



The Riley Group, Inc.

Geotechnical Engineering • Environmental • Wetland Services

GEOTECHNICAL ENGINEERING REPORT

**2nd and Bell Mixed Use Building
2304 - 2nd Avenue
Seattle, WA 98121**

Project No. 2004-041

Prepared By:

**The Riley Group, Inc.
10728 Lake City Way NE
Seattle, WA 98125**

Prepared for:

**Mr. Greg Arms
Milestone NW, LLC
5659 Pleasure Point Lane
Bellevue, WA 98006**

September 1, 2004

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The Riley Group, Inc.

Geotechnical Engineering • Environmental • Wetland Services

September 1, 2004

Mr. Greg Arms
Milestone NW, LLC
5659 Pleasure Point Lane
Bellevue, WA 98006

Subject: Geotechnical Engineering Report
2nd and Bell Mixed Use
2304 - 2nd Avenue
Seattle, WA 98121
Project No. 2004-041

Dear Mr. Arms:

As requested, we have performed a geotechnical engineering study for the above referenced subject site. This scope of work included completing 5 test borings on site. Three of the test borings were drilled in the south portion of the site and combined with environmental investigation. Two of the test borings were drilled in the north portion of the site. The attached geotechnical report presents our findings and recommendations for the geotechnical aspects anticipated for the project design and construction.

Our field exploration indicates that the site is underlain by 10 to 20 feet of loose to very dense silty SAND with gravel overlying 10 to 20 feet of very hard sandy SILT to silty CLAY over very dense silty fine SAND. Groundwater seepage was encountered at depth of 43 feet below ground surface (bgs) during the field exploration.

In our opinion, the native soil is suitable to support the building as proposed. We understand that you plan to demolish the existing building and redevelop the site to include an 8-story mixed-use building with 3 levels of underground parking. Excavations about 30 feet below existing ground surface are planned to accommodate the proposed building's lowest parking level. The anticipated finished floor for the lowest parking level will be within the very dense silty fine sand underlying the site.

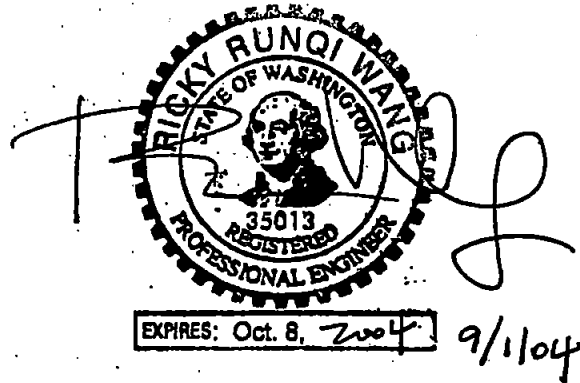
Underpinning will be needed for excavations below the foundation of the existing building to the north of the site and below the basement wall along the north end of 2nd Avenue. Temporary shoring will be needed to complete the excavations along all other property lines. Based on our geotechnical analysis, Riley recommends that the temporary shoring include a soldier pile wall with tiebacks and wood lagging. A soil nail wall is also considered an option. Once the building area has been excavated to the final floor grade, the building can be supported on conventional spread footings bearing on the dense native soil. The lowest-level parking floor can be similarly supported.

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We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
THE RILEY GROUP, INC.



Chien-Lin Chen

Chien-Lin (Johnny) Chen, E.I.T.
Project Engineer

JC/RW

Ricky R. Wang, Ph.D., P.E.
Principal Engineer

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1.0 PROJECT DESCRIPTION

The site is located at the northeast corner of 2nd Avenue and Bell Street in Seattle, Washington. The street address is 2304 - 2nd Avenue, Seattle, Washington. The approximate location of the site is shown on the Vicinity Map, Figure 1. The site is occupied by a two-story building.

The project consists of redeveloping a rectangular-shaped parcel of land approximately 12,960 square feet (120' by 108') and constructing an eight-story mixed-use building with three levels of below-grade parking. To reach the lowest parking level elevation, excavations of approximately 30 feet will be required along existing streets and property lines. Underpinning to the neighboring building to the north of the site will be needed before general excavation. Temporary shoring will be needed along the streets and the alley.

At the time of preparing this report, topographic boundary survey, detailed building plans, and site grading plans were not available for our review. We anticipate that the structure will be a mixed-used building including seven residential wood-framed levels over one concrete retail level with three below grade parking levels. We also anticipate that the structure will be supported on a perimeter foundation wall with a structural load of 10 to 20 kips per linear foot and on a series of isolated columns, for supporting the roof-truss, with a structural load of up to 1,200 kips per column.

Riley requests to review design drawings, plans and related specifications to verify that our project understanding is correct and that our recommendations have been properly interpreted and incorporated into project design and construction. If actual features vary or changes are made, we should review them in order to modify our recommendations as required.

2.0 SCOPE OF WORK

On March 11, 2004, Riley drilled three test borings (B-1 through B-3) to a maximum depth of 25.5 feet below ground surface (bgs). Borings were drilled with a limited access hollow stem auger drill rig. The test borings were drilled within the south portion of the building, approximately 10 feet north of the south wall along Bell Street.

On August 5, 2004, Riley drilled two additional test borings to a maximum depth of 49 feet bgs in the north portion of the site. Borings were drilled with a truck-mounted hollow stem auger drill rig. Test boring B-4 was drilled in the northwest corner of the site, and B-5 was drilled in the northeast corner of the site. The approximate test boring locations and other site features are shown on Figure 2.

Using the information obtained from our subsurface exploration, we performed analyses to develop geotechnical recommendations for project design and construction of the following:

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- Soil and groundwater conditions
- Seismic consideration
- Excavation shoring
- Foundations
- Slab-on-grade construction
- Lower level walls
- Structural fills
- Construction considerations

3.0 SITE CONDITIONS

3.1 Surface

The site includes a rectangular-shaped area approximately 12,960 square feet (120 feet by 108 feet) and is located at the northeast corner of the intersection of 2nd Avenue and Bell Street in Seattle, Washington. The site is bounded by an alley on the east, Bell Street on the south, 2nd Avenue on the west, and a commercial building on the north.

The entire site is occupied by a two-story building, which has been vacant since a fire in 2001. There is a basement (boiler room) at the northwest corner of the site along 2nd Avenue. The building to the north of the site is a single story building with a basement along the alley. The site gently slopes down to the north with an overall elevation difference of less than three feet.

3.2 Soils

In general, the native soil encountered during field exploration is relatively consistent. The site is underlain by 10 to 20 feet of loose to very dense silty SAND with gravel overlying 10 to 20 feet of very hard sandy SILT to silty CLAY over very dense silty fine SAND.

The *Geology of Seattle, Washington*, by Richard W. Galster and William T. Laprade (1970) shows that the soils are mapped as Glaciolacustrine Deposits that include very stiff to hard, clayey silt or silty clay with local thin beds of fine sand. This description is generally consistent with our field exploration findings. More detailed descriptions of the subsurface conditions encountered are presented on the Test Boring Logs, Figures A-2 through A-8 in Appendix A.

3.3 Groundwater

Minor groundwater seepage was encountered at depth of 43 feet bgs during field exploration. Perched groundwater may be expected during excavation. The water flow rate will depend on the season of the construction. The amount of groundwater seepage should be minor.

3.4 Seismic Considerations

Puget Sound area falls within Seismic Zone 3, as classified by the 1997 Uniform Building Code (UBC). Based on the soil conditions encountered and the local geology from Table 16-J of the 1997 UBC the native soil profile type is S_C.

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Seismic

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations from a seismic event. Liquefaction mainly affects geologically recent deposits of fine-grained sands that are below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction, thus reducing or eliminating the soil's strength.

We reviewed the results of our field and laboratory testing and assessed the potential for liquefaction of the site's soil during an earthquake. The native soils include very dense silty sand and very hard sandy silt /silty clay, which are not liquefiable during an earthquake event. We believe that the liquefaction potential of native soil is minimal.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, the site is suitable for the proposed construction from a geotechnical standpoint. Riley understands that the existing site buildings will be demolished. All deleterious materials related to previous construction should be removed from the site. However, the existing basement wall along the 2nd Avenue will likely remain on the site.

Underpinning and temporary shoring may be required for excavations below the existing building to the north of the site, and below the existing basement wall along 2nd Avenue. Temporary shoring may be needed to complete the excavations along the other property lines. The proposed building can be supported on a spread footing foundation bearing on dense silty sand. The floor slab can be similarly supported.

A shoring system consisting of soldier pile and tieback anchors will be suitable for the subject site excavation. Soil nail wall can be an alternative depending on the soil condition, subcontractor's experience, and time of construction. We recommend that earthwork be performed in dry season conditions. Based on the experience of the condominium projects in the area, groundwater control during excavation in dry summer months is generally not needed. However, if the construction extended to the wet season, it can be accomplished using conventional ditches and sumps.

Detailed recommendations regarding the above issues and other geotechnical design considerations are provided in the following sections. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Underpinning

Based on our understanding of the project, excavations will extend below the adjoining building foundations and therefore will require underpinning. Underpinning will provide vertical support for these buildings and eliminate lateral stresses that the foundations

would impose on shoring and new lower-level walls. Underpinning will also be needed for excavation below the existing basement wall along the 2nd Avenue.

Riley recommends using underpinning piles, which consist of steel beams installed beneath the footing in drilled shafts. The typical construction procedure for underpinning piles is to drill a shaft below the footing, install a steel beam, and align it vertically. The shaft annulus is then backfilled with structural concrete below the excavation level and lean mix above the final excavation level. The underpinning piles should be steel-wedged and dry-packed or shotcreted to ensure full contact with the bottom of the existing footing.

Underpinning piles should extend to a minimum depth of 10 feet below the excavation level. At this depth, piles will be supported in the very dense silty fine sand. The piles can be designed for an end bearing capacity of 20,000 pounds per square foot (psf). The shaft resistances between structural concrete and native soils can be designed using 1,500 psf in undisturbed native soil.

4.3 Excavations

Construction of the proposed building will require maximum excavations approximately 30 feet below the existing ground surface. Given the depth of the proposed excavations and their close proximity to the street and utilities, underpinning to the adjacent building and temporary shoring will be required along the proposed building perimeter to support the adjacent alley and streets.

In the following section of the report, tieback wall and soil nailing shoring systems will be discussed for the excavation. Both shoring systems require underground easement towards adjacent streets for soil nails and tieback anchors. The tieback anchors and soil nails should also be carefully planned to avoid underground utilities and building structures.

Soldier Pile Shoring

This shoring method supports the excavation using a system of conventional soldier piles, tieback anchors, and wood lagging. We recommend that soldier piles have a maximum spacing of eight feet center to center. For the expected excavation depths, we anticipate that at least two rows of tiebacks will be required. Recommended soil parameters for design of the shoring for multiple tiebacks are summarized on Figures 5 and 6. To account for arching effects, lateral loading on the lagging can be reduced by 50 percent. Unlagged excavation heights should not exceed six feet. No portion of the excavation should remain unsupported overnight.

The tieback anchors along bond length can be designed for an allowable unit shaft resistance of 1,500 psf in native soil. The shaft resistance can be achieved using open hole tremie grouting. The bonded length is that portion of the anchor that extends beyond the no load zone, as defined on Figure 7. Within the no load zone, anchors should be sleeved and left ungrouted to prevent load pickup in this region.

All anchors should be tested to verify design capacities. At minimum, all anchors should be stressed to 130 percent of their design capacity and then locked off at the design load. At least ten percent of the anchors, with a minimum of two anchors, should be proofstressed and stressed to 200 percent of the design pullout capacity. The geotechnical engineer should select the locations of these test anchors.

A monitoring program must be implemented to verify the performance of the shoring system and possible excavation effects on adjacent building and properties. The first step in this program should consist of surveying building feature elevations, documenting the condition of the existing properties, alley and adjacent buildings. This documentation should include a photographic record.

Monitoring of the shoring system should occur 2 times per week as the excavation proceeds and then 1 time every two weeks once the excavation is completed. A registered land surveyor should be retained to establish the baseline data and obtain the bi-weekly readings. Monitoring data can be obtained by the project contractor. Monitoring should continue until the permanent new lower walls are adequately braced. Monitoring should include surveying the vertical and horizontal alignment of the top of each soldier pile. Monitoring points should also be established at the middle height of the shoring at 25-foot horizontal intervals. These mid-level points should also be surveyed to record horizontal and vertical movements. The project's structural and geotechnical engineers should review the monitoring data weekly.

Soil Nail Shoring

As an alternative to conventional shoring, the excavation could be supported using soil nailing techniques. Soil nailing would allow for construction of the shoring and permanent building foundation walls simultaneously using top-down construction procedures. However, its success depends on the time of construction and contractor's experience. To fully determine whether this shoring method will work, Riley can perform further study (if needed) with other project team members.

Soil nailing stabilizes vertical excavations by reinforcing the soil mass with passive inclusions (soil nails). Soil nails typically consist of ¾- to 1 3/8-inch diameter steel bars that are centrally grouted in six- to eight-inch diameter augered holes. The nails are normally spaced at four- to six-foot centers with nail rows tied together with two to four No. 4 rebar to create a waler. The typical soil nails are between 15 and 25 feet long. Following the installation of a row of nails, the excavation face is covered with a shotcrete facing that is reinforced with either welded wire mesh or rebar. The nails are then secured to the shotcrete wall with a steel plate and bolt assembly. A typical soil nailed wall detail is shown on the attached Figure 8. Once grout strengths are achieved, the excavation continues below the wall and the construction sequence is repeated until the bottom of the excavation is reached.

Based on the soils encountered at the site, we recommend using the following soil parameters for soil nailing design:

Soil Parameters	Silty Sand	Sandy Silt	Silty Clay
Unit Weight (pcf)	125	120	120
Friction Angle (degree)	35	34	32
Cohesion (psf)	200	250	400
Nail Shaft Resistance (psf)	1,500	1,500	1,500

Excavation and wall construction sequencing should not exceed a height of six feet. Care must be taken to prevent caving for initial excavation in loose fill. Temporary protection such as soil berms and flash coating should be considered. The shaft resistance assumes open hole tremie grouting. Soil nail verification tests should be performed to verify the soil resistance before construction. The shotcrete wall should be designed to support a uniform lateral earth pressure of 100 psf.

We would be pleased to work with your structural engineer in preparing a complete set of soil nail wall design drawings and construction specifications. Alternatively, this can be accomplished using a design build approach with your shoring contractor.

4.4 Foundations

Spread Footing

Following the site excavation, the building may be supported on conventional spread footing foundations bearing on the very dense silty fine sand underlying the site.

We recommend designing foundations for a net allowable bearing capacity of 10,000 pounds per square foot (psf). For short-term loads, such as wind and seismic, a 1/3 increase in this allowable capacity can be used.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the side of the footing and buried portion of the foundation stem wall can also be considered for resisting lateral loads. We recommend calculating this lateral resistance using an equivalent fluid weight of 250 pcf. At perimeter locations, we recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be constructed neat against competent fill soil or backfilled with structural fill as described in the Structural Fill section. The recommended passive resistance value includes a safety factor of 1.5.

With spread footing foundations as recommended in this section, you should expect maximum total and differential post-construction settlements of one inch and ½ inch, respectively.

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4.5 Slab-on-Grade Construction

Native dense silt sand will provide suitable support for slab-on-grade construction. Riley recommends that the concrete slab be set on top of native soil. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer of clean, free-draining sand or gravel that has less than 5 percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

Where moisture by vapor transmission is undesirable, an eight to ten-mil thick plastic membrane should be placed on a four-inch thick layer of clean gravel. The membrane should be covered with one to two inches of clean, moist sand to guard against damage during construction and to aid in curing of the concrete.

For the anticipated floor slab loading, we estimate post-construction floor settlements of $\frac{1}{4}$ to $\frac{1}{2}$ inch. For thickness design of the slab subjected to point loading from storage racks and fork lift vehicle traffic, we recommend using a subgrade modulus (Ks) of 400 pounds per square inch per inch of deflection (pci).

4.6 Lower Level Walls

For lower level basement walls, we recommend using a pressure equivalent to 35 pcf for unrestrained walls and 55 pcf for restrained walls. The walls must also be provided with adequate drainage and should be waterproofed. Typically, for walls constructed against shoring, drainage consists of pre-fabricated drainage panels, such as Miradrains, that are attached to the lagging face and connected to a perforated pipe at the base of the wall as shown in Figure 9. Each drainage panel is typically 3 feet wide and is spaced eight feet at centers horizontally. The pipe is then tightlined through the footing to a sump for discharge of collected water.

4.7 Structural Fill

In our opinion, the upper silty sand with gravel may be used as structural fill if the moisture content can be properly controlled. However, the native silt and clay will be difficult to control the compaction if construction occurs in winter. If construction will be performed in winter, the owner/contractor should be prepared to import free-draining, granular material for use as structural fill and backfill.

Prior to use, a geotechnical engineer should examine and test all materials imported to the site for use as structural fill. Structural fill should be placed in uniform loose layers not exceeding 12 inches and should be compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by ASTM Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard.

Where structural fill is required, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
3 inches	100
No. 4	0-75 %
No. 200	0-5 %*

*Based on the 3/4-inch fraction.

4.8 Construction Considerations

An important construction consideration is weather and its impact on construction scheduling. The native soil is highly moisture sensitive and will be difficult to work with in wet weather. Riley recommends that the major excavation activities be performed in dry summer.

We recommend that a geotechnical engineer be present on-site to inspect the foundation subgrade preparation before pouring concrete. The foundation subgrade should be very dense undisturbed silty sand. If prepared footing subgrades are to remain exposed during the winter season or periods of wet weather, it may be helpful to place a lean concrete "mud mat" or a layer of gravel to help protect the subgrades after they have been inspected and until the footings are poured.

5.0 ADDITIONAL SERVICES

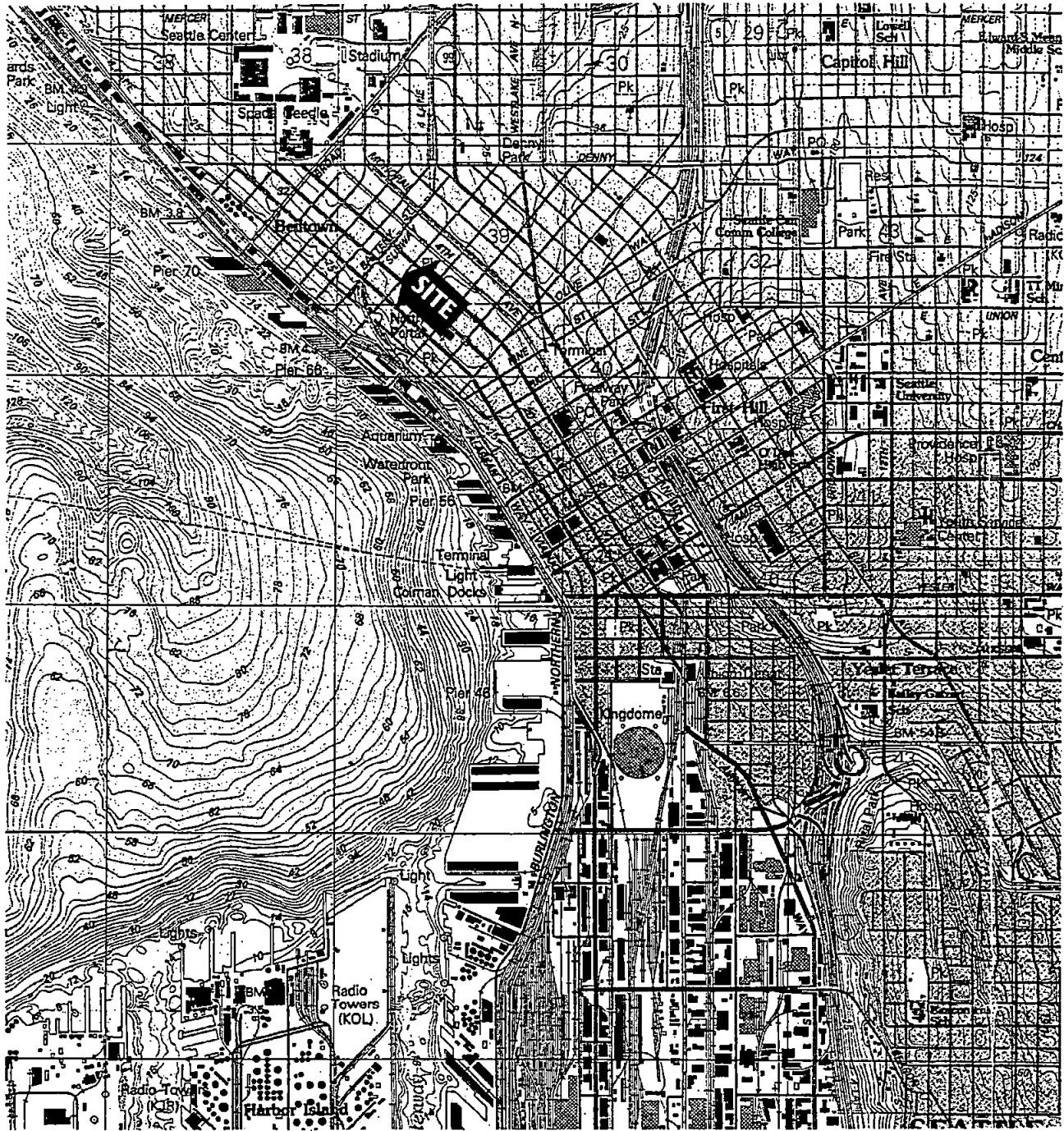
Riley is currently under contract with Milestone NW, LLC to provide further geotechnical consultation as the project design develops. Riley requests to review preliminary and final design plans and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design and construction.

The integrity of the shoring and foundation depend on construction procedures and proper site preparation. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent.

6.0 LIMITATIONS

This report is the property of The Riley Group, Inc., and Milestone NW, LLC and was prepared in accordance with generally accepted geotechnical engineering practices. This report intends for specific application to the proposed 2nd and Bell Street Mixed Use Building project in Seattle, WA, and for the exclusive use of Milestone NW, LLC and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based upon data obtained from the subsurface investigation and our literature review. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, The Riley Group, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.



0 1/2 1 MILES

approximate graphical scale

SCALE 1: 25 000
CONTOUR INTERVAL 5 METERS

USGS 7.5 X 15 MINUTE QUADRANGLE
SEATTLE SOUTH, 1983



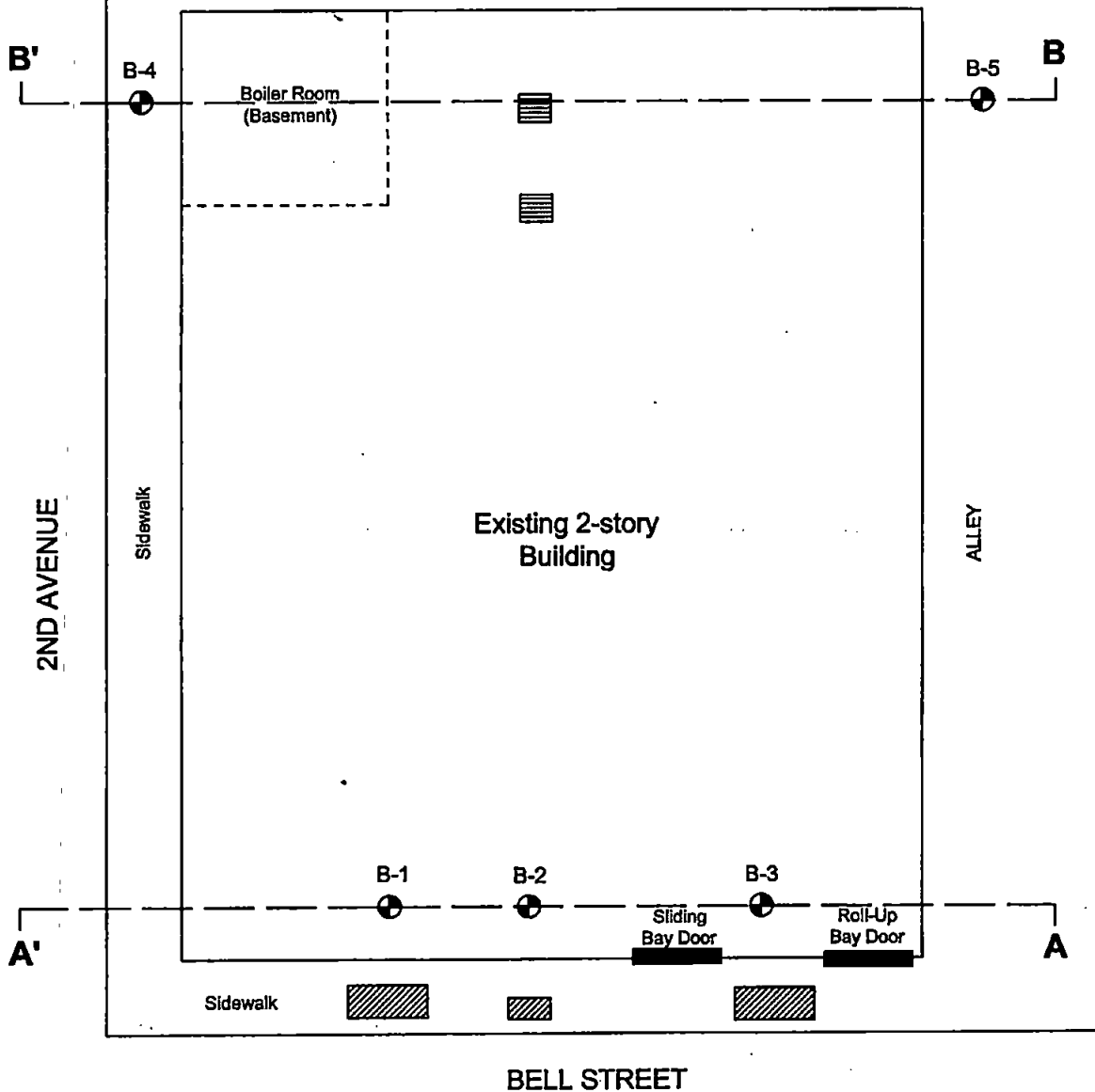
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2nd and Bell Mixed Use Building



Site Vicinity Map

Figure 1

Site Address: 2304 2nd Avenue, Seattle, Washington



- 
Geotechnical/Environmental Boring (B-1 ~ B-3)
 B-1 Location Drilled by Riley on 3/11/04
- 
Geotechnical Boring (B-4 & B-5)
 B-4 Location Drilled by Riley on 8/5/04

- 
Approximate Location of Closed-In-place USTs
- 
Former Drain Sump Locations
 (Based on our review of Seattle DPD Microfilm Plans dated 1925)



DRAWING NOT TO SCALE


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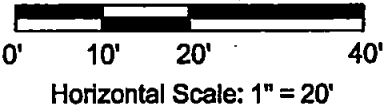
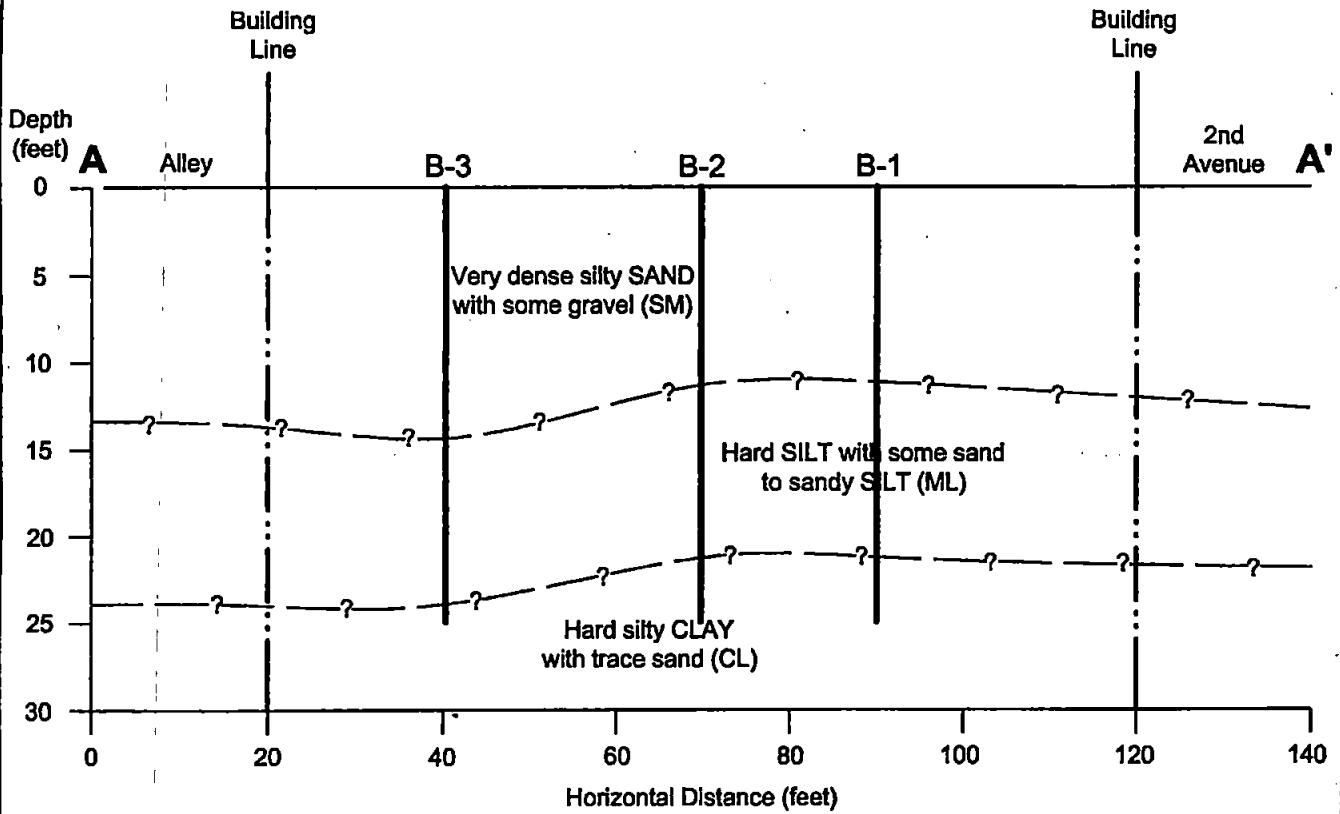
2nd and Bell Mixed Use Building

Geotechnical Test Boring Location

Figure 2

Site Address: 2304 2nd Avenue, Seattle, Washington

SOUTHEAST SECTION




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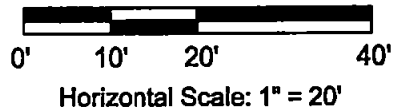
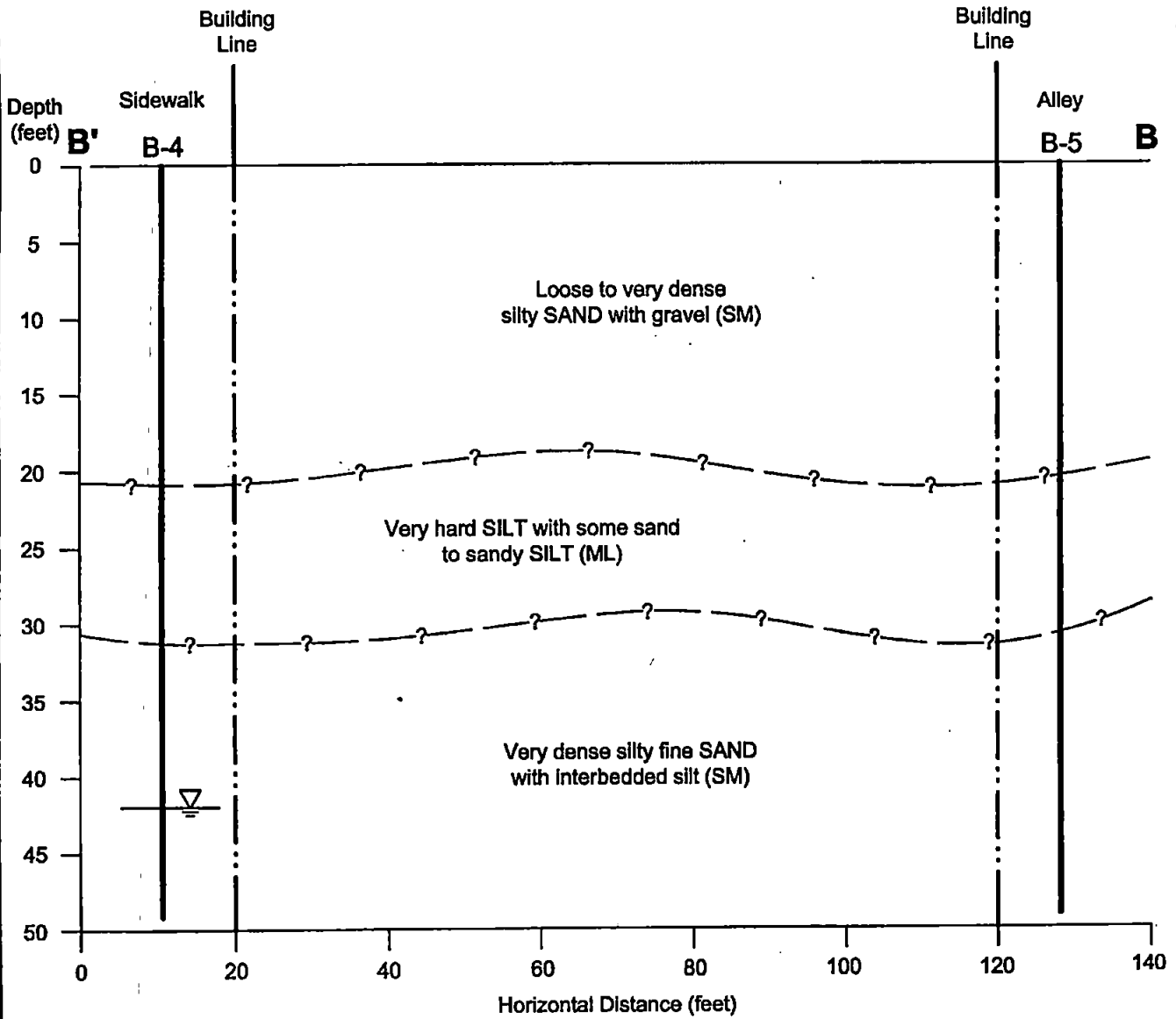
2nd and Bell Mixed Use Building

SE Geologic Cross Section

Figure 3

Site Address: 2304 2nd Avenue, Seattle, Washington

NORTHWEST SECTION



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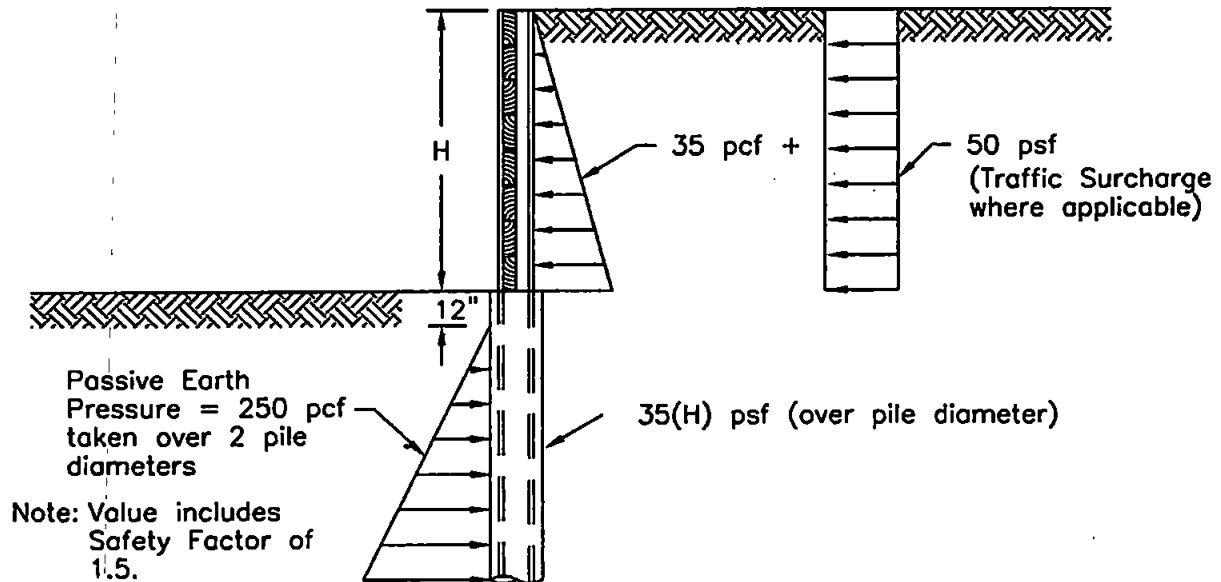
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NW Geologic Cross Section

Figure 4

Site Address: 2304 2nd Avenue, Seattle, Washington

EARTH PRESSURE DESIGN PARAMETERS FOR SOLDIER PILE CANTILEVER WALL



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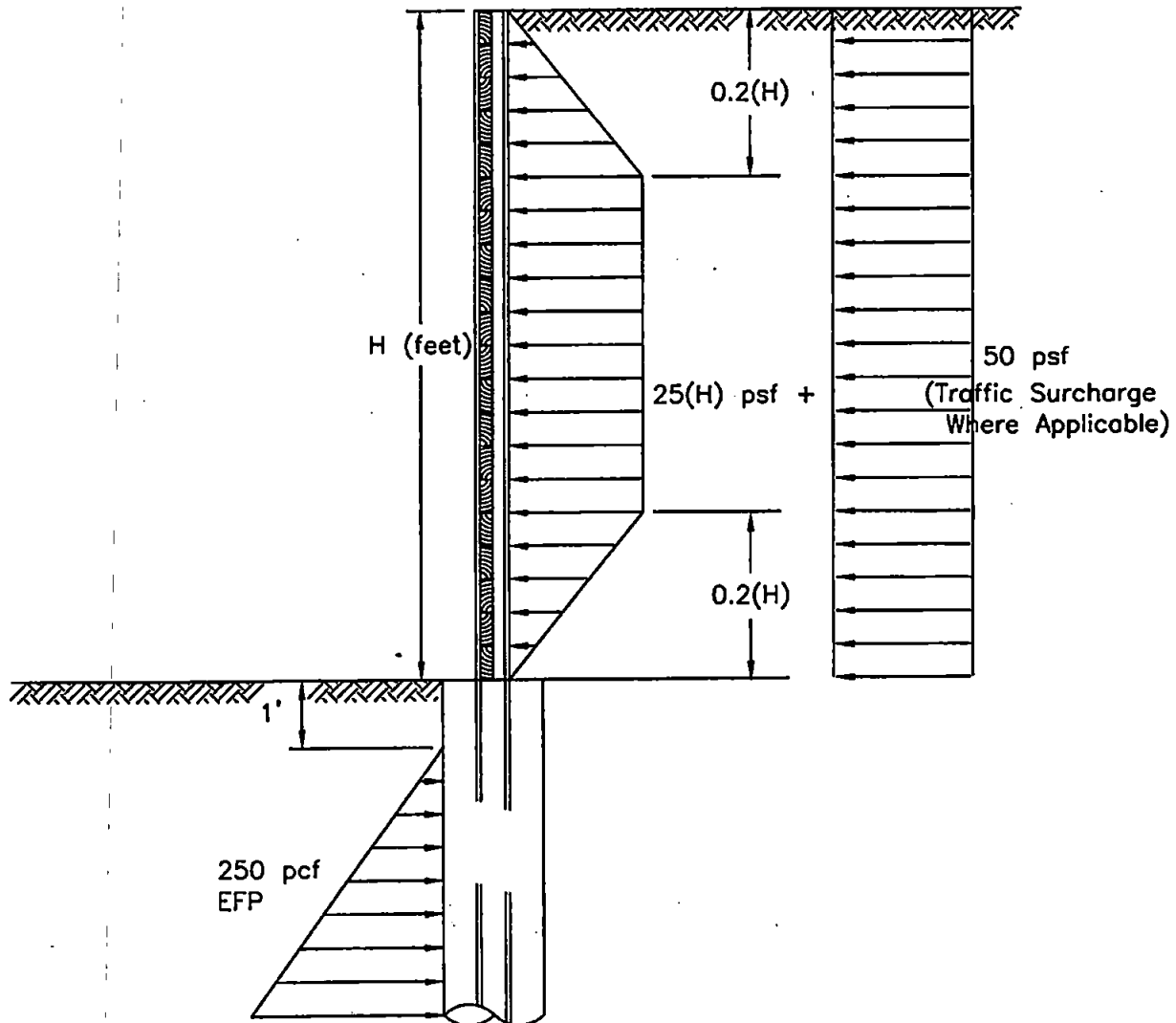
2nd and Bell Mixed Use Building

Earth Pressure Diagram

Figure 5

Site Address: 2304 2nd Avenue, Seattle, Washington

TIEBACK SOLDIER PILE/LAGGING SHORING WALL FOR TWO OR MORE ROWS OF TIEBACKS



* Passive pressure can be taken over 2 pile diameter. A safety factor of 1.5 is included.

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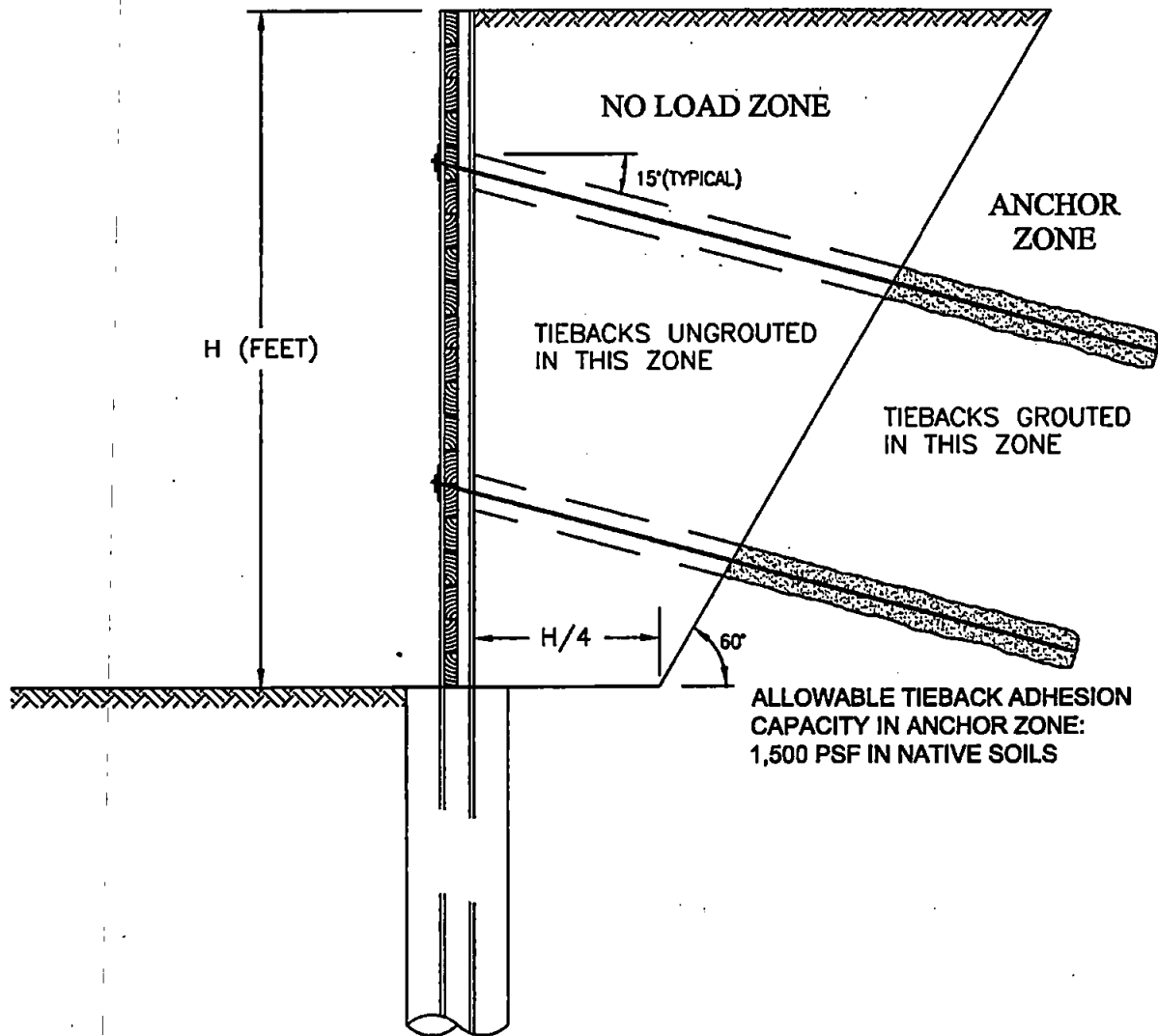
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Soldier Pile Pressure Diagram

Figure 6

Site Address: 2304 2nd Avenue, Seattle, Washington

TIEBACK SOLDIER PILE/LAGGING SHORING WALL



ALLOWABLE TIEBACK ADHESION CAPACITY IN ANCHOR ZONE:
1,500 PSF IN NATIVE SOILS

NOT TO SCALE



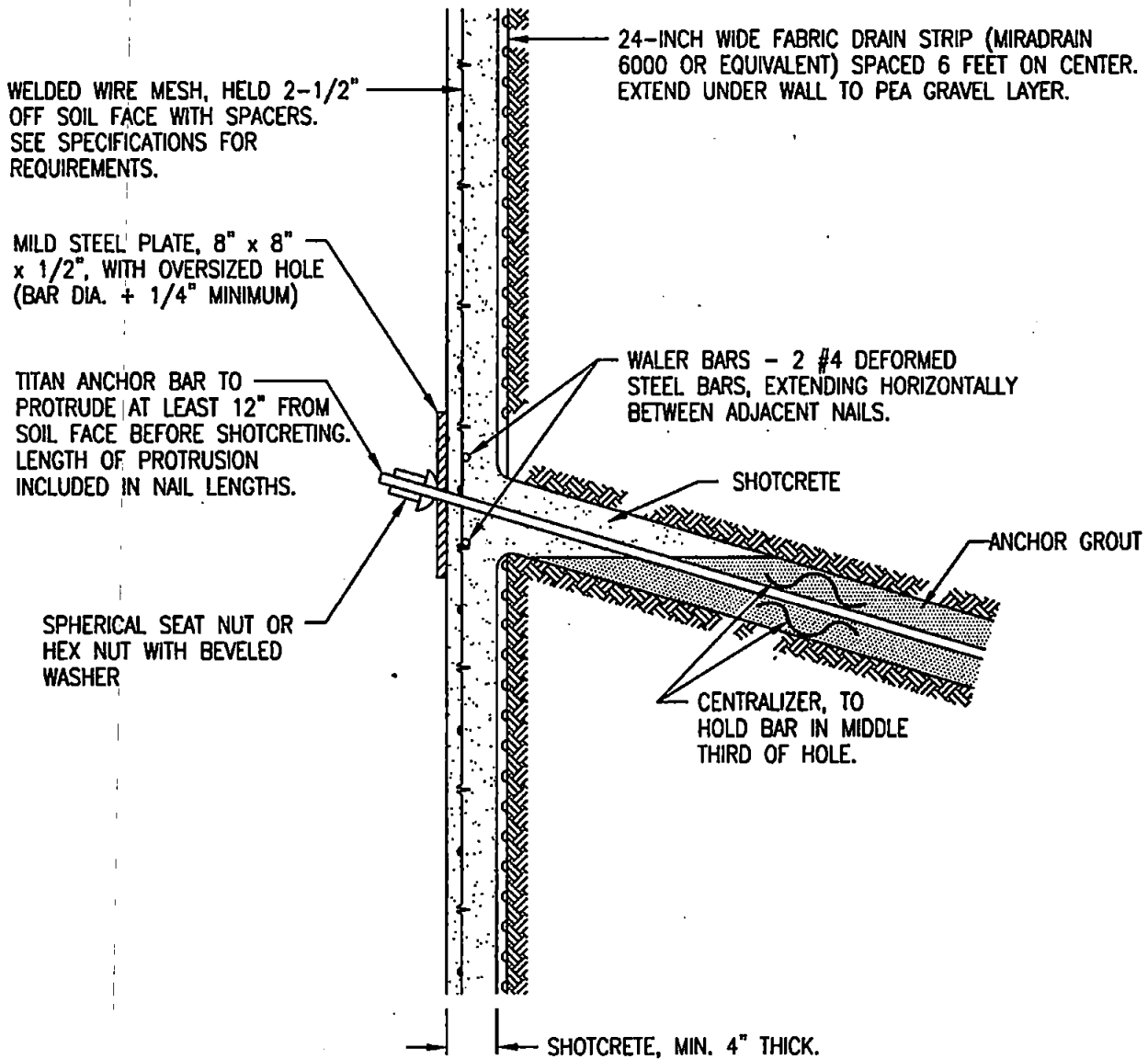
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2nd and Bell Mixed Use Building

Load/No Load Zone Diagram

Figure 7

Site Address: 2304 2nd Avenue, Seattle, Washington



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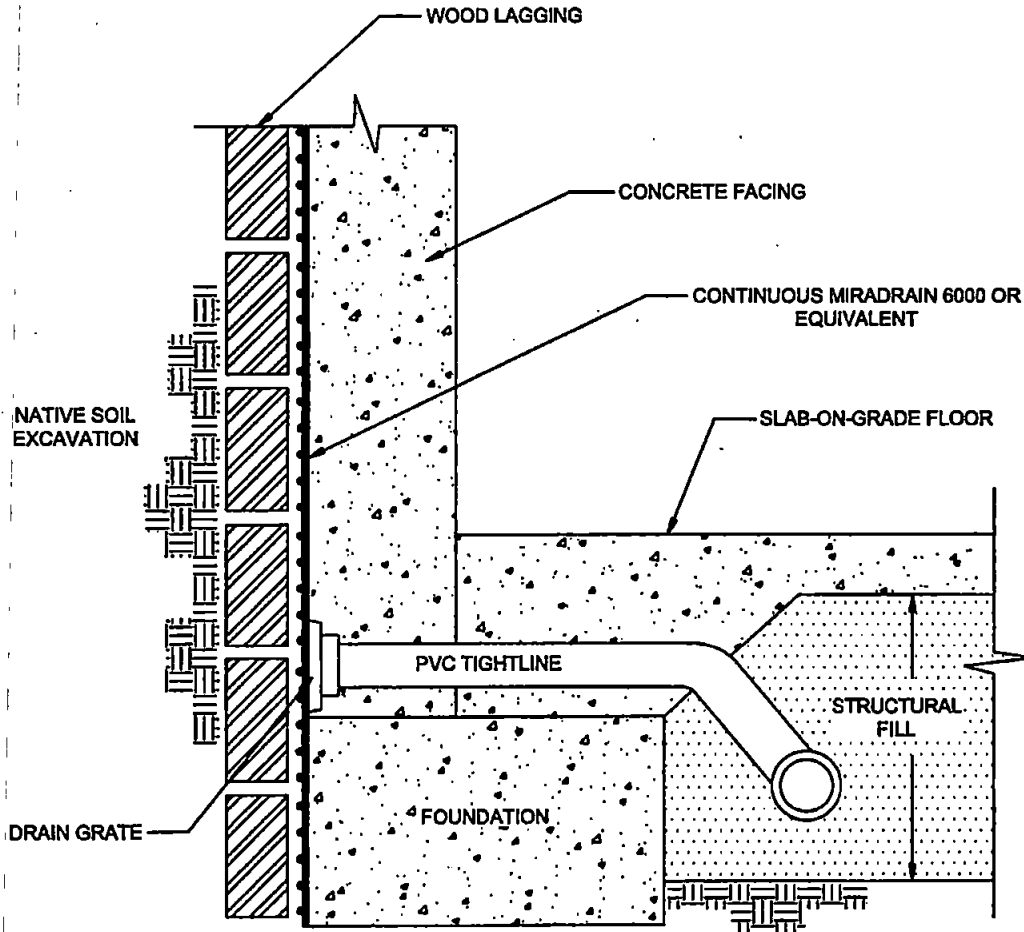
2nd and Bell Mixed Use Building

Soil Nailed Wall Section

Figure 8

Site Address: 2304 2nd Avenue, Seattle, Washington

BASEMENT WALL DRAINAGE BEHIND SHORING



NOTE:
DRAIN THROUGH WALL SHOULD BE INSTALLED AT MIDDLE OF
LAGGING.



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2nd and Bell Mixed Use Building

Basement Wall Drainage Detail

Figure 9

Site Address: 2304 2nd Avenue, Seattle, Washington

**APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING**

**2nd and Bell Mixed Use Building
2304 - 2nd Avenue
Seattle, Washington**




On March 11 and August 5, 2004, we performed our field exploration using limited access track-mounted drill rig and truck-mounted drill rig. We explored subsurface soil conditions at the site by advancing five test borings to a maximum depth of 49 feet below existing grade. The test boring locations are shown on Figure 2. The test boring locations were approximately determined by measurements from existing property lines and streets. The Test Boring Logs are presented on Figures A-2 through A-8.

A geologist/engineer from our office conducted the field exploration and classified the soil conditions encountered, maintained a log of each test boring, obtained representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test borings were placed in closed containers and taken to our laboratory for further examination and testing. The moisture content of typical sample was measured and is reported on the Test Boring Logs.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION	
COARSE GRAINED SOILS	More than 50% material larger than No. 200 sieve	GRAVELS More than 50% of coarse fraction is larger than No. 4 sieve	CLEAN GRAVELS <5% fines	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GRAVELS with fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
				GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	CLEAN SANDS <5% fines	GC
		SW			Well-graded sands, gravelly sands, little or no fines.
		SANDS with fines		SP	Poorly-graded sands or gravelly sands, little or no fines.
				SM	Silty sands, sand-silt mixtures, non-plastic fines.
		FINE GRAINED SOILS	More than 50% material smaller than No. 200 sieve	SILTS AND CLAYS Liquid limits less than 50%	SC
ML	Inorganic silts, rock flour, clayey silts with slight plasticity.				
CL	Inorganic clays of low to medium plasticity, (lean clay).				
SILTS AND CLAYS Liquid limits greater than 50%	OL			Organic silts and organic clays of low plasticity.	
	MH			Inorganic silts, elastic.	
	CH			Inorganic clays of high plasticity, (fat clays).	
HIGHLY ORGANIC SOILS			OH	Organic clays of high plasticity.	
			PT	Peat.	

DEFINITION OF TERMS AND SYMBOLS

SAND or GRAVEL	Density	<u>SPT (Blows/Foot)</u>	 2" Outside diameter split spoon sampler  2.4" Inside diameter ring sampler or Shelby tube  Water level (date)
	Very loose	0-4	
	Loose	4-10	
	Medium dense	10-30	
	Dense	30-50	
Very dense	>50		
SILT or CLAY	<u>Consistency</u>	<u>SPT (Blows/Foot)</u>	Tr Torvane reading, tsf Pp Penetrometer reading, tsf DD Dry density, pcf LL Liquid limit, percent PI Plasticity index N Standard penetration, blows per foot
	Very soft	0-2	
	Soft	2-4	
	Medium stiff	4-8	
	Stiff	8-15	
	Very stiff	15-30	
	Hard	>30	



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2nd and Bell Mixed Use Building

Unified Soil Classification System

Figure A-1

Site Address: 2304 2nd Avenue, Seattle, Washington

Boring No. B-1

Logged by : TN
Date: 3/11/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)
- mottled brown Brown to gray silty SAND with some gravel, moist, very dense, (SM).	Very Dense	5	H	50/6"	10.6
			H	50/6"	10.5
			H	50/5"	8.7
			H	50/6"	11.1
Gray SILT with some sand to sandy SILT, trace gravel, low plasticity, moist, hard, (ML).	Hard	15	H	50/6"	17.5
			H	50/6"	16.8
			H	50/4"	14.0
Dark gray silty CLAY with trace sand, moist, hard, (CL).	Hard	20	H	50/6"	15.2
			H	50/4"	21.8
Terminated at 25.5'. No groundwater seepage encountered.		25	H	100/4"	17.5



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Test Boring Log B-1

Figure A-2

Site Address: 2304 2nd Avenue, Seattle, Washington

Boring No. B-2

Logged by : TN

Date: 3/11/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)	
Brown to gray silty SAND with some gravel, moist, very dense, (SM).	Very Dense	5	H			Encountered Rock No Recovery
			H			
		10	H	50/5"	8.1	
Gray SILT with some sand to sandy SILT, some mottled brown and interbedded silty sand, low plasticity, moist, hard, (ML).	Hard	15	H	50/6"	22.1	
			H	50/6"	15.5	
		20	H	50/3"	14.2	
Dark gray silty CLAY with trace sand, moist, hard, (CL).	Hard		H	50/6"	16.9	
		25	H	50/3"	23.3	
Terminated at 25.5'. No groundwater seepage encountered.			H	100/4"	21.7	



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Test Boring Log B-2

Figure A-3

Site Address: 2304 2nd Avenue, Seattle, Washington

Boring No. B-3

Logged by : TN
Date: 3/11/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)
- with some silty clay Brown to gray silty SAND with some gravel, moist, very dense, (SM).	Very Dense	5	H	50/6"	13.9
			H	50/5"	9.3
			H	50/4"	7.1
			H	50/6"	10.6
			H	50/3"	15.3
Gray SILT with trace sand to sandy SILT, trace gravel, low plasticity, moist, hard, (ML).	Hard	15	H	50/4"	22.7
			H	50/5"	13.6
			H	50/4"	14.0
Dark gray silty CLAY, moist, hard, (CL).	Hard	20	H	50/3"	13.0
			H	100/4"	16.8
Terminated at 25.5'. No groundwater seepage encountered.		25			



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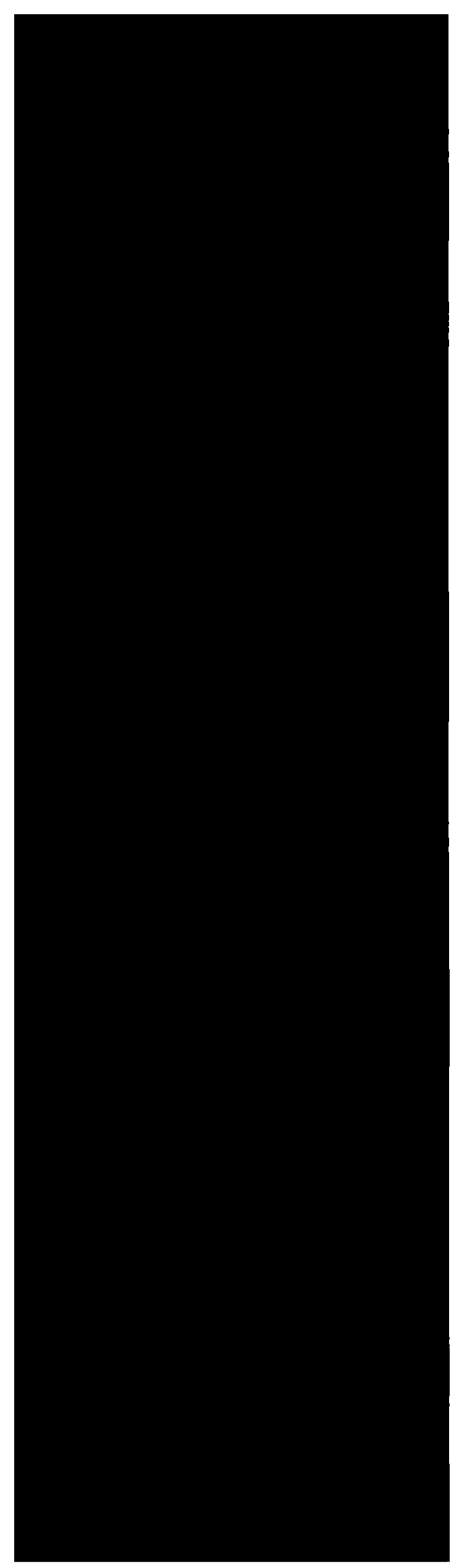
2nd and Bell Mixed Use Building

Test Boring Log B-3

Figure A-4

Site Address: 2304 2nd Avenue, Seattle, Washington

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Boring No. B-4

Logged by : PL
Date: 8/5/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)	
5" concrete sidewalk. Brown silty SAND with trace gravel, moist to wet, loose, (Fill).	Loose	5	I	6	—	No Recovery
			I	7	17.6	
Brown to gray silty SAND with trace gravel, damp to moist, dense to very dense, (SM).	Dense	10	I	31	17.7	
			I	88/11"	17.6	
	Very Dense	20	I	50/3"	16.3	
I			50/6"	13.1		
Gray SILT with some sand to sandy SILT with trace gravel, low plasticity, damp to moist, very hard, (ML).	Very Hard	25	I			



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Test Boring Log B-4

Figure A-5

Site Address: 2304 2nd Avenue, Seattle, Washington

Boring No. B-4 (cont.)

Logged by : PL
Date: 8/5/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)	
Gray silty fine SAND, with interbedded silty layers, moist to wet, very dense, (SM).	Very Dense	35	I	75/12"	27.3	
		40	I	62	29.7	
	Very Dense	45	I	85/12"	28.3	▼ (8/5/04)
		50	I	50/4"	23.7	
Terminated at 49.0'. Minor groundwater seepage encountered at 43.0'.		55				

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Test Boring Log B-4

Figure A-6

Site Address: 2304 2nd Avenue, Seattle, Washington

Boring No. B-5

Logged by : PL
Date: 8/5/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)
4" brick alley. Brown to gray silty SAND with some gravel, interbedded sandy silt layer, damp to moist, dense to very dense, (SM).	Dense	5	I	32	12.3
	Very Dense	10	I	50/5"	10.3
		15	I	50/6"	15.1
		20	I	50/4"	12.8
Gray SILT with some sand to sandy SILT, low plasticity, damp to moist, very hard, (ML).	Very Hard	25	I	80/11"	18.3
			I	50/5"	17.0



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Test Boring Log B-5

Figure A-7

Site Address: 2304 2nd Avenue, Seattle, Washington



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13

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Boring No. B-5 (cont.)

Logged by : PL

Date: 8/5/04

Approximate Elev.: N/A

Soil Description	Consistency/ Relative Density	Depth (feet)	Sample	(N) Blows /ft	Moisture Content (%)
Gray silty SAND, with interbedded silty layers, moist to wet, very dense, (SM).	Very Dense	35	I	56	18.0
		40	I	56	27.2
	Very Dense	45	I	50/6"	25.1
		50	I	50/6"	24.3
Terminated at 49.0'. No groundwater seepage encountered.		55			



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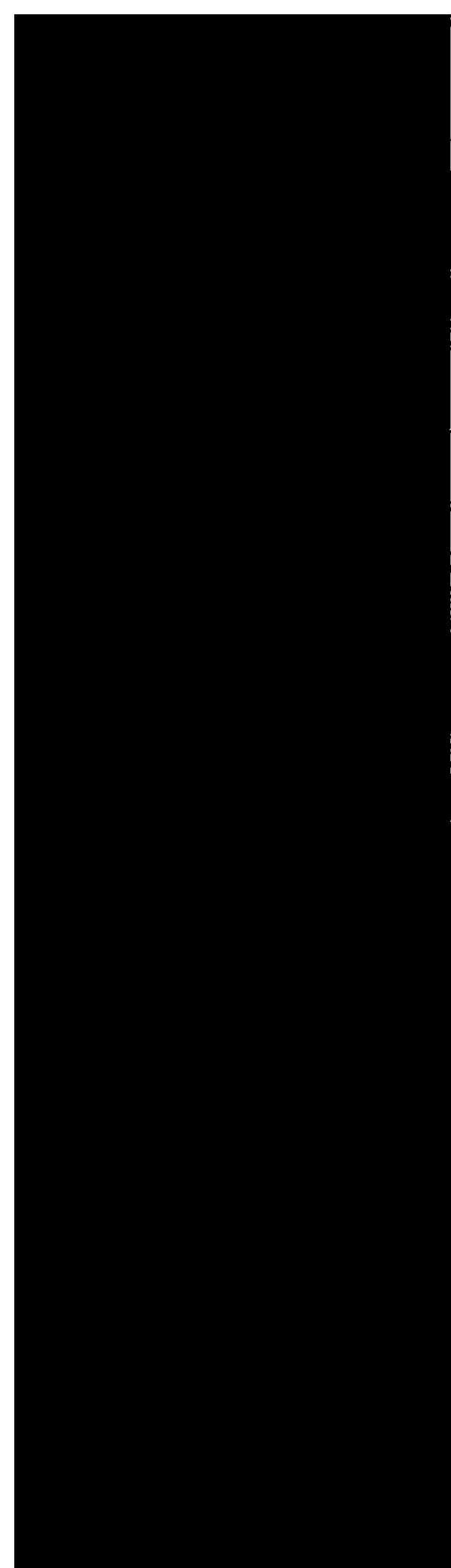
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2nd & Bell Mixed Use Building

Test Boring Log B-5

Figure A-8

Site Address: 2304 2nd Avenue, Seattle, Washington



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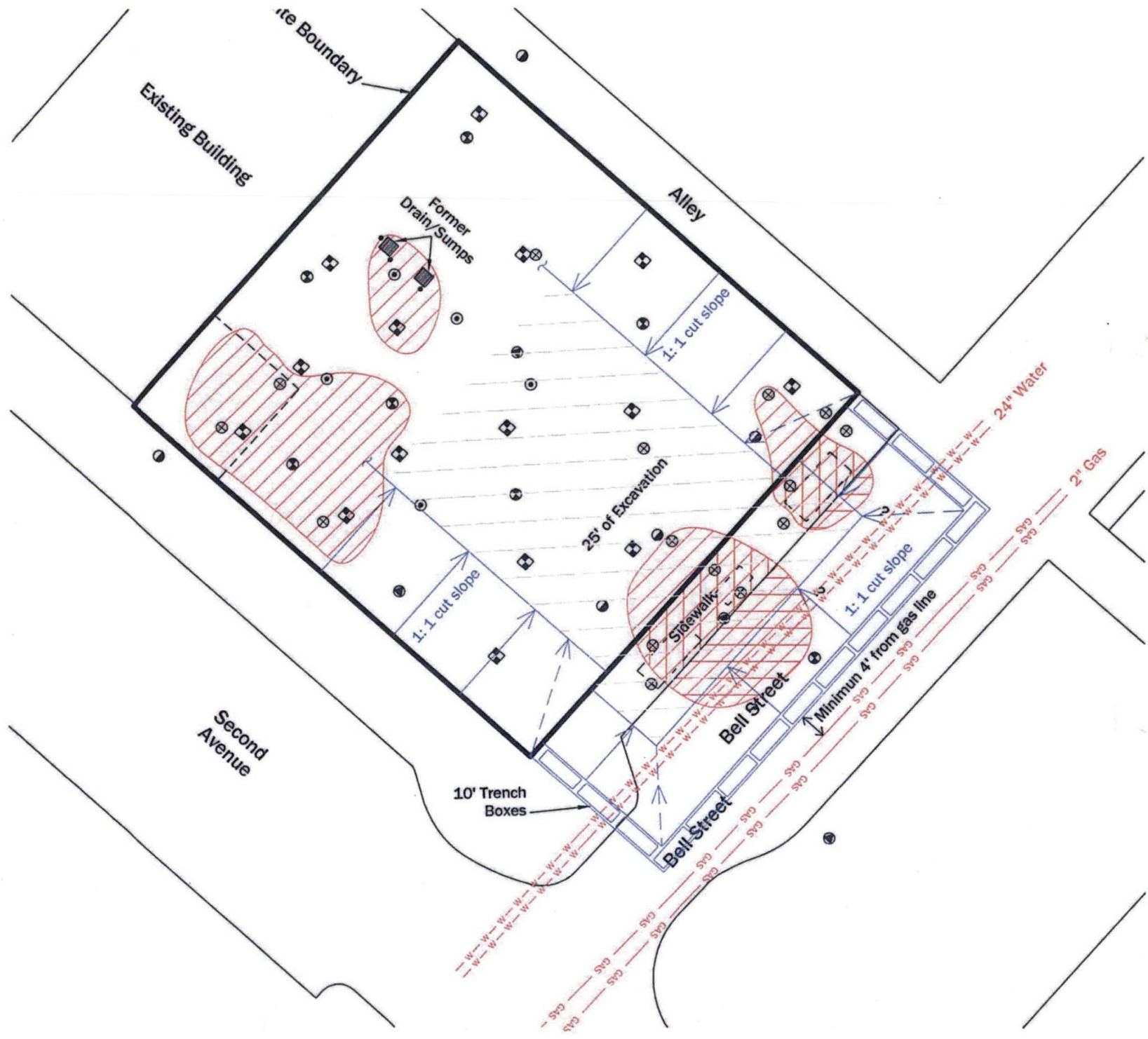
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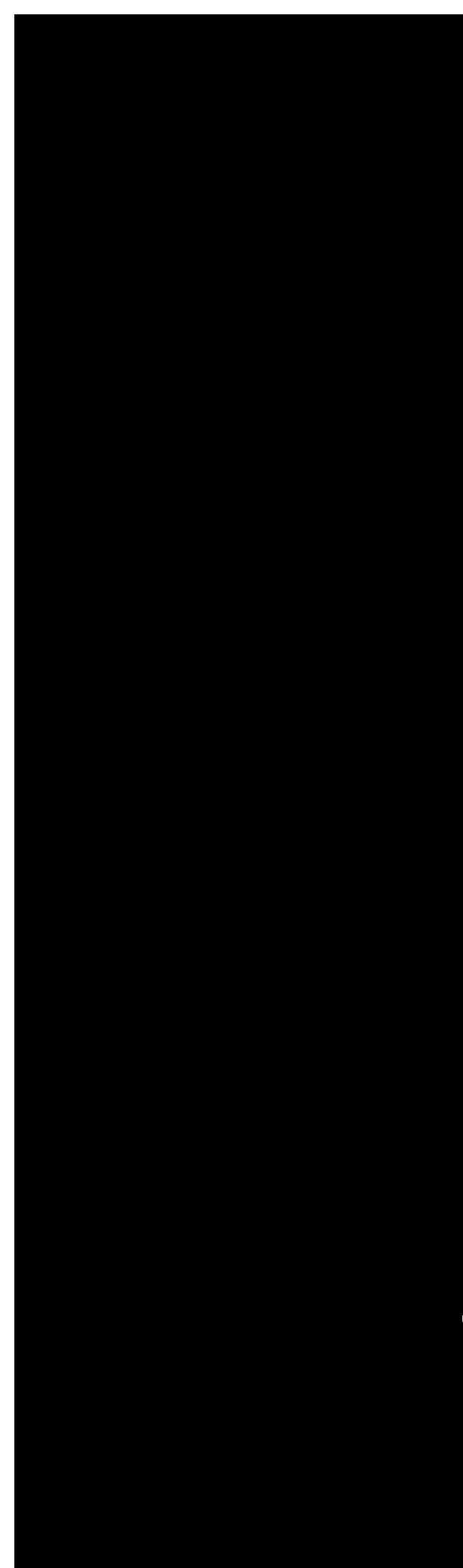
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Not A Shoring Plan



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