

Seismic Risk Assessment

REPORT NO. SRA-61-05

for

BLOCK #44-2 (GYMNASIUM)

UPLANDS ELEMENTARY SCHOOL

**3461 Henderson Road
Victoria, BC
V8P 5A8**

Facility No: 6161044

**School District No. 61
Greater Victoria School District**

**Structural Engineering Guidelines for the
Performance-based Seismic Assessment and Retrofit of
Low-rise British Columbia School**

This Seismic Risk Assessment (SRA) report is the report that documents the seismic risk posed by a potentially high risk school block.

The Ministry of Education requires that a School District submit a SRA for any school block as the first due diligence step in support of the District's request that the given block be added to the list of high risk school blocks in the province.

The Engineers and Geoscientists British Columbia (EGBC) was requested by the Ministry of Education to develop the format and technical requirements for the SRA.

From a structural engineering perspective, the SRA for a high risk block is the first step toward starting a Seismic Project Identification Report (SPIR) that will document seismic retrofit options for the seismically deficient school block.

On-going feedback from engineering practitioners is encouraged to advance future enhancements of the SRA document.

| Table 1.1: Seismic Risk Assessment Summary | | |
|---|--|---|
| No. | Technical Topic | Summary |
| 1 | School Name and School District | <ul style="list-style-type: none"> • Uplands Elementary • Greater Victoria School District (SD #61) |
| 2 | Block No. / Name | <ul style="list-style-type: none"> • Block #44-2 • Gymnasium |
| 3 | Engineer-of-Record Structural Firm | <ul style="list-style-type: none"> • Graham Taylor • TBG Seismic Consultants |
| 4 | Technical Reference | <ul style="list-style-type: none"> • Seismic Retrofit Guidelines 3rd Edition (June, 2017) |
| 5 | Year Built, Number of Storeys, Clear Storey Height, Floor Area | <ul style="list-style-type: none"> • 1958 / 62 • 1 Storey • 4900 mm • 430 m² |
| 6 | Type of Construction | <ul style="list-style-type: none"> • #21A (older wood frame) |
| 7 | Soil Type | <ul style="list-style-type: none"> • Site Class C |
| 8 | Previous Seismic Upgrade | <ul style="list-style-type: none"> • None |
| 9 | Liquefaction Potential | <ul style="list-style-type: none"> • Low risk |
| 10 | Post-earthquake Maximum Sa(1.0) | <ul style="list-style-type: none"> • 42 %g (subduction) |
| 11 | PPR Thresholds (subduction) | <ul style="list-style-type: none"> • 55 %g (green / yellow) • 90 %g (yellow / red) |
| 12 | Risk | <ul style="list-style-type: none"> • H3 (High Level 3) |

(Professional Seal and Signature)
Date



**Figure 2.1: West Elevation
Block #44-2
Gymnasium
Uplands Elementary School**

INTRODUCTION

This chapter details the engineering analysis that generated the seismic risk classification (H3) given on the summary page (page 1-1).

BLOCK DESCRIPTION

A typical cross-section of the block is given in Figure 3.1. A description of the significant structural elements in this block is as follows:

Type of Construction: This block is comprised primarily of late 1950s wood frame construction one storey in height.

Crawl Space: The gymnasium has a crawl space where the exterior concrete foundation walls are restrained against out-of-plane rocking by the intersecting end walls.

Year of Construction: The gymnasium was initially built in 1958 with an extension in 1962. The type of construction is similar for the two years of construction.

Storey Height: The gymnasium is one storey in height with a clear storey height of 4900 mm.

VLS: The VLS is comprised of wood frame walls.

Lateral System: Above the foundations, the lateral deformation resisting system is comprised of horizontal boards (shiplap).

Roof Diaphragm: The wood roof diaphragm is a non-governing element of this block construction.

SOILS

This block is founded on Site Class C soils (firm ground).

GOVERNING PORTION OF BLOCK

The in-plane behavior of the exterior wood frame walls is the governing element of this block. Figure 3.1 illustrates a typical gymnasium configuration. The north and south exterior walls are the governing gymnasium walls (east / west shaking).

The data used in the SRG3 analysis (Analyzer Version 3.0) of the in-plane deformation of the exterior wood frame walls is given in Table 3.1. The in-plane performance of these walls was determined to have a "H3 – High Level 3" Priority Retrofit Ranking.

POST-EARTHQUAKE EVALUATION

The ground motion rating results for use in the post-earthquake evaluation of this block are given in Table 3.2. Some comments on the values in Table 3.2 are as follows:

Governing Hazard Type: The subduction hazard is the governing earthquake hazard type for this block. The maximum ground motion for this block is lowest for the subduction hazard. The subduction hazard has the largest numerical value for the deaggregated ground motion that has a 2% probability of exceedance in 50 years.

Sa(1.0): All numerical values given in Table 3.2 are deaggregated spectral acceleration Sa(1.0) values (%g units) for the subduction hazard.

PPR Thresholds: The green / yellow PPR threshold value in Table 3.2 is the ground motion value at the transition from the green damage state to the yellow damage state (peak drift limit $\leq 3\%$). The yellow / red PPR threshold value is the ground motion value at the transition from the yellow damage state to the red damage state (peak drift limit $> 10\%$).

RISK SUMMARY

The risk ranking of the block is summarized as follows:

Risk: This block has been assigned a “H3 – High Level 3” Priority Retrofit Ranking.

Exterior Walls: This risk ranking is governed by the in-plane performance of the exterior wood frame walls.

| Table 3.1: Analysis Data for In-Plane Performance of Gymnasium Exterior Wood Frame Walls | | |
|---|-------------------------|--------------|
| No. | Data Description | Value |
| 1 | SRG3 prototype | W-4 |
| 2 | R_m | 11 % W_s |
| 3 | Clear storey height | 4900 mm |
| 4 | Peak drift limit | 3 % |

| Table 3.2: Post-earthquake Evaluation Data | |
|---|--|
| Data Description | Maximum $S_a(1.0)$ Value |
| Post-earthquake Engineering Assessment | 42 %g |
| PPR Green / Yellow Threshold | 55 %g |
| PPR Yellow / Red Threshold | 90 %g |

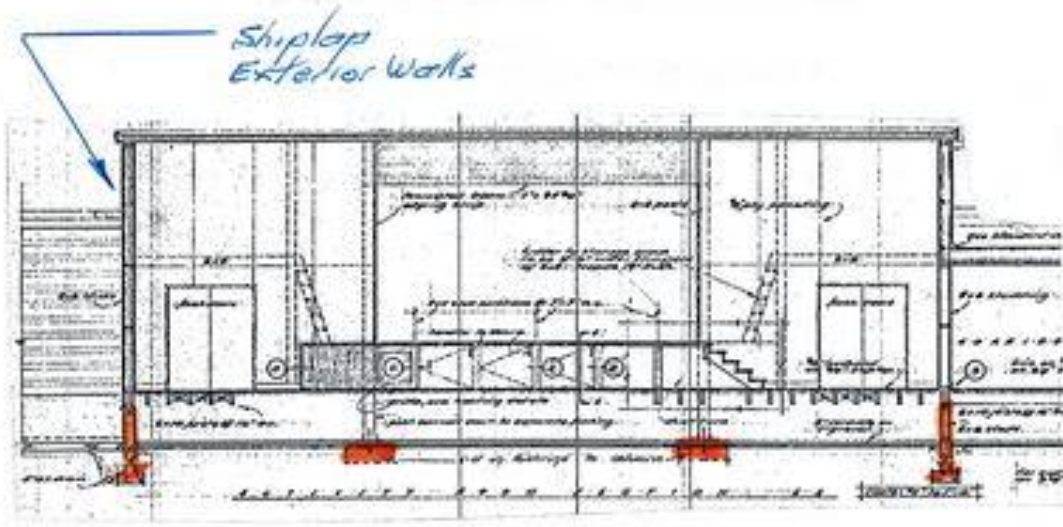


Figure 3.1: Typical Section
Block #44-2
Gymnasium
Uplands Elementary School