

MAY. 20. 2005 9:29AM MERRILL MARINE TERM.

NO. 796 P. 3/4

FROM DESIGNER: Roger E. Gagnon P.E. (DBA Gagnon Eng'g)

DATE: May 25 05

Job Name:

Merrill's Marine Terminal/Robb Mill

Address of Construction:

Danforth St. Port Land/ME

2003 International Building Code

Construction project was designed according to the building code criteria listed below:

Building Code and Year IBC/2003 Use Group Classification(s) S2

Type of Construction \_\_\_\_\_

Will the Structure have a Fire suppression system in Accordance with Section 903.5.1 of the 2003 IRC \_\_\_\_\_

Is the Structure mixed use? \_\_\_\_\_ if yes, separated or non separated (see Section 302.3) \_\_\_\_\_

Supervisory alarm system? \_\_\_\_\_ Geotechnical/Soils report required? (See Section 1802.2) \_\_\_\_\_

**STRUCTURAL DESIGN CALCULATIONS**

Submitted for all structural members (102.1, 102.1.1)

Live load reduction (1603.1.1, 1607.6, 1607.10)

Floor live loads (1603.1.2, 1607.11)

Floor snow loads (1603.1.5, 1603)

Ground snow load,  $P_g$  (1603.2)

If  $P_g > 10$  psf, flat-roof snow load,  $P_f$  (1603.5)

If  $P_g > 10$  psf, snow exposure factor,  $C_e$  (Table 1603.3.1)

If  $P_g > 10$  psf, snow load importance factor,  $I_s$  (Table 1604.5)

Roof thermal factor,  $C_t$  (Table 1603.3.2)

Sloped roof snowload,  $P_s$  (1603.4)

Seismic design category (1612.3)

Elastic seismic force-resisting system (Table 1617.2.2)

Response modification coefficient,  $R$ , and deflection amplification factor,  $C_d$  (Table 1617.2.2)

Analyze procedure (1616.2, 1617.5)

Design base shear (1617.4, 1617.5.1)

Flood loads (1602.1.6, 1612)

Flood hazard area (1612.9)

Elevation of structure

Other loads

Concentrated loads (1607.4) Fork truck wheels

Partition loads (1607.5)

Impact loads (1607.3)

Misc. loads (Table 1607.6, 1607.8.1, 1607.7, 1607.12, 1607.15, 1610, 1611, 2404)

Wind loads (1603.1.4, 1603)

Design option utilized (1602.1.1, 1603.6)

Basic wind speed (1603.5)

Building category and wind importance factor,  $I_w$  (Table 1604.5, 1603.5)

Wind exposure category (1603.4)

Internal pressure coefficient (ASCE 7)

Component and cladding pressures (1603.1.3, 1603.6.2.2)

Main force wind pressures (1603.1.1, 1603.6.2.1)

Earthquake design data (1603.1.5, 1614 - 1623)

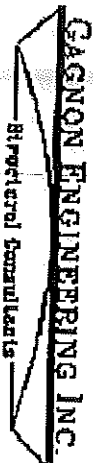
Design option utilized (1614.1)

Seismic use group (Category) (Table 1604.6, 1616.2)

Spectral response coefficients,  $S_{DS}$  &  $S_{D1}$  (1616.1)

Site class (1615.1.5)

\* Bldg Loads By Robb EG 5/25/05



198 MAIN STREET  
GORHAM, MAINE 04038  
Fax: 207-839-8035

### FAX TRANSMISSION COVER SHEET

Date: 04/16/05 From: GAGNON ENGINEERING  
Attn To: Mrs. Agent Fax No. 87428716  
Co/Org: Code Enforcement No. of Pgs: \_\_\_\_\_ (Including Cover Page)  
Re: Merrill/EUBB VIT

**Please Call 207-839-8085 if you have any problems receiving this fax.**

*This message is intended only for the use of the individual or entity to which it is addressed or copied (below), and may contain information that is privileged and confidential. If the reader of this message is not the intended recipient, any dissemination, distribution, or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone.*

Special instructions or message:

Merrill/King Terminal

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PLEASE REVIEW AND CALL IF YOU HAVE ANY QUESTIONS/PROBLEMS. THANK YOU.

Copied:



**Statement of Special Inspections**

Project: Merrill / Rubb VII, Foundations (& Site)

Date: June 14, 2005

Location: West Danforth / West Commercial - Merrill's Marine Terminal

Engineer in Responsible Charge (Foundations & Site): Roger R. Gagnon, P.E.  
(Gagnon Engineering, Inc.)

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with Structural Tests and Special Inspections requirements of IBC (2003, specifically Section 1704. It includes Materials and Work requiring Special Inspections by this Code. The inspections to be performed, list of qualified and approved Individuals & Agencies conducting such inspections.

Report Requirements. Special Inspectors shall keep records of inspections. The special inspector shall furnish inspection reports to the Building Official, and to the Design Professional in Responsible Charge. Reports shall indicate

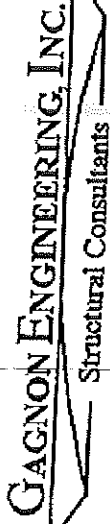
- That the Work inspected was done in conformance with approved construction documents.
- Discrepancies shall be brought to the attention of the immediate attention of the Contractor for Correction.
- If the Discrepancies are not corrected, the Discrepancies shall be brought to the attention of the Building Official and to the Design Professional in Responsible Charge, prior to the completion of that phase of the Work.
- A Final Report documenting Required Inspections and the Corrections of any Discrepancies noted in the Inspections shall be submitted at a point in time agreed upon by the permit applicant and the Building Official prior to the start of Work

Inspection (& Testing) Agents:

Agent #1: Gagnon Engineering, Inc. (Gorham, Maine)

Agent #2: S.W.Cole Engineering, Inc. (Gray, Maine)





**Project: Merrill / Rubb VII**

**Special Inspections: Concrete**

Date 06-14-05 By: RG

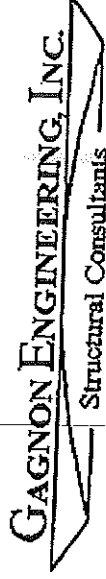
No.	Item (1)	Agent #	Scope	Freq. (3)
1	Reinforcing Shop Drawings	(2) #1	Materials, sizes, Layout, General Compliance, Footings, Walls, Slabs	
2	Concrete Mix Designs	#1	Compressive Strength, Ingredients, w/c, Slump, Additives, Walls, Footings, Slabs	
3	Footings	#1	Forms, Steps, Reinforcing	B/C
4	Walls	#1	Forms, Reinforcing, Protect & Cure	B/C
5	Inserts	#1	Anchor Bolts, Anchors & Inserts	B/C
6	Floor Slabs	#1	Reinforcing Layout, Details, Surface Preps, Concrete Placements, Protect & Cure	C/W
7	Testing	#2	Strength, Air, Slump, etc.	C/W

Notes.

- (1) Refer to Contract Plans & Specifications for Details.  
 (2) Agents:

#1) Gagnon Engineering, Inc.  
 #2) SW Cole Engineering, Inc

- (3) Frequency Codes. Perform Initial and work-complete inspections for all items; follow-up as required. Perform intermediate inspections or tests as follows:  
 X/R = min percent / random  
 C/W = continuous / with work  
 B/C = Before covered



**Project: Merrill / Rubb VII**

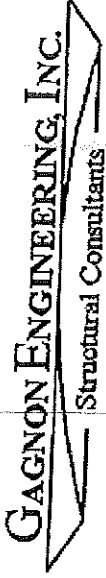
**Special Inspections: Site Work**

Date: 06-14-05 By: RG

No.	Item	Agent #	Scope	Freq.
	(1)	(2)		(3)
1	General Pre-Excavation & Prep	#1	Asphalt Removal, Pre-Excavation, Proof-Compaction	50/R
2	Wall Excavations	#1	Initial Excavations, Bearing Capacity, Sub-Footing Fills	B/C
3	Wall Fills	#2	Materials, Specs/Gradations, ASTM D1557, Placement, Moisture Contr., Compaction	C/W
4	Sub-Floor Fills	#2	Materials, Specs/Gradations, ASTM D1557, Placement, Moisture Contr., Compaction	C/W
5	Storm & Underdrain	#1	Materials, Prep Install, Back-Fill	50/R

**Notes.**

- (1) Refer to Contract Plans & Specifications for Details.
- (2) Agents:
  - #1) Gagnon Engineering, Inc.
  - #2) SW Cole Engineering, Inc
- (3) Frequency Codes. Perform Initial and work-complete inspections for all items; follow-up as required. Perform intermediate inspections or tests as follows:
  - X/R = min percent / random
  - C/W = continuous / with work
  - B/C = Before covered



# Report of Special Inspections

Project: Merrill / Rubb VII (Foundations & Site)  
Location: West Commercial - Merrill's Marine Terminal  
Owner: Merrill's Marine Terminal  
Owner's Address: 60 LA Danforth Street, Portland ME

Agent:  
Special Inspector:  
Inspection Item:

To the best of my information, knowledge, and belief, the Special Inspections required for this project, itemized in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

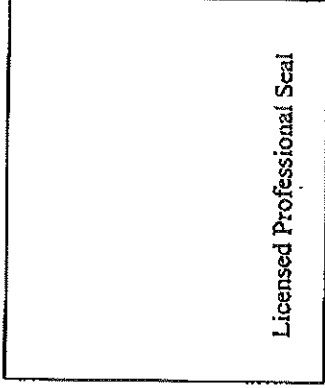
(Attach continuation sheets if required to complete the description of corrections.)

Respectfully submitted,  
Agent or Special Inspector

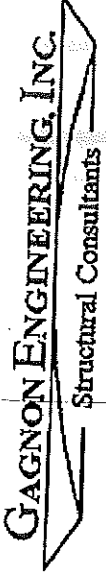
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\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



Licensed Professional Seal



# Final Report of Special Inspections

Project: Merrill / Rubb VII, (Foundations & Site)  
Location: West Commercial – Merrill’s Marine Terminal  
Owner: Merrill’s Marine Terminal  
Owner’s Address: 601A Danforth Street, Portland ME

Agent:  
Special Inspector:  
Inspection Item:

To the best of my information, knowledge, and belief, the Special Inspections or testing required for this project, and designated for this agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of corrections.)

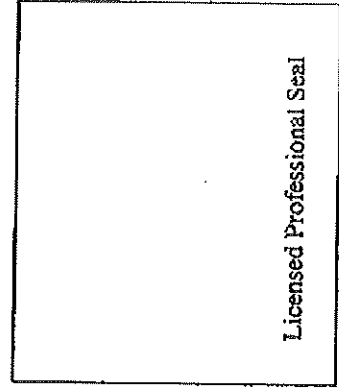
Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,  
Agent or Special Inspector

\_\_\_\_\_  
Type or print name

\_\_\_\_\_  
Signature

Date



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We Cover The World.



BUILDING SYSTEMS

TELEFAX

COMPANY:

RUBB INC.,  
Sanford Airport  
P.O. Box 711  
Sanford, Maine 04073  
Tel: (207) 324-2877  
Fax: (207) 324-2347  
E-mail: info@rubbusa.com

ATTN: MIKE NUGENT

FROM: GARY SUTRYN

FAX NO: 207-874-8716

NO. SHEETS: 8

REF: MRRJUL 7

DATE: 6/15/05

Sent [ ]

- SPECIAL INSPECTIONS } ATTACHED  
4 PAGES }  
- SEMI QUALITY PLAN }  
3 PAGES }  
STATEMENT OF RESPONSIBILITY TO  
FOLLOW SOON.

AS

R

AG



AN INTERNATIONAL COMPANY



CERTIFICATE No. US870887



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BUILDING SYSTEMS

# TELEFAX

COMPANY:

RUBB INC.,  
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P.O. Box 711  
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Fax: (207) 324-2347  
E-mail: info@rubbusa.com

ATTN: MIKE NUGENT

FROM: GARY SUTRYN

FAX NO: 207-874-8716

NO. SHEETS: 8

REF: MGRRLU 7

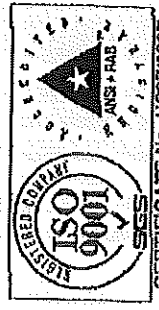
DATE: 6/15/05

Sent [ ]

- SPECIAL INSPECTIONS } ATTACHED  
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 3 PAGES }  
 STATEMENT OF RESPONSIBILITY TO  
 FOLLOW SOON.



AN INTERNATIONAL COMPANY



CERTIFICATE NO. USA70887

Rubb Inc., Sanford, Me. 04073

# Statement of Special Inspections

Page 1 of 4

Project: MERRILL 7 STRUCTURE  
 Location: MERRILL MARINE TERMINAL, PORTLAND, ME.  
 Owner: SPRAGUE ENERGY  
 Design Professional in Responsible Charge: GARY B. SUTRYN, P.E.

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspections applicable to this project and the name(s) of the Special Inspectors and the identity of other approved agencies (if any) to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

- Structural
- Mechanical/Electrical/Plumbing
- Architectural
- Other

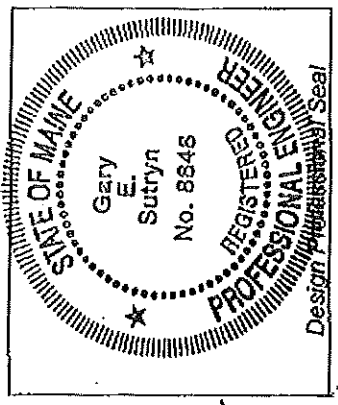
A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Prepared by:

GARY B. SUTRYN, P.E.  
 (type or print name)

[Signature]  
 Signature

6/14/05  
 Date



Page 2 of 4

# Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- |  |  |
|--|--|
| <input type="checkbox"/> Soils and Foundations<br><input type="checkbox"/> Cast-in-Place Concrete<br><input type="checkbox"/> Precast Concrete<br><input type="checkbox"/> Masonry<br><input checked="" type="checkbox"/> Structural Steel<br><input type="checkbox"/> Cold-Formed Steel Framing | <input type="checkbox"/> Spray Fire Resistant Material<br><input type="checkbox"/> Wood Construction<br><input type="checkbox"/> Exterior Insulation and Finish System<br><input type="checkbox"/> Mechanical & Electrical Systems<br><input type="checkbox"/> Architectural Systems<br><input type="checkbox"/> Special Cases |
|--|--|

Special Inspector	Firm	Address, Telephone, e-mail
1. GARY SUTRYN	RUBB INC.	SAMPSON, ME. 207-324-2877
2.		
3.		
4. Testing Agency (if applic.)		
5. Testing Agency (if applic.)		
6. Other		

Note: The special inspections and testing will be performed by qualified Rubb personnel unless another firm is designated in the above table.

# Quality Assurance Plan

## Quality Assurance for Seismic Resistance

Seismic Design Category **D**

Quality Assurance Plan Required (Y/N) **YES**

Description of seismic force resisting system and designated seismic systems:

**ORDINARY STEEL CONCENTRIC BRACED FRAMES**

## Quality Assurance for Wind Requirements

Basic Wind Speed (3 second gust) **100 MPH**

Wind Exposure Category **C**

Quality Assurance Plan Required (Y/N) **NO**

Description of wind force resisting system and designated wind resisting components:

**ORDINARY STEEL CONCENTRIC BRACED FRAMES.**

## Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated above must submit a Statement of Responsibility.

## Structural Steel

Page 4 of 4

Special Inspection	Inspection frequency	Scope
1. Fabricator Certification/ Quality Control Procedures	One time report.	Review shop fabrication and quality control procedures.
2. Material Certification	One time report.	Review certified mill test reports, bolt certification and weld electrode certifications. Provide structural steel vendor information (name, etc.)
3. Bolting	Intermittent.	Inspect installation and tightening of pre-tensioned high-strength bolts.
4. Welding	100 % visual inspection	Visually inspect all welds. Verify size and length of fillet welds.
5. Structural Details	Inspect sample each week	Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.

RUBB INC., Sanford, Me. 04073

# SEISMIC QUALITY PLAN

Page 1 of 3

Project: *Merrill 7 structure*

Location: *Merrill Marine Terminal, Portland, Me.*

Owner: *Sprague Energy*

Design Professional in Responsible Charge: *Gary E. Sutryn, P.E.*

This *Seismic Quality Plan* is submitted prior to commencement of structure fabrication as required in the Building Code. This *Seismic Quality Plan* encompasses the following disciplines:

- Structural
- Mechanical/Electrical/Plumbing
- Architectural
- Other:

A final letter of completion documenting satisfactory completion of all Seismic Quality Plan requirements shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Prepared by:

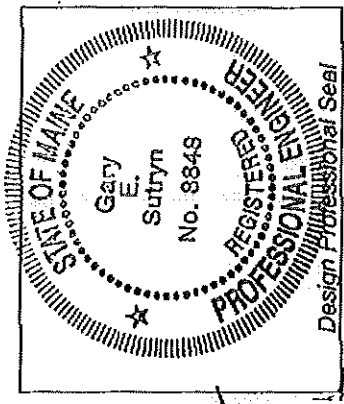
*GARY E. SUTRYN*

(type or print name)

*Gary E. Sutryn* / *6/15/05*

Signature

Date



RUBB INC., Sanford, Me. 04073

## **SEISMIC QUALITY PLAN – Rubb Structures**

Page 2 of 3

### **DESIGNATED SEISMIC FORCE RESISTING SYSTEMS:**

- A) Truss arch spans – resists side to side seismic forces.
- B) Bracing cables and compression purfins in the braced bays – resists end to end seismic forces.

### **SPECIAL INSPECTIONS REQUIRED: See also attached table.**

- 1.) Review quality control procedures.
- 2.) Review purchased material certifications.
- 3.) Inspect installation of pre-tensioned high strength bolts.
- 4.) Welding:
  - 100 % visual inspection of all welds.
  - welding performed according to AWS D1.1
    - use only qualified welders
    - follow written welding procedures.
- 5.) Inspect completed structural components to verify compliance with construction drawings.

### **DOCUMENTATION REQUIRED TO SUBMIT TO BUILDING OFFICIAL:**

- material certifications for structural steel, structural bolts and welding electrode.
- vendor names of structural steel suppliers.
- statement of responsibility.
- letter of completion of requirements in this plan.

RUBB INC., Sanford, Me. 04073

**Seismic Quality Plan – Seismic systems**

Page 3 of 3

Special Inspection	Inspection frequency	Scope
1. Fabricator Certification/ Quality Control Procedures	One time report.	Review shop fabrication and quality control procedures.
2. Material Certification	One time report.	Review certified mill test reports, bolt certification and weld electrode certifications. Provide structural steel vendor information (name, etc.)
3. Bolting	Intermittent.	Inspect installation and tightening of pre-tensioned high-strength bolts.
4. Welding	100 % visual inspection.	Visually inspect all welds. Verify size and length of fillet welds.
5. Structural Details	Inspect sample each week.	Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details.





# GEI Consultants, Inc.

July 8, 2004  
Project 04082-2

1021 Main Street  
Winchester, MA 01890-1970  
781-721-4000  
781-721-4073 Fax

Mr. P. D. Merrill  
Merrill Marine Terminal Services, Inc.  
601 Danforth Street  
Portland, Maine 04102

Re: **Subsurface Investigation and Settlement Analysis**  
**Proposed Rubb Warehouse No. 7**  
**Merrill Marine Terminal**  
**Portland, Maine**

0506 AS  
72 AS  
30

Dear Mr. Merrill:

This letter summarizes the results of our subsurface investigation and settlement analysis for the proposed Rubb Warehouse No. 7 at the Merrill Marine Terminal in Portland Maine. This work was performed in accordance with our proposal dated April 20, 2004.

## **Project Description**

The footprint of the proposed warehouse is shown on Figure 1. The warehouse will consist of a Rubb fabric building supported on shallow footing foundations with a reinforced concrete slab-on-grade floor. The design floor elevation is at El. 22 and up to 4 to 6 feet of fill will have to be placed in portions of the building footprint to create a level surface for the building. The design storage load is 1,000 psf. The Rubb building is very flexible, and it can tolerate relatively large differential settlements. We understand that you would prefer a concrete floor, but would also consider using a flexible asphalt pavement. A concrete floor must be designed to prevent excessive cracking that could result in contamination of the stored product with concrete residue from the floor. Selection of the type of floor will be based on both cost and serviceability considerations.

## **Existing Subsurface Data**

There is a considerable amount of existing soil boring and laboratory test data available from previous investigations at the Merrill Marine Terminal. We reviewed this existing information and have incorporated applicable data from these previous investigations in the evaluation performed for this project.

The following existing soil borings are located close to the location of the proposed warehouse: D-14, B-402, B-216, B-302, B-1, B-2 and B-3. Information on compressibility and preconsolidation of the organic silt and clay strata is available from laboratory consolidation tests performed on samples obtained from the mudflat areas on the south and west sides of the marine terminal and from a storage area located north of the bridge that borders the north side of the marine terminal.

### **Subsurface Investigation**

We engaged Northeast Diamond Drilling Co. to perform two soil borings (B-501 and B-502) to evaluate the thickness of the compressible organic silt and clay strata at the proposed warehouse location and to obtain undisturbed samples for laboratory consolidation tests. The boring locations are shown on Figure 1 and boring logs are contained in Appendix A. These boring locations were selected to obtain samples for laboratory testing from portions of the proposed warehouse footprint that have experienced the least amount of surcharge from previous bulk storage loading.

The borings were advanced by driving a 4-inch ID casing and cleaning out the casing with a roller bit. Standard 2-inch OD (1 $\frac{3}{8}$ -inch ID) split spoon samples were obtained in accordance with ASTM D1586 at intervals varying from 5 to 10 feet. Eight undisturbed 3-inch-diameter thin-wall tube samples of the organic silt and clay were obtained with a hydraulic fixed-piston (Osterberg) sampler. The borings were advanced to refusal at depths of 49.6 feet in B-501 and 72.4 feet in B-502.

### **Laboratory Testing**

Five one-dimensional consolidation tests were performed to obtain data on compressibility and preconsolidation of the organic silt and clay strata. Compression curves from the consolidation tests are contained in Appendix B. The test specimen from B-502 U4 appeared to be disturbed by the presence of a piece of gravel that damaged the cutting edge of the thin-wall tube and the test results for this specimen proved to be unusable.

Compressibility indices from the consolidation tests are plotted in Figure 2 and pre-consolidation pressures from the consolidation tests are plotted in Figure 3, along with the data from the previous investigations.

### **Subsurface Soil Conditions**

The general soil profile in the area of the proposed warehouse consists of: 10-20 feet of granular fill and sand; 30-50 feet of soft organic silt and clay; and about 5-10 feet of sand and/or glacial till overlying bedrock.

The granular fill varies from widely-graded sand with gravel to narrowly-graded silty fine sand. The natural sand underlying the fill typically consists of narrowly-graded silty to clayey fine sand. The standard penetration test N-values in the granular fill and sand

indicates that the in-place density of the soil typically ranges from very loose to medium dense, with most of the soil in a loose condition.

The thickness of the soft organic silt and clay increases from about 30 feet at the west end of the warehouse to about 50 feet at the east end. At the west end there is about 10 feet of organic silt overlying about 20 feet of clay. At the east end there is no organic silt and the clay is about 50 feet thick.

The clay is an older marine deposit of glacial origin and the upper portion of the clay stratum has undergone significant geologic preconsolidation due to desiccation. The organic silt is a more recent deposit that has not experienced the same geologic preconsolidation as the clay. The preconsolidation data from the consolidation tests indicate that the preconsolidation profile for the clay at the warehouse location is similar to the preconsolidation profile obtained from the previous tests on samples from the mudflat areas. However, the organic silt at the warehouse location shows significantly higher preconsolidation than indicated by the previous tests on samples from the mudflat areas. This preconsolidation is probably due to surface surcharge loadings.

At the east end of the warehouse the clay stratum contains layers of silty to clayey fine sand varying from less than an inch to several feet in thickness. A surficial geology map for the Portland area indicates that the glacial marine clay stratum transitions to a glacial marine sand to the northeast of the marine terminal site, and this transition can be seen in the northeastern-most borings from the previous site investigations.

The groundwater level at the east end of the warehouse appears to be about El. 13 based on previous measurements performed in boring B-3. The groundwater level at the west end of the warehouse is tidal, and an average level of El. 5 (approximate mean tide level) was assumed for analysis.

### **Settlement Analyses**

We performed one-dimensional settlement analyses to estimate the magnitude of settlement due to compression of the soft organic silt and clay strata under the weight of the new fill and storage loading. Analyses were performed for the soil profiles from borings B-501 (west end) and B-502 (east end) using a recompression index of 0.02 and a virgin compression index of 0.20 for both the organic silt and clay. For the analyses at the east end we applied an adjustment for the estimated percentage of sand layers in the clay stratum. We used the preconsolidation profile shown in Figure 3 where it is greater than the existing vertical effective stress, and we assumed an overconsolidation ratio of 1.05 due to aging where the preconsolidation profile in Figure 3 is less than the existing effective stress. The stresses in the organic silt and clay strata due to the weight of the fill (500 to 600 psf) and storage loading (1,000 psf) were calculated using the Boussinesq elastic solution for uniform loading over a rectangular area, with the fill and storage loading applied over the full warehouse footprint. The settlement calculations were performed using the computer program SAF distributed by Prototype Engineering, Inc.

The estimated settlement due to compression of the organic silt and clay is in the range of 1 to 3 inches. The estimated settlements for the specific cases analyzed are as follows:

Location	Est. Settlement, inches	Notes
West End - South side (boring B-501)	1.0	Location with least preconsolidation, stress increase is less at side
West End - Center in Scrap Steel Storage Area	1.5	Assumed full preconsolidation by steel storage surcharge, stress increase is greatest at center
East End - South side (boring B-502)	2.5 (3.5)	Location with least preconsolidation, stress increase is less at side
East End - Center in Salt Storage Shed Area	3.0 (4.0)	Assumed the existing surcharge is equivalent to a ground level at El. 24, stress increase is greatest at center.

Number in ( ) is the value before adjustment for sand layers.

Differential settlements resulting from the compression of the organic silt and clay are expected to be relatively gradual because the differences in the estimated settlements are largely due to differences in the compression within the lower portion of the clay stratum.

There is a significant potential for differential settlements due to local variations in compression of the loose fill and sand overlying the organic silt and clay, which is not reflected in the settlement analyses summarized above. Because these soils are highly variable and are located directly below the structure, they may produce relatively sharp differential settlements across short distances. These sharp differential settlements can be reduced by providing a layer of compacted fill below the structure

### Conclusions and Recommendations

Our subsurface investigation and analyses indicate that the existing preconsolidation of the organic silt and clay is sufficient to prevent large settlements under the weight of the new fill and storage loading. Therefore, we conclude that preloading is not required. It is our understanding that the estimated settlement of 1 to 3 inches due to deep-seated compression of the silt and clay is within the tolerable limits for the Rubb building superstructure. The floor slab should be designed with sufficient reinforcing and control joints to tolerate settlements of this magnitude.

We recommend that the following minimum thicknesses of controlled compacted fill be placed below the footings and floor slab to reduce differential settlements due to the loose fill and sand directly below the structure (includes the 9-inch minimum thickness of Structural Fill directly below the floor slab per our recommendations for the slab design):