STRUCTURAL EVALUATION OF

EL CERRITO HIGH SCHOOL

WESTERN 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. 01B300 X2

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10.1 Introduction

The purpose of this report is to perform a seismic assessment of the El Cerrito High School buildings 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.

We performed 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 in accordance with Tier I of FEMA 310 document. 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 removal of any finishes. Therefore, identification of structural conditions hidden by architectural finishes or existing grade was not performed.

10.2 Description of the School

The El Cerrito High School school is a large campus with eight major buildings constructed from 1938 to 1965. The Main Classroom Building, Unit A, (Figures 2, 4, & 5) is a large three story reinforced concrete building, of approximately 54, 615 gsf, constructed in 1938. The Gymnasium, Unit E, (36,788 gsf), was also constructed in 1938 (Figures 14, 15, 16) and is a large reinforced concrete building with a steel trussed and wood famed roof. A locker room addition to the Gymnasium Building was added in 1965. The Shop Building, Unit G, (Figure 19) was also built in 1938, (11,609), constructed with reinforced concrete walls, a steel girder roof with wood joists and a straight sheathing wood roof diaphragm with tie rods in the truss system.

In 1949, two buildings were added. Unit C, (27,843 gsf), (Figures 7, 8, &9) is a three story classroom building constructed with reinforced concrete. Unit D, (8,203 gsf), (Figures 10, 11) is a one story cafeteria building built with wood framing and stucco walls over a concrete base building which includes a basement mechanical room.

In 1953, an Auto Shop, Unit H was added, (Figure 20) which is wood framed with a steel trussed roof and straight sheathing wood diaphragm. The diaphragm has a tie rod system in the roof trusses.

In 1965, the campus added two buildings plus the gym locker addition (Figure 17). Unit F, is a Theater and Classroom building (Figure 18) housed in a tilt up concrete structure with a wood framed roof. Unit B is a Science Classroom Building (Figure 6) housed in a building with similar tilt up concrete construction.

10.3 Site Seismicity

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

The classroom buildings have an educational occupancy (Group E, Division 1 and 2 buildings) and the gymnasium has an assembly occupancy (Group A, Division 3), which has an importance factor in the 1998 CBC of 1.15. The campus is located at a distance of less than 2 kilometers from the Hayward fault.

Most of the buildings are shear wall buildings. The concrete or wood shear walls have a response modification factor R=4.5. 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:

$$V = \frac{2.5CaIW}{R} = \frac{2.5(0.44x1.5x1.15)W}{4.5} = 0.422W$$

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. High School Building, Richmond High School District, El Cerrito, CA Sheets: 1-16 by P.L. Dragon & C.R. Schmits Architects, 1938, Sheets: S1-S10 by W. Adrian, Structural Engineer, 1938. Application No. 2244.
2. Gym & Shops Buildings, High School, Richmond High School District, El Cerrito, CA, Sheets: 1-9 by P.L. Dragon & C.R. Schmits Architects, 1938, Sheets: S1-S9 by W. Adrian, Structural Engineer, 1938. Application No. 2624 & 2625.
3. Additions to El Cerrito Junior Senior High School (Classroom Wing Addition and Cafeteria Building) Building, , Richmond School District, Sheets A1-12, by Charles F. Strothoff Architect, Sheets S1-S13, W. Adrian, L. Graham, W. Hayes, Structural Engineers, 1949.
4. Automobile Shop, El Cerrito High School, Richmond High School District, El Cerrito, CA, Sheets: 1-15, by Schmits & Hardman Architects, 1953. Application No. 10456.
5. El Cerrito High School Additions, (Gymnasium Locker Addition, New Music and Drama Building, New Classroom Wing), Richmond Union High School District, El Cerrito, CA, 1965, Sheets: A1-A19, S1-S7, by Akol Architects / Jens Hansen & Associates. Application No. 25769.
6. “Measure D” – WCCUSD Elementary School – UBC related fault parameters by Jensen- Van Lienden Associates, Inc., Berkeley, California.

7. "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.

10.5 Site Visit

DASSE visited the site on August 11, 2002. The main purpose of the site visit was to evaluate the physical condition of the buildings and in particular focus on the lateral force resisting elements. Following items were evaluated during the site visit:

1. Type and Material of Construction
2. Type of Construction at Roofs, Floors, and Walls.
3. Type of Finishes
4. Type of Roof
5. Covered Walkways
6. Presence and Frequency of Windows
7. Presence of Window Walls or High Windows in exterior and interior walls
8. Visible cracks in superstructure, slab on grade and foundation

During the site visit, each building was visited and signs of cracking or settlement were looked for. Most buildings were older and well worn, but did not have hazardous signs of structural distress. Since all of the buildings were constructed prior to the 1971 San Fernando Earthquake, they do not have the seismic design considerations of current times incorporated into their construction.

The Main Classroom building, Unit A, is a large three story reinforced concrete building with a partial basement constructed as part of the original school in 1938. The building is in good repair from a structural standpoint, however, its method of construction is now dated. It is a long and narrow non-ductile concrete building relying on exterior pier walls mostly for seismic resistance. The end walls are mostly solid and there are some interior concrete walls mostly located at stairways.

To the north, a two story covered walkway passes to another reinforced concrete classroom building (Unit C). The covered walkway is separated from either structure, but does not have adequate seismic stability on its own. In its longitudinal direction the walkway will pound on the two buildings during strong ground shaking. The walkway needs seismic strengthening in its transverse direction to keep it from collapse if subjected to strong ground movement.

Unit C, another reinforced concrete classroom building relies on transverse moment frames and longitudinal shear walls for seismic stability. A north facing window wall has caused all of the longitudinal shear wall on that building face to be omitted, thus, the building only has longitudinal shear walls on the southern corridor side of the building. This will cause the building's seismic response to behave in a torsional manner and could have grave consequences. Additionally, the transverse concrete moment frames do not have adequate ductile detailing and could experience brittle and sudden non-ductile shear failures prior to exhibiting ductile bending behavior. This building is a non-ductile concrete building without adequate shear strength by current standards and should be retrofitted.

Unit D, the Cafeteria is a large kitchen and cafeteria building constructed with wood framing and on a concrete base. The roof utilizes steel beams spanning the width of the open room with infill roof joists and diagonal sheathing at the roof and shear walls. The concrete foundation utilizes spread footings and incorporates a boiler room at the southern end where the hillside slopes away. The Cafeteria building has an abundance of windows and thus does not have an adequate amount of wood shear walls. The lack of wood shear walls and the lengths that the roof diaphragm spans mean that the building is vulnerable to partial collapse if the building were subjected to a major earthquake.

Unit G, the Shop Building is a concrete walled building with a steel trussed roof. This is one of three original buildings on campus. Roof joists infill between roof trusses and straight sheathing provides the roof decking. Cross braced tie rods are provided in the truss framing to act as the roof diaphragm. The building has a slab on grade floor and a spread footing foundation system. The concrete walls are well detailed and are quite strong. The apparent seismic deficiency is the span of the roof diaphragm and the concrete wall ties at the roof level. However, the roof diaphragm construction poses the life safety threat that the concrete walls could pull away from the roof and exhibit a partial collapse during a major seismic event.

Unit H, the Automobile Shop is a wood framed building with a steel trussed roof. The roof has steel tie rods in the diaphragm to act as a roof diaphragm. The building has many door and window openings and does not have adequate amounts of wood shear walls.

Unit F, is a Drama and Music building construction is a 1960's tilt up concrete building. The wall panels have inlaid rock on the exteriors. There is a considerable amount of shear wall in the building, however the roof is not adequate as a roof diaphragm. The building has a plywood diaphragm, but lacks the ties to adequately connect the tilt up walls to the roof. Thus, the roof diaphragm construction poses the life safety threat that the concrete walls could pull away from the roof and exhibit a partial collapse during a major seismic event.

Unit E is a large gymnasium building which is one of the original campus buildings. The building has ample amounts of concrete walls to act as shear walls on the perimeter and between different portions of the building at the interior. The roof construction is of steel trusses with wood roof joists spanning between trusses and straight sheathing as decking. The roof framing incorporates tie rods between trusses as diaphragm bracing. The wall to roof connections are also not adequate by current standards.

The construction concepts used in this building were good, however, the seismic requirements of current times are much greater that in 1938 when this building was constructed. Unfortunately, the roof diaphragm construction poses the life safety threat that the concrete walls could pull away from the roof framing and cause the roof trusses to loose vertical support during a major seismic event.

Unit B, is a science classroom building similar in construction to the Drama and Music building. The building construction is a 1960's tilt up concrete building. The wall panels have inlaid rock on the exteriors. There is a considerable amount of shear wall in the building, however the roof is not adequate as a roof diaphragm. The building has a plywood diaphragm, but lacks the ties to adequately connect the tilt up walls to the roof. Thus, the roof diaphragm construction poses the life safety threat that the concrete walls could pull away from the roof and exhibit a partial collapse during a major seismic event.

Out at the football field, several smaller buildings were located for field activities. The football stands housed some storage rooms for program activities. While drawings were not available for these buildings, by observation we did not observe buildings that we thought would pose a seismic threat.

10.6 Review of Existing Drawings

Unit A, the Main Classroom Building:

The Main Classroom Building, circa 1938, is a three story reinforced concrete pier wall building with a partial basement. The building has suspended concrete slab and joist floors at floors 1, 2, &3 and roof, interior concrete columns, and perimeter concrete pier walls. The partial basement includes a partial habitable cafeteria area and an inhabitable crawl space, thus the first floor is entirely suspended. Some solid concrete walls are located at the interior stairway walls. The floor plans are primarily open with concrete pier walls at the perimeter and column and beam construction at the interior corridors. The partition walls are non-structural. The foundation system is a spread footing system.

Primarily, the building does not have adequate concrete shear walls nor an adequate concrete moment frame. The building fits into a class of concrete buildings, built prior to 1976, known as non-ductile concrete pier wall buildings. These buildings typically have a lack of adequate seismic shear strength and reinforcement detailing characteristics that allow sudden brittle shear failures during seismic events prior to ductile behavior from yielding due to bending.

Unit B, the Science Classroom Building:

The Science Classroom Building, circa 1965, is a tilt up concrete building with a wood framed roof. The tilt up concrete walls have a stone facing on the exterior. The roof framing employs a glued laminated girder line spanning on interior steel columns down the building center in the longitudinal direction. Roof joists span between perimeter tilt up walls and the glued laminated girders. The roof sheathing is ½" plywood for use as a diaphragm. The foundation system is a spread footing system.

This building has an ample amount of concrete wall for use as shear walls. However, this class of tilt up building has been found to not have adequate wall-to-roof connections for wall out-of-plane seismic forces. The consequences are that during a major seismic event, the walls could pull away from the roof framing and allow partial collapse of the roof structure and/or the falling away and collapse of the heavy concrete walls.

Unit C, a Classroom Building:

The Classroom Building, circa 1949, is a three story reinforced concrete shear wall and moment frame building set into the hillside. The floors and roof are concrete slabs spanning between transverse concrete moment frames at 15’-0” centers. In the longitudinal direction, shear walls are located at the corridor side of the building. The window wall facing the side street does not have any solid concrete walls. The foundation system is a spread footing system.

The building has a three sided seismic bracing system due to the lack of shear bracing on the window wall side (north side). The transverse building moment frames are not ductile and could fail in a brittle shear manner prior to resisting code prescribed seismic forces or loads imposed by a major seismic event. Additionally, the building is built into a hillside and the east end of the building is two stories as the west end of the building is three stories.

This building could experience a significant torsional response from the one sided longitudinal concrete shear wall on the corridor side of the building (south) and from the two and three story transverse concrete moment frames. The seismic response to a major earthquake could be a partial building collapse.

Unit D, The Cafeteria:

The Cafeteria, circa 1949, is a tall one story wood framed building supported on a concrete foundation and partial basement extending out of the sloping hillside to the south. The tall roof is framed with steel girders spaced at 15’-0” with 2x12 joists spanning between girders. A mechanical room is located at the south west side of the building in the partial basement. The foundation system is a spread footing system.

The building is severely lacking for adequate wood shear walls (currently of diagonal sheathing). If subjected to major earthquake shaking, this building could experience a collapse of the wood framed cafeteria structure.

Unit E, The Gymnasium:

The Gymnasium is one of the original campus buildings, circa 1938. The building is a complex reinforced concrete walled building with long span steel trusses in the roof structure, wood joists spanning between trusses and straight sheathed decking. The roof diaphragms are strengthened for seismic shear with X braced tie rods between truss panel points. The building has two gymnasium areas, seating areas at the boy’s gym and lower roof portions at auxiliary rooms and spaces. A lower rise locker room addition was added using concrete masonry construction in 1965. The foundation system is a spread footing system.

Both the gymnasium and Locked addition have adequate concrete or CMU walls to resist code level seismic forces. However, this complex building is found to not have adequate wall / roof connections for wall out-of-plane seismic forces nor adequate diaphragm shear strength. The consequences are that during a major seismic event, the walls could pull away from the roof framing and allow a loss of vertical support for roof trusses. Partial collapse of the roof structure and/or the falling away and collapse of the heavy concrete walls is a possibility during a major earthquake.

Unit F, The Music and Drama Building:

The Music and Drama Building, circa 1965, is a concrete tilt up building with a wood framed roof. The tilt up concrete walls have a stone facing on the exterior. The roof framing employs glued laminated beams spanning the width of the building with roof joists spanning between glued laminated beams. The roof sheathing is ½" plywood for use as a diaphragm. The foundation system is a spread footing system.

This building has an ample amount of concrete wall for use as shear walls. However, this class of tilt up building has been found to not have adequate wall / roof connections for wall out-of-plane seismic forces. The consequences are that during a major seismic event, the walls could pull away from the roof framing and allow partial collapse of the roof structure and/or the falling away and collapse of the heavy concrete walls.

Unit G, Shop Building:

The Shop Building, circa 1938, has perimeter concrete walls, and steel trusses spanning the width of the building. The roof framing is 2x8 wood roof joists spanning between roof trusses and steel tie rod X bracing in the roof truss system for a diaphragm. The roof sheathing is 1x straight sheathing. The roof framing accommodates large skylight openings. The foundation system is a spread footing system.

This building has an ample amount of concrete wall for use as shear walls around the perimeter. However, the roof diaphragm is not strong enough to span from perimeter wall to perimeter wall in the transverse direction and required interior lines of resistance. The ramifications are that the mid section of the building could experience excessive deflections during major seismic ground motions. These deflections could lead to diaphragm yielding or to increased wall tie forces out-of-plane at the roof level.

Additionally, this building is found to not have adequate wall / roof connections for wall out-of-plane seismic forces. The consequences are that during a major seismic event, the walls could pull away from the roof framing and allow partial collapse of the roof structure and/or the falling away and collapse of the heavy concrete walls.

Unit H, Automobile Shop Building:

Automobile Shop Building, circa 1953. The building is smaller than the original Shops Building. The Automobile Shop Building is constructed with wood framed walls, and has a steel trussed roof. The roof framing is wood joists spanning between roof trusses and steel tie rod X bracing in the truss system for a diaphragm. The roof and wall sheathing is 1x6 tongue and groove diagonal sheathing. The foundation system is a spread footing system.

The building is severely lacking for adequate wood shear walls (currently of diagonal sheathing). If subjected to major earthquake shaking, this building could experience a collapse of the wood framed structure caused by a lack of shear walls.

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.

This campus was constructed between 1938 and 1965. All of the buildings have classic seismic deficiencies that have been learned about in buildings constructed before the 1971 San Fernando Earthquake. The concrete buildings are of non-ductile concrete construction and do not have adequate seismic strength by year 2002 standards. The heavy wall (concrete) and wood roof buildings do not have adequate roof diaphragms nor adequate wall to roof connection ties.

Item	Building Structural Deficiencies
1.	Unit A, Main Classroom Building. The building has a lack of adequate seismic

	shear resistance. Non-ductile concrete pier walls do not have adequate ties to avoid brittle shear failure. The two story covered walkway between Unit A and Unit C needs additional transverse seismic bracing to strengthen the structure.
2.	Unit B, Science Building. The building has a lack of adequate concrete wall-to-roof tie connections. Does not have adequate roof sub-diaphragms or roof cross ties. The heavy walls could pull away from the roof and fall.
3.	Unit C, Classroom Building. The building has a lack of adequate seismic shear resistance. Non-ductile concrete moment frames do not have adequate ties to avoid brittle shear failure.
4.	Unit D, Cafeteria Building. The building has a lack of adequate seismic shear resistance. The diagonal sheathed wood shear walls are grossly overloaded with seismic forces. The roof diaphragm also does not have adequate shear resistance. The covered walkway between Unit D and Unit A needs new seismic bracing to stabilize the structure.
5.	Unit E, Main Gymnasium. The building has very thick concrete walls, however the roof framing is very light in comparison. The concrete wall-to-roof connections are not adequate and the roof diaphragm shear strength from tie rod cross ties are also not adequate. The heavy walls could pull away from the roof and fall. The Locker Addition is a tilt up wall with a wood framed roof addition. The addition has a lack of adequate concrete wall-to-roof tie connections. The roof diaphragm does not have adequate roof sub-diaphragms or roof cross ties. The heavy walls could pull away from the roof and fall.
6.	Unit F, Music and Drama Building. The building has a lack of adequate concrete wall-to-roof tie connections. The roof diaphragm does not have adequate shear resistance, roof sub-diaphragms or roof cross ties. The heavy walls could pull away from the roof and fall.
7.	Unit G, Shops Building. The building has a lack of adequate concrete wall-to-roof tie connections. The roof diaphragm does not have adequate shear resistance, roof sub-diaphragms or roof cross ties. The roof diaphragm spans are too great and interior lines of bracing are needed. The heavy walls could pull away from the roof and fall.
8.	Unit H, Automobile Shop. The building does not have adequate wood shear walls to resist a major earthquake. The roof diaphragm also does not have adequate shear resistance. This building could fall from the seismic weight of the heavy truss roof and lack of seismic shear resistance during a major earthquake.

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.	Unit A, Main Classroom Building. Building requires a complete seismic retrofit with addition of new concrete shear walls and associated collector beams and footings. Concrete diaphragms are adequate with the addition of new shear wall elements. Provide 2 new transverse concrete SMRF seismic frames in the two story walkway.	1.0	B1
2.	Unit B, Science Building. Building requires a complete seismic retrofit of the roof diaphragm, roof sub diaphragms and roof-to-wall ties.	1.1	B2
3.	Unit C, Classroom Building. Building requires a complete seismic retrofit with addition of new concrete shear walls and associated collector beams and footings. Concrete diaphragms are adequate with the addition of new shear wall elements.	1.0	B3
4.	Unit D, Cafeteria Building. Building requires a complete seismic retrofit with addition of new plywood shear walls and plywood roof diaphragm strengthening. Provide new cantilever columns to brace the covered walkway for seismic loads.	1.0	B4
5.	Unit E, Main Gymnasium. Building requires a complete seismic retrofit of the roof diaphragm with the addition of angle cross ties and roof-to-wall ties. Trusses will require replacement or strengthening to support added weight of diaphragm bracing.	1.1	B5, B6
6.	Unit F, Music and Drama Building. Building requires a complete seismic retrofit of the roof diaphragm, sub diaphragms, cross ties and roof-to-wall connection ties.	1.1	B7
7.	Unit G, Shops Building. Building requires a complete seismic retrofit of the roof diaphragm, roof sub diaphragms and roof-to-wall ties. The building also requires two interior braced frames with footings to reduce diaphragm spans.	1.3	B8
8.	Unit H, Automobile Shop. Building requires a complete seismic retrofit with addition of new plywood shear walls and a plywood roof diaphragm.	1.1	B9

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.

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 in Phase 1A.

10.13 Limitations and Disclaimer

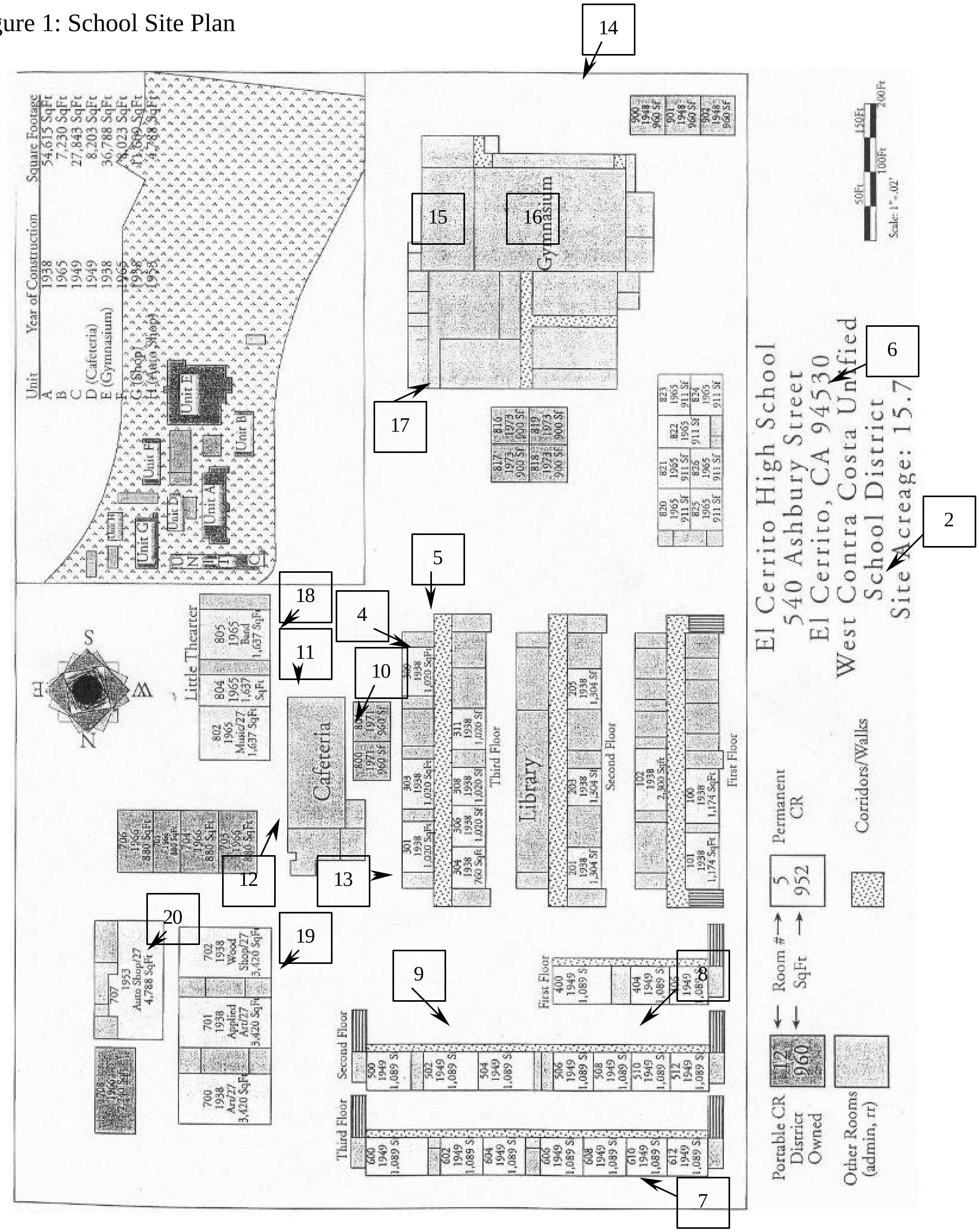
This report includes a qualitative (visual) evaluation and a limited quantitative seismic evaluation of each school building. Obvious gravity or seismic deficiencies that are identified visually during site visits or on available drawings are identified and documented in this report. Elements of the 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 Site Plan



Appendix A

Figure 2: Unit A, Main Classroom Building

Figure 3: School Plaque

Figure 4: Unit A, at rear

Figure 5: Unit A, Main Classroom Building, South Elevation

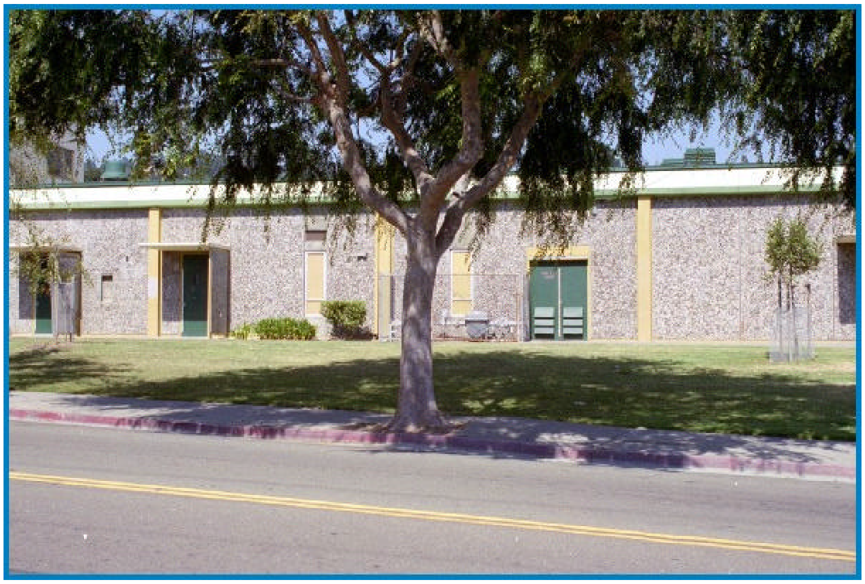


Figure 6: Unit B, Science Building

Figure 7: Unit C, Classroom Building, North Elevation

Figure 8: Unit C, Classroom Building, South Elevation

Figure 9: Unit C, Classroom Building, South Elevation

Figure 10: Unit D, Cafeteria, West Elevation

Figure 11: Unit D, Cafeteria, South Elevation

Figure 12: Unit D, Cafeteria, North Elevation

Figure 13: Covered Walkway from Unit D to Unit A

Figure 14: Unit E, Gymnasium, South Elevation

Figure 15: Unit E, Girls Gymnasium (east portion)

Figure 16: Unit E, Boy's Gymnasium (south portion)

Figure 17: Unit E, Gymnasium Locker Addition, North Elevation, Unit B, Science Building beyond

Figure 18: Unit F, Drama and Music Building, West Elevation

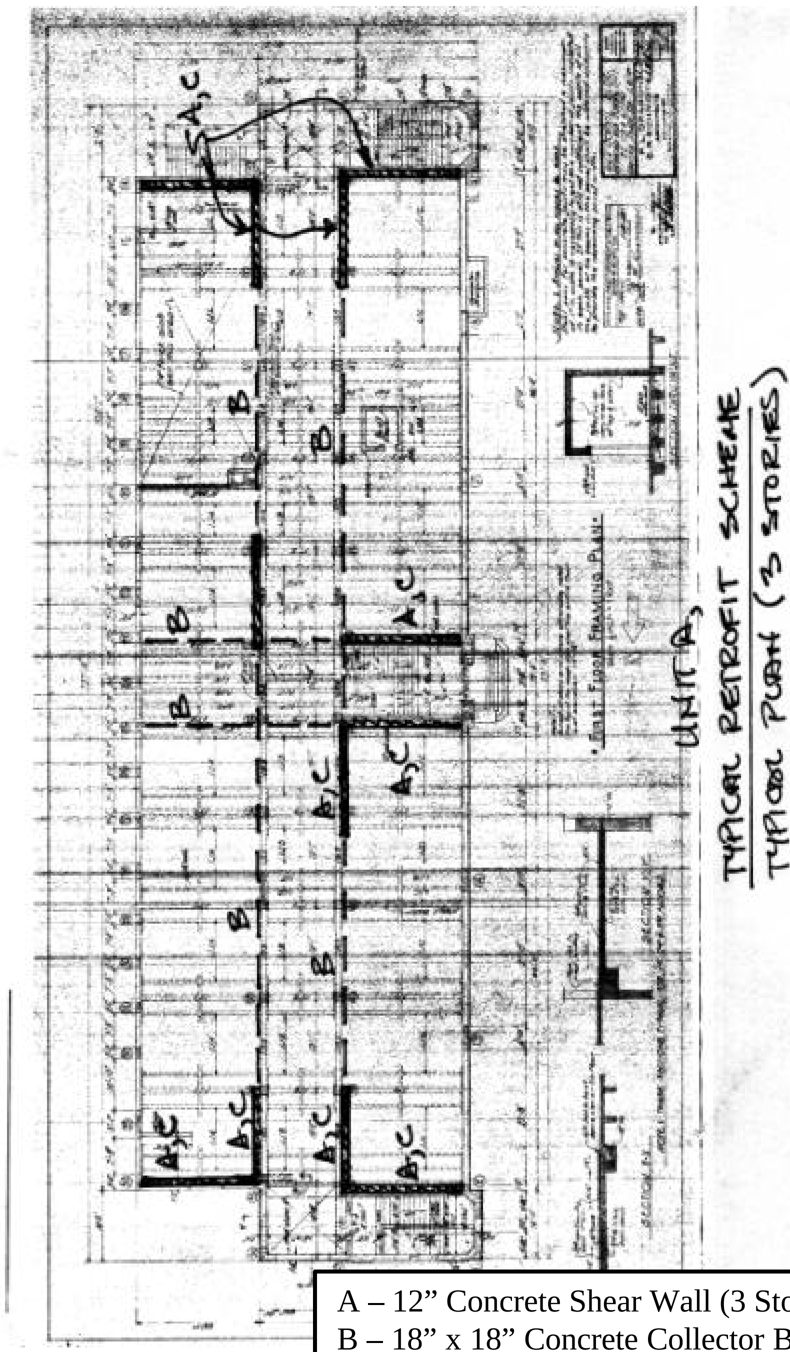
Figure 19: Unit G, Shops Building, West Elevation

Figure 20: Unit H, Automobile Shop Building, West Elevation

Figure 21: Site Portable Buildings

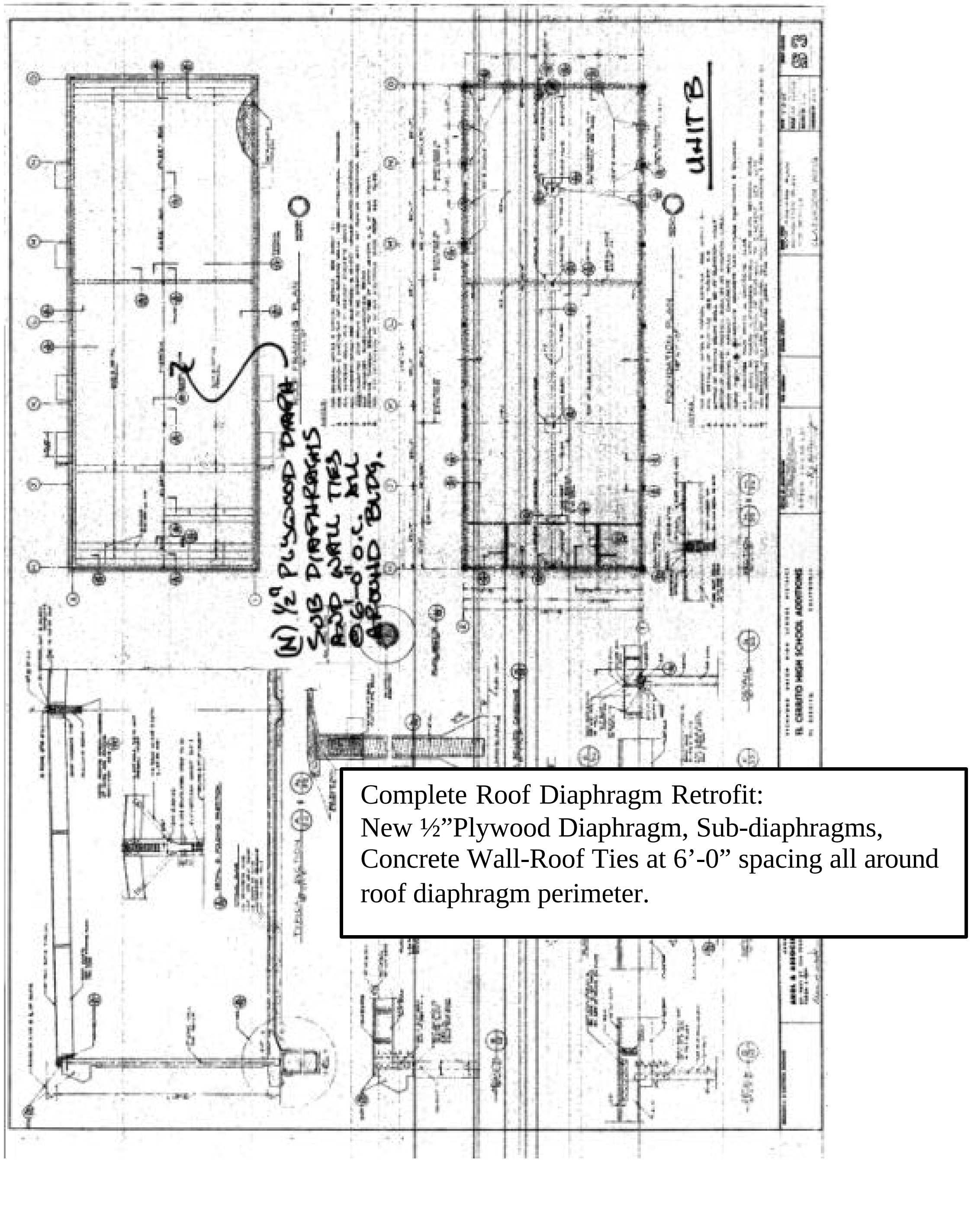
Figure 22: Additional Site Portable Buildings

APPENDIX B

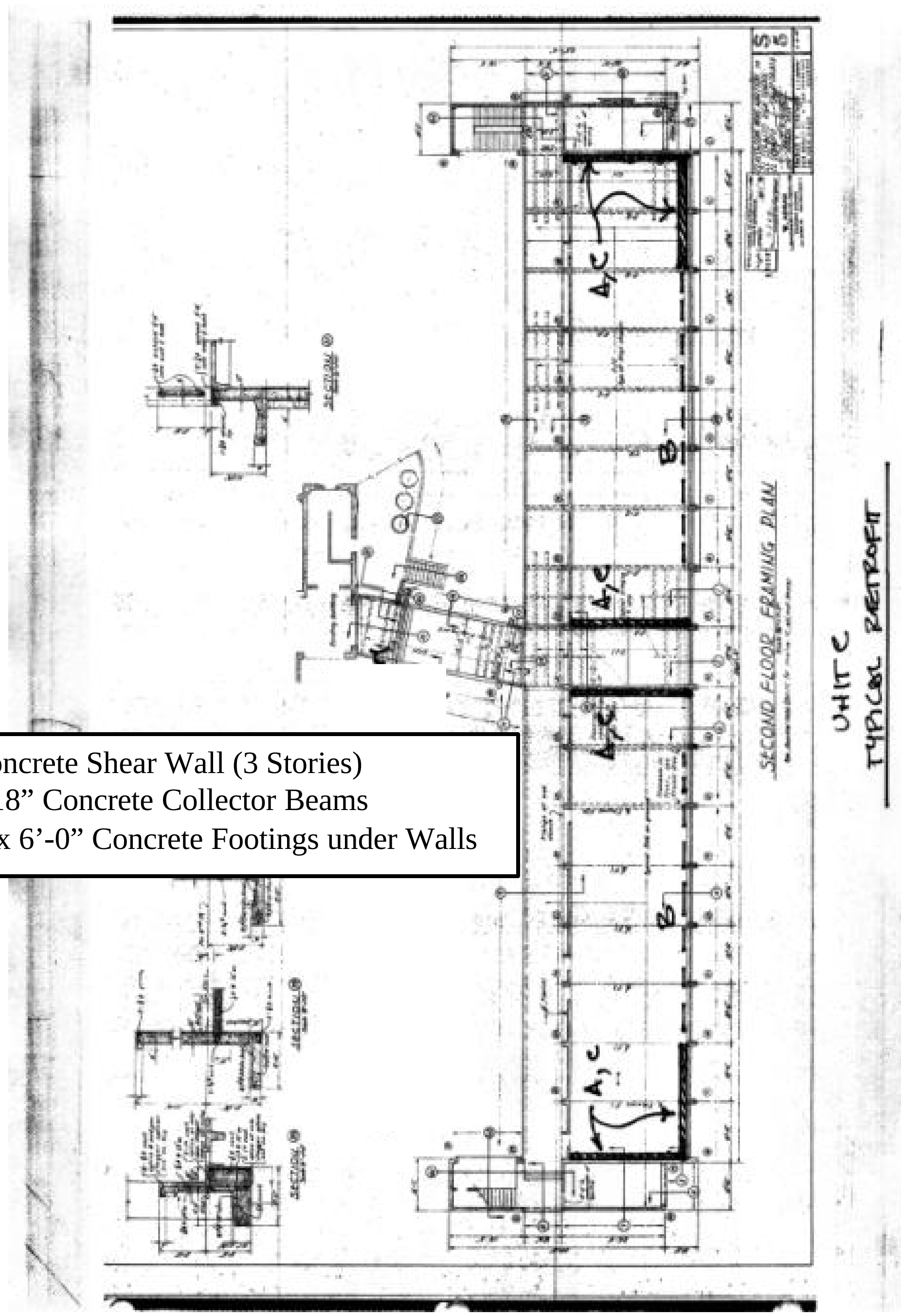


A – 12” Concrete Shear Wall (3 Stories)
B – 18” x 18” Concrete Collector Beams
C – 4’-0” x 6’-0” Concrete Footings under Walls

Drawing B1. Unit A, Main Classroom Building, Seismic Retrofit Scheme

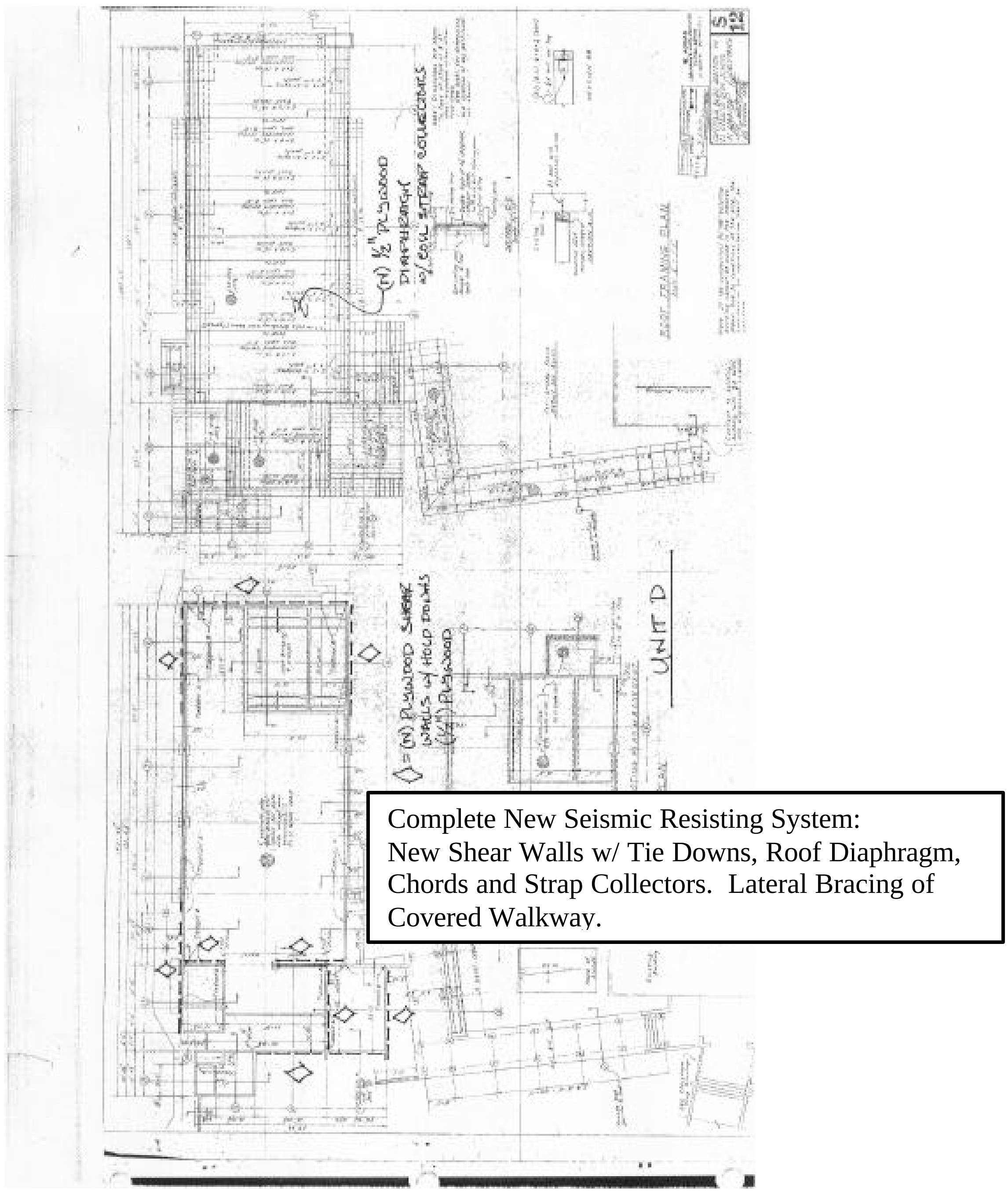


Drawing B2. Unit B, Science Building, Seismic Retrofit Scheme



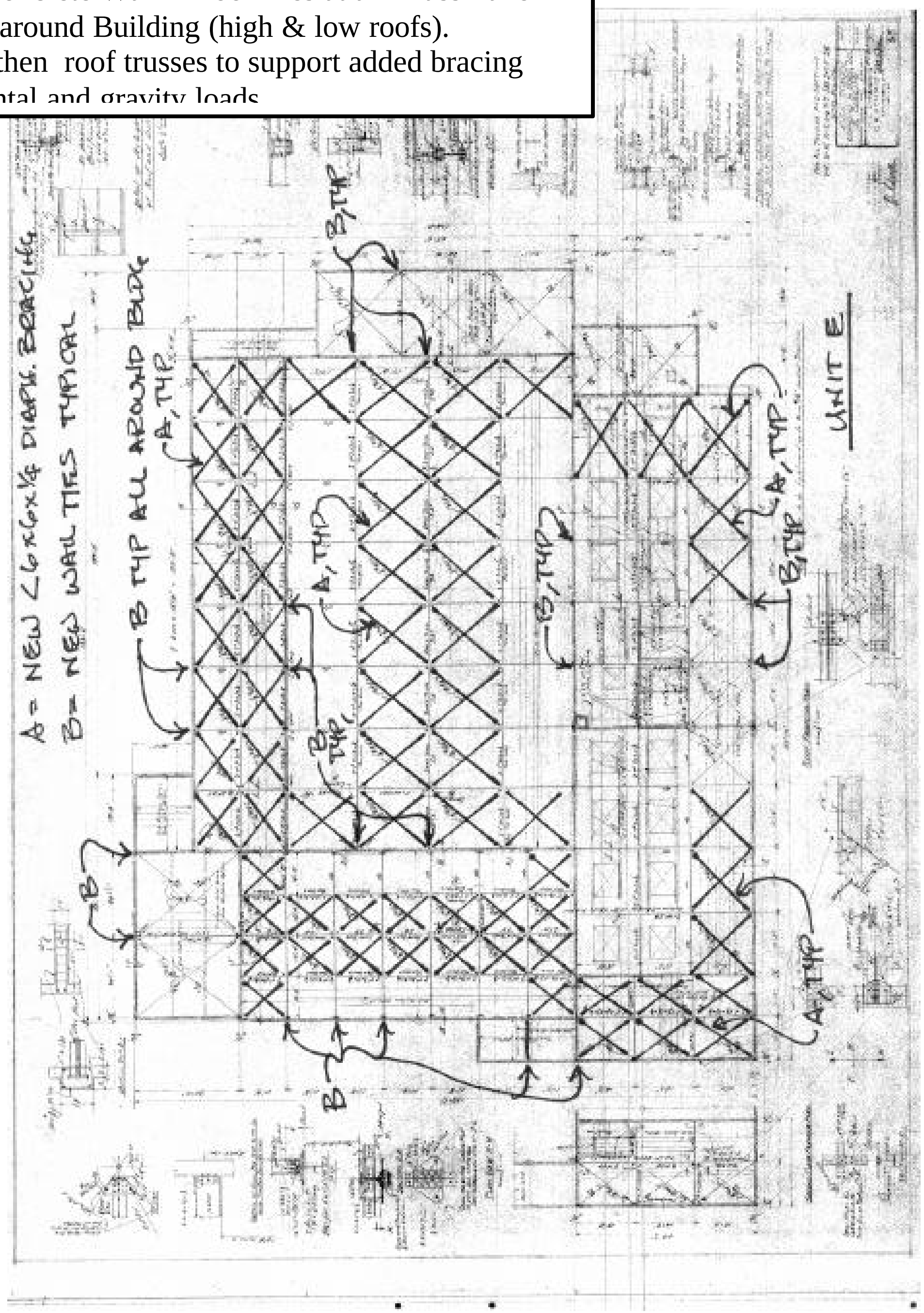
A – 12” Concrete Shear Wall (3 Stories)
B – 18” x 18” Concrete Collector Beams
C – 4’-0” x 6’-0” Concrete Footings under Walls

Drawing B3. Unit C, Classroom Building, Seismic Retrofit Scheme

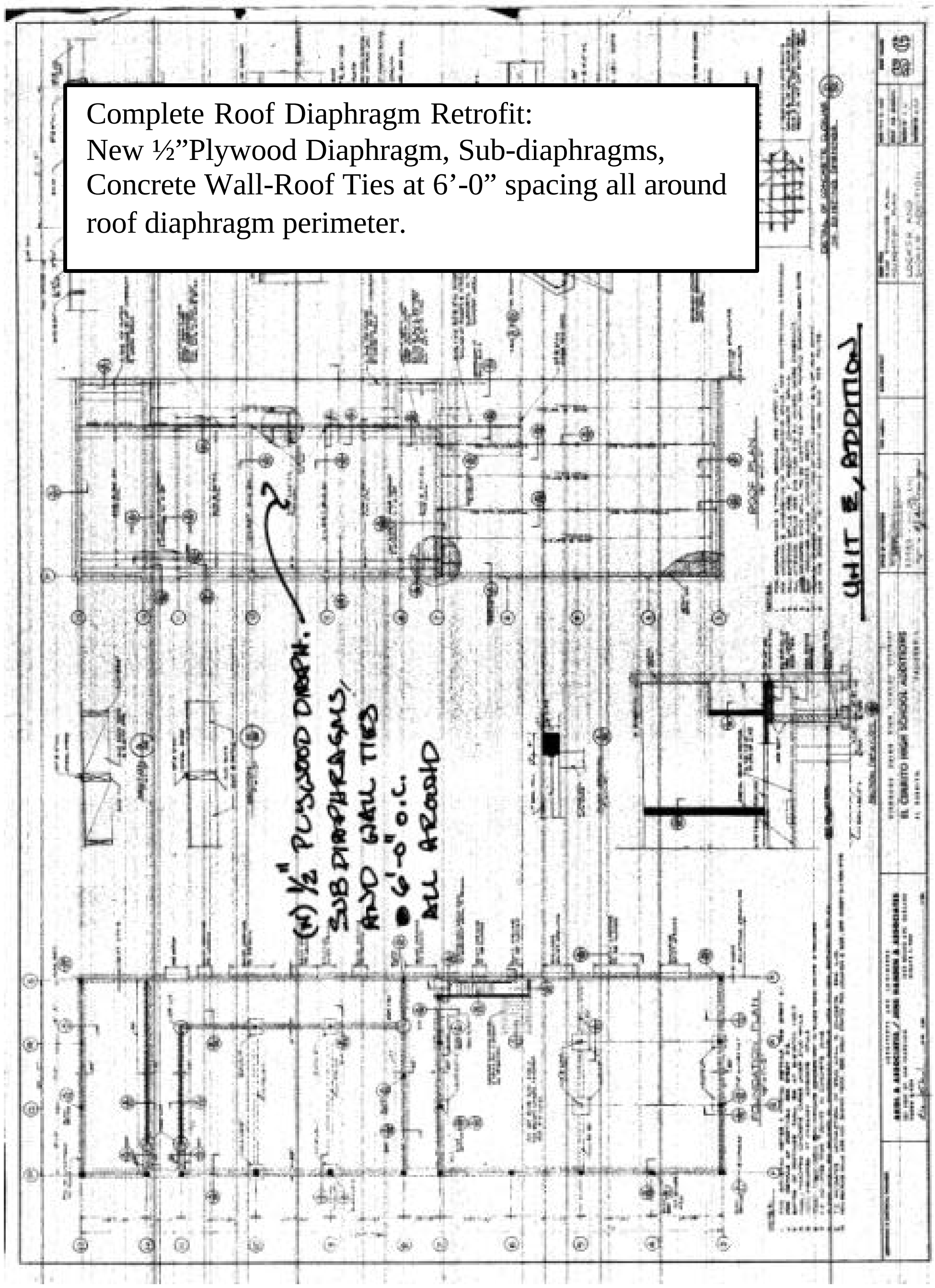


Drawing B4. Unit D, Cafeteria, Seismic Retrofit Scheme

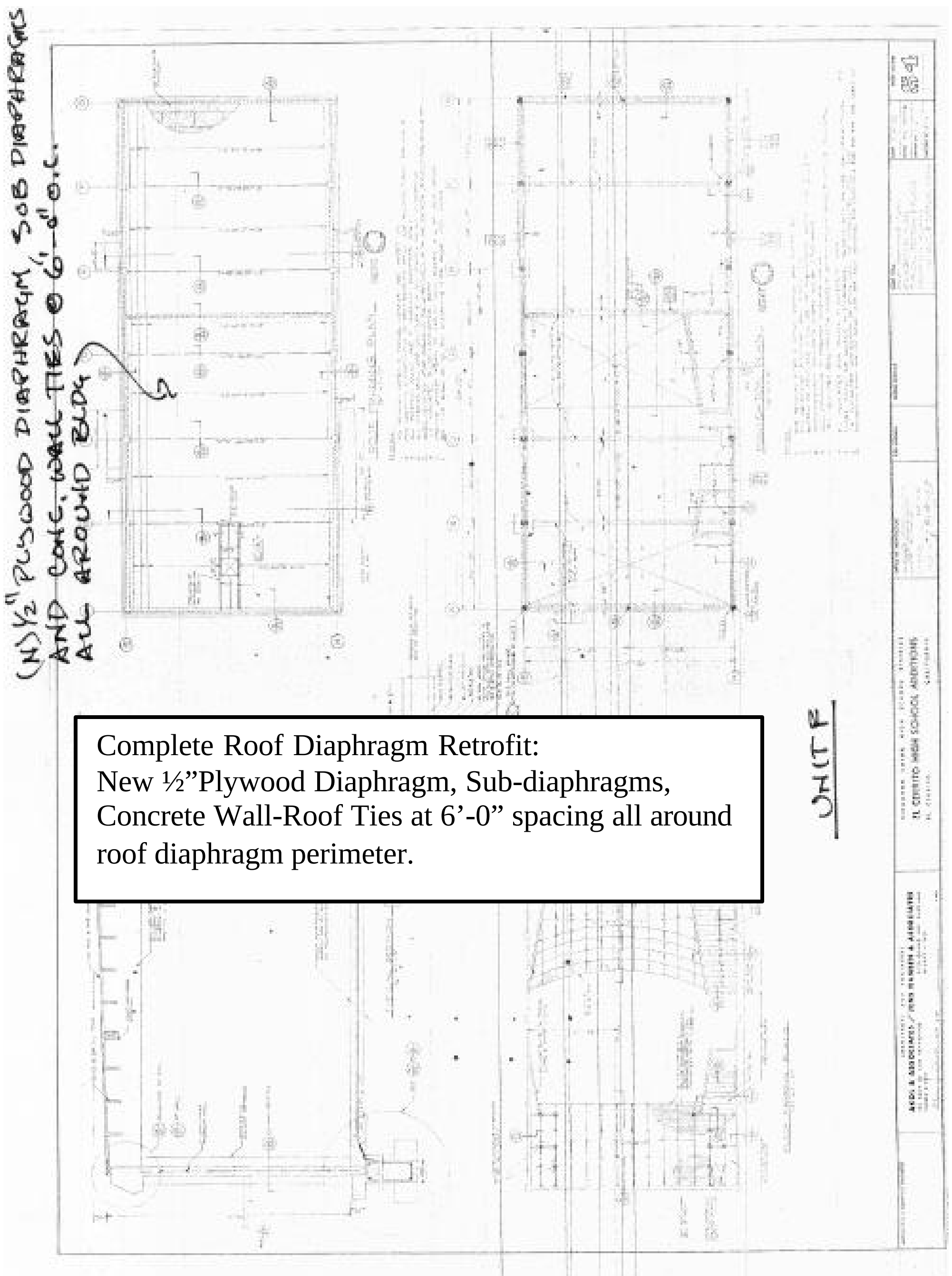
Roof Diaphragm Retrofit:
New L 6x6 Angle Bracing in Roof Diaphragms,
New Concrete Wall – Roof Ties at all Truss Panel Points around Building (high & low roofs).
Strengthen roof trusses to support added bracing horizontal and gravity loads.



Drawing B5. Unit E, Gymnasium, Seismic Retrofit Scheme



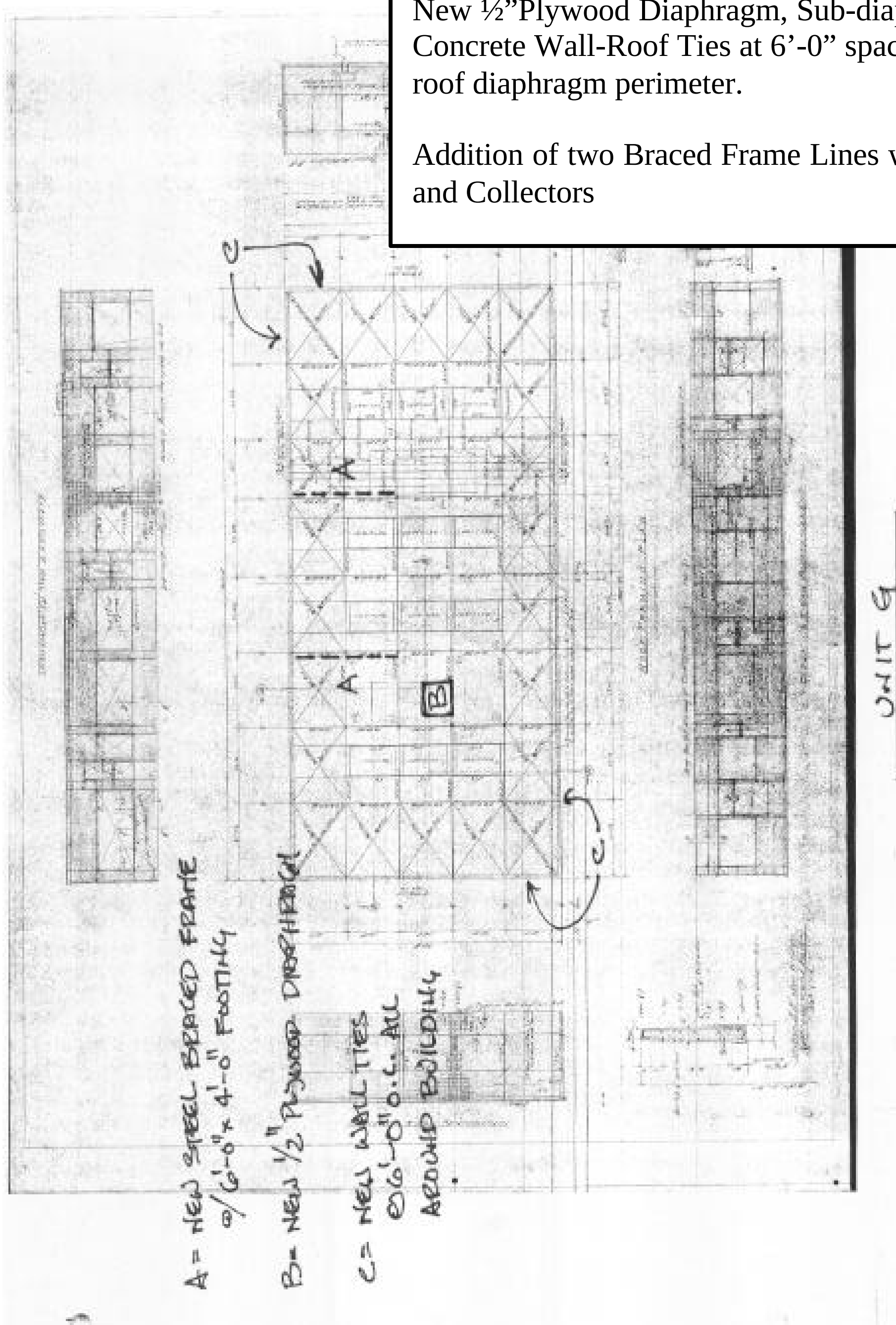
Drawing B6. Unit E Locker Addition, Seismic Retrofit Scheme



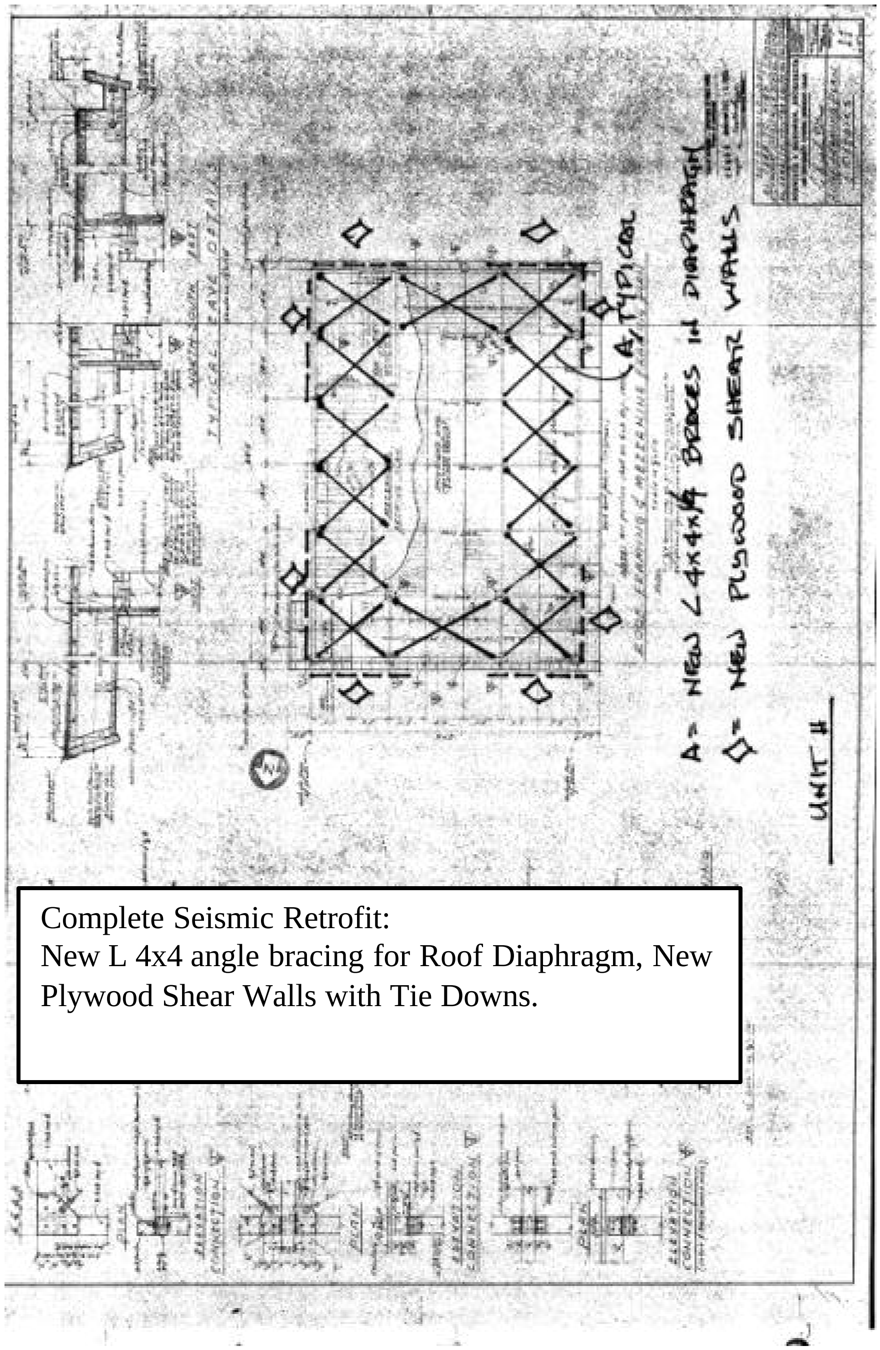
Drawing B7. Unit F, Drama & Music Building, Seismic Retrofit Scheme

Complete Roof Diaphragm Retrofit:
New ½"Plywood Diaphragm, Sub-diaphragms, Concrete Wall-Roof Ties at 6'-0" spacing all around roof diaphragm perimeter.

Addition of two Braced Frame Lines with Footings and Collectors



Drawing B8. Unit G, Shops Building, Seismic Retrofit Scheme



Drawing B9. Unit H, Automobile Shop, Seismic Retrofit Scheme