Engineers

January 18, 2019

Stuart Kerr
Surfside Holdings (Beacon) Ltd.
c/o Analogue Projects Ltd.
P.O. Box 42090, 2200 Oak Bay Avenue
Victoria, BC V8R 6T4

Dear Stuart,

RE: Beacon Hill Residential - Structural Review **RJC No. VIC.118828.0002**
505 - 521 Quadra Street., Victoria BC

1.0 INTRODUCTION

As requested Read Jones Christoffersen Ltd. has completed a review of the existing residential building structure at 505 Quadra Street in Victoria, British Columbia.

The review undertaken was of a visual nature with no attempt to review or inspect every element or portion of the building. No testing or dismantling of any coverings was performed. Inspection was made on a random basis with no attempt to review or inspect every element or portion of the building. The intent of the review was to determine areas of visually obvious deterioration and need for repair and to determine, in a general way, the overall quality and sufficiency of the aspects of the building inspected, but not to ascertain the quality or sufficiency of any specific element of the building.

Existing drawings available were dated August 1966 by L.O. Lund Architect and John Motherwell & Associates Engineering Ltd. However there were a few differences between the existing structure and available drawings.

The purpose of this review was to evaluate the existing structure and outline to steps and upgrades to meet the requirements in the 2018 BC Building Code. The review was also in response to noticeable floor deflections in the building.

2.0 BUILDING DESCRIPTION

The existing building is a four-story wood frame structure with a below-grade crawlspace/basement. The building is believed to be constructed circa 1966. The applicable building code at the time was likely the 1960 National Building Code of Canada. Gravity and seismic loads for this code would have been less stringent than today.

- Flooring comprised of tongue and groove planks on 2x10 joists with wood herringbone struts.
- 2x4 stud bearing walls

- Beams over windows and cantilever balconies supported by 6x12 drop beams
- Load bearing elements on conventional reinforced concrete strip footing foundations
- Basement/crawlspace slab on grade floor.

3.0 OBSERVATIONS

The crawlspace provided the visual review of the structural members of the first floor and below. It appeared that there were different attempts to combat floor deflections within the crawlspace. All to be temporary repairs and with varying levels of acceptability. Nailing of the herringbone struts to joists did not appear to be consistent or poorly constructed with nails completely missing structural elements. It also seen that the flooring was only stapled to the joists. This had resulted in joists twisting and skewing due to the lack of lateral support.

There was a concrete strip footing that was not constructed but is shown on the drawings. A stairwell adjacent to this footing also was not constructed. Footings appearing to be in good condition without any noticeable settlement.

Hallways and a vacated unit were reviewed but no structural elements were exposed. However there were noticeable floor deflections in these areas which were on multiple floors of the building. The deflection was to an extent that water was not able to drain properly in the bathroom tub. Drywall was also cracking in these areas due to the excessive deflection.

4.0 GRAVITY REVIEW

The current British Columbia Building Code 2018 (BCBC 2018) specifies a live load of 40psf for residential floors and 100psf for lobbies and balconies. No change in occupancy is expected for this structure.

The most notable item was the concrete footing that was not constructed. It is likely that the necessity of the footing was overlooked when the adjacent stair was deleted. This strip footing was to support a load bearing wall located above. As a result, the missing footing has caused overloading the joists on the first floor and significant deflections of multiple floors above. It appears this issue had been identified earlier but only temporary shoring in the crawl space had been constructed. The unit above on the second floor was also unoccupied which will reduce load in this area.

Joists for the interior units, the main lobby, and the majority of the balconies appear to be designed for a live load of 50psf. While the balcony located at the south-east corner units of the building appear to be designed for 24psf. The capacity of the interior units' joists are acceptable for the BCBC 2018 live loads. The main lobby has 50% capacity of the live loads specified in the code which is due to the same joist sizing and spacing used throughout the building. Balconies also have a 50% live load capacity with the exception of the balconies located at the south-east corner, which only has a 24% load capacity. This is largely due to the under-sized drop beams supporting the cantilevers.

5.0 SEISMIC REVIEW

Earthquake provisions were first introduced into the code in the 1960's. However, seismic requirements have changed considerably since the time this building was constructed. We compared the seismic load resisting capacity of the existing structure with the requirements of BCBC 2018. The seismic review is based on our observations and measurements on site and the existing drawings.

Seismic resistance within typical wood frame construction has generally required wood sheathing or drywall on bearing walls to provide the lateral resistance to the structure. Commonly on 4 story structures such as this, wood sheathing must be used to provide any substantial level of seismic resistance. Our review of the site conditions and the existing drawings indicated no evidence that wood sheathing exists on any interior bearing walls. Furthermore, it is clear that no sheathing exists on the basement walls where the seismic shear force would be the greatest. Thus interior walls only have drywall paneling on the floors above grade. It is expected that only the exterior walls are sheathed. However the majority of the building's exterior are windows or doors with only a few segments of wall at the corners. The diaphragm (floor) is tongue and grove planks nailed only at wall locations and only stapled to joists. The existing floor diaphragms do not appear to provide significant resistance to support seismic loads.

Based on above, it is our opinion that the building has an overall resistance to seismic loading of no more than 10% of the loading prescribed in the BCBC 2018. There are several factors that contributed to this but most notably is the under-utilized interior bearing walls as vertical shear walls and their load path to foundations.

6.0 REPAIRS AND UPGRADING

This report explores extending the life span of the building by ±50 years which would require upgrading this building to meet 100% of gravity loads and approximately 70% of earthquake loads outlined in the BCBC 2018.

The first item that should be addressed is the missing footing noted above. It is strongly recommended to provide a strip footing as originally designed to support the bearing wall. Expected work would be as follows and should be done as soon as possible:

- Provide temporary shoring under the unsupported bearing wall, (possibly jack up joist flush).
- Reinstate deflected 2x10 joists under bearing wall as necessary.
- Excavate soil within crawlspace for adequate soil approved by the soils engineer for bearing.
- Pour new concrete strip footing.
- Provide new 2x4 pony-wall on new strip footing to support load bearing wall above.

Note, that the steps above is the minimal requirement for life safety. This may not level the deflected floors above. This would require much more extensive shoring and repair over multiple levels. Any jacking up of joist in the crawlspace will likely cause shifting of walls/floors/door frames above. Rework to level floors and re-finish the interior is to be expected.

To meet the BCBC 2018 loading values, the lobby and balconies would need to be upgraded. Expected upgrade for the lobby would be as follows:

- Sister 2x10 joists under lobby area
- Reinstate herringbone struts or provide blocking between joists

Expected upgrade work for the balconies would be as follows:

- Sister 2x10 cantilever joists.
- Ply LVL beams to each side of the existing 6x12 drop beam.
- Alternatively, shore joists and replace existing drop beam with new PSL beam.
- Possible end post upgrades could be expected at each end of the drop beams.

There is no requirement to from the BCBC 2018 to upgrade existing buildings to resist current seismic loading criteria. The decision as to whether or not seismic upgrading is required, and if so then to what level, is left to the "Authority Having Jurisdiction," which in this case is the City of Victoria. Seismic upgrading is often required when a building undergoes a change in use or occupancy. If a seismic upgrade is required, the City of Victoria typically refers to the City of Vancouver building bylaw. The bylaw indicates that an existing building which is able to resist 70% of the seismic loading specified in BCBC 12 is considered adequate for "life safety." Buildings that have been evaluated having less than 70% of the current BCBC code seismic resistance shall be upgraded.

The following work for an upgrade would be required to meet 70% of current code levels:

- Select interior walls to be utilized for seismic retrofit. Approximately 50m length of walls at each floor are required in each direction. Including corridor walls and walls within units. (This is with walls are sheathed on one side only. Less wall would be required if walls are sheathed on both sides. at lower levels)
- Under select walls, excavate adjacent to existing strip footings, doweling into these footings and pouring new concrete.
- Provide crawl space pony walls with new sheathing on one side and with sill bolts and hold-downs into the concrete footings.
- Upgrade interior walls with new sheathing on one side, improved nailing and hold downs between floors.
- Upgrade exterior walls with improved nailing and hold-downs between floors. Replace sheathing if required.
- Upgrade diaphragm by nailing new sheathing nailed through the existing tongue and grove planks to the existing joists.
- Upgrade connections between floor/roof diaphragms at wood shear walls.
- Nail steel strapping to the diaphragm around the perimeter of the building for drags into exterior shear walls.

7.0 SUMMARY AND RECOMMENDATIONS

Wood joists in the typical units appear to be performing reasonably. Footings also did not show any signs of settlement. However there were a few items with in the structure that should be addressed. If the intent is to lengthen the lifespan of the building, the work described above should be completed.

We highly recommend addressing the missing footing first and as soon as possible. Fortunately, temporary shoring has been put into place to halt further damage and reduce risk to occupants in the building. A new footing here should be constructed as indicated in the previous section. This item is considered as a necessary repair and not an upgrade. However, this would be a good opportunity to use the wall above as a shearwall as the footings would need to be upgraded.

The balcony at the south east corner at each level should also be addressed as well. Specifically the drop beam supporting the cantilever. Although all balconies do not meet the specified loads in BCBC 2018, this specific area should at least be designed for a live load capacity of 40psf.

The seismic capacity of the existing building is significantly less than that required by the BCBC 2018 and upgrades may be required by the City of Victoria if significant renovations are contemplated. The City of Victoria will need to provide direction on the level of structural upgrade should they require this project to follow the Vancouver Bylaw.

8.0 LIMITS OF LIABILITY

This report is intended to provide the Client with a general description of the structural systems employed in the buildings and to comment on their general condition which may be apparent at the time of our inspection.

This report has been prepared for the exclusive use of the Client and can be relied on by any lender to the above property and the present owners. The contents of this report may not be quoted in whole or in part or distributed to any person or entity other than by the Client.

Read Jones Christoffersen Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust the above satisfies your current requirements. If you require any further information, please contact the undersigned.

Any and all previous opinions expressed by Read Jones Christoffersen Ltd. either verbally or in writing, regarding the condition of the above elements are superseded by this report.

Yours truly,

READ JONES CHRISTOFFERSEN LTD.

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