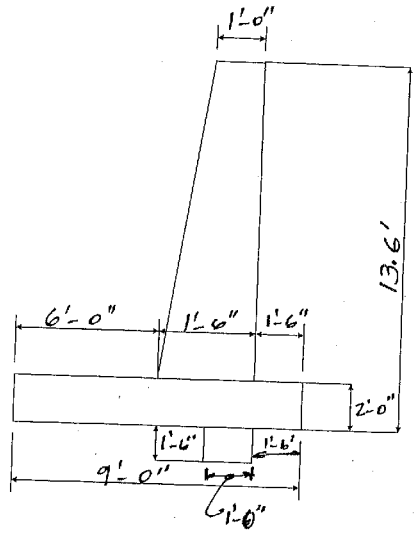
Toe

S"A1" - WT toe	2.453304
S"A2" - WT toe	2.03689
Vu (k)	8.980386
Mu (k-in)	58.01973
d	20.78
bar (area)	0.44
Vc (k)	31.54182 OK
Ru (psi)	11.39003
p(req'd)	0.00019
Mcr	546.4416
1.2Mcr	655.7299
As (sq in)	0.063222

Heel

		X	M
w(soil)	8.325	3.125	26.01563
w(conc)	1.875	3.125	5.859375
	10.2		31.875

Vu (k)	16.8
Mu (k-in)	595
d	21.5
bar (area)	1
Vc (k)	32.63471 OK
Ru (psi)	107.2652
p(req'd)	0.001817
Mcr	546.4416
1.2Mcr	655.7299
As (sq in)	[illegible]



Inter-office communication

To: Gene Geiger, Administrator,
Office of Geotechnical Engineering

Date: November 16, 2004

From: David H. Stammen, P.E., Contracts Administrator
By: Scott C. Boyer, P.E.

Subject: MOT-75-14.60 PID 23828 Stage 1 Plans

Please find attached Stage 1 Plans, Geotechnical Report, and letter of transmittal from the consultant on subject project. Please review and provide comments on or before December 15, 2004.

Please direct comments to Scott C. Boyer, P.E., (937) 497-6807.

DHS

DHS/SCB

c: Boyer
File

NOV 2004

TRANSYSTEMS CORPORATION

November 15, 2004

Mr. Scott C. Boyer, PE
District Contract Manger
District 7 - Production
Ohio Department of Transportation
1001, St. Mary's Avenue
Sidney, Ohio 45365

RECEIVED
NOV 16 2004
PRODUCTION
DISTRICT 7 - SIDNEY

SUBJECT: Stage I submission
MOT-75-14.60
PID#23828

Dear Mr. Boyer:

On November 2, 2004 we made a Partial Stage I submittal for the above referenced project that included a Design Exception Request along with the Project Design Criteria, Maintenance of Traffic Alternative Analysis, and Signal Warrant Analysis. Included with this submission are the following documents:

1. Four sets of 11 x 17 Stage I plans (63 sheets each)
2. Four copies of the Bridge Preliminary Design Report
3. Four copies of the Soils Investigation Report
4. Compilation of Utility Coordination Information

At this time a supplemental site plan is included with the Stage I plan set as required by the ODOT Bridge Design Manual (BDM) Section 201.2.3. We performed a preliminary hydraulic analysis to compare the Water Surface Elevations (WSE's) between the existing and proposed conditions. The design year (50-year), 100-year, and 500-year floods from the FEMA Flood Insurance Study (FIS) as well as Miami Conservancy District (MCD) floods were analyzed. To perform the analysis we combined ground survey cross sections and FEMA FIS information with cross sections and river profile data provided by MCD. **Our preliminary analysis shows that the proposed bridge will not affect the WSE's along The Great Miami River.** We will submit a complete hydraulic report per BDM Section 201.2.3 once the pier types are determined and we receive the FEMA HEC-2 model.

We are continuing our efforts to coordinate with utilities within the project area. The list included with this submission (Item 4 above) outlines the contacts made thus far, and the plans have been updated with the information received. We will be sending a copy of the Stage I plan set to all affected utilities, and will copy you.

5747 Perimeter Drive, Suite 240 • Dublin, Oh 43017 • Phone: (614) 336-8480 • Fax: (614) 336-8540

At this time we request the Department to provide us with a Pavement Design for the project. Included is a copy each of the Stage I plan set, and the soils report for the purposes of pavement design. Roadway borings on the mainline were taken on the shoulders and show a pavement type that is an asphalt overlay on concrete. Since these borings are not representative of actual depths on the mainline and ramp pavements, we chose to show the existing pavement build-up based on a combination of the existing plans for MOT-25-15.88 and the Safety upgrade plans for MOT-75-13.88. Boring # 11 was taken on Stanley Avenue pavement and the typical sections for Stanley Avenue show a 9" asphalt pavement over 7" of sub-base.

If you have any questions or require more information on this matter, please do not hesitate to call.

Sincerely,

TranSystems Corporation

Asvin Mandadi

Asvin Mandadi, P.E.
Senior Roadway Engineer

Enclosure as noted.

Cc: File