

December 22, 2011

Ms. Suenn Ho  
**Mulvanny G2 Architecture**  
601 SW 2<sup>nd</sup> Avenue, Suite 1200  
Portland, Oregon 97204

**Re: Astoria Heritage Square  
Structural Due Diligence Report  
AAI Project #: A11110**

Dear Suenn,

As requested, we have completed our due-diligence research for the proposed Heritage Square project in Astoria, Oregon. Our scope was primarily the northern half of the site, but conclusions herein can be assumed to be relevant to the southern half as well. The purpose of this research was to determine the adequacy of the site to support the proposed uses, such as the Garden of Surging Waves, the Sunday Market, a new amphitheater, the steel & glass pavilion structures and general use as a place for community assembly.

Information for the development of this report was obtained from four site observation visits, from various meetings and conference calls with the project team and the City of Astoria, from rebar locating and concrete testing from Carlson Testing, from preliminary structural analysis performed on the slabs, beams, walls and columns, from a review of GRI's draft geotechnical report, and from pictures, details and a partially complete record of original construction drawings. The following is a summary of our findings:

### **Description of the existing site**

The site is one entire city block, bounded by Duane and Exchange Streets, and 11<sup>th</sup> and 12<sup>th</sup> Streets. After the Astoria fire of 1922, which destroyed the majority of the downtown structures, which were elevated and wood-framed, the city streets and sidewalks were reconstructed and redefined by continuous chairwalls and vaulted sidewalk structures. These chairwalls and vaulted sidewalk structures are constructed of concrete and they form the boundary around the Heritage Square site. Note that these structures have been found to be in various stages of deterioration around the site, and around the City of Astoria, but they will be addressed in a separate report, which will focus on their repair and replacement for all locations in the City.

Currently only one building exists on the Heritage Square site, and that is the American Legion Building (ALB), which was constructed circa 1923. The building is approximately 50' x 100' in plan, is oriented in the N/S direction and is located in the southern end of the block along Exchange Street. To the north and west of the ALB, the site was brought up to street-level by placement of fill material after removal of the original 1941 Safeway store. To the northeast of the ALB, the basement of the 1957 Safeway is exposed as the wood floor at the ground level collapsed in early 2011. The remainder of the site (to the northeast and east of the ALB) is framed by concrete beams and slabs constructed in 1948, 1957 (the majority) and in 1963. Refer to our attached site structural drawings for additional information.

### **Description of existing conditions**

During our site visits, we found that the existing elevated concrete structure (in general) appeared to be in good shape. With the exception of the chairwalls and vaulted sidewalk structures, as mentioned above, only some limited areas of deterioration/damage was noticed. A more thorough future review could define each column, beam, slab and footing as: "adequate as is", "needs to be repaired", or "needs to be replaced", but at this time we feel that there are only a few locations of "needs to be repaired". These include areas in columns or slabs where concrete spalling has occurred and the reinforcing steel has extensive corrosion. With the help of Carlson Testing's GPR (ground penetrating radar) device, we were able to determine the approximate size, spacing and depth of the typical reinforcing steel in the slabs, beams and columns. In addition, during the geotechnical boring work, three 6" diameter concrete cores were cut through the elevated concrete slab and these concrete core samples were taken to Carlson Testing's lab for compression testing. Even though the core samples did not meet the ASTM testing specifications, they did average 8,519psi in strength, which gives us a comfort level that the existing concrete is at least 4,000psi strength. The most obvious existing element is the American Legion Building. This AMB is structurally independent from the support of the slabs around it and should not be a structural issue.

### **Structural analysis results**

The intent of our structural analysis was to determine how strong the existing structural elements are, and if they are adequate to support the new loads from the Astoria Heritage Square site plan, based on the proposed construction at this time. Note that this analysis was preliminary in nature, and was based on the average slab, beam, column, footing, etc.; it was not intended as a thorough review of all loads and capacities of the entire structural system. The NE corner of the site was the first constructed elevated concrete deck, and it is a one-way slab system on a grid of approximately 15' x 15'. The remaining elevated decks are a two-way slab system on a grid of approximately 14' x 15'. The typical slab is 5" thick with #5 bars spaced at about 8" o.c. each way. The typical beam is 12" wide x 18" deep with (3) # 6 continuous bars and #3 stirrups at 12" o.c. The typical column is 12" square with (4) #6 vertical bars and #2 ties at 12" o.c. Based on using 40ksi steel (rebar prior to 1960) and using 4,000psi concrete, we found that the structural elements appear to be adequate to support the 100psf code-prescribed live load for a public gathering area.

### **Review of structural aspects of the geotechnical report**

We have reviewed GRI's draft geotechnical report for the site and have summarized the structural aspects of the report and added our conclusions as follows: From a gravity load standpoint, new loads placed over existing fill will be adequate, provided we design for an allowable bearing of 1,500psf and provide a minimum of 2' of structural fill directly under footings and under all new plaza areas. This structural fill will reduce long-term settlement to an acceptable level. New concentrated loads, such as at the new steel & glass pavilion structures, would be best supported by steel micropiles with diameters of around 6". The entire existing Safeway basement area should be brought up to finished grade with structural fill which is anticipated to have mostly instantaneous settlement upon completion of the amphitheater floor. From a lateral standpoint, the most significant finding in the geotech report is that there is a potential of up to 11" of seismic-induced liquefaction settlement. This concerns us the most at the new steel & glass pavilion columns and footings, so we would design the foundations with cross-ties to ensure that the foundation elements move downward together if seismic generated settlement were to occur. Finally, new retaining walls would need to be constructed to retain the soil under the new amphitheater floor, to be placed along the perimeter of the depressed area.

**Review of existing tilt braces located in the Safeway basement**

The original wood floor of the Safeway was left in place and exposed to weather after the rest of the structure was demolished. In early 2011, this structure collapsed leaving the four original concrete basement walls. On the west of this basement, the concrete wall is serving as a retaining wall for the fill soils of the western parking lot. On the north wall, the wall is a masonry infill of a concrete beam and column line separating the vaulted sidewalk and chair wall structure from the original basement. On the south and east sides of the basement, the walls are concrete and do not retain any soil (separating the original basement from the unfinished space beneath the parking lot slabs).

As a precaution, the City of Astoria had braces installed on each of these four walls, extending from the top of the wall down to the concrete slab on grade of the original basement. In general, the walls on the east, south and north sides of the structure have relatively small loads on them. However, it is not clear how well these walls are tied to the concrete slabs and beams at the parking lot and at the vaulted sidewalk. For this reason, these wall braces are an adequate temporary precaution to prevent the walls from separating from those outside slabs.

For the west wall, the 1957 Safeway construction drawings describe it as an existing retaining wall. However, we have no documentation on how this retaining wall was constructed and cannot be sure that it was designed as a cantilever retaining wall. Furthermore, since soil loads are large, the braces likely do not have enough capacity to brace the top of the wall. Based on our site visits, this wall appears to be performing adequately. We would suggest that the City provide additional monitoring of this wall to verify the wall is not rotating. This monitoring program could be performed by maintenance personnel and would simply be a "measure and record" on a bi-monthly basis.

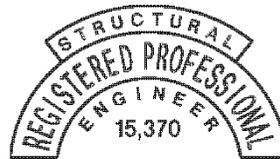
**Conclusion**

Overall, it appears that the site will be structurally adequate for its proposed use as the new Astoria Heritage Park, without a complete tear-down and re-build. Note that, due to the age of the existing concrete structure, more maintenance and repairs should be anticipated over the coming years, versus the expectation of the performance of a new structure. Finally, since the vaulted sidewalk and chairwall structures surround the site, and must be structurally competent for this project to be constructed, these elements should be addressed and upgraded where necessary as part of a separate review and design effort. Please call if you need any further assistance.

Best regards,



Richard J. Amodeo, S.E.  
Principal



EXPIRES: 12/31/11