STRUCTURAL EVALUATION OF

SEAVIEW ELEMENTARY SCHOOL

WEST CONTRA COSTA UNIFIED SCHOOL DISTRICT (WCCUSD)

For

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Kaiser Building
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By

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10.1 Introduction

The purpose of this report is to perform a seismic assessment of the Seaview Elementary School in San Pablo, CA. The structural assessment includes a site walk through and a limited study of available architectural and structural drawings. 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 and a limited study of available architectural and structural drawings. The general structural condition of the buildings and any seismic deficiencies that are apparent during our site visit and review of existing drawings are documented in this report. This report includes 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

Located in San Pablo, the school was originally constructed in 1972 with the addition of multiple portable buildings at various stages. The three permanent structures on the campus are all single story pod buildings built with a hybrid wood/steel-framed system. The two classroom buildings identified as Unit B and C are identical structures. The administration building, Unit A, is slightly smaller, but shares the same pod-type layout of rooms as is found in the other two buildings. In addition to these buildings, the campus has a total of five portable buildings. The four individual portable classroom buildings were erected in 1998, while the larger, cafeteria portable dates back to 1965. The total square footage of the permanent structures is about 20,111 square feet.

10.3 Site Seismicity

The site is a soil classification S_D in accordance with the 1998 California Building Code (CBC) and as per the consultants, Jensen Van Lieden Associates, Inc.

The main classroom building has an educational occupancy (Group E, Division 1 and 2) and the cafeteria/kitchen building has an assembly occupancy (Group A, Division 3), both of which have an importance factor in the 1998 CBC of 1.15. The campus is located at a distance of about 2.9 kilometers from the Hayward fault. The buildings described above utilize plywood shear walls to resist seismic loads. Plywood shear wall systems have a response modification factor R=5.5. The 1998 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 1998 CBC is:

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44x1.41x1.15)W}{5.5} = 0.324W$$

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. Classroom & Administration Buildings: Oleg N. Ivanitsky, A.I.A. Architect, Sheets A-A – A-B, A-1, A-5 – A-7, February 24, 1969; Frank E. McClure & David L. Messinger Consulting Structural Engineers, Sheets S-1 – S-6, February 24, 1969.
2. “Measure M” – WCCUSD Elementary School – UBC revised parameters by Jensen- Van Lienden Associates, Inc., Berkeley, California.
3. “Geological Hazard Study – Recently constructed portable buildings – 24 school sites for Richmond Unified School District,” by Jensen-Van Lienden Associates, Inc. dated March 7, 1990.
4. “Measure M” roofing report by “the Garland Company Inc.”, Orinda, California.

10.5 Site Visit

DASSE visited the site on November 6th, 2001 and March 8th, 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. The 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 single story classroom buildings have a plan arrangement of two pods or clusters of classrooms that are symmetrical about a central space (see figures 4, 5, 6, and 7). These buildings have wood framed walls with an exterior stucco finish. The interior ceilings are a mix of suspended T-bar with panels and acoustical tile attached to the structure. Substantial lengths of solid walls were observed in these structures. Similar to the repeated classroom building, the administration building has wood framed walls, finished with stucco, and with significant solid lengths (see figures 2 and 3). The oldest of the portable buildings, the cafeteria, has steel roof beams in which significant rusting was observed (see figures 8 and 9). Deterioration of this type is deemed a life safety hazard. Elsewhere among the portable structures, hard electrical conduits were found passing from structure to structure without provision for the possible differential movement of these buildings. This, too, constitutes a life safety hazard.

10.6 Review of Existing Drawings

The classroom buildings of Units B and C are symmetrical, single story buildings (see figures 4, 5, 6, and 7). The pod-type classroom configuration of these buildings in plan results in some walls skewed relative to the orthogonal directions. The structure is framed with 2x12 roof joists at 24" on center that are supported by wood bearing walls and four 3-pinned steel arches. Plywood sheathing (1/2") covers the roof framing to provide a continuous roof diaphragm across some significant spans (up to 57'-6"). Lateral forces are resisted primarily by plywood shear walls, most of which occur at the exterior walls. There appears be a substantial length of shear wall in both directions. It is also noted that the 3-pinned arches will provide a secondary lateral force resisting system. While double top plates are provided at the top of the wood framed walls, the splice connection has minimal capacity and is identified as a life safety concern. Additionally, collector elements are not detailed for the interior shear walls. The building's foundation system consists of typical 1'-2" wide reinforced concrete spread footings with grade beams used to tie the arch bases together. A positive connection between this foundation and the wood shear walls for the purpose of resisting uplift forces has not been provided, which constitutes another life safety hazard. The existing roofs of the classroom buildings, Unit B and C, are about 3 to 5 years old and appear to be in acceptable condition.

Construction drawings available for review of the administration building, Unit A, were incomplete at this time. However, because Unit A was designed and constructed along with the classroom buildings, Unit B and C, it is most likely that the conditions identified as life safety concerns at these buildings can be expected to exist at the administration building (see figures 2 and 3). The existing roof of the administration building, Unit A, is about 3 to 5 years old and appears to be in acceptable condition.

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 seismic evaluation methods, although no numerical structural analyses were performed. The seismic performance levels that the FEMA 310 document seeks to achieve are lower than the current Building Code. However, it attempts to identify potential for building collapse, partial collapses, or building element life safety falling hazards when buildings are subjected to major earthquake ground motion.

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.	Unit A, B, & C: Strength of chord/collector elements is likely to be inadequate to resist prescribed forces. Continuity of chord/collector elements is lacking at some shear wall locations.
2.	Unit A, B, & C: Positive connection of shear walls to foundation is lacking.
3.	Cafeteria/Kitchen Portable: Rusting observed at steel roof beams
4.	Portable Buildings: Electrical conduits are connected to adjacent buildings with no provision to accommodate differential movement.

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.	Provide new strapping and blocking at inadequate locations.	1.5	N/A
2.	Provide new holdown anchors into existing foundation.	1.5	N/A
3.	Remove existing cafeteria portable building	1.0	8, 9
4.	Provide new flexible electrical conduits between portable buildings,	1.9	N/A

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 and based on FEMA 310 requirements, 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.

The next step was to arrive at a structural deficiency rating between 1 and 10, with a rating of 1 representing a school campus in which the building's seismic force resisting systems are woefully inadequate.

Based on the school district's budgetary constraints and scheduling requirements, each school campus was given a phasing number between one and three. Phase I represents a school campus with severe seismic deficiencies, Phase II represents a school campus with significant seismic deficiencies and Phase III 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 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 building 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, local seismic strengthening work in addition to that described above will be required. All new construction should be supported on new footings.

3. Overall, this school campus has a seismic priority of 8 and we recommend that seismic retrofit work be performed in Phase III.

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

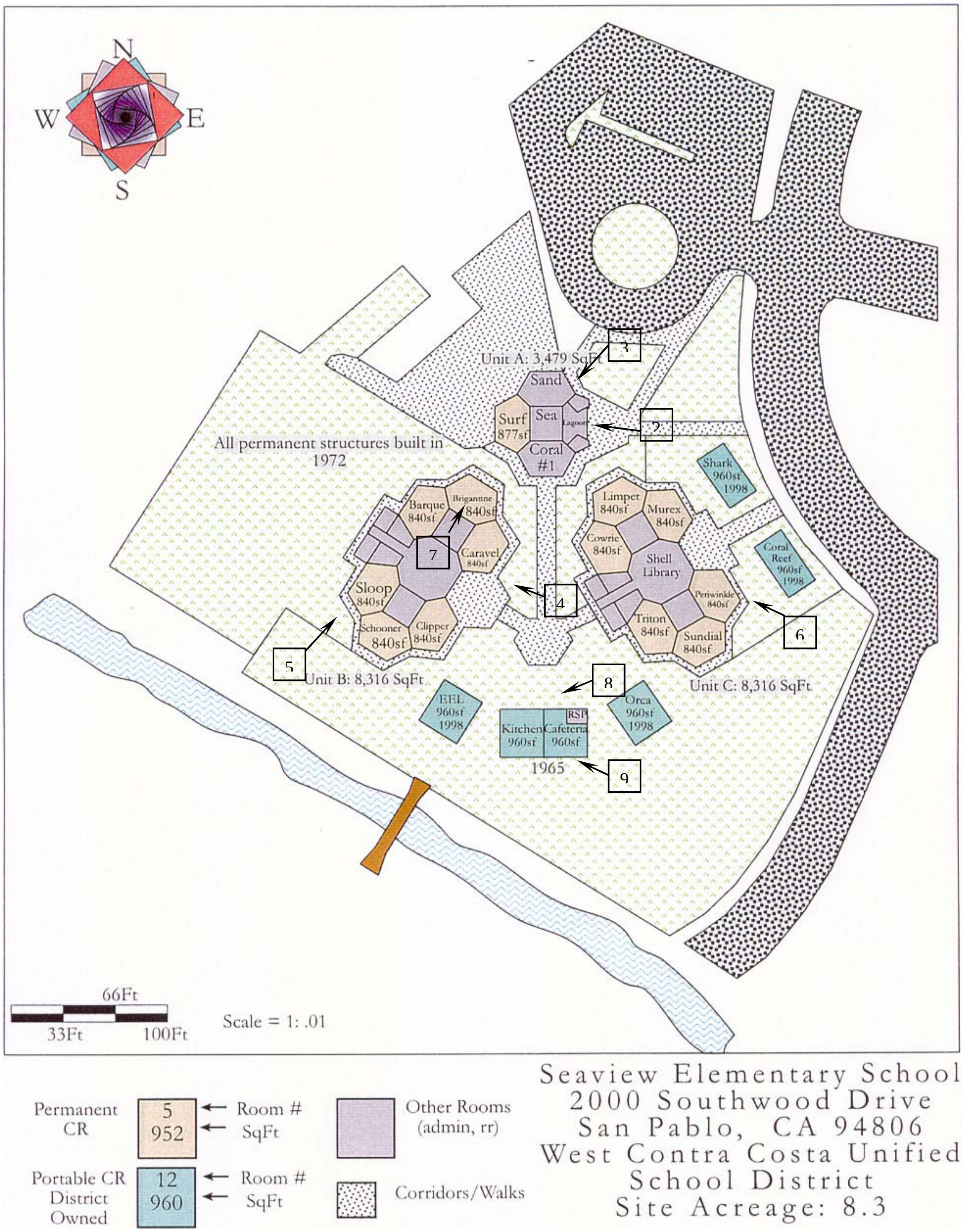

Figure 1: School Layout Plan

Figure 2: Administration Building, Unit A, main entrance

Figure 3: Administration Building, Unit A, north face

Figure 4: Classroom Building, Unit B, east face

Figure 5: Classroom Building, Unit B, west face

Figure 6: Classroom Building, Unit C, east face

Figure 7: Classroom Buildings, Units B & C, interior

Figure 8: Portable Buildings, north face

Figure 9: Cafeteria Portable, rusted roof beams