ASCE 31-03
Structural Evaluation Report

For

Atherton Library
2 Dinkelspiel Station Lane
Atherton, California

February 11, 2009

Prepared for:
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Contents

SUMMARY OF FINDINGS

The following report summarizes the results of an ASCE 31-03 evaluation for the facility located at 2 Dinkelspiel Station Ln. This report has been prepared at the request of the Town of Atherton to determine whether or not the facility's two buildings meet the Life-Safety Performance Level. The following is a list of findings contained within this report and any subsequent recommended mitigations.

1. Both the original 1929 building and the 1981 addition will need several modifications to meet the Life-Safety Performance Level outlined in ASCE 31-03. Please note that ASCE 31 has replaced FEMA 178 and FEMA 310 as the current recognized standard for the seismic evaluation of existing buildings.

2. The original building constructed in 1929, having little to no available structural drawings, is assumed to have a single sheathed plank shear wall system. This system will need to be reinforced to accommodate the large seismic forces and create an adequate load path to transfer forces to the foundation. Additionally, it should any stucco walls be used as lateral shear walls, they must be replaced with plank or plywood sheathing walls as stucco walls are not an acceptable form of lateral-force resisting system per the current governing building codes.

3. The original structure has insufficient connections. Continuous chord elements should be installed to complete a load path along the entire perimeter of the diaphragm. Also, wood sill connections will need adequate anchorage conditions, with spacing no more than 6 feet on center.

4. For both buildings (1929 and 1981 addition) the Spanish ceramic roof tiles will need to be anchored to the roof overhang to avoid dislodging during future seismic events, a common Life Safety concern.

5. The canopy at the East entrance of the 1929 structure will need adequate anchorage back to the structural framing, with no more than 6 feet between anchors.

6. The multi-level panels at the 1929 building will need to have connections back to the structure which allow for a .02 drift ratio. Additionally, each wall panel will need a minimum of two bearing connections.

7. The hard ceiling of suspended lath and plaster in the 1929 building will additionally need to be seismically braced at every 12 square feet of area.

8. The 1981 Addition has a weak shear wall along its north wall, adjacent to where the two buildings meet. This 15 foot of wall needs to be strengthened per the Tier 2 analysis by adding plywood sheathing, appropriate blocking and proper nailing, to resist 980 pounds per linear foot of shear (ASD). If this wall cannot be strengthened, additional shear walls in the East/West direction will need to be provided to resist the remaining lateral forces.

9. The anchorage for the wall mentioned in item #8 will also need to be strengthened or added because the existing 5/8" x 10" anchor bolts at 4'-0" on center do not provide sufficient shear resistance from the wall down to the foundations.

10. For the 1981 building's exterior wall-to-diaphragm connections, further in-plane anchorage will need to be added to transfer the shear forces from the diaphragm into the rim boards, into the plywood sheathed shear walls. Also, rim board straps are recommended for in-plane shear anchorage.

11. The re-entrant corner at the North/East of the 1981 structure may potentially see torsional effects as the seismic shear is transferred in the diaphragm. This can be avoided by adding reinforcement with drag struts, which will drag the shear force in the walls back into the diaphragm and vice versa.

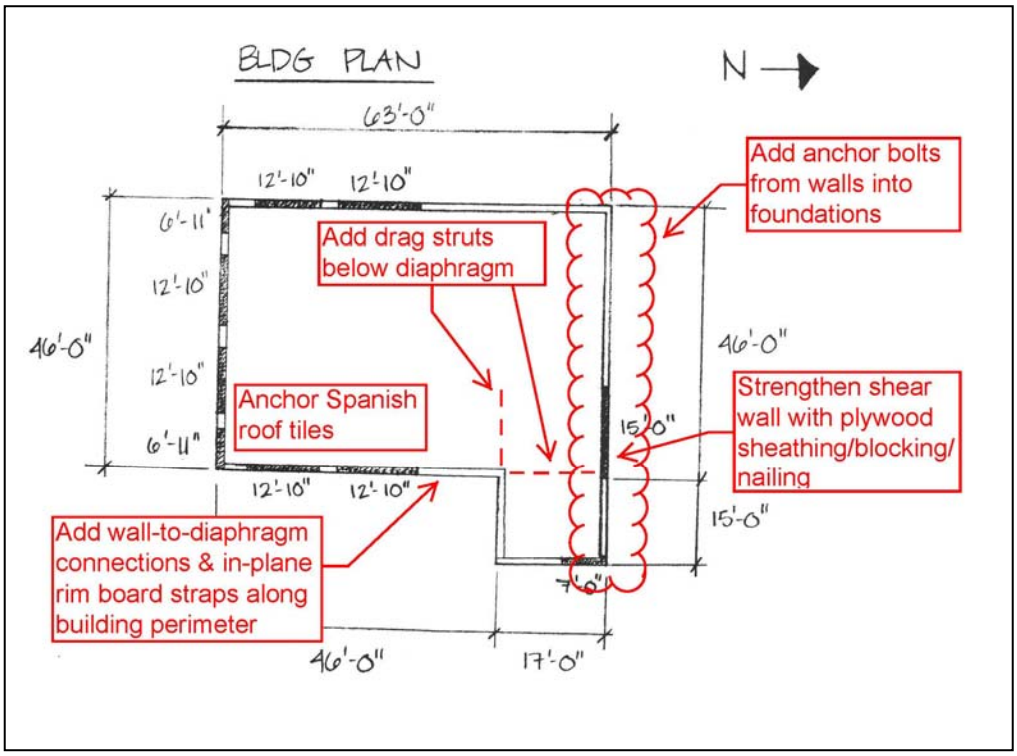


FIGURE 1- 1981 Building Addition Plan Summary of Recommendations

A. PURPOSE AND SCOPE

A1. PURPOSE OF REPORT

The purpose of this evaluation is to determine whether the buildings' structural systems meet the *Life-Safety* seismic performance level required by the State of California's Real Estate Services Division (RESD). This requirement States that, "The Building has been evaluated and meets the Life Safety Performance Level as set forth in FEMA 178 or its equivalent".. Since its initial publication in 1992, FEMA 178, NEHRP Handbook for the Seismic Evaluation of Existing Buildings (BSSC 1992a), has been superseded by ASCE 31-03. As such, this guideline has been used for the evaluation of the said buildings.

It should be noted that the facility in question is actually composed of two unique structures. These include one structure competed in approximately 1929, and one newer addition completed in 1981. The newer structure was added on to the original building, without use of any visible expansion joint.

A2. METHOD AND SCOPE OF EVALUATION

As noted above, the appropriate standard to assess whether or not the building meets a level of "Life Safety" in regards to future seismic events is ASCE-31-03. This document identifies buildings of certain age and construction type as "Benchmark Building" or buildings that are generally perceived as compliant. Where a particular building falls within the parameters of this classification, only limited evaluation is normally required. Where a building falls outside of these parameters, a full assessment is required to determine whether the said building does or does not meet the stated performance level. For the purposes of this evaluation, this Performance Level is "Life-Safety."

Since the buildings in question do fall outside of these parameters, a full ASCE 31 has been performed. This evaluation starts with a "Tier 1 – Screening Phase" that attempts to assess main components of the buildings' seismic force resisting system by the use of standard checklists and simplified structural calculations. These procedures also include assessment of the buildings' major non-structural components that could pose a risk to Life-Safety during a significant seismic event, and assessment of the building foundation system and site.

Where any potential deficiencies are found during the initial Tier 1 analysis, ASCE-31 methodology requires that these potential deficiencies be corrected or that a refined evaluation be completed which could better assess the potential risk of these items. This second order evaluation phases are termed Tier 2 and Tier 3 and generally require substantially greater levels of effort. These subsequent assessments can either consist of a complete evaluation, or in some instances, may consist of a limited tier 2 evaluation focused on a certain "perceived" deficiency. This procedure is outlined in Figure 2 on page 6.

For the purposes of this assessment, a complete Tier 1 and "deficiency only" Tier 2 evaluation was required to completely assess these buildings and included the following items:

1. Site visit to establish general conditions of building and to verify generally information shown on the drawings.
2. Preparation of rapid screening evaluation techniques and calculations for the structural system using ASCE 31-03 design guidelines for Life-Safety Performance Level Tier 1.
3. Additional limited analysis using ASCE 31-03 design guidelines for Life-Safety Performance Level Tier 2.

A3. LIMITATIONS

The services performed for this project have been provided at a level that is consistent with the general level of skill and care ordinarily provided by engineers practicing Structural Engineering. Work provided is done under the constraints of time and budget. Conclusions and information presented in this report are dependent on information provided by others. No warranty is expressed or implied.

It should also be noted that a number of factors make it difficult to fully and easily assess the current condition of the existing structural elements. These include both the limited documentation available and the presence of hard finishes in many areas. Where possible, the existing acoustical ceiling tiles were temporarily removed so that these areas could be evaluated.

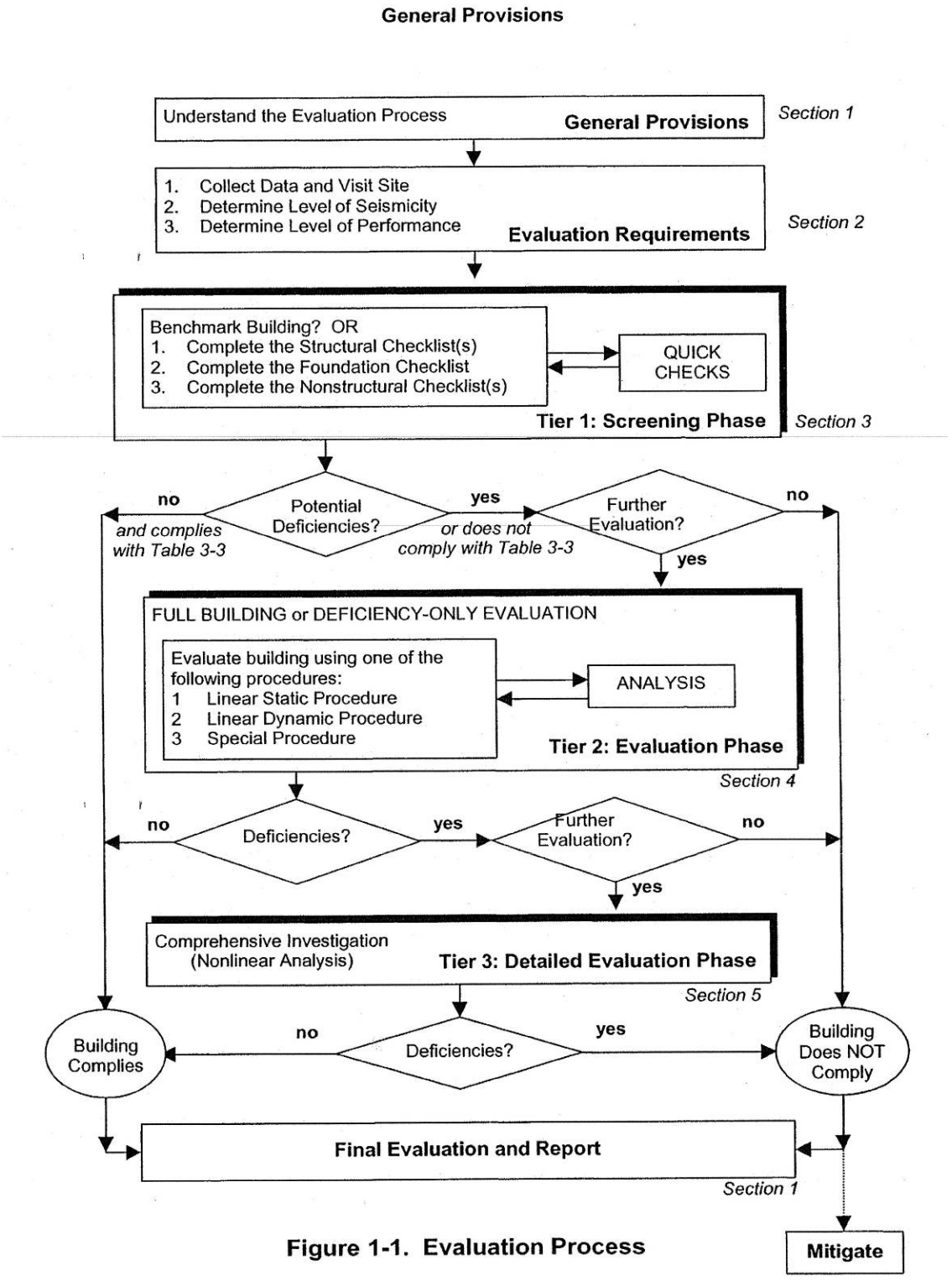


Figure 1-1. Evaluation Process

FIGURE 2- ASCE 31-03 Evaluation Procedure

B. SITE SEISMICITY AND SOILS

B1. GENERAL

The successful performance of building in areas of high seismicity depends up the combination of strength, structural component ductility, and the presence of a fully interconnected, balanced, and complete lateral force resisting system. As the level of seismicity is decreased, the demands on the structural system are decreased.

The peninsula is in a region of historically high seismic activity and seismic potential. The San Andreas fault line is located approximately 5 miles away from the structure, proving the site to be highly susceptible to an earthquake of sizeable magnitude. See Figure 3 below for a map of this.

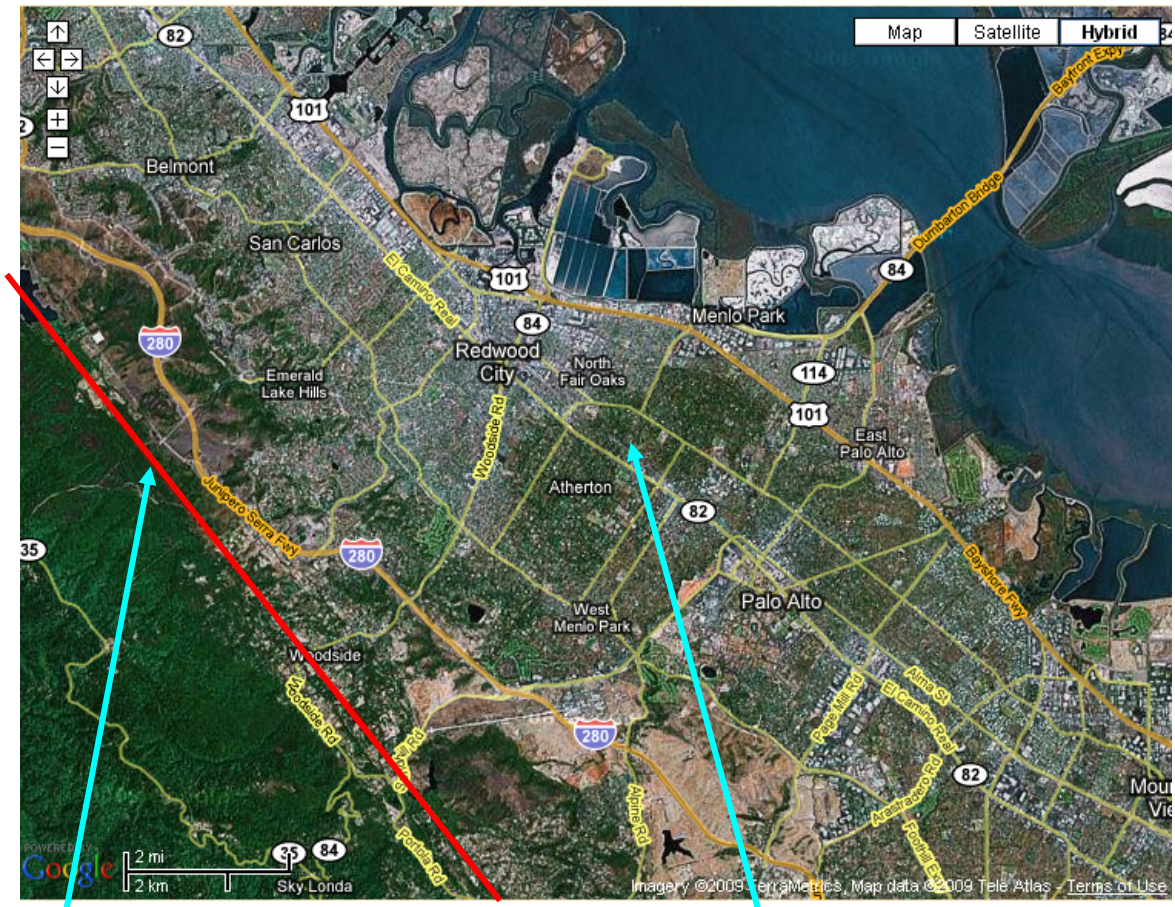


FIGURE 3- Site Map of Distance to Nearest Fault Line

B2. SITE ACCELERATIONS

In general site "Seismicity" or the potential for strong ground motion is classified into regions of Low, Medium, and High. These regions are based upon mapped site accelerations S_S and S_1 which are then modified by site coefficients F_a and F_v to produce Design Spectral Accelerations S_{DS} (short period) and S_{D1} (1 second).

Design Spectral accelerations computed for this site are as follows:

S_{DS}= 1.159g
S_{D1}= .759g

As indicated below by the site accelerations, this standard places the subject property in a region of HIGH Seismicity.

Region of Seismicity	S_{DS}	S_{D1}
Low	<.167g	<.067g
Moderate	<.500g >.167g	<.200g >.067g
High	**>.500g**	**>.200g**

FIGURE 4- Site Seismicity Based on Design Accelerations

B3. SITE SOILS

The foundations are made up of continuous grade beams along the perimeter of the building, which are visible from the exterior of the structure, along with spread footing over the interior of the building. No soils report is available, but the following site soils assumptions were made based on the building site location.

Site Characteristics	
Fault Rupture Potential	Assumed Moderate
Liquefaction Potential	Moderate
Land Slide Potential	Site is Flat -Assumed Low

FIGURE 5- Site Characteristics

C. BUILDING DESCRIPTIONS

C1. GENERAL

The subject properties for this evaluation consist of two structures, one built in 1929 and the other built in 1981. Each structure is approximately rectangular in plan area and was constructed from light framed wood panels or sheathing. Limited structural drawings were available, but a set of drawings from the 1981 addition was available for some of the evaluation. Each building has been evaluated independently and their respective evaluations are presented in Appendices C-E. Descriptions of each building as well as FEMA building designations are given below.

C2. ORIGINAL BUILDINGS (1929)

The original building is two stories tall and is approximately 1600 square feet. The building appears to have been constructed in 1929 and is comprised of light framed timber. Due to a lack of available structural drawings and hard ceilings, it is assumed that the structure is made up of straight sheathed wood planks, studs and joists, with no structural plywood as plywood wasn't an available construction material in 1929.

Building Characteristics- Structural Original 1929 Construction	
Building Code	1927 UBC (assumed)
Exterior Wall System/Cladding	Planks (assumed)
ASCE 31 Building Type	Type W1- Wood Light Frame
Lateral Force System	Planks (assumed)
Roof System	Planks over wood joists
Second Floor System	Planks (assumed)
Interior Columns	n/a
First Floor system	Planks (assumed)
Foundation System	Continuous footings

Figure 6- Structural Characteristics for Original 1929 Building

C3. LIBRARY ADDITION (1981)

In 1981, one building was added adjoining the east end of the original 1929 structure. The one story building is approximately 63'x46' and is approximately 3100 square feet. The building appears to have been constructed in 1981 and is comprised of plywood sheathed walls around the with four columns at the interior at an approximate grid spacing of 12' on center each way. The building has a plywood sheathed roof system with 15" x 5" glu-lam beams and 15" x 1 ½" ceiling joists.

Building Characteristics- Structural 1981 Addition	
Building Code	1979 UBC (assumed)
Exterior Wall System/Cladding	Plywood Sheathing
ASCE 31 Building Type	Type W1 – Wood Light Frame
Lateral Force System	½" Plywood Sheathed Wood Studs (assumed)
Roof System	Panelized plywood roof system with wood joists and girders and glu-lam beams/collectors
Interior Columns	TS 4x4x1/4
First Floor system	Panelized plywood with wood joists and girders and glu-lam beams
Foundation System	Continuous/spread footings

Figure 7- Structural Characteristics for 1981 Addition

D. TIER 1 EVALUATION PHASE- FINDINGS

D1. GENERAL

The original building and the one story addition have been evaluated independently. The original building is attached to the 1981 addition by an adjoining wall. The new building is directly attached to the original building with no visible seismic joint. The newer 1981 addition was found to have minor deficiencies which will require some additional work to reach the Life-Safety performance level as stated in ASCE 31-03. However, the original 1929 structure was found to have potentially major structural deficiencies, which will need further investigation and renovations to bring up to an appropriate Life-Safety performance level. These items are noted below.

D2. ORIGINAL 1929 BUILDING

There are a few major deficiencies which should be corrected to bring the building up to an adequate Life-Safety Performance Level per ASCE 31-03. These items include an insufficient lateral-force-resisting system, weak connection details and unanchored cladding and canopy. These are expanded as follows:

1. The original building is assumed to rely only on single plank sheathed walls as the primary lateral-force-resisting system, which has a very low shear capacity to resist lateral forces. Given this information as well as a lack of structural drawings to see the specific design of the lateral system, it is assumed that an insufficient load path exists for seismic effects to transfer the inertial forces to the foundation.

2. The original structure has deficient connections as well. It is safe to assume that the interconnection between the first and second floor isn't capable of transferring overturning and shear forces, especially on account of the insufficient lateral-force-resisting system. Also, wood sills are assumed to require additional proper anchorage to the foundation.

3. During the site visit it was noticed that the Spanish tiles laid along the roof overhangs are not anchored to the structure, creating a potential hazard to life safety in the event of an earthquake, where the heavy tiles will be free to fall. Multi-story panels will need revised detailing to accommodate the story drift. Walls will also require a minimum of two bearing connections for each wall panel. Finally, the canopy system at the main entrance of the original structure lacks adequate anchorage back to the structural framing.

D3. ADDITION (1981)

Constructed in 1981, the one story addition appears to be in relatively good shape, though it has several apparent deficiencies. These are explained as the following:

1. There is an inadequacy in the lateral force resisting system in the east/west direction. From the Tier 1 calculations in Appendix D, average shear demand in this direction is 375 pounds per linear foot, however the wall adjoining the original 1929 building to the 1981 addition is assumed to have wood plank sheathing, which only allows a max of 100 pounds per linear foot of shear. As this is the east/west shear wall on the north face of the 1981 addition, the weakness represents a potential Life Safety concern.

2. The Spanish tiles along the roof overhangs are not properly anchored to the structure, which poses a threat as a seismic event could easily knock one of the tiles loose and down to the walkway below. Currently, the tiles sit one on top of the other, free to be shift under lateral force.

3. Finally, the lay-in tiles that occur at the ceiling of the library in the 1981 addition are not secured with clips, though they are laterally restrained by the grid system that they lay in, posing very little threat to falling down.

E. LIMITED TIER-2 EVALUATION- SUPPLMENTAL FINDINGS

E1. GENERAL

Where items are initially noted as NC or “Non-Compliant” during the Tier 1 evaluation, the screening process may end and a rehabilitation procedure implemented. As an alternative, the designer may choose to conduct a more detailed evaluation which may eventually reveal that the condition in question, while existing, does not represent a “Life-Safety” condition. This subsequent step is called a Tier 2 evaluation and is shown diagrammatically in Figure 2.

As indicated below, several conditions were determined to be “non-compliant” during the initial screening. Some of these items, however, were not Life-Safety concerns. See below for further evaluation.

E2. ORIGINAL 1929 BUILDING

From this building's initial Tier 1 analysis, several non-compliant items were re-evaluated per the Tier 2 process, where enough information was available to assess. The non-compliant load path required no Tier 2 analysis.

Due to the dated construction of this building, it is safe to assume that the chord elements are discontinuous. This discontinuity can make the diaphragm more flexible, thereby causing more damage around the perimeter. To provide continuity, continuous chord elements should be installed to complete a load path, which is necessary in achieving a Life-Safety performance level.

Also, it is safe to assume that wood sill bolts are insufficient as well. Adequate bolts should be placed no more than 6 feet apart, capable of resisting lateral forces from the lateral system above.

As previously stated, the shear walls of the structure are assumed to be single plank sheathed walls, which have relatively small shear capacities. Therefore, as one of the main deficiencies in this building, causing a life-safety hazard, more sufficient shear walls will need to be added to strengthen the lateral system's resistance to earthquakes.

As there is no evidence otherwise, it cannot be denied that stucco might be used as shear walls in some locations of the original 1929 structure, which is in direct violation of current code regulations. Therefore an alternate, lateral system must be used in place of any stucco walls.

Because there was no existing anchorage for the Spanish ceramic tiles above the roof overhangs, no calculations were necessary to check adequacy. Anchorage must be provided for these items so as to avoid life-safety hazards of falling tiles off of the overhangs in the event of an earthquake.

Multi-story panel detailing will need to accommodate a drift ratio of 0.02. If the connectors are expected to deform, they should be capable of doing so without loss of structural support for the panel. Panel bearing connections will also need to be upgraded, so as to provide a minimum of two bearing connections per panel. Only one bearing connection can result in a dangerous lack of redundancy. If connections are non-existent, they will need to be installed to this minimum design.

The canopy located over the East entrance over the original 1929 structure will need to be properly anchored to the structural framing at no more than 6 feet on center. Improper anchorage can present a life-safety hazard. Should existing anchorage be found, it should be checked for required spacing as well as strength especially for shallow anchors which commonly fail in pull-out.

Finally, the last non-compliant item being analyzed in the Tier 2 assessment for the 1929 structure is the suspended lath and plaster. The hard ceilings in this building will need seismic bracing for every 12 square feet of area, as this element may be acting as a structural diaphragm to resist in-plane seismic forces.

E3. ADDITION (1981)

From the findings in the Tier 1 evaluation, the lateral-force-resisting system in the east/west direction was in question. The Tier 2 requirements call for a more exact approach to the lateral force calculations, showing a more precise distribution of lateral forces to each shear wall. From the calculations shown in Appendix D, the single sheathed wall in question only has an expected strength of just 266 pounds per linear foot, where as the demand is 980 pounds per linear foot. Upon this more precise analysis approach, it is apparent that the shear wall is highly under designed and the lateral system along this line of wall will need to be reinforced to resist higher loads.

Because there was no existing anchorage for the Spanish ceramic tiles above the roof overhangs, no calculations were necessary to check adequacy. Anchorage must be provided for these items so as to avoid life-safety hazards of tiles falling off of the overhangs in the event of an earthquake.

Per the Tier 2 procedure, the ceiling lay-in tiles are best evaluated based upon engineering judgment. Because the tiles are laterally secured between grids and they are constructed of light weight material, it is our opinion that the tiles need no additional clips for anchorage.

In the general analysis of the Tier 2 procedure, several items were deficient as well. In-plane anchorage from the diaphragm to the shear walls was found to be insufficient. Additional connections should be provided, including rim board straps to resist in-plane forces. Also, at the foundation level, extra anchor bolts should be installed along the wall that joins the 1981 building to the original 1929 structure. Finally, the re-entrant corner of the 1981 structure should be reinforced with drag struts to resist any torsional effects in the diaphragm.

APPENDIX A

Site Photos

Original 1929 Two Story Structure

Connection where 1929 Two Story Structure Meets 1981 Addition

Continuous Footing Along Exterior of 1981 Addition

Floor Joists Below 1981 Addition

Floor Joists Below 1929 Structure

Canopy Adjacent to 1929 Structure

APPENDIX B

Evaluation Procedure

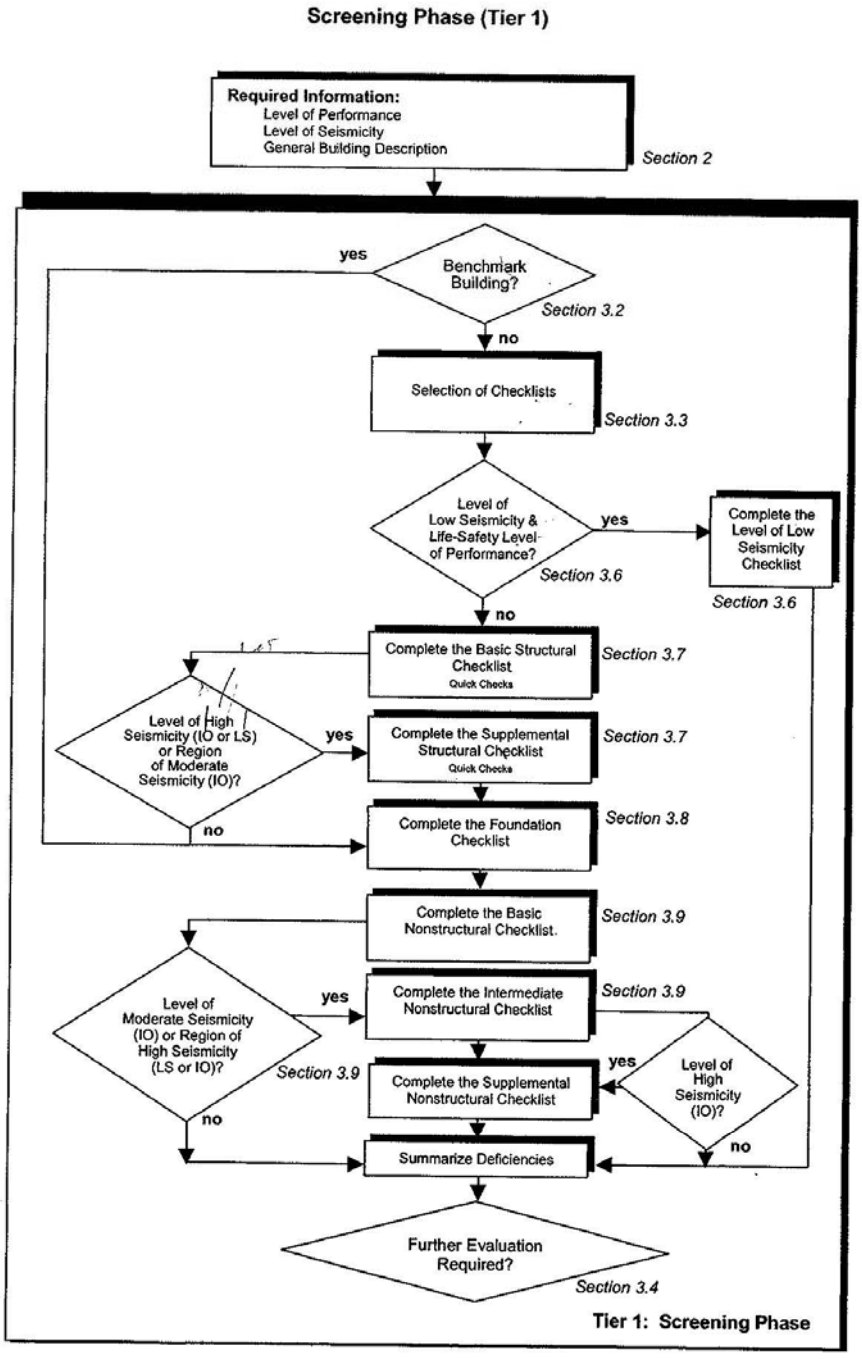


Figure 3-1. Tier 1 Evaluation Process

APPENDIX C

Evaluation Checklists

1929 STRUCTURE

3.7.1 Basic Structural Checklist for Building Type W1: Wood Light Frames

This Basic Structural Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

C3.7.1 Basic Structural Checklist for Building Type W1

These buildings are single- or multiple-family dwellings of one or more stories in height. uilding loads are light and the framing spans are short. Floor and roof framing consists of wood j ts or rafters on wood studs spaced no more than 24 inches apart. The first floor framing is sup ted directly on the foundation, or is raised up on cripple studs and post-and-beam supports. T foundation consists of spread footings constructed on concrete, concrete masonry block, ick masonry or even wood in older construction. Chimneys, where present, consist of solid h masonry, masonry veneer, or wood frame with internal metal flues. Lateral forces are res d by wood frame diaphragms and shear walls. Floor and roof diaphragms consist of straight or agonal lumber sheathing, tongue-and-groove planks, oriented strand board, or plywood. Shear w s consist of straight or diagonal lumber sheathing, plank siding, plywood, oriented strand board, stu o, gypsum board, particle board, or fiberboard. Interior partitions are sheathed with plaster or gypsum board.

Building System

C (NC) N/A — LOAD PATH: The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)

(C) NC N/A — VERTICAL DISCONTINUITIES: All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)

(C) NC N/A — DETERIORATION OF WOOD: There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)

(C) NC N/A — WOOD STRUCTURAL PANEL SHEAR WALL FASTENERS: There shall be no more than 15 percent of inadequate fastening such as overdriven fasteners, omitted blocking, excessive fastening spacing, or inadequate edge distance. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.3.3.2)

Lateral-Force-Resisting System

(C) NC N/A — REDUNDANCY: The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)

1929 STRUCTURE

Screening Phase (Tier 1)

C NC N/A SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than the following values for Life Safety and Immediate Occupancy (Tier 2: Sec. 4.4.2.7.1):

Structural panel sheathing	1,000 plf
Diagonal sheathing	700 plf
Straight sheathing	100 plf
All other conditions	100 plf

C NC N/A STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings shall not rely on exterior stucco walls as the primary lateral-force-resisting system. (Tier 2: Sec. 4.4.2.7.2)

C NC N/A GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard shall not be used as shear walls on buildings over one story in height with the exception of the uppermost level of a multi-story building. (Tier 2: Sec. 4.4.2.7.3)

C NC N/A NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 for Life Safety and 1.5-to-1 for Immediate Occupancy shall not be used to resist lateral forces developed in the building in levels of moderate and high seismicity. Narrow wood shear walls with an aspect ratio greater than 2-to-1 for Immediate Occupancy shall not be used to resist lateral forces developed in the building in levels of low seismicity. (Tier 2: Sec. 4.4.2.7.4)

C NC N/A WALLS CONNECTED THROUGH FLOORS: Shear walls shall have interconnection between stories to transfer overturning and shear forces through the floor. (Tier 2: Sec. 4.4.2.7.5)

C NC N/A HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story due to a sloping site, all shear walls on the downhill slope shall have an aspect ratio less than 1-to-1 for Life Safety and 1 to 2 for Immediate Occupancy. (Tier 2: Sec. 4.4.2.7.6)

C NC N/A CRIPPLE WALLS: Cripple walls below first-floor-level shear walls shall be braced to the foundation with wood structural panels. (Tier 2: Sec. 4.4.2.7.7)

C NC N/A OPENINGS: Walls with openings greater than 80 percent of the length shall be braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or shall be supported by adjacent construction through positive ties capable of transferring the lateral forces. (Tier 2: Sec. 4.4.2.7.8)

Connections

C NC N/A WOOD POSTS: There shall be a positive connection of wood posts to the foundation. (Tier 2: Sec. 4.6.3.3)

C NC N/A WOOD SILLS: All wood sills shall be bolted to the foundation. (Tier 2: Sec. 4.6.3.4)

C NC N/A GIRDER/COLUMN CONNECTION: There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)

1929 STRUCTURE

Screening Phase (Tier 1)

3.7.1S Supplemental Structural Checklist for Building Type W1: Wood Light Frames

This Supplemental Structural Checklist shall be completed where required by Table 3-2. The Basic Structural Checklist shall be completed prior to completing this Supplemental Structural Checklist.

Lateral-Force-Resisting System

C NC (N/A) HOLD-DOWN ANCHORS: All shear walls shall have hold-down anchors constructed per acceptable construction practices, attached to the end studs. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.7.9)

Diaphragms

(C) NC N/A DIAPHRAGM CONTINUITY: The diaphragms shall not be composed of split-level floors and shall not have expansion joints. (Tier 2: Sec. 4.5.1.1)

C (NC) N/A ROOF CHORD CONTINUITY: All chord elements shall be continuous, regardless of changes in roof elevation. (Tier 2: Sec. 5.1.3)

C NC (N/A) PLAN IRREGULARITIES: There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)

C NC (N/A) DIAPHRAGM REINFORCEMENT AT OPENINGS: There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)

(C) NC N/A STRAIGHT SHEATHING: All straight sheathed diaphragms shall have aspect ratios less than 2-to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)

(C) NC N/A SPANS: All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)

(C) NC N/A UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)

(C) NC N/A OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)

Connections

C (NC) N/A WOOD SILL BOLTS: Sill bolts shall be spaced at 6 feet or less for Life Safety and 4 feet or less for Immediate Occupancy, with proper edge and end distance provided for wood and concrete. (Tier 2: Sec. 4.6.3.9)

1929 STRUCTURE

Screening Phase (Tier 1)

3.8 Geologic Site Hazards and Foundations Checklist

This Geologic Site Hazards and Foundations Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Geologic Site Hazards

The following statements shall be completed for buildings in levels of high or moderate seismicity.

(C) NC N/A LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)

(C) NC N/A SLOPE FAILURE: The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)

(C) NC N/A SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)

Condition of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

(C) NC N/A FOUNDATION PERFORMANCE: There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)

The following statement shall be completed for buildings in levels of high or moderate seismicity being evaluated to the Immediate Occupancy Performance Level.

(C) NC N/A DETERIORATION: There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2)

Capacity of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC (N/A) POLE FOUNDATIONS: Pole foundations shall have a minimum embedment depth of 4 feet for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)

The following statements shall be completed for buildings in levels of moderate seismicity being evaluated to the Immediate Occupancy Performance Level and for buildings in levels of high seismicity.

(C) NC N/A OVERTURNING: The ratio of the horizontal dimension of the lateral-force-resisting system at the foundation level to the building height (base/height) shall be greater than $0.6S_a$. (Tier 2: Sec. 4.7.3.2)

1929 STRUCTURE

Screening Phase (Tier 1)

C	NC	(N/A)	TIES BETWEEN FOUNDATION ELEMENTS: The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Section 3.5.2.3.1, Tier 2: Sec. 4.7.3.3)
C	NC	(N/A)	DEEP FOUNDATIONS: Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)
(C)	NC	N/A	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story in height. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5)

1929 STRUCTURE

3.9.1 Basic Nonstructural Component Checklist

This Basic Nonstructural Component Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Partitions

C NC N/A — UNREINFORCED MASONRY: Unreinforced masonry or hollow clay tile partitions shall be braced at a spacing equal to or less than 10 feet in levels of low or moderate seismicity and 6 feet in levels of high seismicity. (Tier 2: Sec. 4.8.1.1)

Ceiling Systems

C NC N/A — SUPPORT: The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions. Gypsum board partitions need not be evaluated where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.2.1)

Light Fixtures

C NC N/A — EMERGENCY LIGHTING: Emergency lighting shall be anchored or braced to prevent falling during an earthquake. (Tier 2: Sec. 4.8.3.1)

Cladding and Glazing

C NC N/A — CLADDING ANCHORS: Cladding components weighing more than 10 psf shall be mechanically anchored to the exterior wall framing at a spacing equal to or less than 4 feet. A spacing of up to 6 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.1)

C NC N/A — DETERIORATION: There shall be no evidence of deterioration, damage or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.4.2)

C NC N/A — CLADDING ISOLATION: For moment frame buildings of steel or concrete, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.3)

C NC N/A — MULTI-STORY PANELS: For multi-story panels attached at each floor level, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.4)

C NC N/A — BEARING CONNECTIONS: Where bearing connections are required, there shall be a minimum of two bearing connections for each wall panel. (Tier 2: Sec. 4.8.4.5)

1929 STRUCTURE

Screening Phase (Tier 1)

C NC N/A INSERTS: Where inserts are used in concrete connections, the inserts shall be anchored to reinforcing steel or other positive anchorage. (Tier 2: Sec. 4.8.4.6)

C NC N/A PANEL CONNECTIONS: Exterior cladding panels shall be anchored out-of-plane with a minimum of 4 connections for each wall panel. Two connections per wall panel are permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.7)

Masonry Veneer

C NC N/A SHELF ANGLES: Masonry veneer shall be supported by shelf angles or other elements at each floor 30 feet or more above ground for Life Safety and at each floor above the first floor for Immediate Occupancy. (Tier 2: Sec. 4.8.5.1)

C NC N/A TIES: Masonry veneer shall be connected to the back-up with corrosion-resistant ties. The ties shall have a spacing equal to or less than 24 inches with a minimum of one tie for every 2-2/3 square feet. A spacing of up to 36 inches is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.5.2)

C NC N/A WEAKENED PLANES: Masonry veneer shall be anchored to the back-up adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 4.8.5.3)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.5.4)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A URM PARAPETS: There shall be no laterally unsupported unreinforced masonry parapets or cornices with height-to-thickness ratios greater than 1.5. A height-to-thickness ratio of up to 2.5 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.1)

C NC N/A CANOPIES: Canopies located at building exits shall be anchored to the structural framing at a spacing of 6 feet or less. An anchorage spacing of up to 10 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.2)

Masonry Chimneys

C NC N/A URM CHIMNEYS: No unreinforced masonry chimney shall extend above the roof surface more than twice the least dimension of the chimney. A height above the roof surface of up to three times the least dimension of the chimney is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.9.1)

Stairs

C NC N/A URM WALLS: Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry with a height-to-thickness ratio greater than 12-to-1. A height-to-thickness ratio of up to 15-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.10.1)

C NC N/A STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure shall not rely on shallow anchors in concrete. Alternatively, the stair details shall be capable of accommodating the drift calculated using the Quick Check procedure of Section 3.5.3.1 without including tension in the anchors. (Tier 2: Sec. 4.8.10.2)

1929 STRUCTURE

Screening Phase (Tier 1)

Building Contents and Furnishing

C NC N/A — TALL NARROW CONTENTS: Contents over 4 feet in height with a height-to-depth or height-to-width ratio greater than 3-to-1 shall be anchored to the floor slab or adjacent structural walls. A height-to-depth or height-to-width ratio of up to 4-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.11.1)

Mechanical and Electrical Equipment

C NC N/A — EMERGENCY POWER: Equipment used as part of an emergency power system shall be mounted to maintain continued operation after an earthquake. (Tier 2: Sec. 4.8.12.1)

C NC N/A — HAZARDOUS MATERIAL EQUIPMENT: HVAC or other equipment containing hazardous material shall not have damaged supply lines or unbraced isolation supports. (Tier 2: Sec. 4.8.12.2)

C NC N/A — DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the anchorage or supports of mechanical or electrical equipment. (Tier 2: Sec. 4.8.12.3)

C NC N/A — ATTACHED EQUIPMENT: Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced. (Tier 2: Sec. 4.8.12.4)

Piping

C NC N/A — FIRE SUPPRESSION PIPING: Fire suppression piping shall be anchored and braced in accordance with NFPA-13 (NFPA, 1996). (Tier 2: Sec. 4.8.13.1)

C NC N/A — FLEXIBLE COUPLINGS: Fluid, gas, and fire suppression piping shall have flexible couplings. (Tier 2: Sec. 4.8.13.2)

Hazardous Materials Storage and Distribution

C NC N/A — TOXIC SUBSTANCES: Toxic and hazardous substances stored in breakable containers shall be restrained from falling by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 4.8.15.1)

1929 STRUCTURE

Screening Phase (Tier 1)

3.9.2 Intermediate Nonstructural Component Checklist

This Intermediate Nonstructural Component Checklist shall be completed where required by Table 3-2. The Basic Nonstructural Component Checklist shall be completed prior to completing this Intermediate Nonstructural Component Checklist.

Ceiling Systems

C NC N/A — LAY-IN TILES: Lay-in tiles used in ceiling panels located at exits and corridors shall be secured with clips. (Tier 2: Sec. 4.8.2.2)

C NC N/A — INTEGRATED CEILINGS: Integrated suspended ceilings at exits and corridors or weighing more than 2 pounds per square foot shall be laterally restrained with a minimum of four diagonal wires or rigid members attached to the structure above at a spacing equal to or less than 12 feet. (Tier 2: Sec. 4.8.2.3)

C NC N/A — SUSPENDED LATH AND PLASTER: Ceilings consisting of suspended lath and plaster or gypsum board shall be attached to resist seismic forces for every 12 square feet of area. (Tier 2: Sec. 4.8.2.4)

Light Fixtures

C NC N/A — INDEPENDENT SUPPORT: Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures. (Tier 2: Sec. 4.8.3.2)

Cladding and Glazing

C NC N/A — GLAZING: Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface, shall have safety glazing. Such glazing located over 10 feet above an exterior walking surface shall be laminated annealed or laminated heat-strengthened safety glass or other glazing system that will remain in the frame when glass is cracked. (Tier 2: Sec. 4.8.4.8)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A — CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 shall have vertical reinforcement. (Tier 2: Sec. 4.8.8.3)

C NC N/A — APPENDAGES: Cornices, parapets, signs, and other appendages that extend above the highest point of anchorage to the structure or cantilever from exterior wall faces and other exterior wall ornamentation shall be reinforced and anchored to the structural system at a spacing equal to or less than 10 feet for Life Safety and 6 feet for Immediate Occupancy. This requirement need not apply to parapets or cornices compliant with Section 4.8.8.1 or 4.8.8.3. (Tier 2: Sec. 4.8.8.4)

Masonry Chimneys

C NC N/A — ANCHORAGE: Masonry chimneys shall be anchored at each floor level and the roof. (Tier 2: Sec. 4.8.9.2)

1929 STRUCTURE

Mechanical and Electrical Equipment

C NC (N/A) VIBRATION ISOLATORS: Equipment mounted on vibration isolators shall be equipped with restraints or snubbers. (Tier 2: Sec. 4.8.12.5)

Ducts

C NC (N/A) STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts shall be braced and shall have flexible connections at seismic joints. (Tier 2: Sec. 4.8.14.1)

1991 ADDITION

3.7.1 Basic Structural Checklist for Building Type W1: Wood Light Frames

This Basic Structural Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

C3.7.1 Basic Structural Checklist for Building Type W1

These buildings are single- or multiple-family dwellings of one or more stories in height. Building loads are light and the framing spans are short. Floor and roof framing consists of wood joists or rafters on wood studs spaced no more than 24 inches apart. The first floor framing is supported directly on the foundation, or is raised up on cripple studs and post-and-beam supports. The foundation consists of spread footings constructed on concrete, concrete masonry block, brick masonry or even wood in older construction. Chimneys, where present, consist of solid brick masonry, masonry veneer, or wood frame with internal metal flues. Lateral forces are resisted by wood frame diaphragms and shear walls. Floor and roof diaphragms consist of straight or diagonal lumber sheathing, tongue-and-groove planks, oriented strand board, or plywood. Shear walls consist of straight or diagonal lumber sheathing, plank siding, plywood, oriented strand board, stucco, gypsum board, particle board, or fiberboard. Interior partitions are sheathed with plaster or gypsum board.

Building System

(C)	NC	N/A	LOAD PATH: The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)
(C)	NC	N/A	VERTICAL DISCONTINUITIES: All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)
(C)	NC	N/A	DETERIORATION OF WOOD: There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)
C	NC	(N/A)	WOOD STRUCTURAL PANEL SHEAR WALL FASTENERS: There shall be no more than 15 percent of inadequate fastening such as overdriven fasteners, omitted blocking, excessive fastening spacing, or inadequate edge distance. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.3.3.2)

Lateral-Force-Resisting System

(C)	NC	N/A	REDUNDANCY: The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)

1981 ADDITION

Screening Phase (Tier 1)

C NC N/A SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than the following values for Life Safety and Immediate Occupancy (Tier 2: Sec. 4.4.2.7.1):

Structural panel sheathing	1,000 plf
Diagonal sheathing	700 plf
Straight sheathing	100 plf
All other conditions	100 plf

C NC N/A STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings shall not rely on exterior stucco walls as the primary lateral-force-resisting system. (Tier 2: Sec. 4.4.2.7.2)

C NC N/A GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard shall not be used as shear walls on buildings over one story in height with the exception of the uppermost level of a multi-story building. (Tier 2: Sec. 4.4.2.7.3)

C NC N/A NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 for Life Safety and 1.5-to-1 for Immediate Occupancy shall not be used to resist lateral forces developed in the building in levels of moderate and high seismicity. Narrow wood shear walls with an aspect ratio greater than 2-to-1 for Immediate Occupancy shall not be used to resist lateral forces developed in the building in levels of low seismicity. (Tier 2: Sec. 4.4.2.7.4)

C NC N/A WALLS CONNECTED THROUGH FLOORS: Shear walls shall have interconnection between stories to transfer overturning and shear forces through the floor. (Tier 2: Sec. 4.4.2.7.5)

C NC N/A HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story due to a sloping site, all shear walls on the downhill slope shall have an aspect ratio less than 1-to-1 for Life Safety and 1 to 2 for Immediate Occupancy. (Tier 2: Sec. 4.4.2.7.6)

C NC N/A CRIPPLE WALLS: Cripple walls below first-floor-level shear walls shall be braced to the foundation with wood structural panels. (Tier 2: Sec. 4.4.2.7.7)

C NC N/A OPENINGS: Walls with openings greater than 80 percent of the length shall be braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or shall be supported by adjacent construction through positive ties capable of transferring the lateral forces. (Tier 2: Sec. 4.4.2.7.8)

Connections

C NC N/A WOOD POSTS: There shall be a positive connection of wood posts to the foundation. (Tier 2: Sec. 4.6.3.3)

C NC N/A WOOD SILLS: All wood sills shall be bolted to the foundation. (Tier 2: Sec. 4.6.3.4)

C NC N/A GIRDER/COLUMN CONNECTION: There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)

1981 ADDITION

Screening Phase (Tier 1)

3.7.1S Supplemental Structural Checklist for Building Type W1: Wood Light Frames

This Supplemental Structural Checklist shall be completed where required by Table 3-2. The Basic Structural Checklist shall be completed prior to completing this Supplemental Structural Checklist.

Lateral-Force-Resisting System

C NC (N/A) HOLD-DOWN ANCHORS: All shear walls shall have hold-down anchors constructed per acceptable construction practices, attached to the end studs. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.7.9)

Diaphragms

(C) NC N/A DIAPHRAGM CONTINUITY: The diaphragms shall not be composed of split-level floors and shall not have expansion joints. (Tier 2: Sec. 4.5.1.1)

(C) NC N/A ROOF CHORD CONTINUITY: All chord elements shall be continuous, regardless of changes in roof elevation. (Tier 2: Sec. 4.5.1.3)

C NC (N/A) PLAN IRREGULARITIES: There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)

C NC (N/A) DIAPHRAGM REINFORCEMENT AT OPENINGS: There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)

(C) NC N/A STRAIGHT SHEATHING: All straight sheathed diaphragms shall have aspect ratios less than 2-to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)

(C) NC N/A SPANS: All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)

C NC (N/A) UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)

(C) NC N/A OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)

Connections

(C) NC N/A WOOD SILL BOLTS: Sill bolts shall be spaced at 6 feet or less for Life Safety and 4 feet or less for Immediate Occupancy, with proper edge and end distance provided for wood and concrete. (Tier 2: Sec. 4.6.3.9)

1981 ADDITION

Screening Phase (Tier 1)

3.8 Geologic Site Hazards and Foundations Checklist

This Geologic Site Hazards and Foundations Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Geologic Site Hazards

The following statements shall be completed for buildings in levels of high or moderate seismicity.

C NC N/A — LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)

C NC N/A — SLOPE FAILURE: The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)

C NC N/A — SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)

Condition of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A — FOUNDATION PERFORMANCE: There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)

The following statement shall be completed for buildings in levels of high or moderate seismicity being evaluated to the Immediate Occupancy Performance Level.

C NC N/A — DETERIORATION: There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2)

Capacity of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A — POLE FOUNDATIONS: Pole foundations shall have a minimum embedment depth of 4 feet for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)

The following statements shall be completed for buildings in levels of moderate seismicity being evaluated to the Immediate Occupancy Performance Level and for buildings in levels of high seismicity.

C NC N/A — OVERTURNING: The ratio of the horizontal dimension of the lateral-force-resisting system at the foundation level to the building height (base/height) shall be greater than $0.6S_a$. (Tier 2: Sec. 4.7.3.2)

1981 ADDITION

Screening Phase (Tier 1)

(C)	NC	N/A	TIES BETWEEN FOUNDATION ELEMENTS: The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Section 3.5.2.3.1, Tier 2: Sec. 4.7.3.3)
C	NC	(N/A)	DEEP FOUNDATIONS: Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)
C	NC	(N/A)	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story in height. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5)

1981 ADDITION

Screening Phase (Tier 1)

3.9.1 Basic Nonstructural Component Checklist

This Basic Nonstructural Component Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Partitions

C NC N/A — UNREINFORCED MASONRY: Unreinforced masonry or hollow clay tile partitions shall be braced at a spacing equal to or less than 10 feet in levels of low or moderate seismicity and 6 feet in levels of high seismicity. (Tier 2: Sec. 4.8.1.1)

Ceiling Systems

C NC N/A — SUPPORT: The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions. Gypsum board partitions need not be evaluated where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.2.1)

Light Fixtures

C NC N/A — EMERGENCY LIGHTING: Emergency lighting shall be anchored or braced to prevent falling during an earthquake. (Tier 2: Sec. 4.8.3.1)

Cladding and Glazing

C NC N/A — CLADDING ANCHORS: Cladding components weighing more than 10 psf shall be mechanically anchored to the exterior wall framing at a spacing equal to or less than 4 feet. A spacing of up to 6 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.1)

C NC N/A — DETERIORATION: There shall be no evidence of deterioration, damage or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.4.2)

C NC N/A — CLADDING ISOLATION: For moment frame buildings of steel or concrete, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.3)

C NC N/A — MULTI-STORY PANELS: For multi-story panels attached at each floor level, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.4)

C NC N/A — BEARING CONNECTIONS: Where bearing connections are required, there shall be a minimum of two bearing connections for each wall panel. (Tier 2: Sec. 4.8.4.5)

1981 ADDITION

C NC N/A INSERTS: Where inserts are used in concrete connections, the inserts shall be anchored to reinforcing steel or other positive anchorage. (Tier 2: Sec. 4.8.4.6)

C NC N/A PANEL CONNECTIONS: Exterior cladding panels shall be anchored out-of-plane with a minimum of 4 connections for each wall panel. Two connections per wall panel are permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.7)

Masonry Veneer

C NC N/A SHELF ANGLES: Masonry veneer shall be supported by shelf angles or other elements at each floor 30 feet or more above ground for Life Safety and at each floor above the first floor for Immediate Occupancy. (Tier 2: Sec. 4.8.5.1)

C NC N/A TIES: Masonry veneer shall be connected to the back-up with corrosion-resistant ties. The ties shall have a spacing equal to or less than 24 inches with a minimum of one tie for every 2-2/3 square feet. A spacing of up to 36 inches is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.5.2)

C NC N/A WEAKENED PLANES: Masonry veneer shall be anchored to the back-up adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 4.8.5.3)

C NC N/A DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.5.4)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A URM PARAPETS: There shall be no laterally unsupported unreinforced masonry parapets or cornices with height-to-thickness ratios greater than 1.5. A height-to-thickness ratio of up to 2.5 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.1)

C NC N/A CANOPIES: Canopies located at building exits shall be anchored to the structural framing at a spacing of 6 feet or less. An anchorage spacing of up to 10 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.2)

Masonry Chimneys

C NC N/A URM CHIMNEYS: No unreinforced masonry chimney shall extend above the roof surface more than twice the least dimension of the chimney. A height above the roof surface of up to three times the least dimension of the chimney is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.9.1)

Stairs

C NC N/A URM WALLS: Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry with a height-to-thickness ratio greater than 12-to-1. A height-to-thickness ratio of up to 15-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.10.1)

C NC N/A STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure shall not rely on shallow anchors in concrete. Alternatively, the stair details shall be capable of accommodating the drift calculated using the Quick Check procedure of Section 3.5.3.1 without including tension in the anchors. (Tier 2: Sec. 4.8.10.2)

1981 ADDITION

Screening Phase (Tier 1)

Building Contents and Furnishing

C NC N/A — TALL NARROW CONTENTS: Contents over 4 feet in height with a height-to-depth or height-to-width ratio greater than 3-to-1 shall be anchored to the floor slab or adjacent structural walls. A height-to-depth or height-to-width ratio of up to 4-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.11.1)

Mechanical and Electrical Equipment

C NC N/A — EMERGENCY POWER: Equipment used as part of an emergency power system shall be mounted to maintain continued operation after an earthquake. (Tier 2: Sec. 4.8.12.1)

C NC N/A — HAZARDOUS MATERIAL EQUIPMENT: HVAC or other equipment containing hazardous material shall not have damaged supply lines or unbraced isolation supports. (Tier 2: Sec. 4.8.12.2)

C NC N/A — DETERIORATION: There shall be no evidence of deterioration, damage, or corrosion in any of the anchorage or supports of mechanical or electrical equipment. (Tier 2: Sec. 4.8.12.3)

C NC N/A — ATTACHED EQUIPMENT: Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced. (Tier 2: Sec. 4.8.12.4)

Piping

C NC N/A — FIRE SUPPRESSION PIPING: Fire suppression piping shall be anchored and braced in accordance with NFPA-13 (NFPA, 1996). (Tier 2: Sec. 4.8.13.1)

C NC N/A — FLEXIBLE COUPLINGS: Fluid, gas, and fire suppression piping shall have flexible couplings. (Tier 2: Sec. 4.8.13.2)

Hazardous Materials Storage and Distribution

C NC N/A — TOXIC SUBSTANCES: Toxic and hazardous substances stored in breakable containers shall be restrained from falling by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec. 4.8.15.1)

1981 ADDITION

3.9.2 Intermediate Nonstructural Component Checklist

This Intermediate Nonstructural Component Checklist shall be completed where required by Table 3-2. The Basic Nonstructural Component Checklist shall be completed prior to completing this Intermediate Nonstructural Component Checklist.

Ceiling Systems

C NC N/A — LAY-IN TILES: Lay-in tiles used in ceiling panels located at exits and corridors shall be secured with clips. (Tier 2: Sec. 4.8.2.2)

C NC N/A — INTEGRATED CEILINGS: Integrated suspended ceilings at exits and corridors or weighing more than 2 pounds per square foot shall be laterally restrained with a minimum of four diagonal wires or rigid members attached to the structure above at a spacing equal to or less than 12 feet. (Tier 2: Sec. 4.8.2.3)

C NC N/A — SUSPENDED LATH AND PLASTER: Ceilings consisting of suspended lath and plaster or gypsum board shall be attached to resist seismic forces for every 12 square feet of area. (Tier 2: Sec. 4.8.2.4)

Light Fixtures

C NC N/A — INDEPENDENT SUPPORT: Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures. (Tier 2: Sec. 4.8.3.2)

Cladding and Glazing

C NC N/A — GLAZING: Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface, shall have safety glazing. Such glazing located over 10 feet above an exterior walking surface shall be laminated annealed or laminated heat-strengthened safety glass or other glazing system that will remain in the frame when glass is cracked. (Tier 2: Sec. 4.8.4.8)

Parapets, Cornices, Ornamentation, and Appendages

C NC N/A — CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 shall have vertical reinforcement. (Tier 2: Sec. 4.8.8.3)

C NC N/A — APPENDAGES: Cornices, parapets, signs, and other appendages that extend above the highest point of anchorage to the structure or cantilever from exterior wall faces and other exterior wall ornamentation shall be reinforced and anchored to the structural system at a spacing equal to or less than 10 feet for Life Safety and 6 feet for Immediate Occupancy. This requirement need not apply to parapets or cornices compliant with Section 4.8.8.1 or 4.8.8.3. (Tier 2: Sec. 4.8.8.4)

Masonry Chimneys

C NC N/A — ANCHORAGE: Masonry chimneys shall be anchored at each floor level and the roof. (Tier 2: Sec. 4.8.9.2)

1981 ADDITION

Screening Phase (Tier 1)

Mechanical and Electrical Equipment

C NC (N/A) VIBRATION ISOLATORS: Equipment mounted on vibration isolators shall be equipped with restraints or snubbers. (Tier 2: Sec. 4.8.12.5)

Ducts

C NC (N/A) STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts shall be braced and shall have flexible connections at seismic joints. (Tier 2: Sec. 4.8.14.1)

APPENDIX D

Structural Calculations

Project:	Job No.:	
Description: 1929 ORIGINAL BLDG	Date:	Sht:
	By: J.R. Ck:	

VERY LIMITED STRUCTURAL INFORMATION OR DRAWINGS WERE AVAILABLE THEREFORE MINIMAL CALCULATIONS WERE DONE BECAUSE OF UNKNOWN BLDG MATERIALS & DIMENSIONS.

THE FOLLOWING CALCS INCLUDE...

- PSEUDO LATERAL FORCE MAGNITUDE
- TIER 1 OVERTURNING CHECK

Project:	Job No.:	
Description: 1929 ORIGINAL BLDG	Date:	Sht:
	By: J.R. Ck:	

PSEUDO LATERAL FORCE

$V = C S_a W$

$C = 1.1$ (TBL 3-4)

$S_a = \frac{S_{D1}}{T}$

$S_{D1} = 0.759\ g$ (USGS)

$T = C_t h_n^{\beta}$

$\beta = 0.75$

$h_n = 21'$

$C_t = 0.060$

$T = 0.060\ (21')^{0.75} = 0.59$ SEC

$S_a = \frac{0.759}{0.59} = 1.29$

$V = 1.1(1.29)W$

$= 1.42\ W$

Project:	Job No.:	
Description: 1929 ORIGINAL BLDG	Date:	Sht:
	By: J.R. Ck:	

OVERTURNING – TIER 1 CALC

$\frac{\text{BASE}}{\text{HEIGHT}} = \frac{31'}{21'} = 1.48 > 0.6\,S_a$ ✓ OK

$0.6\,S_a = 0.6(1.29) = 0.774$

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

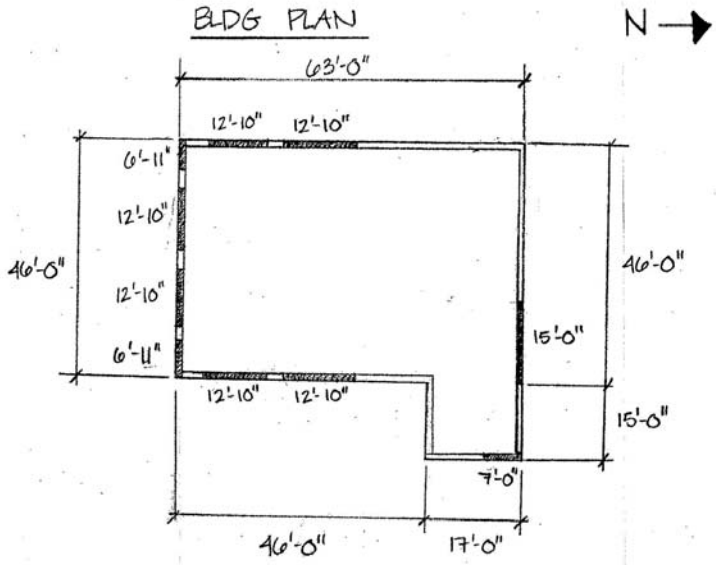
IN ADDITION TO THE GENERAL TIER 1 CHECKLIST, CALCULATIONS WERE DONE FOR SEVERAL TIER 1 ITEMS, NON-COMPLIANT TIER 2 ITEMS, AS WELL AS A GENERAL TIER 2 ANALYSIS OF THE STRUCTURE.

THE FOLLOWING CALCS INCLUDE...

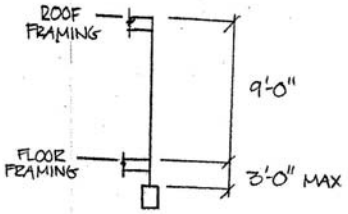
- BLDG PLAN/SECTION
- PSEUDO LATERAL FORCE
- BLDG WEIGHS
- SEISMIC LOADING
- SHEAR STRESS IN WALLS (TIER 1 CALC)
- SHEAR STRESS IN WALLS (TIER 2 CALC) ↑ MORE ACCURATE
- WALL SHEAR SHOWN ON PLAN
- DIAPHRAGM ASSESSMENT
- CHORD FORCES
- COLLECTOR FORCES
- WALL ANCHORAGE TO ROOF DIAPHRAGM
- TIER 1 OVERTURNING CALCS
- FOUNDATIONS

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. / Ck:	

BLDG PLAN



ELEVATION



Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

PSEUDO LATERAL FORCE:

$V = CS_aW$

$C = 1.3$ (TBL 3-A)

$S_a = \frac{S_{D1}}{T}$

$S_{D1} = 0.759g$ (USGS)

$T = C_t h_n^{\beta}$

$\beta = 0.75$

$h_n = 13'$

$C_t = 0.060$

$T = 0.060\,(13')^{0.75} = 0.41$ SEC

$S_a = \frac{0.759}{0.41} = 1.85$

$V = 1.3(1.85)W$

$= \boxed{2.41W}$

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

BLDG WEIGHTS

ROOF LOADS

COMP ROOFING	6.0
5/8" PLYWOOD	1.8
FRAMING	4.0
INSULATION	1.0
CEILING 5/8" GYP	2.8
MECH/ELEC.	2.4
MISC.	2.0
	20 PSF

SPANISH TILES ABOVE EXT. WALLS
4' DEPTH
↳ 19 PSF

WALLS (EXTERIOR)

1/2" PLYWOOD	1.5
FRAMING (2x6 @16"o/c)	1.4
PLASTER 1"	10.0
5/8" GYP	2.8
MISC.	0.3
	16 PSF

WALLS (INTERIOR)

1/2" PLYWOOD	1.5
FRAMING (2x6 @16"o/c)	1.4
5/8" GYP (2 SIDES)	5.6
MISC.	0.5
	9 PSF

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

WEIGHTS FOR SEISMIC LOADING

TOTAL ROOF WT = 20PSF * 3153 FT^2 = 63.06^K

TOTAL SPANISH TILE WT = 19PSF * 217 FT = 4.123^K

TOTAL E/W WALL WT FOR N/S SEISMIC

L EXT. WALL = 46' + 15' + 15' + 15' = 91'

L INT. WALL = 31' + 15' = 46'

EXT WALL WT = 16 PSF (91')(13'/2) = 9.464^K

INT WALL WT = 9PSF (46')(13'/2) = 2.691^K

12.155^K

TOTAL N/S WALL WT FOR E/W SEISMIC

L EXT. WALL = 63' + 46' + 17' = 126'

L INT. WALL = 17' + 7' = 24'

EXT. WALL WT = 16 PSF (126')(13'/2) = 13.104^K

INT. WALL WT = 9 PSF (24')(13'/2) = 1.404^K

14.508^K

$V_{N/S} = 2.41\,(63.06^K + 4.123^K + 12.155^K) = \boxed{79.3^K}$

$V_{E/W} = 2.41\,(63.06^K + 4.123^K + 14.508^K) = \boxed{81.7^K}$

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

SHEAR STRESS CHECK (TIER 1 CALCULATION)

$V_j^{AVG} = \frac{1}{m}\left(\frac{V_j}{A_w}\right)$ $\quad m = 4.0$ (TABLE 3-7)

$A_{w\ E/W} = L_{E/W} = 6.92' \times 2 + 12.83' \times 2 + 15' = 54.5'$

$V_{j\ E/W}^{AVG} = \frac{1}{4.0}\left(\frac{81.7^K}{54.5'}\right) = 0.375^{KLF}$

* NG FOR SHEARWALL @ GL1
(STRAIGHT SHEATHING $V_{ALLOW} = 100$ plf $< V_u = 355$ plf)

$A_{w\ N/S} = L_{N/S} = 12.83' \times 4 + 7' = 58.32'$

$V_{j\ N/S}^{AVG} = \frac{1}{4.0}\left(\frac{79.3^K}{58.32'}\right) = 0.340$ KLF ✓

OK, ALL SHEAR WALLS IN N/S DIRECTION ARE SHEATHED W/ PLYWOOD ($V_{ALLOW} = 1.0$ KLF ✓)

1981 ADDITION

Tier 2 Shear Stress Check ← TIER 2 CALCULATION

Direction	Length of Wall	Trib Area / Total Area	Shear (kips)	h/L	m (Table 4-8)	Q_{up}/m (klf)	Q_{CE}	$Q_{CE} > Q_{up}$/m ?
N/S *	12.83	0.23	18.239	1.013	4.5	0.316	1.02	YES
N/S *	12.83	0.23	18.239	1.013	4.5	0.316	1.02	YES
N/S *	12.83	0.25	19.825	1.013	4.5	0.343	1.02	YES
N/S *	12.83	0.25	19.825	1.013	4.5	0.343	1.02	YES
N/S *	7	0.04	3.172	1.857	3.65	0.124	1.02	YES
E/W *	6.92	0.08	6.536	1.87	3.65	0.259	1.02	YES
E/W *	12.83	0.15	12.26	1.01	4.5	0.212	1.02	YES
E/W *	12.83	0.15	12.26	1.01	4.5	0.212	1.02	YES
E/W *	6.92	0.08	6.536	1.87	3.65	0.259	1.02	YES
E/W **	15	0.54	44.12	0.87	3	0.980	0.266	NO

* Plywood Sheathing - use 10d nailing @ 4"oc at panel edges per UBC1976

** Straight Sheething - use 100plf allowable shear

Project:

Job No.:

Description: 1981 ADDITION

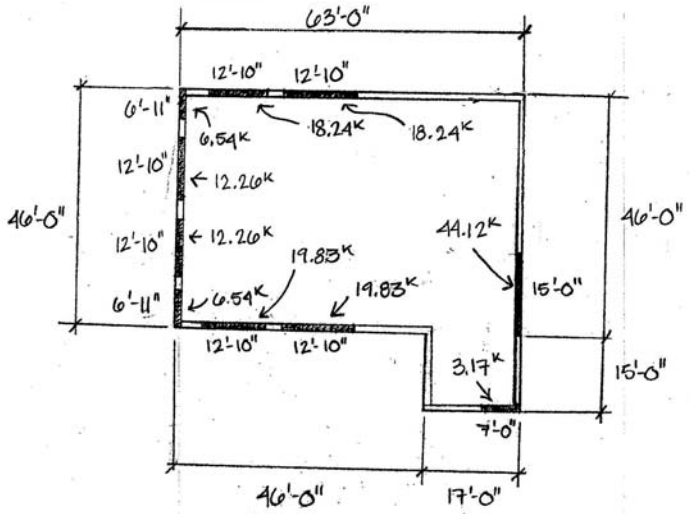
Date:

Sht:

By: J.R.

Ck:

BLDG PLAN - SHEAR WALL FORCES → PER TIER 2 CALC

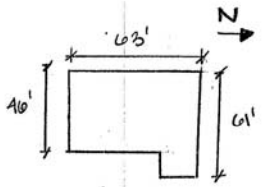


Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. / Ck:	

DIAPHRAGM ASSESSMENT

$$F_{Px} = \frac{1}{C}\,\frac{\Sigma F_i}{\Sigma W_i}\,W_x$$

$C = 1.3$ (TABLE 3-4)



DIAPHRAGM FORCES

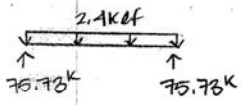
rim beams strapped

$$F_{Px\ N/S} = \frac{2.41\,(79.3^{K})}{1.3} = 147.01^{K}$$

$$F_{Px\ E/W} = \frac{2.41\,(81.7^{K})}{1.3} = 151.46^{K}$$

MAX V IN DIAPHRAGM:

E/W $W_{Px} = \frac{151.46^{K}}{63'} = 2.4^{klf}$



$$R_{MAX} = \frac{2.4^{klf} * 63'}{2} = 75.73^{K}$$

$$V_{MAX} = \frac{75.73^{K}}{46'} = 1.65^{klf} = Q_{UD}$$

$$\frac{Q_{UD}}{M} = \frac{1.65^{klf}}{3.5} = 471\ plf$$

$Q_{CE} * 2$ (↑ ALLOWABLE LOAD FACTOR [4.2.4.4]) $= 675\ plf * 2 = 1350\ plf > 471\ plf$ ✓ DIAPHRAGM OK

Project:	Job No.:	
Description:	Date:	Sht:
	By: J.R. Ck:	

CHORD FORCES

$W_{DIAPHR.\ E/W} = \frac{151.46^K}{63'} = 2.4^{KLF}$

$M_{DIAPHR} = \frac{WL^2}{8} = \frac{2.4^{KLF}(63')^2}{8} = 1190.7^{K\text{-}FT}$

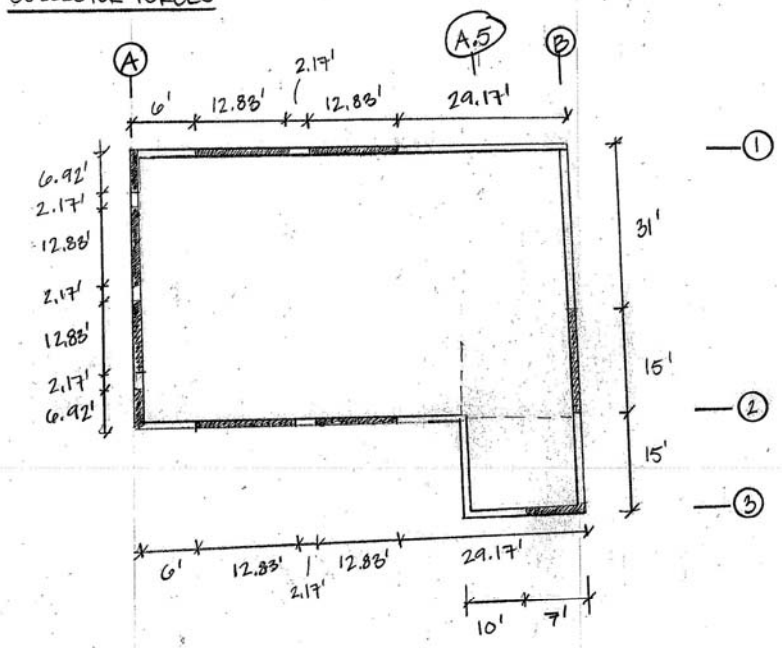
CHORD FORCE $T = C = \frac{1190.7^{K\text{-}FT}}{46'} = \frac{25.93^{KIPS}}{3.5} = 7.41^K$

↑ DIAPHRAGM "M" FACTOR PER TABLE 4-8

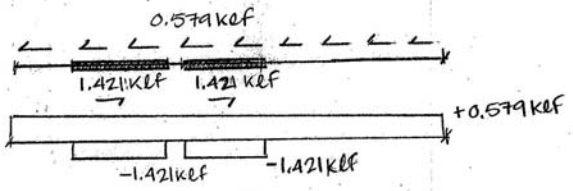
CHORD MEMBERS & SPLICES SHOULD BE DESIGNED FOR THIS TENSION FORCE.

Project:	Job No.:	
Description:	Date:	Sht:
	By: J.R. Ck:	

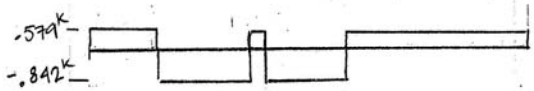
COLLECTOR FORCES



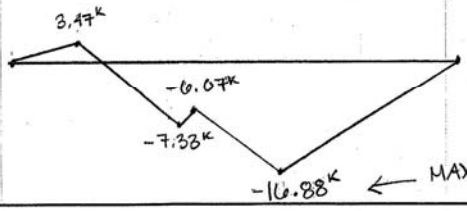
LINE (1)



SHEAR DIAG.



COLLECTOR FORCE DIAG.

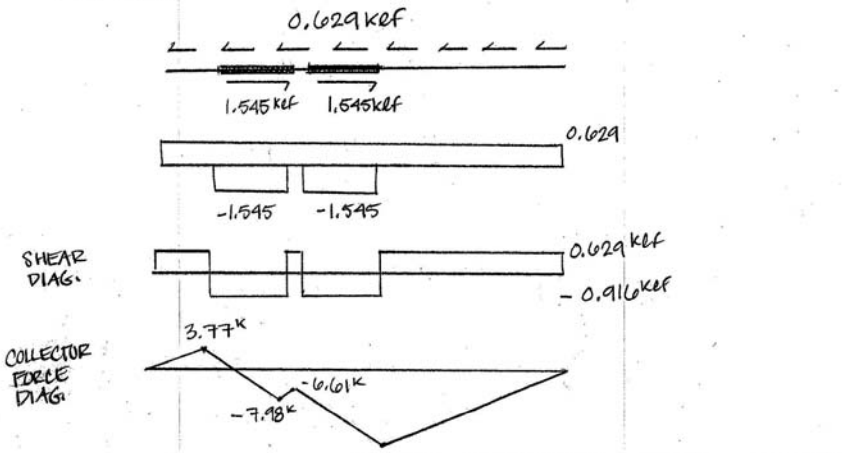


RIMBOARDS ALONG LINE (1) ARE CONTINUOUS ∴ COLLECTORS OK

← MAX = $\frac{16.88^K}{3.5}$ = 4.8K ← M FACTOR

Project:	Job No.:	
Description:	Date:	Sht:
	By: J.R. / Ck:	

LINE ②



← MAX FORCE = $\frac{18.37^K}{3.5} = 5.25^K$

↑ M FACTOR FOR DIAPHRAGM

→ RIMBOARDS ALONG LINE ② ARE CONTINUOUS, ∴ COLLECTORS OK.

[NOTE: RE-ENTRANT CORNERS ALONG LINES 2 & A.5 SHOULD BE CHECKED FOR STRAPPING/TIES]

LINE ③

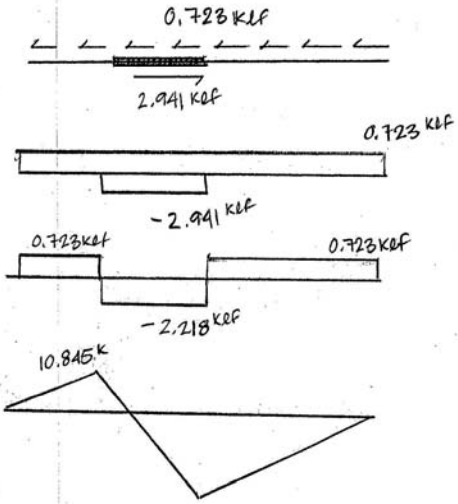
CONTINUOUS RIMBOARDS ∴ COLLECTORS OK

LINE Ⓐ

VERY FEW OPENINGS, COLLECTORS OK

Project:	Job No.:	
Description:	Date:	Sht:
	By: J.R. Ck:	

LINE (B)



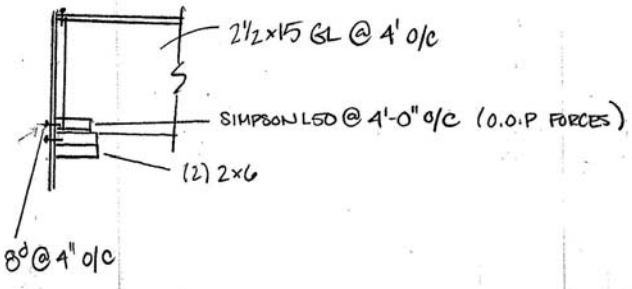
$-22.13^K \Rightarrow MAX = \frac{22.13^K}{3.5} = 6.41^K$

↖ M FACTOR FOR DIAPHRAGM

COLLECTOR DETAILING IS UNKNOWN AT LINE B. IT IS ASSUMED THAT ADEQUATE COLLECTORS WILL NEED TO BE INSTALLED IN ADDITION TO SHEAR WALL REINFORCEMENT

Project:	Job No.:	
Description:	Date:	Sht:
	By: J.R. Ck:	

WALL ANCHORAGE TO ROOF DIAPHRAGM



OUT OF PLANE ANCHORAGE

F_p = ? SDSW [4.2.5.1]

? = 0.3 (LS)

S_{DS} = 1.159

W = (19PSF x 4') + (16PSF * 13'/2) = 180 PLF

F_p = 0.3 (1.159)(180 PLF) = 62.6 PLF

F = 62.6 PLF * 4' = 250.4#

LSD CAPACITY (ASD) = 420# O.O.P. ANCHORAGE OK ✓

IN PLANE ANCHORAGE

F = 471 PLF (SEE DIAPHRAGM SHEAR CALCS)

F = 471 PLF x 4"/12"/1 = 157#

NAIL SHEAR CAPACITY = 65# * 1.6 = 104# < 157# NG.

NEEDS ADDITIONAL IN PLANE ANCHORAGE AND SUGGESTED RIMBOARD CLIPS TO RESIST IN PLANE LOADING

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

OVERTURNING - TIER 1 CALC

$\frac{\text{BASE}}{\text{HEIGHT}} = \frac{46'}{13'} = 3.54 > 0.6S_a$ ✓ OK

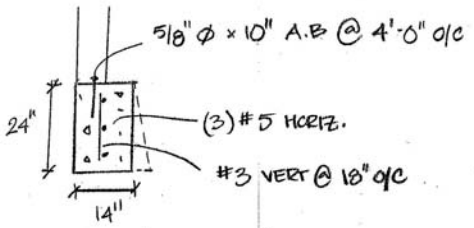
$0.6S_a = 0.6(1.85) = 1.11$

Project:	Job No.:	
Description: 1981 ADDITION	Date:	Sht:
	By: J.R. Ck:	

FOUNDATION

TYP. ALONG EXTERIOR

$f_c' = 2500$ psi



$DL = (160PSF * 12') + (20PSF * 46'/2) + (19PSF * 4') = 728$ PLF
(WALLS) (ROOF) (OVERHANG)

ROOF LL = $20PSF * 46'/2 = 460$ PLF

A.B. SHEAR CHECK

LARGEST SHEAR FROM SHEAR WALL = $\frac{44.12^K}{15'} = 2.94$ klf

5/8" ϕ @ 4'-0" o/c

$V_u = 2.94^{klf} * 4' = 11.76^K \rightarrow Q_{UF} = \frac{11.76^K}{1.3} = 9.05^K$

↖ C FACTOR TABLE 3-A (FORCE CONTROLLED)

PER ACI 318-05

NOMINAL SHEAR STRENGTH OF ANCHOR IN SHEAR = V_{SA}

$V_{SA} = n 0.6 A_{se} f_{uta}$

n = 1 A.B.

$A_{se} = \frac{\pi}{4}\left(d_o - \frac{.9743}{n_t}\right)^2 = \frac{\pi}{4}\left(5/8 - \frac{.9743}{11}\right)^2 = 0.23in^2$

$f_{uta} = 60$ ksi

$\phi V_{SA} = 0.65(1)(0.6)(.23in^2)(60ksi) = 5.38^K < V_u$ NG ∇

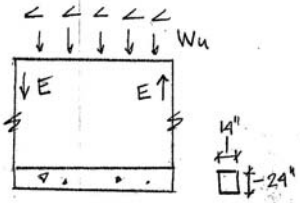
→ ADDITIONAL A.B. REINF. REQ'D AT NORTH FACE OF BLDG

SURROUNDING WALLS $V_{u\,MAX} = 19.825^K/12.83' = 1.55$ klf $* 4'$
$= 6.2^K/1.3 = 4.77^K < \phi V_{SA}$ ✓ OK

Project:	Job No.:	
Description:	Date:	Sht:
	By: J.R. Ck:	

FOUNDATION CONT'D

- CHECK BEARING FROM GRAVITY LOADS



$W_u = 1.2D + 0.5L_r$
$= 1.2(728\ PLF) + 0.5(460\ PLF)$
$= 1104\ PLF$ (CONC. STRENGTH DESIGN)

$E_{MAX} = \frac{44.12^K \times 12'}{15'}$
$= 35.3^K$

GRADE BEAM
BEARING AREA (PER FOOT) $= 14" \times 12" = 168\ in^2$

$q_a' = 2000\ psi$ (ASSUMED, NO SOILS REPORT INFO AVAIL)

$A_{req'd}\ (PER\ FT) = \frac{D+E}{1.33 q_a} = \frac{.728^K + 35.3^K}{1.33 \times 20ksi} = 13.541\ in^2 < 168\ in^2$

✓ SOIL BEARING OK

OVERTURNING CHECKED IN TIER 1 CALCULATION ATTACHED & WAS FOUND TO BE COMPLIANT. THEREFORE NO CONCERN ABOUT UPLIFT OR NEGATIVE SOIL BEARING PRESSURE

APPENDIX E

Site Mapped Spectral Accelerations

Conterminous 48 States
2003 NEHRP Seismic Design Provisions
Latitude = 37.4629
Longitude = -122.1957
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 ,Fv = 1.0
Data are based on a 0.01 deg grid spacing

Period (sec)	Sa (g)
0.2	1.738 (Ss, Site Class B)
1.0	0.789 (S1, Site Class B)

Conterminous 48 States
2003 NEHRP Seismic Design Provisions
Latitude = 37.4629
Longitude = -122.1957
Spectral Response Accelerations SMs and SM1
SMs = Fa x Ss and SM1 = Fv x S1
Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)
0.2	1.738 (SMs, Site Class D)
1.0	1.183 (SM1, Site Class D)

Conterminous 48 States
2003 NEHRP Seismic Design Provisions
Latitude = 37.4629
Longitude = -122.1957
Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)
0.2	1.159 (SDs, Site Class D)
1.0	0.789 (SD1, Site Class D)

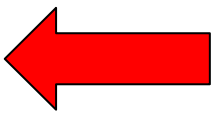


Figure E1- Mapped Spectral Accelerations (Site Adjusted)

APPENDIX F

Cost Estimates

The Crosby Group

Projec Atherton Library	Date: 2/09		Sht:
Description: Seismic Upgrade	By: DPN	Ck: DPN	

Cost Estimate

Item	*Description*	*Quantity*	*Units*	*Unit price*	*Total price*	*Remarks*
1	New Shear Walls	110	LF	$100.00	$11,000.00	
2	Chord & Collector Upgrade	360	LF	$30.00	$10,800.00	
3	Wood Sill Connections	360	LF	$20.00	$7,200.00	
4	Diaphragm upgrade incl part. Reroof.	4100	SQFT	$28.00	$114,800.00	
5	Roof Tile Anchorage	1440	SQFT	$10.00	$14,400.00	
6	Entrance Canopy Anchorage	1	EA	$6,000.00	$6,000.00	
7	Foundation work	360	LF	$60.00	$21,600.00	
8	Hard Ceiling Anchorage	1800	SQFT	$12.00	$21,600.00	
			Sub Total:		**$207,400**	
9	Overhead & General Condition			15%	$31,110.00	
			Sub Total:		**$238,510**	
10	Profit			10%	$23,851.00	
			Sub Total:		**$262,361**	
11	Engineering				$24,000.00	
12	Contingency			10%	$20,740.00	

Total Estimate: $307,101