GEOTECHNICAL ENGINEERING REPORT
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
BRIDGE NO. 06590, EASTBOUND E23 ON RAMP
STATE PROJECT 151-273
WATERBURY, CONNECTICUT

by

Haley & Aldrich, Inc.
East Hartford, Connecticut

for

Berger, Lehman Associates, P.C.
Wethersfield, Connecticut

File No. 91313-100
Revised May 2003

Haley & Aldrich, Inc.
100 Corporate Place
Suite 105
Rocky Hill, CT 06067-1803

Tel: 860.282.9400
Fax: 860.721.0612
HaleyAldrich.com

HALEY & ALDRICH

Revised 8 May 2003
19 July 2001
File 91313-100

Berger, Lehman Associates, P.C.
20-30 Beaver Road
Wethersfield, Connecticut 06109

Attention: Thomas J. Bulzak, P.E.

Subject: U.S. Interstate Route 84 Reconstruction
Bridge No. 06590, Eastbound E23 On Ramp
State Project 151-273
Waterbury, Connecticut

Ladies and Gentlemen:

This report presents our evaluation of subsurface conditions and geotechnical engineering recommendations for Bridge No. 06590, Eastbound E23 On Ramp, for the I-84 reconstruction project. This work was conducted in accordance with our agreement dated 26 December 2000.

In summary, subsurface conditions consist of fill, glaciofluvial deposits and glacial till over bedrock. Bridge No. 06590 is a two span bridge supported by two abutments and a center pier. We recommend the structure be supported on spread footings bearing on undisturbed glacial till, bedrock, or granular fill placed above these materials. Our detailed recommendations follow.

PROPOSED CONSTRUCTION

Bridge No. 06590 (formerly referred to as Structure 2) will be the new Exit 23 eastbound on ramp from Hamilton Avenue to I-84. It will be located along the north side of the existing Exit 23 on ramp on the south side of I-84, east of Hamilton Avenue in Waterbury, Connecticut, see Figure 1, Project Locus. Bridge No. 06590 will pass over the proposed Exit 24 eastbound off ramp.

Bridge No. 06590 will be a continuous two span bridge with a welded steel curved plate girder superstructure. The bridge will be 59.9 m in length, from Sta. E23 31+446.6 to E23 31+506.5. Span lengths are 28.5 m and 27.9 m, and the deck width is 8.92 m. The bridge will have a center pier and abutments at each end.

There will be a U-wingwall on the east side of Abutment 1; the west side of Abutment 1 will connect to Abutment 1 of Structure 1&3, Hamilton Avenue over I-84. Abutment walls will be approximately 9 m high above the top of footing and will be skewed in relation to the

bridge centerline. Bridge grade will range from El. 122 at I-84 to El. 123 at Hamilton Avenue; Exit 24 road grade beneath Bridge No. 06590 will be about El. 113.5.

Elevations in this report are in meters and refer to NGVD 29.

SITE CONDITIONS

Trees and grassed areas are present at Abutment 1 and the pier, and the site is paved at Abutment 2.

Ground surface at Abutment 1 ranges from El. 121.5 to 122.5. At the pier location grade is between El. 119.5 and 120.5, and at Abutment 2 grade is about El. 117. Ground surface to the north of Bridge No. 06590 slopes down to I-84 at El. 114, and to the south slopes up to El. 124 at Hamilton Avenue.

There is a 300 mm dia. clay storm drain pipe that passes under Bridge No. 06590 about 3 m east of the pier location. There is also a manhole about 2 m south of the pier. A 900 mm dia. reinforced concrete pipe (RCP) storm drain extends northeast from the manhole under the proposed structure. There are underground electrical lines at the intersection of Hamilton Avenue and the existing E23 on ramp. Based on discussions with Berger Lehman, we understand all utilities in the vicinity of Bridge No. 06590 will be relocated prior to construction.

SUBSURFACE INVESTIGATIONS

Recent Explorations

Five test borings (S2-1 through S2-5), two at each abutment and one at the center pier, were drilled by General Borings, Inc. of Prospect, Connecticut. Borings S2-1 through S2-4 were drilled between 13 December and 18 December 2000 and S2-5 was drilled on 4 May 2001. The test borings were drilled with 76 mm I.D. casing to depths ranging from 11.43 to 17.98 m, including 3.0 to 6.1 m of rock coring. Bedrock was cored at each boring with a 51-mm I.D. NX core barrel. Standard Penetration Tests were conducted at maximum 1.5-m intervals in the overburden soil.

The boring locations are shown on Figure 2. A-I Engineers, Middletown, Connecticut, surveyed as-drilled locations and elevations. Haley & Aldrich monitored the explorations. Test boring logs are included in Appendix A.

Subsurface Conditions

Subsurface conditions encountered in the explorations consist of fill, glaciofluvial deposits, and glacial till, overlying bedrock. Soil strata are described below, in order of increasing

depth. Subsurface profiles at each substructure are shown in Figures 3A through 3C. Subsurface data from the test borings are summarized on Table I.

Thickness (m)	Generalized Description
3.05 to 6.25	**Fill** – Medium dense, brown, SAND, trace to some gravel, trace to some silt, with occasional cobbles and boulders. Wood is present in S2-5. Topsoil is present at ground surface in S2-1 and S2-5. Weathered petroleum odors were noted in boring S2-5.
0.95 to 2.49	**Glaciofluvial Deposits** – Very dense, brown SAND, some gravel, trace silt and light brown to orange brown, SAND, little silt, trace gravel. Glaciofluvial deposits are present in S2-2 and S2-3.
4.38 to 7.47	**Glacial Till** – Very dense, light brown, coarse to fine SAND and Gravel, trace to some silt, with numerous cobbles and boulders.

Bedrock – Bedrock is described as hard, fresh to slightly weathered, granitic GNEISS, and is part of the Waterbury Gneiss formation. Bedrock encountered in borings is between EL. 106.37 to EL. 110.95. Elevations of the top of rock are listed in Table I and shown in the subsurface profiles, Figure 3A through 3C.

Groundwater Conditions

Water was measured in S2-1 at EL. 118.7 on 15 December 2001 and in R15A at El. 115.1 on 28 March 2001. The other borings did not encounter water. Water levels were measured upon completion of drilling and may not represent stabilized groundwater.

Based on groundwater level readings from surrounding borings (R15A) and the water level measured in S2-1 we expect groundwater will be perched above the glacial till stratum. Groundwater levels will fluctuate with season, precipitation and nearby construction activity.

Laboratory Testing

Three grain size analyses (ASTM D422) were performed on representative soil samples to confirm visual classification and to aid in determining engineering properties. Laboratory testing results are included in Appendix B.

GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Foundation Type

We recommend that the abutments, pier, and wingwalls be founded on spread footing foundations bearing on undisturbed dense glacial till, bedrock, or granular fill placed above these materials.

Foundation Design Criteria

Design foundations using the following criteria:

- Design footings bearing on soil or a combination of soil and rock for a maximum allowable bearing pressure equal to a maximum allowable bearing pressure of 770 kPa.
- Design footings founded on soil to bear a minimum 1.2 m below proposed exterior grade, for frost protection.
- Place a layer of granular fill, having a minimum thickness of 0.3 m, over the natural soil or bedrock to create a uniform bearing surface and to protect soil bearing surfaces from disturbance.
- For footings designed for the recommended bearing pressure, we estimate total settlement will be less than 12 mm, with differential settlements between adjacent abutment and piers less than 6 mm. Settlement will occur as load is applied.

Abutment 1

The bearing elevation for Abutment 1 will be El 112.4, and granular fill subgrade 0.3 m below abutment subgrade will be at El. 112.1. Borings S2-1 and S2-4 indicate Abutment 1 will bear in glacial till. Bedrock is between El. 110.83 and El. 110.95, 1.15 to 1.27 m below granular fill subgrade level. See subsurface profile on Figure 3A.

Abutment 1 Wingwall 1A

The bearing elevation for Abutment 1 Wingwall 1A will be El.112.4, and granular fill subgrade 0.3 m below the footing will be El. 112.1. Borings S2-1 and S1, 3-8 indicate that the eastern portions of the footing near Bridge No. 06590 will bear on glacial till and the western portion near Structure 1, & 3 on bedrock. See Figure 3A.

Abutment 1 Wingwall 1C

Wingwall 1C supports fencing and retains limited fill. This wingwall will be constructed in the backfill zone of Wingwall 1A. The bearing elevation ranges from El. 117 to El. 120.8. Wingwall 1A should be designed for any additional load imposed by Wingwall 1C.

Pier

The bearing elevation for the Pier will be El. 110.8, and granular fill subgrade will be El. 110.5. Borings S2-5 indicates the pier will bear in glacial till. Bedrock is at El. 107.79, 3.01 m below the pier subgrade. See Figure 3C.

Abutment 2

The bearing elevation for Abutment 2 will be El 111.0, and granular fill subgrade will be El. 110.7. Borings S2-2 and S2-3 indicate Abutment 2 will bear in glacial till. Bedrock is between EL. 106.37 and EL.108.56, 1.34 m to 3.53 m below abutment subgrade. See Figure 3C.

Lateral Earth Pressures

Abutments and wingwalls should be designed for active earth pressure, traffic surcharge and seismic pressures as shown on Figure 4.

Sliding and overturning criteria are also provided on Figure 4.

Seismic Design

A seismic soil coefficient, S, equal to 1.0 is recommended. The soils at the site are not liquefaction susceptible under the design earthquake event. Seismically induced settlement should not be significant.

Environmental Observations

Odors similar to fuel were in the fill in S2-5 at the pier. The environmental impacts of contamination should be evaluated by the Department's environmental consultant, including whether excavated materials may be reused as fill, worker health and safety, and other issues.

Structure Backfill and Drainage

Pervious structure backfill should be placed behind the abutments and abutment wingwalls above a line defined by a 1V:1.5H slope extending up from the heel of the footing and extending to the bottom of subgrade. Pervious structure backfill should meet the

requirements of CONNDOT Form 815 M.02.05.

We recommend the abutments and wingwalls be drained by 100 mm dia. weep holes installed according to CONNDOT specifications. Maximum spacing between weep holes should be 3 m.

Reuse of Excavated Soils

The existing soils to be excavated consist primarily of fill and glacial till deposits. Based on the results of the sieve analyses in Appendix B, these soils do not meet gradation requirements for pervious structure backfill or granular fill. Excavated fill and glacial till deposits will generally be suitable for reuse as embankment fill. Contaminated soils at the pier may not be suitable for reuse and may require special deposal.

CONSTRUCTION CONSIDERATIONS

This section provides comments related to foundation construction and other geotechnical aspects of the project. It will aid those responsible for preparation of contract plans and specifications and those involved with construction monitoring. Contractors should evaluate potential construction problems on the basis of their own knowledge and experience in the area and on the basis of similar localities, taking into account their own proposed equipment, construction methods and procedures.

Existing Utilities

A number of utilities are located near Bridge No. 06590, including a 300 mm dia. and a 900 mm dia. storm drains and underground electrical lines. Based on discussions with Berger Lehman we understand that all nearby utilities will be relocated prior to construction.

Excavation and Temporary Lateral Support

Temporary excavations up to about 8 m high will be required to construct foundations for abutments. Temporary lateral support will be required to limit the size of the excavation and protect Hamilton Avenue. Steel sheet piling is not expected be feasible due to cobbles and boulders in the overburden. We anticipate soldier piles and lagging will be feasible, although pre-excavation or rotary drilling will be required at some locations to penetrate boulders. Soil nail walls may also be feasible for portions of excavations in the glacial till. However excavations will penetrate below groundwater and provisions for drainage behind the shotcrete face will be required.

Excavations will be primarily in soil but will encounter some bedrock along Wingwall 1A. Conventional heavy construction equipment appears practical for excavation of overburden soils. Controlled blasting will likely be required for bedrock removal.

Excavation geometry should conform to OSHA excavation regulations contained in 29 CFR Part 1926, latest edition. Temporary soil slopes of 1V:1H (Soil Profile Type B), or flatter, appear appropriate above groundwater but should be confirmed during construction based on conditions at the time of excavation. OSHA requires excavations greater than 6 m to be designed by a Registered Professional Engineer.

Dewatering

Groundwater is expected to be present in the fill and glaciofluvial deposits, perched over the dense glacial till, and should be anticipated in excavations for the abutments and pier. We anticipate that dewatering may be accomplished by open pumping from filtered sumps. Surface water should be diverted from excavations.

CLOSURE

This report has been prepared for specific application to the I-84 Reconstruction Project, as understood at this time, in accordance with generally accepted geotechnical engineering practice. In the event that changes in the nature, design or location of the project elements are planned, the conclusions and recommendations contained in this report should not be considered valid, unless the changes are reviewed by Haley & Aldrich, Inc. and the conclusions of this report modified or verified in writing.

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

We appreciate the opportunity to provide engineering services on this project. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Kurtis E. Amidon
Engineer

Dan T. Kinard, P.E.
Vice President

John P. Dugan, Jr., P.E.
Senior Vice President

Enclosures:

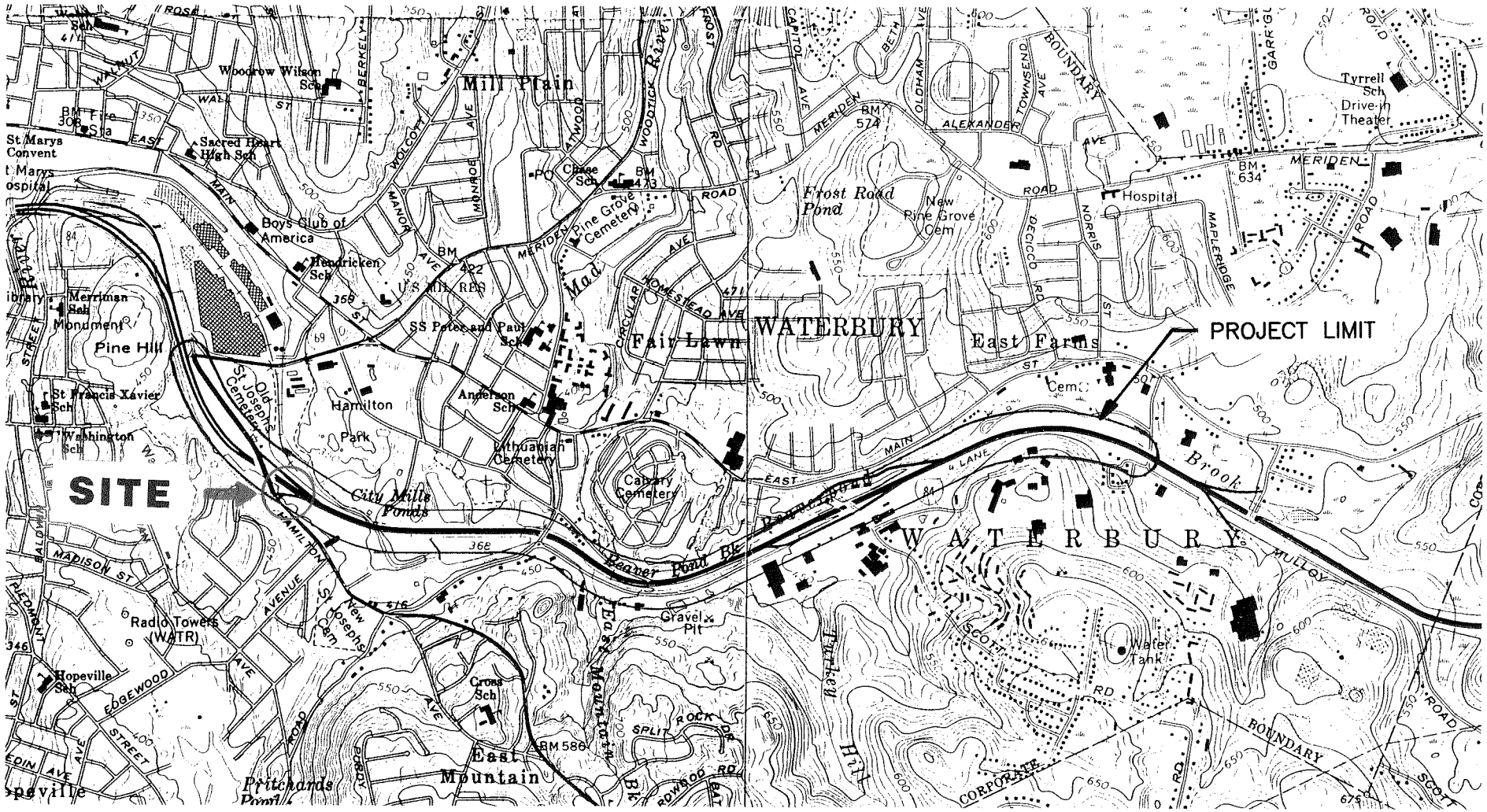
- Table I - Summary of Subsurface Data
- Figure 1 - Project Locus
- Figure 2 – Subsurface Exploration Plan
- Figure 3A – Abutment 1
- Figure 3B – Pier Section
- Figure 3C – Abutment 2 Section
- Figure 4 – Recommended Lateral Loads on Unrestrained Abutments and Wingwalls
- Appendix A – Recent Test Borings Logs
- Appendix B – Results of Laboratory Testing

TABLE I
SUMMARY OF SUBSURFACE DATA
BRIDGE 06590, EASTBOUND E23 ON RAMP
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

EXPLOR. NUMBER	ELEV. (m)	DEPTH (m)	THICKNESS OF SOIL STRATA (m)			BEDROCK LEVEL (m)		GROUNDWATER LEVEL (m)	
			FILL	GLACIO FLUVIAL	GLACIAL TILL	DEPTH	ELEV.	DEPTH	ELEV.
Recent									
S2-1	122.08	15.24	3.66	--	7.47	11.13	110.95	3.35	118.73
S2-2	118.26	13.72	3.51	2.49	5.89	11.89	106.37	--	--
S2-3	116.94	11.43	3.05	0.95	4.38	8.38	108.56	--	--
S2-4	121.65	14.32	4.57	--	6.25	10.82	110.83	--	--
S2-5	119.68	17.98	6.25	--	5.64	11.89	107.79	--	--

NOTES:
1. "--" indicates not encountered
2. Elevations are in meters and refer to the NGVD 29.
3. Refer to boring logs for detailed soil and rock descriptions.
4. Groundwater levels were measured shortly after drilling.

91313-000 A01



SITE COORDINATES: 041°32'47.24"N 073°01'38.27"W (EAST END)
SITE COORDINATES: 041°32'32.18"N 072°58'47.47"W (WEST END)

U.S.G.S. QUADRANGLES: WATERBURY & SOUTHINGTON, CONNECTICUT

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

PROPOSED INTERSTATE 84 WIDENING
WATERBURY, CONNECTICUT
STATE PROJECT NO. 151-0273

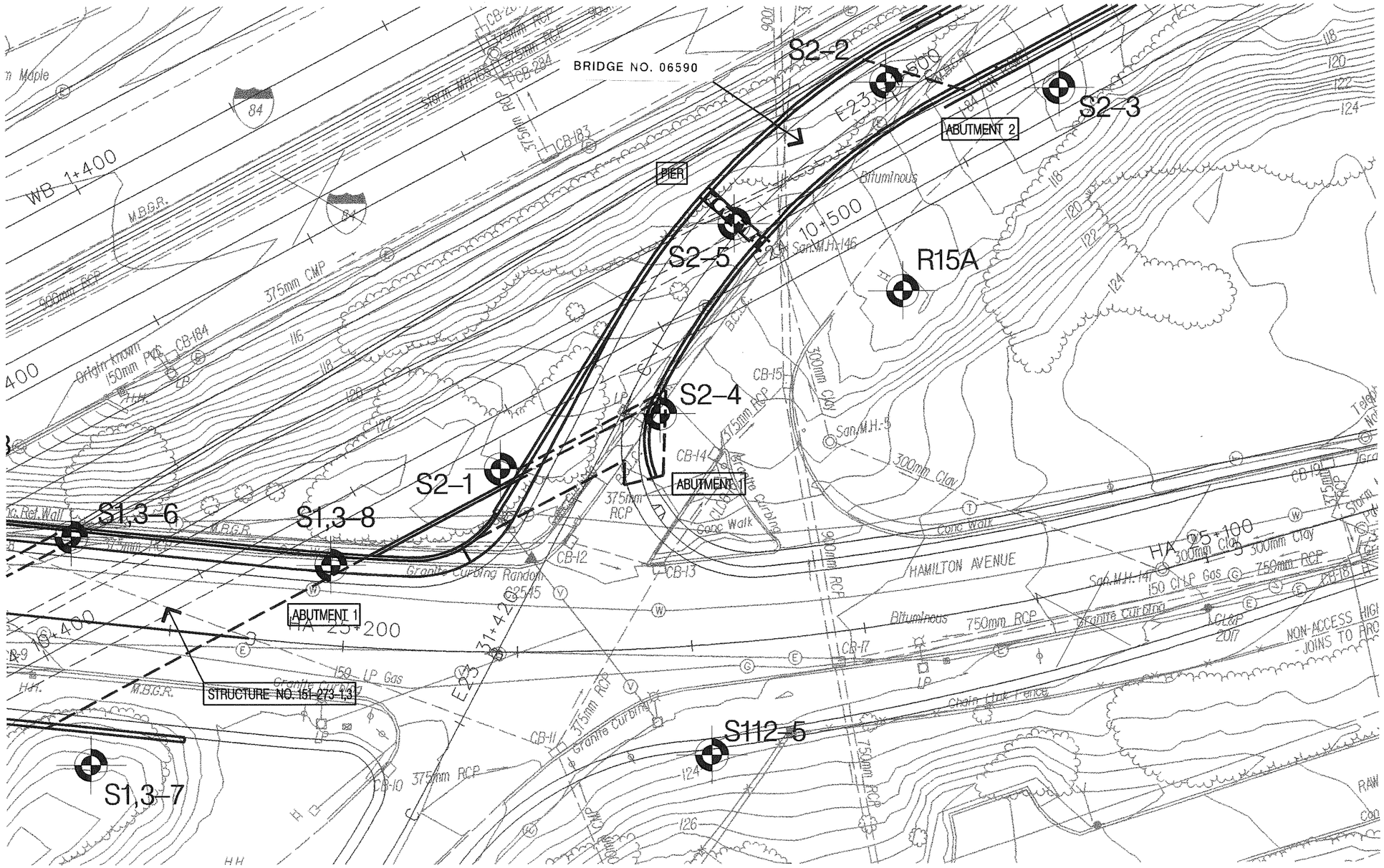
PROJECT LOCUS

0 500m

SCALE: 1:24,000

APRIL 2001

FIGURE 1



PLAN LEGEND

LOCATION OF RECENT TEST BORING DRILLED BY GENERAL BORINGS, INC. OF PROSPECT, CONNECTICUT.

NOTES:

1. BASE PLAN PROVIDED BY BERGER, LEHMAN ASSOCIATES. BORING LOCATIONS WERE SURVEYED BY A-1 ENGINEERS.
2. ELEVATIONS ARE IN METERS, REFER TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION
4. BORING LOG S1,3-8 DRILLED FOR STRUCTURE 1,3 IS INCLUDED IN APPENDIX A. REFER TO STRUCTURE 1,3 REPORT FOR OTHER STRUCTURE 1,3 BORING LOGS.

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

BRIDGE NO. 06590

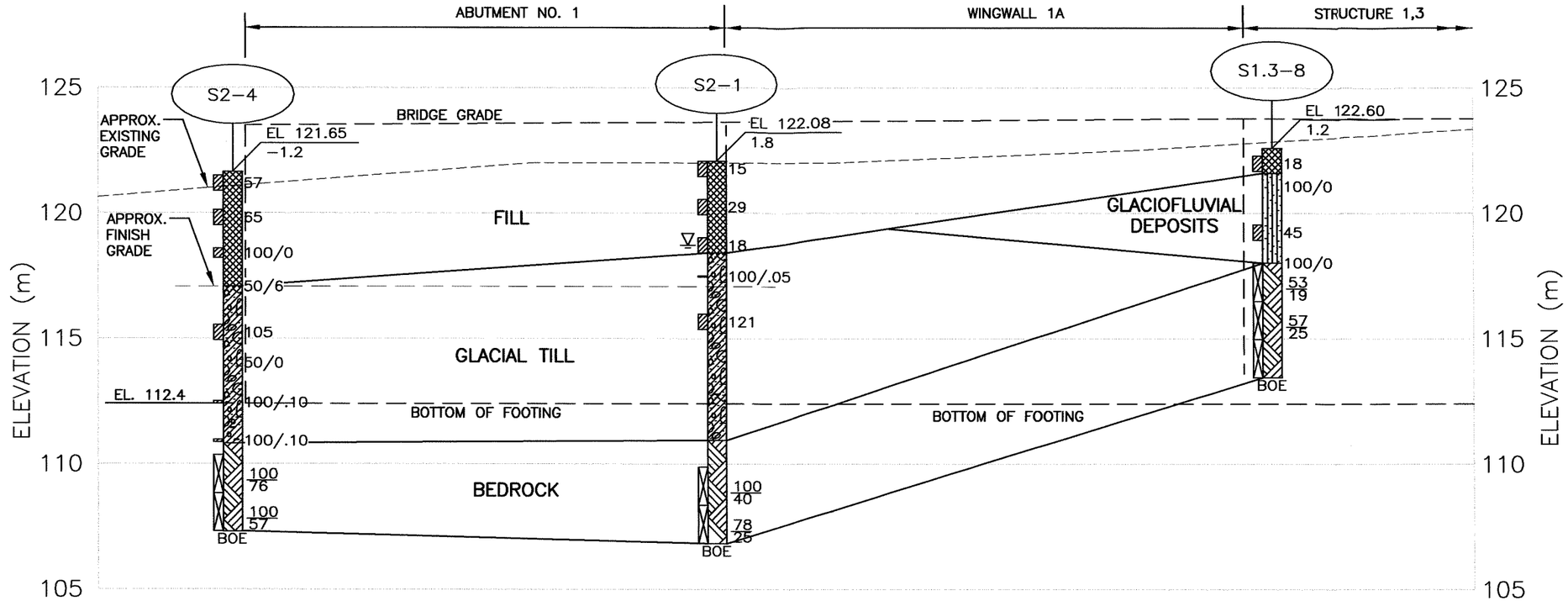
SUBSURFACE EXPLORATION PLAN

SCALE: 1:500

JANUARY 2001

91313-100

FIGURE 2



ABUTMENT 1 AT SKEW
CENTER LINE STATION E23 31+448.7
(LOOKING WEST)

LITHOLOGY GRAPHICS

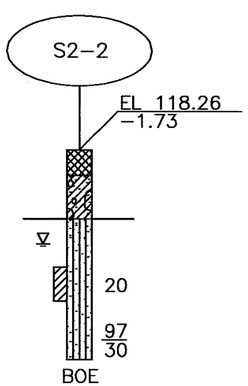
Fill | Glaciofluvial Deposits | Glacial Till | Bedrock

SAMPLER GRAPHICS

SAMPLE OBTAINED BY A 51 mm O.D. SPLIT SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 0.76 m – NUMBER INDICATES STANDARD PENETRATION RESISTANCE N-VALUE OF SAMPLE INTERVAL, IN BLOWS PER 0.3 m

CORE SAMPLE 51 mm DIA.

LEGEND



EXPLORATION DESIGNATION.

SURVEYED GROUND SURFACE ELEVATION (METERS) AT EXPLORATION

APPROXIMATE OFFSET FROM PROFILE BASELINE IN METERS. POSITIVE NUMBER INDICATES UPSTATION. NEGATIVE NUMBER INDICATES DOWNSTATION.

MAJOR STRATUM BOUNDARY BETWEEN DIFFERENT SOIL TYPES

WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING

SAMPLE LOCATION AND INTERVAL. SEE SAMPLER GRAPHIC LEGEND FOR SAMPLE TYPE

RECOVERY (%)
ROCK QUALITY DESIGNATION (%)

BOTTOM OF EXPLORATION

NOTES:

1. SEE FIGURE 2, SUBSURFACE EXPLORATION PLAN, FOR TEST BORING AND FOUNDATION LOCATIONS.
2. FOR DETAILED DESCRIPTION OF SUBSURFACE MATERIAL REFER TO TEST BORING LOGS CONTAINED IN APPENDIX A OF THIS REPORT.
3. LINES REPRESENTING CHANGES IN STRATA ARE BASED UPON INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS AND MAY NOT REPRESENT ACTUAL FIELD CONDITIONS AT OTHER THAN SPECIFIED EXPLORATION LOCATIONS.
4. THE STRATIFICATION LINES SHOWN ON THE GRAPHIC REPRESENTATION OF THE TEST BORINGS REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL OR ROCK TYPES. THE TRANSITION BETWEEN MATERIALS IS APPROXIMATE.

0 5 10
SCALE IN METERS
1:200

HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

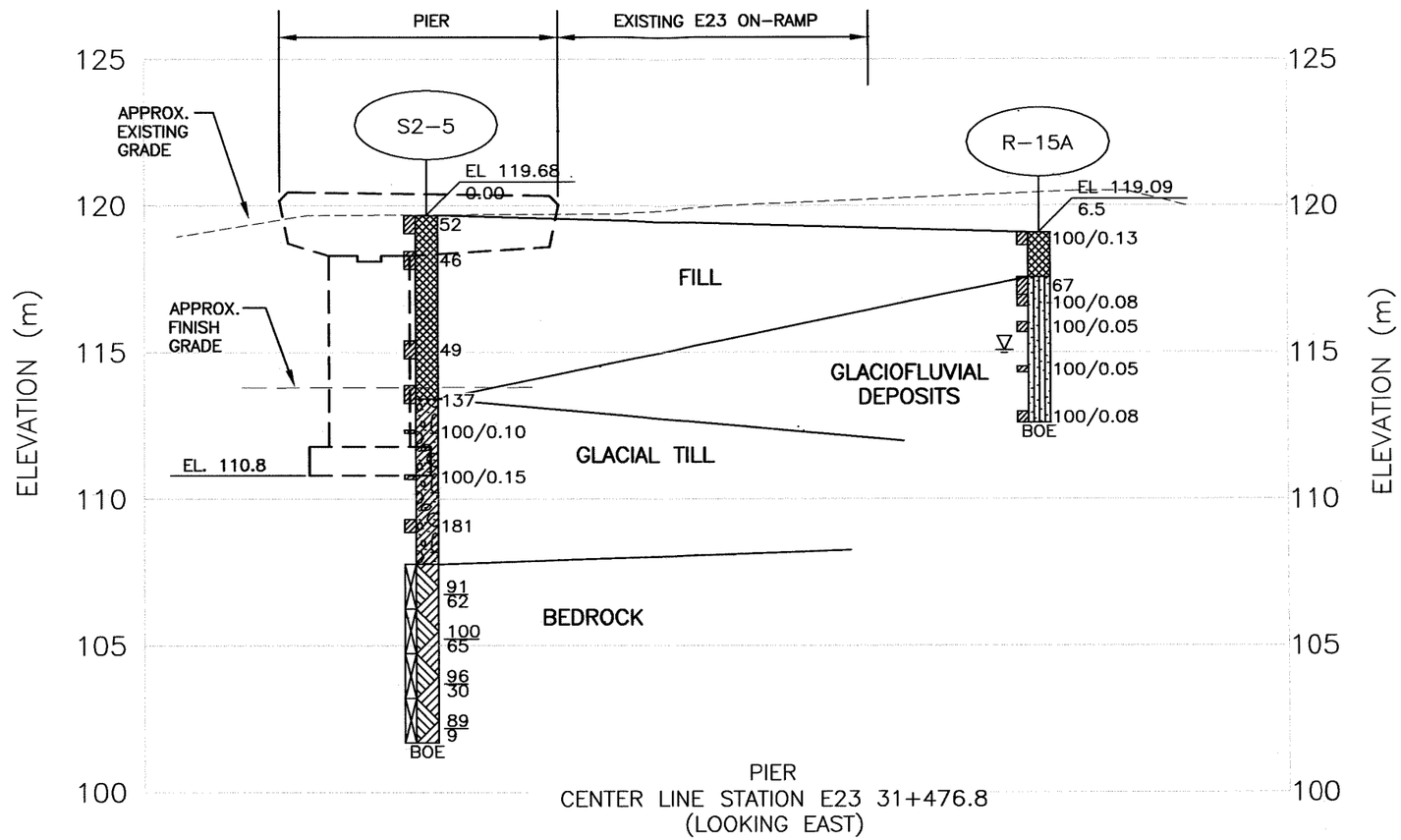
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

ABUTMENT NO. 1
BRIDGE NO. 06590
EASTBOUND E23 ON-RAMP

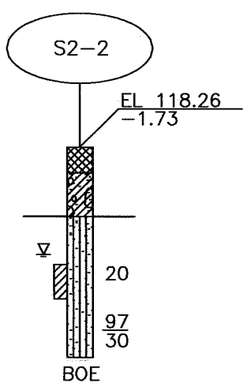
SCALE: AS SHOWN
JUNE 2001

91313-100 B03

FIGURE 3A



PIER
CENTER LINE STATION E23 31+476.8
(LOOKING EAST)



LEGEND

EXPLORATION DESIGNATION.

SURVEYED GROUND SURFACE ELEVATION (METERS) AT EXPLORATION

APPROXIMATE OFFSET FROM PROFILE BASELINE IN METERS. POSITIVE NUMBER INDICATES UPSTATION. NEGATIVE NUMBER INDICATES DOWNSTATION.

MAJOR STRATUM BOUNDARY BETWEEN DIFFERENT SOIL TYPES

WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING

SAMPLE LOCATION AND INTERVAL. SEE SAMPLER GRAPHIC LEGEND FOR SAMPLE TYPE

RECOVERY (%)
ROCK QUALITY DESIGNATION (%)

BOTTOM OF EXPLORATION

SAMPLER GRAPHICS

SAMPLE OBTAINED BY A 51 mm O.D. SPLIT SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 0.76 m – NUMBER INDICATES STANDARD PENETRATION RESISTANCE N-VALUE OF SAMPLE INTERVAL, IN BLOWS PER 0.3 m

CORE SAMPLE 51 mm DIA.

NOTES:

1. SEE FIGURE 2, SUBSURFACE EXPLORATION PLAN, FOR TEST BORING AND FOUNDATION LOCATIONS.
2. FOR DETAILED DESCRIPTION OF SUBSURFACE MATERIAL REFER TO TEST BORING LOGS CONTAINED IN APPENDIX A OF THIS REPORT.
3. LINES REPRESENTING CHANGES IN STRATA ARE BASED UPON INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS AND MAY NOT REPRESENT ACTUAL FIELD CONDITIONS AT OTHER THAN SPECIFIED EXPLORATION LOCATIONS.
4. THE STRATIFICATION LINES SHOWN ON THE GRAPHIC REPRESENTATION OF THE TEST BORINGS REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL OR ROCK TYPES. THE TRANSITION BETWEEN MATERIALS IS APPROXIMATE.

LITHOLOGY GRAPHICS

Fill | Glaciofluvial Deposits | Glacial Till | Bedrock

0 5 10
SCALE IN METERS
1:200

HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

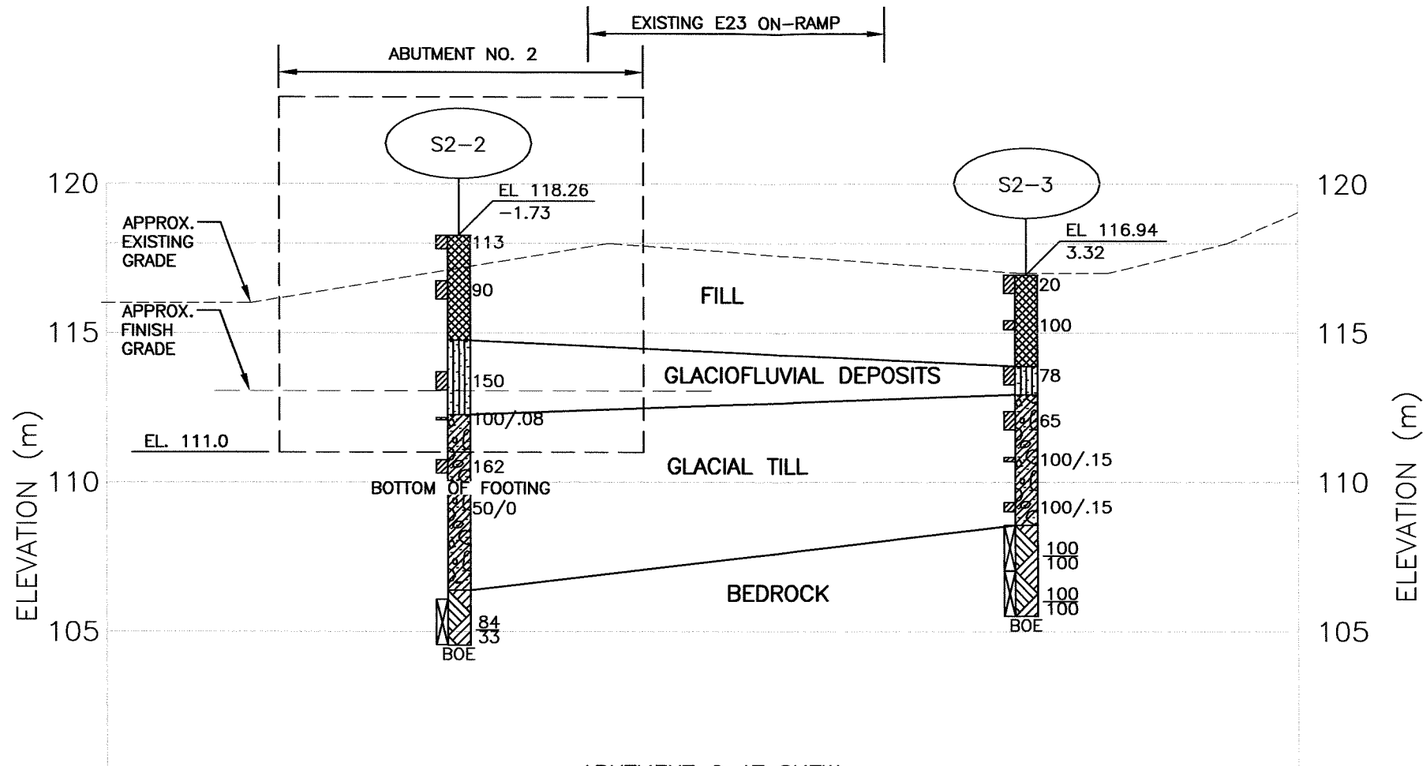
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

PIER
BRIDGE NO. 06590
EASTBOUND E23 ON-RAMP

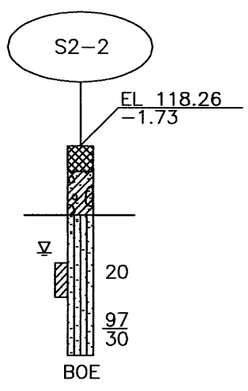
SCALE: AS SHOWN
JUNE 2001

91313-100 B03

FIGURE 3B



ABUTMENT 2 AT SKEW
CENTER LINE STATION E23 31+505.2
(LOOKING EAST)



LEGEND

EXPLORATION DESIGNATION.

SURVEYED GROUND SURFACE ELEVATION (METERS) AT EXPLORATION

APPROXIMATE OFFSET FROM PROFILE BASELINE IN METERS. POSITIVE NUMBER INDICATES UPSTATION. NEGATIVE NUMBER INDICATES DOWNSTATION.

MAJOR STRATUM BOUNDARY BETWEEN DIFFERENT SOIL TYPES

WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING

SAMPLE LOCATION AND INTERVAL. SEE SAMPLER GRAPHIC LEGEND FOR SAMPLE TYPE

RECOVERY (%)
ROCK QUALITY DESIGNATION (%)

BOTTOM OF EXPLORATION

SAMPLER GRAPHICS

SAMPLE OBTAINED BY A 51 mm O.D. SPLIT SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 0.76 m – NUMBER INDICATES STANDARD PENETRATION RESISTANCE N-VALUE OF SAMPLE INTERVAL, IN BLOWS PER 0.3 m

CORE SAMPLE 51 mm DIA.

NOTES:

1. SEE FIGURE 2, SUBSURFACE EXPLORATION PLAN, FOR TEST BORING AND FOUNDATION LOCATIONS.
2. FOR DETAILED DESCRIPTION OF SUBSURFACE MATERIAL REFER TO TEST BORING LOGS CONTAINED IN APPENDIX A OF THIS REPORT.
3. LINES REPRESENTING CHANGES IN STRATA ARE BASED UPON INTERPOLATION BETWEEN SUBSURFACE EXPLORATIONS AND MAY NOT REPRESENT ACTUAL FIELD CONDITIONS AT OTHER THAN SPECIFIED EXPLORATION LOCATIONS.
4. THE STRATIFICATION LINES SHOWN ON THE GRAPHIC REPRESENTATION OF THE TEST BORINGS REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL OR ROCK TYPES. THE TRANSITION BETWEEN MATERIALS IS APPROXIMATE.

LITHOLOGY GRAPHICS

Fill | Glaciofluvial Deposits | Glacial Till | Bedrock

0 5 10
SCALE IN METERS
1:200

HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

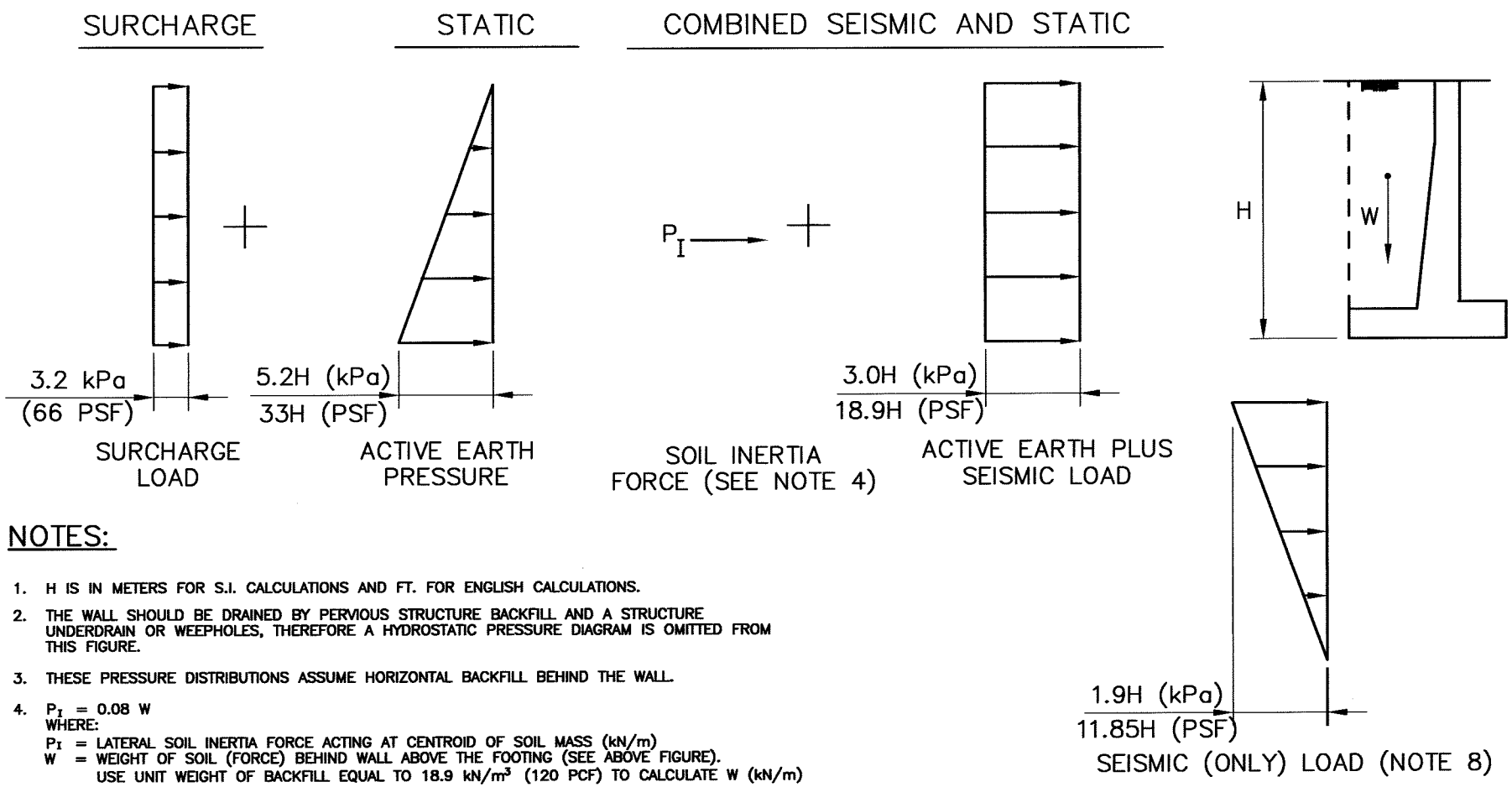
ABUTMENT NO. 2
BRIDGE NO. 06590
EASTBOUND E23 ON-RAMP

SCALE: AS SHOWN
JUNE 2001

91313-100 B03

FIGURE 3C

STRUCT2/91313-100 A04



NOTES:

1. H IS IN METERS FOR S.I. CALCULATIONS AND FT. FOR ENGLISH CALCULATIONS.
2. THE WALL SHOULD BE DRAINED BY PERVIOUS STRUCTURE BACKFILL AND A STRUCTURE UNDERDRAIN OR WEEPHOLES, THEREFORE A HYDROSTATIC PRESSURE DIAGRAM IS OMITTED FROM THIS FIGURE.
3. THESE PRESSURE DISTRIBUTIONS ASSUME HORIZONTAL BACKFILL BEHIND THE WALL.
4. P_I = 0.08 W
   WHERE:
   P_I = LATERAL SOIL INERTIA FORCE ACTING AT CENTROID OF SOIL MASS (kN/m)
   W = WEIGHT OF SOIL (FORCE) BEHIND WALL ABOVE THE FOOTING (SEE ABOVE FIGURE).
   USE UNIT WEIGHT OF BACKFILL EQUAL TO 18.9 kN/m^3 (120 PCF) TO CALCULATE W (kN/m)
5. SLIDING:
   COEFF. OF FRICTION BETWEEN FOOTING AND BASE = 0.60
   FS≥1.5 (STATIC)
   FS≥1.0 (SEISMIC)
6. OVERTURNING:
   FS≥2.0 (STATIC)
   FS≥1.1 (SEISMIC)
7. IGNORE PASSIVE RESISTANCE IN FRONT OF FOOTING.
8. SEISMIC ONLY LOAD WAS DERIVED FROM THE MONONABE OKABE COMBINED STATIC AND SEISMIC LOAD BY SUMMING MOMENTS ABOUT THE TOE.

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

U.S. ROUTE INTERSTATE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

RECOMMENDED LATERAL LOADS ON UNRESTRAINED WINGWALLS

NOT TO SCALE

MARCH 2003

FIGURE 4

APPENDIX A

Recent Test Borings Logs

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-1**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231066.75**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282082.88**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

			Casing				Auger		Mud	Sampler		Core Barrel			
Surface Elevation: **122.08**		Utilized		X						X					X
Date Started: **15 December 2000**		Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Date Finished: **15 December 2000**		Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
Groundwater Observations		Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ **3.35** m after **0** hours		Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	
@ m after hours															

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0.00-0.61	1	0.61	0.45	D	13	7	8	7	0.15	Medium dense loamy SILT and SAND, with some leaves, wood -TOPSOIL-
		1.52-2.13	2	0.61	0.45	D	12	14	15	14		Medium dense light brown fine SAND Medium dense light brown fine SAND, trace silt
		3.05-3.66	3	0.61	0.45	D	7	9	9	73	118.42 3.66	Medium dense light brown SILT and GRAVEL, little coarse to fine sand -FILL-
5		4.57-4.62	4	0.05	0.00	D	100/.05					No recovery
		6.10-6.71	5	0.61	0.30	D	47	56	65	98		Very dense light brown coarse to fine GRAVEL, some coarse to fine sand, some silt Cored boulders from 7.62 m. to 10.21 m.
10											110.95	-GLACIAL TILL-
		12.19-13.71	1	1.52	1.52	C		[RQD = 40%]			11.13	C1- Hard, slightly weathered, gray brown, coarse to fine grained granitic GNEISS. Foliation is moderately dipping, extremely close. Joints are low angle to vertical, very close to close, rough, undulating, discolored to decomposed, open.
		13.72-15.24	2	1.52	1.19	C		[RQD = 25%]				C2- Same as C1, except joints are very close to moderate. Highly fractured zone from 13.72 m. to 14.39 m.
15												

Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**11.1**	**12.19** m	**3.05** m
			No. of Samples	
			5D,2C	

NOTES:

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%

Hole No. **S2-1**
Sheet **1** of **2**

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-1**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231066.75**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282082.88**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	Berger, Lehman Associates, P.C.
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

		Casing				Auger		Mud	Sampler		Core Barrel			
Surface Elevation: **122.08**	Utilized		X						X					X
Date Started: **15 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Date Finished: **15 December 2000**	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
Groundwater Observations	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ **3.35** m after **0** hours	Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	
@ m after hours														

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./ DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
											106.84 15.24	-BEDROCK- Bottom of Exploration at 15.24 m.
20												
25												
30												

Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**11.1**	**12.19** m	**3.05** m
			No. of Samples	
			5D,2C	

NOTES:

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%

Hole No. **S2-1**

Sheet **2** of **2**

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-2**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231049.16**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282143.13**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

		Casing				Auger		Mud	Sampler		Core Barrel			
Surface Elevation: **118.26**	Utilized		X						X		X			
Date Started: **13 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Date Finished:	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
Groundwater Observations	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ ____ m after ____ hours	Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	
@ ____ m after ____ hours														

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0.00-0.45	1	0.45	0.30	D	7	13	100			Very dense brown coarse to fine SAND, some coarse to fine gravel, trace silt, concrete
		1.52-2.13	2	0.61	0.45	D	21	32	58	110		Very dense brown coarse to fine SAND and coarse to fine GRAVEL, with boulders. Boulders 2.59 m. to 3.51 m
											114.75	-FILL-
											3.51	
5		4.57-5.18	3	0.61	0.25	D	52	76	74	61		Very dense brown coarse to fine SAND, some fine gravel, trace silt
											112.26	-GLACIOFLUVIAL DEPOSITS-
		6.10-6.18	4	0.08	0.00	D	100/.08				6.00	No recovery on boulder 6.1 m. to 6.7 m.
		7.52-7.97	5	0.45	0.30	D	43	62	100			Very dense light brown coarse to fine SAND, little fine gravel, little silt
10		9.14-9.14	6	0.00	0.00	D	50/0					No recovery. Cored boulders from 9.6 m. to 10.67 m. with boulders continuing down to 11.89 m.
											106.37	-GLACIAL TILL-
		12.19-13.71	1	1.52	1.28			[RQD = 33%]			11.89	C1- Hard, fresh, gray, pink and white, medium to fine grained GRANITIC GNEISS. Foliation is high angle, extremely close. Joints are low angle to moderately dipping, very close to close, rough, undulating fresh to discolored, open.
											104.54	
											13.72	-BEDROCK-
15												Bottom of Exploration at 13.72 m.

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**		**-** m	**-** m
			No. of Samples	
			6D,1C	

NOTES: **Bomb mounted Diedrich D-50 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings upon completion.**

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%

Hole No. **S2-2**

Sheet **1** of **1**

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-3**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231031.52**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282152.08**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

Surface Elevation: **116.94**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **15 December 2000**	Utilized		X						X					X
Date Finished: **18 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
@ _____ 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				0.76		of bit		Carbide	

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0.00-0.61	1	0.61	0.43	D	4	7	13	29		Medium dense dark brown and gray coarse to fine SAND, little silt, gravel
		1.52-1.82	2	0.30	0.30	D	9	100				Very dense brown coarse to fine SAND, some coarse to fine gravel, little silt
											113.89	-FILL-
		3.05-3.66	3	0.61	0.56	D	16	31	47	68	3.05	Very dense light brown to orange brown laminated fine SAND, little coarse sand, little silt, trace gravel
											112.94 4.00	-GLACIOFLUVIAL DEPOSITS-
5		4.57-5.18	4	0.61	0.30	D	17	27	38	34		Very dense brown fine SAND and medium to fine GRAVEL, little coarse sand, trace silt
												Cored boulder at 5.33m. to 5.94 m.
		6.10-6.25	5	0.15	0.13	D	100/.15					Very dense gray brown coarse to fine SAND and coarse to fine GRAVEL, trace silt
		7.62-7.92	6	0.30	0.13	D	38	100/.15				Very dense brown medium to fine SAND and coarse to fine GRAVEL, little silt
		8.38-9.90	1	1.52	1.52	C		[RQD = 100%]			108.56 8.38	-GLACIAL TILL-
10		9.91-11.43	2	1.52	1.52	C		[RQD = 100%]				C1- Hard slightly weathered, gray coarse to fine grained GRANITIC GNEISS. Foliation is moderately dipping, extremely close. Joints are low angle to vertical, very close to close, rough, undulating, discolored, open. C2- Same as C1
											105.51	-BEDROCK-
											11.43	Bottom of Exploration at 11.43 m.
15												

Casing Size	From	To	Meters of Earth	Rock
HW	**0.0**	**8.4**	**8.38** m	**3.04** m
			No. of Samples	
			6D,2C	

NOTES:

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%

Hole No. **S2-3**

Sheet **1** of **1**

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-4**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231053.74**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282097.28**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

Surface Elevation: **121.65**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **18 December 2000**	Utilized		X						X					X
Date Finished: **18 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
@ _____ 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				0.76		of bit		Carbide	

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0.15-0.76	1	0.61	0.30	D	20	35	22	27	0.15	Black top and road stone Very dense brown coarse to fine SAND, some coarse to fine gravel, little silt
		1.52-2.13	2	0.61	0.30	D	29	33	32	25		Very dense gray brown medium to fine SAND, some coarse sand, some coarse to fine gravel, little silt
		3.05-3.43	3	0.38	0.10	D	5	10	100/0.8			Very dense black and dark brown coarse to fine SAND, some medium to fine gravel, little silt Roller bit at 3.43 m. -FILL-
5		4.57-4.57	4	0.00	0.00	D	50/6				117.08 4.57	On Boulder
		6.10-6.71	5	0.61	0.20	D	38	74	31	39		Very dense brown coarse to fine GRAVEL, some coarse to fine sand, some silt
		7.62-7.62	6	0.00	0.00	D	50/0					On boulder from 7.62 m. to 8.08 m.
10		9.14-9.24	7	0.10	0.10	D	100/.10					Very dense gray coarse to fine GRAVEL, little coarse to fine sand
		10.67-10.77	8	0.10	0.05	D	100/.10				110.83 10.82	Very dense coarse to fine GRAVEL, trace silt, trace fine sand -GLACIAL TILL-
		11.28-12.80	1	1.52	1.52	C		[RQD = 76%]				C1- Very hard, fresh, gray white, coarse to fine grained GNEISS. Foliation is moderately dipping, extremely close joints are low angle to moderately dipping conjunctive close to moderate, rough, undulating to planar, discolored, open.
		12.80-14.32	2	1.52	1.52	C		[RQD = 57%]			107.33 14.32	C2- Same as C1 -BEDROCK-
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**10.7**	**1.28** m	**3.05** m
			No. of Samples	
			8D,2C	

NOTES: **Truck mounted Mobile Drill B-53 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings upon completion**

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%

Hole No. **S2-4**
Sheet **1** of **2**

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-4**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231053.74**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282097.28**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

Surface Elevation: **121.65**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **18 December 2000**	Utilized		X						X					X
Date Finished: **18 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
@ _____ 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				0.76		of bit		Carbide	

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
												Bottom of Exploration at 14.32 m.
20												
25												
30												

Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**10.7**	**1.28** m	**3.05** m
			No. of Samples	
			8D,2C	

NOTES: **Truck mounted Mobile Drill B-53 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings upon completion**

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%

Hole No. **S2-4**
Sheet **2** of **2**

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-5**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231056.82**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282120.43**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

Surface Elevation: **119.68**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **4 May 2001**	Utilized		X						X					X
Date Finished: **4 May 2001**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
@ _____ 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				0.76		of bit		Carbide	

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0.00-0.61	1	0.61	0.20	D	14	27	25	53	0.15	-TOPSOIL- Very dense brown fine SAND, little silt, coarse sand, gravel with brick specks
		1.22-1.83	2	0.61	0.00	D	23	25	21	20		Piece of gravel in spoon. Boulder from 2.74 m. to 3.20 m.
5		4.27-4.88	3	0.61	0.08	D	75	30	19	17		Dense gray coarse to fine SAND and GRAVEL, some wood, trace silt, weathered petroleum odor
		5.79-6.40	4	0.61	0.15	D	79	95	42	26	113.43 6.25	Very dense brown coarse to fine SAND and GRAVEL, trace silt, weathered petroleum odor -FILL-
		7.32-7.42	5	0.10	0.00	D	100/0.10					Very dense brown fine SAND and SILT, trace grave, weathered petroleum odor No recovery. Only gravel wash in spoon
10		8.84-8.99	6	0.15	0.15	D	100/0.15					Very dense brown SILT and fine SAND, little gravel, trace coarse sand
		10.36-10.81	7	0.45	0.15	D	49	81	100			Same as D6, except some medium to fine gravel
		11.89-13.41	1	1.52	1.39	C		[RQD = 62%]			107.79 11.89	-GLACIAL TILL- Very hard, fresh to slightly weathered gray white and pink, coarse to fine grained GRANITIC GNEISS. Foliation is moderately dipping, extremely close. Joints are vertical to low angle, close to moderate, rough, undulating, discolored, open.
		13.41-14.93	2	1.52	1.52	C		[RQD = 65%]				Note: Healed joints present Same as C1, except joints are moderately
15												

Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**11.9**	**11.89** m	**6.10** m
			No. of Samples	
			7D,4C	

NOTES: **Bomb mounted Diedrich D-50 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings. NO = Not Observed**

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%

Hole No. **S2-5**
Sheet **1** of **2**

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S2-5**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231056.82**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282120.43**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

Surface Elevation: **119.68**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **4 May 2001**	Utilized		X						X					X
Date Finished: **4 May 2001**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
@ _____ 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				0.76		of bit		Carbide	

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		14.94-16.46	3	1.52	1.46	C		[RQD = 30%]				dipping to low angle, very close to moderate
		16.46-17.98	4	1.52	1.35	C		[RQD = 9%]				Note: Occasional soil filled fractures Hard, fresh to slightly weathered gray white and pink, coarse to fine grained GRANITIC GNEISS. Foliation is moderately dipping, extremely close. Joints moderately dipping, very close to moderate, rough, undulating to planar, discolored, open. Highly fractured from 14.48 m to 15.94 m. Hard, fresh to slightly weathered, coarse to fine grained GRANITIC GNEISS. Foliation is moderately dipping, extremely close. Joints moderately dipping, indistinct to close, rough, undulating, discolored, open. Highly fractured from 16.46 m to 17.98 m. -BEDROCK- Bottom of Exploration at 17.98 m.
											101.70 17.98	
20												
25												
30												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**11.9**	**11.89** m	**6.10** m
			No. of Samples	
			7D,4C	

NOTES: **Bomb mounted Diedrich D-50 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings. NO = Not Observed**

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%

Hole No. **S2-5**
Sheet **2** of **2**

J. Muccino DRILLER P. Carrera INSPECTOR Haley & Aldrich, Inc. SOILS ENGINEER	SM - 001 - M REV. 1/94 BORING REPORT STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION TOWN: **Waterbury, Connecticut** PROJECT NAME: **Reconstruction of I-84** PROJECT NUMBER: **State: 151-273/H&A: 91313-100** BORING CONTRACTOR: **General Borings, Inc.**	Hole No. **S1.3-8** Line & Station Offset N. Coordinate **231078.47** E. Coordinate **282063.85** **Berger, Lehman Associates, P.C.** PRIME DESIGNER

		Casing				Auger		Mud	Sampler		Core Barrel			
Surface Elevation: **122.60**	Utilized		X						X					X
Date Started: **1 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Date Finished: **1 December 2000**	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	51
Groundwater Observations	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ **NE** m after ____ hours	Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	
@ ____ m after ____ hours														

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
											122.30	ASPHALT
		0.30-0.91	1	0.61	0.30	D	5	8	10	16	0.30 121.60	Medium dense black to brown fine SAND, and silt, little coarse sand, trace fine gravel
											1.00	-FILL-
		1.52-1.52	2	0.00	0.00	D	100/0					No recovery
		3.05-3.66	3	0.61	0.46	D	14	15	30	45		Dense brown SILT, some fine sand, little coarse sand, fine gravel
											118.03	-GLACIOFLUVIAL DEPOSITS-
5		4.57-4.57	4	0.00	0.00	D	100/0	[RQD = 19%]			4.57	No recovery
		4.58-6.10	1	1.52	0.80	C						C1: Hard, fresh to moderately weathered , gray and white, coarse to fine grained GNEISS. Foliation is moderately dipping, extremely to very close. Joints are low angle to moderately dipping, very close to close, rough, discolored, open to tight. Highly fractured from 5.13 m. to 6.10 m.
		6.10-7.62	2	1.52	0.86	C		[RQD = 25%]				C2: Same as C1, except medium to fine grained. Foliation is extremely close. Joints are close. Highly fractured from 6.1 m. to 6.3 m. & 7.32 m. to 7.62 m.
		7.62-9.14	3	1.52	0.45	C		[RQD = 0%]				C3: Whole run is highly fractured rock. No structure
											113.46 9.14	-BEDROCK-
10												Bottom of Exploration at 9.14 m.
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**4.6**	**4.57** m	**4.56** m
			No. of Samples	
			4D,3C	

NOTES: **Truck mounted Mobile Drill B-53 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings upon completion. NE= Not Encountered**

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%

Hole No. **S1.3-8**
Sheet **1** of **1**

M. Jennette	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **R-15A**
DRILLER	STATE OF CONNECTICUT	Line & Station
C. White	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231036.03**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282123.10**
SOILS ENGINEER	PROJECT NUMBER: **State: 151-273/H&A: 91313-100**	**Berger, Lehman Associates, P.C.**
	BORING CONTRACTOR: **General Borings, Inc.**	PRIME DESIGNER

Surface Elevation: **119.09**

Date Started: **28 March 2001**

Date Finished: **29 March 2001**

Groundwater Observations

@ **4.00** m after **0** hours

@ m after

	Casing				Auger		Mud	Sampler		Core Barrel			
Utilized		X			X			X					
Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NQ(st)	NQ(dt)
Size I.D. (mm)	60	76	100	64	50			35	X	35	35	55	51
Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	

DEPTH	Casing blows per half meter	SAMPLE DEPTH IN METERS FROM - TO	NO.	PEN. m	REC m	Type	BLOWS PER 0.15 METERS ON SAMPLER 0-0.15	0.15-0.30	0.30-0.45	0.45-0.60	STRATA CHANGE ELEV./DEPTH (m)	FIELD IDENTIFICATION OF SOIL REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0.00-0.43	1	0.43	0.30	D	13	25	100/0.13		0.15	-TOPSOIL- Very dense brown coarse to fine SAND, little cobble and boulder fragments
		1.52-2.13	2	0.61	0.30	D	13	26	41	39	117.57 1.52	Note: Boulders and cobbles 0.43 to 1.52 m. -FILL- Very dense tan coarse to fine SAND, trace medium to fine gravel, trace silt
		2.13-2.51	3	0.38	0.15	D	39	33	100/0.08			Very dense tan fine SAND, some coarse sand, trace medium to fine gravel
		3.05-3.40	4	0.35	0.25	D	33	31	100/0.05			Very dense red brown coarse to fine SAND, trace fine gravel, trace rock fragments, moist
5		4.57-4.77	5	0.20	0.09	D	39	100/0.05				Note: Drove 0.08 m. casing to 4.57 m. Very dense brown coarse to fine GRAVEL, little medium to fine sand, wet
		6.10-6.48	6	0.38	0.15	D	52	56	100/0.08		112.61 6.48	Very dense brown coarse to fine SAND, trace medium to fine gravel, trace rock fragments -GLACIOFLUVIAL DEPOSITS- Bottom of Exploration at 6.48 m.
10												
15												

Casing Size	From	To	Meters of Earth	Rock
SSA	**0.0**	**3.1**	**6.48** m	**-** m
NW	**3.1**	**6.1**	No. of Samples	
			6D	

NOTES: **Truck mounted Mobile Drill B-53 with wire winch to drive safety hammer. Borehole backfilled upon completion**

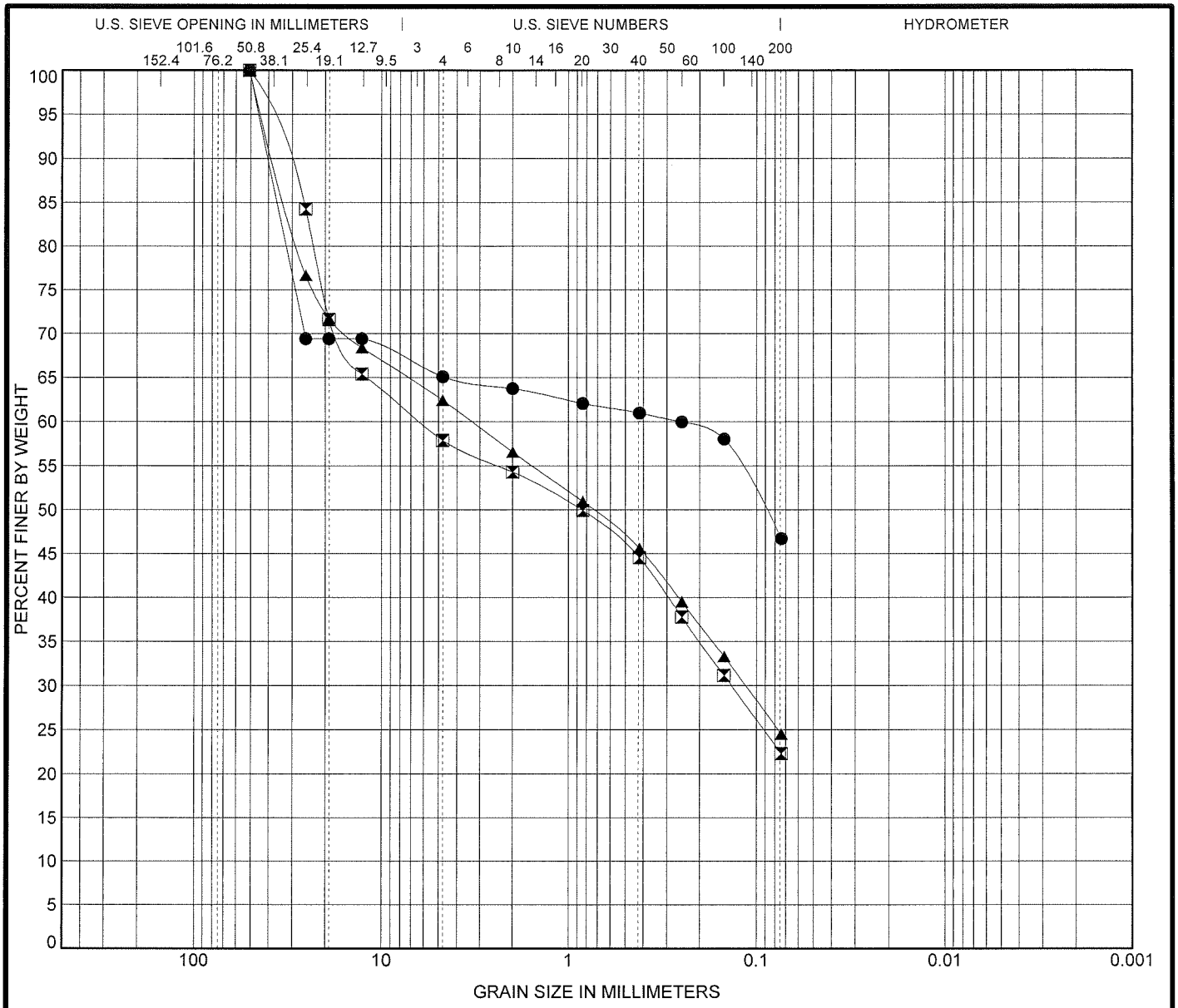
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test

PROPORTIONS USED: Trace=1-10% Little=10-20%, Some=20-35%, And=35-50%

Hole No. **R-15A**

Sheet **1** of **1**

APPENDIX B
Results of Laboratory Testing



	COBBLES	% GRAVEL			% SAND		% FINES	
		COARSE	MEDIUM	FINE	COARSE	FINE	% SILT	% CLAY
●	0.0	30.6	1.3	4.4	2.8	14.3	46.7	
⧗	0.0	15.8	21.1	8.9	9.7	22.2	22.3	
▲	0.0	23.3	10.0	10.1	11.0	21.1	24.5	

	Expl. No.	Sample No.	Depth (m)	LL	PL	PI	Water Content (%)	Cc	Cu
●	S2-1	D3	3.05-3.66				18.8		
⧗	S2-1	D5	6.1-6.71				7.6		
▲	S2-4	D5	6.1-6.71				8.7		

	Sample Description
●	**Light brown SILT and GRAVEL, little coarse to fine sand - FILL**
⧗	**Light brown coarse to fine GRAVEL, some coarse to fine sand, some silt - GLACIAL TILL**
▲	**Light brown coarse to fine GRAVEL, some coarse to fine sand, some silt - GLACIAL TILL**

Remarks:

HALEY & ALDRICH
Glastonbury, Connecticut

I-84 Reconstruction
Waterbury, Connecticut
State Project No.: 151-273

GRAIN SIZE DISTRIBUTION

Date: 5/16/2001 File No.: 91313-100

CONN DOT SIEVE 91313S.GPJ US LAB.GDT 5/16/01