STRUCTURAL EVALUATION OF

TRANSITION LEARNING CENTER

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 Transition Learning Center in Richmond, CA. The structural assessment includes a site walk through. 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 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

The school was built in 1963. The original building is a one-story wood-framed structure (main building). A one-story multi-purpose building and connecting corridor were built at a later unknown date. There are two main buildings (permanent structures) and thirteen portable buildings (see figure 1). The construction dates of the portables are not known, but appear to have at least been built after 1985. The total square footage of the permanent structures is about 44,400 square feet.

10.3 Site Seismicity

The Transition Learning Center campus is not included in this report, but the nearby Tara Hills campus soil information was used. The site coefficients were calculated by scaling fault distances from a map and using the formulas supplied in the 1998 CBC. 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 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 about 2.8 kilometers from the Hayward fault. The main and multi-purpose buildings are wood framed buildings with plywood shear walls, and 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:

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44x1.42x1.15)W}{5.5} = 0.327W$$

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. Kerry Hills School; Jack Buchter, Architect; sheets 2-6 (architectural only); February 1, 1963.
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 January 4th, 2002 and March 7th, 2002. The main purpose of the site visits 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 wood-framed structure with plaster finish and a large number of windows, particularly on the longitudinal walls (see figures 2 and 6 through 9). The building is shaped like an "8", having two interior courtyards (see figure 1). There are interior corridors along the courtyards in the longitudinal direction. The corridors and adjacent classrooms have windows that look out into the courtyards, but there appear to be long segments of shear wall on the opposite side of the corridors (see figure 10). The corridors have acoustical tile ceilings and there are skylights in the areas that are not adjacent to the central courtyards. The classrooms and administration areas have suspended T-bar ceilings. The transverse walls at the classrooms have no openings in them. The main entrance has a canopy above it (see figures 2 and 15). The canopy is only attached to the building along the rear edge and does not align with the roof diaphragm level. Therefore, it appears that, although there is a mechanism to resist lateral motion of the canopy, there is no mechanism to prevent torsion. The canopy does have its own gravity support system consisting of pipe columns and beams.

The multi-purpose building is a wood-framed structure with a plaster finish and a split-level roof (see figure 3 through 5). The multi-purpose building has two main areas: the cafeteria / auditorium and the kitchen. The cafeteria / auditorium area has some windows in the front longitudinal wall and has a high roof that spans about 30 ft between longitudinal walls (see figure 11). The kitchen area has a lower roof and has multiple window openings along the exterior longitudinal wall. The transverse walls of the multi-purpose building have only minor openings. The cafeteria / auditorium has an acoustical tile ceiling and the kitchen area has a plaster ceiling.

The connecting corridor between the main and multi-purpose buildings appears to be attached to the multi-purpose building at the roof diaphragm level (see figure 3), but has a seismic joint at the end adjacent to the main building (see figures 6 and 16). There are windows along the entire rear longitudinal wall of the corridor (see figure 5). At the main building end, there are double doors in the transverse end wall, whereas as the other end of the corridor, the doors to the multi-purpose building are in the front longitudinal wall. Therefore, it appears that there is no lateral force resisting system in the transverse direction at the end near the main building.

10.6 Review of Existing Drawings

The architectural drawings available for review were insufficient to conduct a seismic review of the structure. All pertinent information was determined from the site visit. The architectural drawings were used to confirm the locations of walls and openings that were noted during the site visit, but do not include specific detail information regarding the building's structural system.

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.	The exterior longitudinal walls of the main building have window walls. Therefore, the shear walls along the interior corridors carry the majority of the seismic force and may be overstressed.
2.	The main building roof diaphragm is discontinuous at the courtyard openings. This may lead to high collector forces and some tearing of the roof diaphragm at the corners of the roof opening.
3.	The collector at the east wall of the main building may be overstressed.
4.	The corridor between the main building and multi-purpose building lacks shear panels on the north wall.
5.	The corridor between the main building and multi-purpose building does not appear to be attached to the main building. There is a seismic joint at that end of the corridor. The corridor structure has no lateral support in the transverse direction at one end, and therefore may experience large deflections and potential partial collapse.
6.	At the high roof of the multi-purpose building, the chord splices at the longitudinal walls may be overstressed.
7.	At the multi-purpose building, there may be a displacement incompatibility where the east end wall of the kitchen area frames into the north wall of the multi-purpose room area. This may result in localized damage to the walls.
8.	The entrance canopy appears to lack adequate lateral support. The canopy may partially tear away from the main building during an earthquake event.
9.	There is electrical conduit running between the portables near the roof level that does not have flexible connections. As the buildings move independently, the conduit may get damaged and is a life-safety 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.	Infill some windows at exterior with shear wall. Provide new collector elements and holdowns as required..	1.1	2, 7
2.	Strengthen collectors, add straps on roof at corners of openings.	1.5	N/A
3.	Provide straps above the roof sheathing and new clip angles from blocking to shear walls.	1.3	6
4.	Infill some windows at exterior with shear wall. Provide new collector elements and holdowns as required.	1.2	6

5.	Provide a new frame for independent lateral support in the transverse direction.	1.5	3, 6, 16
6.	Provide new straps above roof sheathing at chords	1.5	3, 5
7.	Strengthen existing connection of low roof into the wall of the multi-purpose room.	1.8	4
8.	Provide knee bracing at frame at the front of the entrance canopy.	2.2	15
9.	Relocate conduit or install flexible connections to accommodate movement.	1.9	14

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 4 and we recommend that seismic retrofit work be performed in Phase II.

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

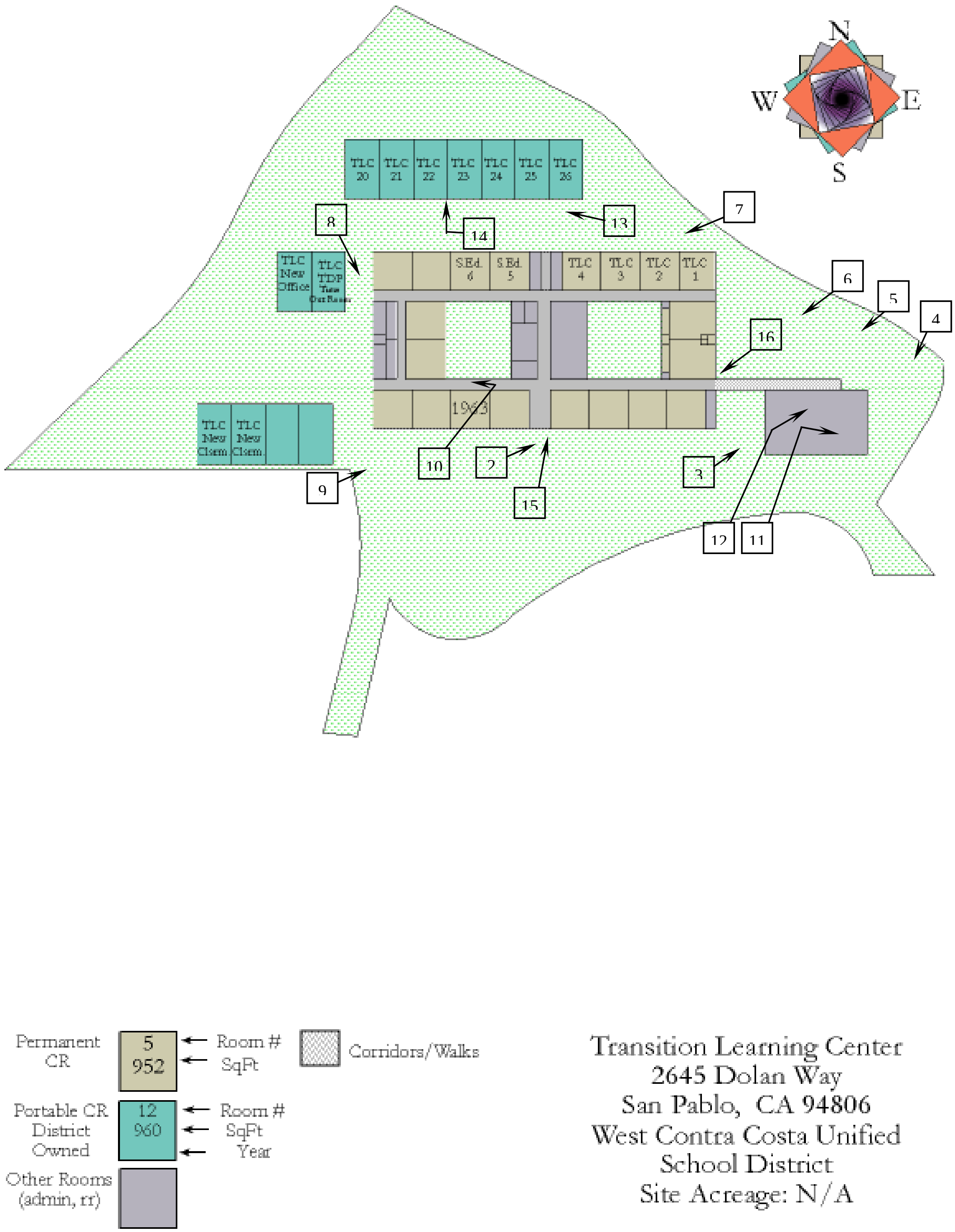

Figure 1: School Layout Plan

Figure 2: South Longitudinal Wall of Main Building (East Half)

Figure 3: South Face of Multi-Purpose Building

Figure 4: East Face of Multi-Purpose Building

Figure 5: North Face of Multi-Purpose Building at Kitchen Area

Figure 6: East Face of Main Building

Figure 7: North Longitudinal Wall of Main Building

Figure 8: West Face of Main Building

Figure 9: South Longitudinal Wall of Main Building (West Half)

Figure 10: Interior Corridor of Main Building at Courtyard Windows

Figure 11: Interior of Multi-Purpose Building Looking at Stage

Figure 12: Interior of Multi-Purpose Building Looking at Kitchen Area

Figure 13: Portable Classrooms

Figure 14: Conduit Running between Portable Classrooms

Figure 15: Entrance Canopy at Main Building

Figure 16: Seismic Joint at Corridor near Main Building