STRUCTURAL EVALUATION OF

PERES ELEMENTARY SCHOOL

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 Peres Elementary School in Richmond, 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, which were apparent during our site visit, are documented in this report. A limited lateral (seismic) numerical analysis was performed to identify deficient lateral elements which could pose life safety hazards.

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

Peres Elementary School is located in the city of Richmond and was re-built in the years 1948, 1954 and 1955. There are eight main buildings on this campus: five main classroom buildings; a multi-purpose room; a library; and a miscellaneous bathroom building. In addition there are four portable buildings. The 1948 classroom buildings (Figures 4 & 5) are located on the north portion of the site and include three rows of one story wood framed classroom buildings with connecting covered walkways. These buildings are window wall buildings with high windows on the door entry sides. The finish material on all of the buildings is stucco, and they have slab-on-grade floors.

The 1954 and 1955 classroom buildings (Figures 2 & 3) are located at the south side of the site and form what is now the main entrance to the campus. These buildings are one story and have raised suspended wood framed floors. The 1954 classroom building has an intermittent perimeter foundation utilizing pier/post/and beam construction. The 1955 building was found to have a skip sheathing roof framing system in the bathroom area.

The 1955 Library (Figure 8) building is a one story tall building with a highly raised suspended wood framed floor. The 1955 Multipurpose Room (Figure 8) building is a tall clear spaced building with a slab-on-grade floor. The 1955 Bathroom building is a small building with a slab-on-grade floor.

An old incinerator is located between the Multipurpose Room and the Library, and is a tall unreinforced masonry structure.

10.3 Site Seismicity

The site is located in The City of Richmond on Harbor Way South**.** The site is a soil classification S_D in accordance with the 1998 California Building Code (CBC) and as per the consultants, Jensen Van Lienden Associates, Inc.

The classroom buildings have an educational occupancy (Group E, Division 1 and 2 buildings), and the multi-purpose 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 3.4 kilometers from the Hayward fault. The buildings are wood framed buildings with shear walls, and have a response modification factor, R = 4.5. The 1998 CBC code 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:

$$V = \frac{2.5C_a IW}{R} = \frac{2.5(0.44)(1.36)(1.15)W}{4.5} = 0.382W$$

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. The calculated base shear was used to perform a limited lateral analysis of the school buildings as described in section 10.7.

10.4 List of Available Documents

Available drawings for review include the following:

1. Donald Powers Smith AIA, Architect, 583 Market Street, San Francisco, 1946, various sheets for the “New Additions and Alterations to the Peres Elementary School,” classroom buildings and covered walkways.
2. I. Thompson, Structural Engineer, 583 Market Street, San Francisco, 1946, “New Additions and Alterations to the Peres Elementary School,” S1-S7.
3. Donald L. Hardison Architect, Harry S. Clausen, S. Richard Komatsu Associate Architects, 225 Broadway, Richmond, California, 1955, Additions and Alterations to Peres School, various sheets A1-A12.
4. Hall, Pregnoff & Matheu, Strutural Engineers, 251 Kearny Street, San Francisco, California, 1955, “Additions and Alterations to Peres School,” sheets S1-S9.
5. “Measure M” – WCCUSD Elementary School – UBC revised parameters by Jensen-Van Lienden Associates, Inc., Berkeley, California.
6. “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.
7. “Measure M” roofing report by “The Garland Company Inc.”, Orinda, California.

10.5 Site Visit

DASSE visited the site on October 22, 2001 at about 9AM. The 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

Peres Elementary School has one story wood framed buildings with stucco exterior finishes. The roof diaphragms are constructed with diagonal sheathing. The wall sheathing is constructed with diagonal sheathing in some locations and let in bracing in other locations. Classrooms and corridors have gypsum board and acoustic tile ceilings. There are many covered walkways in the school campus without adequate lateral bracing. Exterior longitudinal walls of the classrooms have numerous and extensive window openings.

10.6 Review of Existing Drawings

The Original Classroom Buildings, rooms an addition to the Peres School (at the time), were built in 1948 as three rows of one-story classroom buildings with covered walkways and open paved space between buildings. These buildings employed window wall construction on one side for allowance of natural light and clerestory construction on the other side with entry doorways and covered walkways between classrooms and buildings (see Figures 4 & 5). The buildings employed diagonal sheathing for roof diaphragms, short reinforced concrete walls for shear walls, and drilled piers with grade beams for foundations. The floor is a concrete slab-on-grade. The roof joists are 3x16 joists spanning 32'-0" at 4'-0" spacing with 2x8 tongue and grooved diagonal sheathing.

These classroom buildings have diagonal sheathed walls on the exterior of the building but according to drawings have let in bracing on classroom partition walls which greatly reduces the buildings lateral strengths in the transverse directions. The reinforced concrete walls on the longitudinal faces of the buildings are adequate for 1948 codes but the collector elements are not adequate to transfer required lateral loads considerable distances to these concrete shear walls. The diagonal sheathed diaphragms will be highly loaded and overstressed based on anticipated loads.

In 1954, five units of a re-locatable building were brought in and placed on a drilled pier foundation system without interconnecting grade beams. This building is located at the south-west portion of the site. The building construction for this building is not clear on drawings. Transverse walls appear to have diagonal let in braces as their shear resisting elements. Exterior walls appear to have plaster finish over plyscord sheathing. The roof diaphragm has diagonal sheathing. The building is layed out with a central corridor and classrooms on each side.

In 1955, other existing classroom buildings were demolished and a Library building, Multi-purpose building and the Main Classroom building were added. These buildings employed wood framing construction supported on spread footings with raised wood floors and roofs. The Main Classroom building has a central corridor with classrooms to each side. These buildings employ similar construction to that of school buildings in the 1950's with diagonal sheathed walls, roof and floor. This classroom building has considerable lengths of shear wall and is not a seismically hazardous building. This building does have minor seismic deficiencies, however, and would be overstressed if subjected to lateral loads required in current codes.

The multi-purpose building utilizes steel roof beams to provide an open clear span room with 2x10 roof joists between steel beams and ½ inch plywood roof sheathing as the roof decking. The wall sheathing is also 3/8 inch plywood to create shear walls. The Library also employs construction similar to the Main Classroom building. Both of these buildings do not pose life safety hazards for seismic loads, although they would not meet current codes.

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. The seismic performance levels that the FEMA 310 document seeks to achieve are lower than the current Building Code. However, it attempts to identify the potential for building collapse, partial collapses, or building element life safety falling hazards when buildings are subjected to major earthquake ground motion.

The California Building Code (CBC 1998) is the basis of our quantitative seismic evaluation methods. Base shears identified in section 10.3 were used to perform a limited lateral seismic analysis of the school buildings. The scope of the analysis was not to validate every member and detail, but to focus on those elements of the structure determined to be critical and which could pose life safety hazards. Member *strength* values are based on the document FEMA 356, Federal Emergency Management Agency, *"Prestandard and Commentary for the Seismic Rehabilitation of Buildings"* 2000.

10.8 List of Deficiencies

The following structural deficiencies were noted during evaluation of this campus:

Item	Building Structural Deficiencies
1.	Classroom Buildings 1-14 (1948) in the longitudinal direction rely on relatively few four foot long concrete shear walls with remainder of walls being window wall systems or high window walls. These walls do not have adequate shear resistance or collectors or connections to the relatively few concrete shear walls.
2.	Classroom Buildings 1-14 (1948) in the transverse direction rely on classroom

	partition walls with few 1x4 let in braces. These walls do not have the capacity to resist calculated seismic demands.
3.	Covered walkways between all classroom buildings do not have seismic separations between buildings and also act as support for main electrical conduits between buildings.
4.	Classroom Building Rooms 25-33 (1954) are inadequate to resist code prescribed seismic loads. The shear walls employ old and outdated construction methods and the foundation system is not adequate to support the building should a major earthquake and ground motion occur at this site.
5.	Brick incinerator is a falling hazard.

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.	Add adequate plywood shear walls to Classroom building Rooms 1-14 around the perimeters, at the corridor walls and at the classroom partition walls. Provide new collectors and hold downs as required.	1.2	4,5
2.	Add complete lateral bracing to covered walkways. Provide secondary gravity support to walkways at buildings. Add seismic joints in covered walkways between buildings and provide emergency shut-offs and flexible connections for electrical conduits traveling through walkway roofs and across seismic joints.	1.9	4,5,7
3.	Remove brick incinerator.	1.5	8
4.	Classroom Building 25-33 requires infill of intermittent pier foundation system with continuous grade beams under shear walls located around he perimeter, at the corridor walls and at the classroom partition walls. Wall sheathing should be added for shear resisting walls located at the exterior walls, corridor walls and classroom partition walls. Chords and collectors should be added as necessary. Alternately, this building should be demolished and replaced for a similar cost as strengthening.	1.3	6

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.

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 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, this school campus has a seismic priority of 2 and we recommend that seismic retrofit work be performed in Phase I.

10.13 Limitations and Disclaimer

This report includes a qualitative (visual) evaluation and a limited quantitative seismic evaluation of each school building. Obvious gravity or seismic deficiencies that are identified visually during site visits or on available drawings are identified and documented in this report. Elements of the structure determined to be critical and which could pose life safety hazards are identified and documented during limited quantitative seismic evaluation of the buildings.

Users of this report must accept the fact that deficiencies may exist in the structure that were not observed in this limited 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

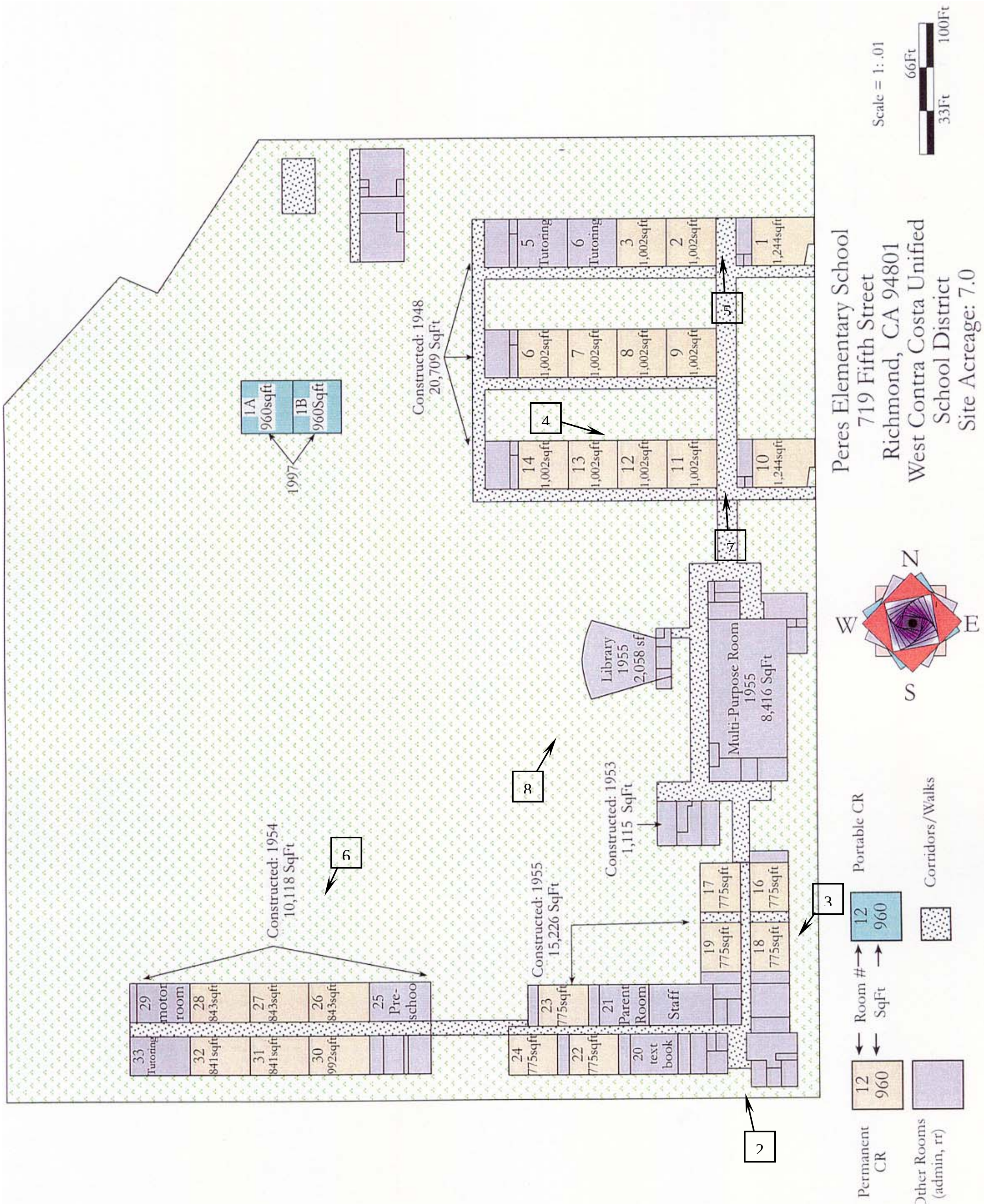

Figure 1: School Layout Plan

Figure 2: South Entrance Elevation

Figure 3: East Elevation

Figure 4: 1948 Classroom Buildings (1 of 3)

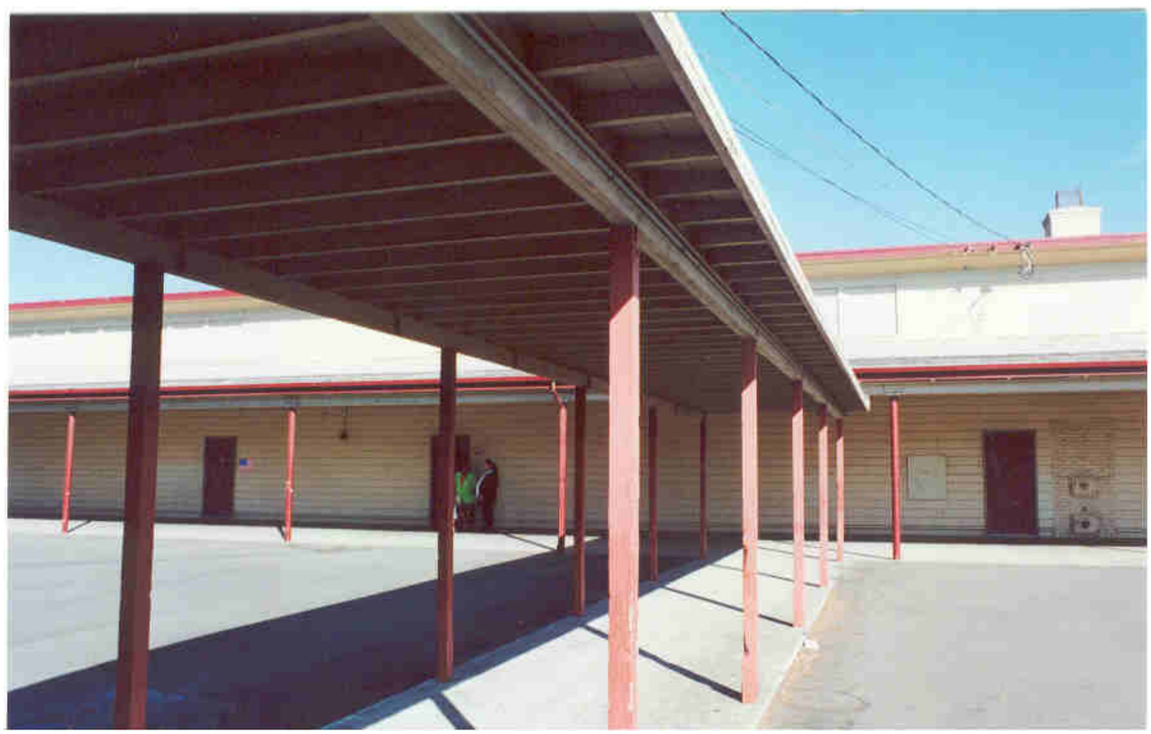

Figure 5: Covered Walkways at 1948 Classrooms

Figure 6: Classroom Building at south-west of site (1954) with intermittent foundations

Figure 7: Electrical Conduits passing through covered walkways

Figure 8: Playground looking north, Library in center