

LOG OF BORING

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Date Started 4/24/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/24/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-06 Station & Offset 238+77.54, 14.80' Lt Ramp B Surface Elev. 752.6ft
 Water Elev. Dry

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen/ RQD	Rec. (ft)	Loss (ft)		Description	Sample	Physical Characteristics										ODOT
							No.	% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Class		
752.6	0					Asphalt (10")												
752.6	0.9'																	
751.7	1.2'					Base course (4")												
751.6		4/4/4				Brown, loose, berm material	1									6	VIS.	
751.4	2																	
749.1																		
	4	9/5/4				Gray and brown, stiff, SANDY SILT , trace gravel, little clay, moist, fill	2									16	VIS.	
746.6	6																	
		7/10/7				Brown, very stiff, SANDY SILT , trace gravel, little clay, with sand seams, damp, fill	3									7	VIS.	
744.1	8																	
		5/13/13				Gray, very stiff, SILT AND CLAY , trace gravel, little sand, blocky, with shale fragments, damp, fill	4	7	4	11	22	56	34	14	18	A-6a		
741.6	10																	
		6/9/6				Gray with black staining, stiff, SILT AND CLAY , trace sand, moist, possible fill	5	0	0	2	50	48	34	14	23	A-6a		
739.1	12																	
		5/4/6				Brownish gray, stiff, SANDY SILT , trace gravel, little clay, damp, possible fill	6									21	VIS.	
736.6	14																	
		5/6/8				Brownish gray, stiff, SANDY SILT , trace gravel, little clay, damp, with root hairs, possible fill	7									24	VIS.	
734.1	16																	
		4/4/7				Brownish gray, stiff, SANDY SILT , trace gravel, little clay, damp	8									19	VIS.	
729.1	18																	
		10/8/35																
727.6	20																	
						Drove on cobbles	9										VIS.	
	22																	
	23.5'																	
	25.0'																	

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/24/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/24/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754Warren County, Ohio

Boring No. NW-07 Station & Offset 241+75.89, 82.34' Lt.
 Water Elev. Dry
 Surface Elev. 757.8ft

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen./ RGD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics								ODOT Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
757.8	0				Asphalt (11")										
757.8	0.9'														
756.9	1.2'				Base course (4")										
756.5		4/4/4			Gray, medium stiff, SILT AND CLAY , little sand, blocky, damp, fill	1								12	VIS.
754.3	2														
	4	6/7/8			Brown and gray, stiff, SANDY SILT , little gravel, little clay, damp, fill	2								11	VIS.
751.8	6														
	8	8/9/11			Brown and gray, very stiff, SANDY SILT , little gravel, little clay, damp, fill	3	16	13	35	15	21	22	7	9	A-4a
749.3	8														
	10	5/6/10			Dark brownish gray, very stiff, SANDY SILT , trace gravel, little clay, damp	4								20	VIS.
748.8	10														
	12	20/7/13			Brown and gray, very stiff, SANDY SILT , trace gravel, little clay, with cobbles, damp	5								9	VIS.
744.3	14														
	16	14/20/21			CLAYSHALE , brown and gray, augered	6								11	VIS.
741.8	16														
	18	44/24/21			SHALE , gray, augered	7									VIS.
739.3	18														
	20	15/45/50-4"			SHALE , gray, augered	8									VIS.
734.3	22														
	24	50-6"			SHALE , gray, augered	9									VIS.
732.8	24														
	25.0'														

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/24/06 Sampler: Type SS Dia. 1.375"Project Identification: WAR-75-3.40 PID 10754Date Completed 4/24/06 Casing: Length 15ft Dia. 3.25"Warren County, OhioBoring No. NW-08 Station & Offset 245+90.82, 71.45' Lt.Water Elev. 753.7ftSurface Elev. 764.7ftCTL Project No. 04120056G

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.		
764.7	0					Topsoil (14")											
764.7	1.2	5/4/5				Dark brown, stiff, SILT AND CLAY , little sand, damp	1								26	VIS.	
763.5	2																
761.2	3.5	8/8/10				Brown, very stiff, ELASTIC CLAY , trace gravel, little sand, some silt, damp, possible till	2	4	4	16	27	49	45	15	24	A-7-5	
758.7	4																
756.2	6	12/10/12				Brown, very stiff, ELASTIC CLAY , trace gravel, little sand, some silt, damp, possible till	3								16	VIS.	
756.2	8																
753.7	8.5	10/20/36				SHALE , gray, augered	4									VIS.	
753.7	10																
751.2	12	37/50-5"				SHALE , gray, augered	5									VIS.	
749.7	14	38/50-4"				SHALE , gray, augered	6									VIS.	
749.7	15.0'																

BOTTOM OF BORING

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

Date Started 4/18/06 Sampler: Type SS Dia. 1.375"
Date Completed 4/18/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754

Date Completed 4/18/06 Casing: Length 25ft Dia. 3.25"

Warren County, Ohio

Water Elev. 781.2ft

Surface Elev. 795.2ft

Boring No. NW-09 Station & Offset 363+38.28, 150.82' Lt.

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen./ R/GD	Rec. (ft)	Loss (ft)		Description	Sample No.	Physical Characteristics						W.C.	ODOT Class	
								% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.			P.I.
795.2	0					Topsoil (11")										
795.2 794.7 794.3	3/3/4					Brown, medium stiff, SANDY SILT , little gravel, little clay, damp	1							11		VIS.
792.2	4	4/5/5				Brown and gray, stiff, SANDY SILT , little gravel, some clay, moist, possible till	2							13		VIS.
789.7	6	5/5/5				Brown and gray, stiff, SANDY SILT , some gravel, some clay, moist, possible till	3	29	9	25	16	21	15	3	15	A-4a
786.7	8	4/5/6				Brown and gray, stiff, SANDY SILT , some gravel, some clay, moist, till	4							13		VIS.
784.2	12	4/5/7				Brown and gray, stiff, SANDY SILT , some gravel, some clay, moist, till	5	21	7	24	27	21	14	3	12	A-4a
781.7	14	6/6/7				Gray, stiff, SANDY SILT , little gravel, little clay, damp, till	6							10		VIS.
779.2	16	4/6/7				Gray, stiff, SANDY SILT , little gravel, little clay, damp, till	7							11		VIS.
776.7	18					Gray, very stiff, SILT AND CLAY , trace gravel, trace sand, with silt seams, damp	8							12		VIS.
771.7	24	10/12/12				Gray, very stiff, SILT AND CLAY , trace gravel, trace sand, with silt seams, damp	9							13		VIS.
770.2																

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/17/06 Sampler: Type SS Dia. 1.375"Project Identification: WAR-75-3.40 PID 10754Date Completed 4/17/06 Casing: Length 25ft Dia. 3.25"Warren County, OhioBoring No. NW-10 Station & Offset 366+68.63, 132.01' Lt.Water Elev. 784.0ftSurface Elev. 790.0ftCTL Project No. 04120056G

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.	
790.0	0					Topsoil (11")										
790.0																
789.5																
789.1		3/3/3				Brown, medium stiff, CLAY , little sand, some silt, moist	1								26	VIS.
	2															
787.0		4/4/5				Brown, stiff, CLAY , little sand, some silt, moist	2	0	0	16	32	52	44	26	23	A-7-6
	4															
784.5																
	6	3/3/4				Brown, medium stiff, SANDY SILT , little gravel, some clay, with silt seams, moist, possible till	3	14	1	27	23	35	14	4	11	A-4a
781.5																
	8	3/4/5				Brown, stiff, SANDY SILT , little gravel, some clay, with silt seams, moist, possible till	4								10	VIS.
779.0																
	10	4/4/4				Brown, medium stiff, SANDY SILT , little gravel, some clay, with silt seams, damp, possible till	5								9	VIS.
779.0																
	12	4/5/6														
776.5																
	14	4/5/6				Gray, stiff, SANDY SILT , little gravel, little clay, damp, till	6								10	VIS.
774.0																
	16	4/5/7				Gray, stiff, SANDY SILT , little gravel, little clay, damp, till	7								8	VIS.
771.5																
	18	4/5/8														
771.5																
	20					Gray, stiff, SANDY SILT , little gravel, little clay, damp, till	8								10	VIS.
766.5																
	22															
766.5																
	24	9/11/12				Brown, very stiff, SILT AND CLAY , trace sand, damp	9								17	VIS.
765.0																
765.0																

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/17/06 Sampler: Type SS Dia. 1.375"Project Identification: WAR-75-3.40 PID 10754Date Completed 4/17/06 Casing: Length 25ft Dia. 3.25"Warren County, OhioBoring No. NW-11 Station & Offset 369+54.44, 138.18' Lt.Water Elev. 774.7ftSurface Elev. 787.2ftCTL Project No. 04120058G

Elev (ft)	Depth (ft)	Std. Pen./ ROD	Rec. (ft)	Loss (ft)		Description	Sample No.	Physical Characteristics									ODOT Class
								% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.		
787.2	0					Topsoil (10")											
787.2 786.7 786.4	2/3/4				0.8'	Brown, medium stiff, SILT AND CLAY , little sand, damp, possible fill	1								25	VIS.	
784.2	6/6/8				3.0'	Brown, stiff, SANDY SILT , trace gravel, little clay, damp	2								20	VIS.	
781.7	2/3/3				5.5'	Brown, medium stiff, SANDY SILT , little gravel, some clay, moist, possible till	3								12	VIS.	
778.7	2/3/4					Brown, medium stiff, SANDY SILT , little gravel, some clay, wet, possible till	4	14	7	29	24	26	14	4	14	A-4a	
776.2	3/3/4					Brown, medium stiff, SANDY SILT , little gravel, some clay, moist, possible till	5								13	VIS.	
773.7	9/11/12				13.5'	Gray, very stiff, SANDY SILT , trace gravel, and clay, wet, till	6									NO REC	
771.2	7/9/11					Gray, very stiff, SANDY SILT , trace gravel, and clay, wet, till	7	2	2	11	44	41	15	4	15	A-4a	
768.7	4/5/6					Gray, very stiff, SANDY SILT , trace gravel, and clay, wet, till	8								19	VIS.	
763.7	12/14/17				21.5'												
762.2					25.0'	Gray, dense, COARSE AND FINE SAND , little gravel, heaving sand	9									NO REC	

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/13/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/13/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754Warren County, Ohio

Boring No. NW-12 Station & Offset 372+43.98, 148.16' Lt.
 Water Elev. Dry
 Surface Elev. 792.9ft

CTL Project No. 04120056G

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.	
792.9	0														
792.9					0.5'										
792.4		3/3/4			Topsoil (6")										
	2				Brown, medium stiff, SILT AND CLAY , trace sand, damp	1								19	VIS.
789.9															
	4	5/6/6			3.0'										
					Brown, stiff, SILT AND CLAY , trace gravel, trace sand, damp	2	0	0	3	19	78	35	13	19	A-6a
787.4															
	6	6/7/8			5.5'										
					Mottled brown and gray, stiff, SANDY SILT , little clay, moist	3								18	VIS.
784.4															
	8	7/8/9			8.5'										
					Brown, very stiff, SANDY SILT , and clay, moist	4								17	VIS.
781.9															
	12	5/10/12													
					Brown, very stiff, SANDY SILT , and clay, moist	5	0	0	31	32	37	17	4	17	A-4a
779.4															
	14	7/9/10			13.5'										
					Gray, very stiff, SANDY SILT , little gravel, little clay, damp, till	6								8	VIS.
776.9															
	16	8/9/11													
					Gray, very stiff, SANDY SILT , little gravel, little clay, damp, till	7								13	VIS.
774.4															
	18	13/14/16			18.5'										
					Gray, medium dense, GRAVEL AND/OR STONE FRAGMENTS W/ SAND AND SILT , trace clay, moist	8								11	VIS.
769.4															
	22														
	24	7/9/12			23.5'										
767.9															
					Gray, very stiff, SILT AND CLAY , little sand, damp, till	9								18	VIS.
	25.0'														

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/14/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/14/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-13 Station & Offset 375+53.26, 142.53' Lt.

Water Elev. Dry
 Surface Elev. 788.1ft

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen./ ROD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics								ODOT Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
788.1	0				Topsoil (9")										
788.1		3/4/4			Brown, medium stiff, SILT AND CLAY , trace gravel, little sand, damp	1								18	VIS.
787.6															
787.3															
	2														
785.1		4/5/6			Brown, stiff, SANDY SILT , little gravel, some clay, damp, possible till	2	13	8	23	25	31	18	6	11	A-4a
	4														
782.6		4/5/5			Brown, stiff, SANDY SILT , little gravel, some clay, damp, possible till	3								12	VIS.
	6														
779.6															
	8														
777.1		6/9/11			Brown, very stiff, SANDY SILT , little gravel, little clay, damp, possible till	4								10	VIS.
	10														
777.1		11/16/17			Brown, hard, SANDY SILT , little gravel, little clay, damp, possible till	5								10	VIS.
	12														
774.6		9/11/14													
	14														
772.1		9/10/12													
	16														
769.6		7/9/12													
	18														
764.6		20/50-6"													
	20														
763.1															
	22														
	24														
	25.0'													8	VIS.

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/14/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/14/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-14 Station & Offset 378+54.50, 149.25' Lt. Water Elev. Dry
 Surface Elev. 788.6ft

CTL Project No. 04120056G

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.		
788.6 788.1 787.7	0	2/3/3				Topsoil (10")											
	2					Brown, medium stiff, SILT AND CLAY , trace gravel, little sand, with roots and root hairs, moist	1								19		VIS.
785.6	4	3/4/5				Brown, stiff, SANDY SILT , little gravel, some clay, damp, till	2									11	VIS.
783.1	6	3/4/6				Brown, stiff, SANDY SILT , little gravel, some clay, moist, till	3	14	6	21	29	30	19	6	15		A-4a
780.1	8	6/6/9				Brown, stiff, SANDY SILT , little gravel, some clay, damp, till	4								11		VIS.
777.6	10	14/15/17															
	12					Brown, dense, COARSE AND FINE SAND , little gravel, trace silt, trace clay, damp	5	20	25	38	9	8	NP	NP	10		A-3a
775.1	14	20/16/19														7	VIS.
772.6	16	14/15/17				Gray, hard, SANDY SILT , trace gravel, little clay, damp, till	6									9	VIS.
770.1	18																
	20	14/28/20														11	VIS.
	22																
765.1	24	50-4"														4	VIS.
763.6																	

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/14/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/14/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754Warren County, OhioWater Elev. DrySurface Elev. 788.3ftBoring No. NW-15 Station & Offset 381+63.38, 148.52' Lt.CTL Project No. 04120056G

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.	
788.3	0														
785.3	3	2/2/2			0.6'	1								17	VIS.
787.7	2														
785.3	4	3/4/4			3.0'	2								17	VIS.
782.8	6	3/4/5			5.5'	3	0	1	35	28	36	22	7	17	A-4a
779.8	8														
777.3	10	8/12/14			8.5'	4								14	VIS.
774.8	12	6/9/13			11.0'	5								10	VIS.
772.3	14	6/5/5			13.5'	6								17	VIS.
769.8	16	4/4/6			16.0'	7								18	VIS.
767.3	18														
764.8	20	50-8"			18.5'	8								11	VIS.
762.3	22														
	24	50-4"				9								6	VIS.
	25.0'														

BOTTOM OF BORING

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.

LOG OF BORING

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Date Started 4/13/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/13/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-16 Station & Offset 24+30.78, 164.98' Lt.

Water Elev. 683.1ft
 Surface Elev. 690.6ft

CTL Project No. 04120056G

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.		
690.6	0					Topsoil (10")											
690.6 690.1 689.7	2/3/3				0.9'	Brown, medium stiff, SANDY SILT , little sand, damp	1								19	VIS.	
687.6	5/4/4				3.0'	Brown, loose, COARSE AND FINE SAND , trace silt, little clay, trace gravel, damp	2								7	VIS.	
685.1	3/4/4					Brown, loose, COARSE AND FINE SAND , trace silt, little clay, trace gravel, damp	3	3	38	38	6	15	NP	NP	14	A-3a	
682.1	12/13/10				8.5'	Brown, medium dense, GRAVEL AND/OR STONE FRAGMENTS , some sand, trace silt, trace clay, with cobbles, damp	4	65	12	10	7	6	NP	NP	9	A-1-a	
679.6	6/8/6					Brown, medium dense, GRAVEL AND/OR STONE FRAGMENTS , some sand, trace silt, trace clay, with cobbles, damp	5								7	VIS.	
677.1	7/9/11					Brown, medium dense, GRAVEL AND/OR STONE FRAGMENTS , some sand, trace silt, trace clay, with cobbles, damp	6								4	VIS.	
674.6	13/16/10					Brown, medium dense, GRAVEL AND/OR STONE FRAGMENTS , some sand, trace silt, trace clay, with cobbles, damp	7								8	VIS.	
672.1	5/7/8				18.5'	Gray, stiff, SILT AND CLAY , trace sand, damp	8								18	VIS.	
667.1	7/9/10				25.0'	Gray, very stiff, SILT AND CLAY , trace sand, damp	9								19	VIS.	

BOTTOM OF BORING

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.

LOG OF BORING

Page 1 of 1

Date Started 4/13/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/13/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754Warren County, OhioWater Elev. 682.8ftSurface Elev. 690.8ftBoring No. NW-17 Station & Offset 27+45.56, 158.61' Lt.CTL Project No. 04120056G

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.	
690.8	0														
690.8	2/3/3				0.7' Topsoil (8")										
690.3					Brown, medium stiff, SANDY SILT , little clay, damp	1								17	VIS.
690.1	2														
687.8	2/3/3				3.0' Brown, loose, COARSE AND FINE SAND , trace silt, some clay, trace gravel, damp	2	0	10	63	4	23	NP	NP	10	A-3a
	4														
685.3	2/3/3				Brown, loose, COARSE AND FINE SAND , little gravel, little silt, trace clay, damp	3								9	VIS.
	6														
682.3	7/5/2				8.5' Gray, medium stiff, SANDY SILT , and clay, wet	4	0	1	1	43	55	22	7	23	A-4a
	10														
679.8	2/3/3				Gray, medium stiff, SANDY SILT , and clay, wet	5								22	VIS.
	12														
677.3	14/15/17				13.5' Gray, dense, GRAVEL AND/OR STONE FRAGMENTS W/ SAND AND SILT , trace clay, moist	6								11	VIS.
	14														
674.8	12/16/19				15.0' Gray, dense, GRAVEL AND/OR STONE FRAGMENTS WITH SAND , little silt, trace clay, moist	7								9	VIS.
	16														
672.3	7/12/13				18.5' Gray, very stiff, SILT AND CLAY , little sand, damp	8								16	VIS.
	18														
667.3	5/7/7														
667.3					Gray, stiff, SILT AND CLAY , little sand, damp	9								18	VIS.
	24														
665.8					25.0'										

BOTTOM OF BORING

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.

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.

LOG OF BORING

Page 1 of 1

Date Started 4/12/06 Sampler: Type SS Dia. 1.375"Project Identification: WAR-75-3.40 PID 10754Date Completed 4/12/06 Casing: Length 25ft Dia. 3.25"Warren County, OhioWater Elev. 684.0ftBoring No. NW-19 Station & Offset 34+01.48, 150.11' Lt.Surface Elev. 695.0ftCTL Project No. 04120056G

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.
695.0	0					Topsoil (10")										
695.0 694.5 694.0	2/3/4				0.9'	Brown, medium stiff, SANDY SILT , some clay, trace gravel, moist	1								18	VIS.
692.0	2/3/3					Brown, medium stiff, SANDY SILT , some clay, trace gravel, moist	2								18	VIS.
689.5	2/3/3					Brown, medium stiff, SANDY SILT , some clay, trace gravel, moist	3	1	0	21	43	35	22	7	20	A-4a
686.5	11/13/15				8.5'	Brown, medium dense, GRAVEL AND/OR STONE FRAGMENTS , and sand, trace silt, trace clay, moist	4								8	VIS.
684.0	17/18/21					Brown, dense, GRAVEL AND/OR STONE FRAGMENTS , and sand, trace silt, trace clay, with cobbles, moist	5	56	22	14	5	3	NP	NP	8	A-1-a
681.5	12/14/16				13.5'	Brown, medium dense, COARSE AND FINE SAND , trace gravel, trace silt, trace clay, moist	6								15	VIS.
679.0	14/14/12					Brown, medium dense, COARSE AND FINE SAND , trace gravel, trace silt, trace clay, moist	7								12	VIS.
676.5	5/6/6				18.5'	Gray, stiff, SILT AND CLAY , trace sand, damp	8								18	VIS.
671.5	5/7/9				23.5'	Gray, very stiff, SANDY SILT , some clay, trace gravel, moist, till	9								12	VIS.
670.0					25.0'											

BOTTOM OF BORING

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.

LOG OF BORING

Page 1 of 1

Date Started 4/12/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/12/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-20 Station & Offset 37+46.49, 156.05' Lt.

Water Elev. 680.8ft
 Surface Elev. 699.3ft

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen./ RQD	Rec. (ft)	Loss (ft)	Description	Sample	Physical Characteristics									ODOT
						No.	% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	Class	
699.3	0				Topsoil (10")											
699.3 698.8 698.3	2/3/4				Dark brown, medium stiff, SILT AND CLAY , trace sand, damp	1									17	VIS.
	2															
696.3	5/4/5				Brown, stiff, SANDY SILT , some clay, little gravel, moist	2									21	VIS.
	4															
693.8	3/3/4				Brown, medium stiff, SANDY SILT , some clay, little gravel, moist	3	13	4	29	18	36	24	10	22		A-4a
	6															
690.8	3/3/4				Brown with dark brown (rust) stains, medium stiff, SANDY SILT , little gravel, little clay, damp	4									12	VIS.
	8															
	10															
688.3	2/3/4				Brown, loose, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT , trace clay, moist	5									14	VIS.
	12															
685.8	10/11/12				Gray, very stiff, SANDY SILT , and clay, moist	6	0	0	0	37	63	18	3	17		A-4a
	14															
683.3	7/9/9				Gray, very stiff, SANDY SILT , and clay, wet	7									21	VIS.
	16															
680.8	9/14/12				Gray, medium dense, COARSE AND FINE SAND , trace gravel, trace silt, trace clay, wet	8									17	VIS.
	18															
	20															
	22															
675.8	7/9/10				Gray, very stiff, SILT AND CLAY , trace sand, damp	9									21	VIS.
	24															
674.3																

BOTTOM OF BORING

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.

LOG OF BORING

Page 1 of 1

Date Started 4/11/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/11/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-21 Station & Offset 40+69.64, 162.93' Lt.

Water Elev. 703.8ft
 Surface Elev. 719.8ft

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen./ RCD	Rec. (ft)	Loss (ft)		Description	Sample No.	Physical Characteristics									ODOT Class
								% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.		
719.8	0					0.5' Topsoil (6")											
719.8	2/3/3					Brown, medium stiff, SANDY SILT , some clay, damp	1									20	VIS.
716.8	4	4/5/6				Brown, stiff, SANDY SILT , some clay, damp	2	0	0	40	31	29	NP	NP	13	A-4a	
714.3	6	5/6/7				Brown, stiff, SANDY SILT , some clay, damp	3								17	VIS.	
711.3	8	4/5/5				8.5' Gray, stiff, SANDY SILT , and clay, damp	4								14	VIS.	
708.8	10	3/4/4				Gray, medium stiff, SANDY SILT , and clay, wet	5	0	0	0	41	59	20	5	21	A-4a	
706.3	12	4/4/5				Gray, stiff, SANDY SILT , and clay, wet	6								21	VIS.	
703.8	14	2/3/4				16.0' Gray, medium stiff, SILT , some sand, trace clay, wet	7								25	VIS.	
701.3	16	2/3/3					8										NO REC
696.3	20																
694.8	22																
694.8	24	7/7/9				23.5' Gray, medium dense, COARSE AND FINE SAND , trace gravel, trace silt, trace clay, moist	9								15	VIS.	
	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.

LOG OF BORING

Page 1 of 1

Date Started 4/12/06 Sampler: Type SS Dia. 1.375"
 Date Completed 4/12/06 Casing: Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-22 Station & Offset 44+04.88, 171.18' Lt.
 Water Elev. Dry
 Surface Elev. 735.6ft

CTL Project No. 04120056G

Elev. (ft)	Depth (ft)	Std. Pen. / R.O.D.	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	0															
735.6																
735.1		3/4/5				0.7'										
734.8						Topsoil (8")										
	2					Brown, stiff, SILT AND CLAY, some sand, damp	1								29	VIS.
732.6		5/7/9				3.0'										
	4					Brown, very stiff, SILT AND CLAY, some sand, trace gravel, damp, possible till	2								11	VIS.
730.1																
	6	10/12/14					3									NO REC
727.1																
	8	14/15/16				Brown, hard, SILT AND CLAY, some sand, trace gravel, damp, possible till	4	8	6	26	28	32	27	14	7	A-6a
724.6																
	12	9/12/15				Brown, very stiff, SILT AND CLAY, some sand, trace gravel, damp, possible till	5								8	VIS.
722.1																
	14	15/16/16				13.5'										
719.6						Gray, hard, SANDY SILT, little gravel, little clay, damp, till	6								8	VIS.
	16	12/14/16														
	18					Gray, very stiff, SANDY SILT, little gravel, little clay, damp, till	7								7	VIS.
717.1																
	20	15/18/21				18.5'										
	22					Brown, dense, COARSE AND FINE SAND, little gravel, trace silt, trace clay, damp	8								3	VIS.
712.1																
	24	9/6/10				22.0'										
710.6						25.0'										
						Gray, very stiff, SILT AND CLAY, trace sand, damp	9								17	VIS.

BOTTOM OF BORING

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.

LOG OF BORING

Page 1 of 1

Date Started 4/12/06 Sampler Type SS Dia. 1.375"
 Date Completed 4/12/06 Casing Length 25ft Dia. 3.25"

Project Identification: WAR-75-3.40 PID 10754
Warren County, Ohio

Boring No. NW-23 Station & Offset 47+45.34, 176.64' Lt.

Water Elev. Dry

Surface Elev. 738.1ft

CTL Project No. 04120056G

Boring No.	Elev. (ft)	Depth (ft)	Std Pen./ RGD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics							ODOT Class	
								% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.		W.C.
NW 25 Station & Offset 47+49.34, 170.04 LL 04/20/2005 NW 25 Borehole GP-1 20' depth	738.1	0				Topsoil (9")										
	738.1 737.6 737.2	3/4/5				Brown, stiff, SANDY SILT , little gravel, trace clay, damp, possible till	1								14	VIS.
	735.1	7/8/9				Brown, very stiff, SANDY SILT , some clay, trace gravel, damp, till	2								10	VIS.
	732.6	7/7/10				Brown, very stiff, SANDY SILT , some clay, trace gravel, damp, till	3	8	12	23	25	32	16	5	10	A-4a
	729.6	18/19/24				Brown, hard, SANDY SILT , some clay, trace gravel, with cobbles, damp, till	4								7	VIS.
	727.1	25/50-6"				Brown, hard, SANDY SILT , some clay, trace gravel, with cobbles, damp, till	5								7	VIS.
	724.6	20/22/30				Gray, hard, SANDY SILT , little gravel, little clay, damp, till	6								7	VIS.
	722.1	15/16/19				Gray, hard, SANDY SILT , little gravel, little clay, damp, till	7								8	VIS.
	719.6	7/8/8				Gray, very stiff, SANDY SILT , little gravel, little clay, damp, till	8								9	VIS.
	714.6	8/6/8				Gray, medium dense, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT , trace clay, damp	9								10	VIS.
	713.1					BOTTOM OF BORING										

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.

APPENDIX C

GB1 SPREADSHEET



Soil Investigation Summary

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

Design CBR is 7

Number of Borings = 47

Classification Counts by Sample																
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	
3	1	4	0	0	2	0	1	0	26	2	0	33	8	0	8	
3%	1%	5%			2%		1%		30%	2%		38%	7%		9%	
3.5%					9.3%							87.2%				

Class @ Surface	
2-5	0
4b	1 2%
5	0
7-5	0
7-6	2 4%
R	1 2%

% Borings	
N ₁ ≤ 5	2%
N ₁ ≤ 10	43%
N ₁ ≥ 20	23%
M+	13%

% @ Surface	
	13%
	4%
	6%
	% Borings
	45%
	6%
	40%

N		N ₁		PI		M		M _{opt}		GI	
Average	21.7	14.3		12.0		32.0		13.5		13.0	6.00
Maximum	78	30	53	27	31	75	67	97	45	24	18
Minimum	4	4	14	11	2	7	5	12	1	6	0

6% 40%

0% 17% 6% 40%

Standard Penetration																
Physical Characteristics																
Moisture																
Classification																
Comments																
#	B #	Boring Location	Depth	To	Cut Fill	n ₂	n ₃	N	N ₁	LL	PL	PI	SH	Clay	P	200
1	P-1	26+45.9, 54.6' LL SR 122	0.0	1.5	0.0	8	8	16		30	16	14	26	31	57	15
			1.5	3.0		9	12	21		34	18	16	46	38	84	19
			3.0	5.0		9	8	17	16							17
2	P-2	30+30.4, 11.9' RL SR 122	0.1	1.6	0.0	5	7	12		24	15	9	26	22	46	11
			1.5	3.0		16	16	32		28	15	13	24	35	59	10
			3.0	5.0		16	18	34	12							15
3	P-3	34+47.4, 59.8' LL SR 122	0.0	1.5	0.0	7	9	16		29	16	13	29	37	66	10
			1.5	3.0		6	9	15		36	20	16	27	52	79	13
			3.0	5.0		13	20	33	15							11
4	C-3	217+56.46, 88.5' LL IR-75	0.6	2.1	-1.0	7	7	14		37	25	12	25	28	53	17
			3.0	4.5		3	3	6		46	27	19	21	28	49	24
			5.5	7.0		3	3	6	6							25
5	P-4	38+73.2, 41.5' RL SR 122	1.0	2.5	-1.0	9	12	21		24	14	10	18	24	42	10
			2.5	4.0		6	7	13		50	23	27	44	47	91	22
			4.0	5.5		4	5	9	9							17
6	C-4	217+55.82, 3.6' RL IR-75	0.5	2.0	-1.0	4	6	10								14
			3.0	4.5		5	6	11		41	27	14	32	45	77	24
			5.5	7.0		3	4	7	7							24
7	C-5	217+55.00, 131.2' RL IR-75	0.5	2.0	-1.0	5	7	12								8
			3.0	4.5		9	12	21		NP	NP	NP				12
			5.5	7.0		12	14	26	12							5
8	P-5	42+35.4, 48.7' LL SR 122	0.0	1.5	0.0	12	15	27								8
			1.5	3.0		15	16	31								
			3.0	5.0		16	16	32	27				20	25	45	8
9	P-6	46+48.0, 19.9' RL SR 122	0.9	2.4	0.0	8	8	16		26	15	11	49	31	80	16
			2.0	3.5		7	9	16		24	15	9	29	27	56	11
			4.0	5.5		4	5	9	9							14
10	P-7	50+52.8, 17.9' LL SR 122	0.8	2.3	2.0	24	23	47		NP	NP	NP	10	9	19	11
			2.5	4.0		6	9	15		23	15	8	26	26	52	8
									15							10
11	P-8	54+49.3, 31.9' RL SR 122	0.8	2.3	1.0	12	13	25		31	15	16	40	19	59	9
			2.5	4.0		15	16	31		25	15	10	32	20	52	10
			4.0	5.5		4	4	8	8							16
12	P-9	57+97.8, 17.2' LL SR 122	0.8	2.3	0.0	14	7	21		32	19	13	28	32	60	17
			2.5	4.0		3	3	6		25	17	8	23	18	41	12
			4.0	5.5		5	7	12	6							11

Problem	
w/	Class
w/	MN

Treatments			
LS	CS	UC	UC
		Class	MN

Analysis

3

#	B #	Boring Location	Depth	To	Cut Fill	Standard Penetration				Physical Characteristics						Moisture		Classification		Comments	Problem		Treatments				Analysis
						f ₂	f ₃	N	N ₆	LL	PL	PI	% Silt	% Clay	P 200	M	M _{opt}	Class	GI		w/ Class	w/ MN	LS	CS	UC Class	UC MN	
13	P-14	59+05.22, 67.64' RL SR 122	8.5	10.0	-11.0	2	2	4		23	15	8	38	33	71	13	10	4a			N		--		3+		
14	P-15	61+49.81, 70.32' LL SR 122	5.5 8.5	7.0 10.0	-8.0	5 9	7 11	12 20	4	43	23	20	26	67	93	21 20	20	7-6									
15	P-10	61+99.2, 23.5' RL SR 122	0.0 1.5 3.0	1.5 3.0 5.0	0.0		3 11 6	12 12 11	23 23 17	12	25	20	5 NP	53 75	14 22	67 97	19 21	15 11	4b 4b	6		4b 4b	M		3 5	1	
16	P-11	65+68.7, 26.8' LL SR 122	0.0 1.5 3.0	1.5 3.0 5.0	0.0	7 7 4	11 12 8	18 19 12	17	45	22	23	43	51	94	23 20	19 18	7-6 7-6	14 16								
17	P-12	69+98.9, 9.0' RL SR 122	0.8 2.5 4.0	2.3 4.0 6.0	0.0	5 4 11	5 5 12	10 9 23	12	22	14	8	35	28	63	17 10	10 11	4a 4a	6 5		MN N		12 14		1 1		
18	P-13	71+97.2, 7.9' LL SR 122	0.8 2.5 4.0	2.3 4.0 5.5	0.0	5 13 14	6 14 16	11 27 30	11	28	15	13	26	30	56	16 11	14 10	6a 4a	5 3								
19	B-7	209+11.82, 87.7' LL Ramp A	0.6 3.0 5.5	2.1 4.5 7.0	0.0	6 10 3	8 8 4	14 18 7	7	30	19	11	21	27	48	15 12	14 14	6a 6a	3		N		16		2		
20	B-10	210+86.24, 139.9' LL Ramp A	1.5 3.0 5.5	3.0 4.5 7.0	0.0	5 3 11	7 3 7	12 6 18	6	30	17	13	26	29	55	11 12	14 10	6a 2-6	5		N				3		
21	V-2	213+09.3, 1.3' LL Ramp A	1.5 3.0 4.5	3.0 4.5 6.0	0.0	20 10 20	15 14 24	35 24 44	24	29	15	14	30	28	58	32 7	14 14	6a 6a	6 4								
22	V-1	217+01.8, 30.3' LL Ramp A	0.1 1.5 3.0	1.6 3.0 4.5	-2.0	10 5 10	10 6 10	20 11 20	11	31	16	15	22	33	55	15 15	14 16	6a 6b	6 7								
23	T-1	217+92.5, 25.7' RL Ramp B	1.0 2.5 4.0	2.5 4.0 5.5	-1.0	8 8 8	7 10 13	13 21	13	28	15	13	29	31	60	13 26	14 19	6a 7-6	6 17		M				1		
24	T-2	220+08.7, 16.2' LL Ramp B	1.5 3.0	3.0 4.5	0.0	9 12	12 32	21 44	21	26	15	13	24	33	57	12 11	14 14	6a 6a	6 3								
25	T-3	223+98.8, 30.0' LL Ramp B	0.1 1.5 3.0	1.6 3.0 4.5	1.0	7 10 16	9 15 19	16 25 35	16	24	14	10	22	25	47	10 10	10 14	4a 6a	2 5								
26	S-1	44+96, 62' LL Ramp C	0.2 1.5 3.0	1.7 3.0 4.5	0.0	10 13 14	13 21 12	23 34 26	23	30	16	14	24	32	56	17 10	14 10	6a 2-4	6 0								
27	S-2	219+27, 4' LL Ramp C	0.1 1.5 3.0	1.6 3.0 4.5	1.0	8 40 39	13 38 36	21 78 75	21	29	15	14	27	34	61	10 12	14 14	6a	7								

#	B #	Boring Location	Depth	To	Cut Fill	Standard Penetration				Physical Characteristics					Moisture		Classification		Comments	Problem w/ Class	Treatments				Analysis
						n ₂	n ₃	N	N _L	LL	PL	PI	% Silt	% Clay	P 200	M	M _{opt}	Class	GI		LS	CS	UC Class	UC MN	
28	S-5	229+54.39' Lt. Ramp C	0.2 1.5 3.0 8.5	1.7 3.0 4.5 10.0		6 14 14 9	12 18 14 9	18 32 28 18		30	15	15	20	44	64	15 10	14	6a	8						
29	S-6	233+50.0, 0.0' Rt. Ramp C	0.0 1.5 3.0 4.5	1.5 3.0 4.5 6.0	0.0	5 8 5 5	5 8 7 8	10 16 12 11		33	16	17	31	38	69	19 10	16 10	6b 4a	10 3						
30	S-7	237+50.0, 0.0' Rt. Ramp C	0.0 1.5 3.0 4.5	1.5 3.0 4.5 6.0	0.0	5 6 7 17	5 8 7 13	10 14 14 30		18	11	7	9	24	33	5 12	6 10	1b 4a	0 5						
31	L-1	202+87.69, 9.72' Rt. Ramp D	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-2.0	8 16 50 50	10 25 50 50	18 41 50 18		NP	NP	NP	7	5	12	7 17	6 10	1a 4a	0 1						
32	L-2	207+07.70, 0.33' Lt. Ramp D	0.3 1.5 3.0 4.5	1.5 3.0 4.5 6.0	0.0	4 8 7 7	5 9 6 7	9 17 13 14		27	16	11	15	37	52	12 9	11 10	6a 4a	4 3		N			1	
33	L-3	211+05.85, 5.12' Rt. Ramp D	0.3 1.5 3.0 4.5	1.5 3.0 4.5 6.0	1.0	4 7 8 10	4 9 7 12	9 18 15 22		20	14	6	17	32	49	8 10	10 14	4a 3	3		N	14		2	
34	R-1	196+60.8, 8.3' Rt. Ramp E	0.3 1.5 3.0	1.6 2.4 3.8	0.0	28 50 50	50 50 50	78 30		31	17	14	19	35	54	10 10	14 7	6a R R	5	BR BR			2 2		
35	R-2	200+57.8, 3.9' Lt. Ramp E	0.1 1.5	0.8 1.8	1.0	50	50	30		33	18	15	16	49	65	15 19	14	6a	8						
36	R-3	204+54.0, 0.3' Rt. Ramp E	8.5	9.4	-10.0	50	50	30								7		R		BR			2		
37	R-5A	212+54.5, 4.0' Lt. Ramp E	8.5 10.0 11.5 13.0	10.0 11.5 13.0 14.5	-8.5	12 18 12 50	17 19 50 50	29 37 29		16	13	3	18	27	45	4 8 1	10 10	4a 4a							
38	R-5	212+54.5, 4.0' Lt. Ramp E	8.5 13.5	10.0 13.5	-9.0	15	32	47								14									
39	W-4	10+40.0, 0.0' Rt. Commerce Drive	0.8 1.5 3.0	1.5 3.0 4.5	2.0	3 3 3	4 3 3	7 6 6		37	22	15	36	38	74	21 24	17 16	6a 6a	10 10		MN MN N	16 16		3 3 3	
40	W-3	12+85.0, 20.0' Lt. Commerce Drive	6.0 7.5 9.0 10.5 12.0	7.5 9.0 10.5 12.0	-5.0	16 11 8 20	20 50 13 22	36 61 21 22		14	12	2	14	17	31	8 9 16 15	10 10	2-4 4a							
41	W-2	15+00.0, 0.0' Rt. Commerce Drive	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	0.0	15 4 10 7	22 4 10 9	27 27 16 8		32	18	14	27	34	61	12 25 13 25	14 6	6a 1b	7 0		MN M	14		2 1	
42	W-1	18+27.5, 6.4' Rt. Commerce Drive	1.0 2.5 4.0	2.5 4.0 5.5	0.0	5 9 5	5 7 6	10 16 11		27	15	12	31	34	65	12 12	14 14	6a 6a	7 6						

APPENDIX D

SETTLEMENT ANALYSIS



CTL PROJECT NO. 0412 0056 G

PAGE NO. 1

OF: 1

BY: JG

DATE: 3/9/06

SCALE:

Settlement

Sta 226+00 Ramp C Boring S-4

20' Fill

707.9 - 706.9 CLAY $N = 15 \text{ bpf}$
 A-7-6 $LL = 43$
 $W = 23\%$
 $\gamma \approx 120 \text{ pcf}$
 $G_s \approx 2.72$

$$e_o = \frac{W G_s}{100} = \frac{23(2.72)}{100} = 0.63$$

$$C_c \approx \frac{W}{100} = \frac{23}{100} = 0.23$$

$$C_r \approx C_s \approx \frac{W}{1000} = \frac{23}{1000} = 0.023$$

706.9 - 697.9 SANDY SILT $N = 19 \text{ bpf}$
 A-7-6 $LL = 22$
 $W = \frac{12+9+12+14+16}{5} = 12.6\%$
 $\gamma \approx 120 \text{ pcf}$
 $G_s \approx 2.70$

$$e_o \approx \frac{W G_s}{100} = \frac{(12.6)(2.70)}{100} = 0.34$$

$$C_c \approx \frac{W}{100} = \frac{12.6}{100} = 0.126$$

$$C_r \approx C_s \approx \frac{W}{1000} = 0.0126$$

Also Assume 500 psf pre load (glacial) for lower bound.

CTL PROJECT NO. 04120056C₉

PAGE NO. 1

OF: 1

BY: JG

DATE: 5/5/06

SCALE

Time Rate of Settlement

STA 226+00 RAMP C Boring S-4

707.9 - 706.9

LL = 43%

$$C_v \approx 0.23 \frac{ft^2}{day}$$

DAS pg 46

$$t_{90} = \frac{T_v H^2}{C_v} = \frac{0.848 (1)^2}{0.23} \approx 4 \text{ days}$$

706.9 - 697.9

LL = 22%

$$C_v = 0.84 \frac{ft^2}{day}$$

$$t_{90} = \frac{0.848 (4.5)^2}{0.84} = 21 \text{ days}$$

UAAAAA ONE DIMENSIONAL SETTLEMENT ANALYSIS/Federal Highway Administration AAAAAA
 STRIP SYMMETRICAL VERTICAL EMBANKMENT LOADING

Project Name : WAR-75 Client : WEC
 File Name : 1256C226 Project Manager : JG
 Date : 3/ 9/06 Computed by : JG

Settlement for x = 40.00 (ft)

Embankment slope a = 40.00 (ft) Height of fill H = 18.00 (ft)
 Embankment top width = 30.00 (ft) Unit weight of fill = 120.00 (pcf)
 Embankment bottom width = 110.00 (ft) p load/unit area = 2160.00 (psf)
 Ground Surface Elev. = 707.90 (ft) Foundation Elev. = 707.90 (ft)
 Water table Elev. = 697.90 (ft) Unit weight of wat. = 62.40 (pcf)

N§.	LAYER TYPE	THICK. (ft)	COEFFICIENT			UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	VOID RATIO	Settlement (in.)
			COMP.	RECOMP.	SWELL.				
1	COMP.	1.0	0.230	0.023	0.023	120.00	2.65	0.63	1.13
2	COMP.	9.0	0.126	0.013	0.013	120.00	2.65	0.34	4.02

Total Settlement = 5.15

N§.	SUBLAYER		INITIAL (psf)	SOIL STRESSES		SETTLEMENT (in.)
	THICK. (ft)	ELEV. (ft)		INCREMENT (psf)	MAX.PAST PRESS. (psf)	
1	1.00	707.40	200.00	2151.41	560.00	1.13
2	9.00	702.40	660.00	2065.21	1160.00	4.02

Total Settlement = 5.15 (in.)

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

UAAAAA ONE DIMENSIONAL SETTLEMENT ANALYSIS/Federal Highway Administration AAAAAA
 STRIP SYMMETRICAL VERTICAL EMBANKMENT LOADING

Project Name : WAR-75 Client : WEC
 File Name : 1256C226 Project Manager : JG
 Date : 3/ 9/06 Computed by : JG

Settlement for X = 40.00 (ft)

Embankment slope a = 40.00 (ft) Height of fill H = 18.00 (ft)
 Embankment top width = 30.00 (ft) Unit weight of fill = 120.00 (pcf)
 Embankment bottom width = 110.00 (ft) p load/unit area = 2160.00 (psf)
 Ground Surface Elev. = 707.90 (ft) Foundation Elev. = 707.90 (ft)
 Water table Elev. = 697.90 (ft) Unit weight of Wat. = 62.40 (pcf)

NS.	LAYER TYPE	THICK. (ft)	COEFFICIENT			UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	VOID RATIO	Settlement (in.)
			COMP.	RECOMP.	SWELL.				
1	COMP.	1.0	0.230	0.023	0.023	120.00	2.65	0.63	1.81
2	COMP.	9.0	0.126	0.013	0.013	120.00	2.65	0.34	6.25
Total Settlement =									8.07

NS.	SUBLAYER		INITIAL (psf)	SOIL STRESSES		SETTLEMENT (in.)
	THICK. (ft)	ELEV. (ft)		INCREMENT (psf)	MAX.PAST PRESS. (psf)	
1	1.00	707.40	200.00	2151.41	200.00	1.81
2	9.00	702.40	660.00	2065.21	660.00	6.25
Total Settlement =						8.07 (in.)

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

CTL PROJECT NO. 041200576 G PAGE NO. 1 OF: 1
 BY: JG DATE: 3/9/06 SCALE:

SETTLEMENT

STA 208+50 RAMP E Boring A-1

693.5 to 686.2

SANDY SILT
A-4a

$$\bar{N} = 18 \text{ bpf}$$

$$\bar{w} = 12\%$$

$$LL = 21$$

$$\gamma = 120 \text{ pcf}$$

$$\gamma_s \approx 2.70$$

$$e_0 \approx \frac{w \gamma_s}{100} = \frac{12 (2.70)}{100} = 0.324$$

$$C_c \approx \frac{w}{100} = 0.12$$

$$C_r = C_s = \frac{w}{1000} = 0.012$$

Also assume 500 psf preload (glacial) for lower bound.

UAAAAA ONE DIMENSIONAL SETTLEMENT ANALYSIS/Federal Highway Administration AAAAAA
 STRIP SYMMETRICAL VERTICAL EMBANKMENT LOADING

Project Name : WAR-75 Client : WEC
 File Name : 1256E208 Project Manager : JG
 Date : 3/ 9/06 Computed by : JG

Settlement for x = 40.00 (ft)

Embankment slope a = 26.00 (ft) Height of fill H = 13.00 (ft)
 Embankment top width = 44.00 (ft) Unit weight of fill = 120.00 (pcf)
 Embankment bottom width = 96.00 (ft) p load/unit area = 1560.00 (psf)
 Ground Surface Elev. = 693.50 (ft) Foundation Elev. = 693.50 (ft)
 Water table Elev. = 686.20 (ft) Unit weight of wat. = 62.40 (pcf)

N§.	LAYER		COEFFICIENT			UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	VOID RATIO	Settlement (in.)
	TYPE	THICK. (ft)	COMP.	RECOMP.	SWELL.				
1	COMP.	7.3	0.120	0.012	0.012	120.00	2.65	0.32	2.88
Total Settlement =									2.88

N§.	SUBLAYER		SOIL STRESSES				SETTLEMENT (in.)
	THICK. (ft)	ELEV. (ft)	INITIAL (psf)	INCREMENT (psf)	MAX.PAST PRESS. (psf)		
1	7.30	689.85	438.00	1558.43	938.00	2.88	
Total Settlement =						2.88 (in.)	

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

UAAAAA ONE DIMENSIONAL SETTLEMENT ANALYSIS/Federal Highway Administration AAAAAA;
 STRIP SYMMETRICAL VERTICAL EMBANKMENT LOADING

Project Name : WAR-75 Client : WEC
 File Name : 1256E208 Project Manager : JG
 Date : 3/ 9/06 Computed by : JG

Settlement for X = 40.00 (ft)

Embankment slope a = 26.00 (ft) Height of fill H = 13.00 (ft)
 Embankment top width = 44.00 (ft) Unit weight of fill = 120.00 (pcf)
 Embankment bottom width = 96.00 (ft) p load/unit area = 1560.00 (psf)
 Ground Surface Elev. = 693.50 (ft) Foundation Elev. = 693.50 (ft)
 Water table Elev. = 686.20 (ft) Unit weight of Wat. = 62.40 (pcf)

N§.	LAYER TYPE	THICK. (ft)	COEFFICIENT			UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	VOID RATIO	Settlement (in.)
			COMP.	RECOMP.	SWELL.				
1	COMP.	7.3	0.120	0.012	0.012	120.00	2.65	0.32	5.25
Total Settlement =									5.25

N§.	SUBLAYER		SOIL STRESSES			SETTLEMENT (in.)
	THICK. (ft)	ELEV. (ft)	INITIAL (psf)	INCREMENT (psf)	MAX.PAST PRESS. (psf)	
1	7.30	689.85	438.00	1558.43	438.00	5.25
Total Settlement =						5.25 (in.)

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

APPENDIX E

SLOPE STABILITY ANALYSIS

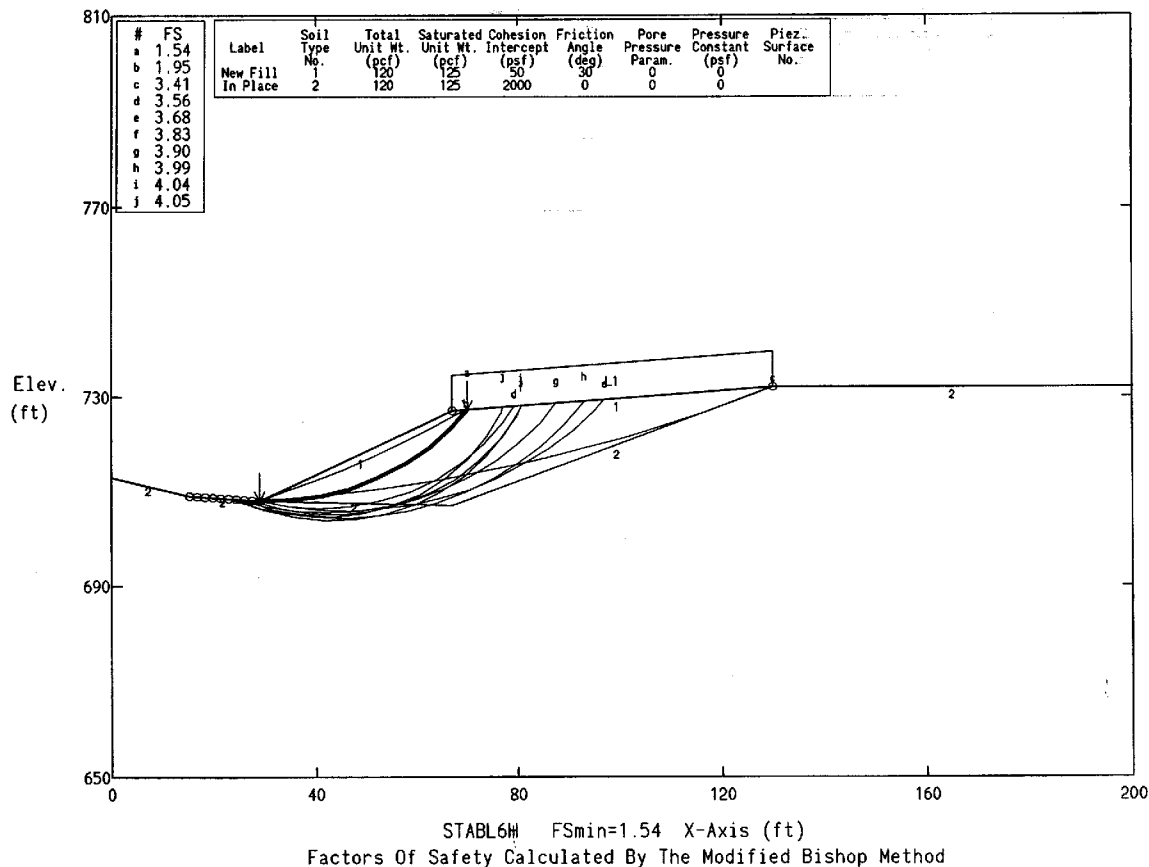


RAMP C

STA. 226+00

WAR-75 Ramp C Sta. 226+00

Ten Most Critical. C:1256C226.PLT By: Roger Evans 5/05/2006 11:47am



PROFIL C:\SLOPE\1256C226.DAT PCSTABL Version 6H /O(0. ,650.)
WAR-75 Ramp C Sta. 226+00

7 5

0. 63. 15. 59. 2

15. 59. 29. 58. 2

29. 58. 67. 77. 1

67. 77. 130. 82. 1

130. 82. 200. 82. 2

29. 58. 67. 57. 2

67. 57. 130. 82. 2

SOIL New FillIn Place

2

120. 125. 50. 30. 0. 0. 0

120. 125. 2000. 0. 0. 0. 0

LOADS

1

67. 130. 200. 0.

CIRCL2-Bishop circular, search

10 10

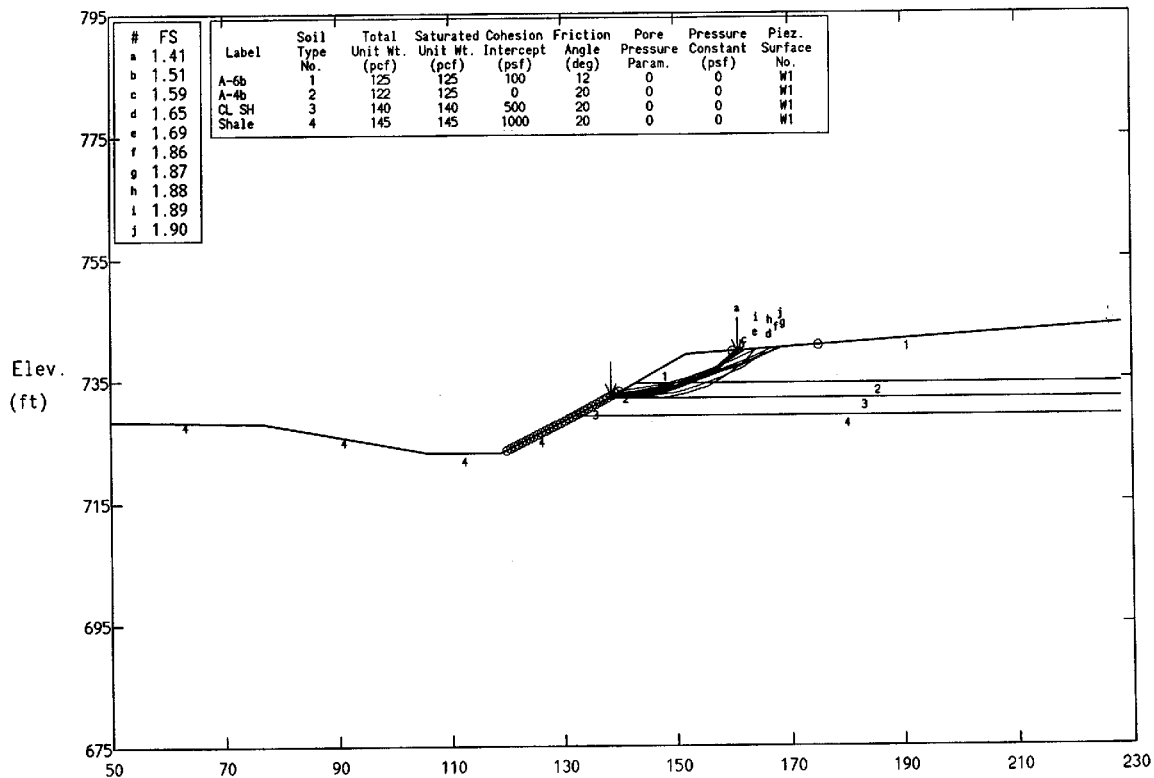
15. 29. 67. 130. 0. 6. 0. 0.

IR 75

STA. 180+00

WAR-75-3.40 Station 180 Warren County, Ohio

Ten Most Critical. C:WAR75180.PLT By: Roger Evans 5/04/2006 4:53pm



STABL6H FSmin=1.41 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

PROFIL C:\SLOPE\WAR75180 PCSTABL Version 6H /O(50. ,675.)
WAR-75-3.40 Station 180 Warren County, Ohio

11 8

0. 53.5 27. 53. 4

27. 53. 56. 48. 4

56. 48. 69. 48. 4

69. 48. 82. 54. 4

82. 54. 88. 57. 3

88. 57. 93. 59.5 2

93. 59.5 102. 64. 1

102. 64. 178. 69. 1

93. 59.5 178. 59.5 2

88. 57. 178. 57. 3

82. 54. 178. 54. 4

SOIL A-6b A-4b CL SH Shale

4

125. 125. 100. 12. 0. 0. 1

122. 125. 0. 20. 0. 0. 1

140. 140. 500. 20. 0. 0. 1

145. 145. 1000. 20. 0. 0. 1

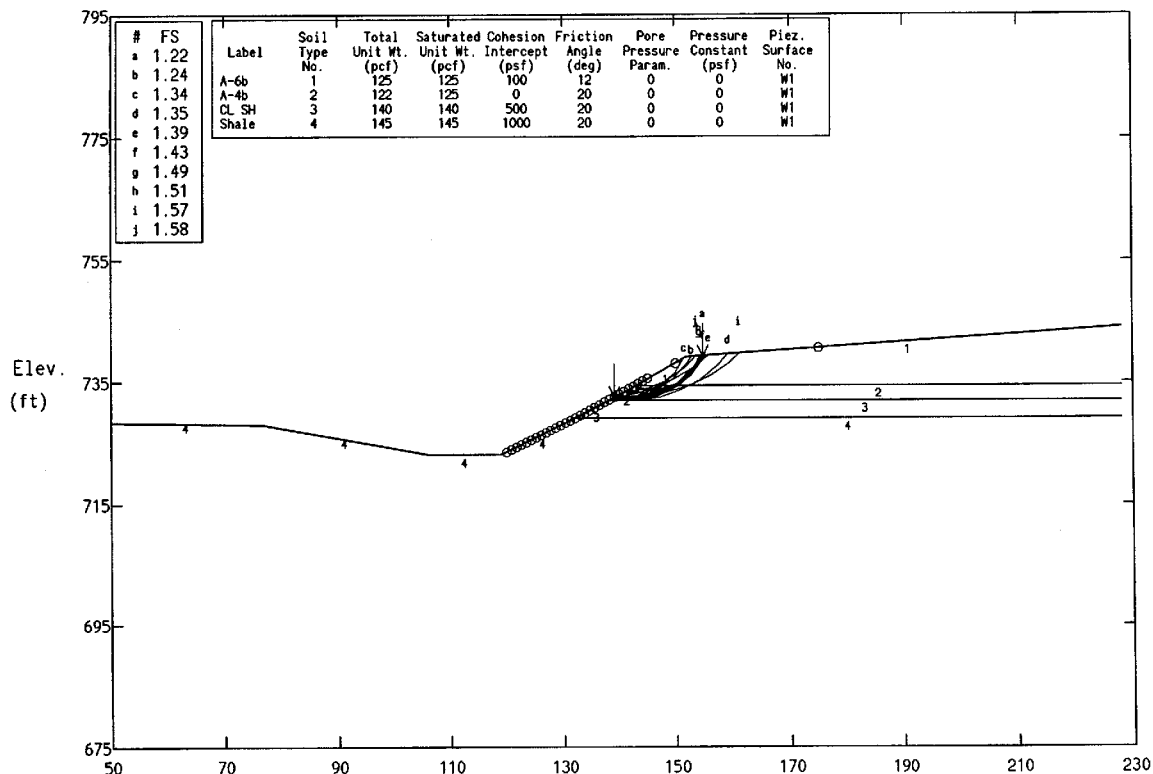
CIRCL2-Bishop circular, search

30 30

70. 90. 110. 125. 0. 4. 0. 0.

WAR-75-3.40 Station 180 Warren County, Ohio

Ten Most Critical. C:WAR75180.PLT By: Roger Evans 5/04/2006 4:52pm



STABL6H FSmin=1.22 X-Axis (ft)
Factors Of Safety Calculated By The Modified Bishop Method

PROFIL C:\SLOPE\WAR75180 PCSTABL Version 6H /O(50.,675.)
WAR-75-3.40 Station 180 Warren County, Ohio

11 8

0. 53.5 27. 53. 4

27. 53. 56. 48. 4

56. 48. 69. 48. 4

69. 48. 82. 54. 4

82. 54. 88. 57. 3

88. 57. 93. 59.5 2

93. 59.5 102. 64. 1

102. 64. 178. 69. 1

93. 59.5 178. 59.5 2

88. 57. 178. 57. 3

82. 54. 178. 54. 4

SOIL A-6b A-4b CL SH Shale

4

125. 125. 100. 12. 0. 0. 1

122. 125. 0. 20. 0. 0. 1

140. 140. 500. 20. 0. 0. 1

145. 145. 1000. 20. 0. 0. 1

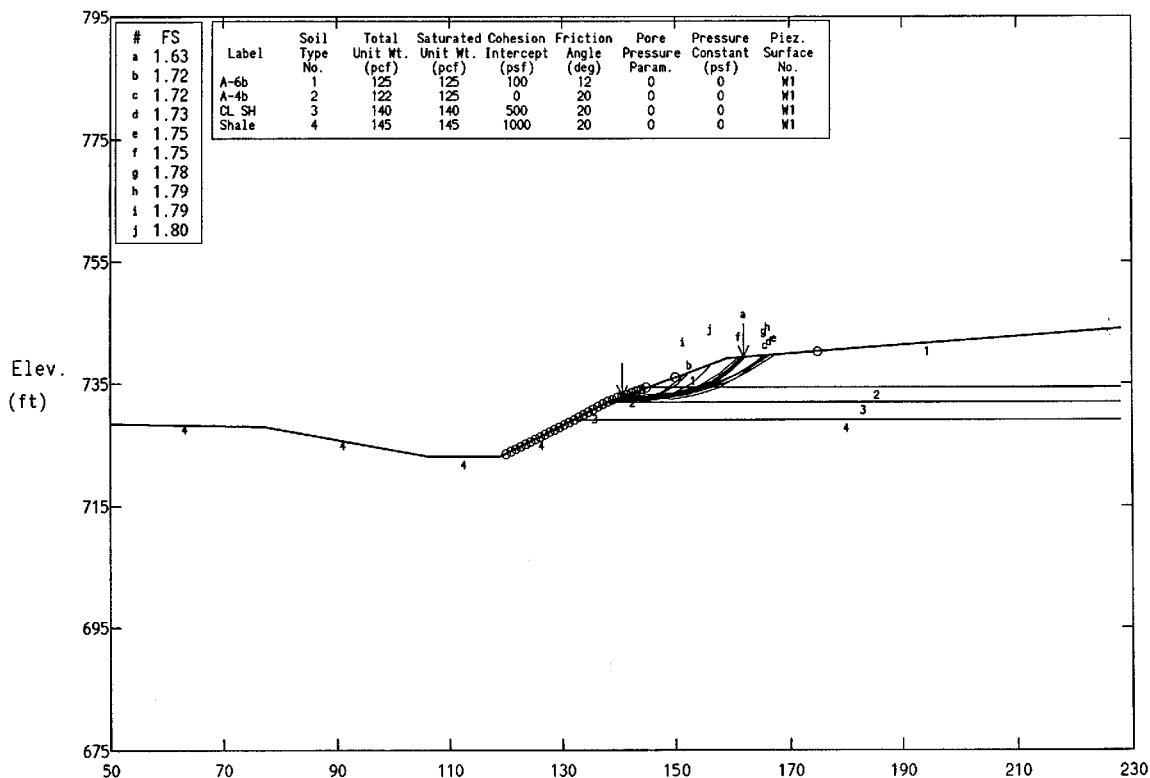
CIRCL2-Bishop circular, search

30 30

70. 95. 100. 125. 0. 4. 0. 0.

WAR-75-3.40 Station 180 Warren County, Ohio

Ten Most Critical. C:WAR75180.PLT By: Roger Evans 5/04/2006 4:56pm



STABL6H FSmin=1.63 X-Axis (ft)

Factors Of Safety Calculated By The Modified Bishop Method

PROFIL C:\SLOPE\WAR75180 PCSTABL Version 6H /O(50. ,675.)
WAR-75-3.40 Station 180 Warren County, Ohio

11 8

0. 53.5 27. 53. 4

27. 53. 56. 48. 4

56. 48. 69. 48. 4

69. 48. 82. 54. 4

82. 54. 88. 57. 3

88. 57. 95.5 59.5 2

95.5 59.5 109. 64. 1

109. 64. 178. 69. 1

93. 59.5 178. 59.5 2

88. 57. 178. 57. 3

82. 54. 178. 54. 4

SOIL A-6b A-4b CL SH Shale

4

125. 125. 100. 12. 0. 0. 1

122. 125. 0. 20. 0. 0. 1

140. 140. 500. 20. 0. 0. 1

145. 145. 1000. 20. 0. 0. 1

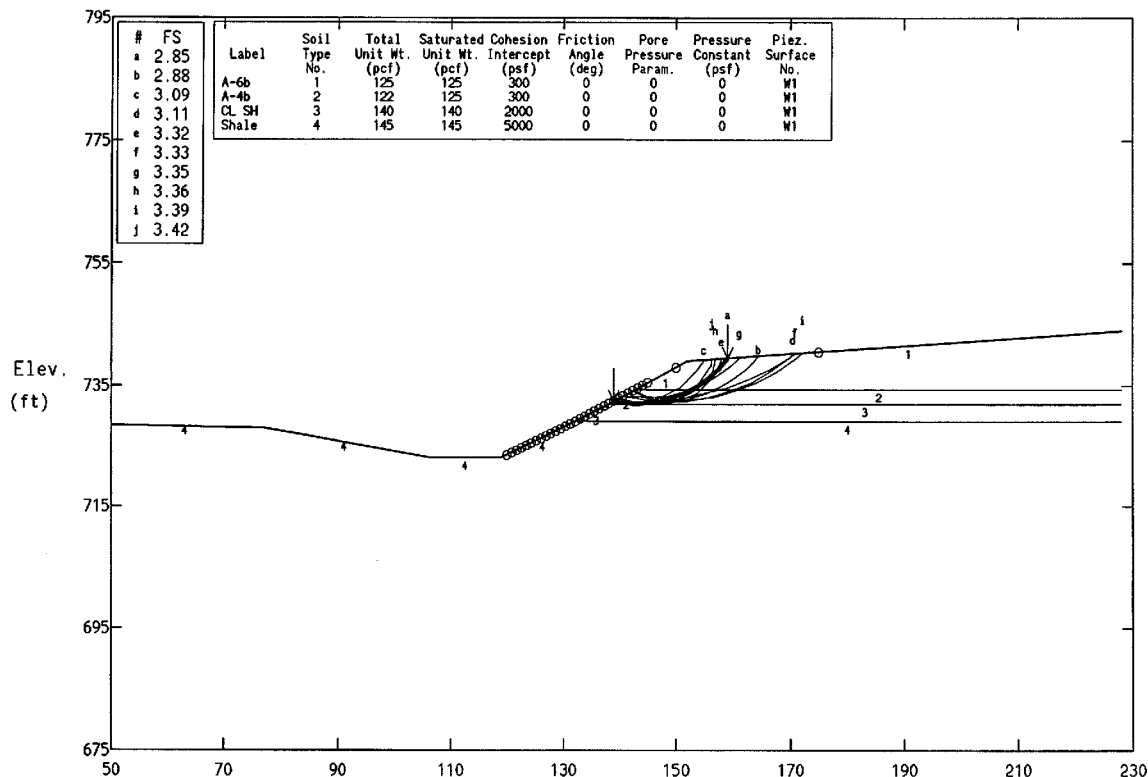
CIRCL2-Bishop circular, search

30 30

70. 95. 100. 125. 0. 4. 0. 0.

WAR-75-3.40 Station 180 Warren County, Ohio

Ten Most Critical. C:WAR75180.PLT By: Roger Evans 5/04/2006 4:50pm



STABL6H FSmin=2.85 X-Axis (ft)
Factors Of Safety Calculated By The Modified Bishop Method

PROFIL C:\SLOPE\WAR75180 PCSTABL Version 6H /O(50. ,675.)
WAR-75-3.40 Station 180 Warren County, Ohio

11 8

0. 53.5 27. 53. 4

27. 53. 56. 48. 4

56. 48. 69. 48. 4

69. 48. 82. 54. 4

82. 54. 88. 57. 3

88. 57. 93. 59.5 2

93. 59.5 102. 64. 1

102. 64. 178. 69. 1

93. 59.5 178. 59.5 2

88. 57. 178. 57. 3

82. 54. 178. 54. 4

SOIL A-6b A-4b CL SH Shale

4

125. 125. 300. 0. 0. 0. 1

122. 125. 300. 0. 0. 0. 1

140. 140. 2000. 0. 0. 0. 1

145. 145. 5000. 0. 0. 0. 1

CIRCL2-Bishop circular, search

30 30

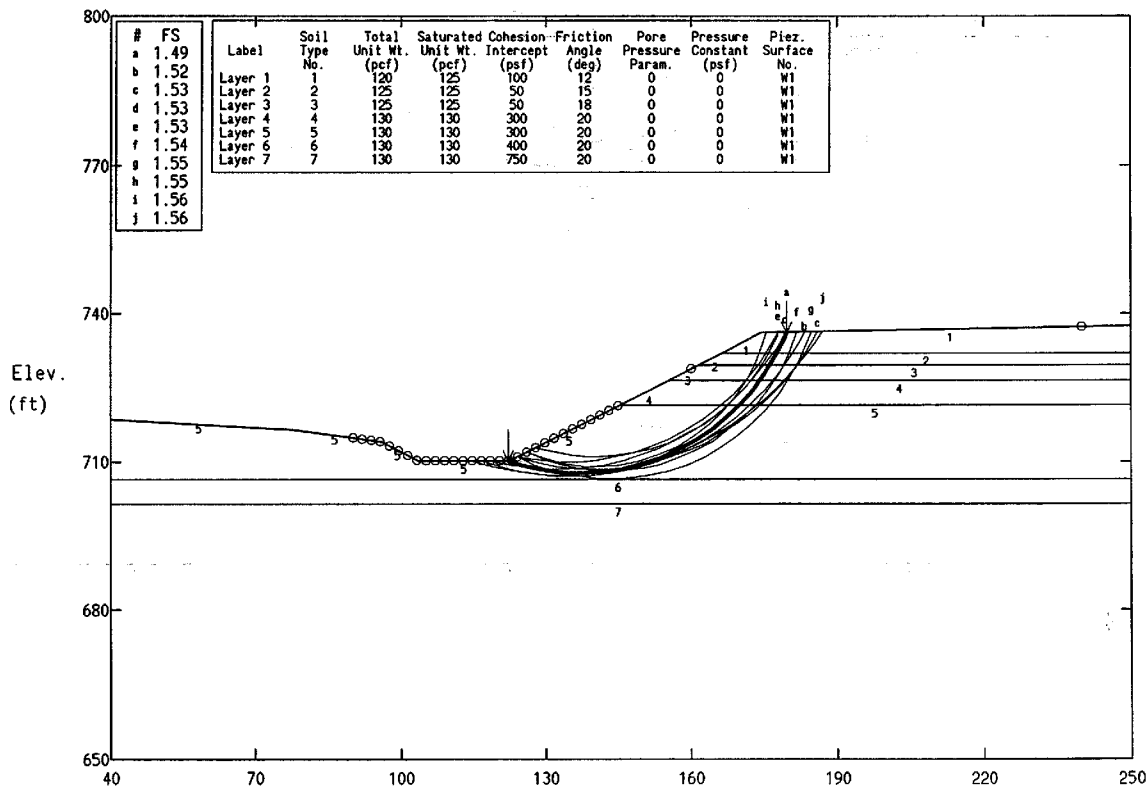
70. 95. 100. 125. 0. 4. 0. 0.

IR 75

STA. 191+00

WAR-75-3.40 Station 191 Warren County, Ohio

Ten Most Critical. C:WAR75191.PLT By: Roger Evans 5/04/2006 5:01pm



STABL6H FSmin=1.49 X-Axis (ft)
Factors Of Safety Calculated By The Modified Janbu Method

PROFIL C:\SLOPE\WAR75191 PCSTABL Version 6H /O(40. ,650.)
WAR-75-3.40 Station 191 Warren County, Ohio

16 10
0. 68.5 37.5 66.5 5
37.5 66.5 56. 64. 5
56. 64. 63.5 60.2 5
63.5 60.2 82.5 60.2 5
82.5 60.2 105.5 71.5 5
105.5 71.5 115.5 76.5 4
115.5 76.5 121.5 79.5 3
121.5 79.5 126.5 82. 2
126.5 82. 134.5 86. 1
134.5 86. 210. 87.5 1
126.5 82. 210. 82. 2
121.5 79.5 210. 79.5 3
115.5 76.5 210. 76.5 4
105.5 71.5 210. 71.5 5
0. 56.5 210. 56.5 6
0. 51.5 210. 51.5 7

SOIL Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 Layer 6 Layer 7

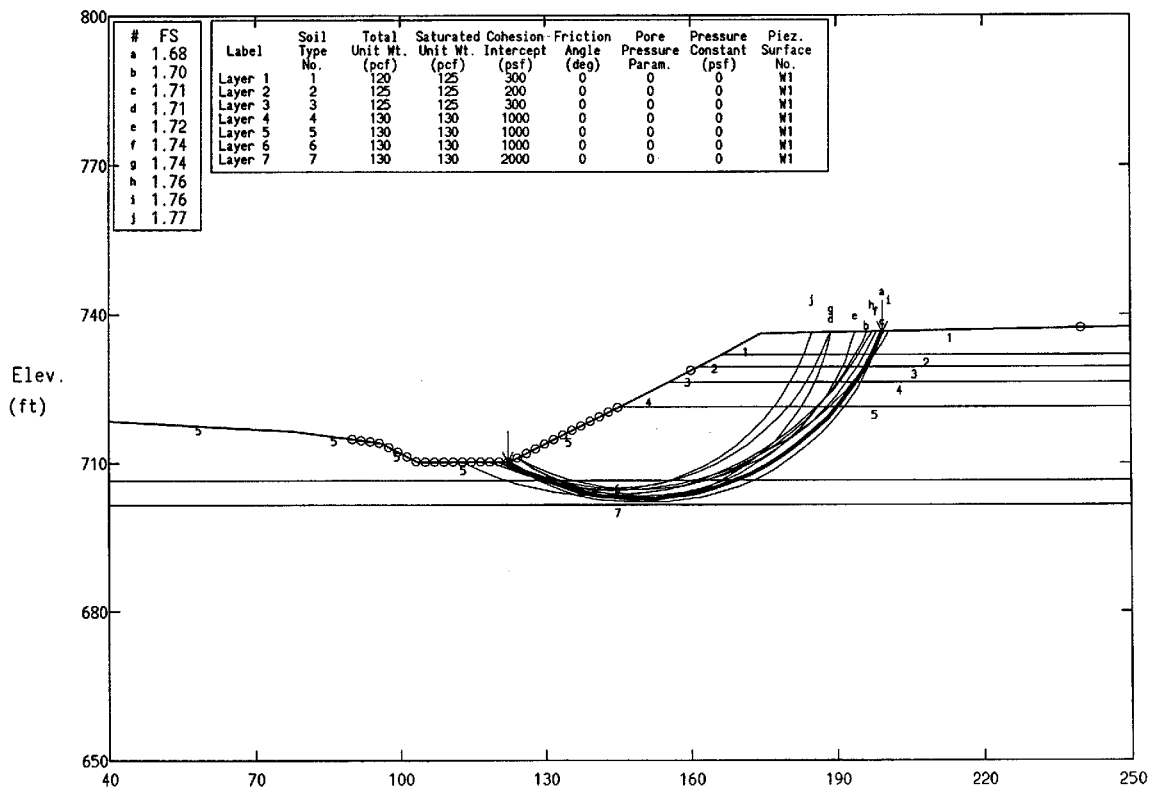
120. 125. 100. 12. 0. 0. 1
125. 125. 50. 15. 0. 0. 1
125. 125. 50. 18. 0. 0. 1
130. 130. 300. 20. 0. 0. 1
130. 130. 300. 20. 0. 0. 1
130. 130. 400. 20. 0. 0. 1
130. 130. 750. 20. 0. 0. 1

CIRCLE-Janbu circular, search
30 30

50. 105. 120. 200. 0. 4. 0. 0.

WAR-75-3.40 Station 191 Warren County, Ohio

Ten Most Critical. C:WAR75191.PLT By: Roger Evans 5/04/2006 4:57pm



STABL6H FSmin=1.68 X-Axis (ft)

Factors Of Safety Calculated By The Modified Janbu Method

PROFIL C:\SLOPE\WAR75191 PCSTABL Version 6H /O(40. ,650.)
WAR-75-3.40 Station 191 Warren County, Ohio

16 10

0. 68.5 37.5 66.5 5

37.5 66.5 56. 64. 5

56. 64. 63.5 60.2 5

63.5 60.2 82.5 60.2 5

82.5 60.2 105.5 71.5 5

105.5 71.5 115.5 76.5 4

115.5 76.5 121.5 79.5 3

121.5 79.5 126.5 82. 2

126.5 82. 134.5 86. 1

134.5 86. 210. 87.5 1

126.5 82. 210. 82. 2

121.5 79.5 210. 79.5 3

115.5 76.5 210. 76.5 4

105.5 71.5 210. 71.5 5

0. 56.5 210. 56.5 6

0. 51.5 210. 51.5 7

SOIL Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 Layer 6 Layer 7

120. 125. 300. 0. 0. 0. 1

125. 125. 200. 0. 0. 0. 1

125. 125. 300. 0. 0. 0. 1

130. 130. 1000. 0. 0. 0. 1

130. 130. 1000. 0. 0. 0. 1

130. 130. 1000. 0. 0. 0. 1

130. 130. 2000. 0. 0. 0. 1

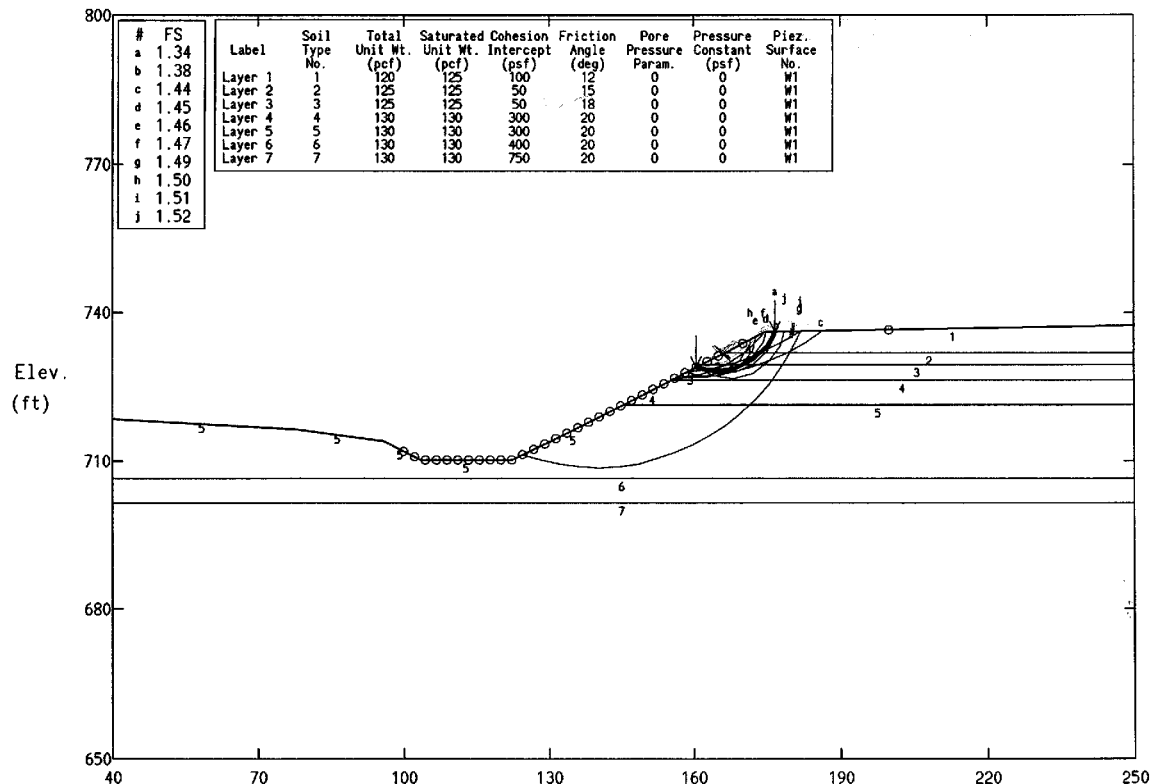
CIRCLE-Janbu circular, search

30 30

50. 105. 120. 200. 0. 4. 0. 0.

WAR-75-3.40 Station 191 Warren County, Ohio

Ten Most Critical. C:WR75191A.PLT By: Roger Evans 5/05/2006 11:52am



STABL6H FSmin=1.34 X-Axis (ft)
Factors Of Safety Calculated By The Modified Janbu Method

PROFIL C:\SLOPE\WR75191A PCSTABL Version 6H /O(40. ,650.)
WAR-75-3.40 Station 191 Warren County, Ohio

16 10

0. 68.5 37.5 66.5 5
37.5 66.5 56. 64. 5
56. 64. 63.5 60.2 5
63.5 60.2 82.5 60.2 5
82.5 60.2 105.5 71.5 5
105.5 71.5 115.5 76.5 4
115.5 76.5 121.5 79.5 3
121.5 79.5 126.5 82. 2
126.5 82. 134.5 86. 1
134.5 86. 210. 87.5 1
126.5 82. 210. 82. 2
121.5 79.5 210. 79.5 3
115.5 76.5 210. 76.5 4
105.5 71.5 210. 71.5 5
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SOIL Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 Layer 6 Layer 7

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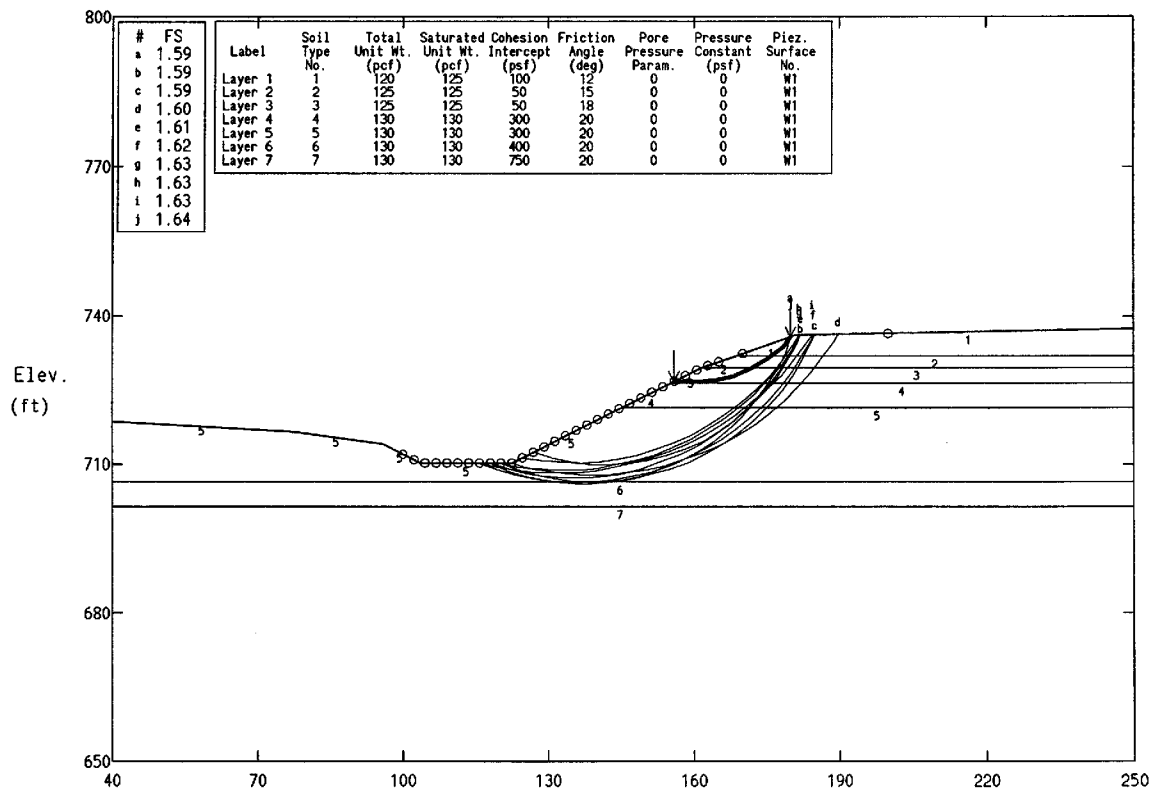
CIRCLE-Janbu circular, search

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WAR-75-3.40 Station 191 Warren County, Ohio

Ten Most Critical. C:WR75191A.PLT By: Roger Evans 5/05/2006 11:54am



STABL6H FSmin=1.59 X-Axis (ft)
Factors Of Safety Calculated By The Modified Janbu Method

PROFIL C:\SLOPE\WR75191A PCSTABL Version 6H /O(40. ,650.)
WAR-75-3.40 Station 191 Warren County, Ohio

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105.5 71.5 115.5 76.5 4
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121.5 79.5 129. 82. 2
129. 82. 141. 86. 1
141. 86. 210. 87.5 1
129. 82. 210. 82. 2
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SOIL Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 Layer 6 Layer 7

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CIRCLE-Janbu circular, search
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60. 125. 130. 160. 0. 4. 0. 0.

inter-office communication

Ohio Department of Transportation District 8 Production Department



TO: Gene Geiger, P.E.
Administrator
Office of Geotechnical Engineering

DATE: March 22, 2006

FROM: Joe Smithson, P.E.
District Geotechnical Engineer

SUBJECT: WAR-75-3.40
PID: 10754

The preliminary geotechnical report submitted by CTL as part of the project PAVR study is included for reference. This is the only copy the District has at the present. My comments on regarding the PAVR study as structure type studies are also included.

The geotechnical costs presented on the Modification Summary are being reviewed by Jeff Pietch. We met with the consultant and CTL and reduced the borings based on the existing soil information. See the attached memo of the meeting minutes. Jeff Pietch is looking into the costs provided by the consultant.

If you have any questions, please contact me at 513-933-6596.

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ENGINEERING

jas

enclosure

cc: file

Proposed Modification Items
WAR IR 75 3.40

Out of Scope Items (Design Costs are original mod. dollars and not final as negotiations are on-going)
* Construction Costs included in current cost estimate

- Structure Type Study for WAR-122-0094: a) additional roadway width required too much asphalt overlay on existing beams which required replacement of all but two existing beams. Also, need over 14" of asphalt overlay which is greater than allowable 8". b) existing structure is skewed at 50 degrees which exceeds the allowable skew for box beams. c) additional width of structure combined with the existing skew would have caused relocation of the channel. This area is in a highly sensitive FEMA flood zone and any channel relocation should be avoided. Design Cost = \$25,000. Construction Cost = \$1,500,000*.
- Additional survey on Pennyroyal Road and SR 122 (to the east): Areas not covered by original aerial mapping. Design Cost = \$20,000. Construction Cost = N/A

Proposed I-75 roadway borings for Global Stability. Design Cost = \$79,000

- Additional roadway borings (9) for Pennyroyal Road and SR 122. Areas not covered by original aerial mapping. Design Cost = ~~\$54,000~~ ^{\$16,700} Construction Cost = N/A
- Construction Cost = N/A

- Additional bridge borings for WAR-122-0094 and Ramp E bridge: Bridge now being replaced and test borings at Ramp E culverts. Design Cost = \$5,000. Construction Cost = N/A

- Roadway changes to SR 122, Access Road, Commerce Drive and Union Road: Curb & Gutter added to SR 122 and Access Road. Revisions to Commerce Drive alignment to avoid fiber optic cable box. Closed gap on Union Road between SR 122 and Access Drive. Design Cost = \$35,000. Construction Cost = \$160,000*.

- Roadway work extension on Pennyroyal Road to meet current superelevation criteria: PAVR comment from ORES. Design Cost = \$10,500. Construction Cost = \$375,000*.

- I-75 cross section changes due to GB-2 requirements, new requirements dated June, 2005: Widening of outside paved shoulder from 10' to 12' to meet current standards. Design Cost = \$14,000. Construction Cost = \$3,500,000*.

- Retaining Wall justification/verification studies and retaining wall design: Determined retaining walls required during PAVR design and review. Design Cost = \$58,000. Construction Cost = Unknown at this time since studies not complete. ¹⁵⁰

- Additional geotechnical borings for retaining walls: Design Cost = ~~\$43,500~~ ^{\$13,500}. Construction Cost = N/A.

- STS for WAR-75-1002 (SR 73) and roadway changes associated with raising the profile to meet vertical clearance criteria: Result of IMS at I-75/SR-73 interchange by City of Springboro. Locals picking up additional design cost and construction cost (difference between original rehab work vs. total replacement). Design Cost = \$80,000. Construction Cost = \$2,000,000.

- BMP requirement changes in October, 2005 and January, 2006: Design Cost = \$24,000. Construction Cost = \$250,000.

- CO hot spot analysis/report preparation: Added requirement to complete Environmental Document. Design Cost = \$7,700. Construction Cost = N/A

- Additional Noise Wall analysis: One (1) additional location identified. Design Cost = ~~\$5,700~~ ^{\$5,700} Construction Cost = \$627,000.

- Provide superelevation on I-75 curve (9000') to meet current criteria: FHWA would not approve design exception. Design Cost = \$40,000. Construction Cost = \$3,500,000.

Geotech Mod:

79,000
51,000
43,500

Noise Wall Geotech Costs? ²⁰⁶



Meeting Minutes

Date: Tuesday, February 14th, 2006

Attendees: WEC - Walid Antonios, Chris Shea
ODOT District 8 - Jeff Pietch, Jon Milesky, Joe Smithson
CTL - Joe Grant, Doug Bait

Subject: WAR-75-3-40 Geotechnical Borings

cc: Correspondence File

The following issues were discussed during the meeting:

1. Joe Smithson indicated that he wants to use a normal spacing of 300' with a maximum not to exceed 350' spacing between Noise Wall Borings. Also, Joe stated that if CTL hit a thick layer of limestone, then they should stop and not core into bedrock.
2. Everybody agreed that there aren't any existing stability problems along slopes of IR 75.
3. Joe Smithson wants to eliminate the borings along IR 75 for global stability based on the existing boring plans along the following stations: sta. 42+00, 44+50, 120+00, 126+00, 255+00, 259+00, 260+00, 265+00, 271+00, 388+00, 391+00, 392+00, 395+00, 397+00.
4. Joe Smithson will provide WEC with the electronic tiff files of all the existing geotechnical borings.
5. Joe Smithson stated that for Pennyroyal Road stability analysis is required based on the two bridge borings drilled. There is no need for additional borings to do stability analysis. Pavement borings for Pennyroyal Road and its side roads are required.
6. CTL will provide WEC with revised modification by 2/15/06. Also, CTL will provide WEC with fee proposal to do the Noise Wall Work, so WEC can authorize the work since it is in the current contract.
7. Joe Smithson indicated that he would like the geotechnical borings plotted at the same scale as the plan and profile sheets for consistency. Also, CTL does not need to supply sheets from the beginning to the end of job for the roadway borings, just in the areas that are being analyzed.



Structure Type Study WAR-75-0394

1. The Discussion of the bridge foundations in Appendix C indicates an allowable bearing pressure of 4 tsf is recommended. The use of 4 tsf is a very conservative value for spread footing bearing on gray shale and limestone bedrock.

Additionally, the Tables 1 and 2 in Appendix indicate an allowable bearing pressure of 3 tsf was used for the abutment spread footings with the footing elevations at 874 ft. This would require excavation 12 ft. into bedrock for the spread footing. The consultant should reevaluate the assumed parameters for the spread footing options.

2. Downdrag loads will be relatively minor as the shallow depth of overburden as well as the proposed embankment height will not lead to significant downdrag loads.
3. Piles should be eliminated from the options as the depth to bedrock would be less than 15 ft.
4. The consultant should look into using a spread foundation for the abutments as the depth to bedrock is 3 ft. from the proposed bottom of footing for the drilled shaft. The use of the spread foundation may require changing the abutment type resist the lateral earth pressures.

Structure Type Study WAR-75-0410L & R

1. Settlement platforms in the MSE wall fill are not necessary as the majority of the settlement will occur during construction. The predicted 1 inch of settlement provided by the consultant is within the tolerable limits of MSE structures.
2. Dynamic pile testing is required for each pile type and ultimate bearing value on all ODOT bridges.
3. Due to differential settlement concerns, the abutments and piers should each be supported on end bearing H-piles for both bridges.
4. Construction of the MSE walls at the abutment locations will require a significant amount of excavation. The excavation for the MSE wall may require a long temporary cut slope to perform an open excavation or temporary shoring will be necessary. The excavation will then have to be filled with select granular material for the MSE wall and embankment material behind the reinforced zone.



The consultant should explore the potential use of a full height abutment supported on piles rather than the MSE wall option.

Structure Type Study WAR-75-1146

1. The location of test boring C-1 is missing from the structure plan view sheet. Additionally, the test boring log is missing from the Appendix.
2. Settlement platforms in the MSE wall fill are not necessary as the majority of the settlement will occur during construction. The predicted 1 inch of settlement provided by the consultant is within the tolerable limits of MSE structures.
3. Downdrag should not be an issue given the subsurface conditions, estimated settlement and roadway geometry.
4. The allowable bearing pressure of 8 tsf assumed for the pier spread foundations should be looked at further. This value is slightly conservative.
5. In Appendix C, Section III, Recommendations: The General Note regarding the drilled shaft having to bear on a limestone layer is not practical. The bedrock geology consists of Interbedded shale and limestone and typical drilled shaft construction methods will make this requirement very difficult to field verify.
6. At the present, the drilled shafts for the abutments are 54" in diameter and 9 ft. in length. Per the FHWA Drilled Shaft Manual, if the length to diameter ratio (L/B) is less than 3, the foundation unit is not considered a drilled shaft. Thus, the conventional methods to determine the axial shaft capacity do not apply. At the present, the L/B ratio is 2 and thus, the FHWA shaft analyses methods do not apply. The consultant should revisit the proposed pier layout and capacities.
7. In consideration of No. 6 above, the support of the abutments on piles may be a more economical option. Additionally, from a construction point of view, the pile option will require less concrete form work than drilled piers.
8. In Appendix C, Section II, Discussion: The recommended shaft end bearing capacity is stated as 30 tsf. However, in Tables 1 through 3, the assumed end bearing capacity is 35 tsf with a side friction of 0.5 tsf for the rock socket. The consultant should review this inconsistency. Additionally, the 0.5 tsf skin friction in the rock socket should be examined as this value appears low.
9. Dynamic pile testing is required for each pile type and ultimate bearing value on all ODOT bridges.



10. Construction of the MSE walls at the abutment locations will require a significant amount of excavation. The excavation for the MSE wall may require a long temporary cut slope to perform an open excavation or temporary shoring will be necessary. The excavation will then have to be filled with select granular material for the MSE wall and embankment material behind the reinforced zone. Additionally, the drilled shaft and column will have to be completely constructed prior to backfill of the MSE wall zone. The consultant should explore the cost of a full height abutment supported on piles rather than the MSE wall and drilled shaft option.

Roadway Geotechnical Comments:

- Comments based on the *Preliminary Subsurface Investigation* report prepared by CTL Engineering, Inc, dated July 8, 2005. The referenced report addresses the recommendations for the S.R. 122 portion of the project only.
1. The submitted GB1 spreadsheets should include the Problems and Treatments columns in the spreadsheet. The consultant can submit an electronic copy of the GB1 spreadsheet for use by the District.
 2. The soil profile drawings do not illustrate the subsurface conditions in the profile view.
 3. Chemical stabilization should be incorporated into the plans rather than the undercuts outlined in Table 4 of the geotechnical report. Generally, chemical stabilization is more economical than undercutting when large areas of roadway are improved.
 4. The test boring logs submitted in the report do not provided sufficient soil description. Per Section 3.8.2.2 of the *Standard Specifications for Subsurface Investigations*, each soil layer should include a description of the color, strength, composition, moisture content, plasticity, structure and degree of compactness of material. The geotechnical consultant should revise the test boring logs in the final report and soil profile submittal.



Structure Type Study WAR-122-0094

1. The subsurface conditions encountered in the test borings (H-1 and H-2) vary considerably. The consultant should incorporate any archive test boring information, if available, to supplement the latest test borings prior to commencement of any additional subsurface investigation. Additional geotechnical study should be expected at this time.
2. The existing bridge is supported on shallow foundations. The existing foundations have a bearing elevation of 685 ft. per the 1939 and 1971 plans. The structures on shallow foundations have performed satisfactorily at this location. The spread footing option should be explored further.
3. The spread footing bearing on the granular outwash may require sheeting and shoring around the footing perimeter to permit dewatering of the footing excavation. The groundwater level presented in boring H-1 is 688.7 ft., which is likely above the anticipated proposed/required bottom of footing elevation.
4. Test boring H-1 encountered dense to very dense granular outwash with cobbles and boulders. The relative density and the presence of cobbles in the outwash will make driving the piles to bedrock difficult. The full pile capacity would be mobilized prior to achieving end bearing on bedrock. Thus, dynamic load testing would be required at the south abutment if a pile foundation is utilized.
5. If the bridge is supported on piles, pile points would be necessary for the south abutment piles only. Points are not necessary for the H-piles bearing on shale and limestone bedrock at the north abutment.
6. The Discussion of the bridge foundations in Appendix C indicates an allowable bearing pressure of 4 tsf is recommended for spread footings on bedrock and the very dense sand and gravel. The use of 4 tsf is a very conservative value for a spread footing bearing on gray shale and limestone bedrock.
7. The top of bedrock per test boring H-2 is 685 ft. The forward abutment piles can be estimated to encounter refusal on bedrock at this elevation. The piles do not have to be driven 4 ft. into bedrock (elev. 679 ft.) as presently summarized in Table 2 of Appendix C and shown on the bridge drawing.
8. Drilled shafts should not be considered for the south abutment due to the granular nature of the subsurface profile. Construction of drilled shafts in the granular profile with a high groundwater level will require casing and/or the use of drilling slurry to maintain an open drill hole. This type of construction is typically not as economical as a driven pile or shallow foundation.

WAR-75-3.40 PID: 10754
PAVR Submittal – District 8 Geotechnical
JOE SMITHSON, P.E.
August 25, 2005



9. The test boring logs submitted in the report do not provided sufficient soil description. Per Section 3.8.2.2 of the *Standard Specifications for Subsurface Investigations*, each soil layer should include a description of the color, strength, composition, moisture content, plasticity, structure and degree of compactness of material. The geotechnical consultant should revise the test boring logs in the final report and soil profile submittal.
10. Any temporary sheeting or shoring over 8 ft. in height and supporting traffic will required the design to be completed and included in the project plans.



WD Partners' Structure Type Study Report

Prepared for:
Ohio Department of Transportation District 8

WAR-75-03.40
PID No. 10754
BRIDGE NO. WAR-122-0094L&R

August 22, 2005



TABLE OF CONTENTS

Structure Type Study Report

1 - 9

Appendix

<inserts>

Appendix A (Construction Cost)

Appendix B (Future Maintenance Cost)

Appendix C (Foundation Recommendation)

Appendix D (Alternate Profiles)



Existing Features and Design Considerations

The existing structure is a single span non-composite prestressed concrete box beam with reinforced concrete abutments utilizing spread footings. The 75-foot span crosses over Dick's Creek with a 50 degree left forward skew. The existing bridge measures 56 foot face to face of guardrail and carries one eastbound, one westbound and one two-way left-turn lane. The proposed alignment will match the existing, which runs tangent across the structure.

One major design consideration was the addition of eastbound and westbound through lanes along with left-turn and right-turn lanes in both directions. The eastbound direction will have two through lanes, one right-turn lane and two left-turn lanes. The westbound direction will have three through lanes and one right-turn lane. These lane configurations result in an out to out proposed bridge width of 147 feet. This width is almost three times greater than the existing structures. The increased width leads to many design challenges, which will be discussed throughout the report. Multiple superstructure and substructure types were evaluated with consideration to economics, constructability, maintainability, and hydraulics.

Preferred Bridge Alternative

The preferred bridge alternative for this site is a single span (85 foot c/c bearing) type 4 (54 inch) prestressed concrete I-beam with a composite reinforced concrete deck. The structure is skewed 55 degrees left forward with an out to out width of 147 feet. The eastbound and westbound directions are separated by a 2-inch gap due to the large overall width and skew. One continuous footing founded on steel piles driven to rock will support the superstructure and the proposed semi-integral abutments. A combination of both straight-faced deflector parapet and modified type 2-A curb will protect traffic on the outside deck limits and median, respectively. The bridge median barrier will match with the roadway typical section median treatment at both limits of the bridge. The resultant toe/toe barrier widths are 64 feet for the westbound direction and 76 feet for the eastbound direction.

Span Arrangement Selection

Increased bridge width raises some issues with the grading below the structure, that call for reconsidering the structure's angle of skew selection. Namely, it is not possible to tie the proposed grading to the existing contours while keeping the 50-degree skew without having to modify the alignment of Dick's Creek. Because of this, the skew angle of the proposed structure had to be increased to 55 degrees (left



forward). To further avoid alteration of Dick's Creek, a retaining wall is proposed at the southwest quadrant of the proposed structure.

Changing the skew angle of the structure has a direct effect on the hydraulic efficiency of the channel. As the skew angle increases, the efficiency of the channel reduces. One method used to counterbalance the effects of increasing the skew is to increase the bridge span. The existing structure's hydraulic opening is 46.2 feet. Using an 85-foot span with a 55-degree skew results in a hydraulic opening of 45.8 feet. Keeping the proposed span length close to the existing requires careful consideration for the abutment construction, since there will be interference of proposed piling and the existing structure's spread footings. There are two ways of resolving this issue. First, the proposed span could be increased to a length that would grant clearance between the piles and the spread footings. In this case, the span would have to be lengthened to 125 feet in order to clear the existing abutments. This would increase the initial construction cost by approximately \$380,000 (this cost does not include the additional cost of raising the roadway profile due to the larger beam section needed for the increased span). The second option consists of keeping the span at 85-feet c/c bearing and removing the existing abutments including the footings. The removal costs add up to approximately \$130,000, which is \$250,000 less than the option of increasing the span length. In addition, the abutment removal option would yield additional savings in future maintenance costs because there would be less structure to maintain. The removal of the existing abutments enables the bridge hydraulic opening to closely match the existing, resulting in a minimal increase to both the design and check discharge headwater elevations.

Aside from skew angle and bridge span length, another factor controlling the hydraulic opening is the low chord elevation. A hydraulic model simulating the existing structure was created using HEC-RAS and compared to the hydraulic data shown on the FEMA Flood Insurance Rate Map and the existing structure plans. The 100-year discharge elevations obtained in our hydraulic model closely match the values provided on the FEMA Flood Insurance Rate Map. The results of the HEC-RAS analysis indicated that the low chord of the existing structure could be lowered significantly, in comparison with the existing structure. However, the existing plans were showing a 100-year discharge elevation that was approximately 3.5 feet higher than the elevation in our hydraulic model. Attempts were made to contact both the Warren County and the City of Middletown Engineering offices and have them verify a high water mark at this site. However, neither office could confirm the water elevation, and as a result, we recommend following



the conservative approach of not reducing the low chord elevation, thus reducing the hydraulic opening. The proposed low chord was set to match the existing structure's low chord at the controlling downstream face. All criteria set forth in section 203.2.H of the Bridge Design Manual (BDM) have been satisfied. This section states that the Ohio Revised Code limits the 100-year water surface elevation rise caused by any encroachment above the natural condition by one foot. See page 6 for additional hydraulic information.

Other span arrangements were studied such as the three span alternative. Three span arrangements were derived from the same philosophy as our preferred single span arrangement, and that is to limit all proposed grading to the area above the ordinary high water mark. In order to keep piers above ordinary high water the center span would have to be at least 40 feet (alternative 5 is 32', 40', 32' c/c bearing). There is a higher potential for disturbance of the existing streambed during construction if piers are used. Introducing piers could also lead to potential aggradation and degradation of the stream. The three span arrangement raises the design and check headwater elevations more than the single span alternative and is also more costly. Hence, the three-span arrangement was found undesirable for this project. See pages 7 and 8 for further information on life cycle costs.

Abutment Selection

The proposed structure meets all the criteria set forth in the Bridge Design Manual for use of semi-integral abutments. Since the skew is above the maximum specified by the standard drawings, the beam seats will need to be specifically designed to accommodate the bearing retainer assemblies. In addition, the turn back wingwalls will need to be designed to take the additional stresses coming from the thermal expansion of the diaphragm. One area of concern is that other Districts have reported deck cracking on highly skewed structures using semi-integral construction. Another alternative would be the use of strip seal expansion joints, however, they are typically avoided because of maintenance issues. Integral abutments were not considered since the BDM limits the maximum skew of an integral bridge to 30 degrees.

Consideration was also given to reusing the existing abutments. This option would not allow for the proposed 55 degree skew. In addition, major modifications would have to be made and semi-integral construction could be of concern due to both the geometry of the existing abutments and the fact that they are founded on spread footings. Two other areas of concern are that the units would also be at least 20 years older than the rest of the structure and that there are



possible loading limitations of the existing spread footing abutments. After reviewing the above information, it is our recommendation to use semi-integral abutments for this site. See Appendix C for the Foundation Recommendation Report.

Superstructure Selection

Many superstructure alternatives were studied for the single span arrangement. The following is a list of the alternatives evaluated as part of this report:

Alternative 1 – 85-foot single span prestressed concrete I-beam (Type 4, 54" deep) with semi-integral abutments. The out/out superstructure width is 147 feet with a 2-inch gap separating the eastbound and westbound superstructures.

Alternative 2 – 85-foot single span A588 steel beam (W36X260) with semi-integral abutments. The out/out superstructure width is 147 feet with a 2-inch gap separating the eastbound and westbound superstructures.

Alternative 3 – 85-foot single span prestressed concrete I-beam (Type 4, 54" deep) with semi-integral abutments. The out/out superstructure width is 147 feet with a 9-foot opening separating the eastbound and westbound superstructures.

Alternative 4 – 85-foot single span A588 steel beam (W36X260) with semi-integral abutments. The out/out superstructure width is 147 feet with a 9-foot opening separating the eastbound and westbound superstructures.

Alternative 5 – 104-foot (32'-40'-32') 3-span continuous slab bridge on typical abutments and capped pile piers. The out/out deck width is 147 feet.

A CON/SPAN culvert was studied as a preliminary alternative. The maximum allowed skew for the end sections on a 48-foot span CON/SPAN culvert section is 1.98 degrees. The 55-degree skew would push the ends of the culvert out past the limits of the other alternatives studied. This could impact the right-of-way significantly, thus increasing the amount of land acquisition. Our hydraulic model for the culvert results in velocities above 8 feet per second. Section 1008.8 in Volume 2 of the L&D Manual states that deep foundations would be required for velocities of this magnitude. It is also standard practice to excavate the channel bottom when using three sided culverts. This would be more obtrusive environmentally when compared to the other alternatives. The above factors lead us to determine that the three-sided culvert was not as practical as the other alternatives studies, and thus the option was not further analyzed.



Consideration was also given to a continuous 3-span concrete slab bridge. This alternative will introduce piers and increase backwater conditions. One benefit of a slab bridge is the fact that the existing profile for S.R. 122 can be matched more closely than the other deeper superstructure alternatives. However, the skew angle of 55 degrees poses some concerns when using a concrete slab bridge. Skewed decks develop twisting moments in the slab, which increase with the angle of skew and these moments vary throughout the slab. Since the most economical way to reinforce the slab is to place the reinforcing steel in the direction of the principle moment, we are concerned that the twisting moments in slab would potentially lead to deck cracking, causing the maintenance issues and possibly requiring premature deck replacement. The initial construction cost of the slab bridge is slightly higher than the prestressed I-beam and steel beam bridges, but the future maintenance cost is higher than the I-beam options due to the replacement of the thicker concrete slab. Because of the reasons mentioned this alternative is not recommended.

Alternatives 1 through 5 allow for 1-foot shoulders, 11-foot work zone lanes and an 11-foot emergency lane to be utilized during stage one construction. Alternatives 3 and 4 require straight-faced parapet to protect the 9-foot opening. If straight-faced barriers are used than the proposed median would need terminal assemblies and guardrail, which would not be aesthetically pleasing. Alternatives 1,2 and 5 use a modified type 2-A median barrier, which matches the median barrier at both bridge limits. This will allow the proposed roadway median to be curbed with no guardrail. In addition, alternatives 1,2 and 5 allow for future growth of the left turn lane without any modifications to the proposed structure. Finally, alternatives 1, 2 and 5 eliminate the need for a straight-faced barrier between the eastbound and westbound superstructures, lessening the cost for future maintenance.



Hydraulic results can be viewed below.

Option	Type	Low Chord El.	25 year		100 year	
			Water Surface El.	Back- water Height (FT.)	Water Surface El.	Back- water Height (FT.)
1 & 3	Type 4 (54") Prestressed I-Beam	702.23	698.47	0.23	699.83	0.33
2 & 4	W36x260 A588 Rolled Steel Beam	702.56	698.47	0.23	699.83	0.33
5	3-Span Continuous Slab	702.38	699.01	0.77	700.38	0.88
-	Existing Bridge	702.21	698.30	0.06	699.66	0.16
-	Existing Channel	-	698.24	-	699.50	-

The velocities for all options are the same for both the design (25-year) and check (100-year) discharges. They are as follows:

25 year – 8.56 ft./sec.

100 year – 9.01 ft./sec.



A cost analysis was performed on all structures that satisfy previously discussed hydraulic criteria in order to determine the most economical alternative. The single span Type 4 prestressed concrete I-beam (alternative 1) was calculated to be the second most economical superstructure for life cycle cost. See the tables on page 8 for the resulting costs for each alternative, including substructure costs.

Future Maintenance Cost Evaluation

Future costs were projected to 2008 construction costs based on an inflation rate of 3.5%. Listed below are several assumptions made for the calculation of life cycle costs for each alternative.

- Life cycle of a structure is 80 years.
- Sealing of concrete structures using epoxy-urethane will occur every 15 years.
- Composite concrete decks will last 40 years.
- Composite concrete decks will require a rigid overlay at 20 years.
- A588 weathering structural steel will require a coating system at 25 years and every 20 years after that.
- Approach slabs will be replaced at the same time the deck is replaced.

Future maintenance items for all superstructure alternatives and years of occurrence can be found below.

Future Maintenance Items

Option #	Type	Future Maintenance Item	Year of Occurrence
1 & 3	Type 4 (54") Prestressed I-Beam	Sealing of Concrete Surface	15, 30, 45, 60, 75
		Ridge Overlay	20, 60
		Deck Replacement	40
2 & 4	W36x260 A588 Rolled Steel Beam	Sealing of Concrete Surfaces	15, 30, 45, 60, 75
		Rigid Overlay	20, 60
		Deck Replacement	40
		Painting of Structural Steel	25, 45, 65
5	3-Span Continuous Slab	Sealing of Concrete Surfaces	15, 30, 45, 60, 75
		Rigid Overlay	20, 60
		Deck Replacement	40



Initial Construction Cost

Option #	Type	# of Beams	# of Spans	Cost	\$/S.F.
1	Type 4 (54") Prestressed I-Beams*	19	1@ 85'	\$2,483,857	\$191
2	W36x260 A588 Rolled Steel Beams*	19	1@ 85'	\$2,530,153	\$195
3	Type 4 (54") Prestressed I-Beams**	18	1@ 85'	\$2,469,177	\$202
4	W36x260 A588 Rolled Steel Beams**	18	1@ 85'	\$2,508,101	\$205
5	3-Span Continuous Slab***	-	32'-40'-32'	\$2,588,583	\$166

Future Maintenance Cost

Option #	Type	Cost	\$/S.F.
1	Type 4 (54") Prestressed I-Beams*	\$4,512,600	\$347
2	W36x260 A588 Rolled Steel Beams*	\$8,622,400	\$664
3	Type 4 (54") Prestressed I-Beams**	\$4,513,300	\$370
4	W36x260 A588 Rolled Steel Beams**	\$8,383,900	\$687
5	3-Span Continuous Slab***	\$6,913,199	\$444

Life Cycle Cost = Initial Const. Cost + Future Maintenance Cost

Option #	Type	Cost	Cost Difference
1	Type 4 (54") Prestressed I-Beams*	\$6,996,457	
2	W36x260 A588 Rolled Steel Beams*	\$11,152,553	+ \$4,156,096
3	Type 4 (54") Prestressed I-Beams**	\$6,982,477	- \$13,980
4	W36x260 A588 Rolled Steel Beams**	\$10,892,001	+ \$3,895,544
5	3-Span Continuous Slab***	\$9,501,683	+ \$2,505,226

* - Based on proposed bridge widths of 67 and 79.83 feet out to out of deck and an 8 ½ inch thick composite deck.

** - Based on proposed bridge widths of 69 and 69 feet out to out of deck and an 8 ½ thick composite deck.

*** - Based on proposed bridge width of 147 feet out to out of deck and a 20-inch thick deck.

See Appendix A for detailed construction costs of all alternatives.



[REDACTED]

A 15 percent contingency has been added to all costs to account for preliminary design.

Substructure costs can be viewed from the Foundation Investigation Report found in Appendix C.

Conclusions

Considering hydraulics along with life cycle costs, environmental concerns, and future expansion for each alternative, the single span Type 4 (54 inch) prestressed I-beam with a composite reinforced concrete deck (alternative 1) on semi-integral abutments is our recommended preferred alternative. Not only is this alternative the second most economical structure in life cycle cost, but it also provides better aesthetics in the median and allows for future expansion of the eastbound left-turn lane.

For further details on our preferred bridge alternative, please see the Hydraulics Report, Site Plan, Phase of Construction Details, Transverse Section and Abutment Section submitted in addition to this report.

Estimate 19717

Estimated Cost: \$2,159,875.29

Contingency: 15.00%

Estimated Total: \$2,483,856.58

*WAR-122-0094 Prestressed I Beam Type 4 (54") 2" Gap Between 67' and 79'-10" Decks. On Semi-Integral Abutments,
Single Span, Turnback Wingwalls Construction Costs*

Letting Date: 04/14/08

Spec Year: 05

Unit System: E

Work Type: BRIDGE REPLACEMENT

Highway Type: 448

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: WARREN

Prepared by Greg Johnson on 07/14/05

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

Group 0100: WAR-122-0094 Over Dick's Creek

0005	202E11202	1.00	LS	\$130,000.00000	\$130,000.00
PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN					
0006	503E11100	1.00	LS	\$221,774.00000	\$221,774.00
COFFERDAMS, CRIBS AND SHEETING					
0007	503E21100	4,585.00	CY	\$25.06059	\$114,902.81
UNCLASSIFIED EXCAVATION					
0008	509E10000	214,800.00	LB	\$0.70000	\$150,360.00
EPOXY COATED REINFORCING STEEL					
0009	511E46200	65.00	CY	\$390.75440	\$25,399.04
CLASS C CONCRETE					
0010	512E10100	2,080.00	SY	\$9.00000	\$18,720.00
SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)					
0011	515E15020	19.00	EACH	\$21,500.00000	\$408,500.00
DRAPED STRAND PRESTRESSED CONCRETE BRIDGE I-BEAM MEMBERS, LEVEL 3, TYPE 4					
0012	515E20000	51.00	EACH	\$844.14679	\$43,051.49
INTERMEDIATE DIAPHRAMS					
0013	516E44100	38.00	EACH	\$531.68477	\$20,204.02
ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)					
0014	518E21200	579.00	CY	\$51.23364	\$29,664.28
POROUS BACKFILL WITH FILTER FABRIC					
0015	518E40000	670.00	FT	\$6.41739	\$4,299.65
6" PERFORATED CORRUGATED PLASTIC PIPE					
0016	526E30000	974.00	SY	\$140.00000	\$136,360.00
REINFORCED CONCRETE APPROACH SLABS (T=17")					
0017	898E10200	648.00	CY	\$550.00000	\$356,400.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (DECK)					
0018	898E11000	60.00	CY	\$550.00000	\$33,000.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (PARAPET)					
0019	898E20160	610.00	CY	\$350.00000	\$213,500.00
QC/QA CONCRETE, CLASS QSC1, SUBSTRUCTURE (ABUTMENT INCLUDING FOOTING)					
0021		1.00	LS	\$253,740.00000	\$253,740.00
SUBSTRUCTURE					

Total for Group 0100: \$2,159,875.29

Estimate 19717

Estimated Cost: \$2,200,132.83

Contingency: 15.00%

Estimated Total: \$2,530,152.75

*WAR-122-0094 Steel beam 2" Gap Between 67' and 79'-10" Decks. On Semi-Integral Abutments, Single Span,
Turnback Wingwalls Construction Costs*

Letting Date: 04/14/08

Spec Year: 05

Unit System: E

Work Type: BRIDGE REPLACEMENT

Highway Type: 448

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: WARREN

Prepared by Greg Johnson on 07/14/05

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

Group 0100: WAR-122-0094 Over Dick's Creek

0005	202E11202	1.00	LS	\$130,000.00000	\$130,000.00
PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN					
0006	503E11100	1.00	LS	\$156,000.00000	\$156,000.00
COFFERDAMS, CRIBS AND SHEETING					
0007	503E21100	4,585.00	CY	\$25.06059	\$114,902.81
UNCLASSIFIED EXCAVATION					
0008	509E10000	202,200.00	LB	\$0.70000	\$141,540.00
EPOXY COATED REINFORCING STEEL					
0009	511E46200	65.00	CY	\$390.75440	\$25,399.04
CLASS C CONCRETE					
0010	512E10100	1,138.00	SY	\$9.00000	\$10,242.00
SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)					
0011	513E10241	467,324.00	LB	\$1.25000	\$584,155.00
STRUCTURAL STEEL MEMBERS, LEVEL 2, AS PER PLAN					
0012	513E20000	4,902.00	EACH	\$2.95559	\$14,488.30
WELDED STUD SHEAR CONNECTORS					
0013	516E44100	38.00	EACH	\$531.68477	\$20,204.02
ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)					
0014	518E21200	536.00	CY	\$51.68286	\$27,702.01
POROUS BACKFILL WITH FILTER FABRIC					
0015	518E40000	670.00	FT	\$6.41739	\$4,299.65
6" PERFORATED CORRUGATED PLASTIC PIPE					
0016	526E30000	974.00	SY	\$140.00000	\$136,360.00
REINFORCED CONCRETE APPROACH SLABS (T=17")					
0017	898E10200	602.00	CY	\$550.00000	\$331,100.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (DECK)					
0018	898E11000	60.00	CY	\$550.00000	\$33,000.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (PARAPET)					
0019	898E20160	620.00	CY	\$350.00000	\$217,000.00
QC/QA CONCRETE, CLASS QSC1, SUBSTRUCTURE (ABUTMENT INCLUDING FOOTING)					
0021		1.00	LS	\$253,740.00000	\$253,740.00
SUBSTRUCTURE					

Total for Group 0100: \$2,200,132.83

Estimate 19717

Estimated Cost: \$2,147,110.50

Contingency: 15.00%

Estimated Total: \$2,469,177.07

*WAR-122-0094 Prestressed I Beam Type 4 (54") 9' Gap Between 69' and 69' Decks. On Semi-Integral Abutments,
Single Span, Turnback Wingwalls Construction Costs*

Letting Date: 04/14/08

Spec Year: 05

Unit System: E

Work Type: BRIDGE REPLACEMENT

Highway Type: 448

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: WARREN

Prepared by Greg Johnson on 07/14/05

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

Group 0100: WAR-122-0094 Over Dick's Creek

0005	202E11202	1.00	LS	\$130,000.00000	\$130,000.00
PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN					
0006	503E11100	1.00	LS	\$221,744.00000	\$221,744.00
COFFERDAMS, CRIBS AND SHEETING					
0007	503E21100	4,804.00	CY	\$24.82376	\$119,253.34
UNCLASSIFIED EXCAVATION					
0008	509E10000	216,925.00	LB	\$0.70000	\$151,847.50
EPOXY COATED REINFORCING STEEL					
0009	511E46200	65.00	CY	\$390.75440	\$25,399.04
CLASS C CONCRETE					
0010	512E10100	2,295.00	SY	\$9.00000	\$20,655.00
SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)					
0011	515E15020	18.00	EACH	\$21,500.00000	\$387,000.00
DRAPED STRAND PRESTRESSED CONCRETE BRIDGE I-BEAM MEMBERS, LEVEL 3, TYPE 4					
0012	515E20000	48.00	EACH	\$844.14679	\$40,519.05
INTERMEDIATE DIAPHRAMS					
0013	516E44100	36.00	EACH	\$533.72844	\$19,214.22
ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)					
0014	518E21200	583.00	CY	\$51.19375	\$29,845.96
POROUS BACKFILL WITH FILTER FABRIC					
0015	518E40000	700.00	FT	\$6.40341	\$4,482.39
6" PERFORATED CORRUGATED PLASTIC PIPE					
0016	526E30000	924.00	SY	\$140.00000	\$129,360.00
REINFORCED CONCRETE APPROACH SLABS (T=17")					
0017	898E10200	610.00	CY	\$550.00000	\$335,500.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (DECK)					
0018	898E11000	96.00	CY	\$550.00000	\$52,800.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (PARAPET)					
0019	898E20160	645.00	CY	\$350.00000	\$225,750.00
QC/QA CONCRETE, CLASS QSC1, SUBSTRUCTURE (ABUTMENT INCLUDING FOOTING)					
0020		1.00	LS	\$253,740.00000	\$253,740.00
SUBSTRUCTURE					

Total for Group 0100: \$2,147,110.50

Estimate 19717

Estimated Cost: \$2,180,956.97

Contingency: 15.00%

Estimated Total: \$2,508,100.52

WAR-122-0094 Steel beam 9' Gap Between 69' and 69' Decks. On Semi-Integral Abutments, Single Span, Turnback Wingwalls Construction Costs

Letting Date: 04/14/08

Spec Year: 05

Unit System: E

Work Type: BRIDGE REPLACEMENT

Highway Type: 448

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: WARREN

Prepared by Greg Johnson on 07/14/05

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

Group 0100: WAR-122-0094 Over Dick's Creek

0005	202E11202	1.00	LS	\$130,000.00000	\$130,000.00
PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN					
0006	503E11100	1.00	LS	\$155,221.00000	\$155,221.00
COFFERDAMS, CRIBS AND SHEETING					
0007	503E21100	4,804.00	CY	\$24.82376	\$119,253.34
UNCLASSIFIED EXCAVATION					
0008	509E10000	207,525.00	LB	\$0.70000	\$145,267.50
EPOXY COATED REINFORCING STEEL					
0009	511E46200	65.00	CY	\$390.75440	\$25,399.04
CLASS C CONCRETE					
0010	512E10100	1,335.00	SY	\$9.00000	\$12,015.00
SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)					
0011	513E10241	442,728.00	LB	\$1.25000	\$553,410.00
STRUCTURAL STEEL MEMBERS, LEVEL 2, AS PER PLAN					
0012	513E20000	4,644.00	EACH	\$2.96279	\$13,759.20
WELDED STUD SHEAR CONNECTORS					
0013	516E44100	36.00	EACH	\$533.72844	\$19,214.22
ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)					
0014	518E21200	540.00	CY	\$51.63941	\$27,885.28
POROUS BACKFILL WITH FILTER FABRIC					
0015	518E40000	700.00	FT	\$6.40341	\$4,482.39
6" PERFORATED CORRUGATED PLASTIC PIPE					
0016	526E30000	924.00	SY	\$140.00000	\$129,360.00
REINFORCED CONCRETE APPROACH SLABS (T=17")					
0017	898E10200	566.00	CY	\$550.00000	\$311,300.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (DECK)					
0018	898E11000	96.00	CY	\$550.00000	\$52,800.00
QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (PARAPET)					
0019	898E20160	651.00	CY	\$350.00000	\$227,850.00
QC/QA CONCRETE, CLASS QSC1, SUBSTRUCTURE (ABUTMENT INCLUDING FOOTING)					
0020		1.00	LS	\$253,740.00000	\$253,740.00
SUBSTRUCTURE					

Total for Group 0100: \$2,180,956.97

Estimate 19717

Estimated Cost: \$2,250,941.71

Contingency: 15.00%

Estimated Total: \$2,588,582.97

WAR-122-0094 3 Span Cont. Slab Bridge, 2" Gap Between 67' and 79'-10" Decks. Construction Costs

Letting Date: 04/14/08

Spec Year: 05

Unit System: E

Work Type: BRIDGE REPLACEMENT

Highway Type:

Urban/Rural Type: RURAL CLASS

Season: SUMMER

County: WARREN

Prepared by GDJ on 08/17/05

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
	<u>Description</u>				
	<u>Supplemental Description</u>				
Group 0100: WAR-122-0094 Over Dick's Creek					
0005	202E11202	1.00	LS	\$130,000.00000	\$130,000.00
	PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN				
0006	503E11100	1.00	LS	\$221,174.00000	\$221,174.00
	COFFERDAMS, CRIBS AND SHEETING				
0007	503E21100	4,661.00	CY	\$24.97689	\$116,417.28
	UNCLASSIFIED EXCAVATION				
0008	507E00200	2,800.00	FT	\$16.14089	\$45,194.49
	STEEL PILES HP12X53, FURNISHED				
0009	507E00250	2,100.00	FT	\$9.62191	\$20,206.01
	STEEL PILES HP12X53, DRIVEN				
0010	507E71200	794.00	FT	\$60.37980	\$47,941.56
	SPECIAL - PILE ENCASEMENT				
0011	509E10000	430,180.00	LB	\$0.70000	\$301,126.00
	EPOXY COATED REINFORCING STEEL				
0012	511E46200	65.00	CY	\$390.75440	\$25,399.04
	CLASS C CONCRETE				
0013	512E10100	1,670.00	SY	\$9.00000	\$15,030.00
	SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)				
0014	512E33000	594.00	SY	\$11.99285	\$7,123.75
	TYPE 2 WATERPROOFING				
0015	516E44100	38.00	EACH	\$531.68477	\$20,204.02
	ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)				
0016	518E21200	479.00	CY	\$52.34443	\$25,072.98
	POROUS BACKFILL WITH FILTER FABRIC				
0017	518E40000	670.00	FT	\$6.41739	\$4,299.65
	6" PERFORATED CORRUGATED PLASTIC PIPE				
0018	526E30000	974.00	SY	\$140.00000	\$136,360.00
	REINFORCED CONCRETE APPROACH SLABS (T=17")				
0019	898E10200	976.00	CY	\$550.00000	\$536,800.00
	QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (DECK)				
0020	898E11000	66.00	CY	\$550.00000	\$36,300.00
	QC/QA CONCRETE, CLASS QSC2, SUPERSTRUCTURE (PARAPET)				
0021	898E20100	129.00	CY	\$462.81338	\$59,702.93
	QC/QA CONCRETE, CLASS QSC1, SUBSTRUCTURE (PIER ABOVE FOOTING)				
0022	898E20160	711.00	CY	\$350.00000	\$248,850.00
	QC/QA CONCRETE, CLASS QSC1, SUBSTRUCTURE (ABUTMENT INCLUDING FOOTING)				
0023		1.00	LS	\$253,740.00000	\$253,740.00
	SUBSTRUCTURE				
				Total for Group 0100: \$2,250,941.71	

WDP JOB#: ODTMP0030

JOB NAME: Prestressed I Beam Bridge With 2" Gap, Over Dick's Creek

BRIDGE: WAR-122-0094

CALCULATED BY: GDJ

CHECKED BY:

DATE: 07/13/05

DATE:

LIFE CYCLE COST

Interest Rate = 3.50%

Item & Extension	Description	2008 Costs	# Years Till	Future Costs
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Sealing of Structure

512E10100	Sealing of Concrete Structures (Epoxy-Urethane)	\$18,720	15	\$31,363
		\$18,720	30	\$52,543
		\$18,720	45	\$88,028
		\$18,720	60	\$147,478
		\$18,720	75	\$247,077
		Total = \$93,600		\$566,489

Rigid Overlay

848E10000	Micro Silica Concrete Overlay Using Hydrodemolition	\$55,441	20	\$110,316
		\$55,441	60	\$436,769
848E20000	Surface Preparation Using Hydrodemolition	\$53,105	20	\$105,668
		\$53,105	60	\$418,366
848E50100	Test Slab	\$1,000	20	\$1,990
		\$1,000	60	\$7,878
Total =		\$219,092		\$1,080,987

Deck Replacement

202E11200	Portions of Structure Removed	\$72,000	40	\$285,067
202E22900	Approach Slab Removed	\$28,541	40	\$113,001
509E10000	Epoxy Coated Reinforcing Steel	\$69,190	40	\$273,941
523E30000	Reinforced Concrete Approach Slabs (T = 17")	\$136,360	40	\$539,885
898E10200	QC/QA Concrete, Class QSC2, Superstructure (Deck)	\$207,350	40	\$820,953
898E11000	QC/QA Concrete, Class QSC2, Superstructure (Parapet)	\$33,000	40	\$130,656
Total =		\$546,441		\$2,163,502

Total = \$3,923,978

15% Contingency

Total Future Costs During Life Cycle of Bridge = \$4,512,600

WDP JOB#: ODTMP0030
 JOB NAME: Steel Beam Bridge With 2" Gap, Over Dick's Creek
 BRIDGE: WAR-122-0094

CALCULATED BY: GDJ
 CHECKED BY:

DATE: 07/13/05
 DATE:

LIFE CYCLE COST

Interest Rate = 3.50%

Item & Extension	Description	2008 Costs	# Years Till	Future Costs
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Sealing of Structure

512E10100	Sealing of Concrete Structures (Epoxy-Urethane)	\$10,575	15	\$17,717
		\$10,575	30	\$29,682
		\$10,575	45	\$49,727
		\$10,575	60	\$83,311
		\$10,575	75	\$139,575
Total =		\$52,875		\$320,012

Rigid Overlay

848E10000	Micro Silica Concrete Overlay Using Hydrodemolition	\$55,442	20	\$110,318
		\$55,442	60	\$436,777
848E20000	Surface Preparation Using Hydrodemolition	\$53,105	20	\$105,668
		\$53,105	60	\$418,366
848E50100	Test Slab	\$1,000	20	\$1,990
		\$1,000	60	\$7,878
Total =		\$219,094		\$1,080,997

Deck Replacement

202E11200	Portions of Structure Removed	\$72,000	40	\$285,067
202E22900	Approach Slab Removed	\$28,541	40	\$113,001
509E10000	Epoxy Coated Reinforcing Steel	\$68,402	40	\$270,821
526E30000	Reinforced Concrete Approach Slabs (T = 17")	\$136,360	40	\$539,885
898E10200	QC/QA Concrete, Class QSC2, Superstructure (Deck)	\$205,150	40	\$812,242
898E11000	QC/QA Concrete, Class QSC2, Superstructure (Parapet)	\$33,000	40	\$130,656
Total =		\$543,453		\$2,151,671

Painting of Structural Steel

514E00100	Surface Preparation of Existing Structural Steel	\$132,181	25	\$312,376
		\$132,181	45	\$621,562
		\$132,181	65	\$1,236,777
514E00200	Field Painting of Existing Structural Steel, Prime Coat	\$30,553	25	\$72,204
		\$30,553	45	\$143,671
		\$30,553	65	\$285,875
514E00300	Field Painting of Existing Structural Steel, Intermediate Coat	\$30,553	25	\$72,204
		\$30,553	45	\$143,671
		\$30,553	65	\$285,875
514E00400	Field Painting of Existing Structural Steel, Finish Coat	\$30,553	25	\$72,204
		\$30,553	45	\$143,671
		\$30,553	65	\$285,875
514E00504	Grinding Fins, Tears, Slivers On Existing Structural Steel	\$1,400	25	\$3,309
		\$1,400	45	\$6,583
		\$1,400	65	\$13,099
514E10000	Final Inspection Repair	\$8,100	25	\$19,142
		\$8,100	45	\$38,089
		\$8,100	65	\$75,789
Total =		\$700,020		\$3,831,979

Total = \$7,497,660

15 % Contingency

Total Future Costs During Life Cycle of Bridge = \$8,622,400

WDP JOB#: ODTMP0030

JOB NAME: Prestressed I Beam Bridge With 9' Gap, Over Dick's Creek

BRIDGE: WAR-122-0094

CALCULATED BY: GDJ

CHECKED BY:

DATE: 07/13/05

DATE:

LIFE CYCLE COST

Interest Rate = 3.50%

Item & Extension	Description	2008 Costs	# Years Till	Future Costs
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Sealing of Structure

512E10100	Sealing of Concrete Structures (Epoxy-Urethane)	\$20,655	15	\$34,604
		\$20,655	30	\$57,974
		\$20,655	45	\$97,127
		\$20,655	60	\$162,722
		\$20,655	75	\$272,616
Total =		\$103,275		\$625,044

Rigid Overlay

848E10000	Micro Silica Concrete Overlay Using Hydrodemolition	\$52,815	20	\$105,091
		\$52,815	60	\$416,081
848E20000	Surface Preparation Using Hydrodemolition	\$50,493	20	\$100,470
		\$50,493	60	\$397,788
848E50100	Test Slab	\$1,000	20	\$1,990
		\$1,000	60	\$7,878
Total =		\$208,616		\$1,029,299

Deck Replacement

202E11200	Portions of Structure Removed	\$70,000	40	\$277,148
202E22900	Approach Slab Removed	\$27,136	40	\$107,438
509E10000	Epoxy Coated Reinforcing Steel	\$71,170	40	\$281,782
523E30000	Reinforced Concrete Approach Slabs (T = 17")	\$129,360	40	\$512,170
898E10200	QC/QA Concrete, Class QSC2, Superstructure (Deck)	\$195,800	40	\$775,223
898E11000	QC/QA Concrete, Class QSC2, Superstructure (Parapet)	\$52,800	40	\$209,049
Total =		\$546,266		\$2,162,811

Total = \$3,924,592

15% Contingency

Total Future Costs During Life Cycle of Bridge = \$4,513,300

WDP JOB#: ODTMP0030
 JOB NAME: Steel Beam Bridge With 9' Gap, Over Dick's Creek
 BRIDGE: WAR-122-0094

CALCULATED BY: GDJ
 CHECKED BY:

DATE: 07/13/05
 DATE:

LIFE CYCLE COST

Interest Rate = 3.50%

Item & Extension	Description	2008 Costs	# Years Till	Future Costs
Sealing of Structure				
512E10100	Sealing of Concrete Structures (Epoxy-Urethane)	\$12,015	15	\$20,129
		\$12,015	30	\$33,724
		\$12,015	45	\$56,499
		\$12,015	60	\$94,655
		\$12,015	75	\$158,581
Total =		\$60,075		\$363,588

Rigid Overlay				
848E10000	Micro Silica Concrete Overlay Using Hydrodemolition	\$52,815	20	\$105,091
		\$52,815	60	\$416,081
848E20000	Surface Preparation Using Hydrodemolition	\$50,493	20	\$100,470
		\$50,493	60	\$397,788
848E50100	Test Slab	\$1,000	20	\$1,990
		\$1,000	60	\$7,878
Total =		\$208,616		\$1,029,299

Deck Replacement				
202E11200	Portions of Structure Removed	\$70,000	40	\$277,148
202E22900	Approach Slab Removed	\$27,136	40	\$107,438
509E10000	Epoxy Coated Reinforcing Steel	\$70,540	40	\$279,288
526E30000	Reinforced Concrete Approach Slabs (T = 17")	\$129,360	40	\$512,170
898E10200	QC/QA Concrete, Class QSC2, Superstructure (Deck)	\$193,600	40	\$766,513
898E11000	QC/QA Concrete, Class QSC2, Superstructure (Parapet)	\$52,800	40	\$209,049
Total =		\$543,436		\$2,151,606

Painting of Structural Steel				
514E00100	Surface Preparation of Existing Structural Steel	\$125,310	25	\$296,138
		\$125,310	45	\$589,253
		\$125,310	65	\$1,172,488
514E00200	Field Painting of Existing Structural Steel, Prime Coat	\$28,947	25	\$68,409
		\$28,947	45	\$136,119
		\$28,947	65	\$270,848
514E00300	Field Painting of Existing Structural Steel, Intermediate Coat	\$28,947	25	\$68,409
		\$28,947	45	\$136,119
		\$28,947	65	\$270,848
514E00400	Field Painting of Existing Structural Steel, Finish Coat	\$28,947	25	\$68,409
		\$28,947	45	\$136,119
		\$28,947	65	\$270,848
514E00504	Grinding Fins, Tears, Slivers On Existing Structural Steel	\$1,300	25	\$3,072
		\$1,300	45	\$6,113
		\$1,300	65	\$12,164
514E10000	Final Inspection Repair	\$8,100	25	\$19,142
		\$8,100	45	\$38,089
		\$8,100	65	\$75,789
Total =		\$664,653		\$3,638,378

Total = \$7,290,309

15 % Contingency

Total Future Costs During Life Cycle of Bridge = \$8,383,900

WDP JOB#: ODTMP0030
 JOB NAME: 3 Span Slab, 2" Gap in Bridges
 BRIDGE: WAR-122-0094

CALCULATED BY: GDJ
 CHECKED BY:

DATE: 07/17/05
 DATE:

LIFE CYCLE COST

Interest Rate = 3.50%

Item & Extension	Description	2008 Costs	# Years Till	Future Costs
------------------	-------------	------------	--------------	--------------

Sealing of Structure

512E10100	Sealing of Concrete Structures (Epoxy-Urethane)	\$15,030	15	\$25,180
		\$15,030	30	\$42,186
		\$15,030	45	\$70,676
		\$15,030	60	\$118,408
		\$15,030	75	\$198,374
Total =		\$75,150		\$454,825

Rigid Overlay

848E10000	Micro Silica Concrete Overlay Using Hydrodemolition	\$63,452	20	\$126,256
		\$63,452	60	\$499,880
848E20000	Surface Preparation Using Hydrodemolition	\$61,097	20	\$121,570
		\$61,097	60	\$481,327
848E50100	Test Slab	\$1,000	20	\$1,990
		\$1,000	60	\$7,878
Total =		\$251,098		\$1,238,900

Deck Replacement

202E11200	Portions of Structure Removed	\$87,000	40	\$344,456
202E22900	Approach Slab Removed	\$28,541	40	\$113,001
509E10000	Epoxy Coated Reinforcing Steel	\$244,664	40	\$968,688
523E30000	Reinforced Concrete Approach Slabs (T = 17")	\$136,360	40	\$539,885
898E10200	QC/QA Concrete, Class QSC2, Superstructure (Deck)	\$529,100	40	\$2,094,844
898E11000	QC/QA Concrete, Class QSC2, Superstructure (Parapet)	\$36,300	40	\$143,721
Total =		\$1,061,965		\$4,204,595

Total = \$6,011,322

15% Contingency

Total Future Costs During Life Cycle of Bridge = \$6,913,100

Appendix C

Bridge # WAR-122-0094 L/R Over Dicks Creek

Foundation Recommendations

Bridge No. WAR-122-0094 L/R Foundation Recommendations

I. INTRODUCTION

This project consists of designing a replacement structure for Bridge No. WAR-122-0094 L/R over Dicks Creek. The proposed new structures are recommended to be a single-span superstructure on semi-integral abutments. The proposed total width for the L & R structures is 144'-0" toe to toe of barrier. The existing structure is approximately 60 feet wide.

Foundation recommendations for these structures are based on 2 borings obtained by CTL for ODOT in June 2005. Boring H-1 was drilled near the rear abutment and H-2 was drilled near the forward abutment. Two borings were taken for the existing bridge. *There is a substantial variation noted in the soil profiles at borings H-1 and H-2. We recommend that four additional borings be obtained in step 8, to better define the subsurface profile. Note that for structures wider than 100 feet, ODOT Specifications for Subsurface Investigations recommends a minimum of two borings at each substructure unit.*

II. DISCUSSION

GENERAL:

In general, the subsurface profile consists of silty sand and gravel with cobbles over weathered shale with limestone interbedded in the shale bedrock. The top of weathered shale is at approximate elevation of 668 at H-1 and 684 at H-2. Competent bedrock was encountered at elevation 668 at the rear abutment and 679.5 at the forward abutment. The general overall subsurface conditions at this site could be described as very stiff material located at approximate elevation of 690 and competent bedrock is located at a variation in elevation of 670 to 680.

The following three types of foundations appear to be feasible for this structure. Spread footing, drilled shafts, and driven pile foundations. The bottom of footing elevation should be a minimum of 4 feet, normal to the 2 to 1 slope for footings on piles or drilled shafts and 5 feet below the flowline and on bedrock for a spread footing (BDM 204.3). Note that the existing bridge spread footings may not be supported on bedrock. The following is a discussion summary for each type.

SPREAD FOOTINGS:

The spread footing for the *rear abutment* could be founded on the silty sand and gravel layer, at or below elevation 684 and the *forward abutment* could be founded on the gray weathered shale material at or below elevation 684. Note that the existing spread footing is at a plan elevation of approximately 687. Standard Penetration Test N values are more than 50 blows per foot for both proposed abutment footing locations. *The recommended allowable bearing pressure is 4 tons per square foot for the very dense silty sand and gravel and 4 tons per square foot and for the gray weathered shale. If there is a desire to place the abutment*

Bridge No. WAR-122-0094 L/R Foundation Recommendations

spread footings lower to ensure that they are founded on bedrock, spread footing should not be considered as an economical alternative for this design.

Preliminary calculations by WD Partners indicate that the total abutment loads to the foundation are approximately 5600 kips (total load at each abutment, L & R together, when using a continuous footing for the eastbound structure and the westbound structure). Initial calculations/assumptions indicated that the footing width may be approximately 7 feet.

Depending on the exact location of the proposed structure, any interference with the existing abutment and footing will require removal of all or a portion of the existing substructure.

DRILLED SHAFTS:

Drilled shafts used to support the proposed bridge should be designed as end bearing drilled shafts. At this time for, estimating purposes, a minimum drilled shaft tip elevation of 674 is recommended for both abutments of the L & R bridges. After obtaining the additional requested borings, a more refined drilled shaft design length can be provided. The estimated required diameter for the drilled shafts is 48". The maximum spacing is anticipated to be 15 feet for the rear and forward abutments. ***The recommended allowable end bearing pressure is 30 tons per square foot.***

Depending on the exact location of the proposed structure, any interference with the existing abutment and footing will require removal of all or a portion of the existing substructure.

PILES:

A pile foundation for these structures would consist of HP 10x42 steel H piles. The piles should be driven to refusal in the relatively soft bedrock. Final tip elevations are estimated to be 680 at both abutments. The bottom of the pile cap should be set as stated above in the general section. Pile points are needed.

Depending on the exact location of the proposed structure, any interference with the existing abutment and footing will require removal of all or a portion of the existing substructure.

III. RECOMMENDATIONS

The foundation design recommendations for the substructures for these structures are as follows:

Abutments

1. We recommend supporting the proposed abutments on steel H piles driven to refusal in bedrock. The cost estimate indicates that this is a reasonable and economical design alternative. If HP10x42 piles are used, we recommend that the maximum pile load not exceed 55 tons per pile. If the final design consists of relatively short batter piles, the

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations

designer must evaluate the bending stresses caused by lateral loads to ensure the pile size chosen is not overstressed. Since there is a potential for boulders to be present and because there are limestone stringers present, pile points are recommended. Pile testing is not required.

2. The H pile estimated length (driven length) and the order length (furnished length) are 15' and 20', respectively.

General Recommendations:

1. The cost for a cofferdam will be relatively small for all alternatives.

Table 1: Preliminary Design Summary for Rear Abutment

Foundation Design Discussion of Alternative bridge types

Spread footing:

1. Footing elevation 684.0
2. The allowable bearing pressure for the spread footing is 4 tons per square foot.

Piling: Two rows of HP10x42 piles, maximum ultimate bearing value = 110 tons
 Estimated Length=15' Driven Length = 15'
 Order Length =20' Furnished Length = 20'

Drilled shafts:

1. The allowable end bearing resistance for the shale bedrock is 30 tons per square foot.
2. The allowable side friction resistance is neglected for the shale bedrock.
3. 48" diameter in soil and 42" diameter in the weathered shale

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations

Table 2: Preliminary Design Summary for Forward Abutment

Location	Forward Abutment				
Station of FA	STA 51+31.50 ±, Centerline bearing				
Borings	H-2 (STA 51+99, 35' RT)				
Substructure Type	Stub abutment on piles				
Footing Elevation	691.75 ft ±				
Vertical Load	5600 Kips (3000 Kips for East Bound (Left) and 2600 Kips for West Bound (Right))				
Water Table Elevation	689.50 ft ±				
Soil Type from boring A2	<p>704.5 ft existing surface elevation new roadway surface is to be at 709.57 +/-</p> <p>-----</p> <p>704.50 to 690.5– 14.0 ft of brown silty - Avg. N= 9</p> <p>-----</p> <p>690.5 to 685.0– 5.5' of brown silty clay Avg. N = 46</p> <p>-----</p> <p>685.0 ft top of bedrock From 685.0 to 679.5 ft – 5.5 ft of Gray weathered shale Below 679.5 feet cored shale –with limestone RQD is, 20% - 27%.</p>				
Bedrock Elevation	679.5 ft ± Medium Gray shale and some limestone.				
Proposed Foundation Type	Driven Piles				
<p>Foundation Design Discussion for Alternatives:</p> <p>Spread footing:</p> <ol style="list-style-type: none"> 1. Footing elevation 684.0 2. The allowable bearing pressure for the spread footing is 4 tons per square foot. <p>-----</p> <p>Piling: Two rows of HP10x42 piles, maximum ultimate bearing value = 110 tons</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Estimated Length=15'</td> <td style="width: 50%;">Driven Length = 15'</td> </tr> <tr> <td>Order Length =20'</td> <td>Furnished Length = 20'</td> </tr> </table> <p>-----</p> <p>Drilled shafts:</p> <ol style="list-style-type: none"> 1. The allowable end bearing resistance for the shale bedrock is 30 tons per square foot. 2. The allowable side friction resistance is neglected for the shale bedrock. 3. 48" diameter in soil and 42" diameter in the weathered shale 		Estimated Length=15'	Driven Length = 15'	Order Length =20'	Furnished Length = 20'
Estimated Length=15'	Driven Length = 15'				
Order Length =20'	Furnished Length = 20'				

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations

Note that the calculated cost is for both abutments.

Abutments on Piling

ITEM	UNITS	DESCRIPTION	CALCULATIONS	QUANTITY	2008 PRICE	TOTAL
505E11100	LUMP	PILE DRIVING EQUIPMENT MOBILIZATION				7,000
507E00200	FT	STEEL PILES HP10X42, FURNISHED	4x32x20'	2560	21	53,760
507E00250	FT	STEEL PILES HP10X42, DRIVEN	4x32x20'	2560	9	23,040
507E93300	EACH	STEEL POINTS OR SHOES	128	128	60	7,680
509E10000	POUND	EPOXY COATED REINFORCING STEEL	427x150	64,050	0.8	51,240
511E46500	CU YD	CLASS C CONCRETE, FOOTING	4x8'x120'x3'/27	427	260	111,020

\$253,740

Abutments on Drilled Shafts (Shaft Spacing = 15 feet)

ITEM	UNITS	DESCRIPTION	CALCULATIONS	QUANTITY	2008 PRICE	TOTAL
509E10000	POUND	EPOXY COATED REINFORCING STEEL	267x 150	40,050	0.8	32,040
511E46500	CU YD	CLASS C CONCRETE, FOOTING	4x5'x3'x120'/27	267	260	69,420
524E94906	FT	DRILLED SHAFTS, 48" DIAMETER, ABOVE & 42" INTO BEDROCK	36x18' above	648' (48" above rock)	\$375	243,000

\$344,460

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations**Abutments on Spread Footings**

ITEM	UNITS	DESCRIPTION	CALCULATIONS	QUANTITY	2008 PRICE	TOTAL
503	Lump	COFFERDAM		4	2000	8,000
509E10000	POUND	EPOXY COATED REINFORCING STEEL	818x150	122700	0.8	98,160
511E46500	CU YD	CLASS C CONCRETE, FOOTING	4x7'x3'x120'/27 & extra breastwall 4x5'x5'x120'/27	818	260	212,680

\$318,840

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations Evaluation Work Sheets for Type Study Alternatives

LOG OF BORING

Date Started 6/9/05 Sampler: Type SS Dia. 1.375" Project Identification: WAR-75-3.40
 Date Completed 6/13/05 Casing: Length 45ft Dia. 3.25" 04120056G
 Water Elev. 688.7ft S.R 122 Over Dick's Creek
 Surface Elev. 703.7ft Warren County, Ohio
 Boring No. H-1 Station & Offset 51+50.37' Lt.

Elev. (ft)	Depth (ft)	Std. Pen/ RCD	Rec. (ft)	Loss (ft)	Description	Sample No.	Physical Characteristics								ODOT Class
							% Agg	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	W.C.	
703.7	0														
703.7					SAND AND GRAVEL WITH COBBLES (FILL)										
702.7	1	4/4/4			BROWN CLAYEY SILT	1	5	5	9	47	34	28	10	12	A-4a
	2														
700.2	4	5/3/4			BROWN CLAYEY SILT	2								13	VIS
	6														
697.7	8	5/5/4			BROWN CLAYEY SILT	3								11	VIS
	10														
695.2	12	12/13/8			SILTY SAND AND GRAVEL WITH COBBLES	4								8	VIS
	14														
690.2	16	15/15/16			SILTY SAND AND GRAVEL WITH COBBLES	5	51	16	11	14	8			11	VIS
	18														
688.7	20	20/23/30			SILTY SAND AND GRAVEL WITH COBBLES	6								10	VIS
	22														
687.2	24	50-3"			SILTY SAND AND GRAVEL WITH COBBLES	7								8	VIS
	26														
685.7	28	50-4"			SILTY SAND AND GRAVEL WITH COBBLES	8									VIS
	30														
684.2	32	20/50-3"			SILTY SAND AND GRAVEL WITH COBBLES	9								13	VIS
	34														
683.2	36	10/16/30			SILTY SAND AND GRAVEL WITH COBBLES	10								8	VIS
	38														
681.7	40	40/50-4"			SILTY SAND AND GRAVEL WITH COBBLES	11								8	VIS
	42														
680.7	44	50-3"			SILTY SAND AND GRAVEL WITH COBBLES	12								7	VIS
	46														
678.2	48	44/50-4"			SILTY SAND AND GRAVEL WITH COBBLES	13								14	VIS
	50														
675.7	52	50-1"			SILTY SAND AND GRAVEL WITH COBBLES	14								15	VIS
	54														
673.2	56	50-3"			SILTY SAND AND GRAVEL WITH COBBLES	15								7	VIS
	58														
670.7	60	50-6"			SILTY SAND AND GRAVEL WITH COBBLES	16								10	VIS
	62														
668.7	64														

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.

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations

LOG OF BORING (Continued)

Project Identification: WAR-75-3.40

04120056G

Boring No. H-1

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.	
667.6		32%	4.8	0.2	SHALE (83%) MEDIUM GRAY	RC-1									VIS
	36				LIMESTONE (17%) LIGHT MEDIUM GRAY										
	38														
663.7	40	53%	4.8	0.2	SHALE (74%) DARK GRAY	RC-2									VIS
	42				LIMESTONE (26%) LIGHT AND DARK GRAY										
	44														
658.7															
BOTTOM OF BORING															

CTL OH DOT 2 04120056G WAR 75 H SP-3 CTL OH DOT 5 DT 8/20/05

Appendix C

Bridge No. WAR-122-0094 L/R Foundation Recommendations

LOG OF BORING

Date Started 6/14/05 Sampler: Type SS Dia. 1.375" Project Identification: WAR-75-3.40
 Date Completed 6/14/05 Casing: Length 35ft Dia. 3.25" 04120056G
 Boring No. H-2 Station & Offset S1+99.35' Rt. Water Elev. 689.5ft S.R 122 Over Dick's Creek
 Surface Elev. 704.5ft Warren County, Ohio

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.	
704.5	0				TOPSOIL (10")										VIS
704.5 703.7 703.5	2	3/3/2			BROWN SILTY CLAY	1								18	VIS
701.0	4	3/4/6			BROWN SILTY CLAY	2	5	6	15	37	37	38	18	24	A-6b
698.5	6	4/4/5			BROWN SILTY CLAY	3	8	6	11	32	43	36	15	20	A-6a
696.0	8	5/5/8			BROWN SILTY CLAY	4								21	VIS
691.0	14	33/23/23			BROWN SILTY CLAY	5								18	VIS
689.5	16	24/25/23			BROWN SILTY CLAY	6								14	VIS
688.0	18	11/25/37			BROWN SILTY CLAY	7								10	VIS
686.5	20	41/50-4"			BROWN SILTY CLAY	8								6	VIS
685.0	22	38/50-4"			GRAY WEATHERED SHALE	9								6	VIS
684.0	24	50-5"			GRAY WEATHERED SHALE	10									VIS
682.5	26	46/50-4"			GRAY WEATHERED SHALE	11								9	VIS
681.0	28	44/50-5"			GRAY WEATHERED SHALE	12								8	VIS
679.5	30	27%	4.7	0.3	SHALE (80%) MEDIUM GRAY	RC-1									VIS
674.5	32	20%	4.7	0.3	LIMESTONE (20%) LIGHT TO DARK GRAY	RC-2									VIS
669.5	34				SHALE (72%) DARK GRAY										VIS
	35				LIMESTONE (28%) LIGHT TO DARK GRAY										VIS

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.

Inter-Office
Communication

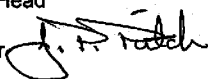
District 8 Production Administration
Office of Detailed Design Administration

DATE: February 28, 2005

TO: Gene Geiger, P.E., Administrator - Office of Geotechnical Engineering

ATTN: Chris Merklin, P.E., Design Resources Section Head

FROM: Jeffery P. Pietch, P.E., District Design Engineer



RE: WAR-75-3.40; PID 10754, Geotech Red Flag Summary

Enclosed is one copy of the Geotech Red Flag summary for the above referenced project as submitted by our consultant, WEC Ohio, Inc..

Please review the information and return any comments to this office by April 1, 2005.

If your office has any questions or requires additional information, please don't hesitate in contacting the consultant directly. Just copy me on any e-mails your office may send.

If you have any other questions regarding the submission, please contact this office.

JPP:jpp

Enclosure

c: Spinosa
Pietch w/copy
File





Engineers of Ohio, Inc.

Anthony Vitale, Sr., P.E. - E-46621

James E. Vitale, Ph.D.

Christopher M. Shea, P.E. - E-57985

Anthony G. Vitale

February 23, 2005

Mr. Michael C. Flynn, P.E., P.S. - District Deputy Director
The Ohio Department of Transportation - District 8
505 South State Route 741
Lebanon, OH 45036

Attn: Mr. Jeffery P. Pietch, P.E. - Project Manager

RE: WAR-75-3.40 - PID No. 10754
Geotechnical Red Flag Summary

Dear Jeff:

With this letter we are submitting 2 (two) copies of the Geotechnical Red Flag Summary for review and comment. Each of the 4 (four) appendices that supports the summary has its' own notebook. The summary was prepared by CTL Engineering, Inc. and reviewed by WEC prior to submission.

Sincerely,

W.E.C. Engineers of Ohio, Inc.

A handwritten signature in black ink, reading "Charles T. West". The signature is fluid and cursive, with the first name "Charles" and last name "West" clearly distinguishable.

Charles T. West, P.E. - Project Manager

ctw/CTW

Enclosures

cc: File, Central File, Doug Batt (CTL Engineering, Inc)

V:\WAR\10754\admin\docs\Letters\022305_jeff_pietch_redflag.doc

GEOTECHNICAL RED FLAG SUMMARY

WAR-75-3.40, PID NO. 10754

WARREN COUNTY, OHIO

CTL PROJECT NO. 04120056G

PREPARED FOR:

**W.E.C. ENGINEERS
3455 MILL RUN DRIVE, SUITE 310
HILLIARD, OHIO 43026**

PREPARED BY:

**CTL ENGINEERING, INC.
1451 S.R. 28 BUILDING B NORTH
LOVELAND, OHIO 45140**

FEBRUARY 18, 2005



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Soil Profile Warren County WAR-122-0.93, (Sheets 1-6), Soil Profile Warren County WAR-25-8.46, MOT-25-0.00 (Sheets 1-7), Soil Profile Warren County WAR-25-8.53, Sheet 9/10)	

1. PROJECT LOCATION AND DESCRIPTION

This project is located in Warren County, Ohio and involves the widening of Interstate 75 (IR 75) into the existing median and the reconfiguration of the SR 122 interchange with IR 75. The project begins approximately 0.70 mile south of SR 122 interchange and continues northward to the Warren County-Montgomery County line for an overall length of approximately 8.80 miles (see Appendix A, Topographic Map). The widening of IR 75 and reconfiguration of the SR 122 interchange will require the replacement and/or rehabilitation of 17 bridges/structures along with the construction of a new three-sided culvert near the new SR 122 interchange. Of the 17 structures identified for the project, 15 of the structures will either be replaced with new structures or widened. The remaining 2 bridges will require deck replacement along with other miscellaneous superstructure work.

In addition to the new and widened structures, the project will also include the reconfiguration of the SR 122 interchange per the Interchange Modification Study (IMS), prepared by URS and dated December 2003. The IMS recommends adding new northbound exit and entrance ramps, providing additional lanes on the southbound ramps and widening SR 122 from Towne Boulevard (west) to Union Road (east) the roadway.

2. GEOLOGY

The project site lies within the Southern Ohio Loamy Till Plain (Physiographic Regions of Ohio, Ohio Department of Natural Resources, 1998). The mapping of these glacial soils (see Appendix A, Surficial Glacial Geology of the Ohio Portion of Cincinnati and Falmouth 30 x 60 Quadrangles, Ohio Department of Natural Resources, 1998 and Surficial Glacial Geology of the Ohio Portion of the Dayton 1:100,000 Quadrangle) indicates the overburden soils in this region are formed primarily in Wisconsin-age glacial tills and ground moraines. These glacial soils are consist of unstratified layers of intermixed clay, silt, sand, and gravel whose composition of these materials varies both laterally and vertically. In addition, a buried valley of glacial outwash consisting of sand and gravel interbedded with glacial till is located where IR 75 crosses Clear Creek. The glacial soils are typically overlain by a layer of silty soil, referred to as loess, on the order of 3 to 5 feet thick.

The soil overburden is underlain by Ordovician-age sedimentary rock consisting of interbedded shale and limestone (see Appendix A, Bedrock Geology of the Monroe, Franklin, Springboro Quadrangles, Ohio Department of Natural Resources, 1994). The rock formations mapped along the project corridor along with their relative composition of interbedded shale and limestone consist of the following as mapped from south to north of the project limits:

- Grant Lake Formation (50% limestone, 50 % shale),
- Arnheim Formation (60% shale, 40% limestone),
- Waynesville Formation (70% shale, 30% limestone)

- Fairview Formation-Miamitown Shale undivided (Fairview- 50% limestone, 50% shale / Miamitown Shale- 90% shale, 10% limestone)
- Drakes-Whitewater-Liberty undivided (Drakes- 90% shale, 10% limestone / Whitewater- 60% shale, 40% limestone / Liberty- 50% limestone, 50% shale)

In general, the rock encountered in this formation is similar and is typically distinguished by some or all of the following features: ratio of shale and limestone within the formation; thickness of shale or limestone beds; the type of bedding observed. The general description of these formation are described as shale gray to bluish gray or maroon (Drakes-Whitewater-Liberty only), weathers to light gray and/or yellowish gray, nodular, wavy, irregular, planar or lenticular (Fairview only), bedding that is thin, medium to thick.

Mapping of the bedrock topography (see Appendix A, Bedrock Topography of the Monroe, Franklin, Springboro Quadrangles, Ohio Department of Natural Resources, 1994) indicates the elevation of the rock surface ranges from about 725 feet at the southern limit of the project corridor and continues to rise to about 925 feet at the northern limit. The exception is where Shake Road crosses IR 75, south of the IR 75/SR 123 interchange, where the rock surface begins fall in elevation from about 800 feet to about 550 feet at Clear Creek. The rock elevation rises as the project continues northward to the northern limit at the Montgomery County line. It should be noted the referenced mapping utilizes 50-foot contours, which are interpolated from topographic surface features, and widely spaced data points where water wells have encountered rock.

Based on the mapping, the depth to rock is very shallow at the southern end of the project where it is less than 50 feet as indicated by wells encountering rock near the project corridor and outcrops near the North Branch of Dicks Creek. The thickness of the soil overburden increases as the project continues northward from the North Branch Dicks Creek where it reaches its maximum thickness on the order of 150 feet at Clear Creek. As the project continues north from Clear Creek, the depths to rock decrease to less than 20 feet south of where Pennyroyal Road crosses IR 75. The depth to rock is typically less than 50 feet from this point to the northern limit of the project at the Montgomery County line.

According to the Ground Water Resources of Warren County, Ohio Department of Natural Resources, 1996, (see Appendix A) the majority of the project corridor yields ground water from wells in the underlying interbedded shale and limestone. The description indicates the source of water is poor and is typically on the order of less than 3 gallons per minute (gpm). The exception is where the project approaches and crosses Clear Creek. Near the immediate area of Clear Creek the source of water is derived from sand and gravel overburden where yields are on the order of 10 to 25 gpm where the sand and gravel layers are the thickest.

3. ORIGINAL CONSTRUCTION PLAN OBSERVATIONS

The following table summarizes the information reviewed by CTL.

Table 1. Summary of Reviewed Historical ODOT Information

Roadway	Project	Type of Work	Date	Notes
IR 75	WAR-75-3.40	Subsurface Investigation Report	2003	Soil Profile for Roadway Widening (median) of IR 75
IR 75 (US 25)	WAR-25-3.50	Soil Profile Drawings	1957	Soil Profile for Original Construction of IR 75 (US 25) from about 3,300 ft South of SR 122 to about 1,400 ft North of SR 123
SR 122	WAR-122-0.93	Soil Profile Drawings	1964	Grade Improvement for Four Sections of SR 122, East of IR 75, from about
IR 75 (US 25)	WAR-25-8.46 MOT-25-0.00	Soil Profile Drawings	1957 / revised 1958	Soil Profile for Original Construction of IR 75 (US 25) from north of SR 123 to Warren Co. / Montgomery Co. Line
IR 75 (US 25)	WAR-8.53 MOT-25-0.00	Soil Profile Drawing	1957	Soil Profile for Original Construction of IR 75 (US 25) from to Warren Co. / Montgomery Co. Line
IR 75 (US 25)	WAR-25-3.46	Original Structure and Roadway Construction Plans	1958	Plan and Profile of Structures along IR 75 with noted foundations types, elevations and, where applicable, estimated pile lengths
IR 75 (US 25)	WAR-25-8.48 MOT-25-0.00	Original Structure and Roadway Construction Plans	1958	Plan and Profile of Structures along IR 75 with noted foundations types, elevations and, where applicable, estimated pile lengths

A summary of the findings of the subsurface investigation report for the widening of IR 75 (see Appendix B, Subsurface Investigation Report WAR-75-3.40, PID# 10754, dated November 28, 2003 and prepared by Resource International, Inc.) are as follows:

- The soil subgrade for the roadway widening is predominantly sandy silts (A-4a) silt and clay (A-6a).
- Silt (A-4b) was encountered within 2 feet of the existing subgrade at 4 of the 6 test boring locations where the A-4b soils were encountered.
- Soils with a natural moisture content at 3 percent or more above optimum, as estimated by GB-1 guidelines (July 2003), were encountered within the upper 4 feet of the existing subgrade in 31 of the 117 test borings.
- Rock was encountered within the upper 5 feet of the existing subgrade in 15 of the 117 test borings drilled. The locations and corresponding depths are summarized in Table 2 below.

Table 2. Summary of Depths to Rock at Test Boring Locations

Test Boring No.	Station	Depth to Rock, ft
B-3	196+00, 32' Rt	2.7
B-62	200+00, 32' Lt	2.8
B-10	252+00, 19' Rt	4.0
B-11	260+00, 32' Rt	2.8

Test Boring No.	Station	Depth to Rock, ft
B-70	264+00, 32' Lt	4.0
B-12	269+00, 19' Rt	4.0
B-13	277+00, 19' Rt	4.3
B-71	273+00, 19' Lt	2.5
B-15	293+00, 32' Rt	4.5
B-19	325+00, 32' Rt	5.0
B-78	329+00, 32' Lt	2.5
B-20	333+00, 19' Rt	3.0
B-27	389+00, 32' Rt	5.5
B-86	393+00, 32' Lt	3.5
B-28	397+00, 19' Rt	4.0

The pavement design parameters recommended for the majority of the project were a CBR value of 6 and a soil support value of 4.4. These values were reduced to a lower CBR ranging from 2 to 5 and a SSV ranging from 2.6 to 3.8 at the following test boring locations.

- Southbound 256+00, 19' Left
- Southbound 273+00, 19' Left
- Southbound 281+00, 32' Left
- Northbound 301+00, 19' Right
- Southbound 164+00, 92.5' Left
- Southbound 196+00, 92.5' Left
- Southbound 204+00, 79.5' Left

OGE CBR
set @ 8

The subsurface investigation report noted that approximately 27 percent of the subgrade soil within the upper 4 feet of the existing subgrade surface would require subgrade stabilization. A summary of the primary types of stabilization described for the IR 75 roadway widening follows:

- The stabilization method for 11 percent of the roadway length would be to proofroll, undercut to a depth of 6 inches to 1 foot, and backfill with Type B or C granular material and geotextile, or stabilize to a depth of 12 inches with cement or lime).
- The next prevalent method of stabilization required proofroll, undercut to a depth of 1 foot to 3 feet, and backfill with Type B or C granular material and geotextile, or stabilize to a depth of 16 inches with cement or lime (6 percent).
- For 3 percent of the roadway length, undercut existing rock to a minimum depth of 24 inches and replace with compacted engineered fill.

For further details regarding the types of stabilization and the corresponding sections of the roadway are presented in Tables 8 and 9 of Appendix B.

The original construction drawings for the plan and profile of the bridge structures indicates piles

were used to support the abutments and piers except for the following substructure units.

Structure and Substructure Unit	Foundation Type
IR 75 over Dicks Creek - Pier #1 and #2	Spread footing
IR 75 over SR 123 – Abutments A, B, C, D	Spread footing
IR 75 over SR 73 – Abutments and Piers	Spread footing
Pennyroyal Bridge over IR 75 – Piers #2 and #3	Spread footing

4. DISTRICT NOTATIONS

CTL contacted representatives with the Warren County Engineer's Office (Mr. Kurt Webber, Chief Deputy Engineer and Mr. Jim Apking, Deputy of Operations). The Warren County Engineer's office did not indicate construction issues or maintenance problems with for roadways within the project corridor.

At the time this report was prepared CTL was unable to contact a representative with ODOT familiar with the historic maintenance of the project corridor, however, CTL anticipates future correspondence with ODOT District 8 and issuing a follow-up letter summarizing ODOT's historical experience with maintenance problems or construction issues.

5. FIELD RECONNAISSANCE REVIEW

The field review consisted of making observations of the project corridor. Mr. Doug Batt with CTL performed a field reconnaissance during December, 2004 and January-February, 2005. The filed reconnaissance was limited to the existing right-of-way except for observations made along Dicks Creek where the proposed northbound IR 75 exit ramp crosses its tributaries. The proposed roadway widening will be into the existing grass median. Additional properties are being evaluated for roadway improvements. Under separate cover, CTL prepared a preliminary Environmental Site Assessment (ESA) screening for 28 parcels located within the proposed right-of-way. The land use for these parcels consisted of residential (15), commercial (2), undeveloped land (11).

The IR 75 mainline structures and corresponding embankments and/or cut slopes were observed for signs of geotechnical concerns. In addition the grass median where the proposed roadway widening, along with the new IR 75 / SR 122 interchange ramps were also observed for geotechnical concerns. The following concerns were noted:

Standing Water

Limited sections of ditch or drainage swales, typically less than 50 feet in length, were observed with standing water. The following areas were noted at the following locations:

1. Existing drainage swale along the east side of IR 75 northbound, south of the existing exit ramp to SR122.
2. Isolated areas within the existing infields of the SR 122 exit and entrance ramps
3. Along the outside shoulders of SR 73 between northbound and southbound IR 75 bridges



4. Existing drainage swale within the center grass median at the following locations:
- Approximately 1 to 1-1/2 miles south of SR 123;
 - Approximately 200 feet north of Clear Creek;
 - Inside median and outside shoulder drainage swales south and north of Pennyroyal Road overpass.

The surrounding ground surface in these areas appeared to be very soft as evidenced by deep tire ruts from vehicles driving off the shoulder.

Erosion

Erosion of the ground surface or slopes was noted at the following locations:

1. The south abutment slope leading from the median sloping down to SR 123. The corrugated metal pipe from the catch basin inlet is exposed due to the erosion. Erosion was also noted around the concrete apron leading to the catch basin inlet. The concrete apron was also severely cracked and appeared to have settled. Debris was noted within catch basin.
2. East of the IR 75 / SR122 interchange, south of SR 122, along southern stream bank of Dicks Creek, immediately southwest of the bridge and below the adjacent Ramada Inn parking lot.

Scour

Localized scour was noted at each of the north and south piers of the existing IR 75 northbound and southbound bridges at Dicks Creek and Clear Creek.

6. SUMMARY OF GEOTECHNICAL ISSUES

Based on the information reviewed and the conditions observed during the field reconnaissance, the most significant geotechnical concern are: 1) the poor subgrade materials within the existing median and 2) poor drainage with the existing grass median and outside shoulders at SR 73. It was also noted that rock was encountered at a relatively shallow depth. Roadway drainage systems and possibly pavements may encounter rock during construction.

The following is the checklist for the geotechnical red flag summary.

Red Flag Summary Checklist

	Design Issues	Comments
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there evidence of soil drainage problems (e.g., wet or pumping subgrade, standing water, the presence of seeps, wetlands, swamps, bogs)?	During and after periods of precipitation, standing water was noted in the IR 75 median at locations typically at or near the near drain inlets. Other isolated locations of very soft subgrade and standing water were noted within the IR 75 median, along the outside shoulders of SR73 and in the infields of the existing exit and entrance ramps at the IR75 / SR122 change.

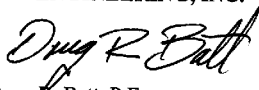
	Design Issues	Comments
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there evidence of any embankment or foundation or foundation problems (e.g. differential settlement, sag, foundation failures, slope failures, scours, evidence of channel migration)?	No obvious evidence, that can be attributed to foundation problems, was noted at the existing structures. Erosion was noted at isolated areas on the SR123 south abutment slope. The drain inlet may be clogged. Also localized scour was noted at the north and south piers at the IR 75 bridge piers over Dicks Creek and Clear Creek. Erosion of the Dicks Creek south stream bank was noted below the Ramada Inn parking lot immediately south of the SR 122 bridge as the stream turns south.
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there evidence of any landslides?	No obvious evidence of landslides was noted in the embankment or cut slopes.
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there evidence of unsuitable materials (e.g. presence of debris or man-made fills or waste pits containing these materials, indications from old soil borings)?	No evidence of unsuitable material was observed within the project corridor.
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there evidence of rock strata (e.g., presence of exposed bedrock, rock on the old soil borings)?	Rock was encountered in 15 test borings within the upper 5 feet as presented in the subsurface investigation report dated 11/28/03 (see Appendix B).
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there evidence of active, reclaimed, or abandoned surface mines?	No evidence of present or past surface mining activities is reported within the project corridor.
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Is there information pertaining to the existence of underground mines?	No information indicated the existence of underground mines within the project corridor.
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Are soil borings needed for pavement design, foundations, (bridge, headwall, retaining wall, noise wall) or slopes?	A subsurface investigation report was prepared for the mainline widening of IR 75 (see Appendix B). ODOT has selected a pavement design. Subsurface investigations are planned for the widening of structure foundations, widening of SR 122, and new exit and entrance ramps for the IR75 / SR122 interchange.
<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Does an undercut appear to be needed?	The subsurface investigation report indicates undercutting and backfilling with granular material and geotextile will be required.
<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Should the Office of Geotechnical Engineering be contacted to evaluate the project site?	OGE GB-1 guidelines have been updated (July 2004) since the issuance of the subsurface investigation report. The recommendations may be affected by the updated guidelines and as a result may affect the selected stabilization methods and/or selected pavement design.
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Possible <input type="checkbox"/> Not Applicable	Are there any other geotechnical issues?	No other geotechnical issues were observed. As additional information from the supplemental subsurface investigation for the structures, SR 122 widening, and IR 75 / SR 122 interchange exit and entrance ramps becomes available additional concerns may require evaluation.

7. CLOSING

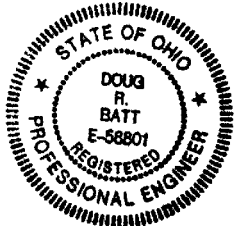
CTL Engineering, Inc. has prepared this report for your use in accordance with generally accepted soil and foundation engineering practices. Analysis, conclusions and other work product of CTL Engineering, Inc. are instruments of service for this project only.

Respectfully Submitted,

CTL ENGINEERING, INC.



Doug R. Batt, P.E.
Project Manager
Licensed Ohio #E-58801





Ohio Department of Transportation
Inter-Office Communication
Office of Geotechnical Engineering
Design Resources Section

Date: February 5, 2004
To: William R. Davis, P.E., District 8 Pavement Planning Engineer
From: William L. Christensen, P.E., Geotechnical Engineer
Subject: WAR - 75 - 3.40, PID 10754, Subsurface Investigation Report

We have completed our review of the subject project. For this review we had the following information:

- Subsurface Investigation Report, dated November 28, 2003, by Resource International, Inc. (RII), received on December 3, 2003
- Addendum 1, Subsurface Investigation, dated January 14, 2004, by RII, received on January 26, 2004

We understand this project to involve the rehabilitation and widening of an 8.76 mile section of IR 75 in Warren County. The project will provide an additional lane in each direction in the median.

This Pre-Stage 1 review is being performed for the pavement design process (Step 7). All subsequent Stage submissions should be submitted for review.

For this review we have initiated the applicable sections of the Geotechnical Engineering Design Checklist, and presented our PE Stage comments on the checklists. It is noted that in this stage of design some questions or subjects may not be far enough along in design to complete the checklist, for example, Plan Notes. We expect all geotechnical design issues to be adequately addressed by Stage 2 design submission, at which time this checklist will be completed.

Please submit the Stage 1 plans, with a completed soil profile, for a review by our Office.

Feel free to contact us if you have any questions about the above information.

WLC 

Attachment

c: W.L. Christensen - Reading File - File

II. Reconnaissance and Planning Checklist

C-R-S: WAR - 75 - 3.40	PID: 10754	Reviewer: WLC	Date: 01/28/04
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All projects must establish the geologic setting and identify possible geologic hazards that may exist in the project area prior to preliminary design. This Reconnaissance and Planning Checklist should be followed as a guide to establishing the above conditions.

<p><input checked="" type="checkbox"/> <input type="checkbox"/> N 1 Has the "Planning and Reconnaissance" section of the ODOT <u>Specifications for Subsurface Investigations</u> been followed?</p> <p>2 Have the following ODOT sources of geotechnical information been reviewed:</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> N <input checked="" type="checkbox"/> X a past construction plans, including soil profile sheets</p> <p><input type="checkbox"/> Y <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> X b past project construction diaries</p> <p><input type="checkbox"/> Y <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> X c interviews with people knowledgeable of the project site</p> <p><input type="checkbox"/> Y <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> X d boring logs on file with the OGE Operations Section</p> <p><input type="checkbox"/> Y <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> X e past District and County Garage maintenance records</p> <p><input type="checkbox"/> Y <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> X f field reconnaissance</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> N 3 Has ODNr geotechnical information been reviewed and incorporated into the project design information:</p> <p>Indicate which references were reviewed:</p> <p><input checked="" type="checkbox"/> "Bedrock Geologic Map(s)"</p> <p><input checked="" type="checkbox"/> "Bedrock Topography Map(s)"</p> <p><input type="checkbox"/> "Known and Probable Karst in Ohio"</p> <p><input type="checkbox"/> "Soil Survey(s)"</p> <p><input type="checkbox"/> Ohio Wetland Inventory Map</p> <p><input type="checkbox"/> aerial photographs</p> <p><input type="checkbox"/> boring logs <input type="checkbox"/> water well logs</p> <p><input checked="" type="checkbox"/> Other _____ List Other items: _____</p> <p><input type="checkbox"/> Y <input checked="" type="checkbox"/> 4 Has information regarding the possible existence of geologic hazards in, or adjacent to, the project area been requested and obtained from individuals in the project area?</p> <p>Indicate which individuals were consulted:</p> <p><input type="checkbox"/> ODOT construction and maintenance employees</p> <p><input type="checkbox"/> ODOT employees (active or retired) who were involved with the original construction?</p>	<p>WAR-25-3.46, WAR-25-8.48-3.46, MOT-25-0.00</p> <p>Springboro, Franklin, and Monroe Quadrangles in Montgomery and Warren Counties.</p> <p><input type="checkbox"/> "Bedrock Structure Map(s)"</p> <p><input type="checkbox"/> "Geologic Map of Ohio"</p> <p><input type="checkbox"/> "Quaternary Geology of Ohio"</p> <p><input type="checkbox"/> National Wetland Inventory Map</p> <p><input type="checkbox"/> Report of Investigations</p> <p><input type="checkbox"/> measured geologic section(s)</p> <p><input type="checkbox"/> Bulletins <input type="checkbox"/> Information Circulars</p> <p>"Ground Water Pollution Potential Report of Warren County, Ohio"</p>
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II. Reconnaissance and Planning Checklist

		<input type="checkbox"/> current, former, adjacent landowner(s) <input type="checkbox"/> County Engineer / County employees <input type="checkbox"/> Township Trustees and employees <input type="checkbox"/> local planning and zoning officials <input type="checkbox"/> City or Village officials <input type="checkbox"/> local geotechnical experts <input type="checkbox"/> Other _____	
Y	N	<input checked="" type="checkbox"/>	5 Has information pertaining to the existence of underground mines within, or adjacent to, the project area (requested from the District AUMIRA Coordinator, DMRM, and DGS) been reviewed?
Y	N	<input checked="" type="checkbox"/>	6 Has the information from DMRM and DGS been reviewed regarding the existence of active, reclaimed, or abandoned surface mines within, or adjacent to, the project areas?
Y	N	<input checked="" type="checkbox"/>	7 Has the "Known and Probable Karst in Ohio" map been reviewed during investigations?
Y	N	<input checked="" type="checkbox"/>	8 Has the DGS been consulted regarding the documented existence of Karstic conditions within, or adjacent to, the project area?
Y	N	<input checked="" type="checkbox"/>	9 Has the potential for rockfall from proposed cuts or existing rock slopes been evaluated?
Y	N	<input checked="" type="checkbox"/>	10 Has the USGS Open File Map Series # 78-1057 entitled "Landslides and Related Features" (Available from DGS) been reviewed during investigations?
Y	<input checked="" type="checkbox"/>	X	11 Has any of the geotechnical information gathered in Question 3, indicated the potential presence of lake bed sediments, organic soil, or peat deposits?
			12 Identify the geologic features that should be further investigated on this project:
			<input type="checkbox"/> Landslide <input type="checkbox"/> Wetland or Peat <input type="checkbox"/> Fractures / Faults in exposed rock faces <input type="checkbox"/> Rockfall <input type="checkbox"/> Karst <input type="checkbox"/> Underground Mine <input type="checkbox"/> Surface Mine

Report does not state as such.

Notes:

PE Stage: We filled out this part of the Geotechnical Engineering Design Checklist using RII's Subsurface Investigation Report, dated November 28, 2003. We may have missed sources that the consultant used, but did not reference. The consultant should review this checklist and submit any necessary modification in an addendum or revised report.

III.C. Subgrade Checklist

C-R-S: WAR - 75 - 3.40	PID: 10754	Reviewer: WLC	Date: 02/05/04
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If you do not have any subgrade work on the project, you do not have to fill out this checklist.

<input checked="" type="checkbox"/> N X	1	Has the subsurface investigation adequately characterized the soil or rock in accordance with the <u>Specifications for Subsurface Investigation</u> ?	117 borings (59 pavement, 58 median)
Y <input checked="" type="checkbox"/> X	2	If soils classified as A-2-5, A-4b, A-5, or A-7-5 are present at the proposed subgrade (soil profile), do the plans specify that these materials need to be removed and replaced?	Only A-4b was found on the project in 2.6% of the top four feet. A-2-5, A-5, and A-7-5 was not found. By cement stabilizing the subgrade (see Note # 2), any A-4b will be stabilized rather than removed. No plan to review.
<input checked="" type="checkbox"/> N X	a	If these materials are to be removed and replaced, have the station limits, depth, and lateral limits for the planned removal been provided?	Table A-1 of Appendix 1. A-4b area shall be removed to a depth of 3 feet, not 2 feet. Replacement material should meet 203.
Y <input checked="" type="checkbox"/> X	3	If there is any rock, shale, or coal present at the proposed subgrade (CMS 204.01), do the plans specify the removal of the material?	Shale was found on the project in 1.7% of the top four feet. No plan to review.
<input checked="" type="checkbox"/> N X	a	If removal of any rock, shale, or coal is required, have the station limits, depth, and lateral limits for the planned removal of the material at proposed subgrade been provided?	Table A-1 of Appendix 1. We concur with these limits. Replacement material should meet 203.
<input checked="" type="checkbox"/> N X	4	In accordance with the <u>Geotechnical Bulletin 1: Plan Subgrades (GB1)</u> , do the SPT, moisture contents, or PI values for proposed subgrade soils indicate the need for subgrade removal or treatment?	26.5% of the top four feet had excess moisture. 32.5% of the top four feet had a $N \leq 10$.
Y <input checked="" type="checkbox"/> X	a	If removal and replacement is applicable, has the detail of subgrade removal been shown on the plans, including depth of removal, station limits, lateral extent, replacement material, and plan notes?	Table A-1 of Appendix 1. The areas listed in this table amount to around 33% of the project. We generally concur with these limits. No plans to review.
Y <input checked="" type="checkbox"/> X	5	If a subgrade treatment is applicable, has the detail of subgrade treatment been shown on the plans, including depth of treatment, percentage of treatment materials, station limits, lateral extent, and plan notes?	Cement stabilization should be considered, see Note #2 below. No plan to review.
Indicate type of subgrade treatment specified:			
<input type="checkbox"/> cement treatment <input type="checkbox"/> lime treatment			Cement stabilization should be considered, see Note #2 below.
<input type="checkbox"/> other _____			

III.C. Subgrade Checklist

Y <input checked="" type="checkbox"/> X	6 If drainage or groundwater is an issue with the proposed subgrade, has an appropriate drainage system (e.g., pipe, underdrains) been provided?	Report does not mention groundwater to be an issue. No plan to review.
Y <input checked="" type="checkbox"/> X	7 Has an appropriate quantity of Proof Rolling been included in the plans (CMS 204.06)?	No plan to review.
<input checked="" type="checkbox"/> N X	8 Has a design CBR value been provided?	Addendum 1 of the report recommends a design CBR of 8. We concur.

Notes:

- PE Stage: 1. The average lower N is 18 blows per foot, so the soil is considered to be stiff enough for Rubblize and Roll.
2. In the report, approximately 33 percent of the widened portion is recommend for subgrade stabilization because of high moisture (See Question #5.a). We would also recommend stabilization of all areas with a N_L less than 10, which would increase this removal percentage. GB1 Section D states that if 30 percent or more of the subgrade needs to be stabilized, design should consider stabilizing the entire subgrade.

Since it is recommended to stabilize 33 percent of the median, we recommend performing a cost analysis for the stabilization of the entire median area according to GB1 Section D. Since the average Plasticity Index for this project is 10, the chemical stabilization option for this project is Cement Stabilized Subgrade (804).

If cement stabilization is chosen:

- The average N_L for the median would have to be calculated to determine the depth according to GB1 Table B.
- Refer to Section H of GB1 for details on setting up a Cement Stabilized Subgrade.
- The shale will have to be removed and replaced with 203 material prior to the cement stabilization.

Bill Christensen

01/08/04 12:24 PM

To: William Davis/Highway/D08/ODOT

cc:

Subject: WAR - 75 - 3.40, PID 10754, Pavement Selection Information

Bill --

Based on information contained in the 11/28/03 Resource International, Inc. (RII) Report and additional information provided by David Vovak of RII, we can make the following recommendations for the subject project's pavement selection:

1. The design CBR for this project is 8.
2. With an overall lower N average of 15.4 and a lower N average of 18 under the existing pavement, Rubblize and Roll is a rehabilitation option for this project.

Feel free to contact me if you have any questions about the above information.

Later,
Bill

=====
William L. Christensen, P.E.
Geotechnical Engineer
Office of Geotechnical Engineering
Voice: 614-275-1367 FAX: 614-887-4084
E-Mail: wchrste@dot.state.oh.us
Web: www.dot.state.oh.us/geotechnical/
=====



davidv@resourceinter
national.com

01/08/04 11:46 AM

To: Bill.Christensen@dot.state.oh.us

cc: joec@resourceinternational.com, nikhilk@resourceinternational.com,
samk@resourceinternational.com, krisl@resourceinternational.com

Subject: RE: GB1 Spreadsheet

Bill,

As per you request, I have tabulated the average CBR values for the project on the attached table. Note that the report reflected approximately the 90th percentile. As discussed, this information will follow formally via an addendum letter to District 8.

The addendum letter will also include a station by station guide of the required stabilization.

District 8 should receive this addendum early next week. The plan and profile sheets will include the stabilization recommendations included in the addendum. These plans are in process and will be submitted upon completion.

David M. Vovak, P.E.
Director - Geotechnical Engineering
Resource International, Inc.
9885 Rockside Road, Suite 145
Cleveland, Ohio

Phone: 216/573-6350
Fax: 216/573-6330
Mobile: 216/287-3838
Direct: 614/797-9534

-----Original Message-----

From: Bill.Christensen [mailto:Bill.Christensen@dot.state.oh.us]
Sent: Wednesday, January 07, 2004 8:57 AM
To: David Vovak
Subject: GB1 Spreadsheet

David --

Here is the spreadsheet that we use for analyzing subgrades.

I have added you to an E-mail list and will send you any updates to this spreadsheet.

Later,
Bill

=====
William L. Christensen, P.E.
Geotechnical Engineer
Office of Geotechnical Engineering
Voice: 614-275-1367 FAX: 614-887-4084
E-Mail: wchriste@dot.state.oh.us
Web: www.dot.state.oh.us/geotechnical/
=====

Section	NB Borings (B-#)	SB Borings (B-#)	Station A	Station B	Average CBR
1	1-7	60-65	180+00	230+00	8.5
2	8-26	66-85	230+00	387+00	7.5
3	27-32	86-91	387+00	435+00	7.5
4	33-53	92-112	435+00	166+00	8.5
5	54-59	113-117	166+00	208+31	7.5
Project					8.0



Ohio Department of Transportation
Inter-Office Communication
Office of Geotechnical Engineering
Design Resources Section

Date: December 12, 2003
To: William R. Davis, P.E., District 8 Pavement Planning Engineer
From: William L. Christensen, P.E., Geotechnical Engineer
Subject: WAR - 75 - 3.40, PID 10754, Subsurface Investigation Report

We have completed a cursory review of the subject report. For this review we only had the Subsurface Investigation Report by Resource International, Inc., received on December 3, 2003.

The subsurface investigation was performed according to GB1, but, with this submission, not all requirements of GB1 have been met. According to the Introduction of GB1:

The Designer, based on the subsurface investigation, is responsible for identifying the method, location, and dimension (including depth) of subgrade stabilization in the plans. When the stabilization or a mixture of stabilization options will be used in spot locations, the limits of the stabilization areas should be established by the Designer, by analyzing the data from the individual borings.

Assuming Resource International is the designer, they need to meet the requirements of GB1. This report fails to:

1. *Identify the Specific Method(s) of Subgrade Stabilization:* The designer proposes every alternative in GB1. They need to make an engineering decision on which one(s) to specifically use and how deep.
2. *Identify the Limits and Depths of the Stabilization:* The designer does not give the Station limits or specific depths of their recommended stabilization methods. The designer does not have to give the Station limits of the areas that do not need any type of stabilization. These Station limits should also include the A-4b and Rock/Shale areas that need to be removed and replaced.

Once the designer updates the subject report, including specific recommendations, according to this IOC and GB1, we will be able to perform a complete review.

Feel free to call us if you have any questions.


WLC:CM

c: W.L. Christensen - Reading File - File

inter-office communication



Ohio Department Of Transportation District 8 Planning & Programs Department

TO: Gene Geiger, P.E., Administrator, Office of Geotechnical Engineering

DATE: December 2, 2003

FROM: William R. Davis, P.E., District 8 Pavement Planning Engineer WRD

SUBJECT: WAR-75-3.40, PID 10754; Subgrade recommendations

Attached is a copy of the report of a recently completed subsurface investigation for the referenced project. The investigation was performed in accordance with the Geotechnical Bulletin 1 (GB1) "Plan Subgrades" dated July 11, 2003. The subject project is a major rehabilitation/major new project and is on the approved Multi-Lane list for FY 2009.

We are requesting from your office a review of the report and recommendations for subsurface treatments and pavement design. The Office of Pavement Engineering is performing a Life Cycle Cost Analysis (LCCA) for this project.

This project is scheduled to be awarded for design in April 2004, so we need the recommendations for pavement selection as soon as possible.

If you have any questions, please call me at 933-6586, or drop me an e-mail. Thanks for your assistance.

WRD:wrđ

Attachment

c: Morse
Martin
Dickey
Bell
file





Resource International, Inc.

Planning, Engineering, Construction Management, Technology

**SUBSURFACE INVESTIGATION REPORT
WAR-75-3.40
PID# 10754
Cincinnati, Ohio**

Prepared for:

Ohio Department of Transportation
District 8
505 South SR 747
Lebanon, Ohio 45036-9518

Prepared by:

RESOURCE INTERNATIONAL, INC.
4480 Lake Forest Drive
Cincinnati, OH 45242

Rii # B-03-023
November 28, 2003



RESOURCE INTERNATIONAL, INC.

November 28, 2003

Mr. William Davis, P.E.
Ohio Department of Transportation
District 8
505 South SR 741
Lebanon, Ohio 45036-9518

Planning

Engineering

Construction Management

Technology

Re: Subsurface Investigation
WAR-75-3.40
PID# 10754
Rii # B-03-023

Dear Mr. Davis:

We are pleased to submit this subsurface investigation report for the above-referenced project. Engineering logs have been prepared and are attached to this report along with the results of laboratory testing. This report includes recommendations for the proposed inside shoulder widening and roadway rehabilitation of 8.76 miles of I-75 north of Cincinnati, Ohio. Note that plan and profile sheets will be provided under separate cover upon completion.

If you have any questions concerning the subsurface exploration or this report, please call.

Sincerely,

RESOURCE INTERNATIONAL, INC.

Nikhil C. Khedekar (cc)

Nikhil C. Khedekar, Ph.D., P.E.
Project Manager - Task # 1

David M. Vovak, P.E.
Director - Geotechnical Engineering

Joseph C. Cron (cc)

Joseph C. Cron, P.E.
Project Executive

cc: Mrs. Cynthia A. Wallace, Consultant Administration Manager (Cover letter only), District 8

Enclosure: Subsurface Investigation Report

4480 Lake Forest Drive
Suite 308
Cincinnati, Ohio 45242
Phone 513-769-6998
Fax 513-769-7055
ResourceInternational.com

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Appendix VI	Stabilization Summary

EXECUTIVE SUMMARY

Resource International, Inc. (RII) has completed the subsurface investigation for the proposed pavement rehabilitation and inside shoulder widening project (WAR-75-3.40). The widening is part of a WAR-75-3.40 project, which entails rehabilitating the existing lanes of I-75, both northbound and southbound, and widening the inside shoulders to 12 feet in both directions. The limits of the project extend 8.76 miles from Milepost 3.40 (Station 180+00) to Milepost 12.20 (Station 208+30.81), north of Cincinnati, Ohio. A Vicinity Map and Conceptual Boring Plan are provided in Appendix II.

Subsurface Data

A total of 117 test borings, including 59 pavement borings and 58 median borings, were drilled at the approximate stations and offsets shown on the boring logs for the referenced project. A detailed tabulation of the test boring locations is provided in Appendix II of the report. The 59 pavement borings were spaced at 800-foot intervals in alternating lanes of the pavement, approximately two feet inside from the outer edge of the passing lane pavement. The 58 median borings were spaced at 800-foot intervals, in alternating lanes in the median, approximately 6 feet from the inside shoulder of the passing lane pavement.

The table below tabulates the percentage of each soil type encountered within the upper approximately 4.0 feet (SS-1 and SS-2) of the existing subgrade.

Table A. Soil Classification Tabulation (SS-1 and SS-2)

Soil Classification	Percentage (%)
A-1-a	2.6
A-1-b	3.4
A-2-4	5.6
A-2-6	0.4
A-3a	0.9
A-4a	44.9
A-4b	2.6
A-6a	24.4
A-6b	12.4
A-7-6	1.3
Shale	1.7

Groundwater was not encountered and/or measured upon completion at all of the test boring locations. Please note that short-term water level readings are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels

and the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

Conclusions and Recommendations

Based on the soil conditions encountered during the drilling phase, it is estimated that approximately 27% of the subgrade soil within the upper 4 feet of the existing subgrade surface will require subgrade stabilization including undercutting and replacing A-4b and/or rock at approximately 5.0 percent of the project area.

Stabilization techniques are noted in the tables below:

Table B. Stabilization Techniques

Method	Treatment
Solution A	Proofroll and undercut 3 to 5 feet and replace with granular material Type B, C, or D, with geotextile as required
Solution B	Proofroll and undercut 1 to 3 feet and replace with granular material Type B, C, or D with geotextile as required; or cement (16")
Solution C	Proofroll and undercut 6 inches to 1 foot and replace with granular material Type B or C, with geotextile as required; or cement or lime (12")
Solution D	Proofroll and undercut 6 inches and replace with granular material type B or C, with geotextile as required; or cement or lime (9")
Solution E	Proofroll and place geotextile fabric as required; or cement or lime (9")
Solution F	Undercut 24 inches of A-4b and replace with engineered fill
Solution G	Undercut 24 inches of rock and replace with engineered fill
Solution H	No stabilization anticipated , proofroll and undercut and replace with granular material Type B, C, or D, as required

Table C. Treatment Estimates

3-5
1-3
5-1
5
Fabric
2' A-4b
2' Rock
Nothing

Section	Station A	Station B	# of Borings	A	B	C	D	E	F	G	H
1	180+00	230+00	13	0%	0%	0%	0%	0%	0%	15%	85%
2	230+00	387+00	39	0%	0%	10%	3%	5%	5%	5%	72%
3	387+00	435+00	12	0%	0%	0%	0%	0%	0%	0%	100%
4	435+00	166+00	42	0%	17%	21%	5%	0%	0%	0%	57%
5	166+00	208+31	11	0%	0%	0%	10%	0%	0%	0%	90%
Project Total:			117	0%	6%	11%	3%	2%	2%	3%	73%

Based on the premise that any engineered fill material, where required, will be consistent with the soils encountered in the test borings, pavement design may be based on the following Table:

Table D. Recommended Soil Parameters for Design

Section	NB Borings (B-#)	SB Borings (B-#)	Station A	Station B	N _{avg.}	GI	CBR	k (pci)	S.S.V.
1	1-7	60-65	180+00	230+00	15	8	6	150	4.4
2	8-26	66-85	230+00	387+00	16	8	6	150	4.4
3	27-32	86-91	387+00	435+00	20	8	6	150	4.4
4	33-53	92-112	435+00	166+00	14	8	6	150	4.4
5	54-59	113-117	166+00	208+31	14	8	6	150	4.4

Please note that this executive summary does not contain all the information presented in the report. The unabridged subsurface investigation report should be read in its entirety to obtain a more complete understanding of the information presented.

1.0 INTRODUCTION

This report is a presentation of the subsurface investigation performed for the proposed pavement rehabilitation and inside shoulder widening of Interstate 75 (I-75), north of Cincinnati, Ohio. The widening is part of a WAR-75-3.40 project, which entails rehabilitating the existing lanes of I-75, both northbound and southbound, and widening the inside shoulders to approximately twelve (12) feet in both directions. The limits of the project extend from Milepost 3.40 (Station 180+00) to Milepost 12.20 (Station 208+30.81). The total project length is 8.76 miles, with two (2) station equations along the alignment as noted below:

1. Sta. 266+41.17 Back = Sta. 267+43.07 Ahead
2. Sta. 448+20.98 Back = Sta. 11+00 Ahead

The proposed pavement and shoulder grades for the project will roughly match the existing pavement grade. The widened southbound and northbound inside shoulders will be constructed within the existing grass median. Drainage is towards the centerline of the grass median. A Vicinity Map and Conceptual Boring Plan are provided in Appendix II.

1.1 Existing Site Conditions

The project is located in parts of Clear Creek, Franklin, and Turtle Creek Townships in Warren County, Ohio. The existing typical pavement section consists of three (3), 12-foot concrete pavement with asphalt overlays of varying depth lanes in each direction with 10-foot outside shoulders. The existing inside shoulder is approximately five (5) feet wide. The existing grass median including the shoulder is approximately 60 to 181 feet wide.

Based on the Soil Profile plans provided for the original construction of I-75, including WAR-25-3.46, WAR-25-8.483.46, and MOT-25-0.000, the existing I-75 ranges in elevation from approximately 702.00 feet mean sea level (msl) to 953.89 feet msl. Both the lowest and highest elevations exist near the northern end of the project limits, with the lowest elevation near station 30+00, and the highest elevation near station 173+00.

Within the project area, there are five (5) over/under passes identified within the I-75 roadway section of the project. These include: County Road 104 (Manchester Road), County Road 48 (Shaker Road), Clear Creek, Lower Springboro Road, and the Clearcreek-Franklin Pennyroyal Road Connection. The three (3) interchanges along the route include exit and entrance ramps for State Route 122, State Route 123, and State Route 73.

1.2 Site Geology

Physiographically, the site lies within the Southern Ohio Loamy Till Plain. The project traverses soil classified predominantly as Wisconsinan-aged glacial tills and ground and end moraines. These glacial features often are formed during the retreat of a glacier, resulting in undifferentiated mixtures of clay, silt, sand and gravel. Outwash deposits comprise areas within river valleys, creek beds or low plains, such as the North Branch Dicks Creek and Clear Creek areas. Outwash deposits consist of undifferentiated sand and gravel deposited by the meltwater in front of glacial ice.

Based on the bedrock geology and topography maps of the Springboro, Franklin and Monroe, Ohio Quadrangles, obtained from the Ohio Department of Natural Resources (ODNR), the bedrock along this section of the roadway changes in composition and elevation notably. The underlying bedrock, along the project alignment, varies between five (5) Ordovician-aged bedrock formations comprised of different percentages of shale and/or limestone. The major formations include the Drakes Formation, Whitewater Formation, and Liberty Formation undivided (percent shale/limestone/dolomite varies on predominant formation present), the Waynesville Formation (70% shale/30% limestone), the Arnheim formation (60% shale/40% limestone), the Grant Lake Formation (50% limestone/50% shale), and the Miamitown Shale-Fairview Formation undivided (percent shale/limestone varies on predominant formation present).

The bedrock surface changes in elevation, along the project limits, from approximately 750 feet mean sea level (msl) at the project beginning, to approximately 925 feet msl at the project ending. The depth to bedrock, along the centerline of the project varies from the ground surface (outcrop) to approximately 150 feet below the existing surface grade. At the project start, just north of Hendrickson Road to approximately Decker Road, the bedrock ranges between 800 and 750 feet msl, with a few outcrops evident around the project beginning and within the vicinity of the North Branch Dicks Creek area. From Decker Road to State Route 73, the bedrock slopes downward towards Clear Creek forming a buried valley with the lowest elevation of 550 feet msl. The overburden within the floodplain of Clear Creek is the thickest section ranging from 100 to 150 feet thick. From State Route 73 to the project end, at the Montgomery County Line, the bedrock slopes upward to an elevation of 925 feet msl.

According to the Ground Water Pollution Potential Report of Warren County, Ohio, published by ODNR, the principal aquifer, supplying much of the water to domestic wells located in the area along most of the project, is the highly fractured shale and limestone bedrock with minor amounts obtained from the glacial till overburden. The depth to water, which varies depending on the thickness of the glacial till, is usually

between 15 to 30 feet. Within the vicinity of Clear Creek north to State Route 73, the groundwater is predominantly supplied by sand, gravel and till deposited within the buried valley. The depth to water in this area ranges between approximately 5 to 15 feet. The illustrations of the general geology of Ohio are presented in Appendix I.

2.0 SUBSURFACE EXPLORATION

A total of 117 test borings, including 59 pavement borings and 58 median borings, were drilled at the approximate stations and offsets shown on the boring logs for the referenced project. A detailed tabulation of the test boring locations is provided in Appendix II of the report. The 59 pavement borings were spaced at 800-foot intervals in alternating lanes of the pavement, approximately two feet inside from the outer edge of the passing lane pavement. The 58 median borings were spaced at 800-foot intervals, in alternating lanes in the median, approximately 6 feet from the inside shoulder of the passing lane pavement.

The boring locations were located and staked by representatives of Resource International, based on established mileposts and landmarks, and surveyed by representatives of Preferred Survey, Inc. The stationing, offset and surface elevations of the test borings are shown on the boring logs in Appendix III. The test borings were drilled between October 20 and October 30, 2003, using an all-terrain vehicle (ATV)-mounted rotary drilling machine utilizing 4.0-inch, continuous, solid flight augers to advance the holes.

Standard Penetration Testing was performed continuously to 5.0 feet below the existing subgrade/surface. The Standard Penetration Test (ASTM D 1586) is conducted by using a 140-pound hammer falling 30.0 inches to drive a 2-inch O.D. split-barrel sampler 18.0 inches. Driving resistance is recorded on the boring logs in terms of blows per 6-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). Standard Penetration blow counts aid in estimating soil characteristics used to calculate bearing capacities and settlement potential.

All soil samples obtained from the drilling operation were preserved in jars and visually classified in the laboratory (in accordance with ASTM D 2488). Selected samples obtained with the split-barrel sampler were tested in the laboratory to determine the soil properties illustrated in Table 1.

Table 1. Laboratory Test Schedule

Laboratory Test	Test Designation	Number of Tests Performed
Natural Moisture Content	ASTM D 2216	348
Gradation – Hydrometer	ASTM D 422	218
Gradation – Sieve	ASTM D 422	114
Plastic and Liquid Limits	AASHTO T89, T90	221

The tests performed are necessary to classify existing soils according to the Ohio Department of Transportation (ODOT) Classification System and to infer engineering properties of importance for pavement design and construction. Results of the laboratory testing appear in Appendix IV, and in part on the boring logs in Appendix III. A description of the soil terms used throughout this report is also included in Appendix III.

Estimates of the unconfined compressive strengths of the cohesive soil samples were made using a hand penetrometer. The unconfined compressive strength is used to estimate the undrained shear strength of cohesive soils. These values are reported on the boring logs in units of ksf. Please note that split-spoon samples are considered to be disturbed and the laboratory determination of their shear strengths may vary from undisturbed conditions.

3.0 SUBSURFACE PROFILE

Interpreted engineering logs have been prepared from the geologist's logs, visual examination of samples, and laboratory testing. The following is a generalization of what was found in the test borings and what is represented on the boring logs.

The existing surface area at fifty-eight (58) of the test boring locations was covered with topsoil with an average thickness of approximately 4.0 inches. The minimum and maximum topsoil thickness ranged from approximately 2 to 10 inches. Note that the topsoil thickness will vary significantly across the project site.

At the remaining fifty-nine (59) test borings locations, the existing pavement section was cored. Appendix V includes a table noting the measured pavement section at each cored test boring location along with photographs of the retained pavement cores. More information is provided about the pavement sections in Section 3.2.

The subsurface soil at the test boring locations consisted primarily of A-4a sandy silts and A-6a silt and clay soils. The table below tabulates the percentage of each soil type encountered within the upper approximately 4.0 feet (SS-1 and SS-2) of the existing subgrade.

Table 2. Soil Classification Tabulation (SS-1 and SS-2)

Soil Classification	Percentage (%)
A-1-a	2.6
A-1-b	3.4
A-2-4	5.6
A-2-6	0.4
A-3a	0.9
A-4a	44.9
A-4b	2.6
A-6a	24.4
A-6b	12.4
A-7-6	1.3
Shale	1.7

Based upon a tabulation of the standard test boring and laboratory testing data the following observations were noted during the application of the Plan Subgrade Guidelines:

- Bedrock was encountered within 5.0 feet of the existing subgrade surface in 15 of the 117 test borings as noted in the table below;

Table 3. Bedrock

Boring No.	Depth to Bedrock (feet)	Boring No.	Depth to Bedrock (feet)
B-3	2.7	B-27	5.5
B-10	4.0	B-28	4.0
B-11	2.8	B-62	2.8
B-12	4.0	B-70	4.0
B-13	4.3	B-71	2.5
B-15	4.5	B-78	2.5
B-19	5.0	B-86	3.5
B-20	3.0		

- A-4b soil was encountered within 2.0 feet of the existing subgrade surface at four (4) of the six (6) test borings where A-4b was encountered;
- Soils with moisture content plus 3 of optimum, as estimated by the Plan Subgrade Guidelines, were encountered within the upper 4 feet of the existing subgrade (SS-1 and SS-2) at 31 of the 117 test borings.

A summation of the range of minimum "N" values within the upper approximately 4 feet (SS-1 or SS-2) of the existing subgrade at all the test boring locations is provided in the table below:

Table 4. Blow Count "N" Tabulation (SS-1 and SS-2)

Minimum Blow Count "N" taken from SS-1 or SS-2 at each test boring location	# of Borings
0-5	2
6-10	36
11-15	35
16-20	13
21+	31

A more comprehensive description of the soils encountered during the drilling program can be found on the boring logs in Appendix III.

The natural moisture contents of the soil samples tested ranged from 3% to 25%, with an average of 11.5%. Approximately 50 percent of the samples tested had moisture contents between 10% and 14%. The natural moisture contents of the soil samples tested for plasticity index ranged from 12% below to 7% above their corresponding plastic limits, but were primarily below their corresponding plastic limits.

3.1 Groundwater

Groundwater was not encountered and/or measured upon completion at any of the test boring locations. However, cave-in occurred in almost all of the borings at completion, after removing the augers. The caving likely influenced the groundwater reading (i.e., the caved-in material may have displaced the water in the borehole, prevented water from entering the borehole or small volumes of water seepage may have collected on top of the caved-in soil [or soil bridge]).

Also, please note that short-term water level readings are not necessarily an accurate indication of the actual groundwater level. In addition, groundwater levels and the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation. The determination of the groundwater levels during construction is the responsibility of the contractor.

3.2 Pavement Improvement Areas

The 59 test borings located on the existing pavement were cored prior to drilling. Photographs of the retained pavement cores along with a summary table are presented in Appendix V. The existing surface area at all cored test boring locations except B-76 was covered with asphalt concrete underlain by concrete pavement. Test boring location B-76 included approximately 16.8 inches of asphalt concrete with no underlying concrete pavement. The asphalt concrete thickness at test boring location B-76 was similar in thickness to the adjacent composite pavement sections. The concrete was underlain by sand and gravel base materials at all the cored test boring location except B-88. The table below notes relevant statistical information on the cored pavement sections:

Table 5. Summary of Pavement Sections

Pavement Material	Number of Borings	Average Thickness (inches)	Minimum Thickness (inches)	Maximum Thickness (inches)
Asphalt Concrete	59	6.3	5.0	16.9
Concrete	58	8.9	2.5	10.6
Base	58	4.8	2.0	30.0

4.0 CONCLUSIONS AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine pavement support capabilities for the soil encountered at the site. These parameters have been used to provide guidelines for the design of the pavement systems, as well as the construction specifications related to the placement of the pavement systems.

4.1 Pavement Recommendations

The soil data compiled indicates that the subgrade soil for the proposed pavement for the shoulder and lane additions is predominantly A-4a sandy silts and A-6a silt and clay soils, as detailed in Table 2 in Section 3.0 of this report.

Based on the premise that engineered fill material, where required, will be consistent with the soils encountered in the test borings, the shoulder widening pavement design may be based on the following recommended design parameters:

Table 6. Recommended Soil Parameters for Design

Section	NB Borings (B-#)	SB Borings (B-#)	Station A	Station B	N _{avg}	GI	CBR	k (pci)	S.S.V.
1	1-7	60-65	180+00	230+00	15	8	6	150	4.4
2	8-26	66-85	230+00	387+00	16	8	6	150	4.4
3	27-32	86-91	387+00	435+00	20	8	6	150	4.4
4	33-53	92-112	435+00	166+00	14	8	6	150	4.4
5	54-59	113-117	166+00	208+31	14	8	6	150	4.4

The N_{avg} was determined by averaging the lowest N values in accordance with the Plan Subgrade Guidelines within the upper 5 feet of each test boring regardless of to the moisture content of each sample. As per the Plan Subgrade Guidelines, a maximum N value of 30 was utilized to determine N_{avg}.

Areas with design parameters less than the above noted values within the upper 4 feet of the existing subgrade elevation, as determine by correlations with laboratory testing, are noted in the table below:

Table 7. Below Recommended Design Parameter Locations

Section	NB/SB	Boring Number	Sample	Station	California Bearing Ratio (CBR)	Modulus of Subgrade Reaction (K)	Soil Support Value (SSV)
2	SB	69	1	256+00	5	135	3.8
2	SB	71	1	273+00	5	135	3.8
2	SB	72	2	281+00	5	135	3.8
2	NB	16	2	301+00	5	135	3.8
4	SB	112	1	164+00	4	125	3.3
5	SB	116	2	196+00	4	125	3.3
5	SB	117	2	204+00	2	100	2.6

4.2 Construction Considerations

All site work shall conform to the latest ODOT Construction and Materials Specifications including the requirements that all excavation, embankment preparation, and construction follow ODOT Item 200 (Earthwork).

Prior to beginning excavation, grading, and/or embankment operations across the site, all necessary clearing and grubbing shall be completed. Topsoil, unsuitable fill materials (as determined by a soil engineer or an experienced soil technician), and/or existing pavement sections (where applicable) should be stripped away from proposed pavement areas prior to excavation.

The proposed subgrade surfaces should be proofrolled with sufficient proofrolling apparatus, prior to placing engineered fill. A soil engineer or an experienced soil technician should be present during proofrolling to determine if soil with inadequate stability exists. Subgrade instability exposed during a proofroll is indicated by deflection, cracking, or rutting of the surface of the subgrade. Soft soil is generally a result of the presence of very moist to wet cohesive soil. Deflecting subgrades may also be due to the presence of subsurface lenses of silt/fine sand which typically contain water because the soil exhibits a higher porosity than the overlying and/or underlying cohesive soil.

Subgrade soils with in-situ moisture content in excess of the optimum moisture content create the possibility of soft subgrades. Of particular concern are the locations with

moisture contents greater than plus 3 of optimum. Per the Plan Subgrade Guidelines, these materials typically require subgrade stabilization.

4.2.1 Subgrade Stabilization

Based on the soil conditions encountered during the drilling phase, it is estimated that approximately 27% of the subgrade soil within the upper 4 feet of the existing subgrade surface will require subgrade stabilization. Methods of improvement recommended by the Plan Subgrade Guidelines were presented in Table 8, below.

Table 8. Stabilization Techniques

Method	Treatment
Solution A	Proofroll and undercut 3 to 5 feet and replace with granular material Type B, C, or D, with geotextile as required
Solution B	Proofroll and undercut 1 to 3 feet and replace with granular material Type B, C, or D with geotextile as required; or cement (16")
Solution C	Proofroll and undercut 6 inches to 1 foot and replace with granular material Type B or C, with geotextile as required; or cement or lime (12")
Solution D	Proofroll and undercut 6 inches and replace with granular material type B or C, with geotextile as required; or cement or lime (9")
Solution E	Proofroll and place geotextile fabric as required; or cement or lime (9")
Solution F	Undercut 24 inches of A-4b and replace with engineered fill
Solution G	Undercut 24 inches of rock and replace with engineered fill
Solution H	No stabilization anticipated , proofroll and undercut and replace with granular material Type B, C, or D, as required

The table below provides a guideline for estimating stabilization techniques over the length of the project on a test boring by test boring basis within each section as defined by the plus 3 moisture content criteria established by the Plan Subgrade Guidelines.

Table 9. Treatment Estimates

Section	Station A	Station B	# of Borings	A	B	C	D	E	F	G	H
1	180+00	230+00	13	0%	0%	0%	0%	0%	0%	15%	85%
2	230+00	387+00	39	0%	0%	10%	3%	5%	5%	5%	72%
3	387+00	435+00	12	0%	0%	0%	0%	0%	0%	0%	100%
4	435+00	166+00	42	0%	17%	21%	5%	0%	0%	0%	57%
5	166+00	208+31	11	0%	0%	0%	10%	0%	0%	0%	90%
Project Total:			117	0%	6%	11%	3%	2%	2%	3%	73%

The moisture content of cohesive soil has a significant effect on the physical properties of the material. It must be noted that the moisture contents illustrated on the boring logs represent the conditions during the drilling phase of the project (drilling performed between October 20th and 30th, 2003). These soil conditions, especially in the surficial soil, may not coincide with the soil conditions that will be encountered during construction. Consequently, the extent/need for subgrade improvement is entirely dependent on the subgrade conditions (i.e., moisture contents) encountered at the time of construction. Cleaning out of the existing underdrain outlets can reduce the subgrade soil moisture content from plus 3% of optimum to optimum in 6 to 8 weeks according to the Ohio Department of Transportation's Plan Subgrade Guidelines dated July 11, 2003.

4.2.1.1 Alternatives

The Interim Guideline allows for lime and/or cement stabilization of soils per ODOT Items 206 and supplemental specification 804, respectively. Based upon the criteria established in the guidelines and the test boring and laboratory testing data, the following table may be used as a guide for estimating lime and/or cement stabilization quantities:

Table 10. Lime and/or Cement Stabilization Effective Areas

Method	Project Area where Stabilization Method is Acceptable
12-in Lime: ODOT Item 206	3.0%
12-in Cement: Sup. Spec. Item 806	6.0%
16-in Cement: Sup. Spec. Item 806	31.0%
Other Means or No Stabilization Required	60.0%

Appendix VI of the report provides a list of recommended stabilization techniques on a sample by sample basis. This table may be used as a general guide for determining stabilization options.

Other methods of subgrade stabilization such as geogrid detailed below are available and certainly may be effective (both physically and economically) in stabilizing the soils. However, it is recommended that regardless of the stabilization technique employed, the adequacy of the stabilization should be verified through the construction of a test section. It is emphasized that all proposed pavement subgrades should be shaped to promote positive drainage, with a minimum slope of 2%. Adequate drainage is necessary for maintaining the stability of the pavement subgrade.

A Geogrid subgrade reinforcement system involves undercutting unsuitable soil and placing a geogrid subgrade reinforcement system (on the exposed subgrade) prior to placing fill. The geogrid should be a minimum *Tensar BX 1100* (or equivalent). The geogrid should be overlain by engineered fill, preferably granular material. The use of a grid adds strength to the subgrade by minimizing the lateral/vertical displacement, which in turn reduces the amount of undercut necessary. The grid employed and the thickness of the engineered fill will be determined by the severity of the instability.

4.2.2 Rubblize and Roll

Subgrade support is critical for rubblize and roll application. As a rule of thumb, areas with moisture content greater than plus 3 of optimum require undercutting and replacement. Moreover, per the Plan Subgrade Guidelines, rubblize and roll is not recommended for areas with an average "N" value below 15. Based upon an analysis, of the test boring and laboratory testing data, the borings taken within the **existing pavement** have an average "N" value of 18. The soils requiring some stabilization or that have "N" values below 15 comprise of approximately 64 percent of the locations across the project length. On a section by section basis, the Plan Subgrade Guidelines defined "N_{avg}" and stabilization summaries are provided for the 59 pavement borings in the table below. Note that the N_{avg} provided in Table 6, in Section 4.1, averaged all 117 borings, rather than the 59 analyzed in the table below:

Table 11. Rubblize & Roll Guideline Tabulation

Section	Station A	Station B	# of Borings	N _{avg}	Areas Requiring Stabilization OR With N<15 (%)
1	180+00	230+00	7	16	71%
2	230+00	383+00	19	17	74%
3	383+00	431+00	6	21	17%
4	431+00	170+00	22	18	68%
5	170+00	208+00	5	18	60%
Project Total:			59	18	64%

Overall N_{avg} = 15.43
Avg. PI = 10.0

4.2.3 Other Considerations

Soil classified as A-4b silt is considered highly frost susceptible and shall be completely removed within the upper 24 inches of the proposed subgrade regardless of its consistency or moisture content. In addition, rock, shale or coal shall be completely removed within 24 inches of the proposed subgrade and be replaced with engineered fill materials, in accordance with ODOT Item 204.05. The following tables identify locations where A-4b silt and rock/shale was encountered within approximately 24 inches of the existing subgrade.

Table 12. A-4b Silt locations (Upper 24")

Boring	Station	Location	Direction	A-4b
B-39	48+00	Pavement	NB	SS-2
B-80	345+00	Pavement	SB	SS-1
B-85	385+00	Median	SB	SS-1
B-101	76+00	Median	SB	SS-2

Table 13. Rock/Shale locations (Upper 24")

Boring	Station	Location	Direction	A-4b
B-3	196+00	Pavement	NB	SS-2
B-11	260+00	Pavement	NB	SS-2
B-62	200+00	Pavement	SB	SS-2
B-78	329+00	Pavement	SB	SS-2

4.2.4 Compaction Requirements

Fill soil placed for pavement support should be placed in loose lifts not to exceed 8.0 inches. Embankment fill soil with a maximum dry unit weight of between 90 and 105 pounds per cubic foot (pcf) shall be compacted to not less than 102% of its maximum dry density obtained by a Standard Proctor Test (ASTM D 698). All other soil subgrade shall be compacted to not less than 100 percent of maximum dry density. Soil with a maximum dry unit weight of less than 90 pcf should not be employed as fill material. Fill soil containing excess moisture shall be required to dry prior to or during compaction to a moisture content not greater than 3 percent above or below optimum. However, for material which displays pronounced elasticity or deformation under the action of loaded rubber tire construction equipment, the moisture content shall be reduced to optimum if

necessary to secure stability. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the site soils engineer.

As per the Plan Subgrade Guidelines, materials classified as A-4b, A-5, A-7-5 may not be utilized as engineered fill materials. Note that it is important to utilize engineered fill material that exceeds the average design parameters outlined on Table 6 in Section 4.1. Therefore, soils classified as A-6b and A-7-6 with GI's greater than 10 should be excluded for use as engineered fill materials.

4.2.5 Groundwater Considerations

Groundwater was not encountered during drilling at any of the borings. However, some areas of either perched water in the natural soils and/or trapped water in the fill materials should be anticipated during construction of the pavement sections. Proper groundwater control measures should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or "boiling" condition if soft silt and/or fine sand is encountered. It is preferable that the groundwater level, if encountered, be maintained at least 24 inches below the deepest excavation. Note that determining and maintaining actual groundwater levels during construction is the responsibility of the contractor.

5.0 LIMITATIONS OF STUDY

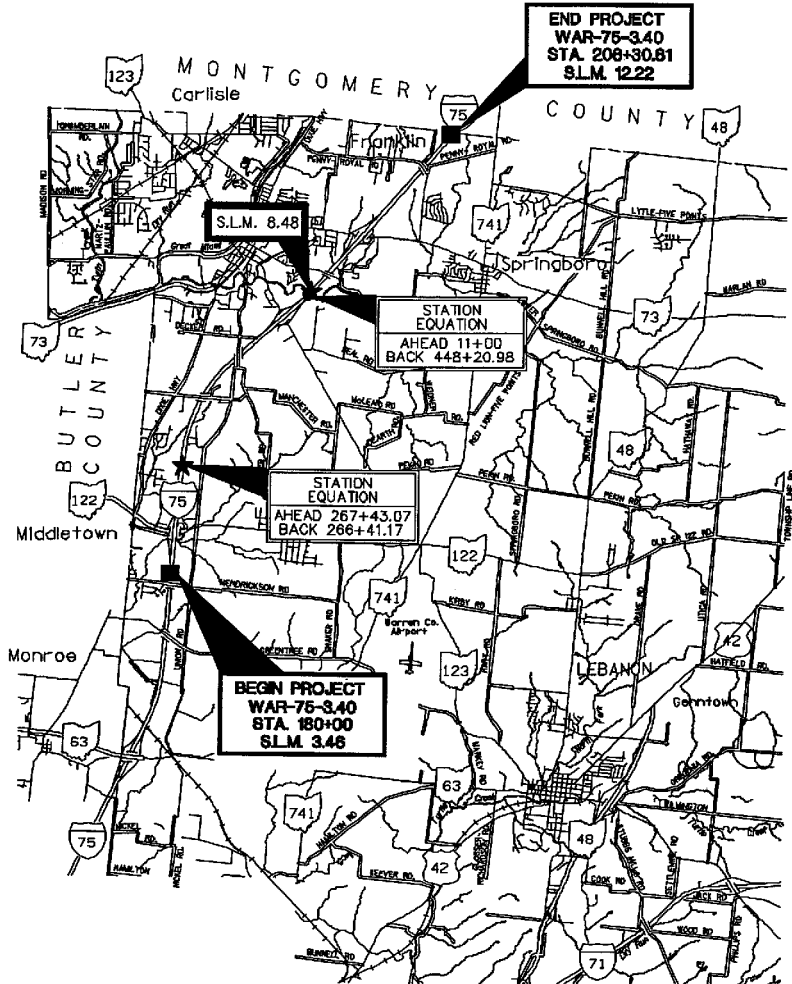
Rii's recommendations for this project were developed utilizing soil information obtained from the test borings that were made at the proposed sites. The soil borings only depict the soil conditions at the specific locations and time at which they were made. The soil conditions at other locations on the site may differ from those occurring at the boring locations.

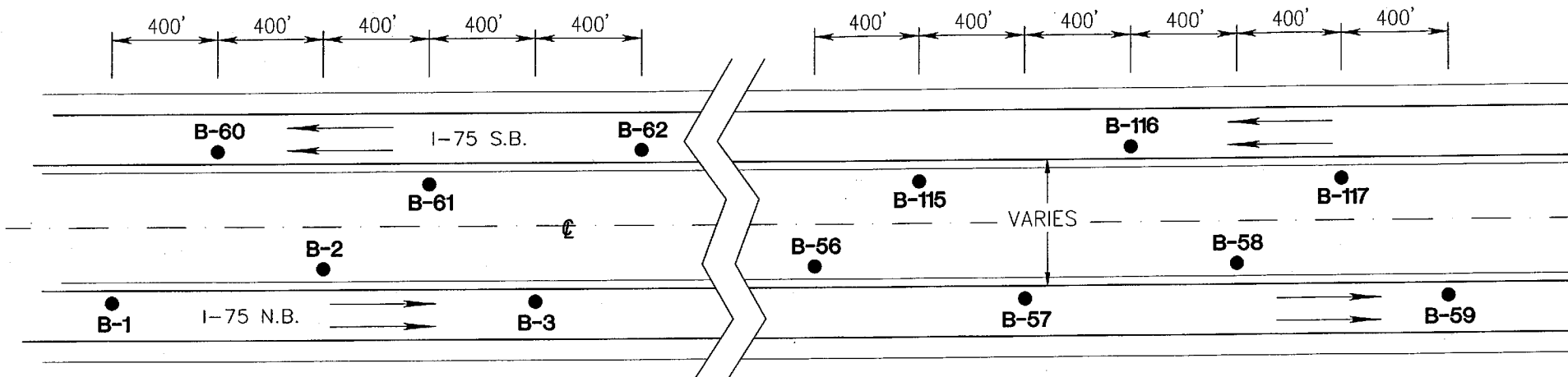
The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the Geotechnical Engineer to determine whether any changes in the foundation or earthwork recommendations are necessary. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the Geotechnical Engineer.

Rii's scope of services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test boring logs regarding odors, staining of soils or other unusual conditions observed are strictly for the information of our client.

Rii's professional services have been performed, the findings obtained, and the recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. Resource International, Inc. is not responsible for the conclusions, opinions, or recommendations made by others based upon the data included herein.







CONCEPTUAL BORING PLAN

WAR 75 - 3.40
WARREN COUNTY, OHIO



PROJECT NO.
Rii #B-03-023

SCALE: 1" = 400'



RESOURCE
INTERNATIONAL, INC.

Test Boring Location Tabulation

Boring	Direction	Station	Offset	Elevation (feet msl)
B-1	NB	180+00	32'Rt.	728.5
B-60	SB	184+00	32'Lt.	724.5
B-2	NB	188+00	19'Rt.	719.1
B-61	SB	192+00	19'Lt.	715.1
B-3	NB	196+00	32'Rt.	712.5
B-62	SB	200+00	32'Lt.	708.5
B-4	NB	204+00	19'Rt.	703.1
B-63	SB	208+00	19'Lt.	708.6
B-5	NB	212+00	32'Rt.	709.7
B-64	SB	216+00	32'Lt.	716.2
B-6	NB	220+00	19'Rt.	721.4
B-65	SB	224+00	19'Lt.	727.9
B-7	NB	228+00	32'Rt.	735.9
B-66	SB	232+00	32'Lt.	742.5
B-8	NB	236+00	19'Rt.	747.6
B-67	SB	240+00	19'Lt.	754.2
B-9	NB	244+00	32'Rt.	758.9
B-68	SB	248+00	32'Lt.	768.7
B-10	NB	252+00	19'Rt.	773.9
B-69	SB	256+00	19'Lt.	780.4
B-11	NB	260+00	32'Rt.	788.4
B-70	SB	264+00	32'Lt.	795.0
Station		266+41		
Equation		267+43		
B-12	NB	269+00	19'Rt.	798.4
B-71	SB	273+00	19'Lt.	806.6
B-13	NB	277+00	32'Rt.	814.6
B-72	SB	281+00	32'Lt.	819.8
B-14	NB	285+00	19'Rt.	820.2
B-73	SB	289+00	19'Lt.	818.6
B-15	NB	293+00	32'Rt.	814.9
B-74	SB	297+00	32'Lt.	808.5
B-16	NB	301+00	19'Rt.	800.7
B-75	SB	305+00	19'Lt.	794.4
B-17	NB	309+00	32'Rt.	793.1
B-76	SB	313+00	32'Lt.	795.1
B-18	NB	317+00	19'Rt.	799.1
B-77	SB	321+00	19'Lt.	804.7
B-19	NB	325+00	32'Rt.	811.7
B-78	SB	329+00	32'Lt.	817.3
B-20	NB	333+00	19'Rt.	821.5



Boring	Direction	Station	Offset	Elevation (feet msl)
B-79	SB	337+00	19'Lt.	827.0
B-21	NB	341+00	32'Rt.	831.7
B-80	SB	345+00	32'Lt.	831.8
B-22	NB	349+00	19'Rt.	827.6
B-81	SB	353+00	19'Lt.	821.8
B-23	NB	357+00	32'Rt.	816.5
B-82	SB	361+00	32'Lt.	809.8
B-24	NB	365+00	19'Rt.	801.6
B-83	SB	369+00	19'Lt.	794.9
B-25	NB	373+00	32'Rt.	789.6
B-84	SB	377+00	32'Lt.	783.5
B-26	NB	381+00	19'Rt.	780.0
B-85	SB	385+00	19'Lt.	782.7
B-27	NB	389+00	32'Rt.	789.2
B-86	SB	393+00	32'Lt.	794.2
B-28	NB	397+00	19'Rt.	797.6
B-87	SB	401+00	19'Lt.	799.8
B-29	NB	405+00	32'Rt.	800.2
B-88	SB	409+00	32'Lt.	795.8
B-30	NB	413+00	19'Rt.	787.0
B-89	SB	417+00	19'Lt.	779.0
B-31	NB	421+00	32'Rt.	772.5
B-90	SB	425+00	32'Lt.	764.5
B-32	NB	429+00	19'Rt.	755.0
B-91	SB	432+00	19'Lt.	749.0
B-33	NB	437+00	32'Rt.	740.5
B-92	SB	441+00	32'Lt.	732.5
B-34	NB	445+00	19'Rt.	723.0
Station		448+20		
Equation		11+00		
B-93	SB	12+00	19'Lt.	714.6
B-35	NB	16+00	32'Rt.	708.8
B-94	SB	20+00	32'Lt.	704.1
B-36	NB	24+00	19'Rt.	700.7
B-95	SB	28+00	19'Lt.	700.6
B-37	NB	32+00	32'Rt.	702.0
B-96	SB	36+00	32'Lt.	702.3
B-38	NB	40+00	19'Rt.	703.9
B-97	SB	44+00	19'Lt.	709.8
B-39	NB	48+00	32'Rt.	717.6
B-98	SB	52+00	32'Lt.	724.0
B-40	NB	56+00	19'Rt.	729.0
B-99	SB	60+00	19'Lt.	735.4
B-41	NB	64+00	32'Rt.	743.2
B-100	SB	68+00	34'Lt.	749.6



Boring	Direction	Station	Offset	Elevation (feet msl)
B-42	NB	72+00	30.3'Rt.	754.7
B-101	SB	76+00	44'Lt.	763.5
B-43	NB	80+00	70.9'Rt.	776.0
B-102	SB	84+00	84.3'Lt.	787.2
B-44	NB	88+00	78.6'Rt.	797.0
B-103	SB	91+00	79.5'Lt.	805.4
B-45	NB	96+00	92.5'Rt.	820.1
B-104	SB	100+00	92.5'Lt.	828.0
B-46	NB	104+00	79.5'Rt.	833.8
B-105	SB	108+00	79.5'Lt.	841.0
B-47	NB	112+00	93.5'Rt.	850.0
B-106	SB	116+00	92.5'Lt.	860.0
B-48	NB	120+00	79.5'Rt.	869.9
B-107	SB	124+00	79.5'Lt.	881.2
B-49	NB	128+00	92.5'Rt.	893.9
B-108	SB	132+00	92.5'Lt.	902.3
B-50	NB	136+00	79.5'Rt.	906.4
B-109	SB	140+00	79.5'Lt.	911.9
B-51	NB	144+00	92.5'Rt.	918.8
B-110	SB	148+00	92.5'Lt.	924.2
B-52	NB	152+00	79.5'Rt.	928.2
B-111	SB	156+00	79.5'Lt.	933.6
B-53	NB	160+00	92.5'Rt.	940.5
B-112	SB	164+00	92.5'Lt.	946.0
B-54	NB	168+00	79.5'Rt.	949.6
B-113	SB	172+00	79.5'Lt.	952.2
B-55	NB	176+00	92.5'Rt.	953.5
B-114	SB	180+00	92.5'Lt.	951.9
B-56	NB	184+00	79.5'Rt.	948.8
B-115	SB	188+00	79.5'Lt.	947.2
B-57	NB	192+00	92.5'Rt.	947.1
B-116	SB	196+00	92.5'Lt.	945.2
B-58	NB	200+00	79.5'Rt.	940.0
B-117	SB	204+00	79.5'Lt.	934.2
B-59	NB	208+00	92.5'Rt.	927.9



RESOURCE INTERNATIONAL, INC.
281 Enterprise Drive
Westerville, OH 43081
(614) 885-1959

REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-1
Sheet 1 of 1
Completion Depth 5.3'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 32+00
Offset 32' RT
Elevation 728.49 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				7.6" - Asphalt			
					0.6		
				9.5" - Concrete			
					1.4		
SS-1	4 7 10	63		2.5" - Sand and gravel base Mottled brown and gray changing to gray SILT and CLAY, some coarse to fine sand, little fine gravel. Very stiff to hard. Damp to moist. -SS-1: ODOT A-6a (7); qh = 9.0+ ksf	1.6	14	31
			2.5				
SS-2	6 10 25	63		-SS-2: ODOT A-6a (8); qh = 9.0+ ksf		16	33
							18
SS-3	29 50/3"	100		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf		12	
			5.0				
				Bottom of Boring = 5.3 feet	5.3		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE
SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING
Initial Dry ft
At Completion Dry ft
Extended NA ft

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



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-2
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 188+00
Offset 19' RT
Elevation 719.05 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1A	3 5 4	83		2.5" - Topsoil FILL: Brown coarse to fine SANDY SILT, some fine gravel, little clay, trace organics. Stiff. Damp. -SS-1A: ODOT A-4a (2); qh = 9.0+ ksf	10	18	13
SS-1B				FILL: Brown fine GRAVEL (pea gravel), little fine to coarse sand, trace silt. Loose. Damp. -SS-1B: Visual* ODOT A-1-a			
SS-2	2 2 3	56		-SS-2: Visual** ODOT A-1-a	3		
SS-3A	3 4 29	67		-SS-3A: Visual* ODOT A-1-a			
SS-3B	50/2"			Mottled brown and gray coarse to fine SANDY SILT, some clay, little coarse to fine gravel. Hard. Moist. -SS-3B: ODOT A-4a (5); qh = 3.0 ksf	11	22	13
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE
SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING
Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

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



RESOURCE INTERNATIONAL, INC.
281 Enterprise Drive
Westerville, OH 43081
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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-3
Sheet 1 of 1
Completion Depth 4.8'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 196+00
Offset 32' RT
Elevation 712.49 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				6.0" - Asphalt			
				10.0" - Concrete	0.5		
				3.0" - Sand and gravel base	1.3		
SS-1	4 12 50/4"	67		Brown fine to coarse SANDY SILT, some fine gravel, little clay. Hard. Moist. -SS-1: Visual** ODOT A-4a; qh = 9.0+ ksf	1.6	11	
			2.5				
SS-2	50/4"	50		Gray weathered SHALE with limestone. Medium hard. Damp.	2.7	4	
SS-3	50/3"	33				3	
			5.0	Bottom of Boring = 4.8 feet	4.8		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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281 Enterprise Drive
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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-4
Sheet 1 of 1
Completion Depth 5.0'
Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 204+00 Boring Method 4.0" SFA
Offset 19' RT Hammer Weight 140 lbs.
Elevation 703.05 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.0" - Topsoil	0.3		
SS-1	3 4 5	89		FILL: Brown fine GRAVEL (pea gravel), some fine to coarse sand, little silt. Loose. Moist to very moist. -SS-1: Visual** ODOT A-1-a	5		
SS-2	3 3 5	94		-SS-2: Visual** ODOT A-1-a	5		
			2.5				
SS-3A	5 10 14 20	17		-SS-3A: Visual* ODOT A-1-a			
SS-3B				Mottled brown and gray SILT and CLAY, little coarse to fine sand, trace fine gravel. Very stiff. Very moist. -SS-3B: Visual** ODOT A-6a; qh = 2.0 ksf	22	34	19
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ∇ Dry ft
Extended ∇ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-5
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 212+00
Offset 32' RT
Elevation 709.69 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 8"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.5" - Asphalt			
				10.0" - Concrete	0.5		
				2.0" - Sand and gravel base	1.3		
SS-1	3 5 7	83	2.5	Mottled brown and gray SILT and CLAY, some coarse to fine sand, trace fine gravel. Stiff. Moist. -SS-1: ODOT A-6a (5); qh = 9.0+ ksf	14	24	13
SS-2	4 5 6	89		Gray fine to coarse SANDY SILT, some clay, little coarse to fine gravel. Stiff. Damp. -SS-2: ODOT A-4a (2); qh = 9.0+ ksf	11	26	17
SS-3	5 6 9 6	79	5.0	-SS-3: Visual** ODOT A-4a; qh = 7.5 ksf	9		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-6
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 220+00
Offset 19' RT
Elevation 721.37 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	3 4 7	83		3.5" - Topsoil	0.3		
				Brown SILT and CLAY, some coarse to fine sand, little fine gravel. Stiff. Damp. -SS-1: ODOT A-6a (6); qh = 9.0+ ksf		27	15
SS-2	6 8 11	89			1.5		
				Brown changing to mottled brown and gray coarse to fine SANDY SILT, some clay, little to trace fine gravel. Very stiff to stiff. Damp to very moist. -SS-2: ODOT A-4a (6); qh = 9.0+ ksf		25	16
SS-3	3 4 5 7	88	2.5				
				-SS-3: Visual** ODOT A-4a; qh = 3.5 ksf			
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-7
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 228+00
Offset 32' RT
Elevation 735.92 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				9.5" - Concrete	0.5		
				2.0" - Sand and gravel base	1.3		
SS-1	5 23 16	22	2.5	Brown and gray coarse and fine GRAVEL (limestone fragments), little fine to coarse sand, trace silt. Dense. Moist. -SS-1: Visual** ODOT A-1-a	1.5	5	
SS-2	8 11 14	83	3.0	Brown coarse to fine SANDY SILT, some clay, trace fine gravel. Very stiff. Damp to moist. -SS-2: ODOT A-4a (4); qh = 6.0 ksf		13	26
SS-3	9 13 17 23	67	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf		14	
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-8
Sheet 1 of 1
Completion Depth 5.0'
Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 236+00 Boring Method 4.0" SFA
Offset 19' RT Hammer Weight 140 lbs.
Elevation 747.61 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	4 6 9	89		4.0" - Topsoil	0.3		
				Mottled brown and gray SILTY CLAY, some fine to coarse sand, little fine gravel. Stiff. Damp. -SS-1: ODOT A-6b (8); qh = 9.0+ ksf	13	34	18
SS-2	5 6 8	94		Mottled brown and gray SILT and CLAY, some coarse to fine sand, trace to little coarse to fine gravel. Stiff to hard. Damp. -SS-2: ODOT A-6a (8); qh = 9.0+ ksf	14	32	17
SS-3	12 19 21 26	83		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf -limestone fragments in SS-3	8		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion NA ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-9
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 244+00
Offset 32' RT
Elevation 758.89 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG	
						LL	PL
				6.0" - Asphalt			
				9.5" - Concrete	0.5		
				3.0" - Sand and gravel base	1.3		
SS-1	3 5 8	89	2.5	Mottled brown and gray SILT and CLAY, some coarse to fine sand, little to some fine gravel. Stiff to medium stiff. Damp. -SS-1: ODOT A-6a (4); qh = 9.0+ ksf	10	24	13
SS-2	7 5 3	67		-SS-2: ODOT A-6a (6); qh = 9.0+ ksf	12	30	17
SS-3	3 3 4 6	79	5.0	-SS-3: Visual** ODOT A-6a; qh = 4.5 ksf	14		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geomembrane Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-10
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 252+00
Offset 19' RT
Elevation 773.85 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.0" - Topsoil	0.3		
SS-1	3 6 43	56		Mottled brown and gray changing to gray SILT and CLAY, some to little coarse to fine sand, some to trace fine gravel. Hard to very stiff. Damp. -SS-1: ODOT A-6a (5); qh = 9.0+ ksf	13	31	19
SS-2	4 10 12	89		-SS-2: ODOT A-6a (8); qh = 9.0+ ksf	15	36	22
			2.5				
SS-3	7 13 21 50	79		-SS-3: ODOT A-6a; qh = 9.0+ ksf -slightly indurated	13		
				Gray weathered SHALE. Very soft. Damp.	4.0		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ∇ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-11
Sheet 1 of 1
Completion Depth 4.7'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 260+00
Offset 32' RT
Elevation 788.41 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				8.0" - Concrete			
				2.0" - Sand and gravel base			
SS-1	3 10 36	39		Mottled gray and brown SILT and CLAY, some coarse to fine sand, little fine gravel (limestone fragments). Hard. Moist. -SS-1: Visual** ODOT A-6a; qh = 4.5 ksf	9	34	19
SS-2	50/4"	75		Gray weathered SHALE. Medium hard to hard. Damp.	7		
SS-3	50/2"	0		Bottom of Boring = 4.7 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-12
Sheet 1 of 1
Completion Depth 4.2'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 269+00
Offset 19' RT
Elevation 798.40 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG	
						LL	PL
				3.0" - Topsoil	0.3		
SS-1	3 4 4	83		FILL: Brown fine and coarse SANDY SILT, some fine gravel (concrete fragments), some clay. Medium stiff. Moist. -SS-1: ODOT A-4a (2); qh = 6.0 ksf	12	23	14
SS-2	4 6 17	78	2.5	Mottled brown and gray SILT and CLAY, some to little coarse to fine sand, trace fine gravel. Very stiff to hard. Moist to damp. -SS-2: ODOT A-6a (7); qh = 9.0+ ksf	14	27	15
SS-3	14 23 50/2"	100		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	12		
				Gray weathered SHALE. Hard. Damp.	4.0		
				Bottom of Boring = 4.2 feet	4.2		
			5.0				

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-13
Sheet 1 of 1
Completion Depth 4.6'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 277+00
Offset 32' RT
Elevation 814.60 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.5" - Asphalt	0.5		
				9.5" - Concrete	1.3		
SS-1	4 6 12	56	2.5	2.5" - Sand and gravel base Brown coarse to fine SANDY SILT, some clay, little fine gravel. Very stiff to hard. Damp. -SS-1: ODOT A-4a (6); qh = 9.0+ ksf	1.5	12	24
SS-2	7 20 42	72		-SS-2: ODOT A-4a (6); qh = 9.0+ ksf		11	22
SS-3	50/3"	0	5.0	Gray weathered SHALE. Medium hard. Damp. Bottom of Boring = 4.6 feet	4.3 4.6		15

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-14
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 285+00
Offset 19' RT
Elevation 820.20 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	2 3 4	50		3.5" - Topsoil	0.3		
				Mottled brown and gray coarse to fine SANDY SILT, little to some clay, some to little fine gravel. Medium stiff to stiff. Damp to moist. -SS-1: ODOT A-4a (0); qh = 7.0 ksf -limestone fragments, glass and organics in SS-1	10	22	14
SS-2	3 4 5	67		-SS-2: ODOT A-4a (4); qh = 9.0+ ksf	13	25	15
SS-3	3 5 7 11	75		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	12		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft.
At Completion ▽ Dry ft.
Extended ▽ NA ft.

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-15
Sheet 1 of 1
Completion Depth 4.8'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 293+00
Offset 32' RT
Elevation 814.92 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				9.0" - Concrete	0.5		
				8.5" - Sand and gravel base	1.3		
SS-1A	4	56			2.0		
SS-1B	5			Mottled brown and gray SILT and CLAY, little to trace coarse to fine sand, little to trace fine gravel. Stiff to hard. Damp.		17	35
			2.5	-SS-1B: ODOT A-6a (9); qh = 8.5 ksf			20
SS-2	7	83				14	36
	12			-SS-2: ODOT A-6a (10); qh = 9.0+ ksf			21
	19						
SS-3	50/4"	50		Gray weathered SHALE. Medium hard. Damp.	4.5	8	
					4.8		
			5.0	Bottom of Boring = 4.8 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-16
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 301+00
Offset 19' RT
Elevation 800.68 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.5" - Topsoil	0.3		
SS-1	2 3 4	89		Mottled brown and gray changing to gray SILT and CLAY, some coarse to fine sand, little fine gravel. Medium stiff. Moist. -SS-1: ODOT A-6a (5); qh = 4.0 ksf	15	30	17
SS-2	4 5 8	78		Mottled gray and brown SILTY CLAY, little coarse to fine sand, trace to some fine to coarse gravel. Stiff to very stiff. Moist to damp. -SS-2: ODOT A-6b (11); qh = 9.0+ ksf	17	34	17
SS-3	10 19 8 12	29		-SS-3: Visual** ODOT A-6b; qh = 8.0 ksf -limestone fragments in SS-3	11		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-17
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 309+00
Offset 32' RT
Elevation 793.07 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				9.0" - Concrete			
				2.5" - Sand and gravel base			
SS-1	3 4 6	83		Gray SILT and CLAY, little coarse to fine sand, trace fine gravel. Stiff. Damp. -SS-1: ODOT A-6a (9); qh = 8.5 ksf	16	34	21
SS-2	5 5 8	61		Gray SILTY CLAY, little coarse to fine sand, little to some coarse to fine gravel. Stiff to hard. Damp. -SS-2: ODOT A-6b (9); qh = 8.5 ksf	16	36	20
SS-3	5 13 21 8	50		-SS-3: Visual** ODOT A-6b; qh = 8.0 ksf -limestone fragments in SS-3	14		
				Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-18
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 317+00 Boring Method 4.0" SFA
Offset 19' RT Hammer Weight 140 lbs.
Elevation 799.08 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.0" - Topsoil			
SS-1	2 3 5	72		Brown coarse to fine SANDY SILT, some clay, some fine gravel. Medium stiff. Damp. -SS-1: ODOT A-4a (1); qh = 6.0 ksf	10	24	15
SS-2	3 4 6	83		Brown SILT and CLAY, some coarse to fine sand, little fine gravel. Stiff to medium stiff. Damp. -SS-2: ODOT A-6a (6); qh = 9.0+ ksf	12	30	16
SS-3	9 4 3 5	75		-SS-3: Visual** ODOT A-6a; qh = 8.5 ksf	16		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-19
Sheet 1 of 1
Completion Depth 5.7'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 325+00
Offset 32' RT
Elevation 811.72 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.5" - Asphalt			
				8.5" - Concrete	0.5		
				2.0" - Sand and gravel base	1.3		
SS-1	6 4 10	11	2.5	Mottled brown and gray coarse to fine GRAVEL, some silt, little coarse and fine sand, trace clay. Medium dense. Very moist. -SS-1: Visual** ODOT A-2-4	1.5	11	
SS-2	10 12 18	83	3.0	Gray SILT and CLAY, trace to little fine to coarse sand, trace to some fine to coarse gravel. Very stiff to hard. Damp. -SS-2: ODOT A-6a (10); qh = 9.0+ ksf		13	33
SS-3A	26 40 50/2"	43	5.0	-SS-3A: Visual** ODOT A-6a; qh = 9.0+ ksf -slightly indurated with limestone fragments		8	
SS-3B			5.0	Gray weathered SHALE. Hard. Damp.	5.0		
			5.7	Bottom of Boring = 5.7 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-20
Sheet 1 of 1
Completion Depth 4.3'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 333+00
Offset 19' RT
Elevation 821.48 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	4 6 9	78		3.5" - Topsoil	0.3		
				Mottled brown and gray fine to coarse SANDY SILT, some coarse to fine gravel, little clay, trace organics. Stiff. Damp. -SS-1: ODOT A-4a (0); qh = 9.0+ ksf	9	23	14
SS-2A	5 10 15	61		Brown coarse to fine SAND, little fine gravel, little silt, trace clay. Medium dense. Moist. -SS-2A: Visual* ODOT A-3a	1.5		
SS-2B			2.5	Gray SILTY CLAY, some fine to coarse sand, some fine gravel. Very stiff. Damp. -SS-2B: ODOT A-6b (7); qh = 9.0+ ksf	2.5	11	32
SS-3	19 27 50/4"	75		Gray weathered SHALE. Medium hard. Damp.	3.0	7	16
			4.3	Bottom of Boring = 4.3 feet			
			5.0				

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-21
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 341+00 Boring Method 4.0" SFA
Offset 32' RT Hammer Weight 140 lbs.
Elevation 831.71 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				6.6" - Asphalt			
				10.0" - Concrete	0.5		
				2.5" - Sand and gravel base	1.4		
SS-1	4 10 12	89	2.5	Brown coarse to fine SANDY SILT, little clay, little fine gravel. Very stiff. Very moist. -SS-1: ODOT A-4a (4); qh = 8.0 ksf	1.6	13	NP NP
SS-2	6 11 18	78	3.0	Brown coarse to fine SANDY SILT, little fine gravel, little clay. Very stiff. Damp. -SS-2: ODOT A-4a (3); qh = 9.0+ ksf		10	17 14
SS-3	8 12 17 23	88	5.0	-SS-3: ODOT A-4a; qh = 9.0+ ksf		10	
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OO Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-22
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 349+00
Offset 19' RT
Elevation 827.61 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.75" - Topsoil	0.3		
SS-1	3 7 12	83		Brown fine to coarse SAND, some fine gravel, little silt, little clay, trace organics. Medium dense. Damp. -SS-1: ODOT A-2-4 (0)	8	17	12
SS-2	5 8 10	89		Brown changing to mottled brown and gray coarse to fine SANDY SILT, some clay, little fine gravel. Very stiff. Damp to moist. -SS-2: ODOT A-4a (4); qh = 9.0+ ksf -trace organics in SS-2	9	21	13
SS-3	9 11 12 17	88		-SS-2: Visual** ODOT A-4a; qh = 9.0+ ksf	11		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: **Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-23
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 357+00
Offset 32' RT
Elevation 816.48 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				5.5" - Asphalt			
				9.0" - Concrete	0.5		
				2.75" - Sand and gravel base	1.2		
SS-1	4 7 15	78	2.5	Mottled brown and gray coarse to fine SANDY SILT, some clay, trace to little fine gravel. Very stiff to stiff. Damp to moist. -SS-1: ODOT A-4a (6); qh = 9.0+ ksf	9	17	14
SS-2	9 12 16	100		-SS-2: ODOT A-4a (6); qh = 7.5 ksf	11	20	15
SS-3	6 6 7 10	79	5.0	-SS-3: ODOT A-4a; qh = 9.0+ ksf	13		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-24
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/28/03
Date Finished: 10/28/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 365+00
Offset 19' RT
Elevation 801.60 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				3.5" - Topsoil	0.3		
SS-1	2 3 6	100		FILL: Brown coarse to fine SANDY SILT, some clay, some fine gravel, trace organics. Stiff. Damp. -SS-1: ODOT A-4a (2); qh = 7.0 ksf	10	19	14
SS-2A	5 5 7	89		FILL: Brown fine GRAVEL (pea gravel), little fine to coarse sand, trace silt, trace clay. Medium dense. Damp.	1.5		
SS-2B				Mottled brown and gray coarse to fine SANDY SILT, some to little coarse to fine gravel, some clay. Stiff. Damp. -SS-2B: ODOT A-4a (3); qh = 9.0+ ksf	2.0	9	20
SS-3	4 5 5 7	92		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	10		14
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-25
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 373+00
Offset 32' RT
Elevation 789.60 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				7.0" - Asphalt			
				8.5" - Concrete	0.6		
				4.0" - Sand and gravel base	1.3		
SS-1	4 5 8	89	2.5	Brown changing to mottled brown and gray coarse to fine SANDY SILT, some clay, little fine gravel. Stiff to very stiff. Moist to damp. -SS-1: ODOT A-4a (5); qh = 9.0+ ksf	1.6	10	16
SS-2	7 10 14	94		-SS-2: ODOT A-4a (4); qh = 9.0+ ksf		10	17
SS-3	6 8 11 16	83	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf		9	
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-26
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 381+00
Offset 19' RT
Elevation 780.01 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.0" - Topsoil	0.3		
SS-1A	3 5 7	56		FILL: Brown coarse to fine SANDY SILT, some fine gravel, some clay, trace organics. Stiff. Moist. -SS-1A: ODOT A-4a (4); qh = 9.0 ksf	10	17	12
SS-1B				FILL: Brown fine GRAVEL (pea gravel), little fine to coarse sand, trace silt, trace clay. Medium dense. Damp.	1.0		
SS-2	6 8 11	67		Mottled gray and brown SILT and CLAY, little fine gravel, trace fine sand. Very stiff. Damp. -SS-2: ODOT A-6a (10); qh = 9.0+ ksf	14	36	21
SS-3	7 7 12 18	79		Gray coarse to fine SANDY SILT, some clay, trace fine gravel. Very stiff. Damp. -SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	14		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-27
Sheet 1 of 1
Completion Depth 5.7'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 389+00
Offset 32' RT
Elevation 789.18 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				5.5" - Asphalt			
				10.0" - Concrete	0.5		
				2.0" - Sand and gravel base	1.3		
SS-1	4 12 17	67		Gray SILTY CLAY, some coarse to fine gravel, little fine to coarse sand. Very stiff. Damp. -SS-1: ODOT A-6b (8); qh = 9.0+ ksf	12	37	20
			2.5				
SS-2	13 19 23	89		Gray SILT and CLAY, some coarse to fine gravel, trace to some fine to coarse sand. Hard. Damp. -SS-2: ODOT A-6a (9); qh = 9.0+ ksf	11	36	22
SS-3	20 43 50/2"	86		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	11		
			5.0				
				Gray weathered SHALE. Hard. Damp. Bottom of Boring = 5.7 feet	5.5		
					5.7		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-28
Sheet 1 of 1
Completion Depth 4.3'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 397+00
Offset 19' RT
Elevation 797.60 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	2 3 5	89		2.5" - Topsoil	0.2		
				Mottled brown and gray SILT and CLAY, some coarse to fine sand, little fine gravel, trace organics. Medium stiff to very stiff. Moist to damp. -SS-1: ODOT A-6a (5); qh = 6.0 ksf	14	27	16
SS-2	4 7 10	89			12	28	15
			2.5	-SS-2: ODOT A-6a (6); qh = 9.0+ ksf			
SS-3A	12 31 50/4"	88			12		
				-SS-3A: Visual** ODOT A-6a; qh = 9.0+ ksf -indurated	4.0		
SS-3B				Gray weathered SHALE. Medium hard. Damp.	4.3		
				Bottom of Boring = 4.3 feet			
			5.0				

NOTES: **Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-29
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 405+00
Offset 32' RT
Elevation 800.16 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG	
						LL	PL
				6.0" - Asphalt			
				10.0" - Concrete	0.5		
				2.5" - Sand and gravel base	1.5		
SS-1	6 7 10	100		Brown coarse to fine SANDY SILT, some clay, little to some coarse to fine gravel. Very stiff to hard. Damp. -SS-1: ODOT A-4a (4); qh = 9.0+ ksf	8	21	13
SS-2	9 11 16	100		-SS-2: ODOT A-4a (4); qh = 9.0+ ksf	9	20	14
SS-3	13 14 19 30	67		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf -limestone fragments in SS-3	8		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-30
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 413+00
Offset 19' RT
Elevation 787.02 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.5" - Topsoil	0.3		
SS-1	3 17 10	28		Brown coarse and fine SANDY SILT, some fine gravel, little clay. Very stiff. Damp. -SS-1: ODOT A-4a (1); qh = 9.0+ ksf	9	20	14
SS-2	9 15 26	78		Mottled gray and brown changing to gray SILT and CLAY, trace to little coarse to fine sand, trace to little coarse to fine gravel. Very stiff to hard. Damp. -SS-2: ODOT A-6a (10); qh = 9.0+ ksf	13	34	19
SS-3	8 11 16 21	79		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	13		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-31
Sheet 1 of 1
Completion Depth 6.5'
Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 421+00 Boring Method 4.0" SFA
Offset 32' RT Hammer Weight 140 lbs.
Elevation 772.46 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				5.8" - Asphalt			
				10.5" - Concrete	0.4		
				3.0" - Sand and gravel base	1.3		
SS-1	3 4 8	56	2.5	Gray changing to mottled gray and brown SILT and CLAY, some to little coarse to fine gravel, little to some coarse to fine sand. Stiff. Damp. -SS-1: ODOT A-6a (6); qh = 9.0+ ksf	11	33	19
SS-2	4 6 7	67		-SS-2: ODOT A-6a (10); qh = 8.0 ksf	11	33	18
SS-3	7 9 6 10	83	5.0	-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	14		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: **Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



RESOURCE INTERNATIONAL, INC.
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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-32
Sheet 1 of 1
Completion Depth 5.0'
Date Started: 10/27/03
Date Finished: 10/27/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 429+00 Boring Method 4.0" SFA
Offset 19' RT Hammer Weight 140 lbs.
Elevation 755.02 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG	
						LL	PL
SS-1	3 7 5	89		3.0" - Topsoil 0.3			
				Mottled brown and gray coarse to fine SANDY SILT, some coarse to fine gravel, some clay. Stiff. Damp. -SS-1: ODOT A-4a (1); qh = 9.0+ ksf	8	20	13
				1.5			
SS-2	5 5 11	78		Mottled brown and gray SILT and CLAY, little to some coarse to fine sand, little fine gravel. Very stiff to stiff. Damp. -SS-2: ODOT A-6a (8); qh = 9.0+ ksf	12	30	17
			2.5				
SS-3	5 6 8 12	88		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	8		
			5.0	Bottom of Boring = 5.0 feet 5.0			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-33
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 437+00
Offset 32' RT
Elevation 740.46 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				7.5" - Concrete			
				4.0" - Sand and gravel base			
SS-1	7 4 3	44	2.5	Brown coarse to fine SANDY SILT, some clay, little fine gravel. Medium stiff. Very moist. -SS-1: ODOT A-4a (3); qh = 4.5 ksf	13	19	13
SS-2	6 5 5	78	3.0	Brown coarse to fine SANDY SILT, little clay, little coarse to fine gravel. Stiff. Damp to moist. -SS-2: ODOT A-4a (3); qh = 5.5 ksf	9	17	12
SS-3	4 5 6 8	75	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	10		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-34
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 445+00
Offset 19' RT
Elevation 723.02 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.0' - Topsoil			
SS-1	2 3 6	100		Mottled brown and gray coarse to fine SANDY SILT, some clay, little fine gravel. Stiff to very stiff. Damp. -SS-1: ODOT A-4a (4); qh = 9.0+ ksf -trace organics in SS-1	9	19	13
SS-2	4 11 6	39		-SS-2: ODOT A-4a (4); qh = 9.0+ ksf	8	19	13
SS-3	4 6 8 13	42		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	10		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-35
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 16+00
Offset 32' RT
Elevation 708.79 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				5.5" - Asphalt	0.5		
				7.5" - Concrete	1.0		
				5.0" - Sand and gravel base	1.4		
SS-1	6 5 3	72	2.5	Brown coarse to fine SANDY SILT, some coarse to fine gravel, some clay. Medium stiff. Moist. -SS-1: ODOT A-4a (3); qh = 9.0+ ksf	10	18	12
SS-2	6 10 12	33	3.0	Mottled brown and black SILT, some clay, little fine gravel, trace coarse and fine sand. Very stiff. Moist. -SS-2: ODOT A-4b (8); qh = 2.5 ksf	13	22	14
SS-3	7 8 10 13	50	5.0	Brown coarse to fine SANDY SILT, some clay, little fine gravel. Very stiff. Damp. -SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	9		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-36
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 24+00
Offset 19' RT
Elevation 700.68 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.5" - Topsoil	0.4		
SS-1	2 3 5	89		Brown coarse to fine SANDY SILT, some to little clay, some to little fine gravel. Medium stiff to hard. Damp. -SS-1: ODOT A-4a (2); qh = 9.0+ ksf	9	16	12
SS-2	10 15 16	61	2.5	-SS-2: ODOT A-4a (6); qh = 9.0+ ksf	9	20	14
SS-3	9 12 18 26	71	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	9		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

Boring Method	4.0" SFA
Hammer Weight	140 lbs.
Hammer Drop	30 inches

NOTES: *Visual only; **Visual with partial testing

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-38
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 40+00
Offset 19' RT
Elevation 703.91 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

TEST LOG				Hammer Drop				
SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG		
					CONTENT	LL	PL	
SS-1	2 3 6	61		4.0" - Topsoil	0.3	9	17	
				Brown coarse to fine SAND and coarse to fine GRAVEL, little silt, little clay. Loose. Damp. -SS-1: ODOT A-2-4 (0)				
SS-2	7 10 15	67	2.5	Brown coarse to fine SANDY SILT, some clay, little fine gravel. Very stiff. Damp. -SS-2: ODOT A-4a (3); qh = 9.0+ ksf	1.5	8	19	
SS-3	9 12 13 15	96		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf		10		
			5.0	Bottom of Boring = 5.0 feet	5.0			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-39
Sheet 1 of 1
Completion Depth 6.2'

Date Started: 10/29/03
Date Finished: 10/29/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 48+00
Offset 32' RT
Elevation 717.64 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				5.5" - Asphalt	0.5		
				10.0" - Concrete	1.3		
SS-1	6 10 16	83	2.5	18.0" - Sand and gravel base. Medium dense. -SS-1: ODOT A-1-b (0)	6	NP	NP
SS-2	12 19 24	78	3.0	Gray SILT, some clay, little to some coarse to fine sand. Hard. Damp to moist. -SS-2: ODOT A-4b (8); qh = 9.0+ ksf	10	18	14
SS-3	20 27 39 50/3"	50	5.0	-SS-3: Visual** ODOT A-4b; qh = 9.0+ ksf	12		
			6.2	Bottom of Boring = 6.2 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-40
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 56+00
Offset 19' RT
Elevation 729.00 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	4 4 6	83		2.75" - Topsoil Dark brown coarse to fine SANDY SILT, some clay, little fine gravel. Stiff. Damp. -SS-1: ODOT A-4a (2); qh = 7.0 ksf	0.3	11	22
SS-2	4 6 7	72	2.5	Brown coarse to fine SAND and fine GRAVEL, little silt, little clay. Medium dense. Damp. -SS-2: ODOT A-2-4 (0)	1.5	8	16
SS-3	9 14 18 20	88	5.0	Mottled brown and gray coarse to fine SANDY SILT, some clay, little fine gravel. Hard. Damp. -SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	3.0	7	12
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-41
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 64+00
Offset 32' RT
Elevation 743.24 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.5" - Asphalt	0.5		
				10.5" - Concrete	1.4		
SS-1	3 6 9	100	2.5	2.0" - Sand and gravel base Mottled brown and gray changing to brown coarse to fine SANDY SILT, some clay, little to some coarse to fine gravel. Stiff to hard. Damp. -SS-1: ODOT A-4a (5); qh = 9.0+ ksf	10	20	13
SS-2	7 13 17	89		-SS-2: ODOT A-4a (4); qh = 9.0+ ksf	10	20	14
SS-3	10 16 19 15	75	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf -increase in gravel in SS-3	8		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-42
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 72+00
Offset 30.3' RT
Elevation 754.70 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	4 7 7	72		3.5" - Topsoil	0.3		
				Brown fine GRAVEL, some fine to coarse sand, little silt, trace clay. Medium dense. Damp. -SS-1: ODOT A-1-b (0)		8	18
SS-2	4 5 6	94			1.5		
				Brown fine to coarse SAND, some fine gravel, little silt, little clay. Medium dense. Damp. -SS-2: ODOT A-2-4 (0)		8	16
SS-3	3 4 5 7	17	2.5				
				Brown coarse to fine SANDY SILT, little fine gravel, trace clay. Stiff. Damp. -SS-3: Visual** ODOT A-4a; qh = 8.5 ksf	3.0	14	13
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-43
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 80+00
Offset 70.9' RT
Elevation 776.04 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				5.5" - Asphalt	0.5		
				9.0" - Concrete	1.2		
				2.5" - Sand and gravel base	1.5		
AS-1	6 3 7	0	2.5	Brown changing to mottled brown and gray SILT and CLAY, some to trace coarse to fine sand, trace fine gravel. Stiff. Moist. -AS-1: ODOT A-6a (8)	16	33	18
SS-2	4 5 8	83		-SS-2: Visual** ODOT A-6a; qh = 9.0+ ksf	18	27	16
SS-3	6 7 7 10	83	5.0	-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	18		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-44
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 88+00
Offset 78.6' RT
Elevation 797.00 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	3 3 5	94		3.0" - Topsoil Brown coarse to fine SANDY SILT, little clay, little fine gravel. Medium stiff. Damp. -SS-1: ODOT A-4a (2); qh = 9.0 ksf	10	17	13
SS-2	4 7 9	89		Brown coarse to fine SANDY SILT, some clay, little coarse to fine gravel. Very stiff to stiff. Moist to damp. -SS-2: ODOT A-4a (5); qh = 9.0+ ksf	13	24	14
SS-3	5 7 8 11	71		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	11		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-45
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 96+00
Offset 92.5' RT
Elevation 820.09 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt	0.5		
				9.5" - Concrete	1.3		
				3.0" - Sand and gravel base	1.6		
SS-1	2 3 6	78	2.5	Mottled brown and gray coarse to fine SANDY SILT, some clay, little coarse to fine gravel. Stiff to very stiff. Moist. -SS-1: ODOT A-4a (7); qh = 9.0+ ksf	14	22	14
SS-2	5 7 9	89		-SS-2: ODOT A-4a (5); qh = 9.0+ ksf	11	19	13
SS-3	6 8 11 13	96	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	11		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-46
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 104+00
Offset 79.5' RT
Elevation 833.80 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.0" - Topsoil 0.3			
SS-1	4 6 3	94		Brown changing to mottled brown and gray coarse to fine SANDY SILT, some coarse to fine gravel, little to some clay. Stiff to medium stiff. Moist to damp. -SS-1: ODOT A-4a (1); qh = 8.5 ksf	12	20	14
SS-2	3 4 5	67		-SS-2: ODOT A-4a (2); qh = 7.5 ksf	12	22	14
			2.5				
SS-3	6 5 3 4	46		-SS-3: Visual** ODOT A-4a; qh = 6.5 ksf	10		
			5.0	Bottom of Boring = 5.0 feet 5.0			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-47
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

Station	112+00
Offset	93.5' RT
Elevation	849.99 ft

Boring Method	4.0" SFA
Hammer Weight	140 lbs.
Hammer Drop	30 inches

NOTES: *Visual only; **Visual with partial testing

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

Initial	Dry	ft
At Completion	∇ Dry	ft
Extended	∇ NA	ft

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-48
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 120+00
Offset 79.5' RT
Elevation 869.88 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.0" - Topsoil	0.3		
SS-1	3 3 5	89		Brown coarse to fine SAND and fine GRAVEL, some silt, trace clay. Loose. Moist. -SS-1: ODOT A-2-4 (0)	8	NP	NP
SS-2	4 6 7	72		Mottled brown and gray fine GRAVELLY SILT, some clay, little coarse to fine sand. Stiff to very stiff. Moist. -SS-2: ODOT A-4a (1); qh = 9.0+ ksf	13	24	15
SS-3	6 7 10 15	71		-SS-3: Visual** ODOT A-4a; qh = 6.0 ksf	15		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-49
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 128+00
Offset 92.5' RT
Elevation 893.92 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				7.0" - Asphalt			
				9.0" - Concrete			
				3.0" - Sand and gravel base			
SS-1	4 4 7	83	2.5	Brown fine GRAVEL, some coarse to fine sand, little silt, little clay. Medium dense. Moist. -SS-1: ODOT A-2-4 (0)	11	17	12
SS-2	12 18 19	22	3.0	Brown fine GRAVELLY SILT, some fine to coarse sand, little clay. Hard. Damp. -SS-2: ODOT A-4a (1); qh = 5.5 ksf	11	25	15
SS-3	17 23 19 30	50	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf -limestone fragments in SS-3	6		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-50
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 136+00
Offset 79.5' RT
Elevation 906.44 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.0" - Topsoil	0.3		
SS-1	2 3 5	78		Brown coarse to fine GRAVEL, some coarse to fine sand, little silt, little clay. Loose. Moist. -SS-1: ODOT A-2-4 (0) -trace organics in SS-1	11	19	12
SS-2	3 5 9	89		Mottled brown and gray fine GRAVELLY SILT, some to little coarse to fine sand, little to some clay. Stiff to very stiff. Moist to very moist. -SS-2: ODOT A-4a (3); qh = 7.5 ksf -trace organics in SS-2	12	21	13
SS-3	4 6 12 15	75		-SS-3: Visual** ODOT A-4a; qh = 6.0 ksf	16		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: **Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-51
Sheet 1 of 1
Completion Depth 6.5'
Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 144+00 Boring Method 4.0" SFA
Offset 92.5' RT Hammer Weight 140 lbs.
Elevation 918.76 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				9.5" - Concrete			
				4.0" - Sand and gravel base			
SS-1	7 7 9	78	2.5	Mottled brown and gray SILT and CLAY, some fine gravel, some fine to coarse sand. Very stiff. Damp. -SS-1: ODOT A-6a (5); qh = 8.5 ksf	14	30	17
SS-2	12 17 20	83	3.0	Mottled brown and gray SILT and CLAY, little to some coarse to fine sand, trace to little coarse to fine gravel. Hard. Moist to damp. -SS-2: ODOT A-6a (9); qh = 9.0+ ksf	16	30	18
SS-3	16 23 37 30	50	5.0	-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	10		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-52
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/29/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 152+00
Offset 79.5' RT
Elevation 928.20 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG	
						LL	PL
SS-1	3 6 6	83		3.0' - Topsoil	0.3		
				Brown coarse to fine SAND and fine GRAVEL, little clay, little silt, trace organics. Medium dense. Damp. -SS-1: ODOT A-2-4 (0)		9	18
SS-2	5 6 4	89			1.5		
				Mottled brown and gray SILT and CLAY, some coarse to fine sand, little fine gravel. Stiff. Moist. -SS-2: ODOT A-6a (6); qh = 9.0+ ksf		18	27
SS-3	2 3 4 6	83	2.5				
				Mottled brown and gray SILT and CLAY, some coarse to fine gravel, little fine to coarse sand. Medium stiff. Damp. -SS-3: Visual** ODOT A-6a; qh = 3.0 ksf	3.0	13	15
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE
SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING
Initial Dry ft
At Completion ▽ Dry ft
Extended ▽ NA ft

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



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-53
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 160+00
Offset 92.5' RT
Elevation 940.52 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				6.0" - Asphalt			
				9.0" - Concrete	0.5		
				2.75" - Sand and gravel base	1.3		
SS-1	6 5 7	100	2.5	Mottled brown and gray coarse to fine SANDY SILT, some clay, trace to some fine gravel. Stiff. Moist to very moist. -SS-1: ODOT A-4a (4); qh = 8.5 ksf	13	22	13
SS-2	4 5 7	89		-SS-2: ODOT A-4a (6); qh = 9.0+ ksf	13	25	16
SS-3	5 6 8 10	92	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	18		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-54
Sheet 1 of 1
Completion Depth 5.0'
Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 168+00
Offset 79.5' RT
Elevation 949.61 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.5" - Topsoil	0.3		
SS-1	4 6	67		Brown coarse to fine SANDY SILT, some to little clay, some to little fine gravel. Stiff. Damp. -SS-1: ODOT A-4a (1); qh = 9.0+ ksf	10	22	15
SS-2	5 8 4	33	2.5	-SS-2: ODOT A-4a (4); qh = 9.0+ ksf	10	22	15
SS-3	5 6 7 9	75	3.0	Brown SILT and CLAY, some fine gravel, some coarse to fine sand. Stiff. Moist. -SS-3: Visual** ODOT A-6a; qh = 4.0 ksf	17		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-55
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 176+00
Offset 92.5' RT
Elevation 953.48 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				6.0" - Asphalt			
				10.0" - Concrete	0.5		
				3.5" - Sand and gravel base	1.3		
SS-1	5 6 7	89		Mottled brown and gray coarse to fine SANDY SILT, some clay, little fine gravel. Stiff to very stiff. Damp to moist. -SS-1: ODOT A-4a (3); qh = 9.0+ ksf	10	19	14
SS-2	8 10 13	83	2.5	-SS-2: ODOT A-4a (6); qh = 9.0+ ksf	11	22	15
SS-3	7 11 16 20	92	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0 ksf	13		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-56
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 184+00
Offset 79.5' RT
Elevation 948.84 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.5" - Topsoil	0.3		
SS-1	3 4 11	33		Brown coarse to fine SANDY SILT, some fine GRAVEL, some clay, trace organics. Stiff. Damp. -SS-1: ODOT A-4a (0); qh = 6.0 ksf	11	26	16
SS-2	12 7 6	94		Mottled brown and gray SILTY CLAY, little to some coarse to fine sand, trace to little fine gravel. Stiff. Moist. -SS-2: ODOT A-6b (10); qh = 6.0 ksf	21	38	22
SS-3	4 6 7 10	83		-SS-3: Visual** ODOT A-6b; qh = 6.0 ksf	19		
			5.0	Bottom of Boring = 5.0 feet	5.0		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-57
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 192+00
Offset 92.5' RT
Elevation 947.08 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				5.5" - Asphalt			
				10.0" - Concrete	0.5		
				3.5" - Sand and gravel base	1.3		
SS-1	6 10 3	33	2.5	Brown coarse to fine SANDY SILT, some coarse to fine GRAVEL, little clay. Stiff. Moist. -SS-1: ODOT A-4a (1)	1.6	12	19
SS-2	2 3 3	94		Mottled brown and gray coarse to fine SANDY SILT, some clay, little fine gravel. Medium stiff. Moist. -SS-2: ODOT A-4a (5); qh = 4.5 ksf	3.0	13	24
SS-3	3 7 10 15	79	5.0	Gray coarse to fine GRAVELLY SILT and CLAY, little fine to coarse sand. Very stiff. Damp. -SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf -increase in gravel in SS-3	4.5	8	
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-58
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 200+00
Offset 79.5' RT
Elevation 940.04 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				3.5" - Topsoil	0.3		
SS-1	2 4 8	33		Brown changing to grayish brown fine GRAVELLY SILT, some coarse and fine sand, some to little clay. Stiff to very stiff. Damp. -SS-1: Visual** ODOT A-4a; qh = 9.0+ ksf	8		
SS-2	6 7 10	100		-SS-2: ODOT A-4a (1); qh = 9.0+ ksf	6	19	13
SS-3	7 9 8 8	83		Mottled brown and gray SILT and CLAY, some coarse to fine sand, trace fine gravel. Very stiff. Moist. -SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	13		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ∇ Dry ft
Extended ∇ NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-59
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/30/03
Date Finished: 10/30/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 208+00
Offset 92.5' RT
Elevation 927.88 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				5.5" - Asphalt			
				10.4" - Concrete	0.4		
				3.0" - Sand and gravel base	1.3		
SS-1	5 10 14	67		Brown fine to coarse SANDY SILT, some clay, some coarse to fine gravel. Very stiff to hard. Damp. -SS-1: ODOT A-4a (4); qh = 9.0+ ksf	12	22	15
SS-2	11 16 23	94	2.5	-SS-2: ODOT A-4a (4); qh = 9.0+ ksf	10	23	15
SS-3	12 18 21 29	67	5.0	-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	8		
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-60
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/24/03
Date Finished: 10/24/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 184+00
Offset 32' LT
Elevation 724.49 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				5.5" - Asphalt			
				9.5" - Concrete	0.5		
				2.0" - Sand and gravel base	1.3		
SS-1	2 3 5	56		Grayish brown SILTY CLAY, some fine gravel, little coarse to fine sand. Medium stiff. Damp. -SS-1: ODOT A-6b (10); qh = 7.5 ksf	11	39	18
			2.5				
SS-2	7 12 17	83		Mottled brown and gray changing to brown coarse to fine SANDY SILT, some clay, little to some fine gravel. Very stiff. Damp. -SS-2: ODOT A-4a (3); qh = 9.0+ ksf	8	21	13
SS-3	10 13 14 19	83		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	9		
			5.0				
				Bottom of Boring = 6.5 feet	6.5		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
RC - Rock Coring



RESOURCE INTERNATIONAL, INC.
281 Enterprise Drive
Westerville, OH 43081
(614) 885-1959

REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-61
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/24/03
Date Finished: 10/24/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 192+00 Boring Method 4.0" SFA
Offset 19' LT Hammer Weight 140 lbs.
Elevation 715.05 ft Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.5" - Topsoil			
SS-1	7 33 12	72		Brown fine GRAVEL, some fine to coarse sand, little silt, little clay. Dense. Damp. -SS-1: ODOT A-2-4 (0)	7	22	14
SS-2	7 11 15	78		Brownish gray coarse to fine SANDY SILT, some clay, some to little fine gravel. Very stiff. Moist. -SS-2: ODOT A-4a (4); qh = 9.0+ ksf	11	23	13
SS-3	6 7 9 12	92		-SS-3: Visual** ODOT A-4a; qh = 9.0+ ksf	9		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-62
Sheet 1 of 1
Completion Depth 4.7'

Date Started: 10/24/03
Date Finished: 10/24/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 200+00
Offset 32' LT
Elevation 708.49 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				6.6" - Asphalt			
				9.0" - Concrete	0.5		
				2.0" - Sand and gravel base	1.3		
SS-1	6 14 39	44	1.5	Mottled brown and gray SILT and CLAY, some fine gravel, some coarse to fine sand. Hard. Moist. -SS-1: ODOT A-6a (2); qh = 9.0+ ksf	13	30	17
			2.5				
SS-2	50/3"	67	2.8	Gray weathered SHALE. Medium hard to hard. Damp.	6		
SS-3	50/2"	0	4.7	Bottom of Boring = 4.7 feet			
			5.0				

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ✓ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
MD - Mud Drilling
WD - Wash Drilling
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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-63
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/24/03
Date Finished: 10/24/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 208+00
Offset 19' LT
Elevation 706.57 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
				4.75" - Topsoil			
SS-1	3 4 5	78		Brown fine GRAVEL, some fine to coarse sand, little clay, little silt. Loose. Damp. -SS-1: ODOT A-2-6 (1)	9	28	14
SS-2	5 6 8	83		Brown changing to mottled brown and gray SILT and CLAY, some coarse to fine sand, some to little fine gravel. Stiff. Damp. -SS-2: ODOT A-6a (3); qh = 9.0+ ksf	12	29	16
SS-3	5 6 7 11	92		-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf	12		
			5.0	Bottom of Boring = 5.0 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
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WD - Wash Drilling
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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-64
Sheet 1 of 1
Completion Depth 6.5'

Date Started: 10/24/03
Date Finished: 10/24/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 216+00
Offset 32' LT
Elevation 716.25 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	PL
				7.0" - Asphalt			
				9.75" - Concrete			
				2.0" - Sand and gravel base			
SS-1	4 5 7	100	2.5	Mottled brown and gray SILTY CLAY, some coarse to fine sand, some fine gravel. Stiff. Damp. -SS-1: ODOT A-6b (5); qh = 7.5 ksf	11	31	15
SS-2	6 6 8	72	3.0	Mottled brown and gray changing to gray coarse to fine GRAVELLY SILT, some coarse and fine sand, little clay. Stiff. Damp. -SS-2: ODOT A-4a (1); qh = 9.0+ ksf	9	23	14
SS-3	9 7 7 5	50	5.0	-SS-3: Visual** ODOT A-4a; qh = 8.5 ksf -slightly indurated	6		
			6.5	Bottom of Boring = 6.5 feet			

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion Dry ft
Extended NA ft

BORING METHOD

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REPORT OF SOIL EXPLORATION

Client ODOT District 8
Project WAR-75-3.40
Project Number B-03-023

Boring Number B-65
Sheet 1 of 1
Completion Depth 5.0'

Date Started: 10/24/03
Date Finished: 10/24/03
Drilled By: C.M.

DRILLING AND SAMPLING INFORMATION

Station 224+00
Offset 19' LT
Elevation 727.93 ft

Boring Method 4.0" SFA
Hammer Weight 140 lbs.
Hammer Drop 30 inches

SAMPLE NO	BLOWS PER 6"	PERCENT RECOVERY	DEPTH	SOIL DESCRIPTION	MOISTURE CONTENT	ATTERBERG LL	ATTERBERG PL
SS-1	10 19 26	67		2.5" - Topsoil Brown changing to mottled brown and gray SILT and CLAY, some coarse to fine sand, little to some coarse to fine gravel. Hard to very stiff. Damp. -SS-1: ODOT A-6a (6); qh = 9.0+ ksf	8	29	16
SS-2	9 12 17	56	2.5	-SS-2: ODOT A-6a (6); qh = 9.0+ ksf	8	27	15
SS-3	10 14 16 19	54	5.0	-SS-3: Visual** ODOT A-6a; qh = 9.0+ ksf Bottom of Boring = 5.0 feet	10		

NOTES: *Visual only; **Visual with partial testing

SAMPLE TYPE

SS - 2" OD Split Spoon
GS - Geoprobe Sample
ST - Shelby Tube
RC - Rock Core
AS - Auger Sample

GROUND WATER READING

Initial Dry ft
At Completion ∇ Dry ft
Extended NA ft

BORING METHOD

HSA - Hollow Stem Augers
SFA - Solid Flight Augers
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