

Seismic Risk Assessment

REPORT NO. SRA-61-04

for

BLOCK #44-1 (CLASSROOMS)

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 #44-1 • Classrooms
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 / 64 • 1 Storey • 3050 mm • 2,080 m²
6	Type of Construction	<ul style="list-style-type: none"> • #21 (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"> • 15 %g (subduction)
11	PPR Thresholds (subduction)	<ul style="list-style-type: none"> • 22 %g (green / yellow) • 34 %g (yellow / red)
12	Risk	<ul style="list-style-type: none"> • H1 (High Level 1)

(Professional Seal and Signature)
Date



**Figure 2.1: North Elevation
Block #44-1
Classrooms
Uplands Elementary School**

INTRODUCTION

This chapter details the engineering analysis that generated the seismic risk classification (H1) 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 classrooms have a crawl space that has exterior concrete foundation walls as high as 1500 mm. Interior crawl space walls are comprised of unsheathed stud walls.

Year of Construction: The classrooms were built in three different construction periods: 1958, 1962 and 1964. The type of construction is similar for all three years of construction.

Storey Height: The classrooms are one storey in height with a clear storey height of 3050 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. The exterior concrete foundation walls act as out-of-plane rocking cantilevers hinged at the top of the narrow concrete footings.

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

SOILS

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

GOVERNING PORTION OF BLOCK

The out-of-plane rocking of the concrete foundation walls is the governing element of this block. Figure 3.1 illustrates the exterior foundation wall configuration. The crawl space interior vertical support is provided by unsheathed stud walls (pony walls). The highly rectangular plan configuration of the classrooms minimizes the out-of-plane rocking restraint provided by the end foundation walls for the mid-length portion of the exterior foundation walls.

The data used in the SRG3 analysis (Analyzer Version 3.0) of the out-of-plane rocking of the exterior concrete foundation walls is given in Table 3.1. The out-of-plane rocking of these walls was determined to have a "H1 – High Level 1" Priority Retrofit Ranking.

IN-PLANE WOOD FRAME RESISTANCE

The wood frame exterior walls in 1962 classrooms were analyzed for their in-plane resistance. These walls were determined to have a “H1 – High Level 1” 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 (drift limit $\leq 10\%$). The yellow / red PPR threshold value is the ground motion value at the transition from the yellow damage state to the red damage state (residual drift limit $> 2\%$).

RISK SUMMARY

The risk ranking of the block is summarized as follows:

Risk: This block has been assigned a “H1 – High Level 1” Priority Retrofit Ranking.

Foundation Walls: This risk ranking is governed by the out-of-plane rocking performance of the exterior concrete foundation walls.

Table 3.1: Analysis Data for Out-of-Plane Rocking of Classroom Exterior Concrete Foundation Walls		
No.	Data Description	Value
1	SRG3 prototype	R-1
2	R_m	3 % W_s
3	Clear storey height	1500 mm
4	Peak drift limit	10 %

Table 3.2: Post-earthquake Evaluation Data	
Data Description	Maximum $S_a(1.0)$ Value
Post-earthquake Engineering Assessment	15 %g
PPR Green / Yellow Threshold	22 %g
PPR Yellow / Red Threshold	34 %g

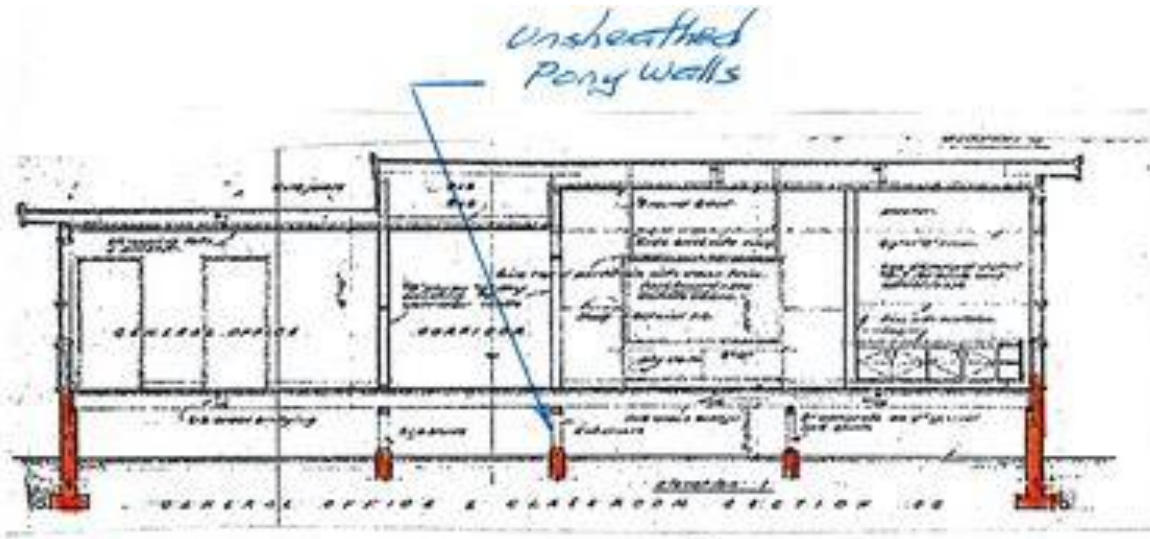


Figure 3.1: Typical Section
Block #44-1
Classrooms
Uplands Elementary School