GEOTECHNICAL ENGINEERING REPORT
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
BRIDGE NO. 04321, HAMILTON AVENUE OVER I-84
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 8 May 2003

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HALEY & ALDRICH

Revised 8 May 2003
25 January 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. 04321, Hamilton Avenue over I-84
State Project 151-273
Waterbury, Connecticut

Ladies and Gentlemen:

This report presents our evaluation of subsurface conditions and geotechnical engineering recommendations for Bridge No. 04321, Hamilton Avenue over I-84, for 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. 04321 is a three span bridge supported by two abutments and two piers. We recommend the structure be supported on spread footings bearing on undisturbed natural soils, bedrock or granular fill placed above these materials. Our detailed recommendations follow.

PROPOSED CONSTRUCTION

Bridge No. 04321 (formerly referred to as Structure 1 & 3) is located at the intersection of I-84 and Hamilton Avenue in Waterbury, Connecticut, see Figure 1, Project Locus. Bridge No. 04321 replaces the existing 16-m wide, 54-m long, four lane, two span bridge. The centerline is approximately 2 meters west of the centerline of the existing bridge. The existing structure carries numerous utilities, which will be relocated temporarily during construction.

Bridge No. 04321 is a continuous three span bridge with a welded steel plate girder superstructure. The bridge is about 141 m in length, span lengths are 33.97 m, 45.98 m, and 57.0 m, and the deck width is 24.75 m. The bridge has two central piers and abutments at each end. U-wingwalls extend along the alignment from the abutments. Abutment walls

range in height from 1.8 to 5.2 m. The abutments have a 56 degree skew in relation to the bridge centerline. The Hamilton Avenue road grade at the proposed bridge ranges from EL. 121 to 123.9; I-84 pavement grade beneath the bridge is approximately 115.

Elevations in this report are in meters and refer to NGVD 29. Elevations from previous exploration logs have been converted from english to metric units.

SITE CONDITIONS

I-84 under the Hamilton Avenue Bridge was constructed in a cut section. Original grade ranged between approximately EL. 120.4 and EL. 122.0, 5.6 to 7 m above the I-84 pavement grade of approximately EL. 115. Hamilton Avenue bridge grade ranges from EL. 120 to 122. Cut slopes along I-84 near the bridge are inclined at slopes ranging from 1V:1.5H to 1V:2.75V. Outcrops are visible between Stations HA 25 + 255 and HA 25 + 325, 30 to 60 m west of the proposed bridge.

SUBSURFACE INVESTIGATIONS

Recent Explorations

Eight borings (S1,3-1 through S1,3-8), two at each abutment and pier, were drilled by General Borings, Inc. of Prospect, Connecticut between 29 November and 13 December 2000. The test borings were drilled with 76 mm I.D. casing to depths ranging from 6.4 to 13.1 m, including 3.0 to 6.1 m of rock coring. Bedrock was cored at each boring with a 55-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.

Previous Explorations

Subsurface explorations conducted in 1955 for the existing structure consisted of one test pit and seven test borings. Explorations were terminated in bedrock 3.3 to 11.6 m below ground surface. The exploration locations are shown on Figure 2, and logs are included in Appendix B.

Subsurface Conditions

Subsurface conditions encountered in the explorations consisted 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 3D. Subsurface conditions at each exploration are summarized on Table I.

Thickness (m)	Generalized Description
0.2 to 3.1	**Fill** – Medium dense dark brown to brown SAND, little to some silt, little gravel with occasional cobbles and boulders. Dense brown SILT with sand and fine gravel was encountered in S1,3-8.
0.7 to 7.6	**Glaciofluvial Deposits** – Very dense brown SAND and GRAVEL with numerous cobbles and boulders.
Up to 7.0	**Glacial Till** –mixtures of sand, gravel, cobbles, and boulders (encountered in previous borings).

Bedrock – Bedrock is described as hard, fresh to moderately weathered, granitic GNEISS, and is part of the Waterbury Gneiss formation. Bedrock encountered in borings is between EL. 109.0 to EL. 119.0. Elevations of the top of rock are in Table I and shown in the subsurface profiles. Outcrops are visible between Stations HA 25 + 255 and HA 25 + 325, 30 to 60 m west of the proposed bridge.

Weathered rock overlies sound rock in previous borings 4, 5 and 7. The thickness of weathered rock varies from 1.4 m to 3.1 m thick.

Groundwater Conditions

Groundwater was not indicated on logs from the previous subsurface investigation. Water was reported in recent boring S1,3-3 at EL. 113.7 immediately after drilling, and may represent drilling water trapped in the borehole. Other borings did not encounter water. 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 C.

GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Foundation Type

We recommend that the abutments, piers, and wingwalls be founded on spread footing foundations bearing on undisturbed dense glaciofluvial deposits, 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 an ultimate bearing pressure of 2500 kPa at a point located a distance of B/3 from the toe, where B is the footing width. Design footings that bear entirely on rock for an ultimate capacity of 4000 kPa. The resultant should be within the middle third. The resistance factor should be 0.45.

- 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 protect soil bearing surfaces from disturbance, and to level rock surfaces, compensate for overbreak and reduce lateral pressures.

- 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 is El 113.2. Borings S1, 3-7 and S1, 3-8 indicate bedrock is between EL. 116.1 and EL. 118.0, 2.9 to 4.8 m above abutment subgrade level. Therefore, Abutment 1 will bear on rock. If possible, the bearing grade should be raised to reduce the amount of soil and rock excavation required.

Pier 1

The bearing elevation for Pier 1 is EL. 112.4. Borings S1,3-5, S1,3-6 and 7 indicate bedrock is between EL. 114.0 and EL. 118.5, 1.6 to 6.1 m below the bedrock surface. Therefore, Pier 1 will bear on rock.

Pier 2

The bearing elevation for Pier 2 is EL. 112.5. Borings S1, 3-3, S1, 3-4, 3, 4 and 6 indicate the bedrock surface is between EL. 109.4 and EL. 115.8. Therefore, Pier 2 will bear on both soil and rock.

Abutment 2

The bearing elevation for Abutment 2 is El 115.0. Borings S1, 3-1, S1, 3-2 and test pit 1 indicate bedrock is between EL. 112.9 and EL.119.0. Therefore, Abutment 2 will bear on both soil and rock.

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 that figure.

Seismic Design

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

Structure Backfill and Drainage

Previous 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 and compacted according to the requirements of Section 2.16, Pervious Structure Backfill.

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 glaciofluvial deposits. Based on the results of the sieve analyses in Appendix C, these soils do not meet gradation requirements for pervious structure backfill or granular fill. Excavated fill and glaciofluvial deposits will generally be suitable for embankment fill.

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.

Excavation and Temporary Lateral Support

Temporary excavations up to about 6.5 m high will be required to construct foundations for abutments. Temporary lateral support will be required to protect Hamilton Avenue and nearby utilities. Steel sheet piling will not be feasible due to the amount of boulders in the overburden. Soldier piles and lagging is feasible, although pre-excavation or rotary drilling will be required at some locations to penetrate boulders. Soil nail walls might also be feasible. However, vertical or near-vertical temporary slopes may not be stable in the coarse-grained site soils, and walls may need to be relatively flat, or construction procedures modified to compensate for the poor standup characteristics of site soils.

Excavations will be in soil and bedrock. Conventional heavy construction equipment appears practical for excavation of overburden soils. The bedrock is hard and will require controlled blasting for efficient 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 but should be confirmed during construction based on conditions at the time of excavation. Temporary cuts in bedrock may be near vertical.

Dewatering

The need for significant dewatering is not anticipated. Surface water should be diverted for excavations. If needed, dewatering may be accomplished using filtered sumps.

Bedrock Excavation

Rock excavation is anticipated at each substructure. Blasting will be required to excavate rock efficiently and in a cost-effective manner. Controlled blasting methods are recommended to maintain ground vibrations and air blast over pressures below allowable levels, control fly rock, and reduce overbreak below foundations and beyond the excavation perimeter. Airblast overpressures should be maintained below 100 Pa (0.014 psi) at the nearest building. Peak particle velocities should be maintained below the limits shown on Figure 5, Safe Levels of Blasting Vibrations.

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 Section
- Figure 3B – Pier 1 Section
- Figure 3C – Pier 2 Section
- Figure 3D – Abutment 2 Section
- Figure 4 – Recommended Lateral Loads on Unrestrained Abutments and Wingwalls
- Figure 5 –Safe Levels of Blasting Vibrations
- Appendix A – Recent Test Borings Logs
- Appendix B – Previous Explorations
- Appendix C – Results of Laboratory Testing

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TABLE I
SUMMARY OF SUBSURFACE DATA
BRIDGE NO. 04321, HAMILTON AVENUE OVER I-84
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	WEATHERED ROCK	DEPTH	ELEV.	DEPTH	ELEV.
Recent										
S1,3-1	119.44	6.40	1.00	2.15	--	--	3.15	116.29	--	--
S1,3-2	120.26	10.67	1.00	6.32	--	--	7.32	112.94	--	--
S1,3-3	115.25	9.10	0.91	1.38	--	--	2.29	112.96	1.55	113.70
S1,3-4	114.91	9.60	2.59	0.69	--	--	3.28	111.63	--	--
S1,3-5	121.89	10.06	0.30	3.51	--	--	3.81	118.08	--	--
S1,3-6	122.55	9.60	3.05	0.46	--	--	3.51	119.04	--	--
S1,3-7	125.25	13.11	1.52	7.62	--	--	9.14	116.11	--	--
S1,3-8	122.60	9.14	1.00	3.57	--	--	4.57	118.03	--	--
Previous										
1	122.3	3.6	1	2.3	--	--	3.3	119.0	--	--
2	120.2	8.0	0.2	5.4	--	--	5.6	114.6	--	--
3	121.0	7.6	--	5.2	--	--	5.2	115.8	--	--
4	121.0	12.2	1	1	6.5	3.1	11.6	109.4	--	--
5	121.2	9.7	--	6.6	--	1.5	8.1	113.1	--	--
6	121.5	11.0	2.8	2.8	3.4	--	9.0	112.5	--	--
7	122.4	9.8	0.6	2.4	4	1.4	8.4	114.0	--	--
8	122.2	12.2	1.4	1.2	7	--	10	112.2	--	--

NOTES:

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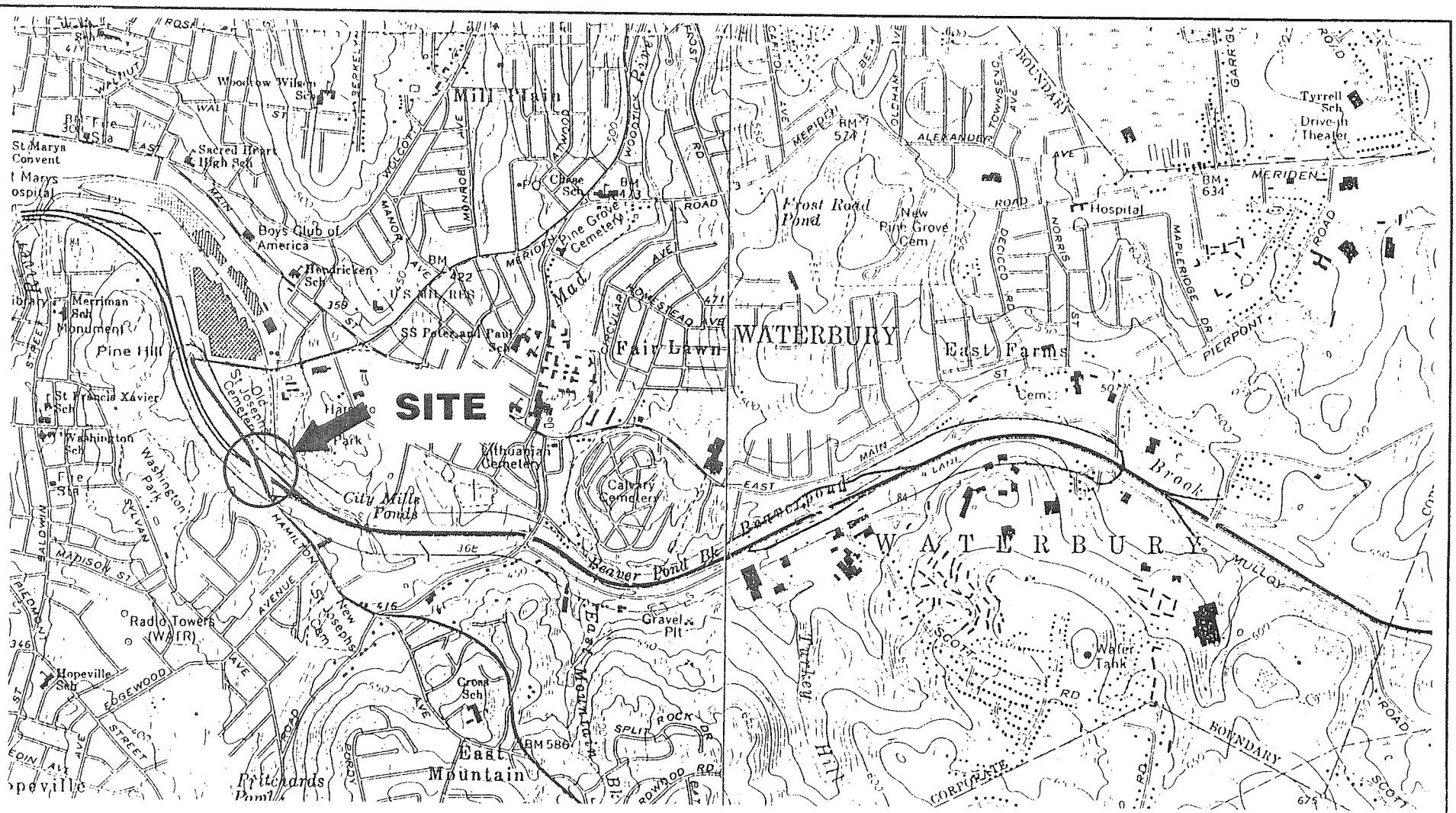
1. "--" indicates not encountered
2. Elevations are in meters and refer to the NGVD 29.
3. Refer to boring logs for detailed soil and rock descriptions.
4. Groundwater levels were measured shortly after drilling.

91313-100 A01



SITE COORDINATES: 41°32'30.96"N 73°01'24.11"W

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

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

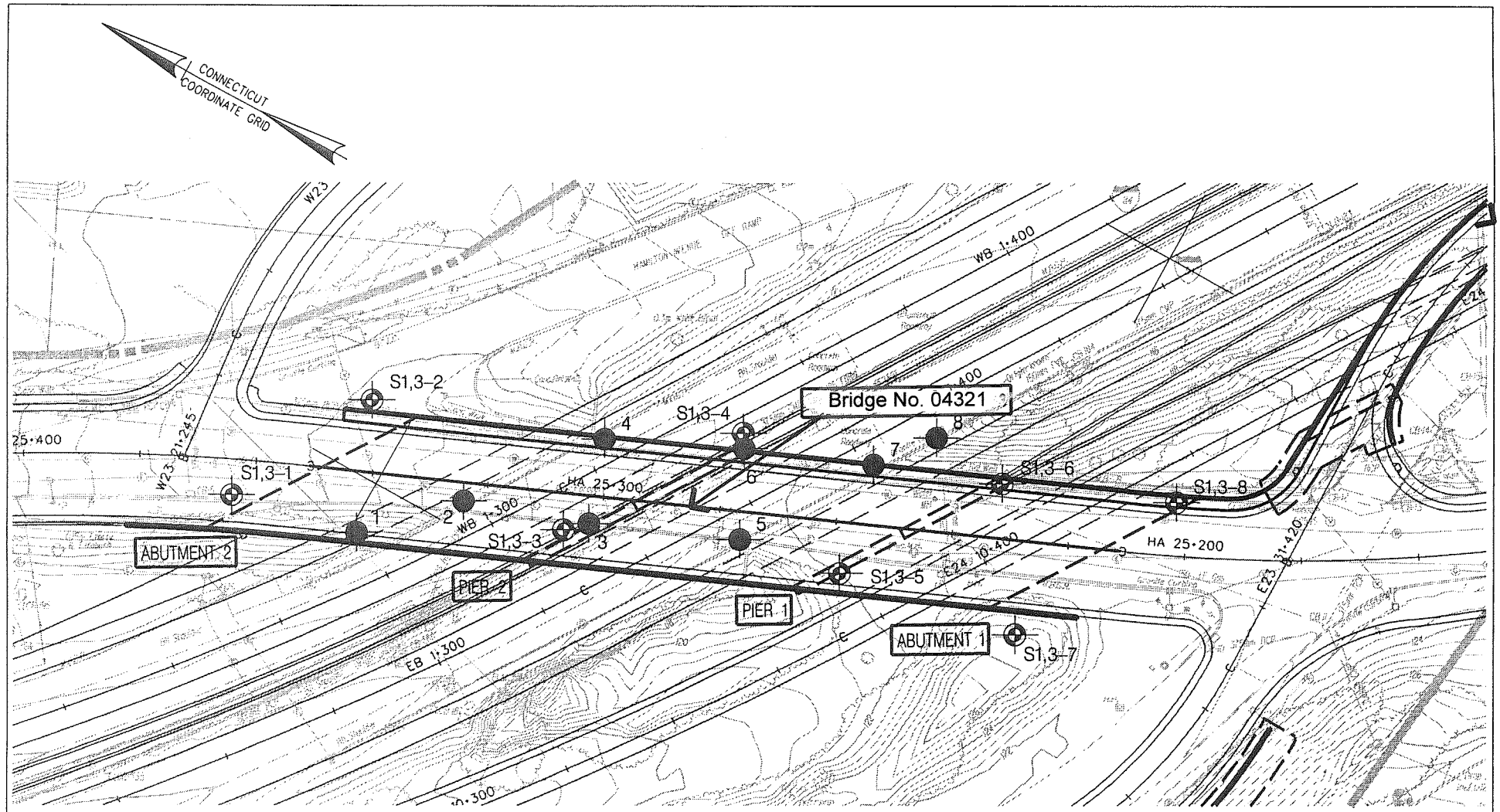
U.S. INTERSTATE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

PROJECT LOCUS
BRIDGE NO. 04321
HAMILTON AVENUE OVER I-84

SCALE: 1:24,000

JANUARY 2001

FIGURE 1



PLAN LEGEND

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

LOCATION OF PREVIOUS TEST BORING

NOTES:

1. BASE PLAN PROVIDED BY BERGER, LEHMAN ASSOCIATES. BORING LOCATIONS WERE SURVEYED BY A-I ENGINEERS.
2. ELEVATIONS ARE IN METERS, REFER TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
3. REFER TO THE TEXT AND APPENDICES.

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

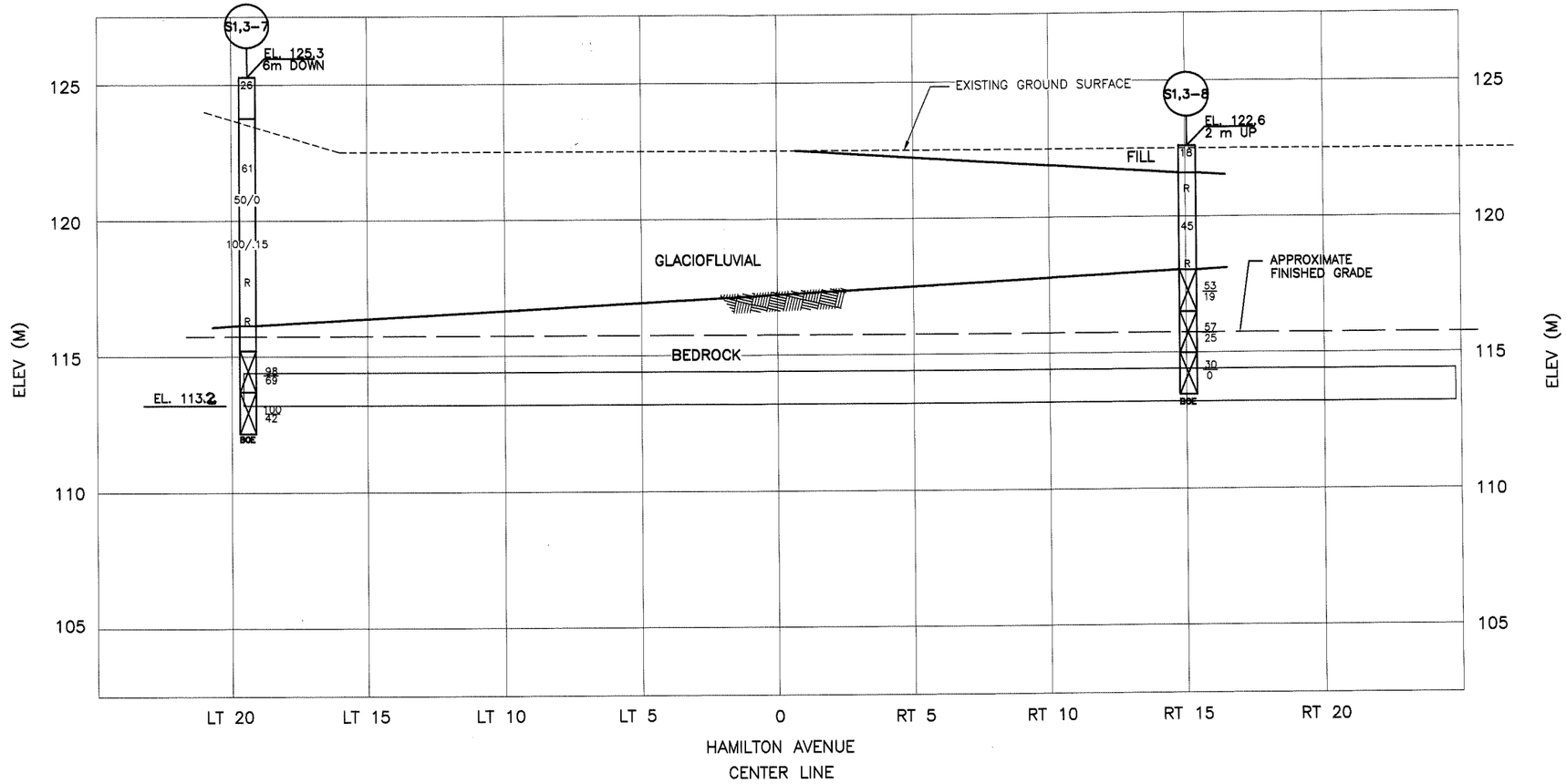
BRIDGE NO. 04321
HAMILTON AVENUE OVER I-84
SUBSURFACE EXPLORATION PLAN

SCALE: 1:1000

JANUARY 2001

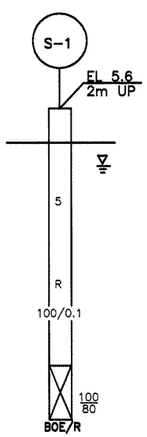
91313-100

FIGURE 2



ABUTMENT 1 AT SKEW
CENTER LINE STATION HA 25+211
(LOOKING NORTH)

LEGEND:



- EL 5.6 / 2m UP — APPROXIMATE GROUND SURFACE ELEVATION / OFFSET DISTANCE AND DIRECTION FROM BASELINE
- MAJOR STRATUM BOUNDARY
- WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING.
- 5 — LOCATION OF SAMPLE OBTAINED BY DRIVING A 50 mm O.D. SPLIT-SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 762 mm. NUMBER INDICATES STANDARD PENETRATION RESISTANCE "N" VALUE, IN BLOWS PER 0.30 m.
- R — INDICATES SPLIT SPOON REFUSAL
- 100/0.1 — SAMPLER DRIVEN <0.30 m, FRACTION INDICATES: NUMBER BLOWS TO DRIVE SAMPLER / DEPTH SAMPLER WAS DRIVEN (m)
- 100/80 — CORE SAMPLE, 50 mm DIA., FRACTION INDICATES: % CORE RECOVERY / ROCK QUALITY DESIGNATION (%RQD)
- BOE/R — BOTTOM OF EXPLORATION/REFUSAL

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 AND B 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

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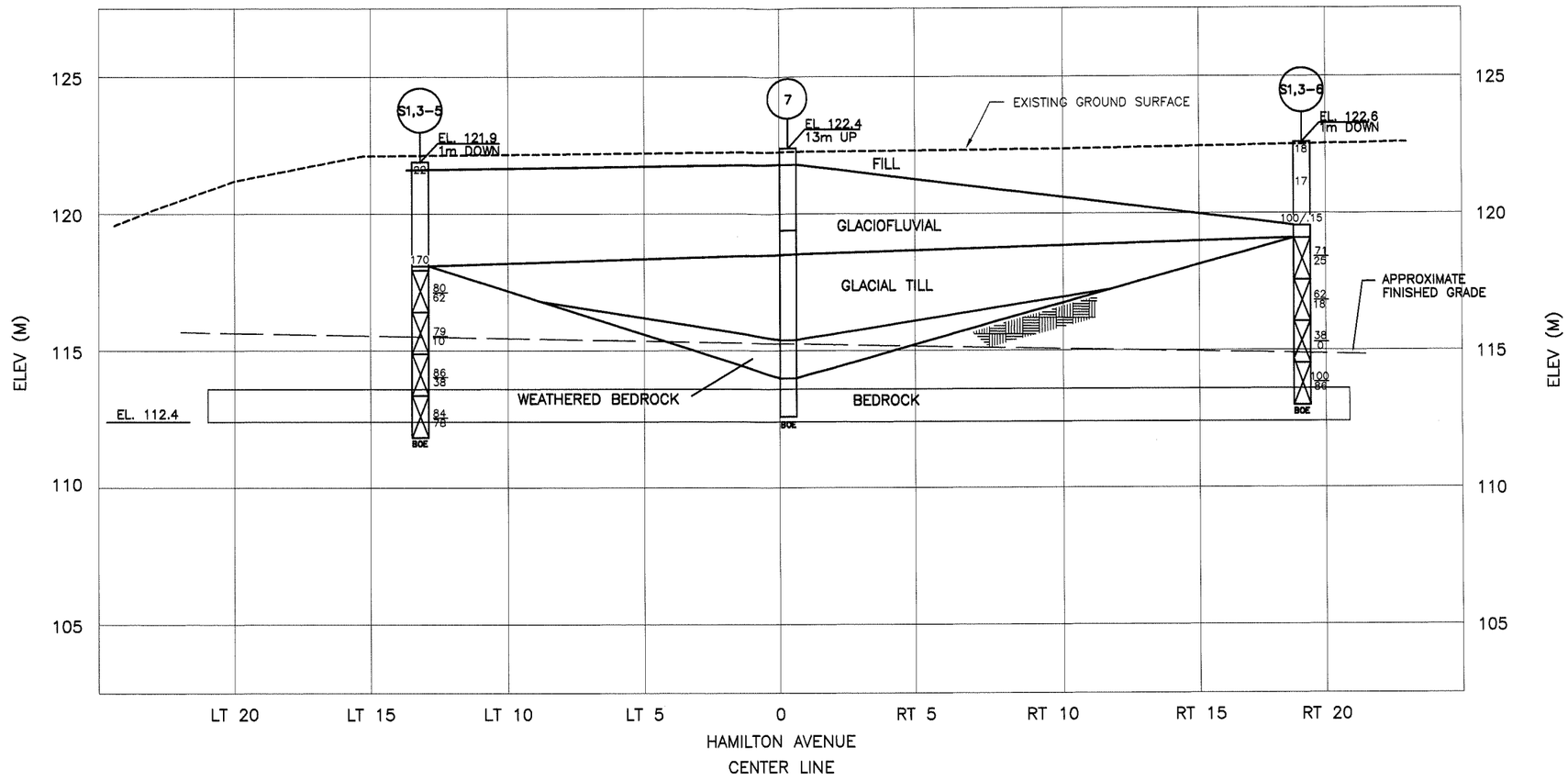
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

ABUTMENT 1 SECTION
BRIDGE NO. 04321
HAMILTON AVENUE OVER I-84

SCALE: AS SHOWN
JANUARY 2001

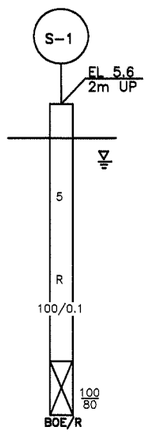
91313-100 B02

FIGURE 3A



PIER 1 AT SKEW
CENTER LINE STATION HA 25+247.5
(LOOKING NORTH)

LEGEND:



- EL. 5.6 / 2m UP — APPROXIMATE GROUND SURFACE ELEVATION OFFSET DISTANCE AND DIRECTION FROM BASELINE
- MAJOR STRATUM BOUNDARY
- WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING.
- 5 — LOCATION OF SAMPLE OBTAINED BY DRIVING A 50 mm O.D. SPLIT-SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 762 mm. NUMBER INDICATES STANDARD PENETRATION RESISTANCE "N" VALUE, IN BLOWS PER 0.30 m.
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- 100/80 — CORE SAMPLE, 50 mm DIA., FRACTION INDICATES: % CORE RECOVERY / ROCK QUALITY DESIGNATION (%RQD)
- BOE/R — BOTTOM OF EXPLORATION/REFUSAL

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0 5 10
SCALE IN METERS
1:200

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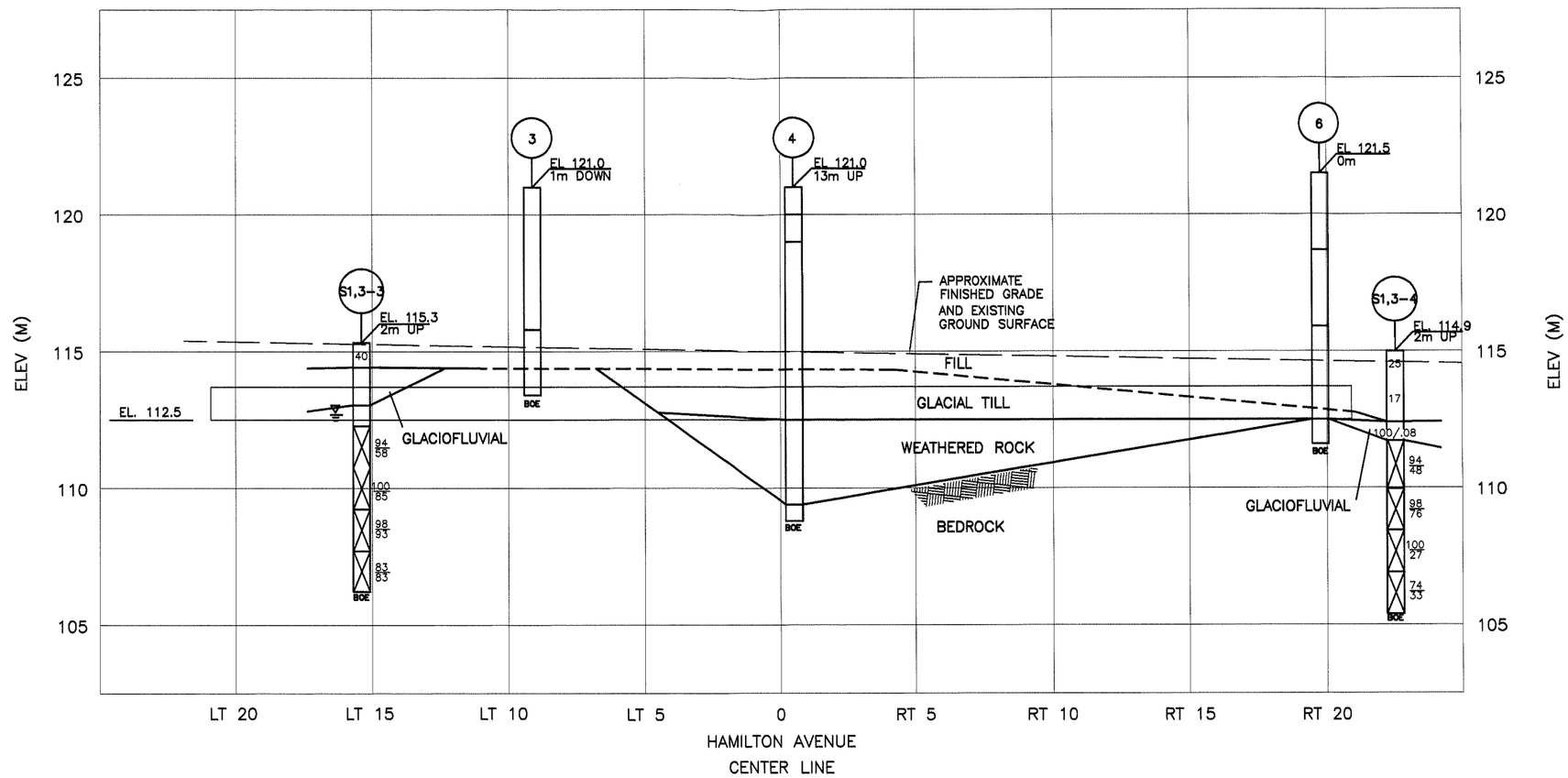
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

PIER 1 SECTION
BRIDGE NO. 04321
HAMILTON AVENUE OVER I-84

SCALE: AS SHOWN
JANUARY 2001

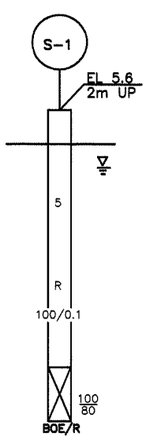
91313-100 B02

FIGURE 3B



PIER 2 AT SKEW
CENTER LINE STATION HA 25+294
(LOOKING NORTH)

LEGEND:



EL 5.6 / 2m UP — APPROXIMATE GROUND SURFACE ELEVATION OFFSET DISTANCE AND DIRECTION FROM BASELINE

MAJOR STRATUM BOUNDARY

WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING.

5 — LOCATION OF SAMPLE OBTAINED BY DRIVING A 50 mm O.D. SPLIT-SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 762 mm. NUMBER INDICATES STANDARD PENETRATION RESISTANCE "N" VALUE, IN BLOWS PER 0.30 m.

R — INDICATES SPLIT SPOON REFUSAL

100/0.1 — SAMPLER DRIVEN <0.30 m, FRACTION INDICATES: NUMBER BLOWS TO DRIVE SAMPLER / DEPTH SAMPLER WAS DRIVEN (m)

100/80 — CORE SAMPLE, 50 mm DIA., FRACTION INDICATES: % CORE RECOVERY / ROCK QUALITY DESIGNATION (%RQD)

BOE/R — BOTTOM OF EXPLORATION/REFUSAL

NOTES:

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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.
5. SOME SOIL AND ROCK AROUND PREVIOUS EXPLORATIONS MAY HAVE BEEN EXCAVATED DURING CONSTRUCTION OF THE EXISTING BRIDGE.

0 5 10
SCALE IN METERS
1:200

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

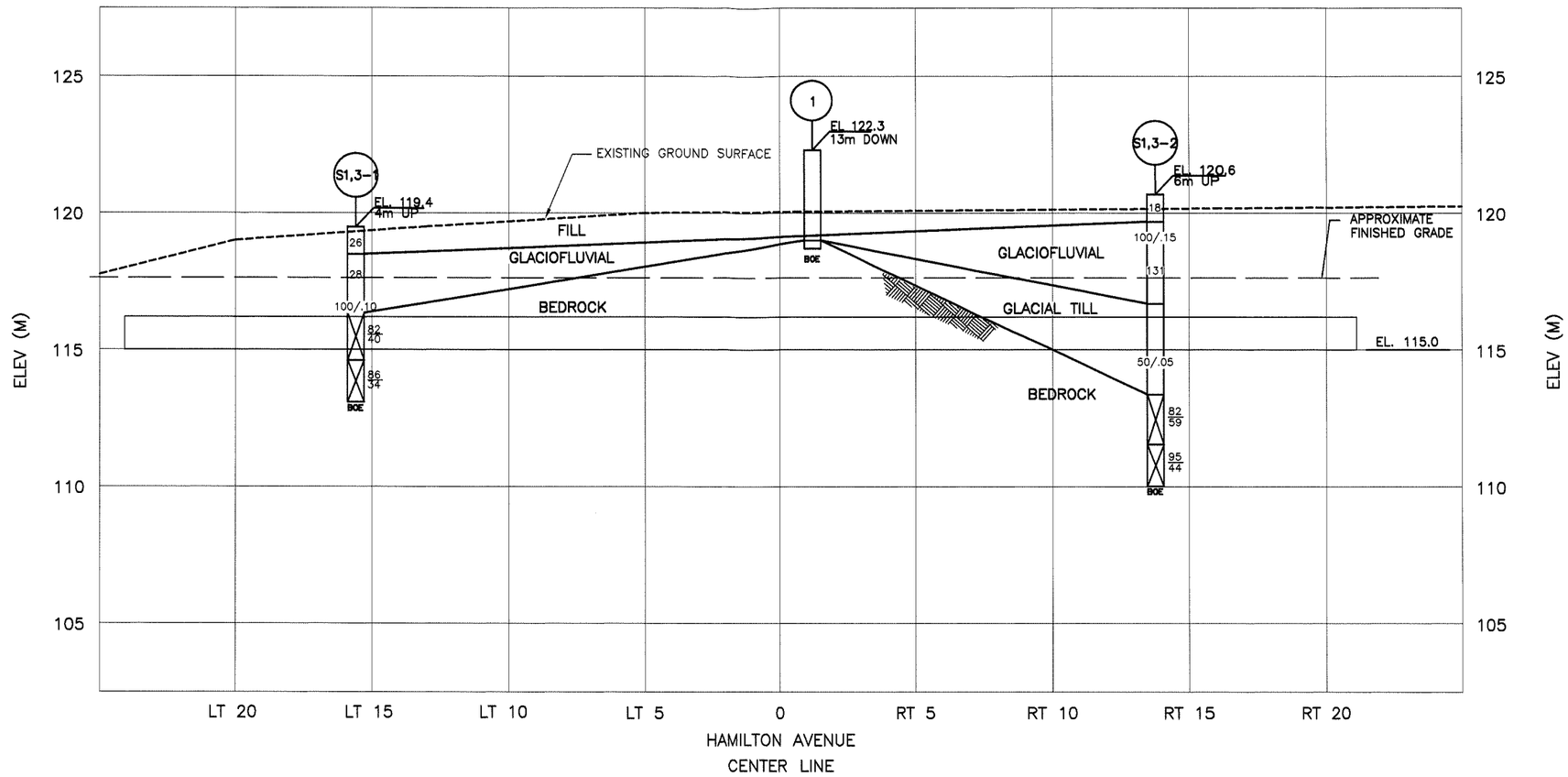
U.S. INTERSTATE ROUTE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

PIER 2 SECTION
BRIDGE NO. 04321
HAMILTON AVENUE OVER I-84

SCALE: AS SHOWN
JANUARY 2001

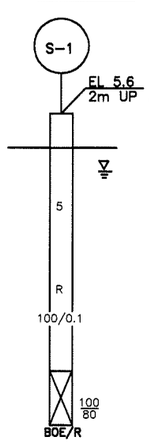
91313-100 B02

FIGURE 3C



ABUTMENT 2 AT SKEW
CENTER LINE STATION HA 25+352
(LOOKING NORTH)

LEGEND:



- EL 5.6 / 2m UP — APPROXIMATE GROUND SURFACE ELEVATION OFFSET DISTANCE AND DIRECTION FROM BASELINE
- MAJOR STRATUM BOUNDARY
- WATER LEVEL NOTED DURING OR SHORTLY AFTER DRILLING.
- 5 — LOCATION OF SAMPLE OBTAINED BY DRIVING A 50 mm O.D. SPLIT-SPOON SAMPLER WITH A 63.5 kg WEIGHT FALLING 762 mm. NUMBER INDICATES STANDARD PENETRATION RESISTANCE "N" VALUE, IN BLOWS PER 0.30 m.
- R — INDICATES SPLIT SPOON REFUSAL
- 100/0.1 — SAMPLER DRIVEN <0.30 m, FRACTION INDICATES: NUMBER BLOWS TO DRIVE SAMPLER / DEPTH SAMPLER WAS DRIVEN (m)
- 100/80 — CORE SAMPLE, 50 mm DIA., FRACTION INDICATES: % CORE RECOVERY / ROCK QUALITY DESIGNATION (%RQD)
- BOE/R — BOTTOM OF EXPLORATION/REFUSAL

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 AND B 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

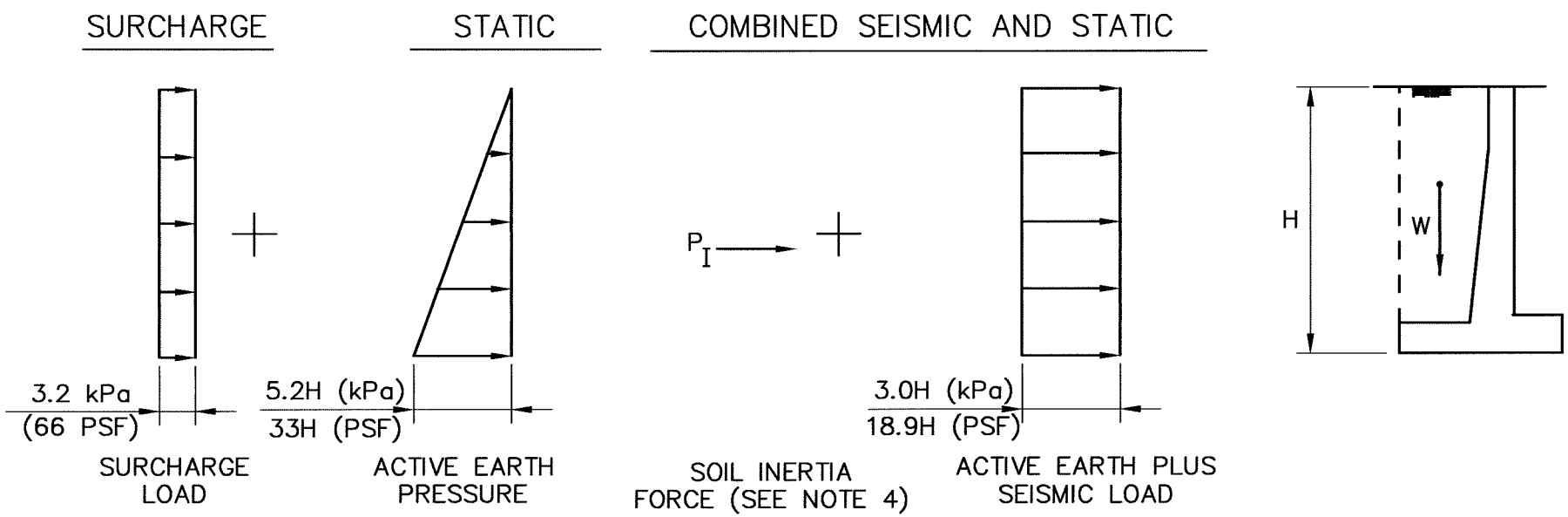
ABUTMENT 2 SECTION
BRIDGE NO. 04321
HAMILTON AVENUE OVER I-84

SCALE: AS SHOWN
JANUARY 2001

91313-100 B02

FIGURE 3D

91313-100 A05



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. RETAINING WALLS WHICH ARE LESS THAN 7.6 m HIGH MAY OR MAY NOT REQUIRE SEISMIC DESIGN.
6. SLIDING:
   COEFF. OF FRICTION BETWEEN FOOTING AND BASE = 0.60
   RESISTANCE FACTOR = 0.85
7. STABILITY:
   RESISTANCE FACTOR = 0.65
8. IGNORE PASSIVE RESISTANCE IN FRONT OF FOOTING.

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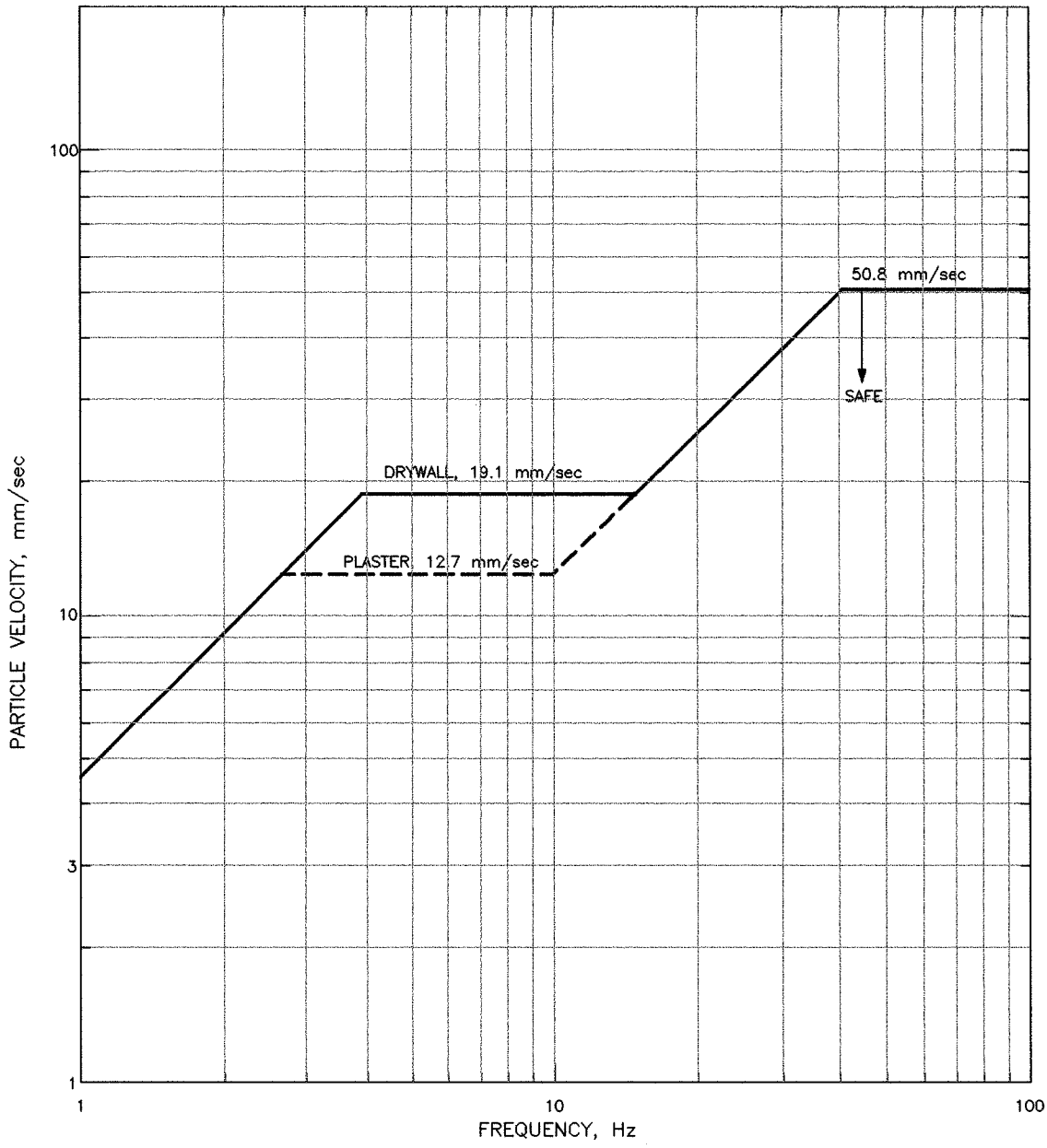
U.S. ROUTE INTERSTATE 84 RECONSTRUCTION
STATE PROJECT NO. 151-273
WATERBURY, CONNECTICUT

RECOMMENDED LATERAL LOADS ON UNRESTRAINED ABUTMENTS AND WINGWALLS BRIDGE NO. 04321

NOT TO SCALE

REVISED APRIL 2001
JANUARY 2001

FIGURE 4



REFERENCE:
BUREAU OF MINES REPORT OF INVESTIGATION 8507, "STRUCTURE RESPONSE AND DAMAGE PRODUCED BY GROUND VIBRATION FROM SURFACE MINING BLASTING", 1980.

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

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

SAFE LEVELS OF BLASTING VIBRATIONS

SCALE: AS SHOWN

JANUARY 2001

91313-100 A07

FIGURE 5

APPENDIX A

Recent Test Borings Logs

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-1**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231220.70**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **281986.33**
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: **119.44**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **13 December 2000**	Utilized		X						X					X
Date Finished: **13 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
@ **NE** m after _____ days	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ m after _____ days	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.)
		0.30-0.91	1	0.61	0.30	D	7	15	11	19	0.28 118.44	Asphalt and Road Base Medium dense dark brown coarse to fine SAND, little fine gravel, silt -FILL-
		1.52-2.13	2	0.61	0.41	D	11	13	15	8	1.00	Medium dense dark brown coarse to fine GRAVEL, some coarse to fine sand, trace silt
		3.05-3.15 3.35-4.87	3 1	0.10 1.52	0.10 1.25	D C	100/10	[RQD = 40%]			116.29 3.15	Very dense brown fine SAND, some gravel, little coarse sand, silt -GLACIOFLUVIAL DEPOSITS-
5		4.88-6.40	2	1.52	1.31	C		[RQD = 34%]			113.04 6.40	C1- Very hard, fresh, gray and white coarse to fine grained BIOTITE ORTHOCLASE QUARTZ GNEISS. Foliation is moderately dipping, extremely close, Joints are low to high angle, rough, undulating, fresh to discolored, open. Note: Healed high and low angle joints. Rock is highly fractured in several places C2- Very hard, fresh, to slightly weathered, gray and white coarse to fine grained BIOTITE ORTHOCLASE QUARTZ GNEISS. Foliation is moderately dipping, extremely close, Joints appear to be conjugate, moderately dipping to low angle, very close to close, rough, undulating, fresh to discolored, open. -BEDROCK- Bottom of Exploration at 6.40 m.
10												
15												

Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**3.1**	**3.35** m	**3.05** m
			No. of Samples	
			3D, 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 SS=Split Spoon
PROPORTIONS USED: Trace=1-10% Little=10-20%, Some=20-35%, And=35-50%

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

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-2**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231207.63**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282012.36**
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: **120.26**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **13 December 2000**	Utilized		X						X					X
Date Finished: **13 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
@ **NE** m after ____ days	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ ____ m after ____ days	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	0.45	D	8	11	7	6	0.15	Asphalt
											119.26	Medium dense gray brown coarse to fine SAND, and medium to fine gravel
											1.00	-FILL-
		1.52-1.82	2	0.30	0.30	D	29	100				Very dense gray brown coarse to fine SAND, and coarse to fine gravel
		3.05-3.50	3	0.45	0.30	D	19	31	100			Same as D2
5												Cored from 4.57 m. to 5.33 m. Boulders R= .61 m.
		6.10-6.15	4	0.05	0.00	D	50/.05					No recovery
											112.94	-GLACIOFLUVIAL DEPOSITS-
		7.62-9.14	1	1.52	1.25	C		[RQD = 59%]			7.32	C1- Very hard, fresh, gray, pink, and white coarse to fine grained granitic GNEISS. Foliation is moderately dipping, extremely close. Joints are low angle, to moderately dipping, very close to close, rough, planar to undulating, discolored, open to tight.
10		9.14-10.66	2	1.52	1.45	C		[RQD = 44%]				C2- Same as C1, except with coarse to fine grained pegmatite, discolored to disintegrated, open. Fractured zone from 10.15 m. to 10.33 m.
											109.59	
											10.67	-BEDROCK-
												Bottom of Exploration at 10.67 m.
15												

Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**7.3**	**3.35** m	**3.05** m
			No. of Samples	
			4D, 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 SS=Split Spoon
PROPORTIONS USED: Trace=1-10% Little=10-20%, Some=20-35%, And=35-50%

Hole No. **S1.3-2**
Sheet **1** of **1**

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-3**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231167.97**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282008.80**
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: **115.25**	Utilized		X						X					X
Date Started: **5 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Date Finished: **5 December 2000**	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
Groundwater Observations	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ **1.55** m after **0** days	Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	
@ m after days														

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	11	17	23	29	0.15	Asphalt
											114.34	Dense brown coarse to fine SAND, some coarse to fine gravel, trace silt, cobble at .91 m.
											0.91	-FILL-
												Boulders from 1.37 m. to 1.83 m. Possible top of rock at 2.29 m.
											112.96	-GLACIOFLUVIAL DEPOSITS-
											2.29	
		3.05-4.57	1	1.52	1.43	C		[RQD = 58%]				Very hard, fresh, gray to pink and white, coarse to fine grained GRANITIC GNEISS. Foliation is low angle extremely close. Joints are low angle to vertical, close to moderate, rough, fresh to discolored, open.
5		4.57-6.09	2	1.52	1.52	C		[RQD = 85%]				Same as C1, except fresh to slightly weathered, joints are very close to moderate, low angle
		6.10-7.62	3	1.52	1.42	C		[RQD = 93%]				Same as C1, except joints are low angle moderate
		7.62-9.14	4	1.52	1.26	C		[RQD = 83%]				Very hard, fresh, dark gray to white, pink, coarse to fine grained GRANITIC GNEISS, foliation is low angle, extremely close. Joints are low angle, moderate, rough, fresh, open.
											106.15	-BEDROCK-
10											9.10	Bottom of Exploration at 9.10 m.
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**3.1**	**2.29** m	**6.08** m
			No. of Samples	
			1D, 4C	

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

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

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-4**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231149.15**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282038.25**
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: **114.91**														
Date Started: **5 December 2000**	Utilized		X						X					X
Date Finished:	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
@ **NE** m after ____ days	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ ____ m after ____ days	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.)
		0.30-0.91	1	0.61	0.20	D	12	14	11	16	0.10	Asphalt Medium dense brown and gray coarse to fine SAND, little medium to fine gravel, trace silt
		1.52-2.13	2	0.61	0.15	D	19	9	8	16	112.32	Medium dense brown little coarse to fine SAND and GRAVEL, trace silt -FILL-
		3.05-3.28	3	0.23	0.10	D	75	100/.08			2.59 111.63	Very dense gray brown GRAVEL, little coarse to fine sand, trace silt
		3.51-5.03	1	1.52	1.43	C		[RQD = 48%]			3.28	-GLACIOFLUVIAL DEPOSITS- C1- Hard, fresh, gray and white, medium to fine grained GNEISS. Foliation is vertical extremely close. Joints are low angle to vertical close to moderate, rough, planar to undulating to planar, discolored, open to tight.
5												
		5.03-6.55	2	1.52	1.49	C		[RQD = 76%]				C2- Same as C1, except joints are very close to moderate.
		6.55-8.07	3	1.52	1.52	C		[RQD = 27%]				C3- Hard, fresh to slightly weathered, gray, coarse to fine grained GNEISS. Foliation is vertical extremely close. Joints are low angle, to high angle, very close to close, rough, planar to undulating to planar, discolored, open to tight.
		8.08-9.60	4	1.52	1.13	C		[RQD = 33%]			105.31 9.60	C4- Hard, fresh, gray and white, coarse to fine grained GNEISS. Foliation is vertical extremely close. Joints are low angle, to moderate dipping, very close close, rough, fresh to discolored, open. Bottom of Exploration at 9.60 m.
10												
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**3.5**	**3.51** m	**6.08** m
			No. of Samples	
			3D, 4C	

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

Hole No. **S1.3-4**
Sheet **1** of **1**

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-5**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231123.01**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282025.14**
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: **121.89**	Utilized		X						X					X
Date Started: **29 November 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Date Finished: **30 November 2000**	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
Groundwater Observations	Hammer (kg)	136	136	136	136			Bit	63.5		Type	X	Diamond	
@ ____ m after ____ days	Fall (m)	0.6	0.6	0.6	0.6				0.76		of bit		Carbide	
@ ____ m after ____ days														

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	0.30	D	5	7	15	14	121.59 0.30	Medium dense, brown coarse to fine SAND, some silt, little fine gravel -FILL-
												Cored through boulder 1.07 m. to 1.83 m. Spun casing through boulder to 2.74 m. Cored boulder 2.74 m. to 3.35 m.
		3.35-3.81	2	0.46	0.25	D	40	70	100		118.08 3.81	Dense brown coarse to fine SAND, some coarse to fine gravel, trace silt, (weathered rock) rock lodged in spoon shoe -GLACIOFLUVIAL DEPOSITS-
		3.96-5.48	1	1.52	1.22	C		[RQD = 62%]				C1: Very hard, fresh gray to pink and white, coarse to fine grained granitic GNEISS, foliation is moderately, dipping, extremely to very close, Joints sets appear conjugate, moderately dipping to high angle, close to moderate, rough, undulating, discolored, open.
5												
		5.49-7.01	2	1.52	1.20	C		[RQD = 10%]				C2: Rock is highly fractured from 5.49 m. to 6.49 m. (no structure) from 6.49 m. to 7.01 m. Hard, fresh, gray white, medium to fine grained BIOTITE GNEISS. Foliation is low angle extremely close. Joints are moderately dipping to low angle very close, rough, planar discolored to fresh, tight.
		7.01-8.53	3	1.52	1.31	C		[RQD = 38%]				
		8.53-10.05	4	1.52	1.27	C		[RQD = 78%]				C3: Hard, fresh gray to slightly weathered, white medium to fine grained BIOTITE GNEISS. Foliation is moderately, dipping, extremely close. Joints are high angle to moderate dipping, close, rough, planar to undulating, discolored, open.
10											111.83 10.06	
												Note: Fractures healed with calcite. Calcite on joint surfaces C4: Same as C3, except fresh, coarse to fine grained. Joints are low angle to moderately dipping, moderate to wide -BEDROCK- Bottom of Exploration at 10.06 m.
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**4.6**	**3.96** m	**6.10** m
			No. of Samples	
			2D, 4C	

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

Hole No. **S1.3-5**
Sheet **1** of **1**

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-6**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231106.08**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282052.24**
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: **122.55**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **1 December 2000**	Utilized		X						X					X
Date Finished:	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
@ ____ m after ____ days	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ ____ m after ____ days	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	0.13	D	7	9	9	16	0.15	CONCRETE Medium dense gray coarse to fine SAND, some silt, little medium to fine gravel
		1.52-2.13	2	0.61	0.25	D	5	6	11	19		Medium dense brown coarse to fine SAND, some coarse to fine gravel, little silt
											119.50	-FILL-
		3.05-3.35	3	0.30	0.18	D	23	100			3.05	Very dense brown coarse to fine GRAVEL, little coarse to fine sand, silt
		3.51-5.03	1	1.52	1.08	C		[RQD = 25%]			119.04 3.51	-GLACIOFLUVIAL DEPOSITS-
5												C1: Very hard, fresh to moderately weathered, gray to pink and white, coarse to fine grained granitic GNEISS. Foliation is high angle, extremely close. Joints are high angle to vertical, spacing is very close to moderate, rough, planar, discolored, open. Highly fractured from 4.06 m. to 5.03 m.
		5.03-6.55	2	1.52	0.94	C		[RQD = 94%]				
		6.55-8.07	3	1.52	0.57	C		[RQD = 0%]				C2: Hard, slightly to moderately weathered, gray white, coarse to fine grained GNEISS. Foliation is high angle, extremely close. Joints are moderately dipping to low angle, close to moderate spacing, rough, undulating, discolored, open highly fractured throughout entire core run.
		8.08-9.60	4	1.52	1.52	C		[RQD = 86%]				C3: Same as C2
10											112.95 9.60	C4: Same as C3, except Joints are low angle to moderately dipping, moderate, tight -BEDROCK- Bottom of Exploration at 9.60 m.
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**3.5**	**3.51** m	**6.10** m
			No. of Samples	
			3D, 4C	

NOTES: **Truck mounted Mobile Drill B-53 with wire winch to drive safety hammer. Borehole backfilled with drill cuttings upon completion. Losing water while coring C1 and C2.**

SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test SS=Split Spoon
PROPORTIONS USED: Trace=1-10% Little=10-20%, Some=20-35%, And=35-50%

Hole No. **S1.3-6**
Sheet **1** of **1**

E. Del Priore	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-7**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231091.50**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282030.50**
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: **125.25**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **2 December 2000**	Utilized		X						X					X
Date Finished: **2 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
@ **NO** m after _____ days	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ _____ m after _____ days	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	0.45	D	10	12	14	18		Medium dense dark brown coarse to fine SAND, little fine gravel, silt
											123.73 / 1.52	Cored from 1.52 m. to 3.05 m. boulders .37 cm. rec. -FILL-
		3.05-3.66	2	0.61	0.30	D	13	9	52	100		Very dense gray brown coarse to fine GRAVEL, some coarse to fine sand, trace silt Boulders 4.57 m. to 5.03 m.
5		4.57-4.57	3	0.00	0.00	D	50/0					
		6.10-6.40	4	0.30	0.15	D	41	100				Very dense brown coarse to fine SAND and GRAVEL
		7.62-7.77	5	0.15	0.08	D	100					Very dense brown coarse to fine SAND, some gravel trace silt -GLACIOFLUVIAL DEPOSITS-
10		9.14-9.14	6	0.00	0.00	D	50/0				116.11 / 9.14	C1- Hard, fresh to slightly weathered, gray and white, coarse to fine grained BIOTITE GNEISS. Foliation is high angle, extremely close. Joints are moderate, rough, planar to undulating to planar, discolored to decomposed, open.
		10.06-11.58	1	1.52	1.49	C		[RQD = 69%]				
		11.58-13.10	2	1.52	1.52	C		[RQD = 42%]				C2- Same as C1, except foliation is extremely close to indistinct. Joints are moderately, dipping to vertical, extremely close to moderate. -BEDROCK-
											112.14 / 13.11	
15												

Casing Size	From	To	Meters of Earth	Rock
NW	**0.0**	**9.1**	**10.06** m	**3.05** m
			No. of Samples	
			6D, 2C	

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

SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test SS=Split Spoon
PROPORTIONS USED: Trace=1-10% Little=10-20%, Some=20-35%, And=35-50%

Hole No. **S1.3-7**
Sheet **1** of **1**

J. Muccino	SM - 001 - M REV. 1/94 BORING REPORT	Hole No. **S1.3-8**
DRILLER	STATE OF CONNECTICUT	Line & Station
P. Carrera	DEPARTMENT OF TRANSPORTATION	Offset
INSPECTOR	TOWN: **Waterbury, Connecticut**	N. Coordinate **231078.47**
Haley & Aldrich, Inc.	PROJECT NAME: **Reconstruction of I-84**	E. Coordinate **282063.85**
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: **122.60**		Casing				Auger		Mud	Sampler		Core Barrel			
Date Started: **1 December 2000**	Utilized		X						X					X
Date Finished: **1 December 2000**	Type	BW	NW	HW	Pipe	Solid	Hollow		SS		B(st)	B(dt)	NX(st)	NX(dt)
Groundwater Observations	Size I.D. (mm)	60	76	100	64				35	X	35	35	55	55
@ **NE** m after ____ days	Hammer (kg)	136	136	136	136			Bit	63.5		Type		Diamond	
@ ____ m after ____ days	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.)
											122.30	ASPHALT
		0.30-0.91	1	0.61	0.30	D	5	8	10	16	0.30	Medium dense black to brown fine SAND, and silt, little coarse sand, trace fine gravel
											121.60	
											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
												-GLACIOFLUVIAL DEPOSITS-
											118.03	
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	
10											9.14	-BEDROCK-
												Bottom of Exploration at 9.14 m.
15												

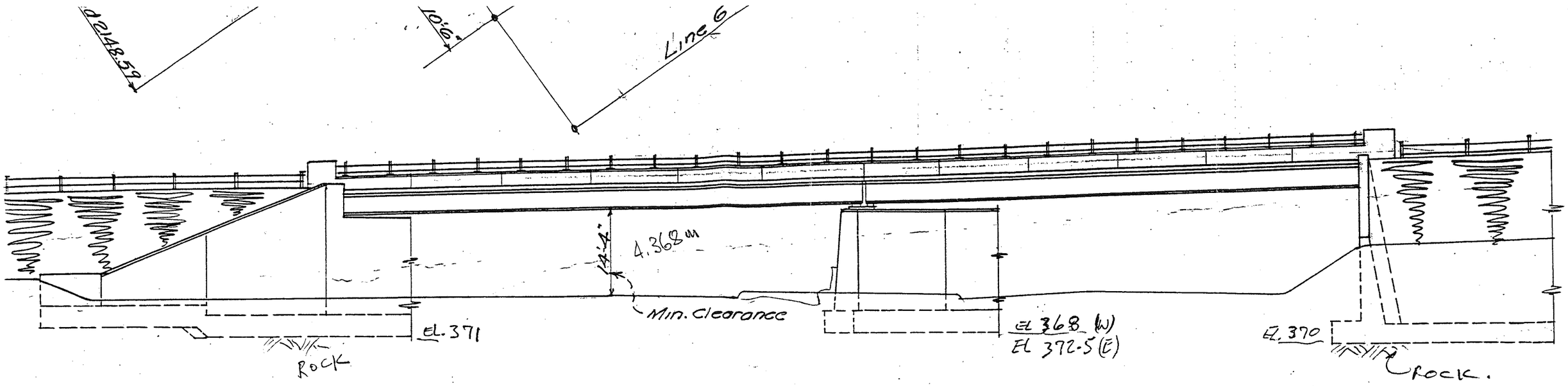
Casing			Meters of	
Size	From	To	Earth	Rock
NW	**0.0**	**4.6**	**4.57** m	**4.56** m
			No. of Samples	
			4D, 3C	

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

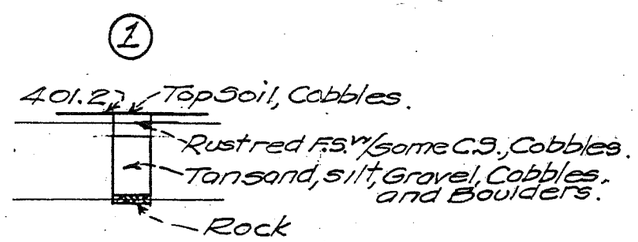
SAMPLE TYPE CODING: D=Driven C=Core A=Auger UP=Undisturbed Piston V=Vane Test SS=Split Spoon
PROPORTIONS USED: Trace=1-10% Little=10-20%, Some=20-35%, And=35-50%

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

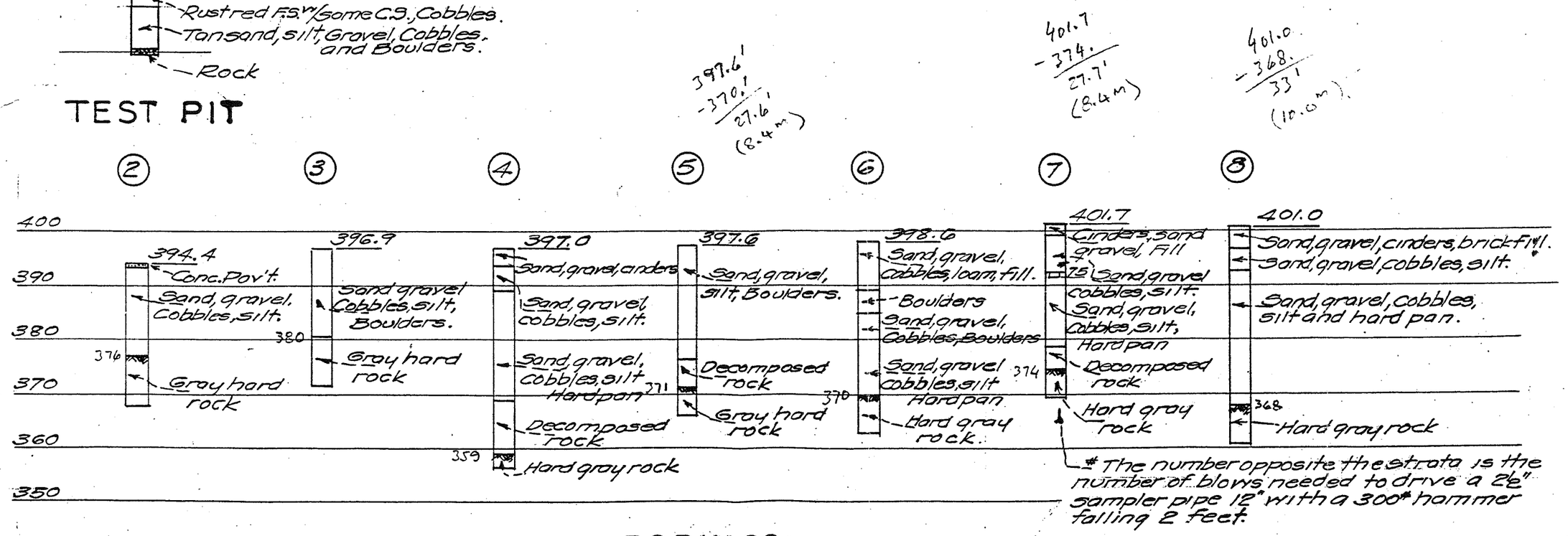
APPENDIX B
Previous Explorations



ELEVATION
Scale 1/16" - 1'0"



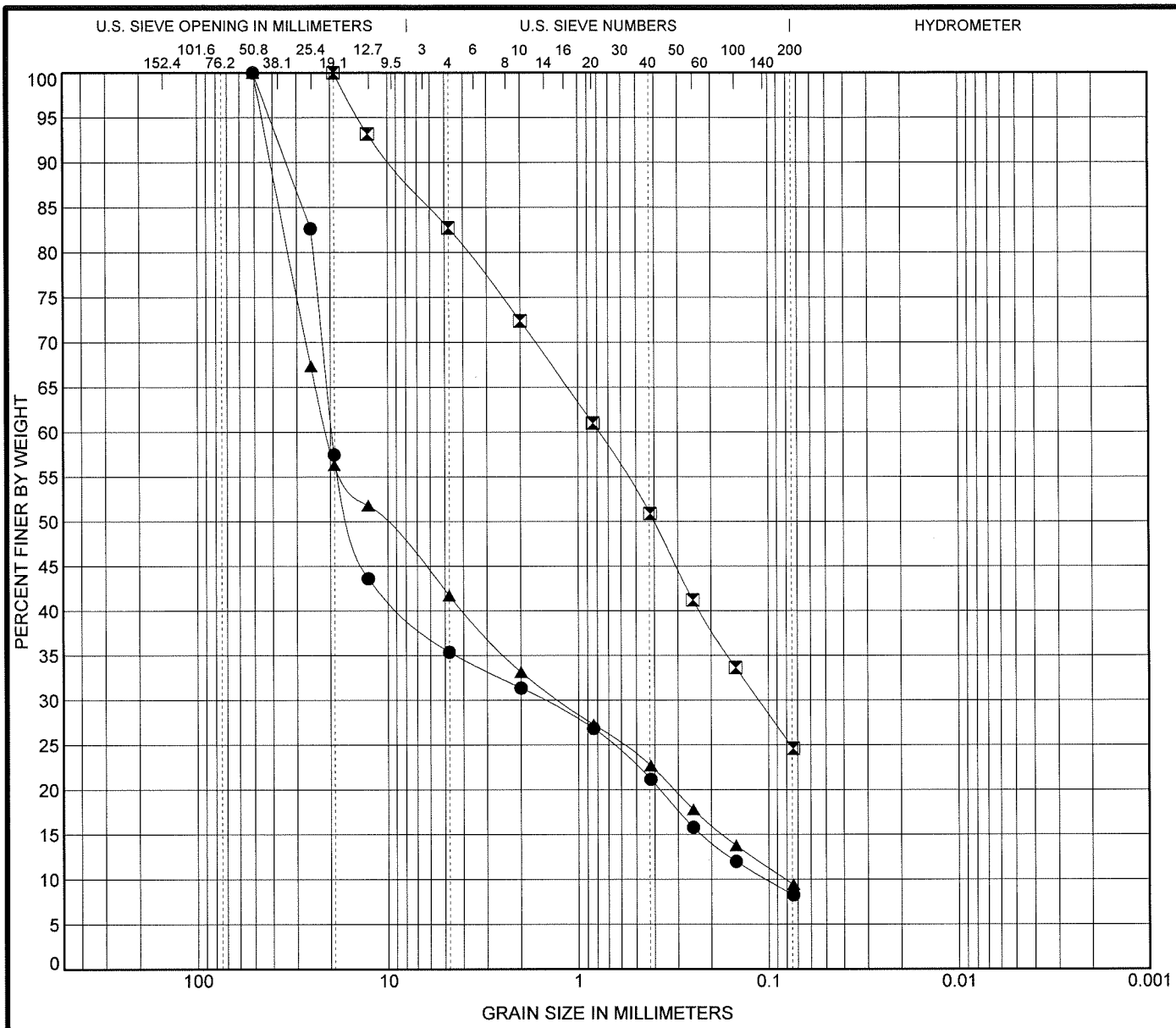
TEST PIT



* The number opposite the strata is the number of blows needed to drive a 2½" sampler pipe 12" with a 300# hammer falling 2 feet.

BORINGS

APPENDIX C
Results of Laboratory Testing



	COBBLES	% GRAVEL			% SAND		% FINES	
		COARSE	MEDIUM	FINE	COARSE	FINE	% SILT	% CLAY
●	0.0	17.3	41.5	9.8	10.2	12.9	8.3	
⊠	0.0	0.0	9.9	17.7	21.5	26.3	24.6	
▲	0.0	32.6	18.5	15.7	10.5	13.2	9.5	

	Expl. No.	Sample No.	Depth (m)	LL	PL	PI	Water Content (%)	Cc	Cu
●	S1 3-1	D2	1.52-2.13				5.0	1.19	192.62
⊠	S1 3-5	D1	0-0.61				17.1		
▲	S1 3-7	D2	3.05-3.66				4.4	0.93	260.05

	Sample Description
●	**Coarse to fine GRAVEL, some coarse to fine sand, trace silt - GLACIOFLUVIAL**
⊠	**Coarse to fine SAND, some silt, little fine gravel - FILL**
▲	**Coarse to fine GRAVEL, some coarse to fine sand, trace silt - GLACIOFLUVIAL**

Remarks:

HALEY & ALDRICH
Glastonbury, Connecticut

U.S. Interstate Route 84 Reconstruction
Waterbury, Connecticut
State Project No.: 151-273

GRAIN SIZE DISTRIBUTION

Date: 1/4/2001

File No.: 91313-100

CONN DOT SIEVE 91313SA.GPJ US LAB.GDT 1/26/01