STRUCTURAL EVALUATION OF

GOMPERS CONTINUATION HIGH SCHOOL

WEST CONTRA COSTA UNIFIED SCHOOL DISTRICT (WCCUSD)

For

WLC Architects
Kaiser Building
1300 Potrero Avenue
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By

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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 Gompers Continuation High 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 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

Formerly known as Roosevelt Junior High School, the campus at Gompers Continuation High School originally dates back to before 1930. The main classroom original building is a three story hollow masonry tiles structure with wood floors and wood roof that has undergone a major retrofit and seismic strengthening to its lateral resisting system in 1934.

The second large building on the campus is the auditorium building (currently used as a paint shop), which is a one story hollow masonry tiles structure with a steel truss roof supporting a wood roof that has also undergone a major retrofit to its lateral resisting system in 1934. Attached to the auditorium building is the Music Room originally a one story wood building, which was expanded with reinforced CMU walls and wood roof addition in 1969. Currently, the auditorium building is not being used by the school.

The two-story gymnasium building was constructed with unreinforced masonry walls, steel floor beams, wood roof and partial steel bracing. The building has been abandoned along with the girls' lockers and the girl's toilet structures.

There is a covered walkway between the auditorium building, the classroom building, and the locker's.

In addition to these large buildings, there are a number of smaller buildings and portables on the campus that are currently not being used by the school. Excluding these portable buildings, the permanent structures used by the school total approximately 40,991 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 campus is located at a distance of 4.0 kilometers from the Hayward fault. This fault, classified as source Type "A" by the 2001 CBC is active and capable of producing earthquakes of Richter magnitude higher than 7.0, and have a high rate of seismic activity. 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 classroom building has a tension-only steel bracing in the longitudinal direction, and tension-only steel bracing and concrete shear walls in the transverse direction, which has a response modification factor of R=2.8.

The Gymnasium building has steel braces has a response modification factor R = 5.5.

The Auditorium building has non-bearing concrete shear walls, which has a response modification factor R=5.5.

Based on the occupancy per the 2001 CBC, the importance factor is equal 1.15.

The seismic design coefficient in the 2001 CBC is:

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44x1.30x1.15)W}{2.8} = 0.587W \quad \text{for the classroom building}$$

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44x1.30x1.15)W}{5.5} = 0.299W \quad \text{for the Gymnasium \& Auditorium buildings}$$

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. Class Room Unit, Roosevelt Junior High School, Plans of Structural Changes, Louis S. Stone Architects and R.H. Cooley Structural Engineer; sheets 1 – 11; October 9, 1933 DSA application #50.
2. Auditorium Unit, Roosevelt Junior High School, Plans of Structural Changes, Louis S. Stone Architects and R.H. Cooley Structural Engineer; sheets 1 – 11; April 9, 1933 DSA application #873.
3. Remodel of Music Room, Roosevelt Junior High School, Barbachano-Ivanitsky Architects; sheets A1 – A2; June 14, 1968 DSA application #30594.
4. Remodel of Music Room, Roosevelt Junior High School, Rutherford & Chekene Structural Engineers; sheets S1 – S2; June 14, 1968 DSA application #30594.

5. Covered Walk & Corridor, Additions & Alterations, Roosevelt Junior High School, Charles E. Strothoff Architect; sheet A1; December 2, 1953, DSA application #113914.

10.5 Site Visit

DASSE visited the site on August 15th, 2002 and November 18th, 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 Classroom building is constructed on a flat site and is predominantly a three story structure, although, a portion of the building's south end has only two stories. The exterior walls are unreinforced hollow masonry "tiles" with plaster finish on the inside as well as on the outside, and are predominate with window openings (Figures 2, 3, 4, 5, 6 and 7). The interior walls are wood stud walls (Figure 8) except for six added concrete walls in the transverse direction at the 3-story portion of the building. The added interior steel columns on the inside were observed covered with plaster. Most walls and ceiling were covered with plaster, which made it hard to investigate the structure without removal of finishes. The corridor ceiling is plaster but acoustical tiles were glued to it. The boiler room has concrete walls, concrete joists (Figure 9), and concrete beams. They were observable due to the unfinished interior boiler room. Except for few locations in the building, no major cracks in the plaster finish or in the concrete walls were observed.

On the opposite side of 8th street, the auditorium building is part of the campus that is no longer used by the high school. For the most part the main floor of the auditorium has been gutted and is currently being used for storage and maintenance. The exterior walls are unreinforced hollow masonry "tiles" with added concrete on the outside. Except for the west wall, they are predominated with window and door openings (Figures 10, 11, 12, and 13). The "tiles" can be observed in the stage area where the walls have no interior finish (Figure 14). The roof structure of spans roughly 65'. The wood Balcony is laterally supported by the Building exterior walls on three sides and by a concrete wall on the fourth side. In general, no major cracks in the structure were observed.

Attached to the West Side of the Auditorium building is the Music room. The original half is a one story wood structure and the other added half is a one story reinforced masonry walls with wood roof.

Adjacent to the main classroom building, the gymnasium building is a two-story building constructed with a combined wood and steel gravity system. At the roof level, wood trusses span the entire transverse width of the building in the absence of a ceiling. The trusses are supported by steel columns that are located just inside of the perimeter masonry walls. From the ground level, the wood joists and steel wide flange beams supported on steel columns framing the second floor above can be observed, as there is no ceiling. The exterior walls are unreinforced hollow masonry "tiles" and are predominate with window openings (Figures 15, 16, and 17). There are very few Wide Flange steel braces in both directions along the exterior walls (Figure 20). The roof straight sheathing forms the roof diaphragm. The second floor diaphragm consists of double angle diagonal bracing. Attached to the gymnasium building is the girls lockers and the girls toilets. The gymnasium building has been observed to be badly deteriorated, and it is recommended that the structure and its attachments be taken out of service and demolished.

10.6 Review of Existing Drawings

The only available drawings for the Classroom building are those of the retrofit work done in 1934. The original building has a wood truss roof spaced at 24" centers and the floors are 2x16 spaced at 16" centers including the 1st floor. The roof and the floors are supported on the exterior hollow masonry tiles at one side and on the stud walls at the other. The retrofit work included adding 6" wide flange steel beams to support part of the gravity load. The beams are supported on 6" wide flange steel columns. The original building had no significant lateral system and the 13" unreinforced hollow masonry walls have extremely poor lateral resistance and performance during earthquakes, and the walls tend to disengage from the floors or shatter between floors. The retrofit work in 1934 created a new lateral resisting system consisting of 12 tension-only steel braced frames in the longitudinal direction, 6 tension-only steel braced frames in the transverse direction for the two story portion of the building, and 6-6" reinforced concrete shear walls in the transverse direction at the three story portion of the building. The work also included adding horizontal trusses for the diaphragm, one at the corridor and one at each exterior wall. The tension-only braces are allowed only in light steel one story structures, and the performance of an unreinforced masonry building using this system is expected to be very poor during a design level earthquake. This is a deficiency that could lead to a life safety hazard. The original roof and floor diaphragms have straight sheathing and they are required to transfer part of the shear to the vertical elements. This is also a potential deficiency that could lead to a life safety hazard. The concrete shear walls combined with the tension-only braces in the same direction could result in an amplification of the lateral forces and cause overstressing during a design level earthquake. Destructive testing of the tile walls is required to determine the actual capacity of the wall element out-of-plane to span between anchors and the capacity of the anchors. If the tests indicate a low shear capacity of the mortar joints, the stability of tiles would be a potential deficiency that could lead to a life safety hazard.

The only available drawings for the Auditorium building are those of the retrofit work done in 1935. The original building has a wood roof supported on steel trusses spaced approximately at 18' centers and spanning 68' supported on steel columns. The original building had no significant lateral system and the unreinforced hollow masonry walls have extremely poor lateral resistance and performance during earthquakes, and the walls tend to disengage from the roof or shatter between the floor and the roof. The 1935 retrofit work included adding 6” reinforced concrete gunite on the exterior side of all exterior walls and 8” on the stage frame, creating non-bearing concrete shear walls as the new lateral resisting system for this structure. These added shear walls are reinforced with a single layer of ½” bars spaced at 12” centers in each way. New concrete beams were added at the windowsill, at the window head, at the lower truss chord, and at the top of the parapet level in the walls’ plane. Also, double angle horizontal bracing were added at the truss lower chord level, concrete stiffeners at the proscenium beam, concrete walls at the balcony girder, and horizontal bracing at the balcony. The roof diaphragm has straight sheathing that does not have the capacity to transfer part of the shear to the vertical elements. This is a potential deficiency that could lead to a life safety hazard. The diagonal bracing at the lower chord level is inadequate to transfer the shear to the vertical elements and to brace the walls out-of-plane. This is a potential deficiency that could lead to a life safety hazard.

Destructive testing of the tile walls in the Auditorium building is required to determine the actual capacity of the wall element out-of-plane to span between anchors and the capacity of the anchors. If the tests indicate a low shear capacity of the mortar joints, the stability of tiles would be a potential deficiency that could lead to a life safety hazard.

There are no drawings available for the Gymnasium building and its attached structures. The information presented is based on the site visit observations only without the removal of the finishes or destructive testing. It appears that the second floor deck has deteriorated and it is a life safety hazard. The existing lateral resisting system provide a capacity far below the required capacity to resist the design earthquake. This is a deficiency that could lead to a life safety hazard. The unreinforced masonry tile walls are not anchored to the roof and floor diaphragms properly and the wall tiles could shatter between anchors. This is a deficiency that could lead to a life safety hazard. The roof diaphragm has straight sheathing that does not have the capacity to transfer the shear to the vertical elements. This is a potential deficiency that could lead to a life safety hazard. In general, it is very expensive to retrofit this unreinforced masonry building and upgrade the lateral resisting elements to be able to resist the design earthquake.

The covered wood walkway was added in 1952 and rigidly attached to the Classroom building, the Auditorium building, and to the Locker’ building. This is a potential deficiency that could lead to a life safety hazard. It is recommended to be removed along with the Gymnasium structure.

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 that the FEMA 310 document seeks to achieve are the Life Safety and the Immediate Occupancy. We have based our evaluation 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 1998) is used as the basis of our quantitative seismic evaluation methods. The scope of the analysis was not to validate every member and detail, but to focus on those elements of the structure 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, *"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.	In the Classroom Building at the first floor level, the six concrete shear walls at the 3 stairways are not adequate in shear.
2.	In the Classroom Building, the tension only braces for this building could amplify the response and cause high drift for the "tile" walls. During the design earthquake, the braces would be overstressed as well as the brace connections.
3.	In the Classroom Building, the steel truss diaphragm is not capable of transferring the forces to the interior frames and the shear walls.
4.	In the Classroom Building, the roof straight sheathing is incapable of transferring the shear to the lateral resisting elements.
5.	In the Classroom Building, there is not enough information about the as built condition.
6.	In the Auditorium Building, the walls anchorage to the roof is not sufficient and the shear transfer from the horizontal truss to the lateral resisting elements is inadequate.

7.	In the Auditorium Building, the roof strait sheathing is incapable of transferring the shear to the lateral resisting elements.
8.	In the Auditorium Building, there is not enough information about the as built condition.
9.	The Gymnasium Building was abandoned. Deterioration was apparent in most of the building. Lateral resisting system is very week, lack of wall tile anchorage, and lack of proper roof shear transfer to the lateral system. The presence of Unreinforced Masonry tiles.
10.	The Corridor Walkway is rigidly connecting three independent structures.

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	Drawing Number
1.	Add Shotcrete to one side of these walls.	1.5	1
2.	Provide new Chevron or diagonal braces or add on existing straps in the existing frames.	1.0	1
3.	Add diagonal braces at the steel truss diaphragm.	1.5	1
4.	Provide plywood sheathing over existing straight sheathing.	1.7	
5.	Perform tests to determine the as built condition.	1.0	
6.	Provide adequate anchorage at all walls by adding more horizontal braces at the attic level.	1.7	2
7.	Provide plywood sheathing over existing straight sheathing.	1.7	
8.	Perform tests to determine the as built condition.	1.0	
9.	Demolish existing Gymnasium building and its attached structures.	1.5	
10.	Remove existing walkway cover at the Gymnasium building attachment structures, and provide slotted connections at the Classroom building.	1.5	

10.10 Portable Units

No existing portables observed during our site visit were being used by the school.

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 be performed to this school campus 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

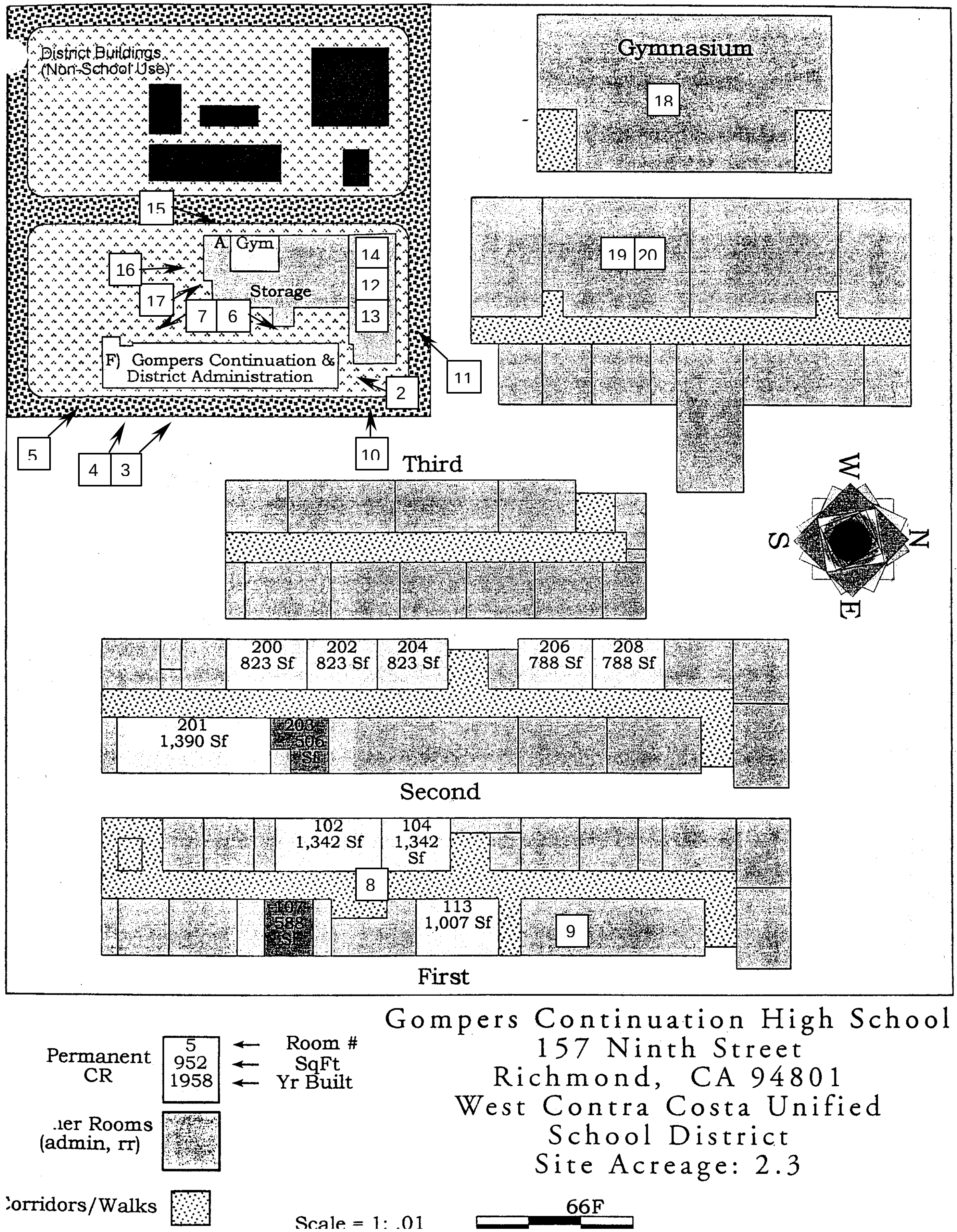


Figure 1: School Layout Plan

Figure 2: Campus Entrance

Figure 3: Classroom Building, exterior east wall

Figure 4: Classroom Building, exterior east wall

Figure 5: Classroom Building, exterior south wall

Figure 6: Classroom Building, exterior west wall

Figure 7: Classroom Building, exterior west wall

Figure 8: Classroom Building, interior corridor

Figure 9: Classroom Building, interior exposed structure

Figure 10: Auditorium Building, exterior east wall

Figure 11: Auditorium Building, exterior north wall

Figure 12: Auditorium Building, interior southwest corner

Figure 13: Auditorium Building, interior northeast corner

Figure 14: Auditorium Building, interior at former stage area

Figure 15: Gymnasium Building, exterior west wall

Figure 16: Gymnasium Building, exterior south wall

Figure 17: Gymnasium Building, exterior southeast corner

Figure 18: Gymnasium Building, interior exposed roof framing

Figure 19: Gymnasium Building, interior exposed floor framing

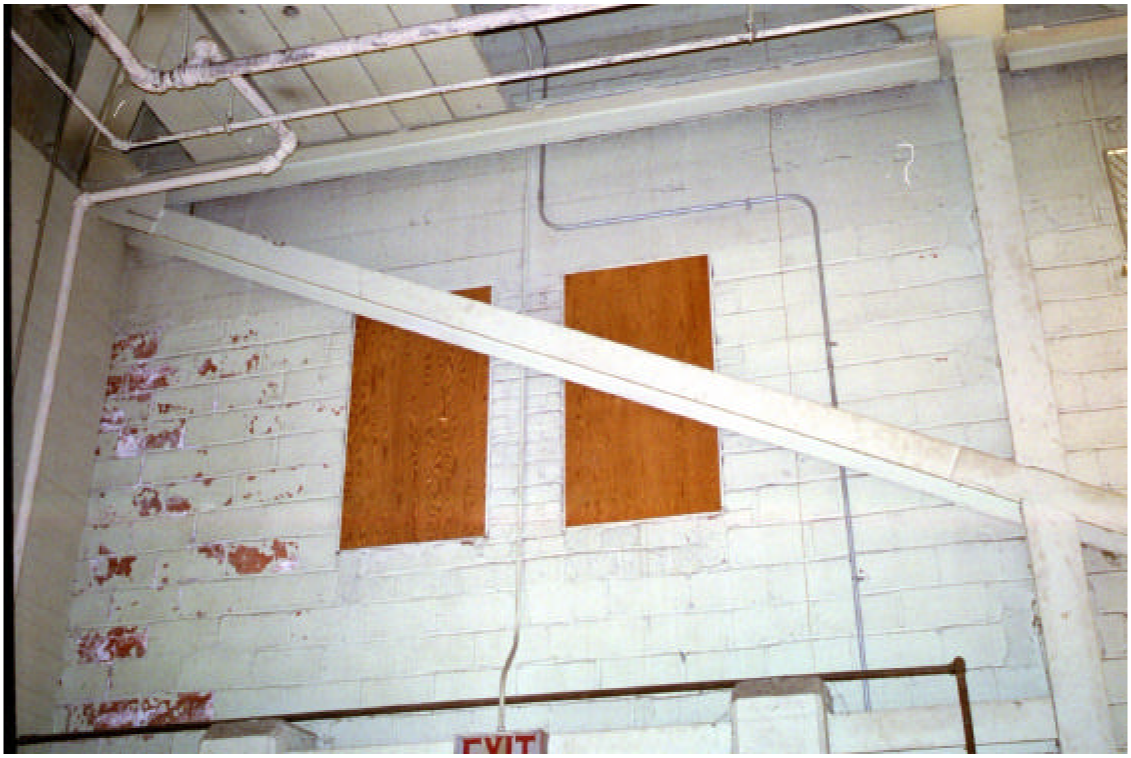
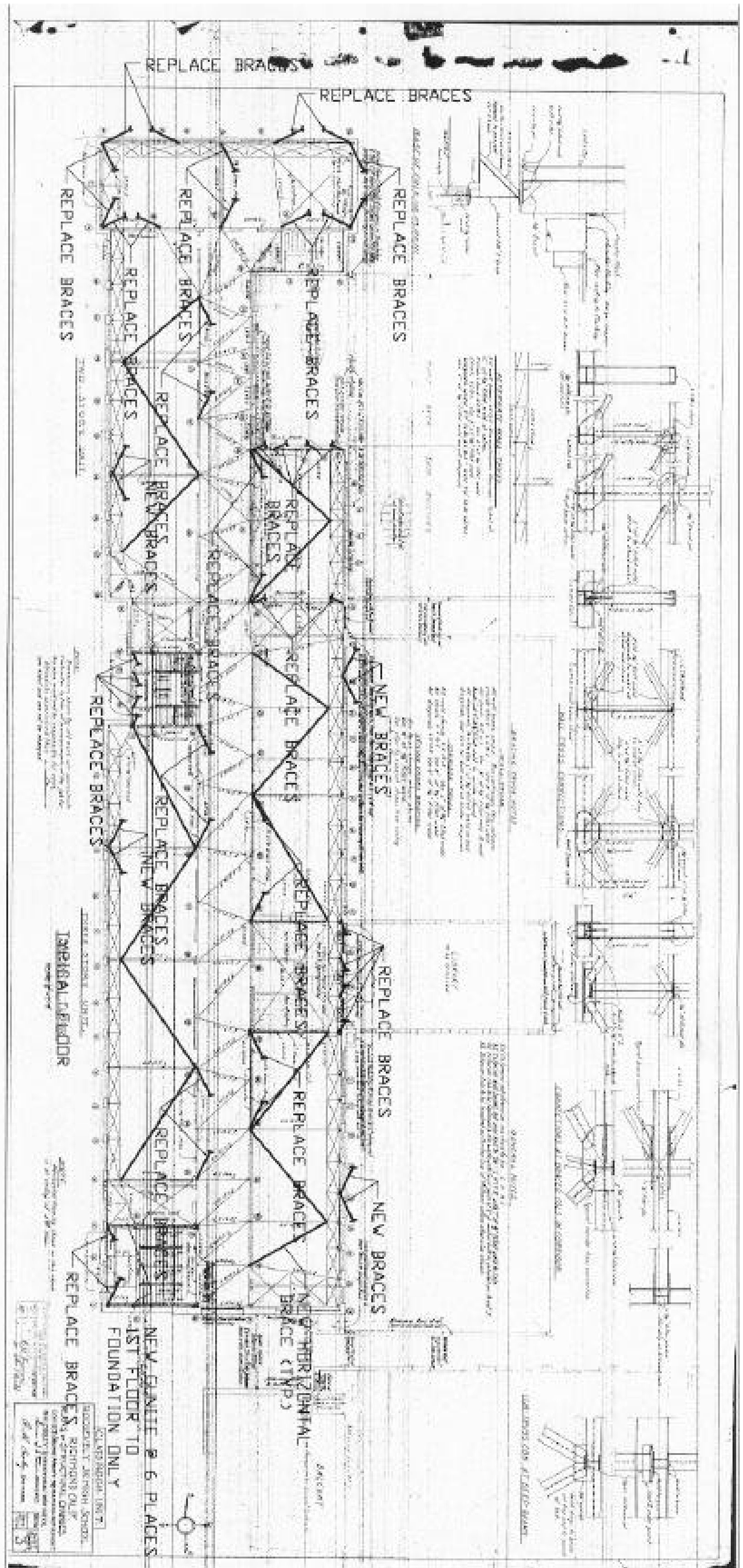
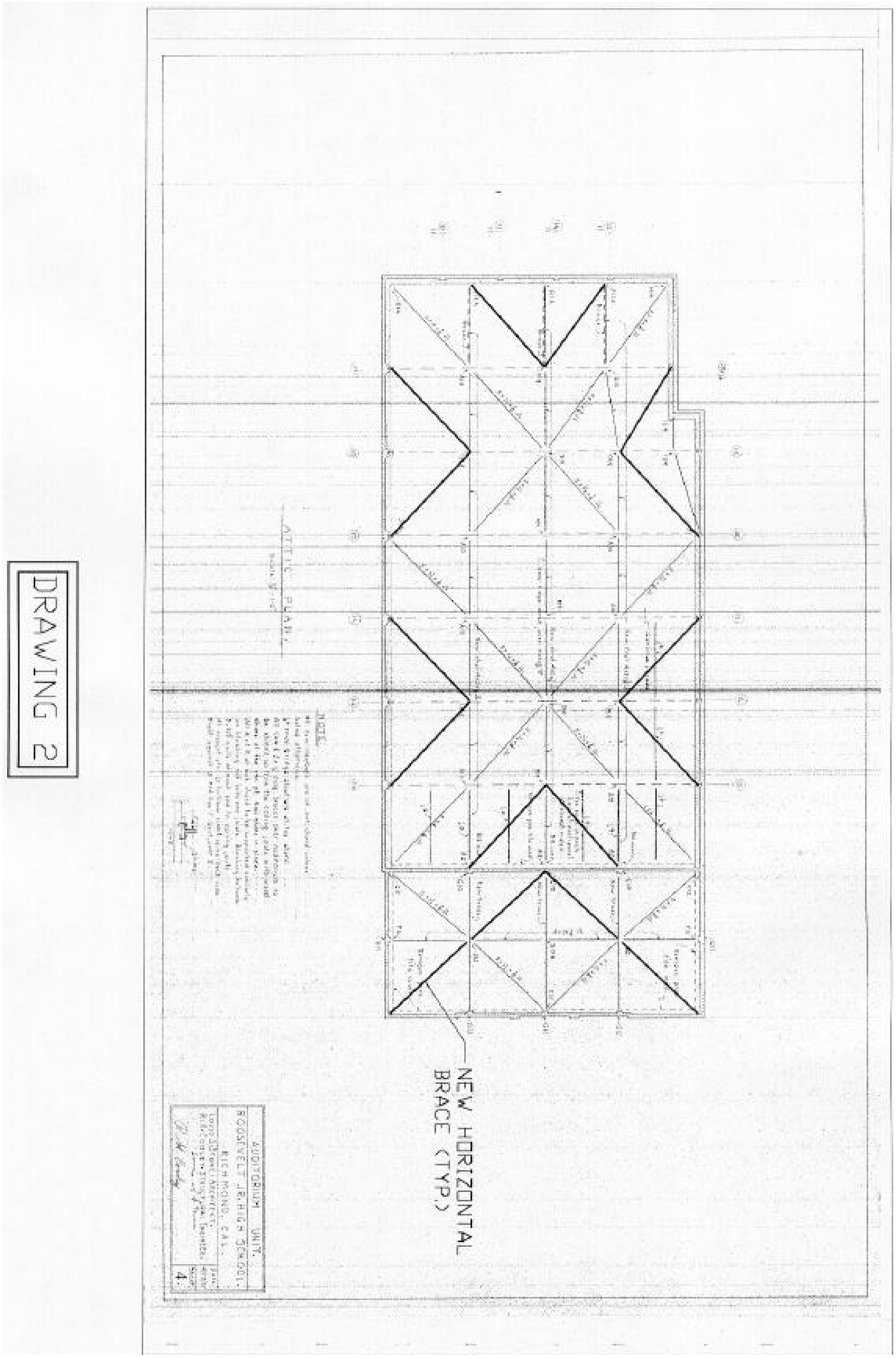


Figure 20: Gymnasium Building, interior exposed braces

Appendix B: Drawings

DRAWING 1




DRAWING 2
NEW HORIZONTAL BRACE (TYP.)
AUDITORIUM UNIT.