Geotechnical Engineering Structure Report
Structure Layout for Design Submission
Extra Work - Retaining Wall at Aetna Parking Garage
State Project 63-H137
Hartford, Connecticut

Prepared for:

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October 27, 2010

STATE OF CONNECTICUT
ULRICH F. LA FOSSE
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LICENSED
PROFESSIONAL ENGINEER

Table of Contents

1.0 GENERAL INFORMATION 1

1.1 General 1

1.2 Datum 1

1.3 Pre-Existing Conditions 1

1.4 Design Criteria 2

1.5 Proposed Structure 2

2.0 GEOLOGY 2

3.0 PREVIOUS GEOTECHNICAL INFORMATION 2

4.0 RECENT SUBSURFACE EXPLORATIONS 2

5.0 LABORATORY TESTING 3

5.1 Pre-Existing Laboratory Data 3

5.2 Gradation Analyses 3

6.0 SUBSURFACE CONDITIONS 3

6.1 Subsurface Profile 3

6.2 Geotechnical Design Parameters 4

6.3 Groundwater 4

7.0 ANALYSIS AND DESIGN RECOMMENDATIONS 5

7.1 Foundation and Type 5

7.2 Bearing Materials 5

7.3 Design Parameters 5

7.3.1 Design of Proprietary Retaining Walls 5

7.3.2 Design of Cast-in-Place Retaining Walls 6

7.4 Settlement Analyses 6

7.4.1 Consolidation Settlement 7

7.5 Drainage 7

7.6 Stability 7

7.7 Seismic Design 8

8.0 CONSTRUCTION RECOMMENDATIONS 8

8.1 Subgrade Preparation 8

8.2 Reuse of Fill 8

8.3 Dewatering 8

8.4 Temporary Lateral Support **9**
8.5 Special Provisions **9**
9.0 LIMITATIONS **9**

Appendices

Appendix 1 – Figures
Appendix 2 – 2010 Boring Logs (RW-1 and RW-2)
Appendix 3 – 2010 Sieve Analyses
Appendix 4 – Pre-Existing Boring Logs
Appendix 5 – Limitations

1.0 GENERAL INFORMATION

1.1 General

This report summarizes the supplementary subsurface exploration program, inferred subsurface conditions, and geotechnical analyses; and provides geotechnical engineering foundation design recommendations for the proposed Retaining Wall south of the Aetna Parking Garage located to east of the Sigourney/Amtrak Rail overpass. This wall is part of the Hartford North segment (ConnDOT No. 63-H137) of the proposed New Britain-Hartford Busway (Busway), in Hartford, Connecticut. The general location of the proposed Retaining Wall is shown on Figure 1 (in Appendix 1).

The overall Busway project entails the design and construction of a 9.4-mile corridor between downtown New Britain and downtown Hartford that follows an abandoned railroad right-of-way. The Busway will be a dedicated roadway that will be reserved for buses as part of the Bus Rapid Transit System (BRT).

This proposed Retaining Wall (Retaining Wall XXX) will be located between the new Aetna Parking Garage and Amtrak Railroad tracks from about Southbound (SB) Station 809+73.90 to 812+98.98.

H.W. Lochner is the Prime Designer for this section of the Busway. Geo**Design**, Inc. (Geo**Design**) is the Geotechnical Subconsultant to H.W. Lochner.

1.2 Datum

All elevations referenced in this report are in feet and are based on NGVD 1929. The coordinates are based on Connecticut Coordinate System, NAD 1983.

1.3 Pre-Existing Conditions

The portion of Amtrak railroad that is south of the proposed retaining wall runs in a generally northeast-southwest orientation from about Elevation (El.) 57 to 50 feet. The tracks are about 45 to 60 feet south of the existing Aetna Parking Garage and about 30 to 45 feet south of the proposed wall. A chain link fence separates the tracks from the relatively level grassed area in front of the Garage.

Based on a geotechnical study for the parking garage, prepared by Dr. Clarence Welti dated July 12, 2007, the existing parking garage is founded on steel H-piles, driven into very dense Glacial Till or to Bedrock. Bottom of existing parking garage pile caps range from about El. 42 to 47 feet.

1.4 Design Criteria

Foundation design recommendations are based on AASHTO Load and Resistance Factor Bridge Design Specifications 4th Edition, 2007 (AASHTO LRFD) with 2008 Interims, ASHTO Standard Specifications for Highway Bridges, 17th Edition, 2002 (ASHTO Working Stress), and Connecticut Department of Transportation Geotechnical Engineering Manual, 2005 Edition. Recommendations are also based on State of Connecticut Department of Transportation (ConnDOT) Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816 (2004). American Society for Testing and Materials (ASTM) publications were followed as the reference standards for field and laboratory tests applicable.

1.5 Proposed Structure

Retaining Wall XXX will be constructed approximately 10 to 13 feet south of the existing Aetna parking garage and will both retain the proposed Southbound Busway, and provide a barrier. The wall will be about 320 feet long extending from Sta. 809+73.90 to 812+98.98, and will have a height of 8.5 to12.5 feet (including a 3.5 foot high parapet), retaining up to four feet of earth. The ground surface in front of and behind the proposed wall will be relatively level. The bottom of footing elevation for the entire length of wall is proposed at El. 45.30 feet. The top of parapet Elevations range from El. 54.27 at the east, to El. 57.63 at the west. The approximate locations of existing features and the proposed wall are shown on Figure 2 (Appendix 1).

2.0 GEOLOGY

Published geologic data indicate that the predominant subsurface material at the site is Artificial Fill over Lake-Bottom Deposits, which overlays Till and Sedimentary Bedrock. The Lake-Bottom Deposits are described having an average thickness of 20 feet consisting of varved clay and silt.

3.0 PREVIOUS GEOTECHNICAL INFORMATION

The preliminary design phase for the Busway (in 2003) included pre-existing Borings SB-90 and RB-42, west of proposed Retaining Wall XXX.

The final design phase studies in 2008 included pre-existing Borings R-11, R-12, RW-102-6 and -7, which were performed west of the proposed Retaining Wall XXX.

The geotechnical study for the Aetna parking garage, prepared by Dr. Clarence Welti contains subsurface data including Borings B-1 and B-2 which are located near the west end of the proposed wall. Ground surface at the time of these explorations is estimated at El. 56 ft, which is about 5 to 6 feet above estimated existing grades.

Boring logs are provided in Appendix 4.

4.0 RECENT SUBSURFACE EXPLORATIONS

In September 2010, Geo**Design** conducted an additional one day subsurface exploration program for Retaining Wall XXX. The new borings, designated RW-1 and RW-2, were approximately located within the proposed retaining wall footprint at about Stations 812+00 and 813+00, respectively. Geo**Design** coordinated the services of New England Boring Contractors of CT, Inc. (NEBC) to perform Standard Penetration Test (SPT, ASTM D 1586) borings. Initial and as-drilled boring locations were surveyed by Connecticut Department of Transportation (ConnDOT) survey crews. As-drilled borings locations are shown on Figure 2 (Appendix 1) and boring logs are included in Appendix 2.

Both borings were carried to a depth of 32 feet into very dense Glacial Till.

5.0 LABORATORY TESTING

Geo**Design** performed two gradation tests on the Fill to verify field classifications and determination of suitability for reuse. The results of these tests are discussed below and are included in Appendix 3.

5.1 Pre-Existing Laboratory Data

Pre-existing laboratory data, included in our August 2010 Retaining Wall Report was used.

5.2 Gradation Analyses

Two gradation tests were performed on Fill samples from Borings RW-1 and RW-2. The tests indicated a Sand content of 50 to 55 percent, Gravel content of 10 to 23 percent, and Fines (non-plastic) content of 22 to 40 percent.

6.0 SUBSURFACE CONDITIONS

6.1 Subsurface Profile

A subsurface profile is presented as Figure 3 (Appendix 1). The legend for the subsurface profile is included as Figure 4. This profile depicts the generalized subsurface conditions along the proposed retaining wall, based on the available subsurface data.

The soil profile can be generally summarized as follows:

- **Topsoil** – 0 to 6-inches thick; over
- **Fill –** 4 to 13.5 feet thick; over
- **Varved Silts & Clays –** 12.5 to 34 feet thick; over
- **Glacial Till** – 32.5 to 40 feet thick; over
- **Bedrock (Red Siltstone/Shale)**

The **Fill** was observed in all borings, and generally consisted of loose to dense, fine to coarse Sand with varying proportions of Silt and Gravel, and locally Brick/Concrete fragments and Organic Fibers. The thickest and thinnest Fill was observed in Borings SB-90 and R-11, respectively. Borings closest to the proposed Wal (RW-1, RW-2, B-1, B-2) revealed a Fill thickness of 5 to 7.5 feet.

The **Varved Clay** was encountered below the Fill with a consistency very soft to very stiff consistency. The Varved Clay in the easterly borings (RW-102-6, R-11, B-2, RW-102-7, RW-1, RB-42, RW-2, R-12) had a limited thickness and was mostly desiccated (most N-Values above 3). The Varved Clay in the westerly borings (SB-90 and B-1) was thicker and had isolated N-Values as low as weight of hammer (WOH).

Where the **Glacial Till** was fully penetrated in Borings SB-90 and B-2, the thickness varied from approximately 31 to 36 feet. This layer generally consisted of fine to coarse Sand, some Silt, with little fine to coarse Gravel. N-values indicate the density of this layer ranges from medium dense to very dense.

Bedrock was encountered in Borings B-2 and SB-90 at depths of 65 and 85 feet, respectively (approximate Elev. -27.6 feet). Rock cores were taken in both borings and were described as red Shale and red Siltstone with Rock Quality Designations (RQDs) of 20 to 47 percent, indicating very poor to poor quality that generally improved with depth.

6.2 Geotechnical Design Parameters

Engineering design parameters for the design of the proposed wall were based on the boring data and laboratory test results. Below is a summary of the engineering design parameters.

Stratum	Total Unit Weight (pcf)	Friction Angle (degrees)	Undrained Shear Strength (psf)	Recompression Ratio (Cr)
Fill	125	32	-	-
Desiccated Varved Clay	110	--	1500	0.04
Soft Varved Clay	110	--	650	0.03
Glacial Till	135	34	-	-

6.3 Groundwater

Groundwater could not be observed in the new borings, due to the drilling method (mud/rotary). However, the pre-existing boring data indicates groundwater at depths of about 3 to 10 feet deep (Elev. 50 to 40) generally increasing in depth from west to east.

Groundwater conditions will vary depending on factors such as temperature, season, precipitation, construction activity and other conditions, which may be different from those at the time of these readings.

7.0 ANALYSIS AND DESIGN RECOMMENDATIONS

Based on the results of bearing and settlement analyses, we recommend the use of shallow spread footing foundations to support the proposed wall, and some light weight wall backfill materials (e.g. 60 pcf fill).

Special recommendations, such as over excavating and use of light weight fill, are included herein to limit bearing pressures on the varved clay, control wall settlements, and protect the Aetna parking garage.

7.1 Foundation and Type

We recommend shallow foundations with bottom of footings constructed below frost depth, a minimum of 42-inches below final grades.

We understand that proprietary walls will be used wherever possible. Since this retaining wall will retain/protect the proposed Busway, proprietary walls (i.e. MSE, T-Wall, or Double-Wal) are feasible.

7.2 Bearing Materials

Based preliminary drawings provided by H.W. Lochner, the proposed bottom of wall footing level will be about El. 45.3 feet. This would place the footings on Fill or soft to stiff Varved Clay.

In its present state, the existing Fill (including the existing embankment fill) is not suitable for support of shallow foundations. This is because of the high variability in its compactness coupled with the risk of excessive and/or differential settlements below the wall. We recommend full removal of the existing Fill and replacement with Light Weight Fill west of Station 811+00, or Compacted Granular Fill east of Station 811+00.

7.3 Design Parameters

We recommend backfill consist of 60 pcf Light Weight Fill (LWF) from Stations 809+73.90 to 811+50, and 125 pcf Pervious Structure Backfill (PSB) from Stations 811+50 to 812+98.98.

7.3.1 Design of Proprietary Retaining Walls

We recommend the following static design parameters for proprietary walls.

	LWF	PSB
Unit Weight of soil above the water table, pounds per cubic foot (pcf)	60	125
Unit weight of soil below the water table, pounds per cubic foot (pcf)	n/a	62.6
Soil Angle of Internal Friction, φ	38	34
Allowable Bearing Capacity (ksf)	2.0	2.0

Coefficient of Friction for Sliding	0.55	0.55
Coefficient of Friction for Soil against Wall, tan δ	0.45	0.40
Coefficient of Passive Earth Pressure, K_P (to be neglected above frost depth)	4.0	3.5
Coefficient of Active Earth Pressure with level backfill, K_a	0.25	0.28

Earth pressure calculations should assume a surface surcharge of 24 inches soil depth or 250 psf. We recommend footings be constructed on a 36-inch thick layer. This layer should consist of LWF west of Station 811+50 and of Compacted Granular Fill (CGF) east of Station 811+50.

7.3.2 Design of Cast-in-Place Retaining Walls

We recommend the following static design parameters for cast-in-place walls. Load Factors should be selected from AASHTO LRFD Table 3.4.1-2

	LWF	**PSB**
Unit Weight of LWF above the water table, pounds per cubic foot (pcf)	60	125
Unit weight of LWF below the water table, pounds per cubic foot (pcf)	n/a	62.6
Soil Angle of Internal Friction, φ	38	34
Nominal Bearing Resistance (Service Limit State) (ksf)	2.0	2.0
Nominal Bearing Resistance (Strength Limit State) (ksf)	4.4	4.4
Bearing Resistance Factor (φ_b)	0.45	0.45
Coefficient of Friction for Sliding (AASHTO LRFD Table 3.11.5.3-1)	0.55	0.55
Coefficient of Friction for Soil against Wall (tan δ)	0.45	0.40
Coefficient of Passive LWF Earth Pressure, K_P (to be neglected above frost depth)	4.0	3.5
Coefficient of Active LWF Earth Pressure with level backfill, K_a	0.25	0.28
Sliding Resistance Factor (φ_τ) (AASHTO LRFD Table 10.5.5.2.2-1)	0.8	0.8

The resistance factors provided above are for the Strength Limit State. In accordance with LRFD Section 10.5.5.1, resistance factors for the Service Limit State shall be taken as 1.0, except for global stability where the resistance factor shall be taken as 0.75. In accordance with LRFD Section 10.5.5.3.3, resistance factors for Extreme Limit State shall be taken as 1.0.

Earth pressure calculations should assume a surface surcharge of 24 inches soil depth or 250 psf. We recommend footings be constructed on a 36-inch thick layer. This layer should consist of LWF west of Station 811+50 and of Compacted Granular Fill (CGF) east of Station 811+50.

7.4 Settlement Analyses

Due to the presence of Varved Clay below the proposed wall, the potential for consolidation settlement was considered. Based on drawings provided by H.W. Lochner, filling of up to four feet is proposed behind Retaining Wall XXX.

In the area of the westerly end of Retaining Wall XXX (Stas. 809+73 to 810+50), about 5 to 10 feet of soft to medium desiccated clay overlies about 20 feet of very soft Varved Clay. If normal fill were used (125 pcf fill), up to approximately two-inches of settlement could occur. Therefore, we have included recommendations to mitigate this settlement and to limit loading of the existing parking garage piles and avoid downdrag.

7.4.1 Consolidation Settlement

Prior to construction of the existing Aetna parking garage, the ground surface was about four feet above the current ground surface in the area in front of the proposed wall. We estimated the potential net change of stress on soils underlying the westerly end of the wall, taking the following into consideration:

- Approximate four foot cut about two years ago,
- Weight of proposed retaining wall (cast-in-place),
- 36-inches of over excavation and replacement with 60 pcf light weight fill (LWF),
- LWF backfill up to 24-inches below the proposed Busway grades,
- 24-inches of 125 pcf pavement section at surface,
- 250 pcf of surcharge

Based on these assumptions/recommendations, we expect that there will be a slight reduction of stress on the underlying Varved Clay. Therefore, if LWF is used and over-excavation is performed, we expect minimal consolidation settlement to occur along the wall.

Due to the generally stiff consistency of the Varved Clay and its thickness, we also expect minimal consolidation settlements to occur below the wall east of Sta. 811+50.

7.5 Drainage

Drainage details for retaining walls should be constructed in accordance with ConnDOT Bridge Design Manual specifications for walls and abutments. Specifically, six-inch underdrains should be installed and connected to roadway drainage.

7.6 Stability

Global stability analyses (as presented in our August 2010 Retaining Walls report) were performed for Retaining Wall 102. Wall 102 is 11 feet high, located approximately 40 feet south of Retaining Wall XXX, on similarly thick and soft Varved Clay, and had a safety factor greater than 1.5 against global overturning. Therefore, by inspection Retaining Wall XXX is deemed to have adequate global stability.

7.7 Seismic Design

Since the proposed retaining wall is in Seismic Zone 1, per Section 4.7.4.1 of AASHTO LRFD 2008 interim, seismic loads do not need to be analyzed. Thus, seismic parameters have not been provided.

8.0 CONSTRUCTION RECOMMENDATIONS

8.1 Subgrade Preparation

Based on the anticipated subgrade materials and conditions, we recommend over excavating 36-inches and replacing with LWF or CGF, as discussed in Section 7.3. We anticipate exposed subgrades to consist of Varved Clay. We recommend that the final six inches of excavation be performed with a smooth-edged bucket. Disturbed subgrades should be over-excavated to firm stable ground and replaced with compacted granular fill or crushed stone wrapped in a non-woven filter fabric.

The LWF should be placed in accordance with the LWF Special Provision for the project, and CGF and PSB should be placed in accordance with Sections 2.14 and 2.16, respectively, of ConnDOT Standard Specifications Form 816. Filling should extend a minimum of 12-inches on either side of the footings for a depth of 36-inches at a slope of 1H:1V.

8.2 Reuse of Fill

Excavated materials are not anticipated to be suitable for re-use as Compacted Granular Fill or Granular Fill due to their elevated Silt content. Topsoil and Subsoil may be stockpiled and reused to dress slopes.

Existing fill that is free of deleterious materials may be reused as embankment fill (ConnDOT Form 816 Section 2.02.03.5). Form 816 does not indicate an acceptable percentage of fines, however, generally more than 35 percent Silt will be difficult to place and compact.

Fill with elevated fines content and Varved Clays are not expected to be suitable for reuse on the project, except for placement of “unsuitable” materials in the outer slopes of an embankment as indicated on ConnDOT Standard Drawing No. 201.

8.3 Dewatering

Relatively low groundwater flow rates are anticipated during foundation construction to dewater the Varved Clay stratum due to its low permeability. However, the contractor should be prepared to collect and remove water caused by local, perched groundwater conditions, and water from precipitation and runoff by means of trenching, sumps, and pumps.

Contractors should take extra precautions when excavating in Varved Clay layer. A six-inch layer of crushed stone wrapped in filter fabric, placed on top of the Varved Clay may be required

to reduce disturbance to this stratum. If the Varved Clay stratum is disturbed, the disturbed portions must be removed and replaced with crushed stone wrapped in filter fabric.

8.4 Temporary Lateral Support

It appears there is adequate space to lay back slopes, and therefore do not anticipate the need for temporary lateral support to construct the proposed wall.

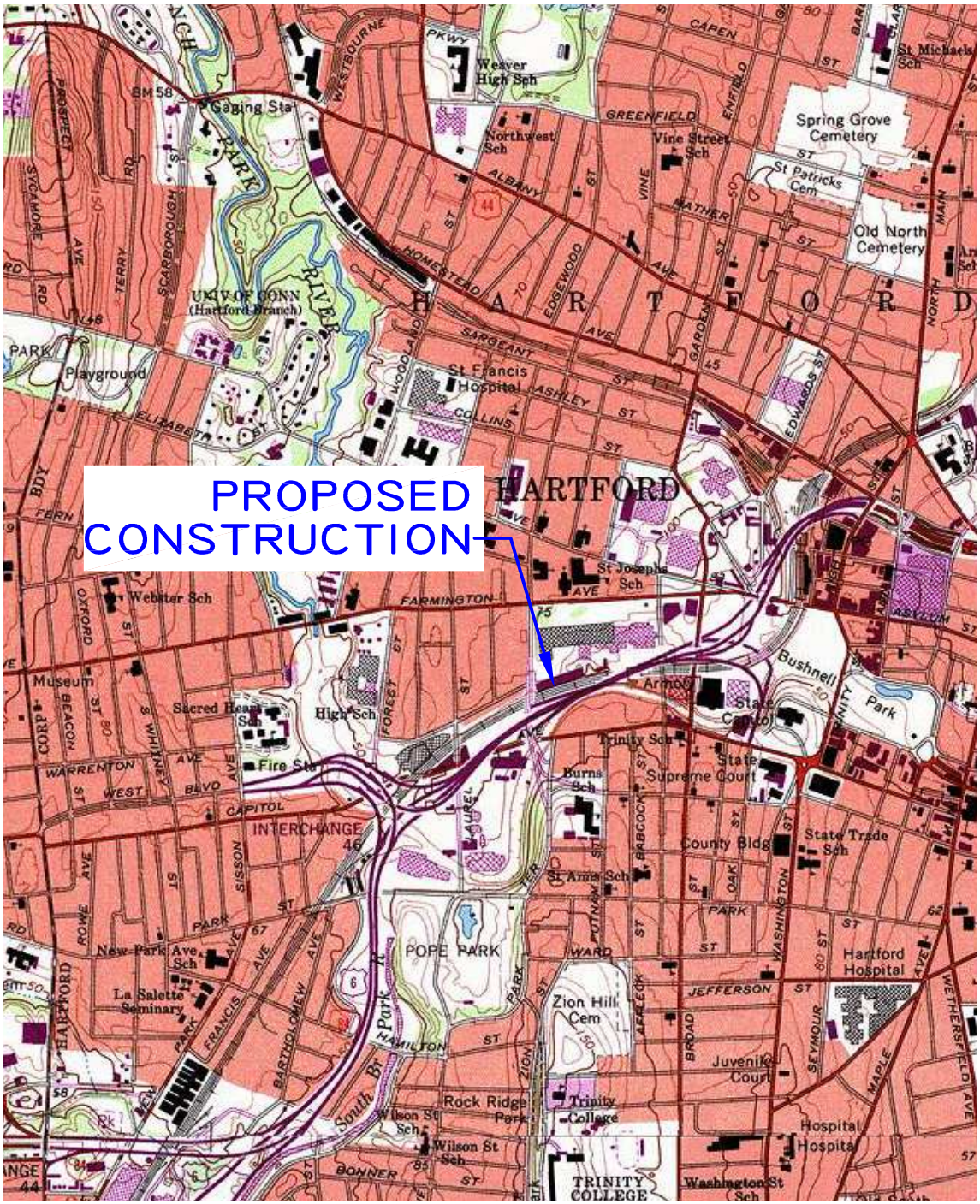
8.5 Special Provisions

A Special Provision for the Light Weight Fill was previously submitted to H.W. Lochner.

9.0 LIMITATIONS

This report is subject to the limitations attached in Appendix 5.

Appendix 1
Figures



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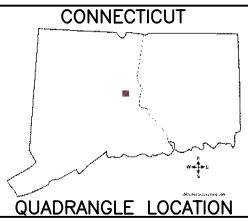
DRAWN BY: MGB | REVIEWED BY: ULF

CONNECTICUT



QUADRANGLE LOCATION

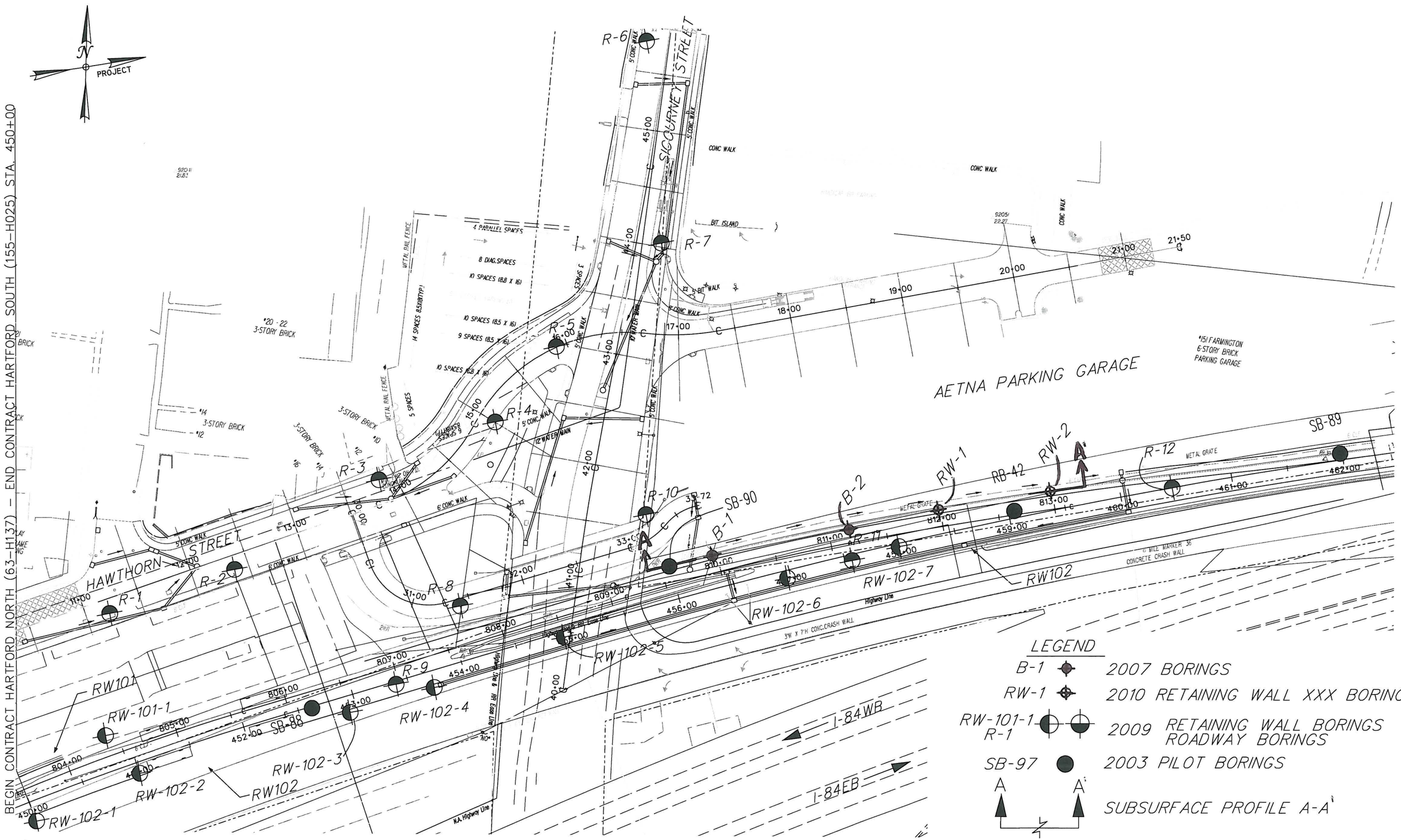
PROJECT LOCATION PLAN
RETAINING WALL XXX
NEW BRITAIN-HARTFORD BUSWAY
STATE PROJECT NO. 63-H137

REFERENCE:
U.S.G.S. 7.5 MINUTE QUADRANGLE: HARTFORD, CT.
Figure was created using TOPO! 2003 software

SCALE IN FEET
0 1000 2000 4000

PROJECT NO. 0331-14.03
DATE: 10-20-10
FIGURE NO. 1

ACAD FILE No. M:\CL\331\14\CADD\Area Map - Broad Stover AAR.dwg



M:\CL\331\14\CADD\4 SHEETS - HTFD BUSWAY NORTH - ROADS & R. WALLS - AS-DRILLED BORING LOC PLAN (as of12-24-09)

DESIGNED BY JWK							
DRAWN BY SMC							
CHECKED BY JWK							
APPROVED BY ULF		NO.	DATE		DRWN.	CHKD	APPVD
		REVISIONS					

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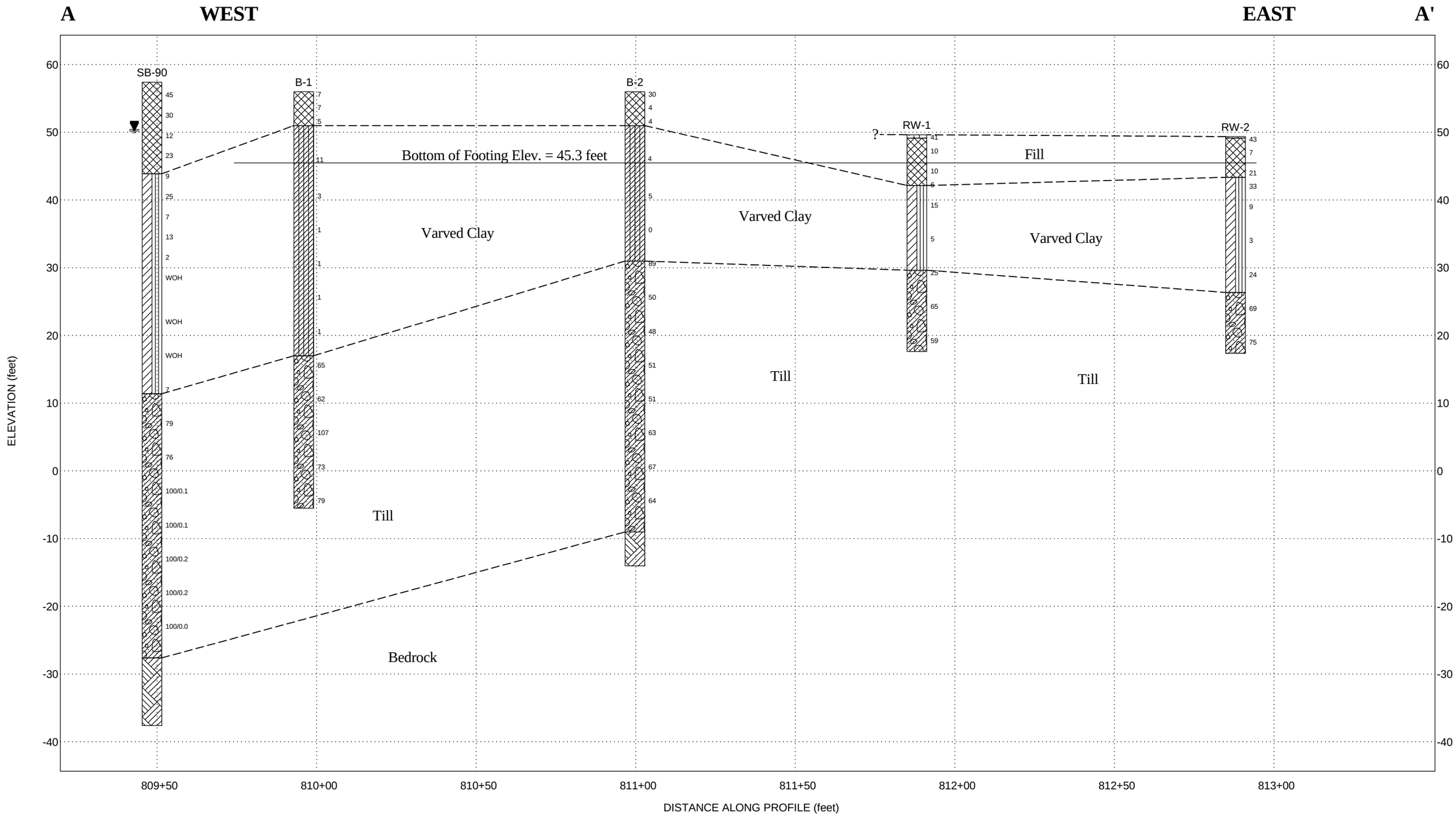
DWG. TITLE
RETAINING WALL XXX
AS-DRILLED EXPLORATION
LOCATION PLAN

PROJECT
STATE PROJECT NO. 63-H137
NEW BRITAIN - HARTFORD BUSWAY

FILE NO. 331-14.03
SCALE 1" = 80'
DATE 10-20-10
FIGURE NO. 2



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0 31
Horizontal Scale (feet)

Vertical Exaggeration: 2x

Notes:
1. Data concerning the various strata have been interpreted at boring locations only. The stratigraphy between borings may vary from that shown.
2. Refer to plan view for subsurface profile location. For strata details and symbol legend, see Subsurface Profile Legend and boring logs appended to this report.
3. Numbers displayed beside boring(s) represent SPT "N" values corresponding to their respective sampling interval. Where coring was performed, numbers represent Recovery and RQD values.

SUBSURFACE PROFILE A-A'

RETAINING WALL XXX
at Aetna Parking Garage

Date: 10/19/10	Drawn By: MGB	Reviewed By: ULF	File No.: 0331-014.03	Figure No.: 3

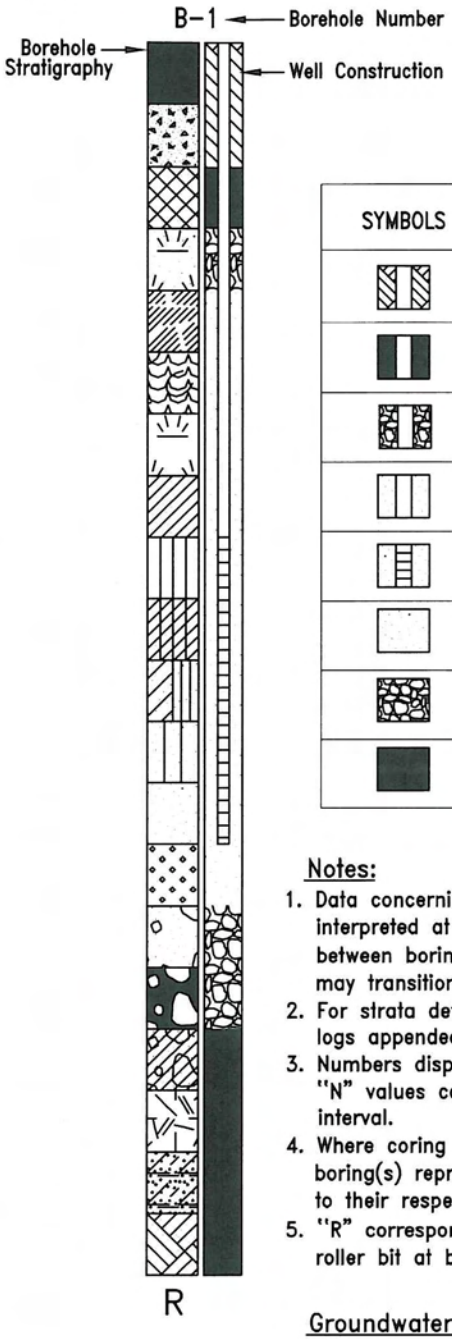
GEO STANDARD 11 X 17 (2/19/04) COPY OF BORING LOGS 9-23-2010 COMBINED FOR PROFILE.GPJ FBNWNL01.GDT 10/19/10

M:\CL\331\14CADD\331-14 SUBSURFACE PROFILE LEGEND.dwg

STRATIGRAPHY SYMBOLS

SYMBOLS	TYPICAL DESCRIPTIONS OF PREDOMINENT MATERIAL TYPE
	ASPHALT
	CONCRETE
	FILL
	TOPSOIL
	SUBSOIL
	ORGANIC SILT OR CLAY WITH SHELLS
	PEAT
	CLAY
	SILT
	CLAY/SILT MIXTURE
	CLAY/SILT/SAND MIXTURE
	SILT/SAND MIXTURE
	SAND/SILT MIXTURE
	POORLY-GRADED SAND
	WELL-GRADED SAND
	SAND/GRAVEL MIXTURE
	SAND/GRAVEL/SILT MIXTURE
	BOULDERS AND/OR COBBLES
	GLACIAL TILL
	DECOMPOSED BEDROCK
	SANDSTONE
	BEDROCK

EXPLANATION OF BORING



WELL SYMBOLS

SYMBOLS	TYPICAL DESCRIPTIONS
	CEMENT SEAL: 1 PIPE
	BENTONITE SEAL: 1 PIPE
	SLOUGH BACKFILL: 1 PIPE
	FILTER PACK: 1 PIPE
	SLOTTED PIPE WITH FILTER PACK: 1 PIPE
	FILTER PACK AT BOTTOM OF HOLE
	SLOUGH AT BOTTOM OF HOLE
	BENTONITE AT BOTTOM OF HOLE

Notes:

1. Data concerning the various strata have been interpreted at boring locations only. The stratigraphy between borings may vary from that shown, and may transition more gradually within borings.
2. For strata details, see Report and boring logs appended to this report.
3. Numbers displayed beside boring(s) represent SPT "N" values corresponding to their respective sampling interval.
4. Where coring was performed, numbers displayed beside boring(s) represent Recovery and RQD values corresponding to their respective sampling interval.
5. "R" corresponds to refusal of sampler, casing and/or roller bit at bottom of boring.

Groundwater Observations (where applicable)

▽ Water Level Reading at time of drilling.

▼ Water Level Reading after completing drilling.

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NEW BRITAIN – HARTFORD BUSWAY
STATE PROJECT NO. 63-H137
FILE NO. 331-14
SUBSURFACE PROFILE LEGEND

DRAWN BY:	CHECKED BY:	DATE:	FIGURE NO.
SMC	JWK	2-17-09	4

Appendix 2
2010 Boring Logs
RW-1 and RW-2

Connecticut DOT Boring Report

Inspector: Jesse McIntyre	Town: New Britain	Hole No.: RW-1	
Engineer: GeoDesign, Inc.	Project No.: 63-H137 / 0331-014.03	Stat./Offset:	
Start Date: 9-21-10	Route No.:	Northing: 839503.76	
Finish Date: 9-21-10	Bridge No.:	Easting: 1015619.85	
		Surface Elevation: 49.6	

Project Description: Busway North Extra Work - 0331-014.03

Casing Size/Type: 4-in	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @None Observed

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0	S-1	15 21 20 20	24	12		Topsoil Fill	Dense, dark brown Top 6": TOPSOIL Bottom 6": fine to coarse SAND, some fine Gravel, trace Silt, trace Roots, Wood, Concrete	
	S-2	7 5 5 4	24	15			Medium dense, dark brown Top 8": fine to coarse SAND, some fine Gravel, trace Silt, Roots, trace Brick Bottom 7": fine to coarse Sand and Silty CLAY, trace fine Gravel, trace Concrete	
5	S-3	4 5 5 6	24	13			Medium dense, Top 4": dark brown fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Roots, Brick Bottom 9": gray brown fine to coarse SAND, some fine to coarse Gravel, trace Silt	45
	S-4	4 3 3 4	24	22		Clay & Silt (varved)	Loose, dark brown Top 4": fine to coarse SAND, some fine to coarse Gravel, little Silt Bottom 18": CLAY and SILT, little fine to medium Sand	
10	S-5	7 7 8 7	24	3			Stiff, brown Silty CLAY	40
15	S-6	2 2 3 3	24	24			Soft, Top 3": gray Silty CLAY Bottom 21": brown CLAY	35
20								30

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 32ft Rock: 0ft	NOTES: HSA to 10 feet, then used drive and wash methods thereafter. Groundwater levels not recorded due to use of drilling fluid	Sheet 1 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Connecticut DOT Boring Report

Inspector: Jesse McIntyre	Town: New Britain	Hole No.: RW-1	
Engineer: GeoDesign, Inc.	Project No.: 63-H137 / 0331-014.03	Stat./Offset:	
Start Date: 9-21-10	Route No.:	Northing: 839503.76	
Finish Date: 9-21-10	Bridge No.:	Easting: 1015619.85	
		Surface Elevation: 49.6	

Project Description: Busway North Extra Work - 0331-014.03

Casing Size/Type: 4-in	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @None Observed

Depth (ft)	SAMPLES: Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
20	S-7	3 6 19 18	24	18		Till	Medium dense, red brown fine to coarse SAND, some Silt, little fine to coarse Gravel	
25	S-8	16 27 38 50	24	18			Very dense, red brown fine to coarse SAND, some Silt, little fine to coarse Gravel	25
30	S-9	18 27 32 44	24	18			Very dense, red brown fine to coarse SAND, some Silt, little fine to coarse Gravel	20
							END OF BORING 32ft	
35								15
40								10

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 32ft Rock: 0ft	NOTES: HSA to 10 feet, then used drive and wash methods thereafter. Groundwater levels not recorded due to use of drilling fluid	Sheet 2 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Connecticut DOT Boring Report

Inspector: Jesse McIntyre	Town: New Britain	Hole No.: RW-2	
Engineer: GeoDesign, Inc.	Project No.: 63-H137 / 0331-014.03	Stat./Offset:	
Start Date: 9-21-10	Route No.:	Northing: 839537.1	
Finish Date: 9-21-10	Bridge No.:	Easting: 1015713.97	
		Surface Elevation: 49.4	

Project Description: Busway North Extra Work - 0331-014.03

Casing Size/Type: 4-in	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @None Observed

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0	S-1	14 17 26 18	24	10		Topsoil Fill	Dense, dark brown Top 2": TOPSOIL Bottom 8": fine to coarse SAND, some Silt, some fine to coarse Gravel, trace Roots, Concrete	
	S-2	4 3 4 5	24	8			Loose, brown Clayey SILT, some fine to coarse Gravel	45
5	S-3	9 9 12 13	24	5		Clay & Silt (varved)	Very stiff, red brown Clayey SILT, some fine to coarse Gravel	
	S-4	19 15 18 12	24	20			Very stiff, red brown CLAY and SILT varved with Silty CLAY (1/8" laminations)	40
10	S-5	3 4 5 6	24	20			Stiff, red brown CLAY and SILT, some fine to coarse Gravel	35
15	S-6	1 1 2 3	24	24			Soft, red brown Silty CLAY, some fine to coarse Gravel, some fine to coarse Sand	30
20								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 32ft Rock: 0ft	NOTES: HSA to 10 feet, then used drive and wash methods thereafter. Groundwater levels not recorded due to use of drilling fluid	Sheet 1 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Connecticut DOT Boring Report

Inspector:	Jesse McIntyre	Town:	New Britain	Hole No.:	RW-2
Engineer:	GeoDesign, Inc.	Project No.:	63-H137 / 0331-014.03	Stat./Offset:	
Start Date:	9-21-10	Route No.:		Northing:	839537.1
Finish Date:	9-21-10	Bridge No.:		Easting:	1015713.97
				Surface Elevation:	49.4

Project Description: Busway North Extra Work - 0331-014.03

Casing Size/Type: 4-in	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: 300 lb. Fall: 24in.	Hammer Wt.: 140 lb. Fall: 30 in.	

Groundwater Observations: @None Observed

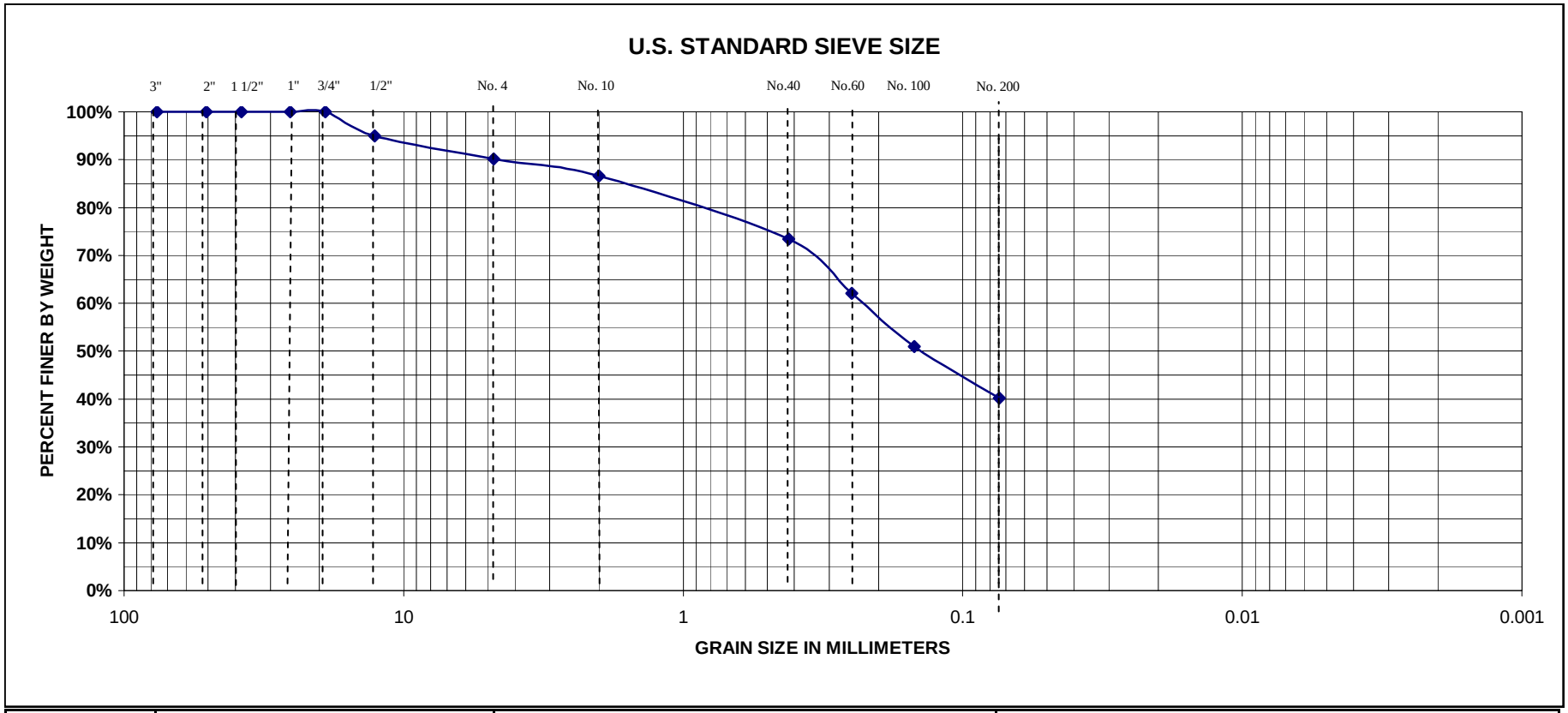
Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
20	S-7	10 14 10 12	24	0		Clay & Silt (varved) *(con't)*	Very stiff, no recovery	
						Till		25
25	S-8	25 26 43 50	24	24			Very dense, red brown fine to coarse SAND, some Silt, little fine to coarse Gravel	
								20
30	S-9	15 35 40 50	24	7			Very dense, red brown fine to coarse SAND, some Silt, little fine to coarse Gravel	
							END OF BORING 32ft	15
35								
								10
40								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 32ft Rock: 0ft	NOTES: HSA to 10 feet, then used drive and wash methods thereafter. Groundwater levels not recorded due to use of drilling fluid	Sheet 2 of 2
No. of Soil Samples: 9 No. of Core Runs: 0		SM-001-M REV. 1/02

Appendix 3
2010 Sieve Analyses



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

GRADATION TEST

RW-XXX @ Aetna

BORING NO.	RW-1
SAMPLE NO.	S-2
DEPTH	2 to 4
TECH.	JPM/CGE
REVIEWER	MGB
DATE	10/20/10
FILE NO.	0331-014.0

BURMISTER SOIL CLASSIFICATION SYSTEM

TEST NO.	MATERIAL SOURCE	DESCRIPTION
1 of 2	FILL	Fine to coarse SAND and Fines, trace fine Gravel

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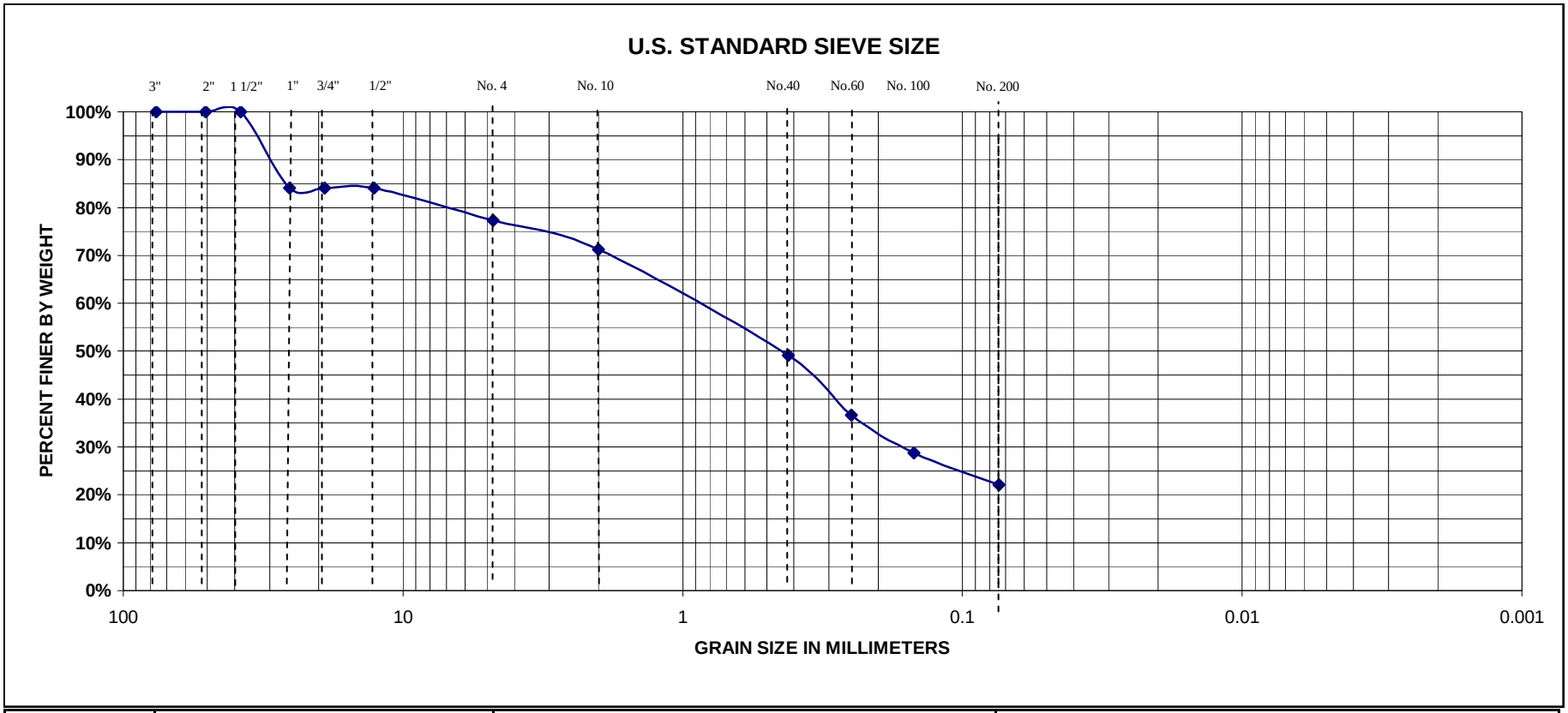
Phone: 203.758.8836 • Fax: 203.758.8842 • www.geodesign.net



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

GRADATION TEST

RW-XXX @ Aetna

BORING NO.	RW-2
SAMPLE NO.	S-1
DEPTH	0-2
TECH.	JPM/CGE
REVIEWER	MGB
DATE	10/20/10
FILE NO.	0331-014.0

BURMISTER SOIL CLASSIFICATION SYSTEM

TEST NO.	MATERIAL SOURCE	DESCRIPTION
2 of 2	FILL	Fine to coarse SAND, some Fines, some fine to coarse Gravel

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Phone: 203.758.8836 • Fax: 203.758.8842 • www.geodesign.net

Appendix 4
Existing Boring Logs

Connecticut DOT Boring Report

Inspector: Ray Underwood	Town: Hartford	Hole No.: RW-102-6	
Engineer: Geo**Design**, Inc.	Project No.: 63-H137 / 0331-014.0	Stat./Offset:	
Start Date: 10-14-08	Route No.:	Northing: 839426.2	
Finish Date: 10-14-08	Bridge No.:	Easting: 1015499.5	
		Surface Elevation: 51.2	

Project Description: New Britain / Hartford Busway - Retaining Wall 2

Casing Size/Type: 3"/NW	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: Fall:	Hammer Wt.: 140 lbs. Fall: 30"	

Groundwater Observations: @None observed

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						6" Crushed Stone		
	S-1	4 8 12 11	24	15		Fill	Medium dense, tan to red brown fine to medium SAND, little fine Gravel, trace Silt (moist)	50
	S-2	8 6 5 8	24	14		Varved Clay	Top 5": Medium dense, tan fine to medium SAND, little fine Gravel, trace Silt Bottom 9": Stiff, red to tan varved CLAY (1/8" partings) and SILT (2 1/2" partings)	
5	S-3	4 6 8 9	24	6			Stiff, red to tan varved CLAY (1/8" partings) and SILT (2 1/2" partings)	45
10	S-4	2 2 3 4	24	24			Medium, red brown to tan (varved 1/8" to 1/4" partings) CLAY and SILT	40
	UP-1		24	24				
15	S-5	2 1 1 2	24	24			Soft, red brown to tan (varved 1/4" to 2" partings) tan CLAY and SILT	35
	S-6	2 1 2 2	24	24			Soft, red brown to tan (varved 1/4" to 2" partings) CLAY and SILT	
							END OF BORING 18ft	
20								30
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 18ft Rock: 0ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 6 No. of Core Runs: 0		SM-001-M REV. 1/02

Connecticut DOT Boring Report

Inspector:	Garry Jacobson	Town:	Hartford	Hole No.:	RW-102-7
Engineer:	Geo**Design**, Inc.	Project No.:	63-H137 / 0331-014.0	Stat./Offset:	
Start Date:	9-29-08	Route No.:		Northing:	839467.9
Finish Date:	9-29-08	Bridge No.:		Easting:	1015593.0
				Surface Elevation:	50.1

Project Description: New Britain / Hartford Busway - Retaining Wall 2

Casing Size/Type: 4"/HW	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: Fall:	Hammer Wt.: 140 lbs. Fall: 30"	

Groundwater Observations: @3' after 0 hours

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0	S-1	7 6 6 7	24	12		Crushed Stone	Top 6": Medium dense, gray fine to coarse GRAVEL	50
						Fill	Bottom 6": Medium dense, brown fine to coarse SAND, little Silt (moist)	
	S-2	5 4 4 3	24	18		Varved Clay	Top 10": Loose, gray fine to medium SAND and SILT(wet)	
							Bottom 8": Medium, gray to brown varved Silty CLAY and Clayey SILT	
5								45
	S-3	2 2 2 2	24	19			Medium, tan varved Silty CLAY and SILT	
10								40
	S-4	2 2 3 4	24	22			Medium, gray varved Silty CLAY and SILT, trace(-) fine Sand	
15								35
	S-5	5 7 7 9	24	24			Stiff, tan to red brown varved SILT and Silty CLAY	
							END OF BORING 17ft	
20								30
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 17ft Rock: 0ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 5 No. of Core Runs: 0		SM-001-M REV. 1/02

Connecticut DOT Boring Report

Inspector: Garry Jacobson	Town: Hartford	Hole No.: R-11	
Engineer: Geo**Design**, Inc.	Project No.: 63-H137 / 0331-014.0	Stat./Offset:	
Start Date: 9-29-08	Route No.:	Northing: 839449.1	
Finish Date: 9-29-08	Bridge No.:	Easting: 1015553.8	
		Surface Elevation: 50.9	

Project Description: New Britain / Hartford Busway - Roadway

Casing Size/Type: 3 1/4" HSA	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: Fall:	Hammer Wt.: 140 lbs. Fall: 30"	

Groundwater Observations: @None observed

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0	S-1	10 12 18 15	24	0		Fill	Medium dense, black to brown fine to coarse SAND, little Silt, little fine to coarse Gravel, (based on auger cuttings)	50
	S-2	15 10 8 11	24	0				
5	S-3	9 14 17 20	24	16		Varved Clay	Very stiff, brown to red, (varved 1-15") Silty CLAY	45
	S-4	12 17 18 16	24	14			Very stiff, brown to red, (varved 1-15") Silty CLAY	
	S-5	6 10 13 17	24	24			Very stiff, brown to red, (varved 1-15") Silty CLAY	
10	S-6	2 7 9 12	24	20			Very stiff, brown to red, (varved 1-2" thick) Silty CLAY	40
15	S-7	2 3 3 4	24	24			Medium, (varved 1.5-2" thick) Silty CLAY	35
							END OF BORING 17ft	
20								30
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 17ft Rock: 0ft	NOTES:	Sheet 1 of 1
No. of Soil Samples: 7 No. of Core Runs: 0		SM-001-M REV. 1/02

Connecticut DOT Boring Report

Inspector: Garry Jacobson	Town: Hartford	Hole No.: R-12	
Engineer: Geo**Design**, Inc.	Project No.: 63-H137 / 0331-014.0	Stat./Offset:	
Start Date: 9-29-08	Route No.:	Northing: 839551.4	
Finish Date: 9-29-08	Bridge No.:	Easting: 1015822.2	
		Surface Elevation: 50.8	

Project Description: New Britain / Hartford Busway - Roadway

Casing Size/Type: 3 1/4" HSA	Sampler Type/Size: SS / 1 3/8"	Core Barrel Type:
Hammer Wt.: Fall:	Hammer Wt.: 140 lbs. Fall: 30"	

Groundwater Observations: @None observed

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						Fill		
	S-1	3 12 12 14	24	12			Medium dense, brown Clayey SILT, little fine to coarse Sand, little fine Gravel	50
	S-2	14 14 14 10	24	14			Medium dense, brown fine to coarse SAND, little Silt	
5								
	S-3	3 5 6 7	24	8		Varved Clay	Top 3": Medium dense, brown fine to coarse SAND, little Silt Bottom 5": Stiff, tan to red brown Silty CLAY	45
	S-4	6 7 7 14	24	18			Stiff, varved red brown to tan Silty CLAY, (wet)	
10								
	S-5	3 4 8 10	24	16			Stiff, brown and dark brown Clayey SILT and Silty CLAY, trace Roots, trace wood fragments	40
15								
	S-6	6 14 28 34	24	18			Top 2": Dense, brown and dark brown Clayey SILT and Silty CLAY, trace Roots, trace wood fragments Middle 10": Dense, red to brown Clayey SILT Bottom 6": Dense, red brown Clayey SILT, some fine to coarse Sand	35
							END OF BORING 17ft	
20								30
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 17ft Rock: 0ft	NOTES: Drilled on paint mark.	Sheet 1 of 1
No. of Soil Samples: 6 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller: Jeff Leavitt/NEBC	**Connecticut DOT Boring Report**	Hole No.: **SB-90**
Inspector: Rachael Marks	Town: West Hartford / Hartford, CT	Stat./Offset:
Engineer: Baker Engineering	Project No.: 171-0305	Northing: 839422.3
Start Date: 8-08-03	Route No.:	Easting: 1015394.4
Finish Date: 8-10-03	Bridge No.:	Surface Elevation: 57.4
Project Description: New Britain to Hartford Busway		
Casing Type/Size: HW 4" ID	Sampler Type/Size: SS/ 1-3/8 " ID	Core Barrel Type: NQ/1 7/8" ID
Hammer Wt.: 300 Fall: 24	Hammer Wt.: 140 Fall: 30	

Groundwater Obs. @ 7.0 after: 0 hours, @7.2 after: 24 hours, @ after: hours

Baker Info: S.O. Number: B25624LPDSOIL41802/42002 File: northern Template: CDOT E (LD4 1/03)

Depth (ft.)	Sample Type/No.	Blows on Sampler per 0.5 ft.	Pen. (ft.)	Rec. (ft./%)	RQD (ft./%)	Generalized Strata Description	Material Description and Notes	Elevation (ft.)
20	S-7	4 3	1.5	1.5			SILTY CLAY (ML/CL) - reddish brown to gray clay and silt, trace very fine sand; moist, medium stiff, @ PL (GLACIAL LAKE DEPOSIT).	37
21	W-N		1.5					36
22								35
23	S-8	4 6 7	1.5	1.3			SILTY CLAY (ML/CL) - reddish brown to gray clay and silt, trace very fine sand; moist, medium stiff, @ PL (GLACIAL LAKE DEPOSIT).	34
24	W-N		1.5					33
25						25.5'	ELEV. 31.9	32
26	S-9	1 1 1	1.5	1.3			CLAY WITH SILT (CL) - reddish brown to gray clay, some silt; moist, soft, +PL; (GLACIAL LAKE DEPOSIT).	31
27	W-N		1.5					30
28								29
29	S-10	1 1 WOH	1.5	1.5			CLAY WITH SILT (CL) - reddish brown to gray clay, some silt; moist, soft, +PL; (GLACIAL LAKE DEPOSIT).	28
30								27
31								26
32	W-N		5.0					25
33								24
34								23
35	S-11	1 WOH WOH	1.5	1.5			CLAY WITH SILT (CL) - reddish brown to gray clay, some silt; moist, very soft, +PL; (GLACIAL LAKE DEPOSIT).	22
36								21
37								20
38	W-N		3.5					19
39								18

Sample Type: S=Split Spoon C=Core UP=Undisturbed Piston V=Vane Shear Test A=Auger
Proportions Used: Trace = 1 - 10%, Little = 10 -20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 85.0' Rock: 10.0' No. of Samples: 20	NOTES:	Sheet **2** of **5** SM-001-M REV. 1/02

Driller: Jeff Leavitt/NEBC	**Connecticut DOT Boring Report**	Hole No.: **SB-90**
Inspector: Rachael Marks	Town: West Hartford / Hartford, CT	Stat./Offset:
Engineer: Baker Engineering	Project No.: 171-0305	Northing: 839422.3
Start Date: 8-08-03	Route No.:	Easting: 1015394.4
Finish Date: 8-10-03	Bridge No.:	Surface Elevation: 57.4

Project Description: New Britain to Hartford Busway

Casing Type/Size: HW 4" ID	Sampler Type/Size: SS/ 1-3/8 " ID	Core Barrel Type: NQ/1 7/8" ID
Hammer Wt.: 300 Fall: 24	Hammer Wt.: 140 Fall: 30	

Groundwater Obs. @ 7.0 after: 0 hours, @7.2 after: 24 hours, @ after: hours

Baker Info: S.O. Number: B25624LPDSOIL41802/42002 File: northern Template: CDOT_E (LD4 1/03)

Depth (ft.)	SAMPLES Sample Type/No.	Blows on Sampler per 0.5 ft.	Pen. (ft.)	Rec. (ft./%)	RQD (ft./%)	Generalized Strata Description	Material Description and Notes	Elevation (ft.)
40–41	S-12	1 1 WOH	1.5	1.5			CLAY WITH SILT (CL) - reddish brown to gray clay, some silt; moist, very soft, +PL; (GLACIAL LAKE DEPOSIT).	17–16
42–44	W-N		3.5					15–13
45–46	S-13	1 1 6	1.5	1.5		46.0'	CLAY WITH SILT (CL) - reddish brown to gray clay, some silt; moist, soft, +PL; (GLACIAL LAKE DEPOSIT). ELEV. 11.4	12–11
47–49	W-N		3.5				SILTY CLAY WITH SAND (CL-ML) - reddish brown clay, some silt, some fine to coarse sand, trace gravel; moist, medium stiff, +PL.	10–8
50–51	S-14	25 37 42	1.5	1.0			SILTY CLAY WITH SAND (CL) - reddish brown clay, some silt, some fine to coarse sand, trace gravel; moist, hard, +PL.	7–6
52–54	W-N		3.5					5–3
55–56	S-15	22 37 39	1.5	0.8		55.0'	ELEV. 2.4 SILT WITH SAND AND GRAVEL (ML) - reddish brown silt, some fine to coarse sand, some fine to medium gravel; moist, very dense, NP; (TILL).	2–1
57–59	W-N		3.5					0–-2

Sample Type: S=Split Spoon C=Core UP=Undisturbed Piston V=Vane Shear Test A=Auger
Proportions Used: Trace = 1 - 10%, Little = 10 -20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 85.0' Rock: 10.0' No. of Samples: 20	NOTES:	Sheet **3** of **5** SM-001-M REV. 1/02

Driller: Jeff Leavitt/NEBC	**Connecticut DOT Boring Report**	Hole No.: **SB-90**
Inspector: Rachael Marks	Town: West Hartford / Hartford, CT	Stat./Offset:
Engineer: Baker Engineering	Project No.: 171-0305	Northing: 839422.3
Start Date: 8-08-03	Route No.:	Easting: 1015394.4
Finish Date: 8-10-03	Bridge No.:	Surface Elevation: 57.4

Project Description: New Britain to Hartford Busway

Casing Type/Size: HW 4" ID	Sampler Type/Size: SS/ 1-3/8 " ID	Core Barrel Type: NQ/1 7/8" ID
Hammer Wt.: 300 Fall: 24	Hammer Wt.: 140 Fall: 30	

Groundwater Obs. @ 7.0 after: 0 hours, @7.2 after: 24 hours, @ after: hours

Baker Info: S.O. Number: B25624LPDSOIL41802/42002 File: northern Template: CDOT E (LD4 1/03)

Depth (ft.)	SAMPLES Sample Type/No.	Blows on Sampler per 0.5 ft.	Pen. (ft.)	Rec. (ft./%)	RQD (ft./%)	Generalized Strata Description	Material Description and Notes	Elevation (ft.)
60	S-16	100/0.1	0.1	0.1		60.0'	ELEV. -2.6 8" COBBLE AND SOME BOULDERS.	-3
61								-4
62	W-N		4.9					-5
63								-6
64								-7
65	S-17	100/0.1	0.1	0			COBBLES AND BOULDERS.	-8
66								-9
67	W-N		4.9					-10
68								-11
69								-12
70	S-18	100/0.2	0.2	0.2			COBBLES AND BOULDERS.	-13
71								-14
72	W-N		4.8					-15
73								-16
74								-17
75	S-19	100/0.2	0.2	0.2			COBBLES AND BOULDERS.	-18
76								-19
77	W-N		4.8					-20
78								-21
79								-22

Sample Type: S=Split Spoon C=Core UP=Undisturbed Piston V=Vane Shear Test A=Auger
Proportions Used: Trace = 1 - 10%, Little = 10 -20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 85.0' Rock: 10.0' No. of Samples: 20	NOTES:	Sheet **4** of **5** SM-001-M REV. 1/02

Driller: Jeff Leavitt/NEBC	**Connecticut DOT Boring Report**	Hole No.: **SB-90**
Inspector: Rachael Marks	Town: West Hartford / Hartford, CT	Stat./Offset:
Engineer: Baker Engineering	Project No.: 171-0305	Northing: 839422.3
Start Date: 8-08-03	Route No.:	Easting: 1015394.4
Finish Date: 8-10-03	Bridge No.:	Surface Elevation: 57.4
Project Description: New Britain to Hartford Busway		
Casing Type/Size: HW 4" ID	Sampler Type/Size: SS/ 1-3/8 " ID	Core Barrel Type: NQ/1 7/8" ID
Hammer Wt.: 300 Fall: 24	Hammer Wt.: 140 Fall: 30	
Groundwater Obs. @ 7.0 after: 0 hours, @7.2 after: 24 hours, @ after: hours		

Baker Info: S.O. Number: B25624LPDSOIL41802/42002 File: northern Template: CDOT E (LD4 1/03)

Depth (ft.)	Sample Type/No.	Blows on Sampler per 0.5 ft.	Pen. (ft.)	Rec. (ft./%)	RQD (ft./%)	Generalized Strata Description	Material Description and Notes	Elevation (ft.)
80	S-20	100/0.0	0.0	0			COBBLES AND BOULDERS.	-23
81								-24
82	W-N		5.0					-25
83								-26
84								-27
85						85.0'	ELEV. -27.6	-28
86				5.0	1.2		SILTSTONE; reddish brown, soft, moderately weathered, high horizontal fractures, moderate vertical fractures, calcite inclusions present.	-29
87	C-1		5.0					-30
88								-31
89				100%	24%			-32
90				5.0	2.35		SILTSTONE; reddish brown, soft, moderately weathered, high horizontal fractures, moderate vertical fractures, calcite inclusions present.	-33
91								-34
92	C-2		5.0					-35
93								-36
94								-37
95				100%	47%		ELEV. -37.6	-38
96							END OF BORING AT 95.0 FEET.	-39
97								-40
98								-41
99								-42

Sample Type: S=Split Spoon C=Core UP=Undisturbed Piston V=Vane Shear Test A=Auger
Proportions Used: Trace = 1 - 10%, Little = 10 -20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 85.0' Rock: 10.0' No. of Samples: 20	NOTES:	Sheet **5** of **5** SM-001-M REV. 1/02

Driller: Mike St. John/NEBC	**Connecticut DOT Boring Report**	Hole No.: **RB-42**
Inspector: Rachael Marks	Town: West Hartford / Hartford, CT	Stat./Offset:
Engineer: Baker Engineering	Project No.: 171-0305	Northing: 839512.1
Start Date: 7/28/03	Route No.:	Easting: 1015689.3
Finish Date: 7/28/03	Bridge No.:	Surface Elevation: 51.1
Project Description: New Britain to Hartford Busway		
Casing Type/Size: HW/4"	Sampler Type/Size: SS/1-3/8"	Core Barrel Type:
Hammer Wt.: 300 Fall: 24"	Hammer Wt.: 140 Fall: 30"	

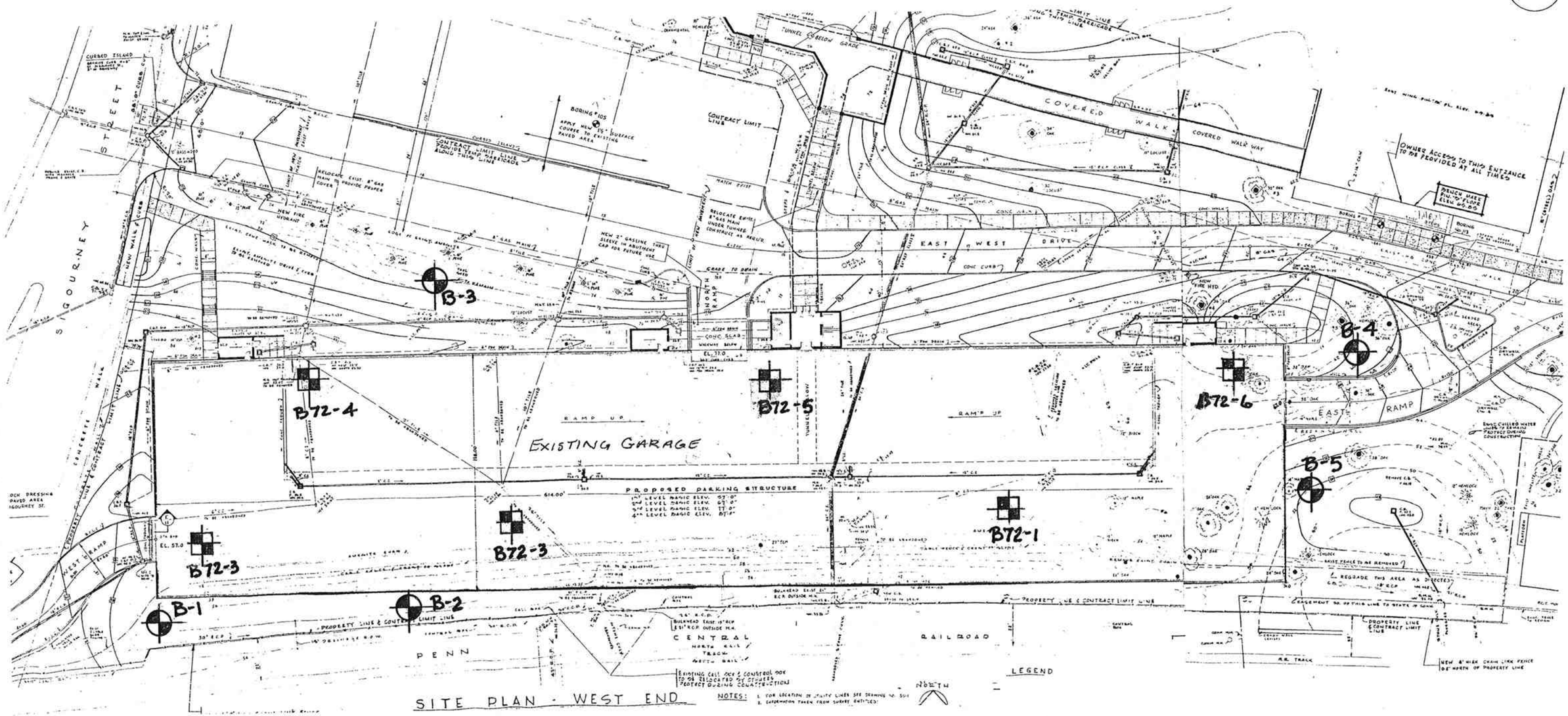
Groundwater Obs. @ 10.0 after: 0 hours, @7.8 after: 48 hours, @ after: hours

Baker Info: S.O. Number: B25624LPDSOIL41802/42002 File: northern Template: CDOT_E (LD4 1/03)

Depth (ft.)	Sample Type/No.	Blows on Sampler per 0.5 ft.	Pen. (ft.)	Rec. (ft./%)	RQD (ft./%)	Generalized Strata Description	Material Description and Notes	Elevation (ft.)
0								51
1	A-N		1.5					50
2	S-1	21 60	1.0	0.0			NO RECOVERY ON S-1	49
3	A-N		2.0					48
4								47
5	S-2	4 4 2	1.5	1.3			WELL GRADED SAND WITH SILT (SW-SM) - gray fine to coarse sand, some silt, little fine gravel; dry, loose, NP; (FILL).	46
6								45
7	A-N		1.5					44
8	S-3	3 3 3	1.5	1.5			WELL GRADED SAND WITH SILT (SW-SM) - gray to brown fine to coarse sand, some silt, little fine gravel; dry, loose, NP; (FILL).	43
9								42
10	A-N		1.5					41
						10.5'	ELEV. 40.6	
11	S-4	5 7 10	1.5	0.5			SANDY CLAY (CL) - gray to brown clay, some fine to medium sand; moist, very stiff, -PL.	40
12								39
13	W-N		1.5					38
						13.5'	ELEV. 37.6	
14	S-5	3 4 6	1.5	1.5			SILTY CLAY (CL-ML) - brown to gray silt, some clay; moist, stiff, +PL; (GLACIAL LAKE DEPOSIT).	37
15								36
16	W-N		1.5					35
						16.5'	ELEV. 34.6	
17	S-6	3 3 5	1.5	1.5			LEAN CLAY (CL) - reddish brown clay, trace very fine sand; moist, stiff, +PL; (GLACIAL LAKE DEPOSIT).	34
18								33
19	W-N		1.5					32
		6					LEAN CLAY (CL) - reddish brown clay, trace very fine	

Sample Type: S=Split Spoon C=Core UP=Undisturbed Piston V=Vane Shear Test A=Auger
Proportions Used: Trace = 1 - 10%, Little = 10 -20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 30.0' Rock: 0.0' No. of Samples: 10	NOTES:	Sheet **1** of **2** SM-001-M REV. 1/02



PROPOSED PARKING STRUCTURE
AETNA CORPORATE HEADQUARTERS
SIGOURNET STREET, HARTFORD, CT

BORING LOCATION PLAN

REVISED: NONE	SCALE: NOT TO SCALE	DATE: JUNE, 2007
DR. CLARENCE WELTI, P.E., P.C. 227 WILLIAMS STREET, P.O. BOX 397 GLASTONBURY, CONNECTICUT 06033		SHEET 1

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT: DESMAN ASSOCIATES

PROJECT NAME: AETNA PARKING GARAGE

LOCATION: HARTFORD, CT.

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA		SS	
SIZE I.D.	3.75"		1.375"	
HAMMER WT.			140 lbs	
HAMMER FALL			30"	

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV
HOLE NO. B-1

GROUND WATER OBSERVATIONS
AT 4.0 FT AFTER 0 HOURS
AT FT AFTER HOURS

START DATE 6/22/07
FINISH DATE 6/22/07

DEPTH	SAMPLE NO.	BLOWS/6"	DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0	1	2-3-4-3	0.00'-2.00'		DARK BR. FINE-MED.SAND, SOME SILT, LITTLE WOOD, BRICKS & CONCRETE - FILL	
	2	3-4-3-2	2.00'-4.00'			
	3	3-3-2-2	4.00'-6.00'			
5					GREY/BR. VARVED SILT, LITTLE CLAY — 5.0	
10	4	4-5-6	10.00'-11.50'			
15	5	1-2-1	15.00'-16.50'			
20	6	1-0-1	20.00'-21.50'		RED/BR./GREY VARVED CLAY AND SILT — 20.0	
25	7	1-0-1	25.00'-26.50'			
30	8	1-0-1	30.00'-31.50'			
35						

LEGEND: COL. A:CORING TIME - MINUTES/FOOT
SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: D. BROMLEY
INSPECTOR:

SHEET 1 OF 2 HOLE NO. B-1

CLARENCE WELTI ASSOC., INC. P.O. BOX 397 GLASTONBURY, CONN 06033	CLIENT DESMAN ASSOCIATES	PROJECT NAME AETNA PARKING GARAGE LOCATION HARTFORD, CT.

DEPTH	SAMPLE NO.	BLOWS/6"	DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
	9	1-0-1	35.00'-36.50'			
					RED/BR.FINE-MED. SAND AND SILT, SOME GRAVEL, TRACE CLAY	39.0
40	10	26-28-37	40.00'-41.50'			
45	11	21-27-35	45.00'-46.50'			
50	12	38-47-60	50.00'-51.50'			
55	13	20-32-41	55.00'-56.50'			
60	14	27-31-48	60.00'-61.50'			
					BOTTOM OF BORING @ 61.5'	61.5
					2" WELL POINT @ 50.0'	
					10.0' OF SCREEN (.010 SLOT)	
65					40.0' OF RISER	
					0' STICKUP	
					SAND FROM 60.0' TO 35.0'	
					BACKFILLED FROM 35.0' TO 0.5'	
70					CONCRETE FROM 0.5' TO 0'	
					7" DIA. ROADBOX COVER	
75						

LEGEND: COL. A:CORING TIME - MINUTES/FOOT

SAMPLE TYPE: D DRY A AUGER C CORE U=UNDISTURBED PISTON S=SPLIT SPOON

PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: D. BROMLEY

INSPECTOR:

SHEET 2 OF 2 | HOLE NO. **B-1**

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT: DESMAN ASSOCIATES

PROJECT NAME: AETNA PARKING GARAGE

LOCATION: HARTFORD, CT.

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA		SS	NQ
SIZE I.D.	3.75"		1.375"	2.0"
HAMMER WT.			140 lbs	
HAMMER FALL			30"	

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV
HOLE NO. B-2

GROUND WATER OBSERVATIONS
AT FT AFTER HOURS
AT FT AFTER HOURS

START DATE 6/21/07
FINISH DATE 6/21/07

DEPTH	SAMPLE NO.	BLOWS/6"	DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0	1	6-16-14-21	0.00'-2.00'		DARK BR. FINE-MED. SAND, SOME SILT, TRACE BRICKS & GRAVEL - FILL	
					2.0	
	2	4-2-2-2	2.00'-4.00'		GREY/BLACK SILT, TRACE ORGANICS & FINE SAND	
	3	2-2-2-2	4.00'-6.00'			
5					5.0	
					RED/GREY VARVED SILT, LITTLE CLAY	
10					10.0	
	4	3-2-2	10.00'-11.50'		RED/BR./GREY VARVED CLAY AND SILT	
15	5	3-2-3	15.00'-16.50'			
20	6	1-0-0	20.00'-21.50'			
25					25.0	
	7	28-41-48	25.00'-26.50'		RED/BR.FINE-MED. SAND AND SILT, SOME GRAVEL, FEW COBBLES	
30	8	17-24-26	30.00'-31.50'			
35						

LEGEND: COL. A:CORING TIME - MINUTES/FOOT
SAMPLE TYPE: D-DRY A-AUGER C-CORE U-UNDISTURBED PISTON S-SPLIT SPOON
PROPORTIONS USED: TRACE 0-10% LITTLE 10-20% SOME 20-35% AND 35-50%

DRILLER: D. BROMLEY
INSPECTOR:

SHEET 1 OF 2 HOLE NO. B-2

CLARENCE WELTI ASSOC., INC. P.O. BOX 397 GLASTONBURY, CONN 06033	CLIENT DESMAN ASSOCIATES	PROJECT NAME AETNA PARKING GARAGE LOCATION HARTFORD, CT.

DEPTH	SAMPLE NO.	BLOWS/6"	DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
	9	19-21-27	35.00'-36.50'			
40	10	18-24-27	40.00'-41.50'			
45	11	19-26-25	45.00'-46.50'			
50	12	51-36-27	50.00'-51.50'			
55	13	21-28-39	55.00'-56.50'			
60	14	14-30-34	60.00'-61.50'			
65	C1		65.00'-70.00'		CORED BEDROCK - RED SHALE RUN #1 65.0' - 70.0' RECOVERED 60" RQD=20%	65.0
70						70.0
75						

LEGEND; COL. A:CORING TIME - MINUTES/FOOT

SAMPLE TYPE: D DRY A-AUGER C CORE U-UNDISTURBED PISTON S-SPLIT SPOON

PROPORTIONS USED: TRACE 0-10% LITTLE 10-20% SOME 20-35% AND=35-50%

DRILLER: D. BROMLEY

INSPECTOR:

SHEET 2 OF 2

HOLE NO. B-2

Appendix 5
Limitations

GEOTECHNICAL LIMITATIONS

Explorations

1. The analyses and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until further explorations are made and construction occurs. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

2. The generalized soil and bedrock profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil and bedrock transitions are probably more erratic. For specific information, refer to the boring logs.

3. The geologic and geomorphologic settings at this site are complex and the uncertain historic site usage has resulted in the varied distribution and stress history of compressible soils across the site. Limited spacing of borings and lab testing can at best, only allow for estimates to be developed for duration and magnitude of consolidation settlements.

4. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in river levels, rainfall, temperature, and other factors occurring since the time measurements were made.

Review

5. In the event that any changes in the nature, design or location, of the proposed retaining wall the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by Geo**Design**, Inc. It is recommended that this firm be provided the opportunity for a general review of design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Use of Report

6. This report has been prepared for the exclusive use H.W. Lochner, Inc., the Connecticut Department of Transportation (ConnDOT), and other members of the design team for specific application to the construction of the Retaining Wall east of the Aetna Parking Garage in Hartford, Connecticut, in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

7. This final design soil and foundation engineering report has been prepared for this project by Geo**Design**. This report is for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.