

CITY OF NANAIMO

CITY HALL ANNEX SEISMIC UPGRADE

STAGE 2

1.0 INTRODUCTION

In September 2008, the City of Nanaimo appointed Herold Engineering Limited (HEL) to conduct a seismic review of The City Hall Annex Building at 238 Franklyn Street. A seismic assessment was completed in accordance with the "*Guidelines for Seismic Evaluation of Existing Buildings*" prepared by the National Research Council Canada Institute for Research in Construction. The assessment identified the City Hall Annex Building as at high risk for structural damage during a significant seismic event.

The City Hall Annex was originally constructed as a two storey warehouse building in 1937. In 1954, a single storey addition to the west elevation linked the warehouse with another existing building and in 1977-1979, a third storey was added.

Stage 1 of the seismic mitigation process began in September 2008. At this time, a condition assessment of the existing structural components was reviewed and materials testing was done on the existing structure to determine locations of reinforcing bar, compressive strengths of building materials and depths of existing footings.

The Stage 2 Seismic Mitigation Feasibility Study has investigated three options for renovation of the City Annex. Each option has been investigated in terms of structural form, effect on architectural, mechanical, electrical systems and project costs.

Therefore there are a series of reports from each discipline appended to this report outlining the impacts of the seismic upgrade on the various building systems.

2.0 BUILDING SUMMARY

The City Hall Annex was originally constructed as a two storey warehouse building in 1937 with a single storey addition to the west elevation in 1954. A further addition to the west elevation also took place at some time. In 1977-1979, a third storey was added over the original building and the addition and renovations on the interior and exterior were completed.

The original building was constructed by Dominion Construction as a warehouse. The building consists of 2 ½ storeys on a slope such that level entry and exit are accommodated. The area of the building footprint is approximately 154 ft x 98 ft.

3.0 BUILDING DEFICIENCIES

The following seismic deficiencies were identified for the existing lateral force resisting system:

- Existing masonry and concrete walls which are potential lateral load resisting elements have insufficient shear and moment capacity to resist lateral loads.
- There is insufficient capacity of the diaphragms to transfer shear to a lateral resisting system at all three levels.
- Existing columns lack anchorage capacity.
- All exterior concrete and masonry walls and interior concrete walls have insufficient out of plane capacity due to lack of reinforcing and lack of connection to floor system.

Upon review of the seismic condition of the building, we conclude that in a seismic event, there is a high risk of significant damage or partial collapse of the building occurring.

4.0 COSTING

Three remediation options were considered. These have varying impacts on the operations of the building versus structural efficiency. Note that the upgrades bring the building up to life safety standards, i.e. 60% of the 2006 British Columbia Building Code.

The cost of temporary lease space is not included in the construction costing. Phasing of the work is allowed for; however it is more likely that the building would require vacating for all or part of the construction period.

Option A (Concrete Stair Core)

The main seismic force resisting system of the building will consist of a new concrete core positioned in the location of the existing main stairwell. Plan bracing will be used at each level to transfer diaphragm loads to the concrete core.

This option requires the complete removal of the main staircase in the building and would likely require the building to be vacated until the work is completed.

Construction Cost \$4,273,878.00

Option B (Concrete Shear Walls)

Option B is very similar to Option A except that the main seismic force resisting system of the building will consist of separate concrete shear walls in the vicinity of the existing main stairwell. Plan bracing will be used at each level to transfer diaphragm loads to the concrete core.

This option retains the stair core, allowing some use of the stairs during construction and allowing some phasing of the work on a floor by floor basis.

Construction Cost \$4,288,742.00

Option C (Roof Expansion)

The main lateral load resisting system will include new and upgraded masonry block walls along the north, south and west walls for the third floor with upgraded masonry block walls below. A new three storey concrete shear wall is proposed near the east side of the building. This option includes new roof joists and roof sheathing along the north, south and east edges of the building including new post and beam supports carried down to the foundation level. Diaphragm upgrades will be required on all floors with blocking, nailing and plywood.

This option moves the lateral resisting elements to the perimeter of the building to minimize walls constructed in the interior of the building and increasing the upper floor area; however more significant diaphragm upgrades are required as a result.

Construction Cost \$4,569,276.00

Based on soft costs of approximately 25% of construction cost, we would estimate the project value to be in the range of \$5.3 million to \$5.7 million plus any lease costs associated with phasing the work.

5.0 SCHEDULE

The above three options are similar in scope and if the building was vacated completely, we anticipate a 12 month construction period. Note that the upgrade costs would then be reduced to approximately \$4 million.

With phasing the work floor by floor to try and retain partial occupancy of the building, the schedule would extend to at least 18 months. See the attached preliminary schedule.

6.0 COST COMPARISON WITH NEW BUILDING

The floor area of the existing building is approximately 3,372 m². Based on a construction cost of \$3,000/m², a new building would cost \$10,116,000.00; therefore the upgrade project is approximately 45% of the new construction cost.

Assuming lease costs based on \$200/m² and vacating a floor for six months at a time, lease costs would be approximately another \$330,000.00, bringing the percentage construction to 48%.

Vacating the building for 12 months does reduce construction cost and schedule; however based on the above, leasing space for 12 months to allow construction to occur would be in the

order of \$725,000.00, making the percentage of new construction approximately 48% once more.

Note that an upgrade cost of 48% is below the threshold recommended by the Builders Owners Managers Association (BOMA) of 70% of building replacement cost. However the figure is considered high and sensitive to other non-seismic condition related issues.

7.0 CONCLUSIONS AND RECOMMENDATIONS

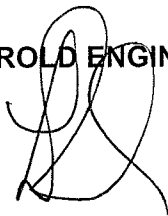
The seismic deficiencies of the building are such that the building requires upgrading to make it life safe for its occupants. The recommended option is considered to be Option A, constructed with the building vacated to minimize cost and schedule. Option A is chosen based on cost and structural efficiency.

With regards to phasing the work, it is considered unlikely that the operations of the building could continue successfully while upgrades of this magnitude were proceeding. Controlling issues such as vibration, noise, dust and accessibility would be very difficult. Solutions such as out of hours working were considered, but determined too costly and would extend the schedule further.

The cost of the upgrades is such that consideration should be made in relation to the economic life of the building. When issues such as sustainability, future usage, operational and maintenance costs are considered over the long term (typically 30 years), purchasing a building or constructing a new building may be economic alternatives to upgrading.

This would require a value analysis done on the various development options available and is outside the scope of this report; however due to the high cost of the upgrades, it is recommended that this be considered.

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