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1130 NW 12th AVE
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June 15, 2001

Hoyt Street Properties, LLC
809 N.W. 11th Avenue
Portland, Oregon 97209

Attn: Mr. Bill Hardt, Construction Manager

Re: Observations of Driven Grout Pile Tests
Block 11, Hoyt Street Properties
Portland, Oregon

Dear Mr. Hardt:

This report presents a summary of our field observations and analysis in connection with the 16-inch diameter driven grout pile load tests on Block 11, Hoyt Street Properties in Portland, Oregon. A total of two pile load tests were conducted, one for compression, and the other for uplift. Our letter report dated April 25, 2001, recommended that the 16-inch diameter displacement piles be driven to suitable set at least 45 feet below the bottom of the pile caps. The design allowable seismic compressive capacity of the piles ranged between 170 and 200 kips. The design allowable seismic uplift capacity ranged between 80 and 120 kips. We recommended that use of the upper value be confirmed by in-situ compressive and uplift load tests. The recommended pile load tests were performed. This letter presents our observations of the test pile installations and the load tests, and our engineering conclusions and recommendations based on the test results.

INSTALLATION OF TEST PILES

The test piles (TP) were installed on May 9 and 11, 2001. A total of 5 test piles and 2 reaction piles were installed. The locations of the test piles and reaction piles are shown on Figure 1, Test Pile Locations.

We understand that the top of the production piles will be about 15 feet below the existing ground surface. Also, the subsurface explorations suggested that a layer of potential liquefiable soil extends to about depths 25 to 35 feet from the existing ground surface. In order to model the future production piles and to reduce the skin friction on the upper section of the test pile, all test piles were installed with the top 25 feet of the piles cased in 16-inch diameter steel pipes. The details of the pile installations are described in the following paragraphs.

Driving: A single-acting air hammer, VULCAN-512, was used to install the piles. The rated maximum driving energy of the hammer is 60,000 ft-lbs. The piles were installed by driving a steel casing with a 2-foot long closed-end steel driving boot to the designated depths. The steel casing supports the soil while concrete is pumped into it under pressure and the steel casing is slowly withdrawn from the ground.

During pile installations, the casing penetration resistance (blows per foot) was observed and recorded for all piles. The pile driving records are enclosed as Attachment A. As shown in Attachment A, the first three test piles, TP-1, TP-2, and TP-3, were driven to a depth of 60 feet from the existing ground surface, which is equivalent to the recommended design depth of 45 feet below the production pile cap. The pile driving records of test piles TP-1 and TP-2 indicated that the piles penetrated through the dense upper sandy gravel at the depth of 58 to 59 feet. As a consequence, two additional test piles, TP-4 and TP-5, were installed to depth 55 feet near TP-2. The test pile tip at depth 55 feet is approximately equivalent to the proposed 40-foot long production piles. Test pile TP-4 was installed for the uplift load test, and test pile TP-5 was for the compression test. In addition, two 55-foot long reaction piles (RP) were installed for conducting the pile compression load test. These two reaction piles were installed without the steel casing on the upper sections.

Grouting: The installed concrete grout volume for test piles TP-1, TP-2, and TP-3 vary between 100 to 104 pump piston strokes. For the other two test piles, TP-4 and TP-5, and reaction piles RP-6 and RP-7, the concrete grout volumes are between 90 to 100 strokes. The piling contractor states that each stroke of the pump injects 1 cu.ft. of grout. Therefore, the measured grout volumes are about 115 to 125 percent of the theoretical pile volumes. This is compatible with the stated industry standard, which specifies a minimum volume of 115 percent of the theoretical volume.

Steel Rebar and Steel Cage: A 35-foot long steel cage was installed into each of the test piles. For test piles TP-2, TP-3, and TP-4, two 1⅜-inch diameter steel rebar were inserted into the bottom of each pile. One 1⅜-inch diameter rebar was also installed in each reaction pile.

OBSERVATION OF PILE LOAD TESTS

The pile tests were conducted on May 21 and 22, 2001, by Precision Measurements, Inc. A pile load test measurement report from Precision Measurements, Inc. is enclosed as Attachment B. An engineer from Squier Associates present during testing verified that the test equipment, set-up, and procedures were in general accordance with applicable standard practice. The following briefly describes the compression and tension load testing set-up and procedures.

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Compression Load Testing: One compression test was performed on test pile TP-5. The static axial compressive load testing was set up and performed in general accordance with ASTM D1143-81, Standard Method for Piles Under Static Axial Compressive Load, and is described as follows:

> Four hydraulic jacks acting against an anchored reaction frame were used to apply compression loading to the test pile. The jacks, supported on a steel plate affixed to the test pile, exerted loading in increments of about 15 percent of design capacity, i.e., 120 tons (18, 36, 54, 72, 90, 108, 126, 144, 162, 180, 198, 216, 228, 240, 258, 276, 294, 300 tons). Load application was resisted by the test beam weight, as well as by four reaction piles. A load cell placed on top of the hydraulic jack was used to measure applied loads and was supported against a 2-inch-thick steel plate welded to the test beam.
>
> The load reaction frame included a main steel beam supported by timber cribbing on either side, supporting shorter steel cross-beams, tied to reaction piles to either side of the test pile. Test beam set-up and anchoring were typical for both compression and tension load testing. Four dial gauges mounted at each corner of the top test plate of the test pile were used to monitor displacements of the test pile at intervals in general accordance with the Quick Load Test Method for Individual Piles (Section 5.6, ASTM D1143-81). Movement of about 0.686 inches was measured at 250 percent of the design load of the test piles in compression. About 63 percent of the deflection appears to have been due to elastic strains, since the measuring apparatus returned to about 0.251 inches at completion of the unloading cycle.

Tension Load Testing: Test pile TP-4 was loaded in tension to 250 percent of the maximum recommended design capacity of 60 tons in general accordance with the Standard Test Method for Individual Piles Under Static Axial Tensile Load, ASTM D3689-90.

> Two hydraulic jacks were used in the tension load test. A 2-inch thick test plate was welded in position on the top side of the test beam for support of the hydraulic jacks. Two (2) displacement dial gauges were attached on either side of the test pile. Readings were taken in general accordance with ASTM D3689 standards under the Quick Load Test Method for Individual Piles (Section 7.7). The jack exerted loading in increments of about 15 percent of 75 tons (11, 23, 34, 45, 56, 68, 79, 90, 101, 113, 124, 135, 143, 150 tons). Movement of about 0.444 inches was measured at the maximum test load, 150 tons. About 61 percent of the deflection appears to have been due to elastic strains, since the measuring apparatus returned to about 0.173 inches at completion of the unloading cycle.

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CONCLUSIONS AND RECOMMENDATIONS

The compression and uplift pile load test results are presented on Figures 2 and 3, respectively. As shown on the figures, the compression and uplift test piles did not failed. However, the maximum uplift test load, 150 tons, in our opinion is very close to the failure load. Based on our observations and analysis, we believe that the driven grout test piles were constructed in general conformance with current engineered construction practice. Measured grout volumes indicate grout volumes were in accordance with currently accepted industry practice. Based upon our engineering analyses and evaluations under considerations of the static pile load tests and the potential pile performance on seismic loading conditions, we recommend that the design seismic compression capacity of 120 tons (240 kips) be assigned for the test pile TP-5. The design seismic uplift capacity of 60 tons (120 kips) is recommended for the test pile TP-4. In our current opinion, if all production piles are constructed following the same procedures and criteria as the test piles, the above seismic compression and uplift capacities can be used for the design of the proposed condominium buildings. We should be retained to assist the Structural Engineer of Record to prepare the specification pile driving section based on the test pile driving and grout procedures and results.

If you have any questions regarding the above pile load tests and our engineering opinions, please do not hesitate to call.

Very truly yours,
Squier Associates, Inc.

by ______________________________
Risheng Piao, P.E.
Project Engineer

RP/AHR/SB/keb

Encl: Figures 1 through 3
Attachments A and B

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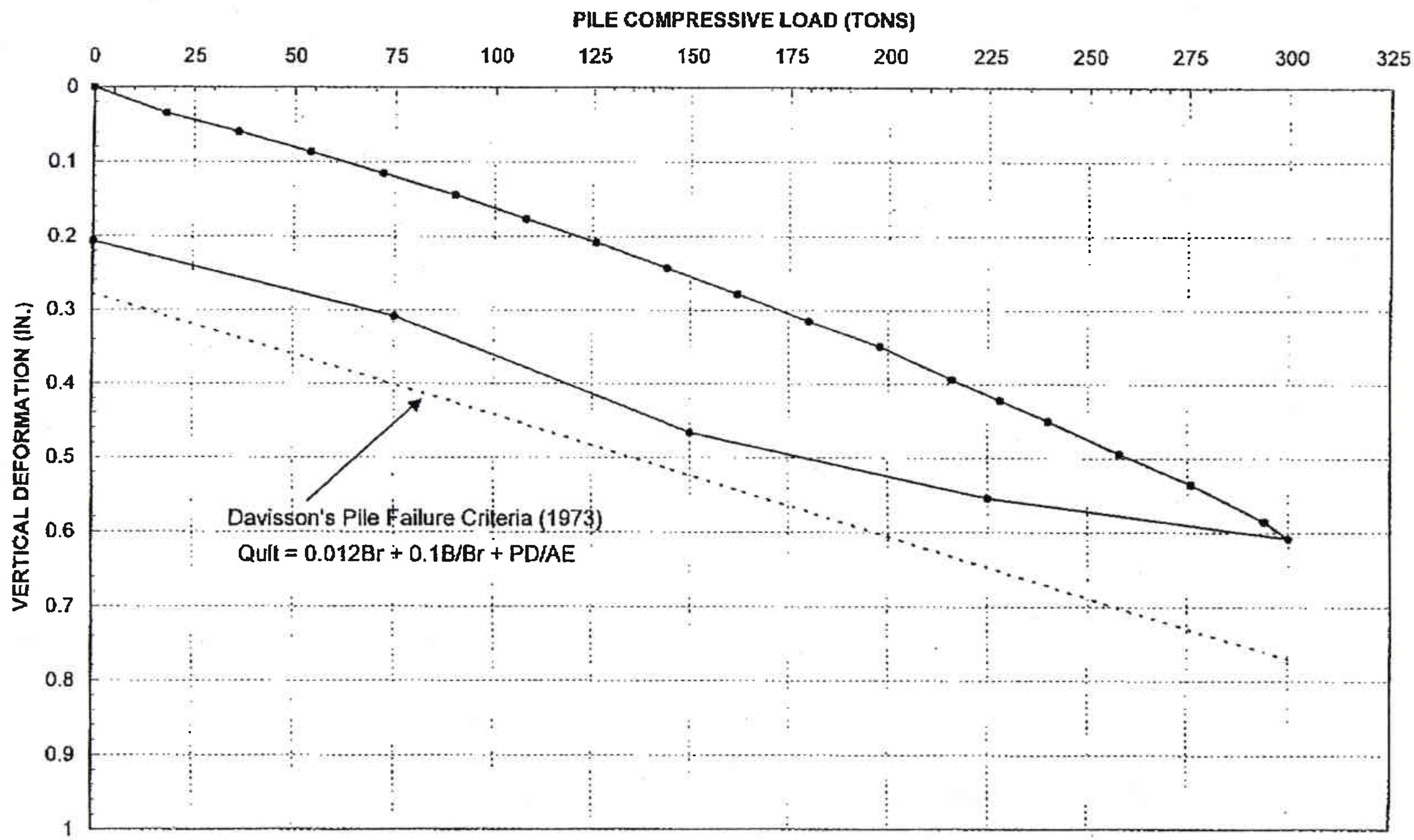
HOYT STREET BLOCK 11
16-INCH DIA. DRIVEN GROUT PILE COMPRESSIVE LOAD TEST



HOYT STREE BLOCK 11
16-INCH DIA. DRIVEN GROUT PILE TENSILE LOAD TEST