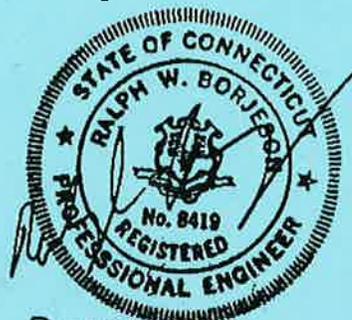


**RECONSTRUCTION OF I-95 OVER WEST RIVER
WEST HAVEN AND NEW HAVEN, CONNECTICUT**

STATE PROJECT NO. 92-522

**FINAL
STRUCTURE SOIL AND ROCK REPORT
REVISED WALL NO. 101**

July 2007



Prepared by

PB Americas, Inc.

Submitted to
CONNECTICUT DEPARTMENT OF TRANSPORTATION



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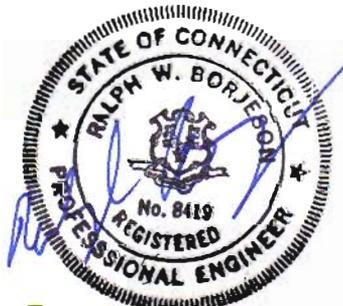
DATE: Nov-14-2007

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1.0 PROPOSED CONSTRUCTION

The retaining walls for the project have changed somewhat from those discussed in the Type Study Report. Two retaining walls, Wall No. 101 and Wall No. 102, were originally proposed as a part of the Reconstruction of I-95 Over West River Project. Wall No. 101 was located along I-95 Southbound and extended from approximately I-95 Station 1+440 to 1+720. Wall No. 102 was located along I-95 Northbound and extended from approximately I-95 Station 1+480 to 1+700. Both of the walls were cast-in-place concrete supported on spread footing foundations, except for the western 70 m (230 ft) of Wall No. 101 which was pile supported.

Wall No. 101 was became a mechanically stabilized earth or prefabricated modular wall located adjacent to I-95 Southbound along Ramp D, extending from Ramp D Station 40+140 to 40+200 and was soil supported.

A Revised Wall No 101 was determined necessary by a change in the sound barrier from timber to masonry units. The new masonry unit sound wall rests on top of the parapet of Wall No. 101, resulting in Revised Wall No. 101 being designed as a cast-in-place concrete wall.

2.0 EXISTING CONDITIONS

Existing subsurface information was not directly available for Wall No. 101. However, borings from Bridge No. 00164 and 00165 combined with information from the surficial geology map of the area indicated the probability that organic silts existed west of approximately I-95 Station 1+500. Sands and silty sands were anticipated to the east.

3.0 PRELIMINARY DESIGN

3.1 Type Study

The Wall Type Study Report for the Reconstruction of I-95 Over West River recommended two retaining walls, Wall No. 101 and Wall No. 102. Wall No. 101 was approximately 255 m (835 ft) long, extending from approximately I-95 Station 1+440 to 1+720 with a maximum height of approximately 6.0 m (20 ft), and an average exposed height of 4.0 m (13 ft). Wall No. 102 was approximately 195 m (640 ft) long, extending from approximately I-95 Station 1+480 to 1+700 with a maximum height of approximately 6.2 m (20.5 ft), and an average exposed height of 4.0 m (13 ft). The walls were each divided into sections, west and east of the abutments of Bridge No. 00165.

Both the walls were supported on spread footing foundations, with preliminary design based on a service limit bearing resistance of 0.240 MPa (5 ksf), except for the western 70 m (230 ft) of Wall No. 101 which was supported on 30.5 m (100 ft) long 355 mm (14 in) friction piles (either square precast prestressed concrete or constant diameter cast-in-place concrete) with an ultimate capacity of 890 kN (100 tons) with 178 kN (20 tons) of down drag acting on the piles.

3.2 Present Design

The present design has divided Wall No. 101 into two walls, now known as Walls 101 and 102. Wall No. 102 was renumbered to become Wall No. 103. Currently, Revised Wall No. 101 extends from Ramp D Station 40+153 to 40+198.

Revised Wall No. 101 is a cast-in-place concrete wall with a masonry unit noise wall that rests on the wall parapet for the entire wall length. Wall No. 101 is 47.2 m (155 ft) long, with the bottom of footing for the westerly 22.2 m (73 ft) being at El 1.0 m (3.3 ft) and for the easterly 25.0 m (82 ft) at El 2.2 m (7.2 ft). The wall

height varies from 4.38 to 2.92 m (14.5 to 9.5 ft). The wall supports the widened I-95 Southbound Off Ramp (Ramp D).

4.0 SUBSURFACE EXPLORATION

Four final design borings were drilled in the vicinity of Revised Wall No. 101. These were W101-1, R-13, W101-2 and W101-3. The locations of the new test borings are shown on Figure 2. A subsurface profile with the new borings and the wall is shown on Figures 3. Boring logs and laboratory data for these borings are provided in Appendix A and Appendix B, respectively. The ground surface at the new borings varied from El 1.47 to 3.65 m (4.8 to 12.0 ft).

The western borings, W101-1 and R-13, indicated approximately 1 to 2 m (3.5 to 6.5 ft) of loose to medium dense sand fill overlying organic silt. The organic silt varied in thickness from 1 to 3.8 m (3.5 to 12.5 ft) being thicker to the west. Based on the borings and the local terrain, it is estimated that organic silt underlies the western 7.5 m (25 ft) of the wall. Boring W101-2 had approximately 2 m (6.5 ft) of sand fill, but did not have any organic silt. Beneath the organic silt or fill was loose to dense, generally medium dense red-brown fine sand, silty fine sand, and fine sand and silt. Groundwater was noted between El 1.1 to -0.94 m (3.5 to -3 ft).

5.0 RECOMMENDATIONS

5.1 General

The organic silt underlying the western approximately 7.5 m (25 ft) of Revised Wall No. 101 is unsuitable for foundation support. It is recommended that this unsuitable material be removed and replaced with granular fill, sloping down at a 1:1 slope from 0.3 m (1 ft) from the base of the wall footing to the bottom of the organic silt. The maximum thickness of the organic silt beneath the wall is

estimated to be approximately 0.5 m (1.5 ft) and extend to El 0 m (0 ft). It appears that excavation and removal will be less expensive than driving piles to support this portion of the wall. Ramp construction will be addressed in the Roadway Report.

For Revised Wall No. 101 it is recommended that after removal and replacement of the unsuitable organic silt, granular fill be placed in accordance with the requirements of Section 2.14 of Form 816 for "Compacted Granular Fill".

Service Limit State

Based on Table C10.6.2.3.1-1 of the AASHTO LRFD Bridge Design Specifications a presumptive allowable average bearing pressure at the service limit state of 0.145 MPa (3 ksf) is recommended for wall design. Settlement at a uniform 0.145 MPa (3 ksf) footing load is estimated to be 10 mm (0.4 in).

Strength Limit State

An ultimate bearing capacity of 1.82 MPa (19 tsf) is recommended for wall design, with a resistance factor of 0.45 for the strength limit state. The ultimate bearing capacity is for vertical loading and needs to be multiplied by a load inclination reduction factor as given in Table 10.6.3.1.3b-2 of the LRFD Specifications, with the horizontal and vertical loads being unfactored loads. At the strength limit state using factored loads and resistances, the resultant of the reaction forces should fall within the middle one-half of the wall base. A friction angle for the soil of 33° with a resistance factor of 0.8 for the strength limit state is recommended for evaluating sliding stability of the footings.

Extreme Event Limit State

For the extreme event limit state a resistance factor of 1.0 should be used.

5.2 Lateral Loads

The wall should be designed for active earth pressure determined in accordance with Figure 4. It is recommended that an effective soil unit weight (γ') of 2000 kg/cm² (125 pcf), an effective angle of internal friction (ϕ') of 35⁰ be used.

The load factors for horizontal earth pressure for the strength limit and the extreme event limit states should be 1.50 maximum and 0.90 minimum and 1.00 for the service limit state.

Since the wall supports a roadway, it should be designed for a surcharge force of 3.63 H kN/m (0.076 H k/ft) acting at H/2 from the base of the footing. The load factors for surcharge earth pressure for the strength limit and the extreme event limit states should be 1.50 maximum and 0.75 minimum, and 1.00 for the service limit state.

5.3 Seismic Loads

Revised Wall No. 101 does not have to be designed for seismic loading because it has a maximum height of 4.38 m (14.5 ft), which is less than the 7.5 m (25 ft) minimum height the ConnDOT Bridge Design Manual requires for seismic design.

5.4 Global Stability

The global stability of Revised Wall No. 101 after removing the organic silt was evaluated, at the service limit state, based on the Service I Load Combination and a resistance factor ϕ of 0.65 and was found to be stable.

5.5 Structure Backfill and Drainage

Pervious structural backfill is recommended behind the wall, above a slope line starting at the top of the heel and extending upward at a slope of 1V:1½H. Pervious structural backfill should be in accordance with the requirements of Section 2.16 of Form 816 for "Pervious Structural Backfill". Where existing

embankment material that will not be excavated falls within the area of pervious structural backfill, it may remain in place. The wall should have underdrains consisting of 150 mm (6 in) CCM pipe, instead of wall drains to avoid water impacting the adjacent structure. Structure underdrains should be in accordance with the requirements of Section 7.51 of Form 816 for "Underdrains and Outlets".

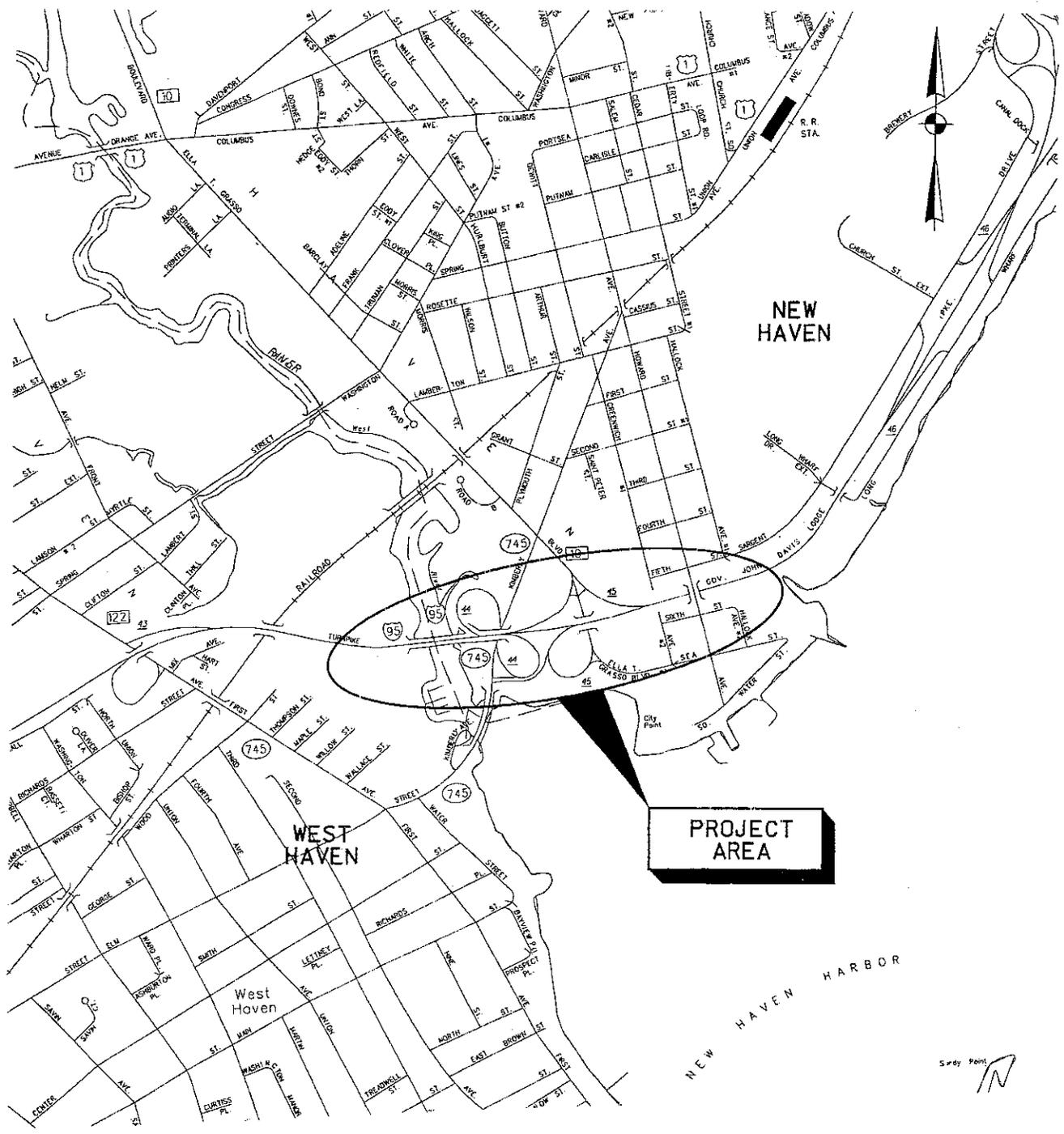
6.0 CONSTRUCTION CONSIDERATIONS

Temporary excavation support will be required in front of the wall to minimize impact on adjacent properties. Temporary steel sheet piling should be appropriate at this site.

It is anticipated that the excavation and replacement of the unsuitable organic silt can be accomplished in an open excavation with 1V:1½H slopes.

The bottoms of the excavations for the wall footings, as well as for the removal of the organic silt may be below the groundwater table. Sump pumping from the corners of the excavations should be sufficient to control groundwater.

FIGURES



**FINAL STRUCTURE SOILS
AND ROCK REPORT
RECONSTRUCTION OF I-95 OVER WEST RIVER
NEW HAVEN / WEST HAVEN, CONNECTICUT**

**REVISED WALL NO. 101
SITE LOCATION PLAN**

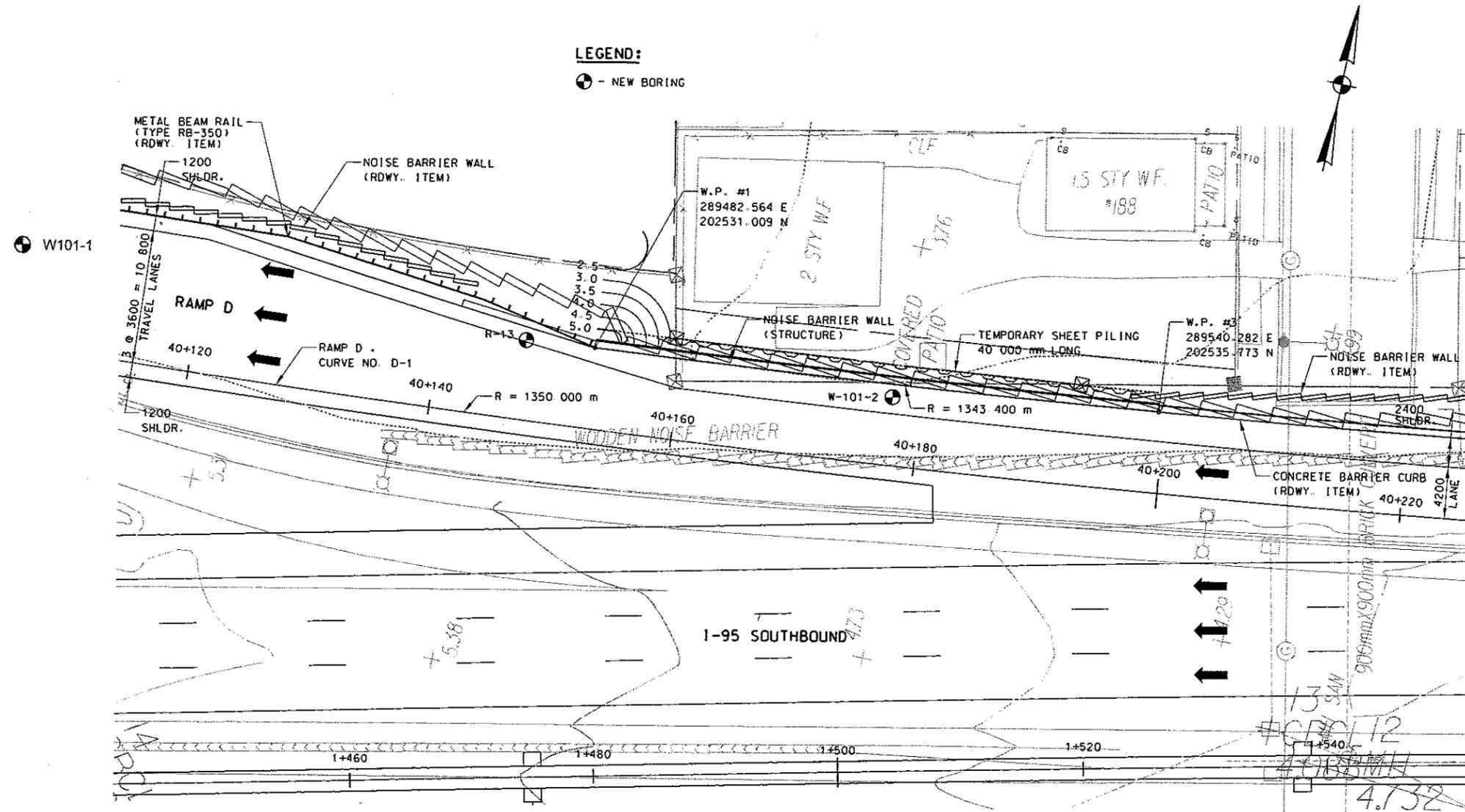
JULY 2007

FIGURE 1



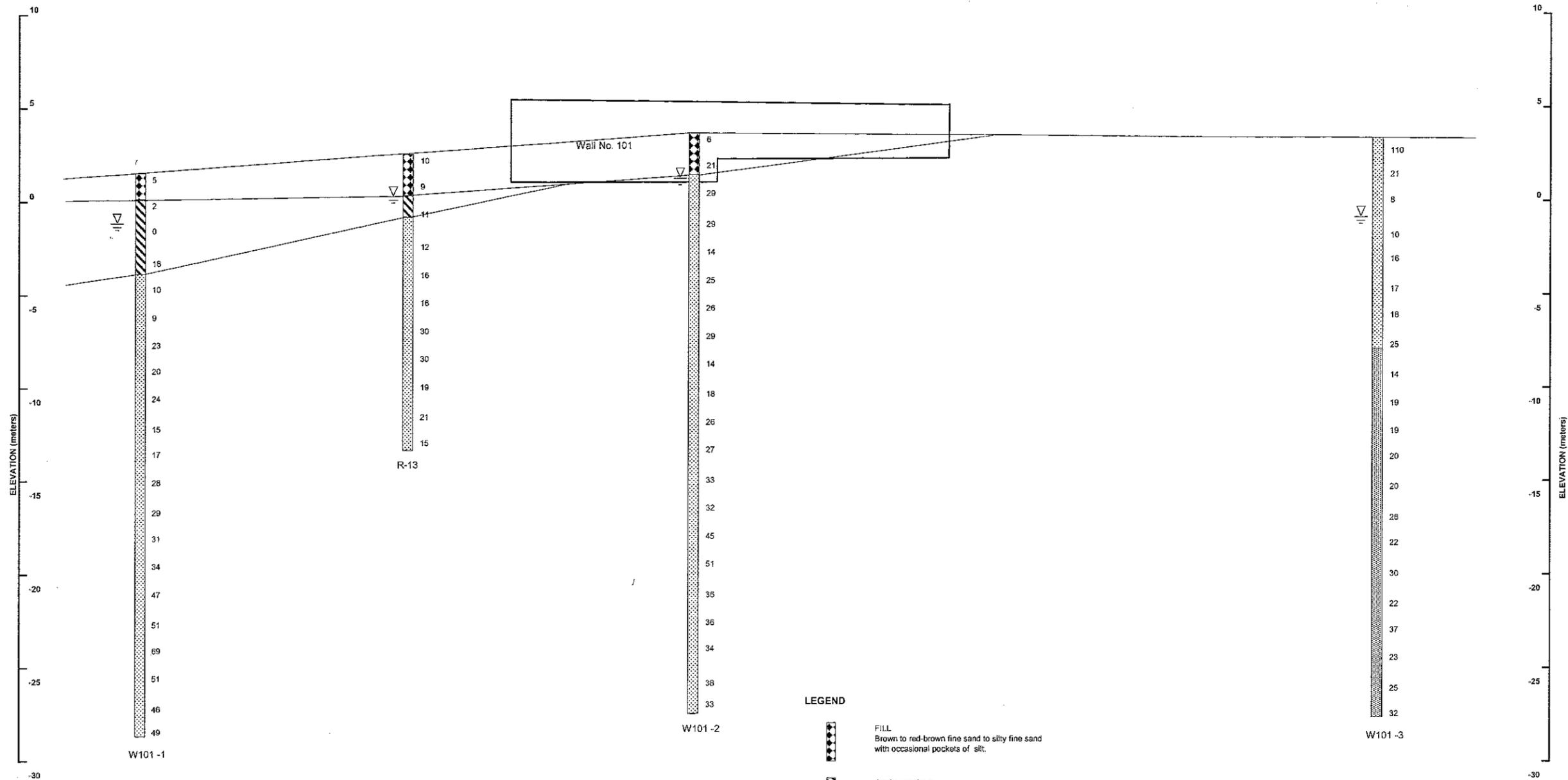
LEGEND:

⊕ - NEW BORING



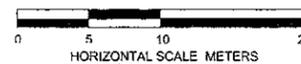
FINAL STRUCTURE SOILS
AND ROCK REPORT
RECONSTRUCTION OF I-95 OVER WEST RIVER
NEW HAVEN / WEST HAVEN, CONNECTICUT
REVISED WALL NO. 101
BORING LOCATION PLAN
JULY 2007 FIGURE 2





LEGEND

- FILL
Brown to red-brown fine sand to silty fine sand with occasional pockets of silt.
- ORGANIC SILT
Gray organic silt.
- SAND AND SILT
Red-brown fine sand, silty fine sand, fine sand and silt to sandy silt.
- SILT
Red-brown sandy silt to silt with gray clayey silt seams
- GROUNDWATER LEVEL
- 18 STANDARD PENETRATION TEST N-VALUE



FINAL STRUCTURE SOILS
AND ROCK REPORT

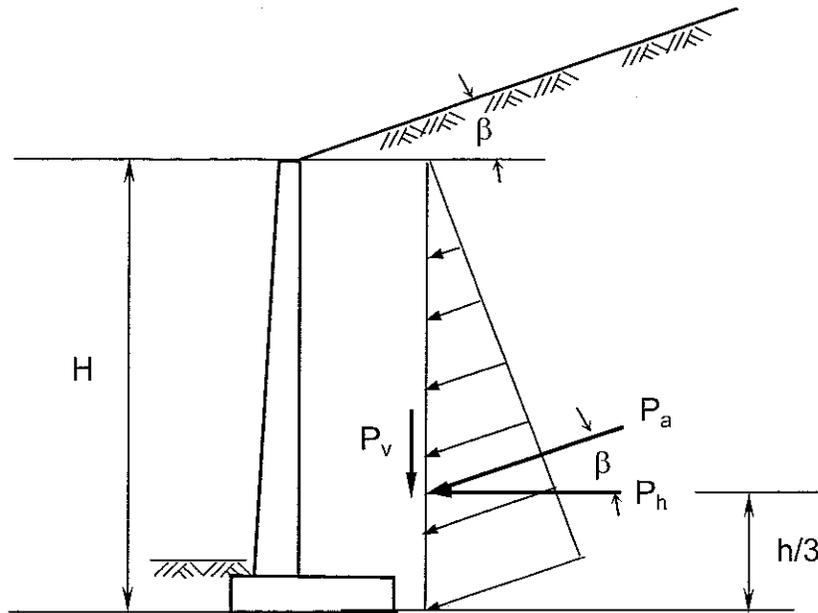
RECONSTRUCTION OF I-95 OVER WEST RIVER
NEW HAVEN / WEST HAVEN, CONNECTICUT

REVISED WALL NO.101
SUBSURFACE PROFILE

JULY 2007

FIGURE 3





γ' = Effective unit weight
 ϕ' = Effective angle of internal friction
 β = Angle of slope

$$K_a = \frac{\sin^2(\theta + \phi')}{\sin^2 \theta \sin(\theta) \left[1 + \sqrt{\frac{\sin(\phi') \sin(\phi' - \beta)}{\sin(\theta) \sin(\theta + \beta)}} \right]^2}$$

$$P_a = \frac{\gamma' h^2}{2} K_a$$

FINAL STRUCTURE SOILS
 AND ROCK REPORT
 RECONSTRUCTION OF I-95 OVER WEST RIVER
 NEW HAVEN / WEST HAVEN, CONNECTICUT

REVISED WALL NO. 101
 LATERAL EARTH PRESSURE

JULY 2007

FIGURE 4



APPENDIX A

TEST BORING LOGS

E. Del Priore		SM - 001 - M REV. 1/94 BORING REPORT								Hole No. W101-1						
DRILLER		STATE OF CONNECTICUT								Line & Station I-95 1+436.4						
R. Sharp / E. Fulton		DEPARTMENT OF TRANSPORTATION								Offset 43.0 LT						
INSPECTOR		TOWN: New Haven / West Haven, CT								N. Coordinate 202529.1						
Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT NAME: Reconstruction I-95 Over West River								E. Coordinate 289449.3						
SOILS ENGINEER		PROJECT NUMBER 92-533								Parsons Brinckerhoff Quade & Douglas, Inc.						
		BORING CONTRACTOR: General Borings, Inc.								PRIME DESIGNER						
Surface Elevation: 1.47		Casing				Auger			Mud		Sampler		Core Barrel			
Date Started: 7/23/2002		Utilized		X		X		X		X		X		X		
Date Finished: 7/24/2002		Type		BW		NW		HW		Pipe		Solid		Hollow		
Groundwater Observations		Size I.D. (mm)		60		76		100		64		150		X		
@ -2.59 m after _____ hours		Hammer (kg)		136		136		136		136		Bit		63.5		
@ _____ m after _____ hours		Fall (m)		0.6		0.6		0.6		0.6		0.80 mm		0.76		
D E P T H	Casing blows per half meter	SAMPLE					BLOWS				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)				
		DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	PER 0.15 METERS ON SAMPLER									
						0 - 0.15	0.15 - 0.30	0.30 - 0.45	0.45 - 0.60							
		15.24 - 15.84	11	0.60	0.51	D	6	8	9	12						
		16.76 - 17.36	12	0.60	0.51	D	10	14	14	16						
		18.29 - 18.89	13	0.60	0.51	D	9	14	15	19						
20		19.81 - 20.41	14	0.60	0.41	D	16	15	16	21						
		21.34 - 21.94	15	0.60	0.46	D	14	17	17	22						
		22.86 - 23.46	16	0.60	0.25	D	21	23	24	32						
		24.38 - 24.98	17	0.60	0.41	D	14	23	28	33						
25		25.91 - 26.51	18	0.60	0.51	D	37	36	33	35						
		27.43 - 28.03	19	0.60	0.41	D	17	24	27	32						
		28.96 - 29.56	20	0.60	0.46	D	16	23	23	33						
30																
Casing		Meters of		NOTES: Bombardier Rig - Raising and dropping of the 140-lb (63.5kg)												
Size	From	To	Earth	Rock	weight was accomplished with an automatic safety hammer.											
100 mm	0	4.57	31.08													
		No. of Samples														
		21D/1UP														
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test										Hole No. W101-1						
PROPORTIONS USED: Trace = 1 -10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%										Sheet 2 of 3						

E. Del Priore	SM - 001 - M REV. 1/94	BORING REPORT	Hole No.	W101-1
DRILLER	STATE OF CONNECTICUT		Line & Station	I-95 1+436.4
R. Sharp / E. Fulton	DEPARTMENT OF TRANSPORTATION		Offset	43.0 LT
INSPECTOR	TOWN:	New Haven / West Haven, CT	N. Coordinate	202529.1
Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT NAME:	Reconstruction I-95 Over West River	E. Coordinate	289449.3
SOILS ENGINEER	PROJECT NUMBER	92-533	Parsons Brinckerhoff Quade & Douglas, Inc.	
	BORING CONTRACTOR:	General Borings, Inc.	PRIME DESIGNER	

Surface Elevation:	1.47	Casing				Auger	Mud	Sampler		Core Barrel					
Date Started:	7/23/2002	Utilized		X		X	X	X	X						
Date Finished:	7/24/2002	Type	BW	NW	HW	Pipe	Solid	Hollow	Bentonite	SS	UP	B (st)	B (dt)	NX (st)	NV II (dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64		150	X		36		35	35	55	55
@ -2.59 m after _____ hours	Hammer (kg)	136	136	136	136				Bit	63.5		Type		Diamond	
@ _____ m after _____ hours	Fall (m)	0.6	0.6	0.6	0.6				0.80 mm	0.76		of Bit		Carbide	

D E P T H	Casing blows per half meter	SAMPLE					BLOWS PER 0.15 METERS ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	0 -	0.15 -	0.30 -	0.45 -		
							0.15	0.30	0.45	0.60		
		30.48 - 31.08	21	0.60	0.41	D	18	24	25	32		Red brown SILT and f SAND, wet.
											31.08	
											-29.61	Bottom of Boring 31.08 m.
35												
40												
45												

Casing			Meters of		NOTES: Bombardier Rig - Raising and dropping of the 140-lb (63.5kg) weight was accomplished with an automatic safety hammer.
Size	From	To	Earth	Rock	
100 mm	0	4.57	31.08		
			No. of Samples		
			21D/1UP		

E. Del Priore		SM - 001 - M REV. 1/94 BORING REPORT								Hole No. R-13					
DRILLER		STATE OF CONNECTICUT								Line & Station I-95 1+474.9					
R. Sharp		DEPARTMENT OF TRANSPORTATION								Offset 35.3 LT					
INSPECTOR		TOWN: New Haven / West Haven, CT								N. Coordinate 202530.4					
Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT NAME: Reconstruction I-95 Over West River								E. Coordinate 289488.5					
SOILS ENGINEER		PROJECT NUMBER 92-533								Parsons Brinckerhoff Quade & Douglas, Inc.					
		BORING CONTRACTOR: General Borings, Inc.								PRIME DESIGNER					
Surface Elevation: 2.36		Casing				Auger			Mud		Sampler		Core Barrel		
Date Started: 7/26/2002		Utilized		X		X			X		X				
Date Finished: 7/26/2002		Type	BW	NW	HW	Pipe	Solid	Hollow	Bentonite	SS	UP	B (st)	B (dt)	NX (st)	NV II (dt)
Groundwater Observations		Size I.D. (mm)	60	76	100	64		150	X	36		35	35	55	55
@	-2.13 m after _____ hours	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@	_____ m after _____ hours	Fall (m)	0.6	0.6	0.6	0.6			0.80 mm	0.76		of Bit		Carbide	
D	Casing	SAMPLE					BLOWS				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)			
E	blows	DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	PER 0.15 METERS ON SAMPLER								
P	per						0 - 0.15	0.15 - 0.30	0.30 - 0.45	0.45 - 0.60					
T	half														
H	meter														
		0.00 - 0.60	1	0.60	0.20	D	2	4	6	7		Brown f SAND, some silt, roots.			
		1.52 - 2.12	2	0.60	0.25	D	3	4	5	3	2.12	Gray f SAND, some silt, trace fibers.			
											0.24	(Gray organic SILT between samples 2 and 3.)			
											3.20				
		3.05 - 3.65	3	0.60	0.56	D	2	2	9	7	-0.84	Gray f SAND, some silt, trace fibers.			
5		4.57 - 5.17	4	0.60	0.60	D	3	5	7	10		Red brown f SAND, little silt.			
		6.10 - 6.70	5	0.60	0.36	D	5	7	9	8		Red brown f SAND, little silt.			
		7.62 - 8.22	6	0.60	0.41	D	6	8	8	10		Red brown f SAND, little silt.			
		9.14 - 9.74	7	0.60	0.30	D	9	13	17	18		Red brown f SAND, some silt.			
10															
		10.67 - 11.27	8	0.60	0.30	D	10	14	16	20		Red brown f SAND, some silt.			
		12.19 - 12.79	9	0.60	0.25	D	7	8	11	13		Red brown f SAND, some silt, trace f gravel.			
		13.72 - 14.32	10	0.60	0.25	D	8	9	12	12		Red brown f SAND, some silt.			
15															
Casing		Meters of		NOTES: Bombardier Rig - Raising and dropping of the 140-lb (63.5kg) safety hammer was accomplished using a wire winch.											
Size	From	To	Earth	Rock											
100 mm	0	4.57	15.84												
		No. of Samples													
		11D													
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test										Hole No. R-13					
PROPORTIONS USED: Trace = 1 -10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%										Sheet 1 of 2					

E. Del Priore		SM - 001 - M REV. 1/94 BORING REPORT								Hole No. W101-2					
DRILLER		STATE OF CONNECTICUT								Line & Station I-95 1+504.8					
E. Fulton		DEPARTMENT OF TRANSPORTATION								Offset 30.3 LT					
INSPECTOR		TOWN: New Haven / West Haven, CT								N. Coordinate 202532.3					
Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT NAME: Reconstruction I-95 Over West River								E. Coordinate 289518.8					
SOILS ENGINEER		PROJECT NUMBER 92-533								Parsons Brinckerhoff Quade & Douglas, Inc.					
		BORING CONTRACTOR: General Borings, Inc.								PRIME DESIGNER					
Surface Elevation: 3.65		Casing				Auger			Mud		Sampler		Core Barrel		
Date Started: 7/25/2002		Utilized		X		X		X		X					
Date Finished: 7/25/2002		Type	BW	NW	HW	Pipe	Solid	Hollow	Bentonite	SS	UP	B (st)	B (dt)	NX (st)	NV II (dt)
Groundwater Observations		Size I.D. (mm)	60	76	100	64		150	X	36		35	35	55	55
@	-2.59 m after _____ hours	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@	_____ m after _____ hours	Fall (m)	0.6	0.6	0.6	0.6			0.80 mm	0.76		of Bit		Carbide	
D	Casing	SAMPLE					BLOWS				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)			
E	blows	DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	PER 0.15 METERS ON SAMPLER								
P	per						0 - 0.15	0.15 - 0.30	0.30 - 0.45	0.45 - 0.60					
T	half														
H	meter														
		0.00 - 0.60	1	0.60	0.20	D	1	2	4	4	Top 0.10m: Dark brown / black SILT, trace leaf detrius, trace roots, little f sand. Bottom 0.10m: Light brown f SAND, trace c sand. Brown f SAND, trace c sand.				
		1.52 - 2.12	2	0.60	0.41	D	8	10	11	15	Red brown f SAND, trace silt, wet.				
		3.05 - 3.65	3	0.60	0.51	D	12	15	14	12	Red brown f SAND, little silt, wet.				
5		4.57 - 5.17	4	0.60	0.51	D	8	13	16	18	Red brown f SAND, little silt, wet.				
		6.10 - 6.70	5	0.60	0.36	D	4	6	8	10	Red brown f SAND, little silt, saturated, rapid dilatancy.				
		7.62 - 8.22	6	0.60	0.41	D	10	11	14	13	Red brown f SAND, little silt, saturated, rapid dilatancy.				
		9.14 - 9.74	7	0.60	0.51	D	10	14	12	13	Red brown f SAND, trace to little silt, wet.				
10		10.67 - 11.27	8	0.60	0.46	D	12	15	14	17	Red brown f SAND, little silt, wet.				
		12.19 - 12.79	9	0.60	0.20	D	5	7	7	9	Red brown f SAND, little silt, wet.				
		13.72 - 14.32	10	0.60	0.25	D	6	8	10	14	Red brown f SAND, little silt, wet.				
15															
Casing		Meters of				NOTES: Bombardier Rig - Raising and dropping of the 140-lb (63.5kg) weight was accomplished with an automatic safety hammer.									
Size	From	To	Earth	Rock											
100 mm	0	4.57	31.08												
		No. of Samples													
		21D/1UP													
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test										Hole No. W101-2					
PROPORTIONS USED: Trace = 1 -10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%										Sheet 1 of 3					

E. Del Priore		SM - 001 - M REV. 1/94 BORING REPORT								Hole No. W101-2						
DRILLER		STATE OF CONNECTICUT								Line & Station I-95 1+504.8						
E. Fulton		DEPARTMENT OF TRANSPORTATION								Offset 30.3 LT						
INSPECTOR		TOWN: New Haven / West Haven, CT								N. Coordinate 202532.3						
Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT NAME: Reconstruction I-95 Over West River								E. Coordinate 289518.8						
SOILS ENGINEER		PROJECT NUMBER 92-533								Parsons Brinckerhoff Quade & Douglas, Inc.						
		BORING CONTRACTOR: General Borings, Inc.								PRIME DESIGNER						
Surface Elevation: 3.65		Casing				Auger			Mud		Sampler		Core Barrel			
Date Started: 7/25/2002		Utilized		X		X			X		X					
Date Finished: 7/25/2002		Type	BW	NW	HW	Pipe	Solid	Hollow	Bentonite	SS	UP	B (st)	B (dt)	NX (st)	NV II (dt)	
Groundwater Observations		Size I.D. (mm)	60	76	100	64		150	X	36		35	35	55	55	
@	-2.59 m after _____ hours	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond		
@	_____ m after _____ hours	Fall (m)	0.6	0.6	0.6	0.6			0.80 mm	0.76		of Bit		Carbide		
D	Casing	SAMPLE					BLOWS				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)				
E	blows	DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	PER 0.15 METERS ON SAMPLER									
P	per						0 - 0.15	0.15 - 0.30	0.30 - 0.45	0.45 - 0.60						
T	half															
H	meter															
		15.24 - 15.84	11	0.60	0.46	D	11	12	14	16					Red brown f SAND, little silt, wet.	
		16.76 - 17.36	12	0.60	0.46	D	10	13	14	17					Red brown f SAND, some silt, wet.	
		18.29 - 18.89	13	0.60	0.36	D	15	16	17	21					Red brown f SAND and SILT, wet.	
20		19.81 - 20.41	14	0.60	0.46	D	16	15	17	24					Red brown SILT and f SAND, saturated, rapid dilatancy.	
		21.34 - 21.94	15	0.60	0.25	D	15	19	26	32					Red brown f SAND, some silt.	
		22.86 - 23.46	16	0.60	0.30	D	17	22	29	36					Red brown f SAND, some silt.	
		24.38 - 24.98	17	0.60	0.41	D	16	17	19	26					Red brown SILT, some f sand.	
25		25.91 - 26.51	18	0.60	0.36	D	15	16	20	27					Red brown f SAND and SILT.	
		27.43 - 28.03	19	0.60	0.46	D	14	17	17	24					Red brown f SAND and SILT.	
		28.96 - 29.56	20	0.60	0.46	D	15	19	19	26					Red brown SILT and f SAND.	
30																
Casing		Meters of		NOTES: Bombardier Rig - Raising and dropping of the 140-lb (63.5kg) weight was accomplished with an automatic safety hammer.												
Size	From	To	Earth	Rock												
100 mm	0	4.57	31.08													
		No. of Samples														
		21D/1UP														
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test											Hole No. W101-2					
PROPORTIONS USED: Trace = 1 -10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%											Sheet 2 of 3					

E. Del Priore	SM - 001 - M REV. 1/94	BORING REPORT	Hole No.	W101-2
DRILLER	STATE OF CONNECTICUT		Line & Station	I-95 1+504.8
E. Fulton	DEPARTMENT OF TRANSPORTATION		Offset	30.3 LT
INSPECTOR	TOWN:	New Haven / West Haven, CT	N. Coordinate	202532.3
Parsons Brinckerhoff Quade & Douglas, Inc.	PROJECT NAME:	Reconstruction I-95 Over West River	E. Coordinate	289518.8
SOILS ENGINEER	PROJECT NUMBER	92-533	Parsons Brinckerhoff Quade & Douglas, Inc.	
	BORING CONTRACTOR:	General Borings, Inc.	PRIME DESIGNER	

Surface Elevation:	3.65	Casing				Auger	Mud	Sampler		Core Barrel					
Date Started:	7/25/2002	Utilized			X		X	X	X						
Date Finished:	7/25/2002	Type	BW	NW	HW	Pipe	Solid	Hollow	Bentonite	SS	UP	B (st)	B (dt)	NX (st)	NV II (dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64			150	X	36		35	35	55	55
@ -2.59 m after _____ hours	Hammer (kg)	136	136	136	136				Bit	63.5		Type		Diamond	
@ _____ m after _____ hours	Fall (m)	0.6	0.6	0.6	0.6				0.80 mm	0.76		of Bit		Carbide	

D E P T H	Casing blows per half meter	SAMPLE					BLOWS PER 0.15 METERS ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	0 -	0.15 -	0.30 -	0.45 -		
							0.15	0.30	0.45	0.60		
		30.48 - 31.08	21	0.60	0.46	D	13	16	17	21		Red brown SILT and f SAND.
											31.08	
												Bottom of Boring 31.08 m.
35												
40												
45												

Casing			Meters of		NOTES: Bombardier Rig - Raising and dropping of the 140-lb (63.5kg) weight was accomplished with an automatic safety hammer.
Size	From	To	Earth	Rock	
100 mm	0	4.57	31.08		
			No. of Samples		
			21D/1UP		

M. Jennett		SM - 001 - M REV. 1/94 BORING REPORT								Hole No. W101-3					
DRILLER		STATE OF CONNECTICUT								Line & Station I-95 1+590.4					
R. Sharp		DEPARTMENT OF TRANSPORTATION								Offset 13.1 LT					
INSPECTOR		TOWN: New Haven / West Haven, CT								N. Coordinate 202534.4					
Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT NAME: Reconstruction I-95 Over West River								E. Coordinate 289606.5					
SOILS ENGINEER		PROJECT NUMBER 92-533								Parsons Brinckerhoff Quade & Douglas, Inc.					
		BORING CONTRACTOR: General Borings, Inc.								PRIME DESIGNER					
Surface Elevation: 3.17		Casing				Auger			Mud		Sampler		Core Barrel		
Date Started: 8/12/2002		Utilized		X		X		X		X					
Date Finished: 8/12/2002		Type	BW	NW	HW	Pipe	Solid	Hollow	Bentonite	SS	UP	B (st)	B (dt)	NX (st)	NV II (dt)
Groundwater Observations		Size I.D. (mm)	60	76	100	64		150	X	36		35	35	55	55
@	~4.11 m after _____ hours	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@	_____ m after _____ hours	Fall (m)	0.6	0.6	0.6	0.6			0.80 mm	0.76		of Bit		Carbide	
D	Casing	SAMPLE					BLOWS				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)			
E	blows	DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	PER 0.15 METERS ON SAMPLER								
P	per						0 - 0.15	0.15 - 0.30	0.30 - 0.45	0.45 - 0.60					
T	half														
H	meter														
		0.31 - 0.91	1	0.60	0.51	D	41	58	52	55				0.00 - 0.31: Asphalt Light brown f SAND, little c sand, little f-c gravel, trace silt.	
		1.52 - 2.12	2	0.60	0.30	D	4	10	11	14				Brown f SAND, trace silt.	
		3.05 - 3.65	3	0.60	0.46	D	5	4	4	7				Brown f SAND, little silt, moist.	
5		4.57 - 5.17	4	0.60	0.30	D	4	4	6	7				Brown f SAND, trace silt, wet.	
		6.10 - 6.70	5	0.60	0.36	D	6	8	8	8				Brown f SAND, trace silt, wet.	
		7.62 - 8.22	6	0.60	0.28	D	5	8	9	11				Brown f SAND, trace silt, wet.	
		9.14 - 9.74	7	0.60	0.33	D	7	8	10	11				Brown f SAND, trace silt, wet.	
10		10.67 - 11.27	8	0.60	0.36	D	12	12	13	15				Brown f SAND, trace c sand, trace silt.	
		12.19 - 12.79	9	0.60	0.33	D	6	6	8	15				11.73	
		13.72 - 14.32	10	0.60	0.41	D	5	9	10	20				-8.56 Red brown SILT, some f sand.	
15														Red brown SILT, some f sand.	
Casing		Meters of		NOTES: Raising and dropping of the 140-lb (63.5kg) hammer was accomplished using a trip lever.											
Size	From	To	Earth	Rock											
100 mm	0	4.57	31.08												
		No. of Samples													
		21D													
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test										Hole No. W101-3					
PROPORTIONS USED: Trace = 1 -10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%										Sheet 1 of 3					

M. Jennett		SM - 001 - M REV. 1/94 BORING REPORT								Hole No. W101-3																															
DRILLER		STATE OF CONNECTICUT								Line & Station I-95 1+590.4																															
R. Sharp		DEPARTMENT OF TRANSPORTATION								Offset 13.1 LT																															
INSPECTOR		TOWN: New Haven / West Haven, CT								N. Coordinate 202534.4																															
Parsons Brinckerhoff Quade & Douglas, Inc.		PROJECT NAME: Reconstruction I-95 Over West River								E. Coordinate 289606.5																															
SOILS ENGINEER		PROJECT NUMBER 92-533								Parsons Brinckerhoff Quade & Douglas, Inc.																															
		BORING CONTRACTOR: General Borings, Inc.								PRIME DESIGNER																															
Surface Elevation: 3.17		Casing				Auger			Mud		Sampler		Core Barrel																												
Date Started: 8/12/2002		Utilized		X		X		X		X																															
Date Finished: 8/12/2002		Type		BW		NW		HW		Pipe		Solid		Hollow		Bentonite		SS		UP		B (st)		B (dt)		NX (st)		NV II (dt)													
Groundwater Observations		Size I.D. (mm)		60		76		100		64		150		X		36		35		35		55		55																	
@ ~4.11 m after _____ hours		Hammer (kg)		136		136		136		136				Bit		63.5		Type				Diamond																			
@ _____ m after _____ hours		Fall (m)		0.6		0.6		0.6		0.6				0.80 mm		0.76		of Bit				Carbide																			
D E P T H	Casing blows per half meter	SAMPLE					BLOWS				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)																													
		DEPTH IN METERS FROM - TO	NO.	PEN. m	REC. m	Type	PER 0.15 METERS ON SAMPLER																																		
							0 - 0.15	0.15 - 0.30	0.30 - 0.45	0.45 - 0.60		Red brown SILT.																													
		15.24 - 15.84	11	0.60	0.60	D	6	7	12	14																															
											Red brown SILT.																														
		16.76 - 17.36	12	0.60	0.60	D	5	7	13	19																															
																		Red brown SILT.																							
		18.29 - 18.89	13	0.60	0.46	D	6	9	11	20																															
20																								Red brown SILT.																	
		19.81 - 20.41	14	0.60	0.43	D	7	11	15	23																															
																														Red brown SILT, trace f sand, trace light gray silt seams (~1mm).											
		21.34 - 21.94	15	0.60	0.48	D	7	9	13	18																															
																	Red brown SILT, trace f sand, trace light gray silt seams (~1-5mm).																								
		22.86 - 23.46	16	0.60	0.51	D	8	12	18	26																															
											Red brown SILT, trace light gray silt seams (~5-10mm).																														
		24.38 - 24.98	17	0.60	0.41	D	7	8	14	21																															
25																							Red brown SILT, trace light gray silt seams (~5-10mm).																		
		25.91 - 26.51	18	0.60	0.48	D	9	15	22	25																															
																													Red brown SILT, trace light gray silt seams (~5-10mm).												
		27.43 - 28.03	19	0.60	0.56	D	6	10	13	19																															
																																			Red brown SILT, trace light gray silt seams (~5-10mm).						
		28.96 - 29.56	20	0.60	0.60	D	9	10	15	25																															
30																	Red brown SILT, trace light gray silt seams (~5-10mm).																								
											NOTES: Raising and dropping of the 140-lb (63.5kg) hammer was accomplished using a trip lever.																														
																							No. of Samples																		
																													21D												
Casing		Meters of				SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test PROPORTIONS USED: Trace = 1 -10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%																																			
Size	From	To	Earth	Rock																																					
100 mm	0	4.57	31.08																																						
Hole No. W101-3																																									
Sheet 2 of 3																																									

APPENDIX B

LABORATORY DATA

LABORATORY TESTING DATA SHEET

Project Name: RECONSTRUCTION OF I-95
 OVER WEST RIVER
 Project No.: L17371
 Project Engineer: D. SCHULZE

Assigned By: R. BORJESON
 Date: AUG.02

Reviewed By:
 Date Reviewed:

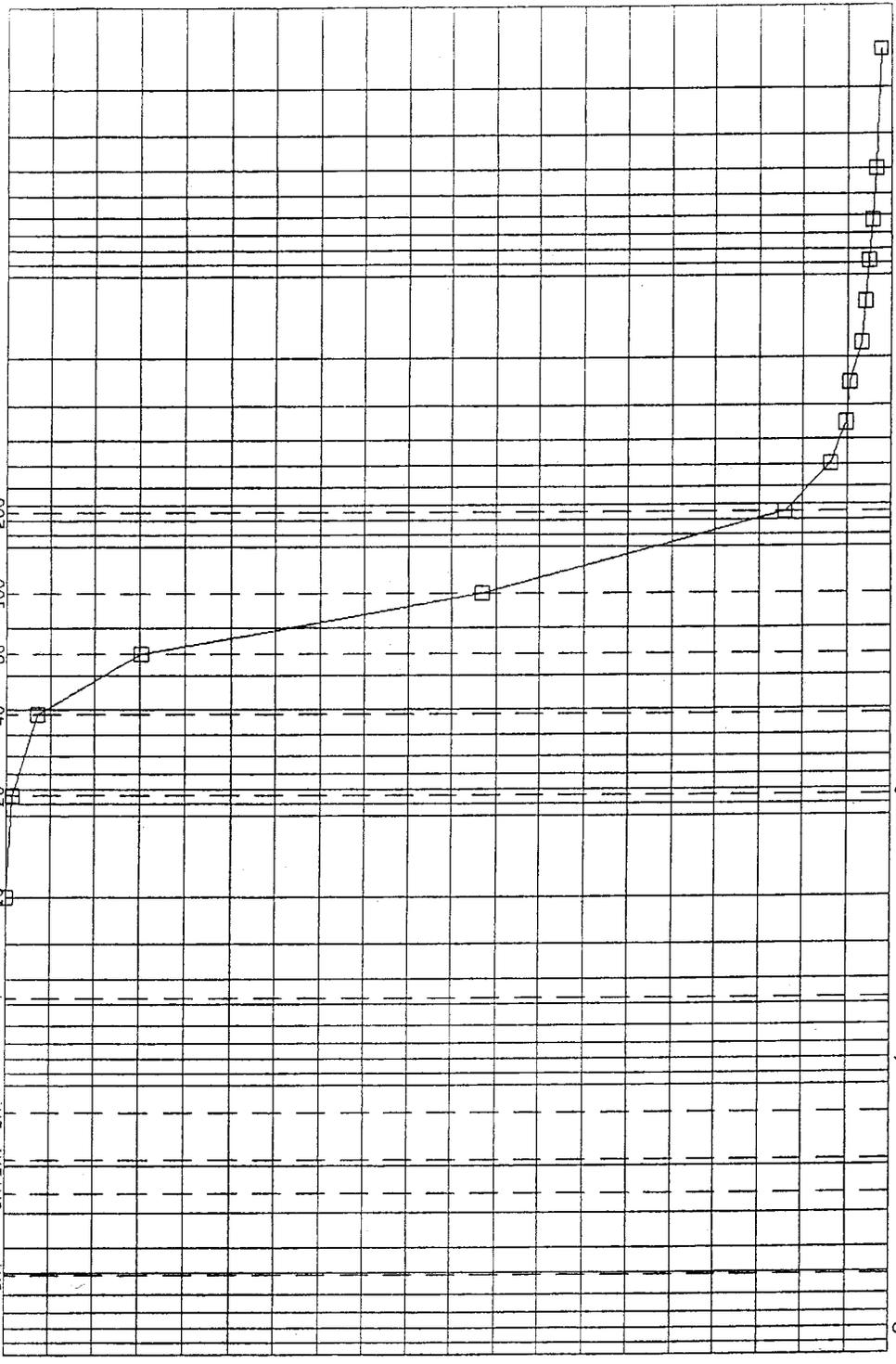
Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests					Density γ_d MAX (pcf) W_{opt} (%)	Perme- ability cm/sec	Torvane or Type Test	Strength Tests			Consol. $\frac{C_c}{1+e_0}$	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2 μ %				ORG %	G_s	Dry unit wt. pcf		
R-9	S-13	60-62	53				73	4							Red-Brown SILT, some fine Sand	
W101-1	S-12	55-57	54				12	2							Red-Brown f-m SAND, little (-) Silt	
	S-17	80-82	55				53	3							Red-Brown SILT and fine SAND	
W101-2	S-13	60-62	56				39	2							Red-Brown fine SAND and SILT	
B164-1	S-19	90-92	57				43	3							Red-Brown fine SAND and SILT	
	S-21	100-102	58				55	5							Brown SILT and fine SAND	
B164-3	S-18	85-87	59				49	3							Red-Brown fine SAND and SILT	
	S-22	105-107	60				80	5							Red-Brown SILT, little (+) fine Sand	
B164-4	S-16	75-77	61				38	3							Red-Brown fine SAND and SILT	
	S-20	95-97	62				27	2							Red-Brown fine SAND and SILT	

PERCENT FINER BY WEIGHT

100 90 80 70 60 50 40 30 20 10 0

U.S. STANDARD SIEVE SIZE

NO. 4 NO. 10 NO. 20 NO. 40 NO. 60 NO. 100 NO. 200
 2 IN. 1 3/4 IN. 1 1/2 IN. 1 IN. 3/4 IN. 3/8 IN. 3/16 IN. 1/8 IN.



GRAIN SIZE IN MILLIMETERS

10² 10¹ 10⁰ 10⁻¹ 10⁻² 10⁻³

GRAVEL FINE COARSE SAND MEDIUM FINE SILT CLAY

TEST NO. 554.1	MATERIAL SOURCE BORING W101-1 SAM. NO. S-12, D-55-57	REMARKS Red-Brown f-m SAND, little (-) Silt
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RECONSTRUCTION OF I-95
 OVER WEST RIVER
 GRADATION TESTS

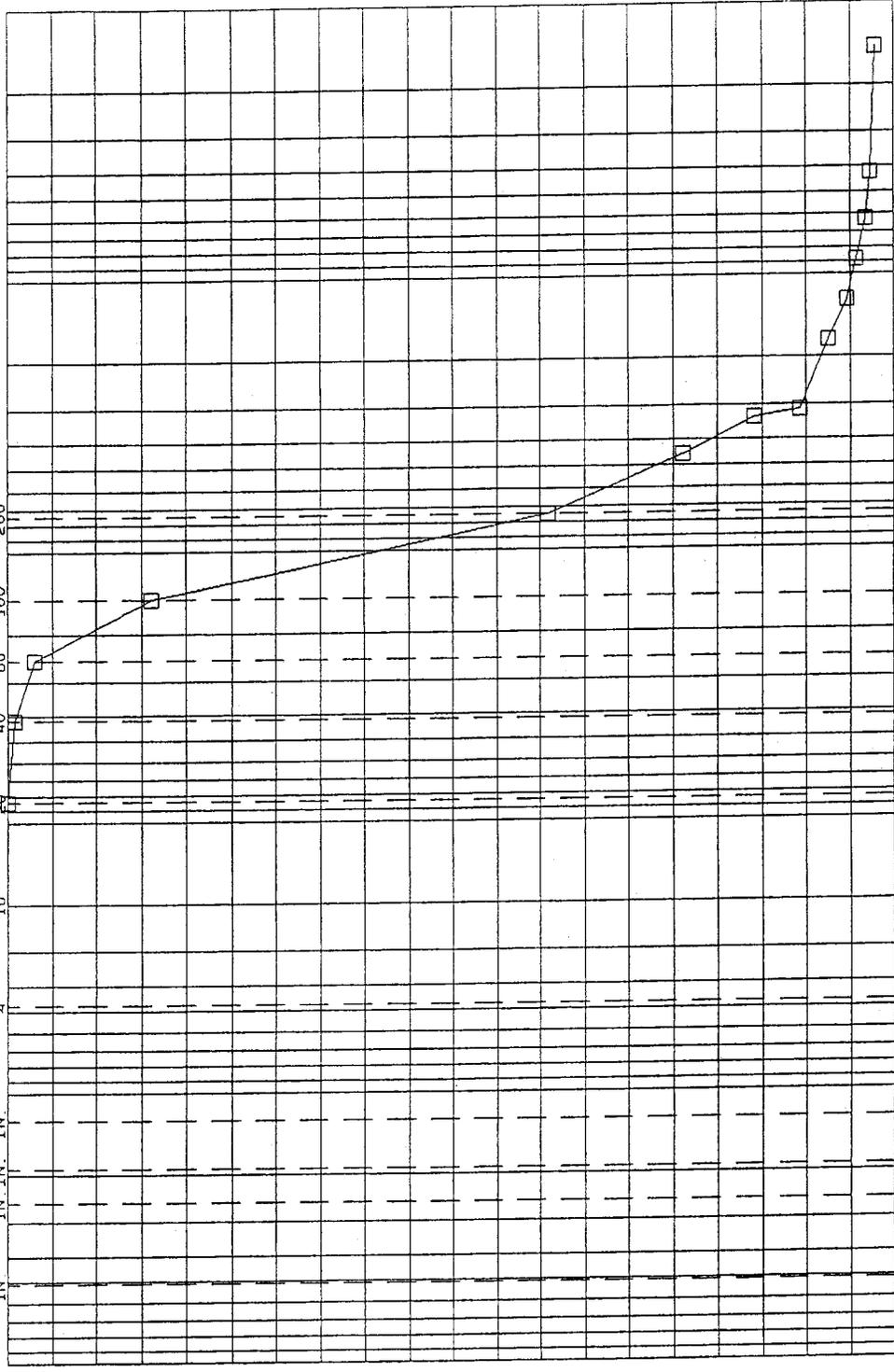
BORING NO W101-1
 SAMPLE S-12
 DEPTH 55-57'
 TECH MST
 REVIEWER DAS

TEST SERIES
 NO. 54
 DATE Aug. 02
 FILE L17371

PERCENT FINER BY WEIGHT

U.S. STANDARD SIEVE SIZE

2 IN
1 3/4 IN
1 1/2 IN
1 IN
4 NO.
10 NO.
20 NO.
40 NO.
60 NO.
100 NO.
200 NO.



10² 10¹ 10⁰ 10⁻¹ 10⁻² 10⁻³

GRAIN SIZE IN MILLIMETERS

COARSE GRAVEL FINE GRAVEL SAND MEDIUM SAND FINE SAND SILT CLAY

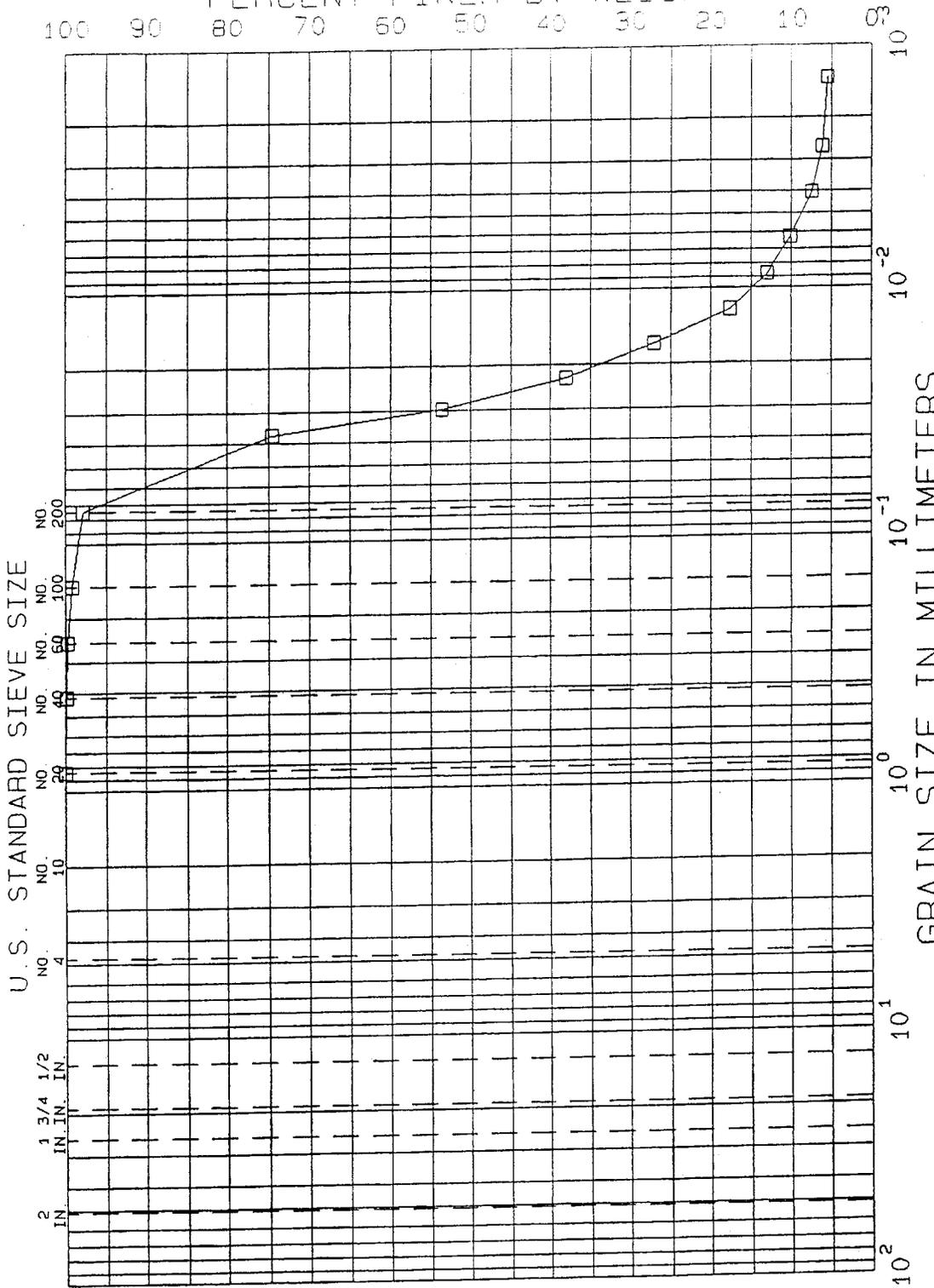
TEST NO. 556.1	MATERIAL SOURCE BORING W101-2 SAM. NO. S-13, D=60-62'	REMARKS Red-Brown fine SAND and SILT
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RECONSTRUCTION OF I-95
OVER WEST RIVER
GRADATION TESTS

BORING NO W101-2
SAMPLE S-13
DEPTH 60-62'
TECH. MST
REVIEWER DAS

TEST SERIES NO 56
DATE Aug. 02
FILE L17371

PERCENT FINER BY WEIGHT



COARSE	GRAVEL	FINE	COARSE	MEDIUM	FINE	SAND	SILT	CLAY
MATERIAL SOURCE								
BORING W101-3								
SAM. NO. S-12, D-55-57								
TEST NO.	REMARKS							
S136.1	Red-Brown SILT							

RECONSTRUCTION OF I-95
OVER WEST RIVER
GRADATION TESTS

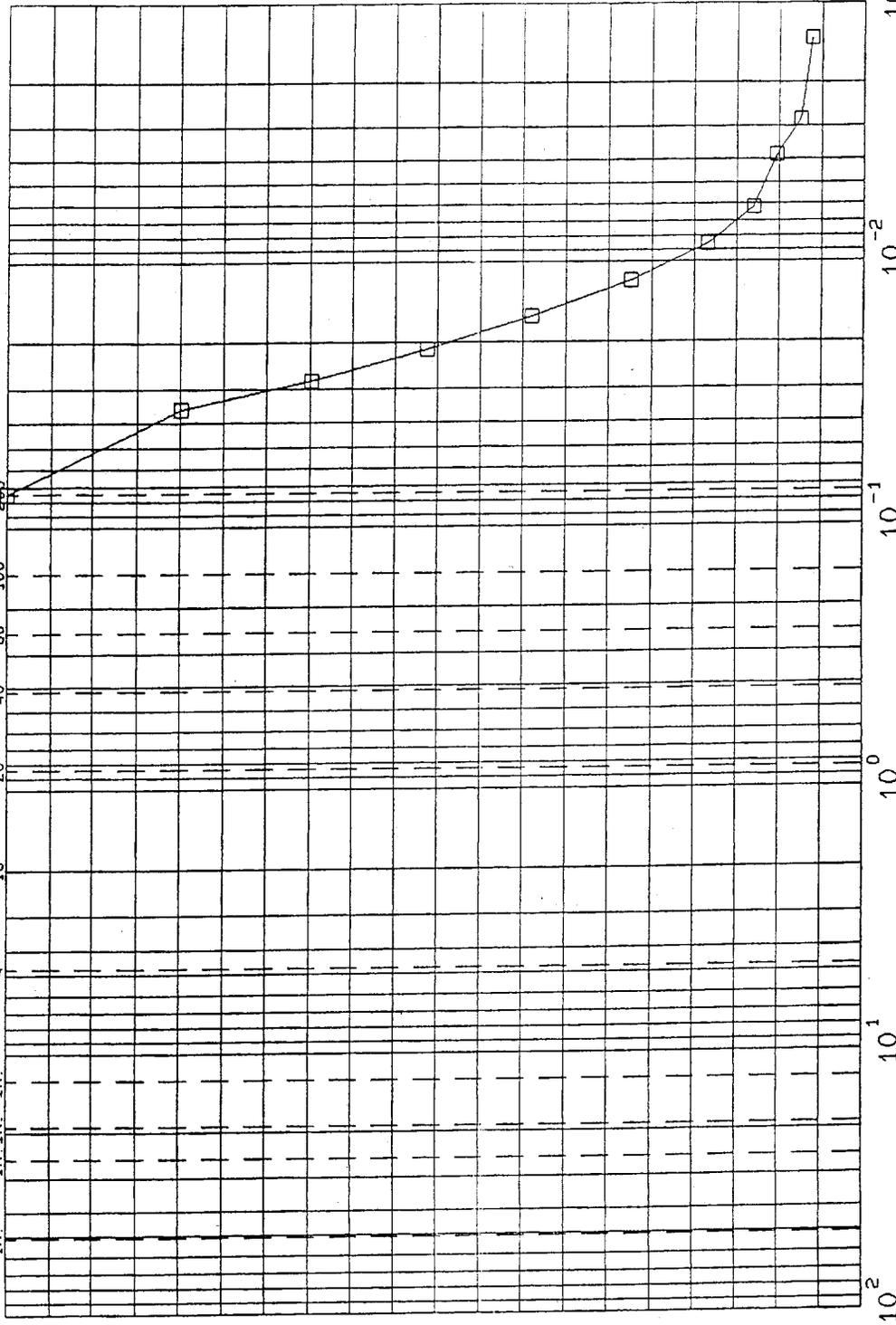
BORING NO. W101-3
SAMPLE S-12
DEPTH 55-57
TECH. MST
REVIEWER DAS

TEST SERIES NO. 136
DATE Aug. 02
FILE L17371

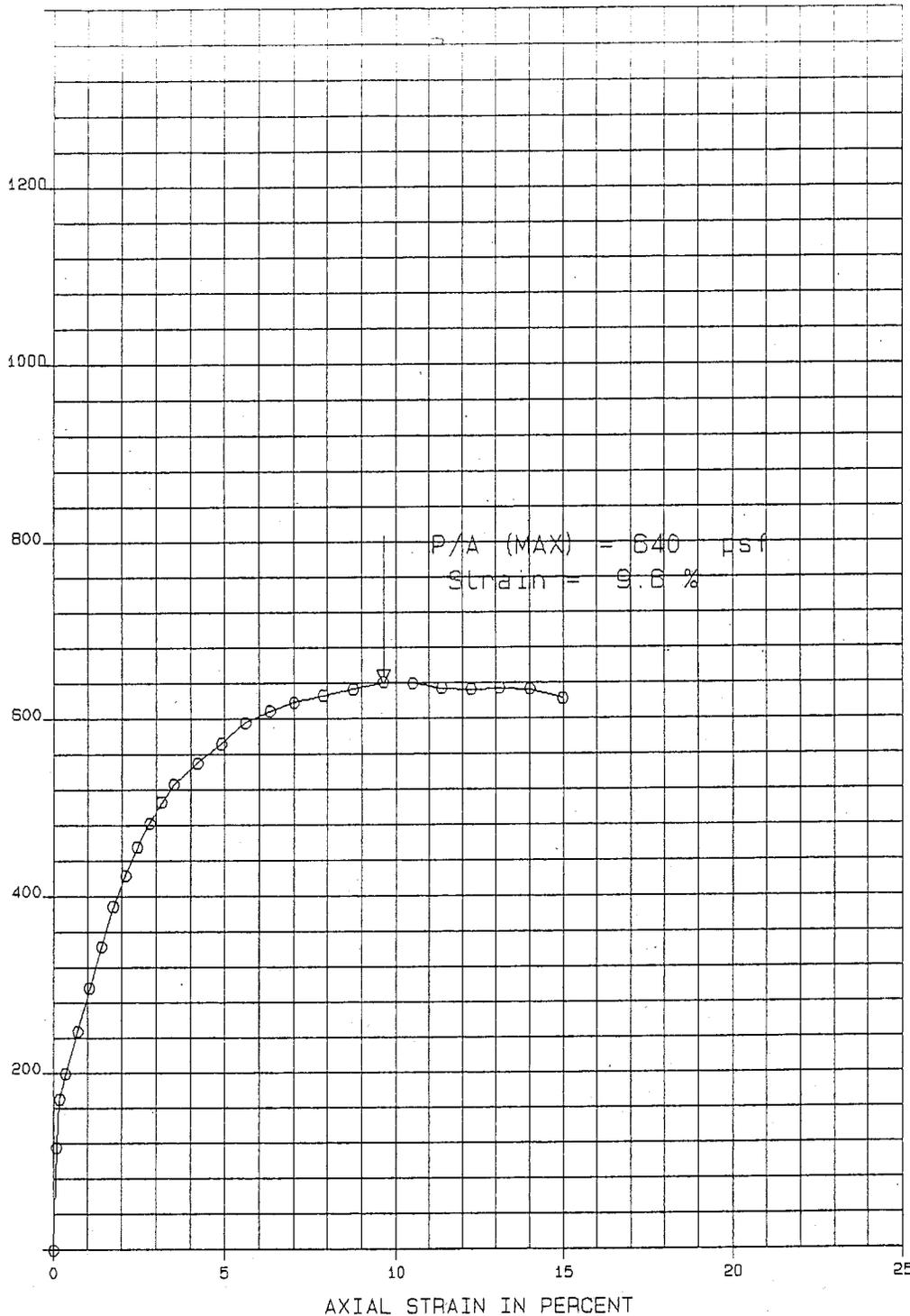
PERCENT FINER BY WEIGHT

U.S. STANDARD SIEVE SIZE

2 IN. 1 3/4 IN. 1/2 IN. NO. 4 NO. 10 NO. 20 NO. 40 NO. 60 NO. 100 NO. 200



DEVIATOR STRESS, P/A, psf



AXIAL STRAIN IN PERCENT

TEST NO. /SYMBOL	INITIAL CONDITIONS			CONDITIONS BEFORE SHEAR				FINAL CONDITIONS	
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT & DIAMETER, IN.	CONFINING STRESS, psf	FINAL BACK PRESSURE,	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT,
T25.0	74.0	56.6	5.72 2.84	792	-	-	-	73.8	-

RATE OF STRAIN, PERCENT PER MINUTE
0.50

SOIL DESCRIPTION:		Grey Organic SILT	
LIQUID LIMIT	66 %	PLASTIC LIMIT	30 %
		SPECIFIC GRAVITY	2.62

RECONSTRUCTION OF I-95 OVER WEST RIVER TRIAXIAL COMPRESSION TESTS (UU)

BORING NO.	W101-1	TEST SERIES NO.	25
SAMPLE DEPTH	13.2-13.7'	DATE	Aug.02
TECH.	MST	FILE	L17371
REVIEWER			

FIGURE

