

**GEOTECHNICAL STUDY**

**CONSTRUCTION OF THE  
NEW BRITAIN - HARTFORD BUSWAY  
ConnDOT Project 171-305**

**Proposed Retaining Wall #104  
Busway Sta 123+35 to Sta 126+70 (Right)**

**Prepared for:  
Close, Jensen & Miller, P.C.**

**Prepared by:  
Dr. Clarence Welti, P. E., P. C.**

**April, 2011**



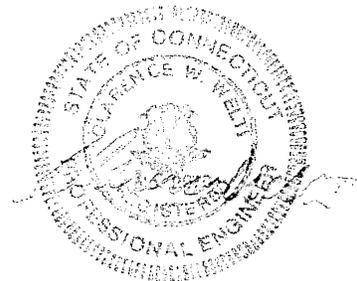
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**Proposed Retaining Wall #104**  
**Busway Sta 123+35 to Sta 126+70 (Right)**

**Prepared for:**  
**Close, Jensen & Miller, P.C.**

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**Dr. Clarence Welti, P. E., P. C.**

**April, 2011**



## **1.0 Introduction and Background:**

**1.1** This study addresses the geotechnical requirements for the design of Retaining Wall #104 proposed as part of the construction for the New Britain to Hartford Busway. The subject wall will be located along the right (easterly) shoulder of the Busway. Wall #104 will begin at about Sta 123+35 and terminate at Sta 126+70 south of the Bass Brook box culvert. The wall will mitigate fills into the wetlands. This study also addresses the geotechnical requirements for design and construction of the wall.

**1.2** Retaining Wall #104 will consist of a proprietary wall system to be approved by the Connecticut DOT. The wall will have a tangent horizontal alignment with the outside face of wall offset 18 feet right of the Busway baseline. The wall will support the right side of the Busway embankment with soil retention heights up to 16± feet above the existing grades. The overall height of the wall to the foundation bottom would be approximately 18 to 20 feet. The foundations will bear on soil. In general, there do not appear to be any unusual construction requirements for Wall #104 based on the topographic and test boring information. The subgrades at some locations will fall in wet or saturated silty soils, which will probably require preparation as cited in section 3.2.1 to avoid remolding of the subgrade soils and permit acceptable compaction of the granular fill.

**1.3** There will be requirements for temporary shoring to avoid encroaching into the wetland areas. The shoring will be located no more than 3 feet laterally off the wall's exterior face. The sheet pilings will be cut off at ground level in front of the wall and left in place to avoid disturbing the new foundations. The temporary sheeting pilings for this wall will fall within the scope of the Standard Specifications Form 816. Temporary Sheet Piling and Cofferdam & Pumping are contractor provided items.

**1.4** The design of the wall will be completed in U.S. Customary Units and in accordance with the LRFD method. It is presumed that the designs for temporary shoring can be completed with other methods such as Allowable Stress Design (ASD) or Load Factor Design (LFD).

**1.5 Field exploration** for the proposed wall included two test borings, RW102-1 and RW102-2 drilled by Associated Borings Company, Inc. in August, 2007. Four supplemental borings, RW-104-X-1 through RW-104-X-4, were drilled in March, 2011 by Associated Borings Company. The supplemental borings were required because the retaining wall was relocated substantially from the preliminary design alignment. The borings were drilled with a 2.5" diameter hollow stem auger to a maximum depth of 27 feet. Standard penetration tests and soil sampling were performed with a standard 2" dia. split spoon sampler using a 140 pound hammer and a hammer fall of 30 inches. It should be noted that the two borings are spaced about 200 feet apart. Pilot test boring SB-32 drilled by Seaboard Drilling, Inc. in March of 2003 for the pilot subsurface investigation is included herein. Baker Engineering NY performed the inspection services for the pilot program. It should be noted that the borings are spaced up to 120 feet apart and no borings were drilled within initial 150± feet length of subject wall. The 2007 borings were drilled for the earlier layout of Wall #102A under the previous design for the project.

## **2.0 Geology and Soils Cross Section + Soil Properties:**

**2.1** The **Geologic Origin** of the natural soils (beneath the fills) at the site and environs consists of glacial lake deposits atop the bedrock or overlying glacial moraine deposits to the rock. The lake deposits consist generally of medium compact fine sand and silt with trace gravel. The glacial moraine consists generally of very dense fine to medium sand and gravel, some silt. The bedrock from geologic mapping is Portland Arkose (Sandstone or Siltstone).

**2.2** The **Soils/Rock Cross Sections** from the borings are generally as follows:

### **Boring RW-102-1 (Busway Sta 125+0; Elev. 93.3):**

FILL: Fine to coarse SAND, GRAVEL and COBBLES to 6± feet, medium compact

FILL; Fine to medium SAND, some Silt, trace Gravel to 13 feet atop SILT to 15 feet, medium compact

SILT, trace Gravel and fine to medium Sand lenses to 27+ feet

### **Boring RW-102-2 (Busway Sta 127+0; Elev. 92.6):**

FILL; fine to coarse SAND, GRAVEL and COBBLES to 2± feet, dense

FILL; fine to medium SAND, some Silt and Gravel to 18 feet, medium compact to dense

Fine SAND and SILT, trace Gravel to 25+ feet, medium compact to dense

### **Pilot Boring SB-32 (Busway Sta 126+60, Elev. 93):**

FILL; SILT, little to some fine to coarse Sand and Gravel to 13.5 feet, very dense to about 10 feet, medium compact below this depth

FILL; fine to coarse GRAVEL, some Silt, trace Sand to 16.5 feet, dense

Fine to coarse SAND and SILT, little Gravel to 22+ feet, medium compact

### **Borings RW-104-X-1 (Sta 123+35; Elev. 87.5), RW-101-X-2 (Sta 124+0; Elev. 82.1), RW-104-X-3 (Sta 125+0; Elev. 80.2), RW-104-X-4 (Sta 126+0; Elev. 78.6):**

At RW-104-X-1, X-2, X-3; Soft PEAT to 1.5 to 2.5 feet

At RW-104-X-4; Topsoil to 6"

At RW-104-X-1; Silty CLAY, some fine to medium Sand and Peat layers to 11 feet, medium compact

At RW-104-X-1 and X-2; strata of SILT or Silty fine SAND, trace Gravel to 25+ feet, medium compact

At RW-104-X-3 and X-4; fine to medium SAND, some Silt and Gravel to auger refusal on bedrock at 16.9 to 20.9 feet below grade, dense to very dense

**2.3 The Groundwater** was observed in the 2007 bore holes at 17 to 18 feet below grade at the completion of the borings; Elev. 75 to Elev. 76. The groundwater will generally be close to the bottom of the fills or near the level of Beaver Brook Elev. 75±. The water table at the 2011 supplemental boring was observed at 3 to 6 feet below the existing grades (about Elev. 74 to Elev. 79).

**2.4 Regarding the Soil Properties** the following will apply:

**New Backfill (Material of Section 3.3 below):**

Unit Weight (moist)	125 pcf
Water Content	6 to 8%
Angle of Internal Friction	34°

**Existing Fills:**

Unit Weight	125+ pcf
Submerged Unit Weight:	66 pcf
Angle of Internal Friction	31° to 33°
Stiffness Modulus	400+ Tons/sf

**Glacial Lake Soils (Sand and Gravel):**

Unit Weight	120 to 125 pcf
Submerged Unit Weight	66 pcf
Angle of Internal Friction	33+°
Stiffness Modulus	500 to 700+ Tons/sf

**Glacial Moraine, Till:**

Unit Weight	130 pcf
Submerged Unit Weight	70 pcf
Angle of Internal Friction	36° to 38°
Typical Stiffness Modulus	>1,000 tons/sf

*Notes:*

*The above soil parameters can be used for the design of temporary shoring.*

*The values of internal friction angle cited are estimated from SPT data*

**2.5** Some of the natural soils and potentially the existing fills will be susceptible to remolding under equipment when wet from ground water or stormwater onto the exposed subgrades.

### **3.0 Foundations and Design Considerations:**

**3.1** Regarding **Design of the Wall**, the soil bearing, overturning and sliding must be addressed in the foundations. The preliminary **Criteria for Foundation Type and Loading** have been assumed

by the writer as follows:

1. The maximum total settlement shall not exceed 1" and the maximum differential settlement shall not exceed ½" in 20 feet of length.
2. The seismic section of the ConnDOT and AASHTO bridge design specifications will not apply to the subject walls with height less than 25 feet.

**3.2** The recommended **Foundation Type** is with spread footings. The footing subgrades shall be on inorganic soils at least 3 feet below the existing grades to be below any frost disturbed soils and after removal of any organic deposits. In general, the footings will largely fall on the natural silty and sand or on the existing fills. The existing fills extend to 12 to 18± feet below the rail bed surface. Regarding establishment of an ultimate bearing capacity, the ultimate loading is based on the internal friction angle, which is related to the soil density and overburden weight. Based on the sample blow counts in the natural soils and fills the angle of internal friction is at least 31°, which indicates an ultimate capacity of at least 20 ksf. The AASHTO LRFD resistance factor based on friction angle estimated from SPT data would be  $\phi_R = 0.35$ . This indicates a design bearing resistance of about 6 to 7 ksf. Based on review of LRFD programs, particularly as relates to reduction for inclined loading, a significant reduction from ultimate bearing capacity is indicated, based on the ratio of lateral loading to vertical loading. This reduction is almost double the reduction for the ASD procedure. **To address this reduction it is suggested that the more appropriate LRFD value for  $\phi$  be 0.50.** Based on the estimated minimum stiffness modulus of 400 Tons/sf (of the fills) the recommended design bearing resistance is 4 ksf to maintain settlements within the design criteria.

**3.2.1** There shall be a layer of compacted granular fill conforming to Form 816, section M.02.01, as underlay beneath the wall footings. The underlay shall be at least 6" thick beneath footings falling on the natural soils, and at least 12" thick beneath footings on the existing fills. The granular fill underlay shall be compacted to at least 95% of modified optimum density. The compacted granular fill will provide a uniformly stiff surface to receive the footings. If the subgrades are wet, the initial 6" layer shall be with No. 8 crushed stone. ***Since the footing subgrades will fall in natural soils and existing fills, Dr. Clarence Welti, P.E., P.C. should perform periodic review of the exposed subgrades to confirm conformance with the above criteria.***

**3.3** The required backfill for the walls shall be Pervious Structure Backfill conforming to ConnDOT Form 816, M.02.05. This material will have a unit weight of 125 pcf and internal friction angle of 34°.

**3.4** The ultimate friction angle between the concrete and soil at the foundation base is 31°. This would result in ultimate sliding factor of **0.60**, based on AASHTO criteria. The applicable resistance factor for sliding of pre-cast concrete on the soil can be  $\phi_R = 0.90$  and for cast in place concrete the factor is  $\phi_R = 0.80$ .

**3.5** Regarding **Lateral Earth Pressure**, the design of free standing walls can be based on active earth pressure using the active pressure coefficient  $K_A = 0.28$  (level backfill). The design lateral loads would include a live load surcharge (usually up to 2 feet of soil). A global stability analysis

was completed for Retaining wall #104 due to the proposed height of fill above the natural silt deposits<sup>1</sup>. The section was taken at Sta 126+0 with total height of 20± feet, plus live load surcharge of 260 psf. The proprietary wall foundations and backfill should extend laterally to at least the 3/4's of the total wall height 'H' to provide a global safety factor of at least 1.3. *It is recommended that the factor 3/4xH should apply for all wall heights of 8 feet or more (measured to bottom of footings).* The results of the global stability analysis are included in the appendices.

**3.6** Regarding **groundwater mitigation**, there shall be 6" structure under drains placed along the entire wall.

**3.7 Summary of Preliminary Foundation Design Parameters for Wall #104:**

PARAMETER	LRFD DESIGN VALUE	ULTIMATE RESISTANCE	COMMENTS
Design Bearing Resistance	4 ksf (based on settlement)	20+ ksf	Resistance factor $\phi_R = 0.35$
Backfill Unit Weight *	125 pcf	–	ConnDOT Form 816 M.02.05
Angle of Internal Friction $\phi_1$ (Backfill) *	34°	–	Compacted Pervious Backfill 95% of MOD
Sliding Factor, pre-cast concrete on soil	0.54	0.60	Resistance factor $\phi_R = 0.90$
Sliding Factor, cast in place concrete on soil	0.48	0.60	Resistance factor $\phi_R = 0.80$
Interface Friction Angle Concrete to Backfill, $\delta$	21°	30°	Value from AASHTO LRFD Manual
Active Pressure Coefficient, $K_A$ (Backfill)	0.28	–	
Frost Protection Depth	4 feet	–	ConnDOT Bridge Design Guide

\* For Backfill conforming to Pervious Structure backfill (section M.02.05)

**4.0 Report Conditions:** This report has been prepared for specific application to the subject project in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made. In the event that any changes in the nature, design and location of structures are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report

<sup>1</sup> SLOPE/W, GEO-SLOPE INTERNATIONAL, 2004

modified or verified in writing.

The analyses and recommendations submitted in this report are based in part upon data obtained from referenced explorations. The extent of variations between explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

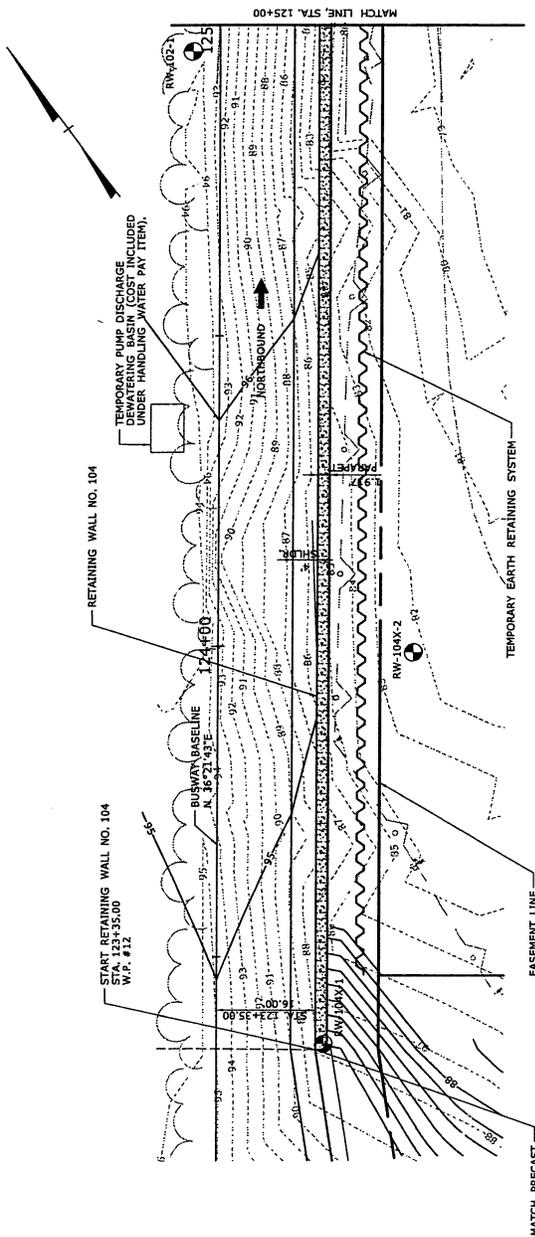
Dr. Clarence Welti, P.E., P.C., should perform a general review of the final design and specifications in order that geotechnical design recommendations may be properly interpreted and implemented as they were intended.

**APPENDIX 1**

**TEST BORING LOGS**

**BORING LOCATION PLAN**

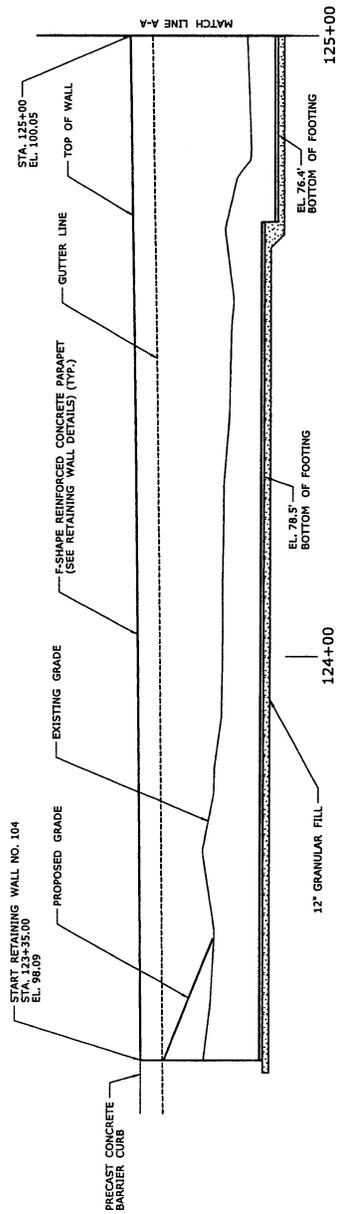
**GLOBAL STABILITY RESULTS**



**PLAN**

**LEGEND**

BORING SYMBOL



**ELEVATION**

Thomas Lloret		SM-001 REV. 10/92		BORING REPORT		SHEET 1 OF 1							
DRILLER Matt Stark		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION				Associated Borings Co., Inc.							
INSPECTOR Wolti & Associates, P.C.		TOWN: New Britain/Newington, CT				BORING CONTRACTOR Close Jensen & Miller, P.C.							
SOILS ENGINEER		PROJECT NAME: Hartford-New Britain Busway				DESIGN ENGINEER							
Surface Elevation: 87.5		PROJECT NUMBER: 171-305				LOCATION:							
Date Started: 3/14/2011		Auger		Casing		Sampler		Core Bar		Hole No. <b>RW-104X-1</b>			
Date Finished: 3/14/2011		Type		HSA						Line & Station 123+36			
Groundwater Observations		Size I. D.		2 1/4 in		2 in				Offset 17' RT			
AT 3 'AFTER 0 HRS		Hammer				140 lb		Bit		N Coordinate 811526.60			
AT 'AFTER HRS		Fall				30 in				E. Coordinate 997887.47			
DEPTH	Casing blows per foot	SAMPLE					BLOWS PER 6 INCHES ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)	
		DEPTH IN FEET FROM - TO	NO.	PEN. INCH	REC. INCH	TYPE	0-6	6-12	12-18	18-24			
5		00.0 - 2.0	1	24	2	D	2	2	2	2	2	Blk. Peat	
		2.0 - 4.0	2	24	0	D	2	1	1	1		11	Red Br. Silty Clay, Some M-F Sand, Blk. Peat Layers
		4.0 - 6.0	3	24	16	D	9	14	16	13			25
	6.0 - 8.0	4	24	16	D	10	10	10	11	25			
											25		
10		10.0 - 12.0	5	24	20	D	6	9	13			17	25
												25	
											25		
15		15.0 - 17.0	6	24	18	D	4	9	14	12			25
												25	
											25		
20		20.0 - 22.0	7	24	6	D	4	5	9	9			25
												25	
											25		
25		23.0 - 25.0	8	24	11	D	4	6	9	19			25
												25	
											25		
30													25
												25	
											25		
35													25
												25	
											25		
40													25
												25	
											25		
From Ground Surface to		Feet Used		Inch Casing Then		Inch Casing For		Feet					
Footage in Earth 25.0		Footage in Rock 0.0		No. of Samples 8		Hole No. <b>RW-104X-1</b>							
SAMPLE TYPE CODING: D = DRIVEN		C = CORE		A = AUGER		UP = UNDISTURBED PISTON							
PROPORTIONS USED: TRACE = 1-10%		LITTLE = 10-20%		SOME = 20-35%		AND = 35-50%							

Thomas Lloret		SM-001 REV. 10/92		BORING REPORT		SHEET 1 OF 1						
DRILLER Matt Stark		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION				Associated Borings Co., Inc.						
INSPECTOR Welti & Associates, P.C.		TOWN: New Britain/Newington, CT		BORING CONTRACTOR Close Jensen & Miller, P.C.		DESIGN ENGINEER						
SOILS ENGINEER		PROJECT NAME: Hartford-New Britain Busway		PROJECT NUMBER: 171-305								
Surface Elevation: 82.1		LOCATION:										
Date Started: 3/14/2011		Auger		Casing		Sampler						
Date Finished: 3/14/2011		Type		HSA		Core Bar						
Groundwater Observations		Size I. D.		2 1/4 in		Hole No. RW-104X-2						
AT 6 ' AFTER 0 HRS		Hammer		140 lb		Bit						
AT ' AFTER HRS		Fall		30 in		Line & Station 123+99						
						Offset 31' RT						
						N Coordinate 811569.07						
						E. Coordinate 997936.16						
DEPTH	Casing blows per foot	SAMPLE				BLOWS PER 6 INCHES ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)	
		DEPTH IN FEET FROM - TO	NO.	PEN. INCH	REC. INCH	TYPE	0-6	6-12	12-18			18-24
5		00.0 - 2.0	1	24	11	D	1	1	1	2	1.5	Blk. Peat
		2.0 - 4.0	2	24	14	D	2	3	5	7		Red Br. F. Silty Sand
		4.0 - 6.0	3	24	16	D	4	7	7	9		
		6.0 - 8.0	4	24	16	D	9	11	16	14		
10		10.0 - 12.0	5	24	8	D	4	7	7	13	12.5	Red Br. Silty Sand, Tr. F. Gravel
15		15.0 - 17.0	6	24	6	D	5	16	21	26	18	Red Br. Silty Sand
20		20.0 - 22.0	7	24	14	D	4	7	10	11	25	End of Boring - 25.0
		23.0 - 25.0	8	24	11	D	6	9	19	26		
25												
30												
35												
40												
From Ground Surface to		Feet Used		Inch Casing Then		Inch Casing For		Feet				
Footage in Earth 25.0		Footage in Rock 0.0		No. of Samples 8		Hole No. RW-104X-2						
SAMPLE TYPE CODING: D = DRIVEN C = CORE		A = AUGER		UP = UNDISTURBED PISTON								
PROPORTIONS USED: TRACE = 1-10%		LITTLE = 10-20%		SOME = 20-35%		AND = 35-50%						

Thomas Lloret		SM-001 REV. 10/92		BORING REPORT				SHEET 1 OF 1					
DRILLER Matt Stark		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION						Associated Borings Co., Inc.					
INSPECTOR Wolti & Associates, P.C.		TOWN:		New Britain/Newington, CT				BORING CONTRACTOR Close Jensen & Miller, P.C.					
SOILS ENGINEER		PROJECT NAME:		Hartford-New Britain Busway				DESIGN ENGINEER					
PROJECT NUMBER:		171-305				LOCATION:							
Surface Elevation: 80.2		Date Started: 3/14/2011		Auger		Casing		Sampler		Core Bar		Hole No. <b>RW-104X-3</b>	
Date Finished: 3/14/2011		Type		HSA								Line & Station 125+03	
Groundwater Observations		Size I. D.		2 1/4 in				2 in				Offset 21' RT	
AT 5 'AFTER 0 HRS		Hammer						140 lb		Bit		N Coordinate 811659.14	
AT 'AFTER HRS		Fall						30 in				E. Coordinate 997988.92	
D E P T H	Casing blows per foot	SAMPLE					BLOWS PER 6 INCHES ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)	
		DEPTH IN FEET FROM - TO	NO.	PEN. INCH	REC. INCH	TYPE	0 - 6	6 - 12	12-18	18-24			
5		2.0 - 4.0	1	24	10	D	2	1	1	2	2.5	Blk. Peat, Wood, Steel	
		4.0 - 6.0	2	24	13	D	4	5	7	7		Red Br. F. Silty Sand	
10		10.0 - 12.0	3	24	8	D	10	10	9	9	13	Red Br. M-F Sand, Tr. F. Gravel	
		15.0 - 17.0	4	24	20	D	10	12	12	14		Refusal - 20.9	
20		20.0 - 20.9	5	9	9	D	10	50/3"	X	X	20.9		
25													
30													
35													
40													
From Ground Surface to		Feet Used		Inch Casing Then		Inch Casing For		Feet					
Footage in Earth 20.9		Footage in Rock 0.0		No. of Samples 5		Hole No. RW-104X-3							
SAMPLE TYPE CODING:		D = DRIVEN		C = CORE		A = AUGER		UP = UNDISTURBED PISTON					
PROPORTIONS USED:		TRACE = 1-10%		LITTLE = 10-20%		SOME = 20-35%		AND = 35-50%					

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INSPECTOR Welti & Associates, P.C.		TOWN: New Britain/Newington, CT				BORING CONTRACTOR Close Jensen & Miller, P.C.						
SOILS ENGINEER		PROJECT NAME: Hartford-New Britain Busway				DESIGN ENGINEER						
PROJECT NUMBER: 171-305		LOCATION:										
Surface Elevation: 78.97												
Date Started: 3/15/2011		Auger		Casing		Sampler		Core Bar		Hole No. <b>RW-104X-4</b>		
Date Finished: 3/15/2011		Type		HSA						Line & Station 125+71		
Groundwater Observations		Size I. D.		2 1/4 in		2 in				Offset 31' RT		
AT 4 'AFTER 0 HRS		Hammer				140 lb		Bit		N Coordinate 811707.97		
AT 'AFTER HRS		Fall				30 in				E. Coordinate 998038.10		
D E P T H	Casing blows per foot	SAMPLE					BLOWS PER 6 INCHES ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		DEPTH IN FEET FROM - TO	NO.	PEN. INCH	REC. INCH	TYPE	0-6	6-12	12-18	18-24		
5		0.0 - 2.0	1	24	6	D	4	5	5	5	0.5	Topsoil
		2.0 - 4.0	2	24	8	D	9	9	9	14		Red Br. M-F Silty Sand, Tr. Clay, Tr. M-F Gravel
		4.0 - 6.0	3	24	6	D	10	10	18	14		
10		10.0 - 12.0	4	24	18	D	13	18	26	19	13	
15		15.0 - 16.9	5	21	20	D	9	33	47	50/3"	16.9	Red Br. M-F Silty Sand, Some C-F Gravel
20												Refusal - 16.9
25												
30												
35												
40												

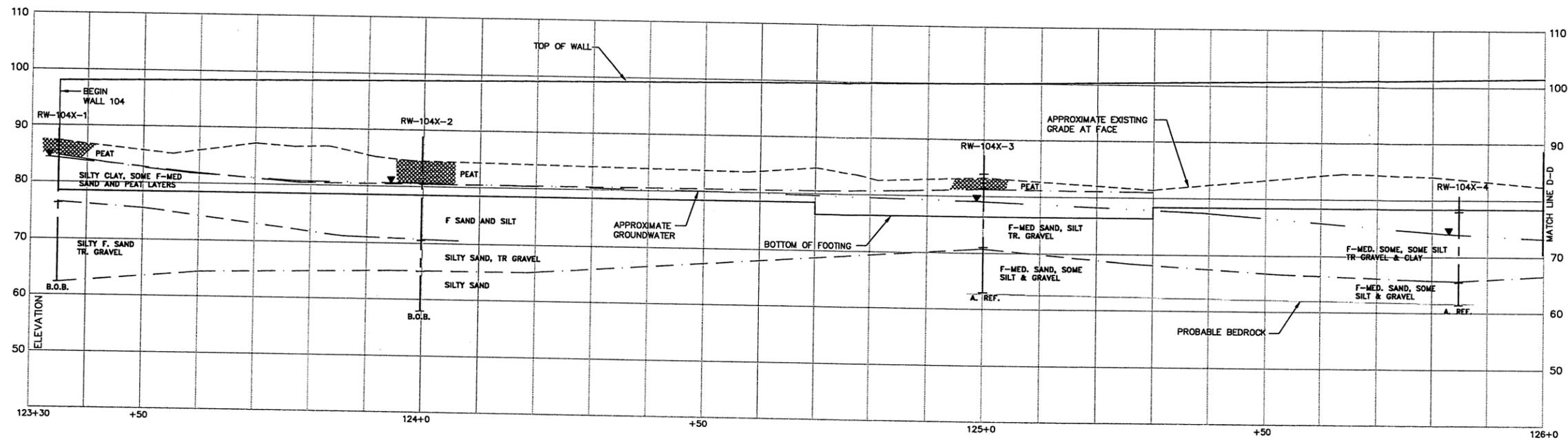
From Ground Surface to		Feet Used		Inch Casing Then		Inch Casing For		Feet	
Footage in Earth 16.9		Footage in Rock 0.0		No. of Samples 5		Hole No. <b>RW-104X-4</b>			
SAMPLE TYPE CODING: D = DRIVEN		C = CORE		A = AUGER		UP = UNDISTURBED PISTON			
PROPORTIONS USED: TRACE = 1-10%		LITTLE = 10-20%		SOME = 20-35%		AND = 35-50%			

Mark Lloret		SM-001 REV. 10/92		BORING REPORT		SHEET 1 OF 1						
DRILLER Don Moodie		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION				Associated Borings Co., Inc.						
INSPECTOR Welti & Associates, P.C.		TOWN: New Britain/Newington, CT		BORING CONTRACTOR Close Jensen & Miller, P.C.								
SOILS ENGINEER		PROJECT NAME: Hartford-New Britain Busway		DESIGN ENGINEER								
PROJECT NUMBER: 171-305		LOCATION:										
Surface Elevation: 93.29		Auger		Casing		Hole No. <b>RW-102-1</b>						
Date Started: 8/24/2007		Type		Sampler		Line & Station 125+0						
Date Finished: 8/24/2007		HSA		SS		Offset 13' LT						
Groundwater Observations		Size I. D. 2 1/4 in		2 in		N Coordinate 811668.10						
AT 17 'AFTER 0 HRS		Hammer		140 lb		Bit						
AT 'AFTER HRS		Fall		30 in		E. Coordinate 997964.90						
DEPTH	Casing blows per foot	SAMPLE				BLOWS PER 6 INCHES ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)	
		DEPTH IN FEET FROM - TO	NO.	PEN. INCH	REC. INCH	TYPE	0 - 6	6 - 12	12-18			18-24
5		0.0 - 2.0	1	24	8	D	5	4	4	6	6	Br. C-F Sand and C-F Gravel, Cobbles (Fill)
		2.0 - 4.0	2	24	8	D	4	5	5	6		
		4.0 - 6.0	3	24	8	D	5	6	7	8		
		6.0 - 8.0	4	24	8	D	7	8	7	9		
		8.0 - 10.0	5	24	8	D	6	7	8	7		
10		10.0 - 12.0	6	24	8	D	5	6	7	7	13	Red Br. M-F Silty Sand, Tr. M-F Gravel (Fill)
		12.0 - 14.0	7	24	8	D	6	7	8	7		
		14.0 - 16.0	8	24	12	D	4	6	7	7		
15		16.0 - 18.0	9	24	12	D	6	6	8	21	15	Red Br. Silt (Fill)
		18.0 - 20.0	10	24	12	D	8	9	9	10		
		20.0 - 22.0	11	24	16	D	9	9	8	12		
25		25.0 - 27.0	12	24	20	D	9	10	10	12	27	Red Br. Silt, Tr. M-F Gravel, W/Lenses of M-F Sand
30											27	End of Boring - 27.0
35											27	End of Boring - 27.0
40											27	End of Boring - 27.0
From Ground Surface to		Feet Used		Inch Casing Then		Inch Casing For		Feet				
Footage in Earth 27.0		Footage in Rock 0.0		No. of Samples 12		Hole No. <b>RW-102-1</b>						
SAMPLE TYPE CODING: D = DRIVEN		C = CORE		A = AUGER		UP = UNDISTURBED PISTON						
PROPORTIONS USED: TRACE = 1-10%		LITTLE = 10-20%		SOME = 20-35%		AND = 35-50%						

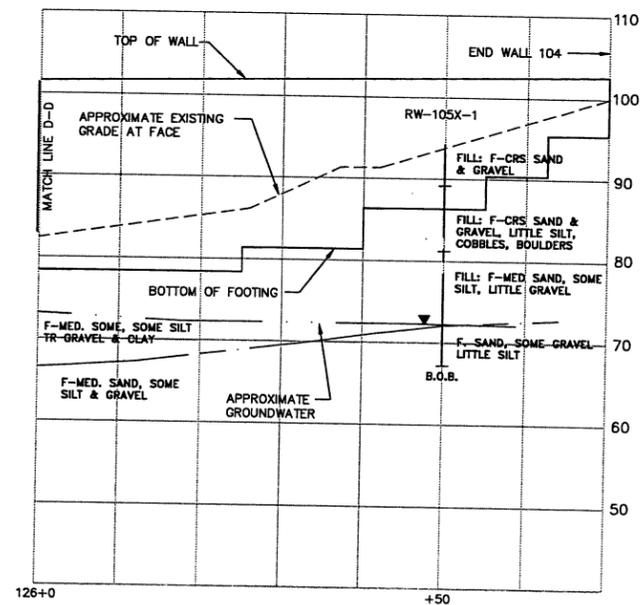
Jaime Lloret		SM-001 REV. 10/92		BORING REPORT				SHEET 1 OF 1							
DRILLER		STATE OF CONNECTICUT		DEPARTMENT OF TRANSPORTATION				Associated Borings Co., Inc.							
Don Moodie		TOWN:		New Britain/Newington, CT				BORING CONTRACTOR							
INSPECTOR		PROJECT NAME:		Hartford-New Britain Busway				Close Jensen & Miller, P.C.							
Welti & Associates, P.C.		PROJECT NUMBER:		171-305				DESIGN ENGINEER							
SOILS ENGINEER		LOCATION:													
Surface Elevation: 92.62		Auger		Casing		Sampler		Core Bar							
Date Started: 8/31/2007		Type		HSA		SS		Hole No. <b>RW-102-2</b>							
Date Finished: 8/31/2007		Size I. D.		2 1/4 in		2 in		Line & Station 127+0							
Groundwater Observations		Hammer				140 lb		Bit							
AT 18 ' AFTER 0 HRS		Fall				30 in		N Coordinate 811837.36							
AT ' AFTER HRS								E. Coordinate 998085.87							
DEPTH	Casing blows per foot	SAMPLE					BLOWS PER 6 INCHES ON SAMPLER				STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)			
		DEPTH IN FEET FROM - TO	NO.	PEN. INCH	REC. INCH	TYPE	0-6	6-12	12-18	18-24					
5		0.0 - 2.0	1	24	8	D	13	17	21	40	2	Blk & Br. C-F Sand and C-F Gravel, Cobbles (Fill)			
		2.0 - 4.0	2	24	8	D	17	31	36	40			Red & Blk M-F Sand, Some Silt, Some C-F Gravel, (Fill)		
		4.0 - 6.0	3	24	10	D	7	11	9	12					
		6.0 - 8.0	4	24	7	D	10	14	16	30					
		8.0 - 10.0	5	24	12	D	11	15	17	14					
	10		10.0 - 12.0	6	24	8	D	10	12	9		9		18	Red Br. F. Silty Sand, Tr. C-F Gravel
			12.0 - 14.0	7	24	10	D	7	9	19		16			
			14.0 - 16.0	8	24	8	D	9	11	7		7			
	15		16.0 - 18.0	9	24	7	D	9	7	11		12		25	End of Boring - 25.0
			18.0 - 20.0	10	24	10	D	6	7	9		7			
	20		20.0 - 22.0	11	24	6	D	7	7	8		10			
			23.0 - 25.0	12	24	12	D	22	36	22		25			
25															
30															
35															
40															
From Ground Surface to		Feet Used		Inch Casing Then		Inch Casing For		Feet							
Footage in Earth 25.0		Footage in Rock 0.0		No. of Samples 12		Hole No. <b>RW-102-2</b>									
SAMPLE TYPE CODING: D = DRIVEN		C = CORE		A = AUGER		UP = UNDISTURBED PISTON									
PROPORTIONS USED: TRACE = 1-10%		LITTLE = 10-20%		SOME = 20-35%		AND = 35-50%									

## **APPENDIX 2**

### **Geologic Sections + Grain Size Gradations (if any)**



SOIL PROFILE - WALL 104



- A. REF. = AUGER REFUSAL
- B.O.B. = BOTTOM OF BORING
- ▼ = OBSERVED GROUNDWATER LEVEL
- = ESTIMATED WATER TABLE
- = STRATUM CHANGE
- = GRADE LINE

REVISIONS		
DATE	NO.	DESCRIPTION

NEW BRITAIN - HARTFORD BUSWAY  
NEWINGTON SECTIONS A & B

STRUCTURE GEOTECHNICAL SECTIONS

SCALE: 1" = 10'      DATE: MARCH 30, 2011

DR. CLARENCE WELT, P.E., P.C.  
227 WILLIAMS STREET, P.O. BOX 597  
GLASTONBURY, CONNECTICUT 06033

SHEET 5