STRUCTURAL EVALUATION OF

PORTOLA MIDDLE SCHOOL

WEST CONTRA COSTA UNIFIED SCHOOL DISTRICT (WCCUSD)

For

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DASSE Design Project No. 01B300x2

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10.1 Introduction

The purpose of this report is to perform a seismic assessment of the Portola Middle School in El Cerrito, 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 and quantitative evaluation of the buildings. 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

The school was built in 1950. The original buildings are a two-story concrete structure with a basement (classroom building), a large one-story concrete and steel structure with a basement (gymnasium), and two concrete and steel structures with wood- and steel-framed sawtooth roofs (laboratory and shop buildings). There are four main buildings (permanent structures) and three portable buildings (see figure 1). There are two 1988 portables and one 1989 portable. The total square footage of the permanent structures is about 123,972 square feet.

10.3 Site Seismicity

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 classroom, laboratory, and shops buildings have an educational occupancy (Group E, Division 1 and 2 buildings) and the gymnasium has an assembly occupancy (Group A, Division 3), both of which have an importance factor in the 2001 CBC of 1.15. The campus is located at a distance of less than 2 kilometers from the Hayward fault. The classroom building is a concrete structure with non-ductile moment frames in the longitudinal direction and shear walls in the transverse direction. The other buildings have concrete shear walls. Non-ductile concrete moment frames are prohibited by the 2001 CBC in seismic zone 4. The concrete shear walls have a response modification factor R=4.5. The cafeteria building and classroom building are wood framed building with shear walls, and have a response modification factor R = 4.5. 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:

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44x1.50x1.15)W}{4.5} = 0.422W$$

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 Documents

1. El Cerrito Junior High School; Miller & Warnecke, Architects and Hall & Pregnoff, Structural Engineers; sheets S-1 (covered walkway), S-101 to S-110 (no architectural dwgs) (Classroom Building), 201 to 214, S-201 to S-208 (Gymnasium), 401 to 406, S-401 to S-404 (Laboratory Building); February 10, 1950; DSA # 7473.
2. Partial Lateral Bracing, Gymnasium Building, Portola Junior High School; Interactive Resources, Inc., Architects and Engineers; S1-S4; November 26, 1989; DSA #53323.
3. Modernization at Portola Jr. High School; HTI Architects and Vogel and Meyer, Structural Engineers; A1- A32, S1-S3; March 18, 1991; DSA # 51301.
4. "Measure D" - WCCUSD MIddle and High Schools– UBC revised parameters by Jensen- Van Lienden Associates, Inc., Berkeley, California.

10.5 Site Visit

DASSE visited the site on August 9, 2002 and October 18, 2002. The 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 entire campus is located on a sloped site. There is evidence of a neighboring land slide that occurred in the distant past and settlement in the paved areas which has resulted in significant cracking of the site pavement (see figure 3). We did not see any evidence of building sliding.

The main classroom building is a two-story concrete structure with a partial basement that is at the ground level on the west side of the building (see figures 1, 4, and 5). The building is boomerang-shaped in plan, having two similar wings (north and south) and a connecting central area that is roughly diamond-shaped in plan (see figure 6). The exterior of the building has concrete spandrel beams with strips of windows and glass block along the length of the building at the first and second floors (see figure 13). There is a system of steel-framed sunshades along the exterior of the classroom wings at the first and second stories. At the ground floor level, there is brick veneer on the walls and columns (see figure 7). At the east side of the building, there are louvered vent openings in the ground floor wall that are not apparent from the structural drawings. At the south end of the building, there is a seismically separate elevator tower(see figure 8). The classrooms and hallways typically have acoustical tile ceilings. At the exterior walkway on the west side of the building, there is a plaster soffit (see figure 7).

At the ground floor of the north wing of the classroom building, door openings in the concrete shear walls were observed that do not appear on the plans. These doors are in the custodial storage space along the east side of the building and link these areas to each other. One opening was sawcut and overcutting is apparent, whereas the other opening appears to have been chipped out (see figures 9 and 10). There is minor cracking evident above the door opening (see figure 10), but this cracking appears to be due to thermal expansion and contraction, not from flexural overstress. Some other cracking of the basement walls was observed. Most of these cracks are oriented vertically and appear to be from shrinkage. There is one significant diagonal crack in the basement wall that begins at the corner of a door opening and extends to the underside of the first floor slab (see figure 11). These cracks may allow moisture to pass and cause rusting of the reinforcing bars.

The gymnasium building shows evidence of some cracking in the exterior concrete walls (see figure 18). There are vertical cracks that are attributable to shrinkage and some diagonal cracking at the corners of door and window openings. There is an acoustical tile ceiling in the main gymnasium that is attached to the underside of the roof slab and there is no ceiling in the locker rooms. The low roof and main gymnasium skylight openings have been infilled with wood framing (see figure 19). There is an accordion partition that hangs from the center truss of the gymnasium roof framing (see figure 16).

The laboratory and shop buildings are similar in construction, but the shop building has about twice as much floor area. At the time of the first site visit, the shop and laboratory buildings were in the process of being re-roofed. This work had been completed by the time of the second site visit. There is some minor cracking evident at the base of the short columns in the laboratory building that is consistent with flexural action during an earthquake event but does not appear to be significant (see figure 23). There is no ceiling in the laboratory and shop buildings (see figure 24).

The covered walkways are connected to the shop, laboratory, and gymnasium buildings, but do not connect to the main building. The covered walkway that connects the laboratory building, gymnasium, and the classroom adjacent to the locker rooms has no seismic separations between buildings and relies on each of these buildings for gravity support. The typical covered walkways have the roof framing exposed from below and show signs of some minor rusting. The covered walkway at the front of the school has a plaster soffit. At the main building, there are conduits and ducts that pass over the seismic joint but do not appear to have flexible connections. There is also conduit running between the portable classrooms at the roof level that does not have flexible connections (see figure 26). At these locations, the conduit may be damaged as the buildings move independently of each other, potentially causing a threat to life safety, such as an electrical fire or low-hanging live electrical wires.

10.6 Review of Existing Drawings

There were no architectural drawings of the main classroom building available for review. Although no drawings of the shop building were available for review, it is similar to the laboratory building and all recommendations in this report that apply to the laboratory building are assumed to apply to the shop building as well. There may be additional work required at the shop building because its larger size leads to higher forces and longer diaphragm spans.

The classroom building has a concrete slab and beams at the first, second and roof levels. The roof and second floor slabs are 4½" thick and have 12" x 22" typical beams running in the transverse direction. At the roof level, there are long skylights that run in the area between the central corridor walls along almost the entire lengths of the classroom wings and at the center connecting area. At these skylights, the roof beams are continuous across the skylight but the slab is not present (see figure 12). The skylight opening in the roof prevents redistribution of the diaphragm shear to the wall lines, making the system less redundant. The first floor slab is 6" thick and has 12" x 22" typical beams running in the transverse direction. These slabs are typically supported by 14" x 16" concrete columns spaced at 16'-0" along the east and west sides of the building and by 20" x 20" concrete columns spaced at 16'-0" along both sides of the central corridor. At some locations, most notably at the west face of the building, the basement level columns change from rectangular above to circular sections below the first floor. In the central connecting area, the slab is supported by round columns, varying from 16" to 20" in diameter (see figure 7). The first and second floor story heights are 15'-0" and the basement is approximately 15 ft tall but varies with location. The foundation typically consists of spread footings under the interior columns, varying from 4 ft. to 9 ft square and 1'-6" wide x 1'-6" deep strip footings under the basement walls. The east wall of the building also acts as a retaining wall, and has a 3'-6" wide x 2'-0" deep strip footing. The concrete slab-on-grade in is 5" thick, which is typical throughout the campus.

There are concrete shear walls, with thicknesses varying from 7" to 12", in the transverse direction at all levels of the main classroom building wings. In the longitudinal direction, there are concrete shear walls at the basement level, but the north wing walls are concentrated near the east edge of the building. This will induce torsion in the building during an earthquake event and force the first floor diaphragm to transfer the seismic shears horizontally from the central corridor of the building to the eastern walls. Furthermore, the irregular boomerang shape of the building will cause the north and south wings to move differently from each other, causing some damage at the central area similar to a re-entrant corner condition. There is a lack of collector elements at the locations where walls are offset from each other horizontally, which also creates higher stresses in the first floor slab. The walls do not always align between the first floor and basement, but at the north wing there are columns below the ends of the walls to resist overturning forces and at the south wing there are transfer girders and occasional walls to serve this purpose.

At the first and second floors, there are walls along the central corridor, but they do not generally extend the full height of the story. Rather, they shorten the effective height of the interior columns to about 4’-6” tall (see figure 12). These short columns are therefore much stiffer than the exterior columns and will resist the majority of the seismic loads in the longitudinal direction. Because of the high shears that the columns are subjected to, these columns have #4 ties spaced at 4” o.c. instead of the typical #3 ties spaced at 9” o.c. These stirrups do not continue into the beam and wall at the tops and bottoms of columns respectively as is required by the current code. Nor are the beam-column connections sufficiently detailed so as to create a ductile flexural failure mode. These short columns are shear-critical at the both the first and second floors, and are expected to behave in non-ductile manner, possibly leading to the complete collapse of the structure.

Where the shear walls intersect with the floor beams, some of the wall vertical steel is not properly confined. This may lead to a reduction in shear capacity as the concrete around these reinforcing bars spalls off. There are also corner locations where the shear wall intersections are not detailed using re-entrant reinforcing bars (see figure 13). As the building moves in an earthquake, these reinforcing bars may be put into tension causing them to spall off concrete. This creates a falling debris hazard directly above a major exit pathway.

The gymnasium and attached stage area have a story height of approximately 31 ft. The roof is a 4” concrete slab that spans 16 ft between steel long-span trusses at the gymnasium area and approximately 10 ft between concrete beams at the stage area. The 7’-6” deep steel trusses at the gymnasium roof span about 86 ft. between concrete-encased steel columns (see figure 16). There is a large skylight opening in the gymnasium roof, measuring about 18’ x 80’, that appears to have additional reinforcing around its perimeter. There is also an attached music room area at the first story with a height of about 13 ft. that has a reinforced concrete slab roof. There is no collector element to tie the music room roof into the north shear wall of the stage area. At the northeast corner of the stage area, there is a concrete flue that goes from the boiler room below to about 5 feet above the high roof level. There is a covered walkway that runs almost completely around the gymnasium building on three sides. It has a wood-framed roof and is supported on by beam hangers attached the building wall on one side and by pipe columns and steel wide-flange beams on the exterior edge. Except as noted below, the covered walkways are well-attached to the gymnasium building and are not expected to lose gravity support.

Below the gymnasium first floor, there is a basement that includes the locker rooms, a boiler room, offices and a classroom. This basement level, which is at ground level on the west side of the building, extends outside of the footprint of the building above on the west side and is unexcavated in other portions of the building. The 4½” thick first floor slab spans between concrete beams at the west portion of the building throughout the building, even in the area that above unexcavated soil. Inside the gymnasium, there is a finished wood floor above the slab and outside of the gymnasium the slab becomes a low roof area. There are also large skylight openings in this roof area. The basement level has reinforced concrete walls and a few reinforced concrete columns. Many of the wall lines are slightly offset from each other or do not extend across the length of the building.

At the east and west walls of the gymnasium and at the west side of the building’s basement level, there are bands of glass block that interrupt the concrete wall along the entire length of the building. These wall lines were seismically retrofitted in 1990 with steel braced frames that use

WT7x24 braces. At the gymnasium walls, the bottom ends of the braces are connected directly to the face of the concrete shear walls with expansion anchors, whereas the upper ends of the braces have bolted gusset plate connections (see figures 14 and 16). Their WT braces are non-compact sections, asymmetrical in section, and are eccentrically loaded at their connections. Therefore, we do not expect them to behave in as ductile of a manner as a conventional brace section. There is also a similar band of glass block at the north wall of the music room that has no additional steel bracing (see figure 15). The concrete walls at the east and west walls span horizontally between the concrete-encased concrete columns that support the roof truss. These composite columns appear to have adequate strength to carry the wall out-of-plane loads. The north and south walls of the gymnasium area are 10” and 12½” thick, respectively, and appear to be overly slender for their 31 ft vertical span. The out-of-plane flexure failure of these walls poses the threat of a partial collapse of the structure. There are concrete shear walls running north-south at the music room and stage area, but they appear to be insufficient to carry the seismic loads from the large gymnasium area and do not to have collector elements tying them into the rest of the gymnasium roof diaphragm. The lack of collector elements may result in some damage to the roof diaphragm at these locations.

At the southwest corner of the gymnasium building, there is a small one-story concrete classroom building structure at the ground level. This building has exterior concrete shear walls on the north and south sides. At the east and west sides, there are windows along the entire length of the building, leaving only the one interior concrete wall to carry the seismic loads in the north-south direction. Although this system is lacking in redundancy, it appears to be adequate to resist the seismic loads. In the area between this classroom and the gymnasium building, there is a section of covered walkway that relies on both buildings for gravity support and has not been detailed to accommodate relative movement of the buildings during an earthquake event (see figure 20). This poses a life safety hazard because there may be a partial collapse of the covered walkway in this area.

The laboratory building is a one-story concrete and steel building situated on a sloping site. Because the ground slopes down from east to west, the eastern portion of the building has a 5” thick concrete slab-on-grade and the western portion has a 5” thick suspended slab that spans between concrete beams and exterior 10” concrete walls (see figure 21). The foundation is a combination of 16” wide x 15” deep strip footings under walls and spread footings that vary from 2’-6” square to 4’-0” square. The roof has a sawtooth shape, with 2x tongue and groove (T&G) straight sheathing on the shallow sloped faces and skylights on the steep faces of the roof structure. (We could observe a layer of plywood being placed in the ongoing re-roofing construction project.) There are diagonal bracing rods in the roof truss at the end bays of each of the sawtooth bents to provide them with stability in the transverse direction. There are also L3x3x5/16 diagonal angle braces that make up a horizontal truss at the base of the sawtooth bents. The remainder of the roof framing is made up of 12WF27 steel beams that span 24 ft. in the transverse direction between 8WF24 steel columns (see figure 24). The exterior columns are encased in concrete and also support a section of 10” concrete wall above. This is an unconventional system that relies on the fixity of the column in the wall above and below the window openings to create a moment-resisting frame with weak columns. At the north end of the building, there is a similar system, except there is no wall above the windows to provide fixity at the tops of the columns (see figure 22). Therefore, the concrete-encased columns at the north end of the building act as short cantilevers sticking up from the shear wall to resist seismic loads. All of these short columns' behavior is governed by flexural action, which should make them behave in a ductile bending manner. However, because of their flexibility these columns could be subjected to large forces and deflections, and thus to large rotational demands. At the west side of the building, the exterior longitudinal wall at the first floor does not continue down to the foundation. Rather, it sits on top of columns and the seismic load is transferred out to the exterior wall through the first floor diaphragm.

The covered walkway typically consists of 6" wide-flange beams spanning up to 12 feet between 4" diameter cantilevered pipe columns. These pipe columns are grouted into pipe sleeves in the 2'-6" square spread footings. The roof has 2" tongue-and-groove sheathing spanning between the wide-flange beams (see figure 25). At the front of the main building, the covered walkway has additional steel framing spanning between 6" wide-flange columns that rest on 2'-6" square spread footings. The covered walkway that runs between the gymnasium building and the laboratory building has no seismic joints to separate the walkway from either building. This poses a threat to life safety because, if the buildings were to move independently of each other during strong ground shaking, the covered walkway could lose gravity support and thus could experience partial collapse.

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 for 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 quantitative seismic evaluation methods and strategies for seismic strengthening of school buildings. The scope of our analyses were not to validate every member and detail, but to focus on those elements of the structures determined by FEMA 310 to be critical and which could pose life safety hazards. Element *strength* values not addressed in the California Building Code were based on the document FEMA 356, Federal Emergency Management Agency, *"A Prestandard and Commentary for the Seismic Rehabilitation of Buildings"* 2000.

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.	There is some apparent localized settlement or sliding of the slope on which the school is built. This is made evident by the significant cracking of site paving.
2.	At the main building, there are short columns between the partial height wall and slab at 1st and 2nd stories that create high windows along the corridor. These elements are flexible relative to the walls and do not have sufficient capacity to resist the seismic loads. Furthermore, the columns are shear-critical, and therefore will have non-ductile behavior.
3.	At the north wing of the main building, the west basement wall is partial height and therefore is not connected to the first floor slab. The center of rigidity of the building at the basement level is dominated by the walls on the east side of the building, inducing a lot of torsion into the building at this level
4.	At the main building re-entrant corners, the manner in which the concrete reinforcement is detailed may lead to spalling of concrete.
5.	There are cracks in the concrete walls in the north wing basement storage area of the main building. There are also exposed reinforcing bars at the doors that have been cut into the basement walls. The exposed reinforcing bars may corrode if exposed to moisture.
6.	The diagonal bracing used in the 1990 retrofit of the Gymnasium uses WT-sections. The bolted top connections of these braces, which provide lateral resistance at the east and west walls, are overstressed
7.	There is a lack of collectors at the roof of the Gymnasium building where the east and west walls of the stage area provide additional lateral support for the main gym area roof and where the north wall of the stage area provides additional lateral support for the music room roof.
8.	The north and south walls of the gymnasium may have inadequate capacity to span vertically between the first floor and roof under seismic loading
9.	There are some minor cracks in the concrete walls of the gymnasium.
10.	There is a covered walkway between the gymnasium and the attached classroom. This walkway is supported by two structurally separate buildings. As they move independently, the covered walkway may lose gravity support and collapse.
11.	At the laboratory and shops buildings, the diagonal roof bracing is inadequate to transfer the seismic forces to the transverse wall lines.
12.	The covered walkway between the Gymnasium and Laboratory Building are connected at each end to buildings. As the buildings move independently, the walkway may tear away and collapse.
13.	Long sections of covered walkways are connected to the adjacent buildings. Because the buildings are much stiffer than the canopy supports, the load will be carried by the building, increasing both the building base shear and the collector

	demands on the connecting beams.
14.	At the portable classrooms, there is conduit running between the portable classrooms at the roof level.

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.	Consult with a geotechnical engineer to determine if there is a slope stability problem that would affect the building structures.	1.9	None
2.	Infill some of the high windows with new concrete wall panels. Provide new 7” thick concrete wall, 64 ft at the 2nd floor, 96 ft. at the 1st floor at interior corridor walls in each wing	1.0	2,3
3.	Infill 80 ft length of the western partial-height 8” thick shear wall to make it a full-height wall. Dowel into existing wall.	1.9	1
4.	Provide a new steel plate at the exterior of the building bolted back into the existing walls to restrain the concrete from spalling off. 4 locations x 6 ft of 24” x 1” plate and two rows of expansion anchors at each location.	2.2	3
5.	Pressure inject epoxy grout to seal the cracks. At the doorway cuts, burn back the exposed rebar 1” from the surface and patch.	3.0	4
6.	Provide new welding of the brace to the gusset plate, total of 16 locations	1.0	5
7.	Provide new concrete collector elements aligned with the stage area walls that tie into the existing concrete roof slab.	1.4	6
8.	Provide new bracing of the walls back to the roof diaphragm to cut down the wall span.	1.0	6
9.	Pressure inject epoxy grout to seal the cracks.	3.0	5
10.	Provide new columns for secondary gravity support of the covered walkway.	1.1	5
11.	Provide additional diagonal bracing similar to existing bracing OR replace existing bays of angle braces with new double angle braces. 14 braces at lab building, 28 (estimated) at shops building.	1.3	7
12.	Provide supplemental support adjacent to each building so that damage will not lead to the collapse of the walkway. Reroute conduits and piping so that it is not supported by covered walkways or has adequate flexible connections	1.1	7
13.	Provide seismic joints in the existing covered walkway.	1.6	7

	Some additional columns will be required for gravity support.		
14.	Provide flexible connections for conduit running between portables.	1.9	None

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 1A.

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.

Appendix A - Figures

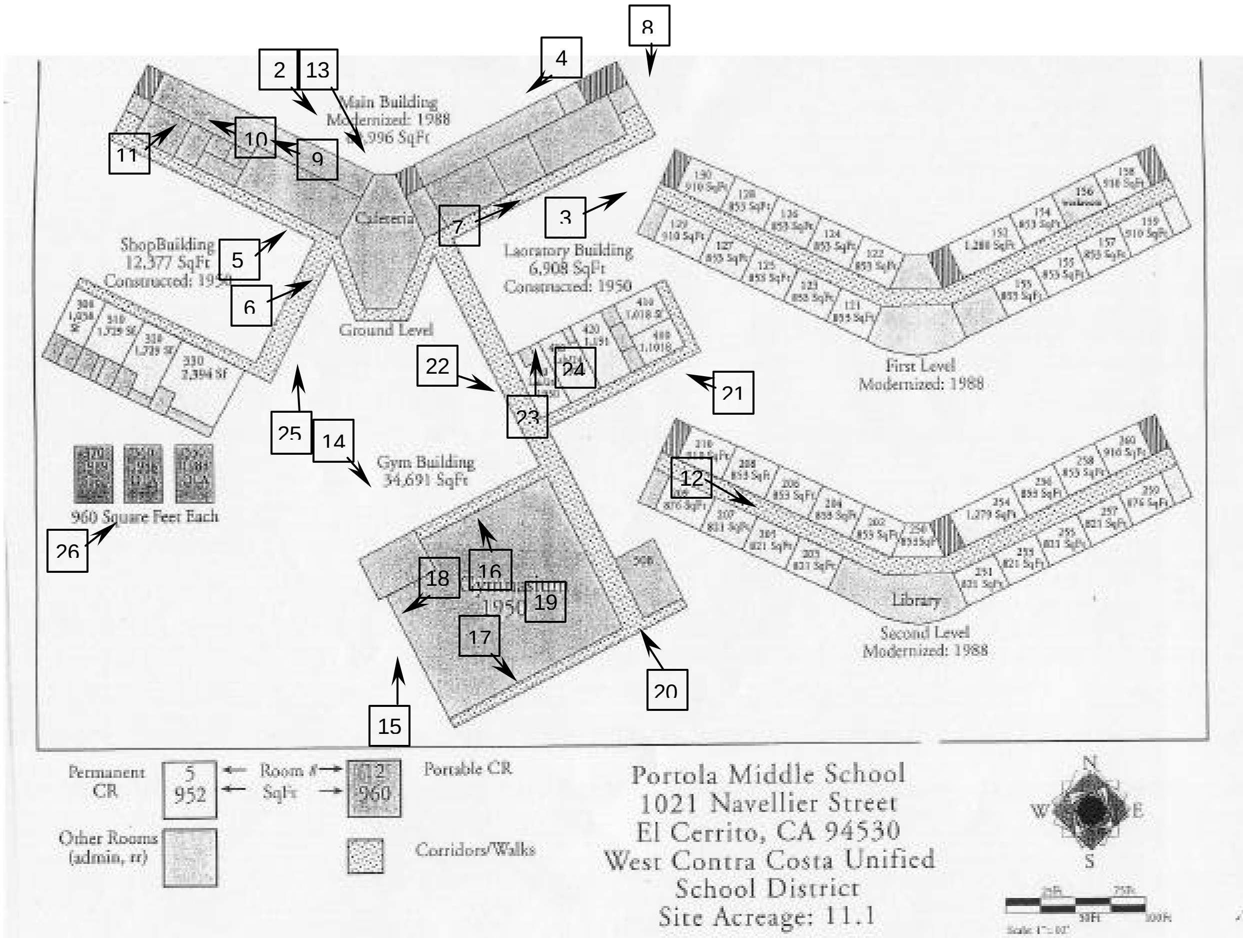


Figure 1: School layout plan

Figure 2: Front of Main Classroom Building

Figure 3: Settlement of site paving adjacent to Main Classroom Building

Figure 4: Front of Main Classroom Building

Figure 5: Rear of Main Classroom Building

Figure 6: Central area of Main Classroom Building

Figure 7: West side of Main Classroom Building at the ground floor

Figure 8: Elevator tower Main Classroom Building

Figure 9: Sawcut opening in basement wall of Main Classroom Building

Figure 10: Rough cut opening in basement wall of Main Classroom Building

Figure 11: Diagonal cracking in the basement wall of Main Classroom Building

Figure 12: Central second floor corridor and skylights at Main Classroom Building

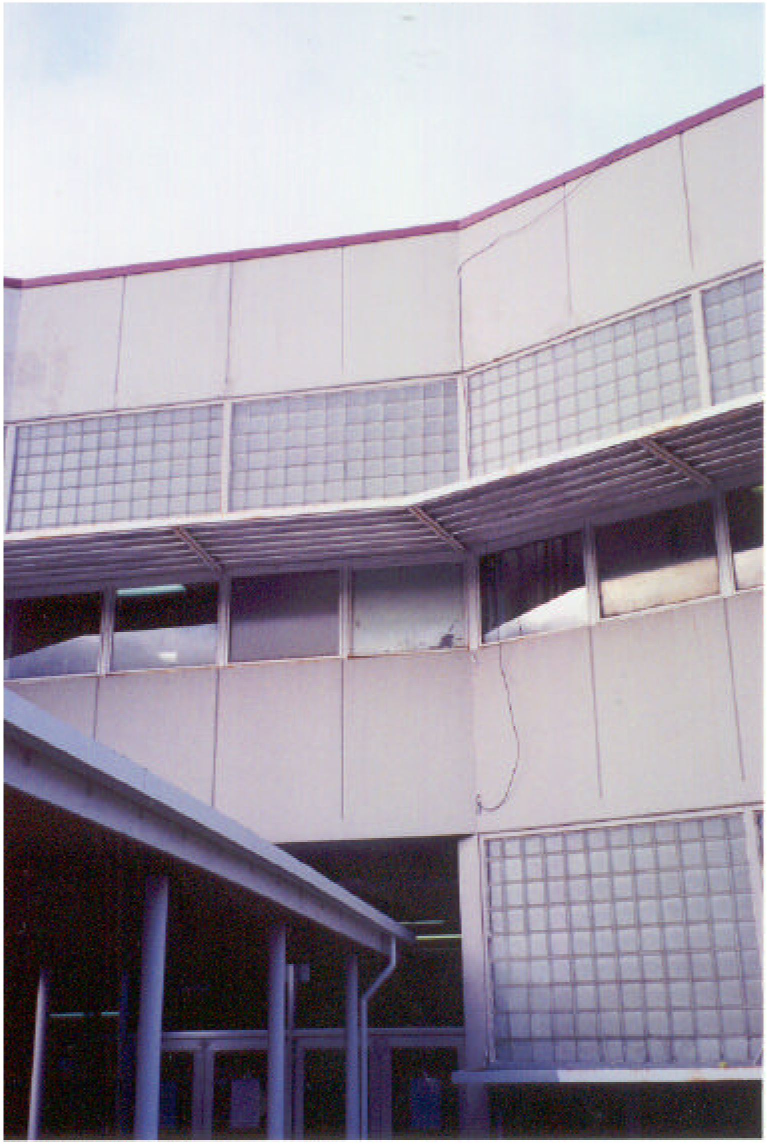


Figure 13: Re-entrant corner at the front of Main Classroom Building

Figure 14: North face of Gymnasium Building

Figure 15: West side of Gymnasium Building

Figure 16: Retrofit bracing at interior of Gymnasium

Figure 17: Retrofit bracing at interior of locker room

Figure 18: Cracks in the wall of Gymnasium Building

Figure 19: Infill of skylight openings at Gymnasium

Figure 20: Covered walkway at Gymnasium Building between locker rooms and attached classroom building

Figure 21: South view of Laboratory Building

Figure 22: West view of Laboratory Building

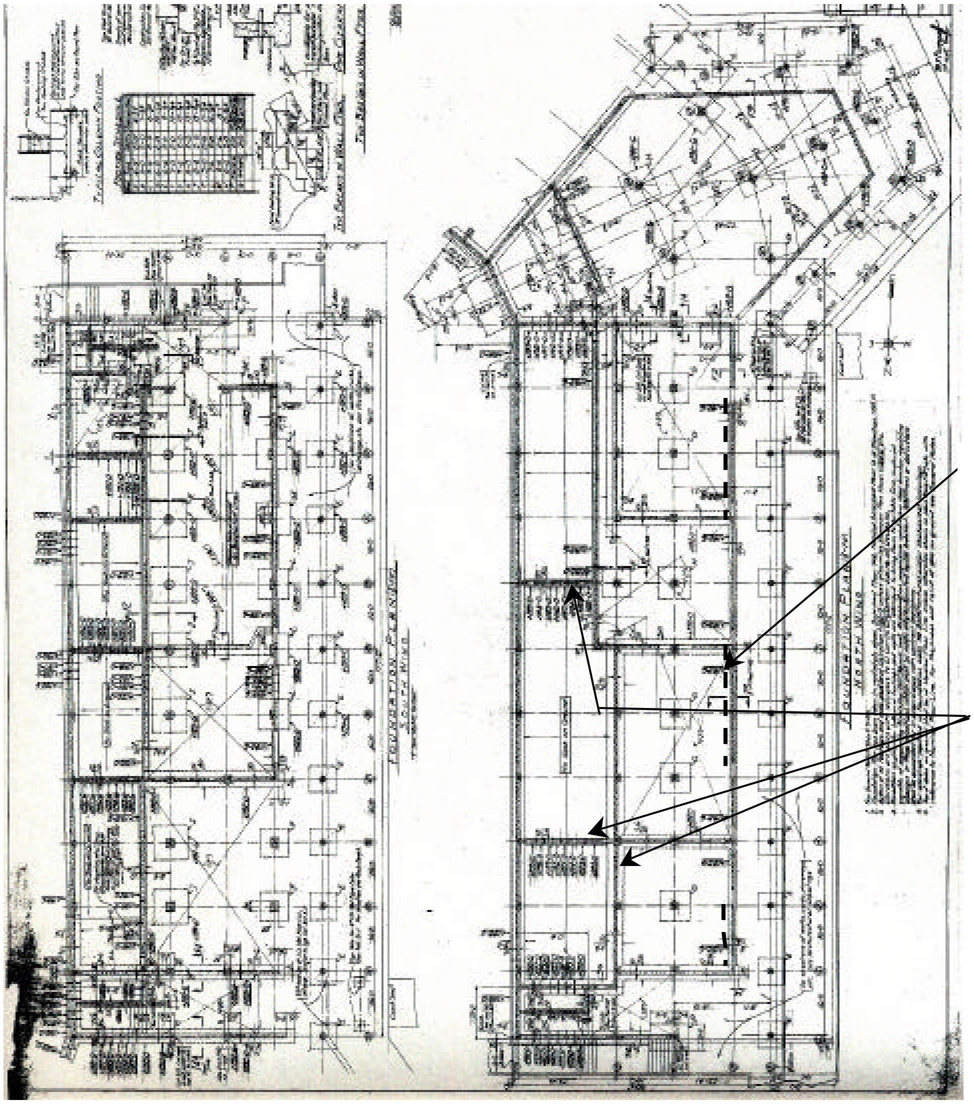
Figure 23: Cracks at the base of columns in Laboratory Building

Figure 24: Sawtooth roof trusses at Laboratory Building

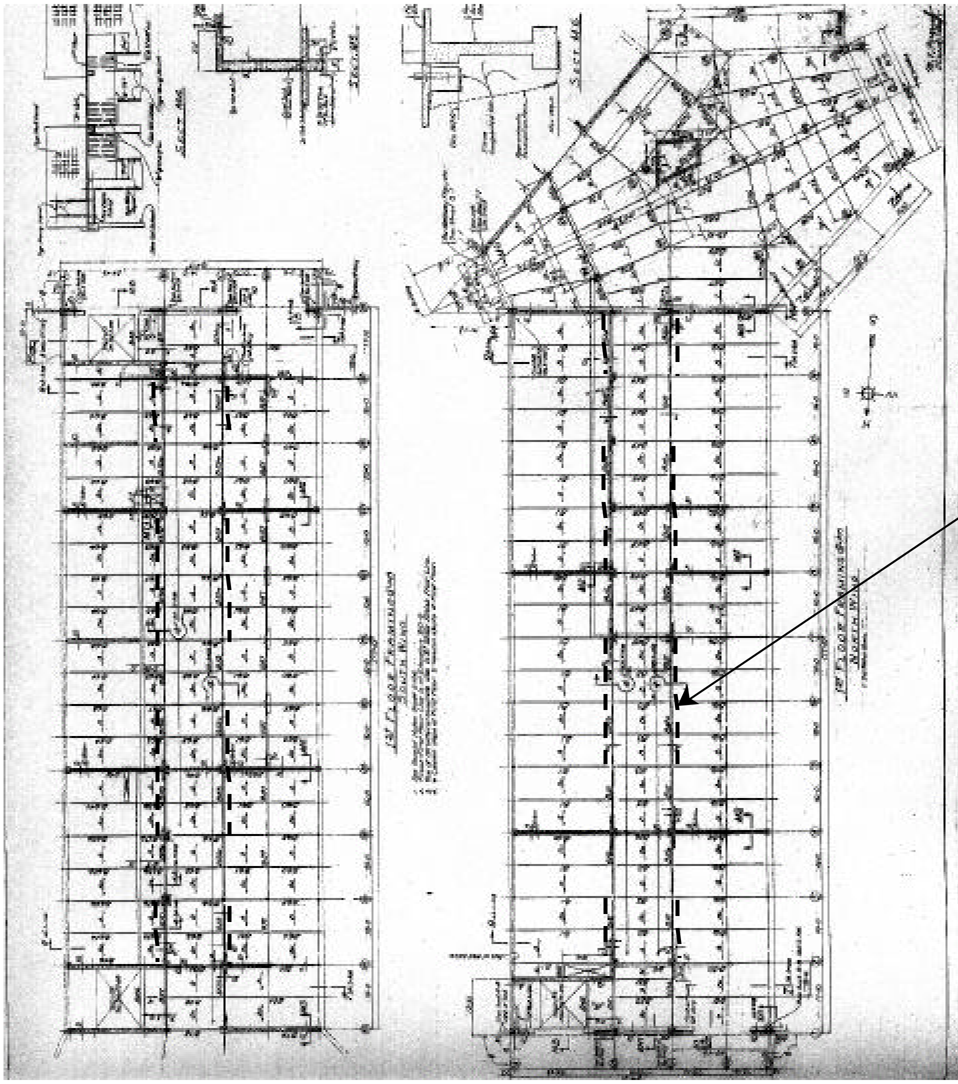
Figure 25: Typical covered walkway

Figure 26: Conduit between portable classrooms

Appendix B – Drawings

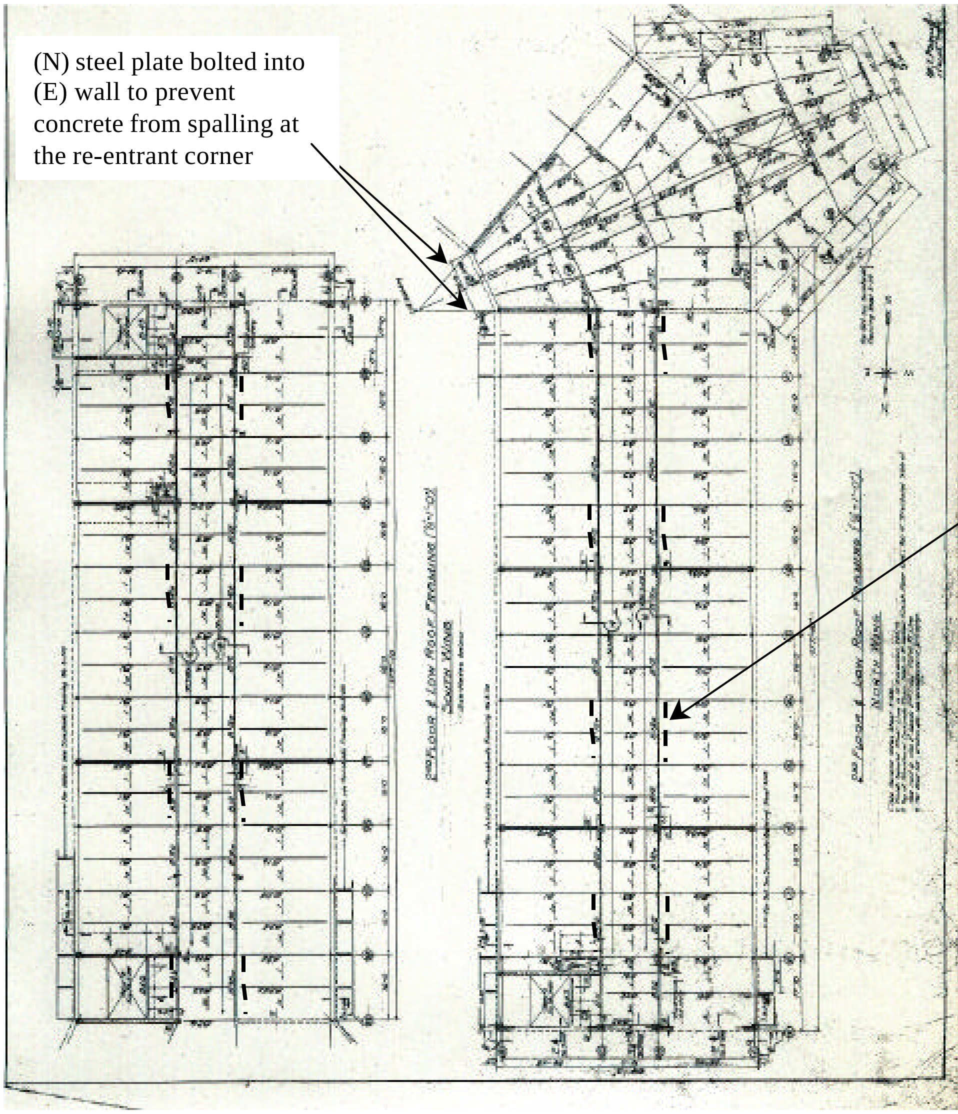


Drawing 1: Main Classroom Building ground floor plan

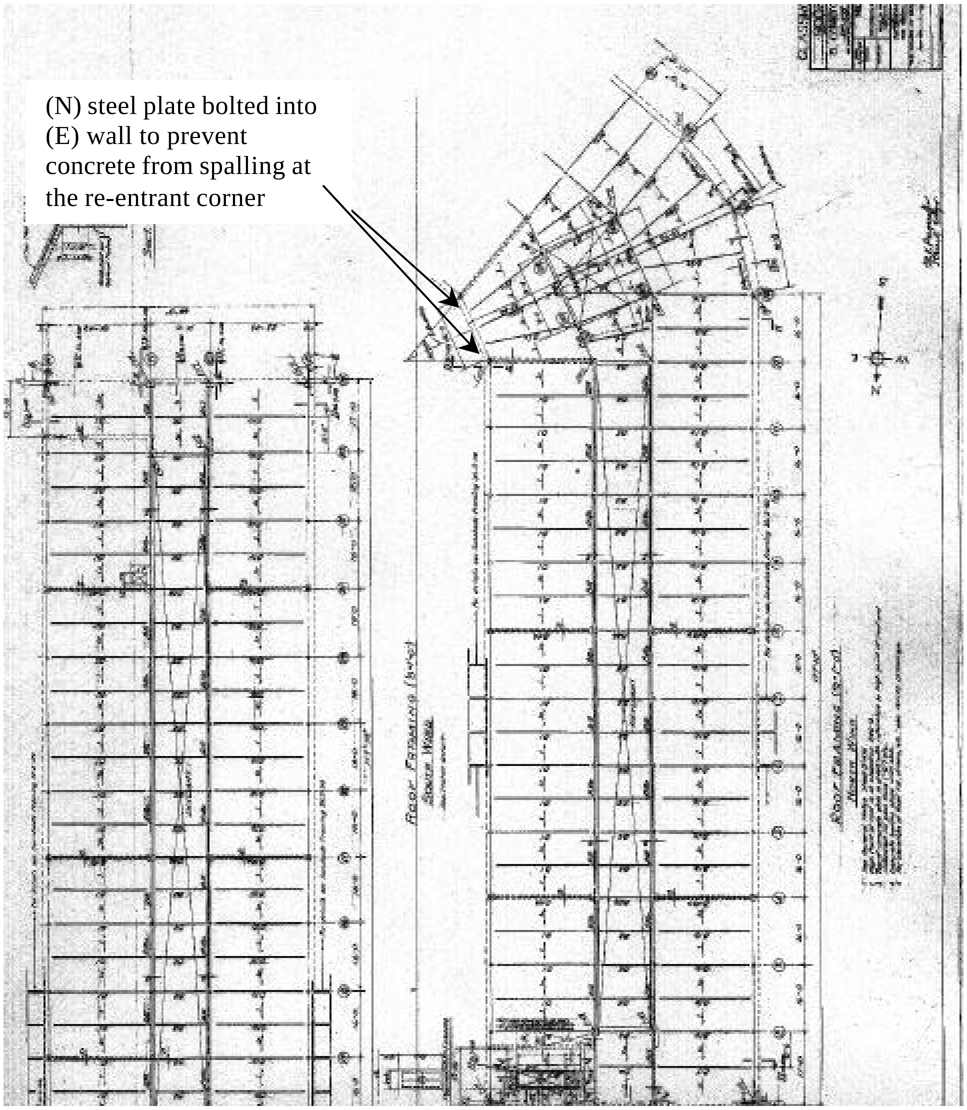


Infill high windows with (N) 7" thick concrete wall panels, typ. Dowel into (E) beam above and partial height wall below.

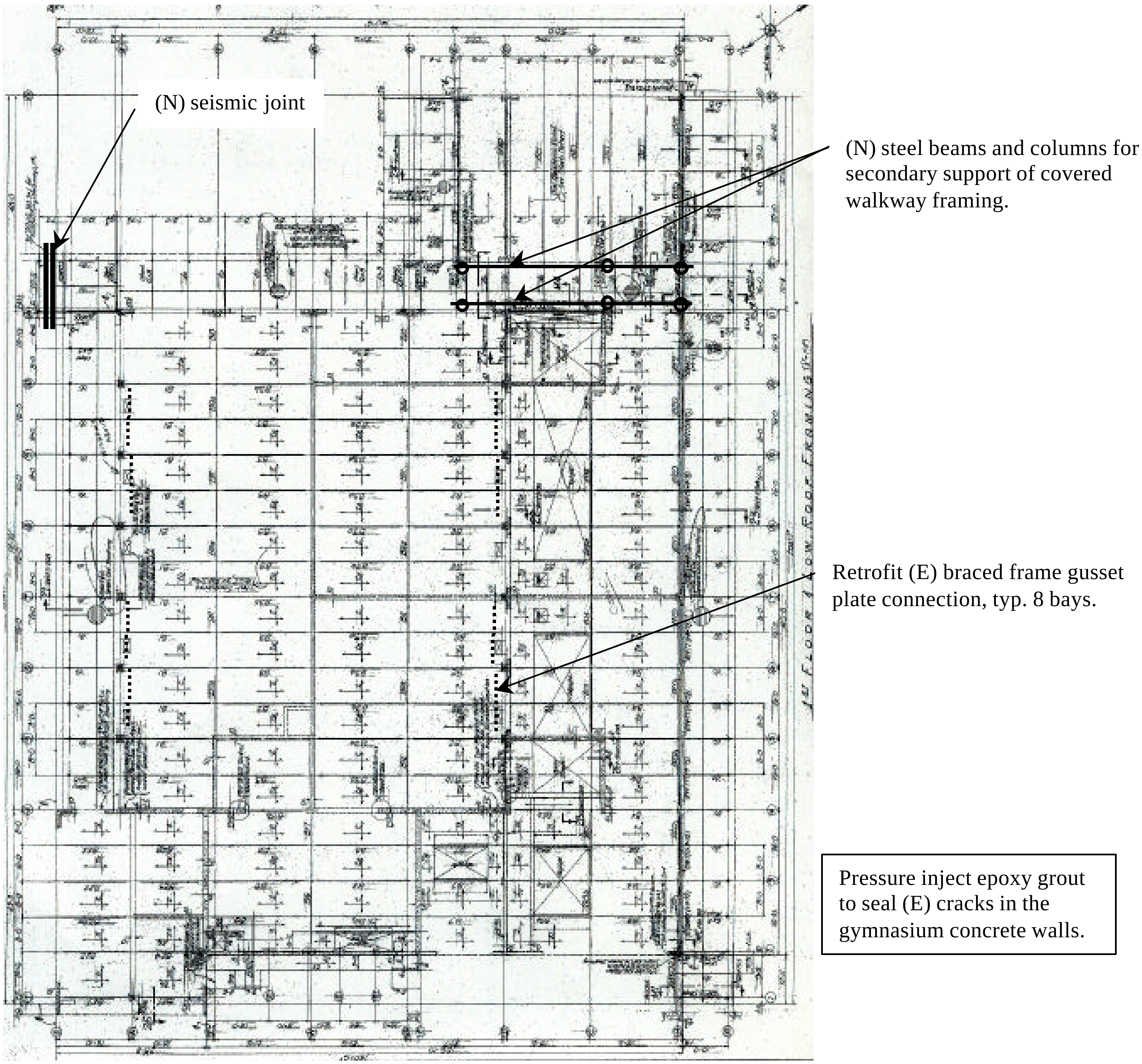
Drawing 2: Main Classroom Building first floor plan



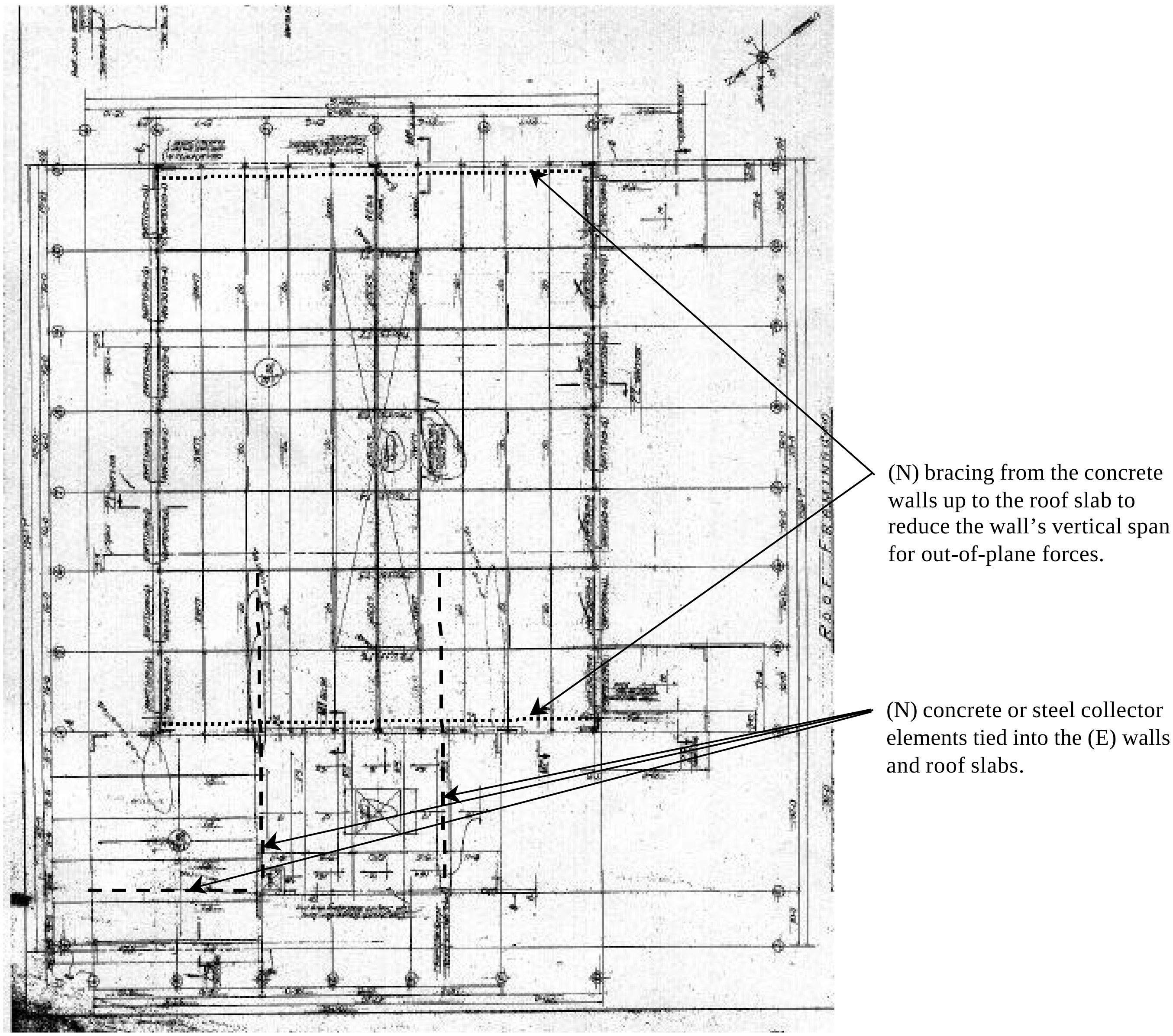
Drawing 3: Main Classroom Building second floor plan



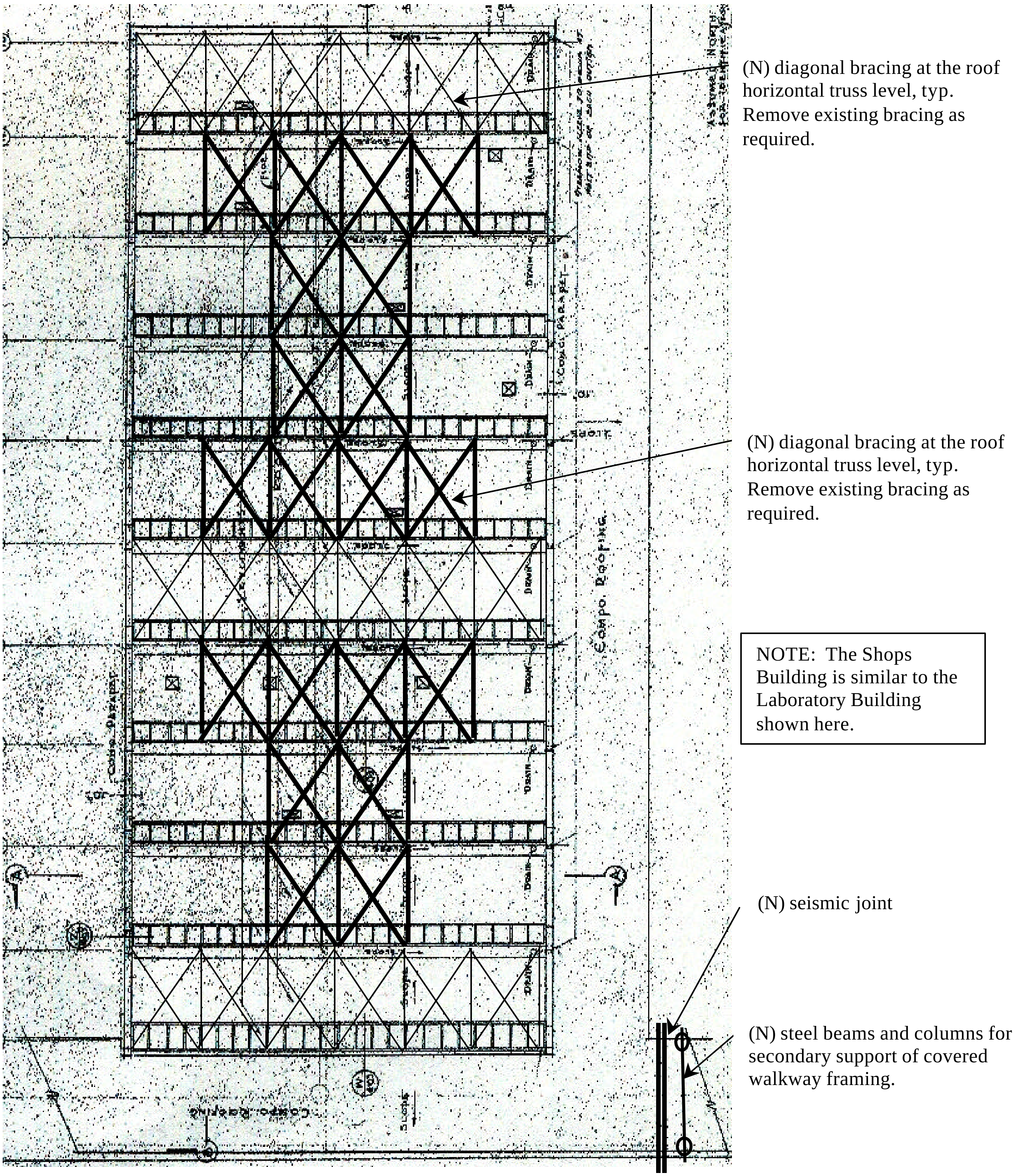
Drawing 4: Main Classroom Building roof plan



Drawing 5: Gymnasium Building first floor and low roof plan



Drawing 6: Gymnasium Building roof plan



Drawing 7: Laboratory Building roof plan