

STRUCTURAL EVALUATION OF
HARBOUR WAY DAY ACADEMY
WEST CONTRA COSTA UNIFIED SCHOOL DISTRICT
(WCCUSD)

For

WLC Architects
Kaiser Building
1300 Potrero Avenue
Richmond, CA 94804

By

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10.1 Introduction

The purpose of this report is to perform a seismic assessment of the Harbour Way Day Academy in Richmond, CA. The structural assessment includes a site walk through. No architectural or structural drawings for this campus were available for review. The purpose of the structural assessment is to identify decay or weakening of existing structural materials (when visible), to identify seismic deficiencies based on our experience with school buildings, and to identify eminent structural life-safety hazards.

The school campus has had a walk-through site evaluation. The general structural condition of the buildings and any seismic deficiencies that are apparent during our site visit. This report includes only a qualitative evaluation and, therefore, numerical seismic analysis of buildings is not included.

The site visits did not include any removal of finishes. Therefore, identification of structural conditions hidden by architectural finishes or existing grade was not performed.

10.2 Description of School

The school was built in the year 1944. There are two buildings on the campus: the main building, a double-wide portable that was constructed in the 1944, and the classroom building, a portable that appears to have been constructed in the 1990's. The total square footage of buildings is 4,960 square feet.

10.3 Site Seismicity

Although the Harbour Way Day Academy is not included in the geotechnical reports for "Measure D", the school is located adjacent to Nystrom Elementary School. Therefore, soil and site seismicity information for Nystrom Elementary School that was prepared for "Measure M" elementary school evaluations is assumed to be applicable to the Harbour Way Day Academy campus as well. The site is a soil classification S_D in accordance with the 2001 California Building Code (CBC) and as per the consultants, Jensen Van Lieden Associates, Inc.

The buildings have an educational occupancy (Group E, Division 1 and 2 buildings), which has an importance factor in the 2001 CBC of 1.15. The campus is located at a distance of about 4.1 kilometers from the Hayward fault. The main and classroom buildings are portable wood structures with diagonally sheathed and plywood shear walls, respectively. Diagonally sheathed shear walls have a response modification factor $R=4.5$ and plywood sheathed shear walls have a response modification factor $R = 5.5$. The 2001 CBC utilizes a code level earthquake, which approximates an earthquake with a 10% chance of exceedance in a 50-year period or an earthquake having a 475-year recurrence period.

The seismic design coefficient in the 2001 CBC is:

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44 \times 1.29 \times 1.15)W}{5.5} = 0.297W \text{ for plywood sheathed shear walls}$$

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44 \times 1.29 \times 1.15)W}{4.5} = 0.363W \text{ for diagonally sheathed shear walls}$$

The site seismicity is used to provide a benchmark basis for the visual identification of deficient elements in the lateral force resisting systems of campus buildings.

10.4 List of Documents

1. "Measure M" – WCCUSD Elementary Schools – UBC revised parameters by Jensen-Van Lienden Associates, Inc., Berkeley, California.

10.5 Site Visit

DASSE visited the site on September 18, 2002. The main purpose of the site visit was to evaluate the physical condition of the structure and in particular focus on the lateral force resisting elements of the building. Following items were evaluated during the site visit:

1. Type and Material of Construction
2. Type of Sheathing at Roof, Floor, and Walls
3. Type of Finishes
4. Type of Roof
5. Covered Walkways
6. Presence of Clerestory Windows
7. Presence of Window Walls or High Windows in exterior and interior walls
8. Visible cracks in superstructure, slab on grade and foundation

The main building is a one-story portable wood-framed structure with wood siding (see figures 2-5). There are multiple window openings on all four sides of the building. At the front face of the building, some of the windows have been infilled with plywood (see figure 3). The connection of the plywood infill to the building does not appear to be adequate to transfer seismic forces. The building sits on a short cripple wall that appears to have straight sheathing and will not be adequate to laterally support the building, the result of which could be that the building could fall off of its foundation. The building has built-up roofing and an acoustical tile ceiling (see figure 6). The ceiling in some portions of the main building is sagging noticeably.

The classroom portable is framed with sheet metal joists and studs. At the exterior of the building, there is metal roofing and T1-11 siding. The longitudinal walls do not have any openings. The openings in the transverse end walls do not appear to be excessive. There is a suspended T-bar ceiling throughout the interior.

10.6 Review of Existing Drawings

There were no existing drawings available for review.

10.7 Basis of Evaluation

The document FEMA 310, Federal Emergency Management Agency, “*Handbook for the Seismic Evaluation of Buildings – A Prestandard*,” 1998, is the basis of our qualitative seismic evaluation methods to identify the structural element deficiencies. The seismic performance levels included in FEMA 310 allow the engineer the choice to achieve the Life Safety Performance or the Immediate Occupancy Performance. We have based our evaluation of school buildings on the Life Safety Performance level, which is defined as “the building performance that includes significant damage to both structural and nonstructural components during a design earthquake, though at least some margin against either partial or total collapse remains. Injuries may occur, but the level of risk for life-threatening injury and entrapment is low.”

Because mitigation strategies for rehabilitating buildings found to be deficient are not included in FEMA 310 document, the California Building Code (CBC 2001) is used as the basis of our strategies for seismic strengthening of school buildings. The scope of our analyses were to focus on those elements of the structures determined by FEMA 310 to be critical and which could pose life safety hazards.

10.8 List of Deficiencies

Building deficiencies listed below have corresponding recommendations identified and listed in Section 10.9, which follow the same order as the itemized list of deficiencies identified below. The severity of the deficiency is identified by a “structural deficiency hazard priority” system based on a scale between 1.0 and 3.9, which is described in Section 10.11. These priority ratings are listed in section 10.9. Priority ratings between 1.0 to 1.9 could be the causes for building collapses, partial building collapses, or life-safety hazards, if the corresponding buildings are subjected to major earthquake ground motions, which are possible at these sites. It is strongly recommended that these life safety hazards are mitigated by implementing the recommendations listed below.

Item	Building Structural Deficiencies
1.	The connection of main building to its foundation may be inadequate. Straight sheathing is inadequate to brace the cripple walls laterally.

10.9 Recommendations

Items listed below follow the same order as the itemized list of deficiencies identified in section 10.8 above.

Item	Recommended Remediation	Priority	Figure Number
1.	Verify existing conditions. Provide new sill bolts and plywood sheathing at cripple walls.	1.2	2, 4, 5

10.10 Portable Units

In past earthquakes, the predominant damage displayed by portable buildings has been associated with the buildings moving off of their foundations and suffering damage as a result. The portables observed during our site visits tend to have the floor levels close to the ground, thus the damage resulting from buildings coming off of their foundation is expected to be minimal. The life safety risk of occupants would be posed from the potential of falling 3 feet to the existing grade levels during strong earthquake ground shaking. Falling hazards from tall cabinets or bookshelves could pose a greater life safety hazard than building movement. The foundation piers supporting the portable buildings tend to be short; thus the damage due to the supports punching up through the floor if the portable were to come off of its foundation is not expected to be excessive.

Because of their light frame wood construction and the fact that they were constructed to be transported, the portable classrooms are not in general expected to be life safety collapse hazards. In some cases the portables rest directly on the ground and though not anchored to the ground or a foundation system could only slide a small amount. In these instances the building could slide horizontally, but we do not expect excessive damage or life safety hazards posed by structural collapse of roofs.

The regulatory status of portables is not always clear given that portables constructed prior to 1982 will likely have not been reviewed by DSA and thus will likely not comply with the state regulations for school buildings. Portables constructed after about 1982 should have been permitted by DSA. The permits are either issued as temporary structures to be used for not more than 24 months or as permanent structures.

10.11 Structural Deficiency Prioritization

This report hazard rating system is based on a scale of 1.0 to 3.9 with 1.0 being the most severe and 3.9 being the least severe. Based on FEMA 310 requirements, building elements have been prioritized with a low rating of 1.0 to 1.9 if the elements of the building's seismic force resisting systems are woefully inadequate. Priority 1.0 to 1.9 elements could be the causes for building collapses, partial building collapses, or life-safety falling hazards if the buildings were subjected to major earthquake ground motion.

If elements of the building's seismic force resisting system seem to be inadequate based on visual observations, FEMA 310 requirements and limited lateral (seismic) calculations, but DASSE believes that these element deficiencies will not cause life-safety hazards, these building elements have been prioritized between a rating low of 2.0 to 3.9. These elements could experience and / or cause severe building damage if the buildings were subjected to major earthquake ground motion. The degree of structural damage experienced by buildings could cause them not to be fit for occupancy following a major seismic event or even not repairable.

The following criteria was used for establishing campus-phasing priority:

First, the individual element deficiencies which were identified during site visit and review of existing drawings were prioritized with a rating between 1.0 to 3.9 and as described in this section.

Next, based on the school district's budgetary constraints and scheduling requirements, each school campus was given a phasing number between one and three. Phase 1A represents a school campus with severe seismic deficiencies, Phase 1B represents a school campus with significant seismic deficiencies and Phase 2 represents a school campus with fewer seismic deficiencies.

10.12 Conclusions

1. Given the vintage of the building(s), some elements of the construction will not meet the provisions of the current building code. However, in our opinion, based on the qualitative and limited quantitative evaluations, the building(s) will not pose serious life safety hazards if the seismic deficiencies identified in section 10.8 are corrected in accordance with the recommendations presented in section 10.9.
2. Any proposed expansion and renovation of the buildings should include the recommended seismic strengthening presented in section 10.9. Expansion and renovation schemes that include removal of any portion of the lateral force resisting system will require additional seismic strengthening at those locations. It is reasonable to assume that where new construction connects to the existing building(s), local seismic strengthening work in addition to that described above will be required. All new construction should be supported on new footings.
3. Overall, we recommend that seismic retrofit work for this school campus be performed in Phase 2.

10.13 Limitations and Disclaimer

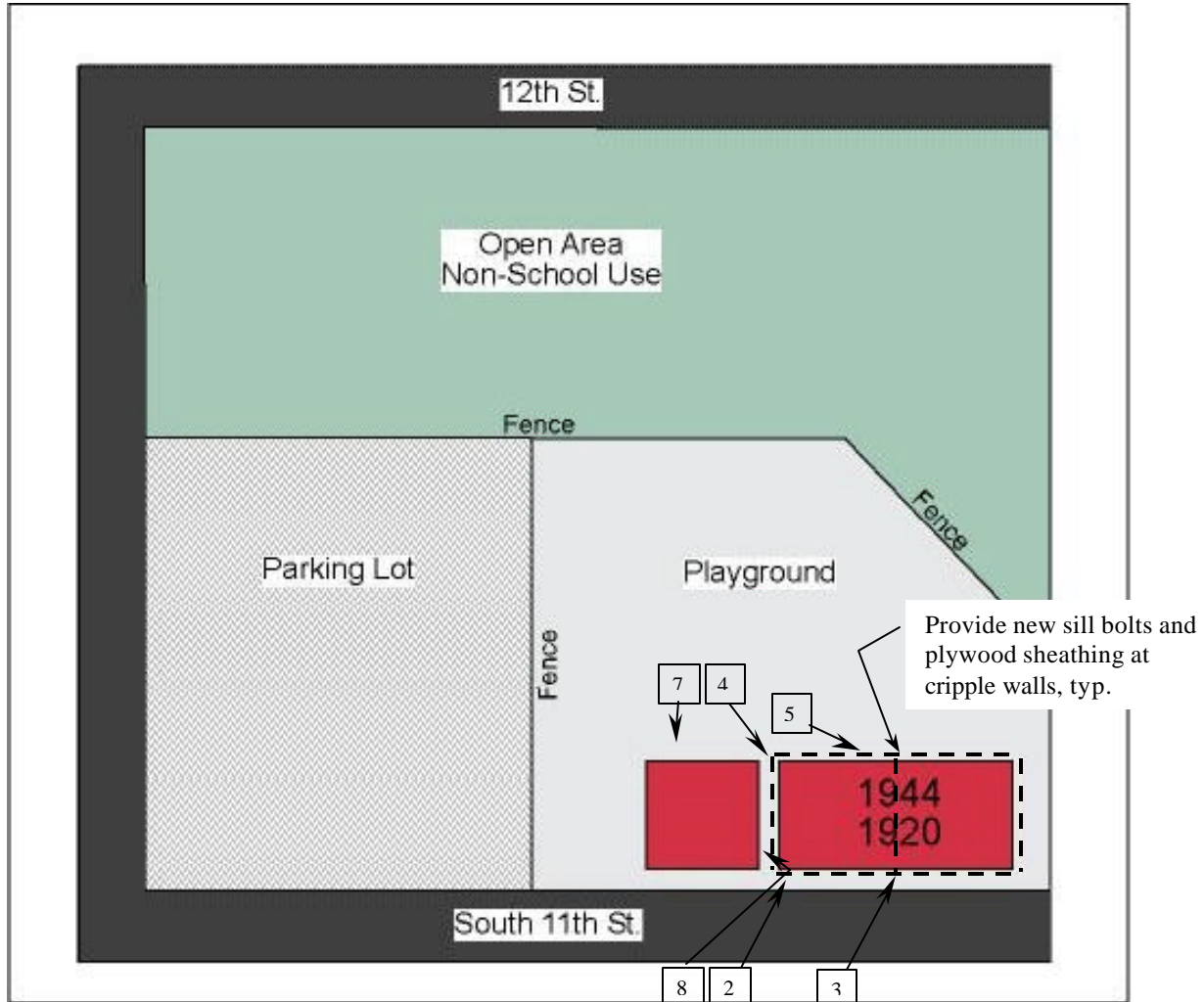
This report includes a qualitative (visual) level of evaluation of each school building. Numerical seismic analyses of buildings are not included in this scope of work. The identification of structural element code deficiencies based on gravity and seismic analysis demand to capacity evaluations are therefore not included. Obvious gravity or seismic deficiencies that are identified visually during site visits or on available drawings are identified and documented in this report.

Users of this report must accept the fact that deficiencies may exist in the structure that were not observed in this evaluation. Our services have consisted of providing professional opinions, conclusions, and recommendations based on generally accepted structural engineering principles and practices.

DASSE's review of portable buildings has been limited to identifying clearly visible seismic deficiencies observed during our site visit and these have been documented in the report. Portable buildings pose several issues with regard to assessing their life safety hazards. First, drawings are often not available and when they are, it is not easy to associate specific drawings

with specific portable buildings. Second, portable buildings are small one story wood or metal frame buildings and have demonstrated fairly safe performance in past earthquakes. Third, there is a likelihood that portable buildings (especially those constructed prior to 1982) are not in compliance with state regulations, either because they were not permitted or because the permit was for temporary occupancy and has expired.

Figures



Harbour Way Community Day Academy
214 South 11th St.
Richmond, CA 94801
West Contra Costa Unified School District
Site Acreage: Not Available

Portable Classroom 1998 ← Yr Built
960 ← SqFt

Map not to scale

Figure 1: School Layout Plan



Figure 2: Front and Side of Main Building



Figure 3: Plywood Window Infill at Front of Main Building



Figure 4: Side of Main Building



Figure 5: Rear of Main Building



Figure 6: Interior of Main Building



Figure 7: Front of Classroom Portable



Figure 8: Side and Rear of Classroom Portable



Figure 9: Interior of Classroom Portable