ATTACHMENT G1

MME

CIVIL + STRUCTURAL ENGINEERING • SINCE 1987

Seismic Evaluation - Tier 1
Cupertino City Hall
10300 Torre Ave
Cupertino, California

Prepared For:
City of Cupertino

Prepared By:
MME Civil + Structural Engineering

MME Job No. 21143.P5

April 19, 2021

April 19, 2022

Susan Michael AIA, Leed AP
Capital Improvement Programs Manager
Public Works
10300 Torre Ave.
Cupertino, California 95014

Re: Cupertino City Hall Seismic Evaluation – Tier 1
MME Project No: 21143.P5

Dear Ms. Michael,

As requested, we have prepared the following building Tier 1 Seismic Evaluation report of the existing Cupertino City Hall located at 10300 Torre Ave., Cupertino, California. Our work includes a seismic evaluation of the existing building based on visual observations of the existing construction and provided documentation. We performed the seismic evaluation under the provisions of the American Society of Civil Engineers (ASCE) 41-17 Standard. We also performed a visual observation of the general condition of the exposed primary structural systems. We have relied solely on existing as-built drawings, technical specifications, and reports provided along with our visual observations of the existing building as the single source of detailed information about the structural components of the building. No removal of finishes or other data collection, such as non-destructive or destructive testing, was provided at this time. Our assessment intends to identify the seismic code conformance of the existing building.

Thank you for the opportunity to assist you with your project. Should you have any questions or comments or require further assistance, please call.

Respectfully yours,

REGISTERED PROFESSIONAL ENGINEER ROBERT RILEY No. S5991 STRUCTURAL STATE OF CALIFORNIA
Robert Riley

Robert Riley, SE
Senior Structural Engineer

REGISTERED PROFESSIONAL ENGINEER DALE A. HENDSBEE No. S3549 STRUCTURAL STATE OF CALIFORNIA
Dale A Hendsbee

Dale Hendsbee, S.E.
Principal

Table of Contents

Executive Summary

The structural deficiencies noted in this report indicate that the building is likely to sustain major damage and not be functionally operable if a significant seismic event were to occur. If damaged, timely delivery of services to the community that are provided using this building would be impacted. Additionally, occupants of the building (public and staff) are at a higher risk of injury compared against a similar occupancy in a building that did not have these deficiencies.

Based on a review of the existing design and subsequent evaluation reports, the current building is very vulnerable to seismic damage. The original design from 1965 was before vast improvements in the science of earthquake engineering was incorporated into the building codes. The extensive remodel in 1986 failed to bring the building into conformance with the improved seismic codes at that time. The building relies on concrete shear walls for lateral load resistance and a combination of concrete walls and isolated concrete columns to support the gravity loads. These elements do not have sufficient ductility to resist seismic lateral displacements without sustaining significant damage. Damage to these critical structural gravity load-resisting elements could result in collapse of the roof structure. The life safety and economic risk could be substantial.

Two scenarios of seismic strengthening have been discussed for the Cupertino City Hall, located at 10300 Torre Ave, Cupertino, CA. The two scenarios correspond to the building's possible risk category classification according to the California Building Code (CBC) table 1604.5. Scenario one is based on its current occupancy as the Emergency Operation Center (EOC) and is designated an essential facility and therefore classified as risk category IV. Scenario two is a reduced risk category of the building where the EOC would be removed and relocated to a different location. This risk category II is similar to the category that is typically used for offices.

We used the ASCE 41-17 Standard for Seismic Evaluation and Retrofit of Existing Buildings, Tier 1 Evaluation in conjunction with the review of previous reports, original 1965 plans, and retrofit 1986 plans to develop the following structural findings and recommendations for improvement.

For our Tier 1 Evaluation, we have included the heavy clay tile roofing in our calculations for the weight of the building. One area that would help reduce seismic loads and therefore strengthening would be to remove and replace the clay tile with a lighter roofing type.

We found that the building does not comply with either the risk category IV or II evaluation criteria unless a seismic strengthening is undertaken. Our findings are similar to the findings in the previous reports. Based on these findings, we recommend that a Tier 2 Deficiency Based Evaluation be performed to investigate a number of these deficiencies to see if any can be waived and to provide a basis for the detailed design of the remediation work. After completion of the Tier 2 evaluation, any remaining deficiencies identified should be retrofitted. We have separated the structural deficiencies into two groups. Group One are items that in our opinion would not benefit from a Tier 2 evaluation. Group Two are items that may benefit from Tier 2 evaluation.

Structural – Scenario 1 Risk Category IV - Immediate Occupancy
This list is a combination of both our Tier 1 Evaluation and the deficiencies that other reports have identified. The structural deficiencies that have been identified are:

Group One – Unlikely that a Tier 2 evaluation would remove the need to upgrade

1. Roof Diaphragm Shear Capacity
2. Roof Diaphragm Collector Splice Capacity
3. Anchor Bolt Connections at top of Shear Walls
4. Out of Plane Connection of Veranda Beam
5. Upper Floor Concrete Shear Wall Shear Capacity
6. Upper Floor Concrete Shear Wall Flexural Capacity
7. Concrete Shear Wall Boundary Members

Group Two – A Tier 2 evaluation **may** remove the need to upgrade

8. Continuous Cross Ties at Upper Floor Shear Wall
9. Upper Floor Concrete Shear Wall Adjacent to Diaphragm Openings Concrete
10. Ground Floor Wall Reinforcing at Openings
11. Concrete Column Reinforcement for Confinement
12. Concrete Column Splices and Girder Stirrups
13. Wall Foundation Dowels Capacity

Structural – Scenario 2 Risk Category II - Collapse Prevention
This list is only the items that we identified in our Tier 1 Evaluation. It does not include items from previous reports. The reduced amount of deficiencies listed below for risk category II are primarily a reflection of the lower safety standards associated with risk category II and therefore fewer items are required to be checked in the Tier 1 Evaluation. Many of the Scenario 1 items would still be deficient in Scenario 2 if they were required to be checked. The structural deficiencies that have been identified are:

1. Upper Floor Concrete Shear Wall Shear Capacity
2. Out of Plane Connection of Veranda Beam
3. Concrete Column Splices and Girder Stirrups
4. Upper Floor Concrete Shear Wall Adjacent to Diaphragm Openings Concrete
5. Column Reinforcement for Confinement
6. Continuous Cross Ties at Upper Floor Shear Wall

Nonstructural

Nonstructural elements were not included in the scope of our Tier 1 analysis. However, several nonstructural items were noted in the previous reports and are summarized in this report for your consideration (See Appendix G).

A. Equipment anchorage capacities are unknown and would require verification and or installation of anchorage and bracing. Equipment that should be considered includes the following:
   - Emergency Generator, including isolators
   - Emergency Generator flexible connections for conduit, fuel, and coolant piping
   - Rooftop HVAC Equipment
   - Elevator Equipment
   - Electrical Transformers, Panels, Switchgear, Cabinets, etc.
   - Suspended Light Fixtures
   - Ductwork and Piping Supports and Bracing
   - Electrical Conduits, Trapezes, Banks, and Trays
   - Fire Sprinkler Piping
   - Accessibility

B. Anchorage and bracing for the existing suspended ceilings and interior partitions

C. Exterior cladding and glazing system

D. Deteriorated veranda fascia on the south elevation

Seismic strengthening noted in our report is not typically required by the CBC unless certain changes are proposed for the building. These changes include occupancy changes, renovations, additions, and loading changes. Our understanding is that none of these changes is being considered at this time. Barring a City of Cupertino requirement that is more rigorous than the CBC, the proposed strengthening that has been recommended is considered voluntary. Scenario 2 could be a change in occupancy and may trigger these nonstructural improvements.

Geotechnical

No geotechnical report has been provided for our review. Foundation improvements may be required and if this is the case, we recommend obtaining a report by a licensed geotechnical engineer.

For our Tier 1 evaluation, we used the City of Cupertino GIS Property Information web-based application to identify Geologic Hazards. For the City Hall location, there are no mapped Liquefaction, Fault Rupture, or Slope Instability issues at this site (Appendix B).

Introduction

The purpose of this evaluation is to review and evaluate the structural systems of the subject building using criteria provided by ASCE 41-17. Because this building has been structurally evaluated several times in the last 10 years, we were able to use the ASCE 41 evaluation to corroborate previous findings. In areas where the previous evaluations were more in-depth than our evaluation, we have reviewed their findings and included them as part of the recommendations. The ASCE 41 evaluation criteria have been tailored for specific building types and desired levels of building performance. This standard provides a means to identify general deficiencies based on the anticipated behavior of specific building types.

The evaluation begins with a Screening Phase (Tier 1) to assess primary components and connections in the seismic force-resisting system using standard checklists and simplified structural calculations. If the element is compliant, it is anticipated to perform adequately under seismic loading without additional review or strengthening. Items indicated as non-compliant in a Tier 1 checklist are considered potential deficiencies that require further analysis.

A limited, deficiency-based Evaluation Phase (Tier 2) can then be used to review in more detail the items determined to be potential deficiencies by Tier 1 checklists and simplified calculations. Non-compliant items are evaluated for calculated linear seismic demand as determined by ASCE 41-17. If the elements are compliant per Tier 2 analysis, the Tier 1 deficiency is waived. However, if the element remains non-compliant after the more detailed Tier 2 analysis, repair or remediation of the deficiency is recommended.

Evaluation Overview

This seismic evaluation report for the existing building located at 10300 Torre Ave, Cupertino, CA, is based on the following:

- The American Society of Civil Engineers/ Structural Engineering Institute (ASCE/SEI 41-17) Standard for Seismic Evaluation and Retrofit of Existing Buildings - Tier 1, Immediate Occupancy and Collapse Prevention level structural evaluation criteria, including:
  - Checklists
  - Analysis
- One site visit for a general review of the structure was performed on August 08, 2021. No destructive testing or removal of finishes was performed or included in the scope.
- Review of the following original drawings dated October 01, 1965
  - Architectural plans (Partial) prepared by Wilfred E. Blessing F.A.I.A & Associates

  - Structural plans and calculations prepared by Kirk C. McFarland Structural Engineer
- Review of the Civic Center Improvement plans dated December 18, 1986
  - Architectural plans prepared by Holland, East & Duvivier
  - Structural plans prepared by CYGNA Consulting Engineers
- Existing material properties as indicated on sheet S10 of the 1965 structural plans. Properties are included in Appendix C.
- Review of the following reports and evaluations:
  - City Hall Seismic Report" by AKH Structural Engineers, 2006
  - "Report of Results from Structural Analysis and Evaluation of Existing Cupertino City Hall" by AKH Structural Engineers, 2011
  - "Final Cupertino ESF Analysis Rev 1", Multiple Project Participants, 2012
  - "Cupertino City Hall Alternates Study Structural Evaluation" by Tipping Mar, 2014
- No Geotechnical Report was available at the time this report was written. Sheet S10 of the original construction documents indicates that soil design information used in the design is from a soils report.
- Seismic review of non-structural elements is not included as part of our Tier 1 evaluation.

Structure Overview

General Site Description

The building is located on a relatively flat lot on the NW corner of Torre Avenue and Rodrigues Avenue in the City of Cupertino.

Structural Performance Objective

Per ASCE 41-17, a structural performance objective consists of a target performance level for structural elements in combination with a specific seismic hazard level. For the seismic assessment of the subject building, two Basic Performance Objective for Existing Buildings (BPOE) were selected.

Scenario 1:

The City Hall building is currently considered an "Essential Facility" by the City of Cupertino based on upgrades in 1986. This is a Risk Category IV as defined by ASCE 7:

> *ESSENTIAL FACILITIES: Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow, or earthquakes.*

For the Tier 1 review to the BPOE, the specified level of performance is Immediate Occupancy (1-B) at the BSE-1E seismic hazard level and Life Safety (3-D) at the BSE-2E seismic hazard level.

The Immediate Occupancy Performance Level as described by ASCE/SEI 41-17 is made up of two parts: the structural performance level and non-structural performance level. The number "1" designates the structural performance level defined as:

Structural Performance Level S-1, Immediate Occupancy, is defined as the post-earthquake damage state in which a structure remains safe to occupy and essentially retains its pre-earthquake strength and stiffness.

The letter designation "B" in the BPOE indicates the nonstructural performance level and is defined as:

Position Retention Nonstructural Performance Level (N-B). Nonstructural Performance Level N-B, Position Retention, is the post-earthquake damage state in which nonstructural components might be damaged to the extent that they cannot immediately function but are secured in place so that damage caused by falling, toppling, or breaking of utility connections is avoided. Building access and Life Safety Systems, including doors, stairways, elevators, emergency lighting, fire alarms, and fire suppression systems, generally remain available and operable, provided that power and utility services are available.

The Life Safety Performance Level as described by ASCE/SEI 41-17 is defined as:

Structural Performance Level S-3, Life Safety, is defined as the post-earthquake damage state in which a structure has damaged components but retains a margin of safety against the onset of partial or total collapse.

The letter designation "D" in the BPOE is defined as:

Hazards Reduced Nonstructural Performance Level (N-D). Nonstructural Performance Level N-D, Hazards Reduced, shall be defined as the post-earthquake damage state in which nonstructural components are damaged and could potentially create falling hazards, but high hazard nonstructural components identified in Chapter 13, Table 13-1, are secured to prevent falling into areas of public assembly or those falling hazards from those components could pose a risk to life safety for many people. Preservation of egress, protection of fire suppression systems, and similar life-safety issues are not addressed in this Nonstructural Performance Level.

Scenario 2:

To reduce the amount of strengthening required the City Hall building could be converted back to an occupancy that is typical for an office building. The primary function that would have to be removed is the EOC. The building could be considered a Risk Category II as defined by ASCE 7:

All buildings and other structures except those listed in Risk Categories I, III, and IV.

For the Tier 1 review to the BPOE, the specified level of performance is Collapse Prevention (5-D) at the BSE-2E seismic hazard level. ASCE/SEI 41-17 defines Collapse Prevention as:

Structural Performance Level S-5, Collapse Prevention, is defined as the post-earthquake damage state in which a structure has damaged components and continues to support gravity loads but retains no margin against collapse.

The letter designation "D" in the BPOE is defined above in Scenario 1

A Tier 1 evaluation of nonstructural elements was not included within the scope of this review.

<u>Site Seismicity</u>
Per ASCE 41-17, 'seismicity', or the potential for ground motion, is classified into regions defined as Low, Moderate, or High. These regions are based upon mapped site accelerations Ss and S1 which are then modified by site coefficients Fa and Fv to produce the Design Spectral Accelerations, SDS (short period), and SD1 (1-second period).

At the time of this report, no geotechnical investigation or report has been provided for the subject site. The soil profile of this building is therefore assumed the default and classified as Site Class D per ASCE 41-17 for use in the determination of site coefficients Fa and Fv.

Per the site values indicated by USGS data and evaluated using seismic acceleration equations and tables of ASCE 41-17, the site is located in a region of High Seismicity with a design short-period spectral response acceleration parameter (SDS) of 1.589g and a design spectral response acceleration parameter at a one-second period (SD1) of 0.623g. See Summary Data Sheet in Appendix D.

The spectral response parameters SS and S1 were obtained for the BSE-1E seismic hazard level for existing structures (BPOE). The acceleration values were adjusted for the maximum direction and site class per ASCE 41-17 Section 2.4.1, and compared to BSE-1N (used by current building code for design of new buildings) to determine the design values for the Tier 1 analysis, since values obtained for the BSE-1E hazard level need not exceed the hazard levels for new construction.

The successful performance of buildings in areas of high seismicity depends on a combination of strength, ductility of structural components, and the presence of a fully interconnected, balanced, and complete seismic force-resisting system.

General

Original 1965 Construction: The original building was a one-story structure above grade with a basement below grade. A 1985 remodel opened one side of the basement, introduced openings in the north basement wall, and created an elevated veranda slab on the north side of the building (Photo 1). These changes created a 2 story building. The building is generally rectangular in plan, with the long side oriented in the east-west direction. The building footprint including the roofed veranda is approximately 136 feet by 112 feet. The interior space is 120 feet by 96 feet and the two floors have a combined area of approximately 23,040 square feet.

The 1st floor is a reinforced elevated concrete slab, supported by concrete joists, beams, and columns. The structural floor from the 1965 drawings is shown in Figure 1. A Structural floor-framing plan of the 1st floor remodel from the 1986 plans is shown in Figure 2.

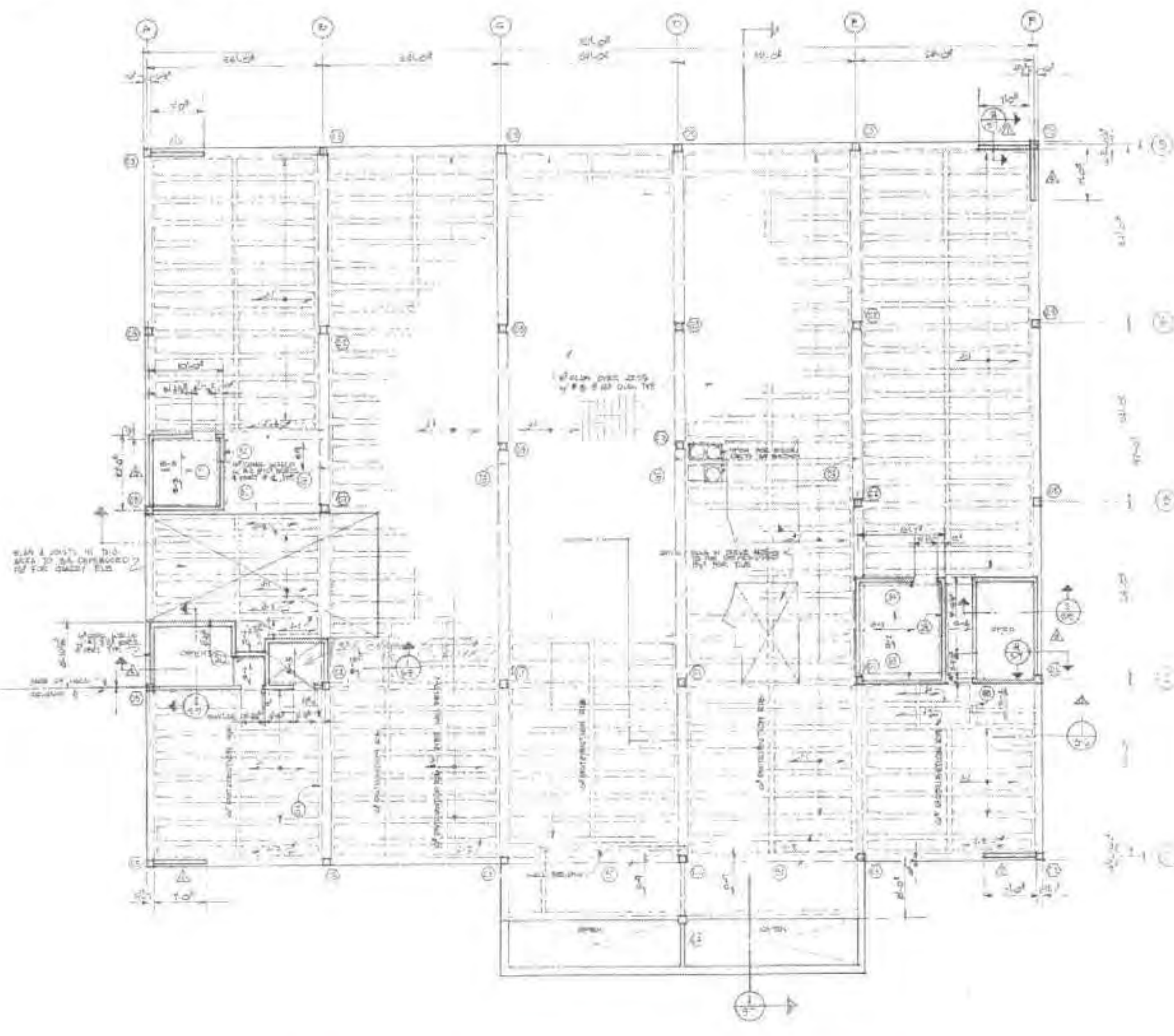


Figure 1 1st Floor Framing Plan, 1965 Structural Drawings

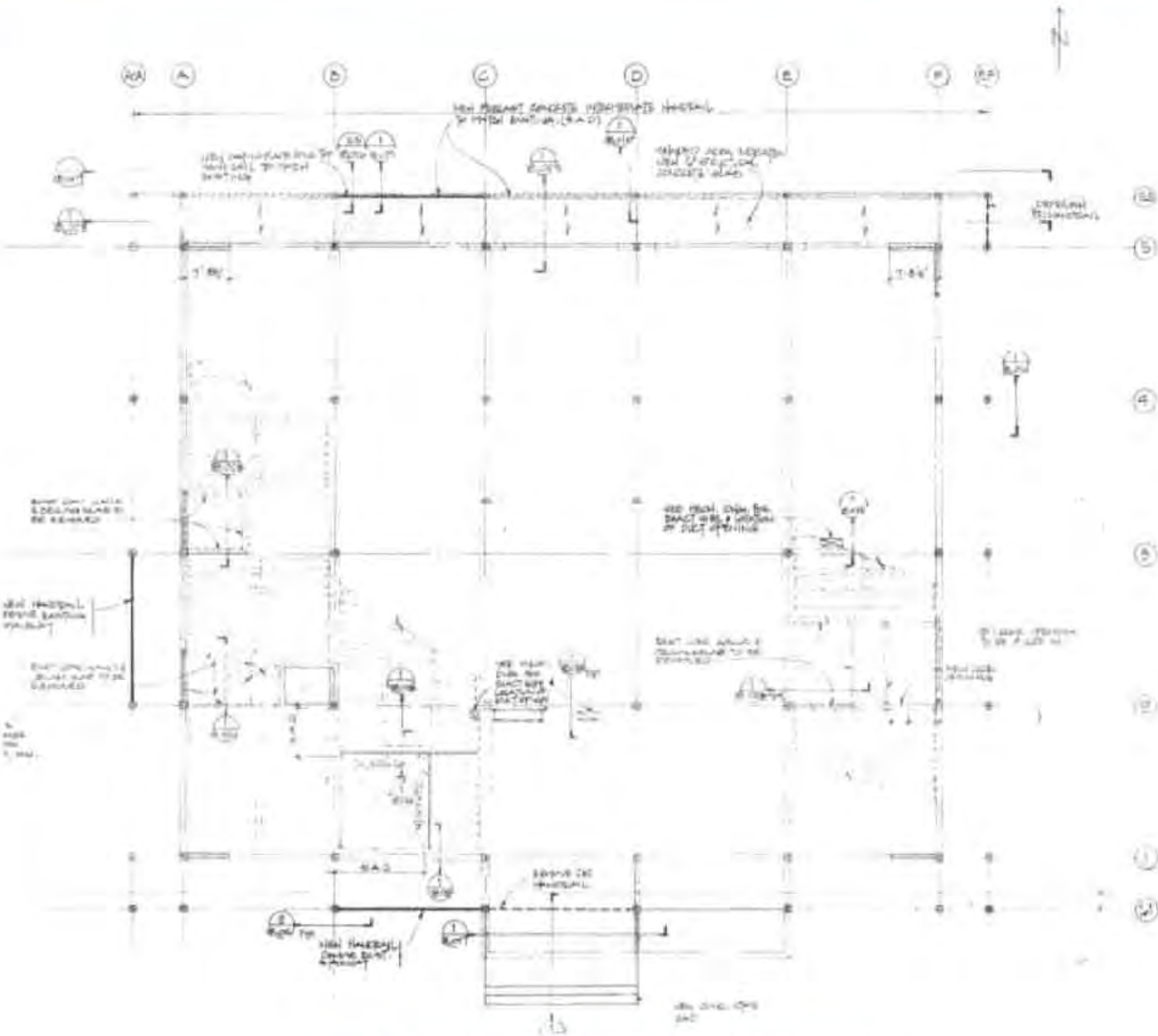


Figure 2 1st Floor Framing Plan, 1986 Structural Drawings

The roof is a mansard type with the lower hip portion having two slopes and the center portion being essentially flat. The hipped lower portion is framed with wood girders at 6' on center, T&G decking overlaid with ½" plywood. The upper flat portion has rafters at 16" on center typical and sheathed with ½" plywood. Rafters and girders are supported by bearing walls, steel beams, or concrete beams. (Figure 3). The sloping roof and mansard are clay tile.

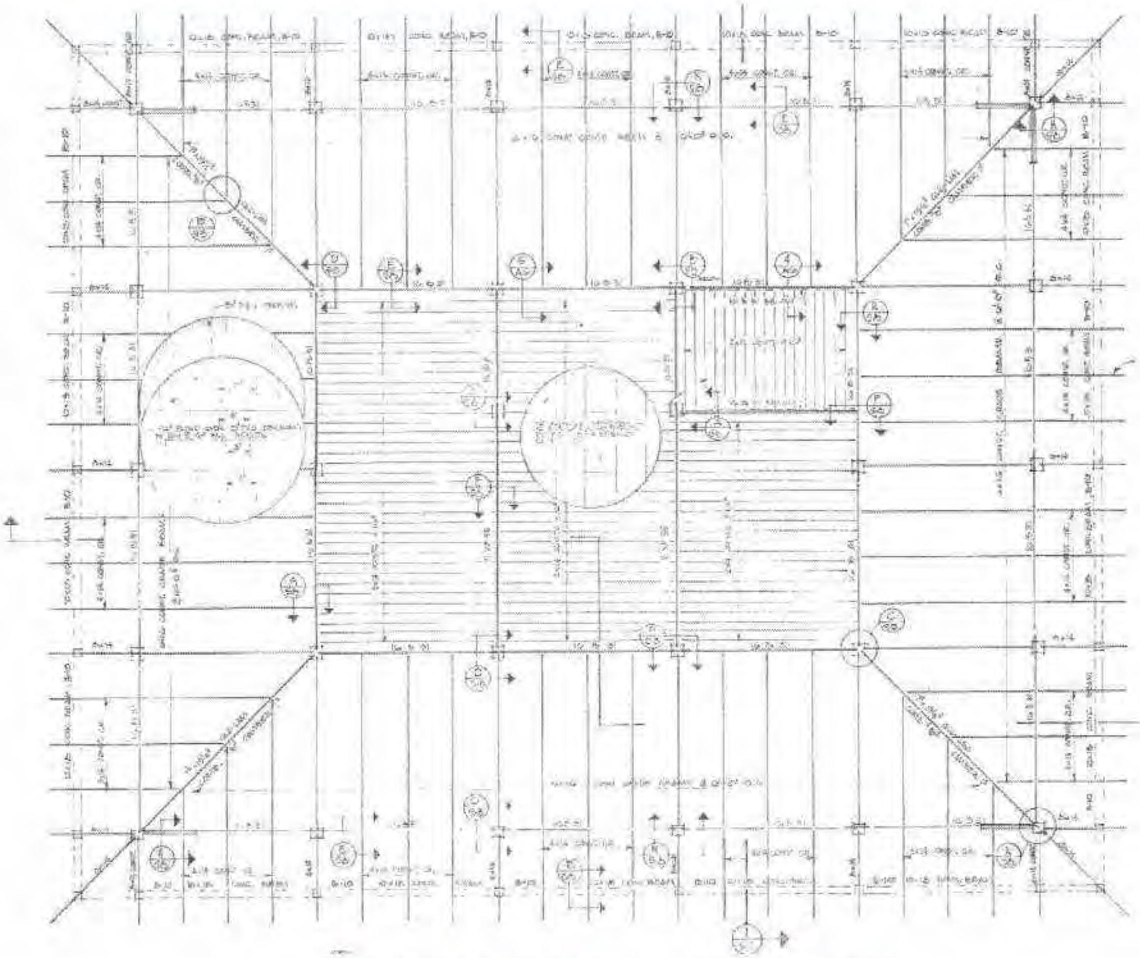


Figure 3 Roof Framing Plan, 1965 Structural Drawings

A full building section from the 1965 drawings is shown in Figure 4.

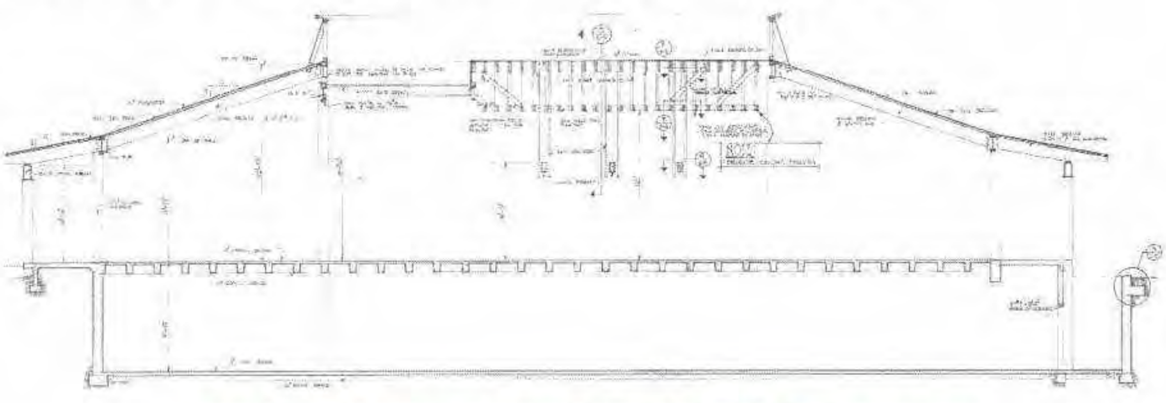


Figure 4 - Full Building Longitudinal Section from 1965 Structural Drawings

Walls

Ground floor/basement walls are reinforced concrete. Walls above the 1st floor elevated slab consist of relatively short shear concrete walls with wood-framed infill walls between the shear walls. Columns supporting beams are typically 12" square reinforced concrete.

Seismic Force-Resisting System

The lateral system of the building is reinforced concrete shear walls. The below-grade perimeter walls in the original plans were 12" thick with a single layer of vertical #6s at 12" and horizontal #5s at 10". The 1986 remodel opened up the northern perimeter basement wall and added reinforcing and 6" to the thickness of the walls (Figure 5).

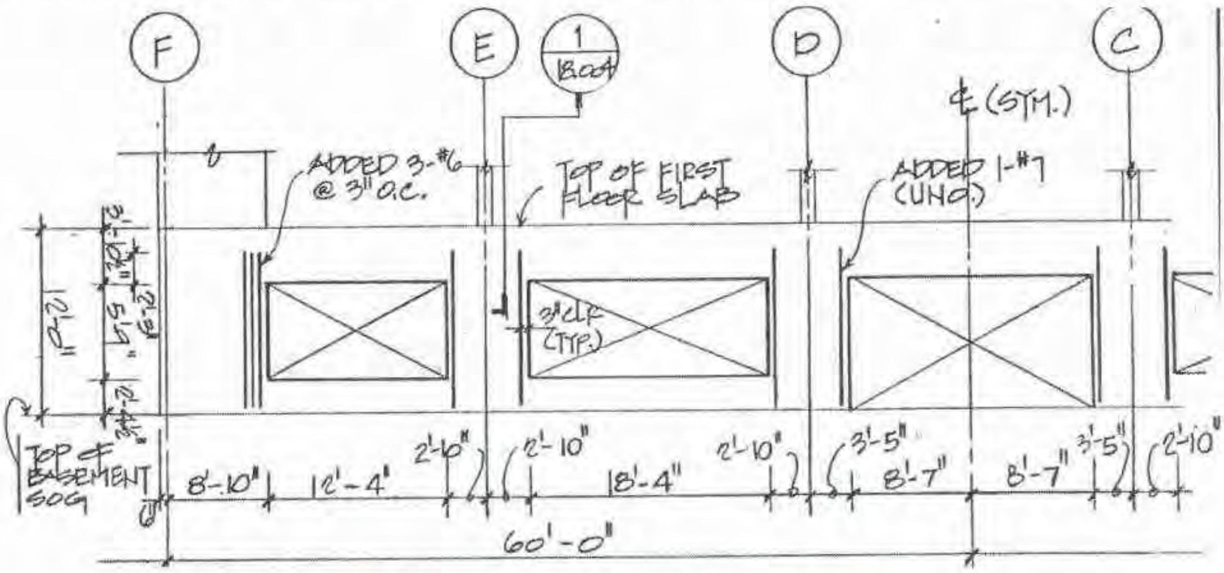


Figure 5 North Wall Elevation 1986 Structural Drawings

The first-floor shear walls are 6" thick reinforced concrete walls and are shown in red in Figure 6 from the 1965 1st Floor Framing Plan. The walls reinforcing and the top of wall anchor bolts are specified in the table shown in Figure 7.

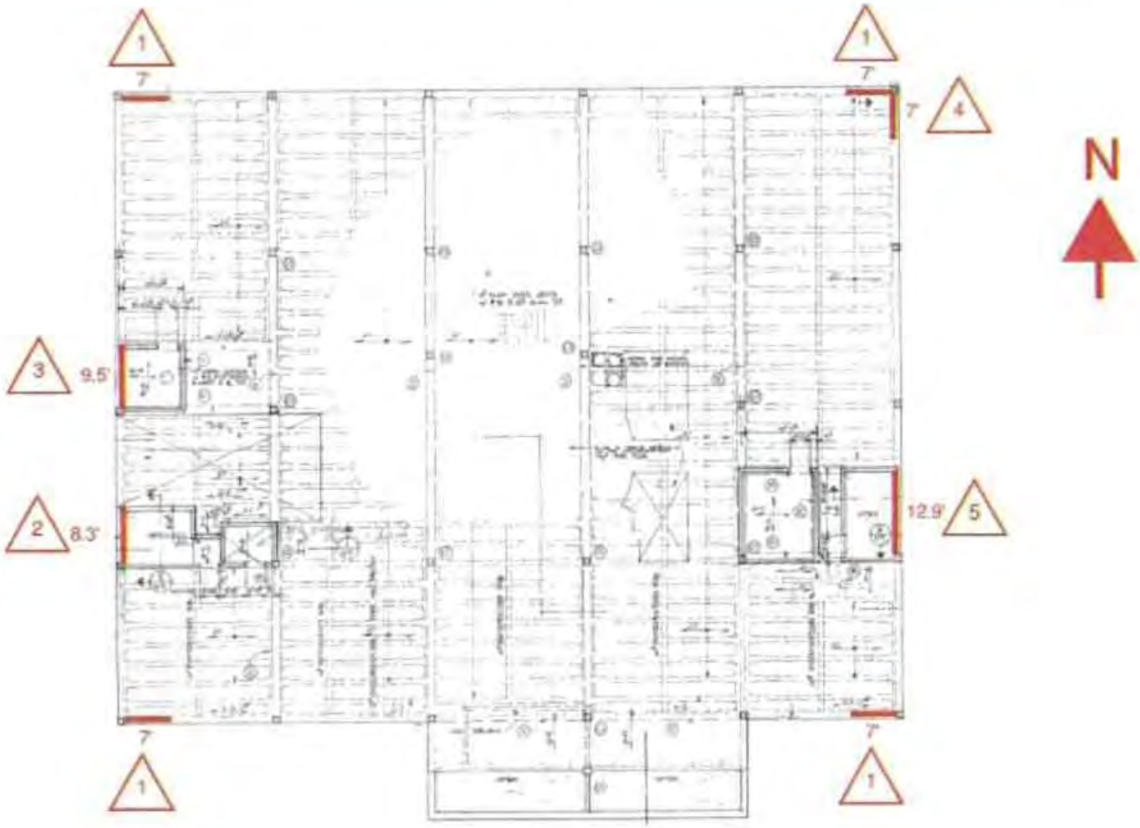


Figure 6 Shear walls from 1965 Structural Plans

SHEAR WALL SCHEDULE

MARK	WALL THICKNESS	A.B. & B3! TO WALL AMOUNT	A.B. & B3! TO WALL SIZE	REBAR EA. END OF WALL AMOUNT	REBAR EA. END OF WALL SIZE	REMARKS
1	6"	7	7/8" φ x 12"	2	#8	TYP. WALL STEEL #4 @ 12" EA. WAY
2	6"	6	7/8" φ x 12"	1	#9	DO.
3	6"	8	7/8" φ x 12"	1	#10	DO.
4	6"	4	7/8" φ x 12"	1	#9	DO.
5	6"	10	7/8" φ x 12"	2	#8	DO.

NOTE:
REBAR @ EACH END OF WALL SHALL BE FULL HEIGHT w/ NO SPLICE @ TOP OF FOUNDATION. PROVIDE #5 DOWELS @ 6" FROM FOUNDATION FOR ENTIRE LENGTH OF WALL.

Figure 7 Shear wall Schedule from 1965 Structural Plans

Foundations

Foundations are generally shallow spread reinforced concrete interior columns and continuous concrete footings at the perimeter. A slab on grade is present over the entire footprint of the building.

Field Verification and Condition Assessment

A visual assessment was performed on August 08, 2021, by MME. The exterior and interior of the structure were observed; the interior review included a walkthrough of the ground and 1st floor.

The structure appeared to be in generally good structural condition with minimal structural damage or deterioration apparent (except as noted below) and appears to be constructed in general accordance with the provided structural drawings.

The veranda fascia on the south elevation has significant wood deterioration, Photo 4. The extent of the deterioration and if it affects the structural members should be investigated during the Tier 2 evaluation.

The veranda slab at the southwest corner has a significant crack and spalling adjacent to the building corner column, Photo 5. The most likely reason is the differential settlement between the building and the slab on grade.

Material Properties

Basic properties for existing structural materials were found on the existing building documentation or per ASCE 41 code prescribed minimum structural values utilized in the analysis calculations can be found in Appendix C.

Building Type

Per ASCE/SEI 41-17, this building can be classified as Building Type C2: Concrete Shear Walls with Stiff Diaphragms and C2a: Concrete Shear Walls with Flexible Diaphragms. There are no interior structural walls, but there are interior concrete columns on a grid pattern supporting the 1st floor and roof. The floor is a concrete slab supported on concrete joists and is classified as a stiff diaphragm. The roof framing consists of plywood sheathing over wood joists, girders, steel beams, and concrete columns. The plywood-sheathed diaphragm is classified as flexible. The foundation system consists of continuous perimeter footings and isolated interior footings. Seismic forces are resisted by concrete and wood diaphragms, and exterior concrete walls.

Historical Performance

In addition to classifying buildings by type of construction, ASCE 41 identifies 'Benchmark Buildings' for each building type. The detailing of seismic force-resisting systems in Benchmark Buildings is generally considered to meet the performance requirements of ASCE 41. A building can be determined to be compliant with the

Benchmark Building requirements after a thorough review of the existing building plans, field verification of construction, and a condition assessment. The evaluation of non-structural elements is still required.

For building types C2 and C2a evaluated to the Immediate Occupancy Structural and Life Safety Performance, the benchmark building code year is 2000 and 1994 respectively. Since the subject building was constructed in 1965 and remodeled in 1986, it does not meet the criteria of a Benchmark Building, and a Tier 1 analysis is required.

Findings and Recommendations

Structural

We performed the ASCE 41-17 Tier 1 Building Type Specific Checklists (Appendix D) based on two scenarios for the two different occupancies: scenario 1 - occupancy category IV and scenario 2 – occupancy category II. We found thirteen (13) and five (5) non-compliant items respectively. We have also included several non-structural non-compliant items either that were noted in previous reports or that we identified during our site visit. See Appendix D and E for retrofit details.

We have separated the structural deficiencies into two groups. The first group are items that in our opinion a Tier 2 evaluation **would not** alleviate the need for the seismic upgrade. The second group may benefit from additional analysis included in a Tier 2 evaluation.

Group One – Unlikely that a Tier 2 evaluation would remove the need to upgrade

1. Roof Diaphragm Shear Capacity: The AKH evaluation determined that the shear capacity of the roof diaphragm was over-stressed. They determined that even if the clay tile roof was removed and replaced with a lighter roofing system, the plywood nailing would need to be upgraded.
   Required for Scenario 1 – occupancy category IV
   Recommendation: The plywood nailing should be upgraded.
2. Roof Diaphragm Collector Splice Capacity: The AKH evaluation determined that the collector splices are over-stressed.
   Required for Scenario 1 – occupancy category IV
   Recommendation: The splice connections should be upgraded.
3. Anchor Bolt Connections at top of Shear Walls: The AKH evaluation and our Tier 1 quick checks determined that the anchor bolts are overstressed.
   Required for Scenario 1 – occupancy category IV
   Recommendation: The anchor bolt connections should be upgraded.

4. Out of Plane Connection of Veranda Beam: The Tier 1 evaluation determined that the connection from the veranda beam to the roof framing is inadequate for out-of-plane loads.
   Required for Scenario 1 – occupancy category IV and Scenario 2 – occupancy category II
   Recommendation: The out of plane connection at the veranda should be upgraded.
5. Upper Floor Concrete Shear Wall Shear Capacity: The Tier 1 evaluation determined that the existing shear walls are over-stressed. In addition, the AKH calculations, as well as the Tipping Mar calculations have shown that the shear walls will require additional capacity.
   Required for Scenario 1 – occupancy category IV and Scenario 2 – occupancy category II
   Recommendation: The shear walls should be upgraded. Upgrades to repair Items 6 through 10 in regards to shear wall retrofits can all be achieved at the same time.
6. Upper Floor Concrete Shear Wall Flexural Capacity: See #6 above
   Required for Scenario 1 – occupancy category IV
7. Concrete Shear Wall Boundary Members: See #6 above
   Required for Scenario 1 – occupancy category IV

<u>Group Two</u> – A Tier 2 evaluation **may** remove the need to upgrade

8. Continuous Cross Ties at Upper Floor Shear Wall: Continuous cross ties do not exist at locations of the upper floor shear walls.
   Required for Scenario 1 – occupancy category IV and Scenario 2 – occupancy category II
   Recommendation: A Tier 2 evaluation may determine that continuous cross ties for the full length of the building are not required.
9. Upper Floor Concrete Shear Wall adjacent to diaphragm openings: Several of the shear walls on the East and West elevations are adjacent to openings in the concrete floor diaphragm.
   Required for Scenario 1 – occupancy category IV and Scenario 2 – occupancy category II
   Recommendation: A Tier 2 evaluation may show that the current geometry is adequate and this does not need to be repaired.
10. Ground floor Wall Reinforcing at Openings: The 1986 remodel that created the openings in the lower level north wall placed additional vertical reinforcement at the openings but did not include horizontal reinforcement.
    Required for Scenario 1 – occupancy category IV
    Recommendation: A Tier 2 evaluation may provide relief from this requirement.

11. Concrete Column Reinforcement for Confinement: The Tier 1 evaluation and previous studies determined that there are not adequate column confinement ties around the longitudinal vertical bars.
    Required for Scenario 1 – occupancy category IV
    Recommendation: A Tier 2 evaluation may reduce some of the need for additional confinement. It is anticipated that some of the columns will still require modification to meet code requirements.
12. Concrete Column Splices and Girder Stirrups: The Tier 1 evaluation determined that the existing longitudinal bar splice lengths and the spacing of stirrups in the concrete beams at the floor level are inadequate.
    Required for Scenario 1 – occupancy category IV and Scenario 2 – occupancy category II
    Recommendation: A Tier 2 evaluation may reduce some of the need for these repairs
13. Wall Foundation Dowels: The Tier 1 evaluation identified that there are dowels into the foundation at the concrete walls. However, the capacity of the dowels needs to be verified.
    Required for Scenario 1 – occupancy category IV
    Recommendation: A Tier 2 evaluation may show that the dowels are adequate.

<u>Non-Structural</u>
We did not complete a Tier 1 evaluation of non-structural elements such as mechanical, electrical, and plumbing (MEP) anchorage and bracing. The previous reports have evaluated these items and have made recommendations for the seismic upgrade.

A. Equipment anchorage capacities are unknown and would require verification and or installation of anchorage and bracing. Equipment that should be considered includes the following:
    - Emergency Generator, including isolators
    - Emergency Generator flexible connections for conduit, fuel, and coolant piping
    - Rooftop HVAC Equipment
    - Elevator Equipment
    - Electrical Transformers, Panels, Switchgear, Cabinets, etc.
    - Suspended Light Fixtures
    - Ductwork and Piping Supports and Bracing
    - Electrical Conduits, Trapezes, Banks, and Trays
    - Fire Sprinkler Piping
B. Anchorage and bracing for the existing suspended ceilings and interior partitions

C. Exterior cladding and glazing system
D. Deteriorated veranda fascia on the south elevation
E. Accessibility

For our Tier 1 Evaluation, we have included the heavy clay tile roofing in our calculations for the weight of the building. One area that would help reduce seismic loads and therefore strengthening would be to remove and replace the clay tile with a lighter roofing type.

Reliability of Seismic Evaluations

In general, structural engineers cannot predict the exact damage to a building as a result of an earthquake. There will be a wide variation of damage from building to building due to the variations in ground motion and varying types and quality of construction. In addition, engineers cannot predict the exact ground motions of the earthquake that may strike a given building. Design and evaluation of buildings are performed using general guidelines and information from past earthquakes. Engineers and the codes used for design and evaluation have been conservative when attempting to ensure that building design meets minimum standards of Immediate Occupancy. This effort is based on science and technology as well as on observations made from actual seismic events. Building design and codes are constantly evolving to better meet performance targets. Continued research will improve predictive methods and facilitate performance-based engineering. It has been estimated that, given design ground motions, a small percent of new buildings and a slightly greater percent of retrofit buildings may fail to meet their expected performance.

This report is general and does not imply that the recommendations listed above are the only structural requirements that must be made to the existing structure to meet current code criteria.

We understand you may have questions regarding this evaluation and are available for comment and explanations. Please call with any questions you may have. Thank you for choosing MME Structural Engineers to assist you with this building seismic review.

APPENDIX A – Photographs

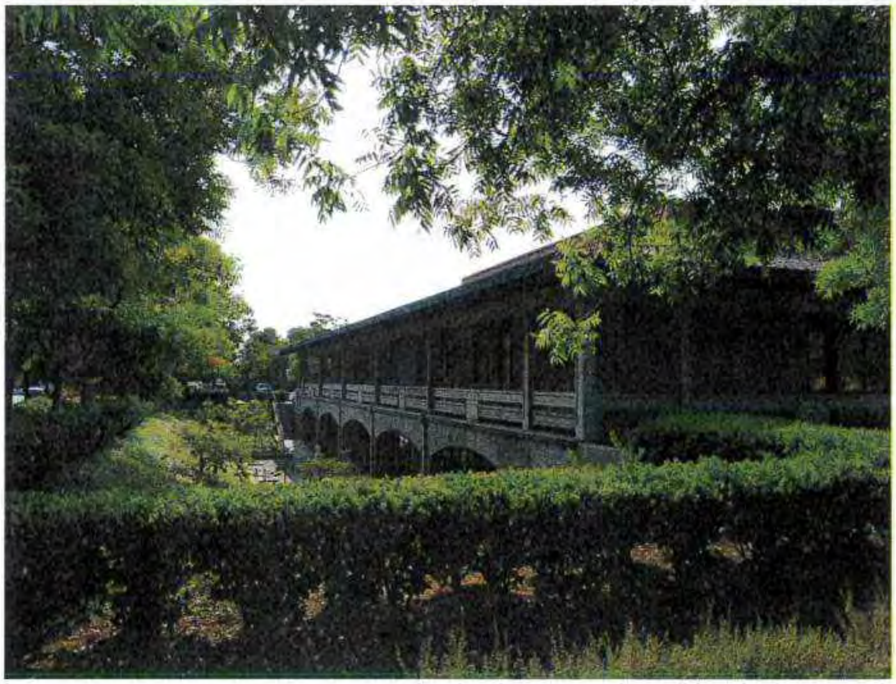


Photo 1 North Elevation with Elevated Veranda Slab

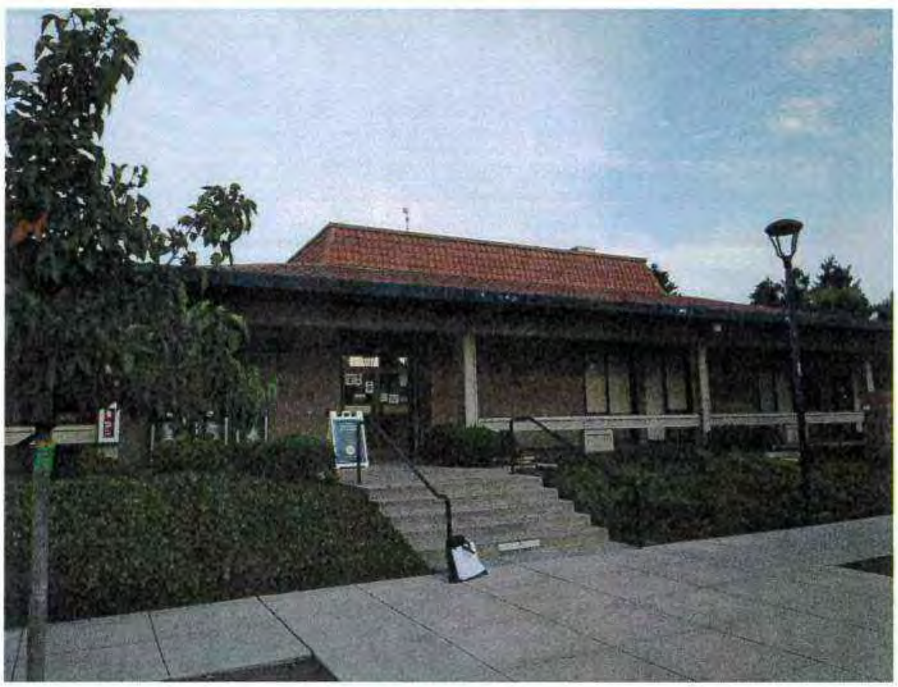


Photo e East Elevation

Photo 2 Veranda Concrete Beam

Photo 3 Damaged Veranda Fascia

Photo 4 Veranda

Photo 5 Veranda

Photo 6 Veranda Damaged Slab on Grade

APPENDIX B – Maps

Location Map

Map 1 Location Map

Geologic Hazard Map

Per the Cupertino GIS Property Information Map, shown below, the subject site is not in a Fault Rupture or Liquefaction-Inundation Zone.

Map 2 Cupertino GIS Map W/ Geologic Hazards

Since no geotechnical report is available, the default class D soil type has been assumed for this investigation.

APPENDIX C – Materials

FOUNDATIONS: The bottom of all footings shall bear on native undisturbed material at least 12" below the present grade or 18" below the rough finish grade, whichever is lower. If excess excavation is made beneath the footings, the excess excavation shall be filled with concrete of the specified mix. The design soil pressure is ---- psf dead load, ---- psf dead and live load, and ---- psf for all loads including wind and seismic. -- see soil report

BACKFILL: Prior to backfilling, concrete forms shall have been stripped and together with all debris shall have been removed from the area. Material used in backfilling shall be free of wood scraps, rubbish, debris or rubble.

CONCRETE: All foundation concrete shall have an ultimate compressive strength of not less than 2,500 psi at 28 days and shall contain not more than 6.75 gallons of water for each 94 pound sack of cement. All concrete for columns, beams, girders, slabs above grade, stairs, etc. shall have an ultimate compressive strength of not less than 3,000 psi at 28 days and shall contain not more than 6.00 gallons of water for each 94 pound sack of cement.

The minimum clear distance from the reinforcing steel to the face of the concrete shall be:

- 3" where concrete is placed against earth
- 2" where concrete is exposed to earth but placed in forms
- 2" where concrete is exposed to weather
- 1½" for beams, girders, and columns
- ¾" for slabs and walls

REINFORCING STEEL: All reinforcing steel shall be deformed intermediate Grade Billet Steel in conformance with ASTM Designations A 15 and A 305. Splices shall be lapped not less than 40 diameters and laps in adjacent bars shall be staggered where practical.

STRUCTURAL STEEL: All structural steel shall be fabricated and erected in conformance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

All Structural steel shall be shop and field painted as described in the specifications. After erection all abraided or burned spots shall be retouched.

CARPENTRY: All framing lumber except sills shall be Coast Region Douglas Fir. Sills shall be Redwood and shall be the full width of the stud. Sills (unless otherwise noted) shall be anchored to the foundation with 5/8" x 12" bolts spaced not more than 4'-0" with one bolt not more than 9" nor less than 4" from each end of each piece of sill. Where sills are bored or notched exceeding one-third of the sill width, extra bolts shall be placed each side of the hole or notch as per ends of pieces. There shall be not less than two bolts in each piece of sill. Sills for structural walls shall be bedded in 1:2 cement mortar not less than one-half inch thick.

Photo 7 Material Properties for 1965 Structural Plans

APPENDIX D - AKH Details

Retrofit Details From "Cupertino City Hall Essential Services Facility Analysis Appendix" by AKH

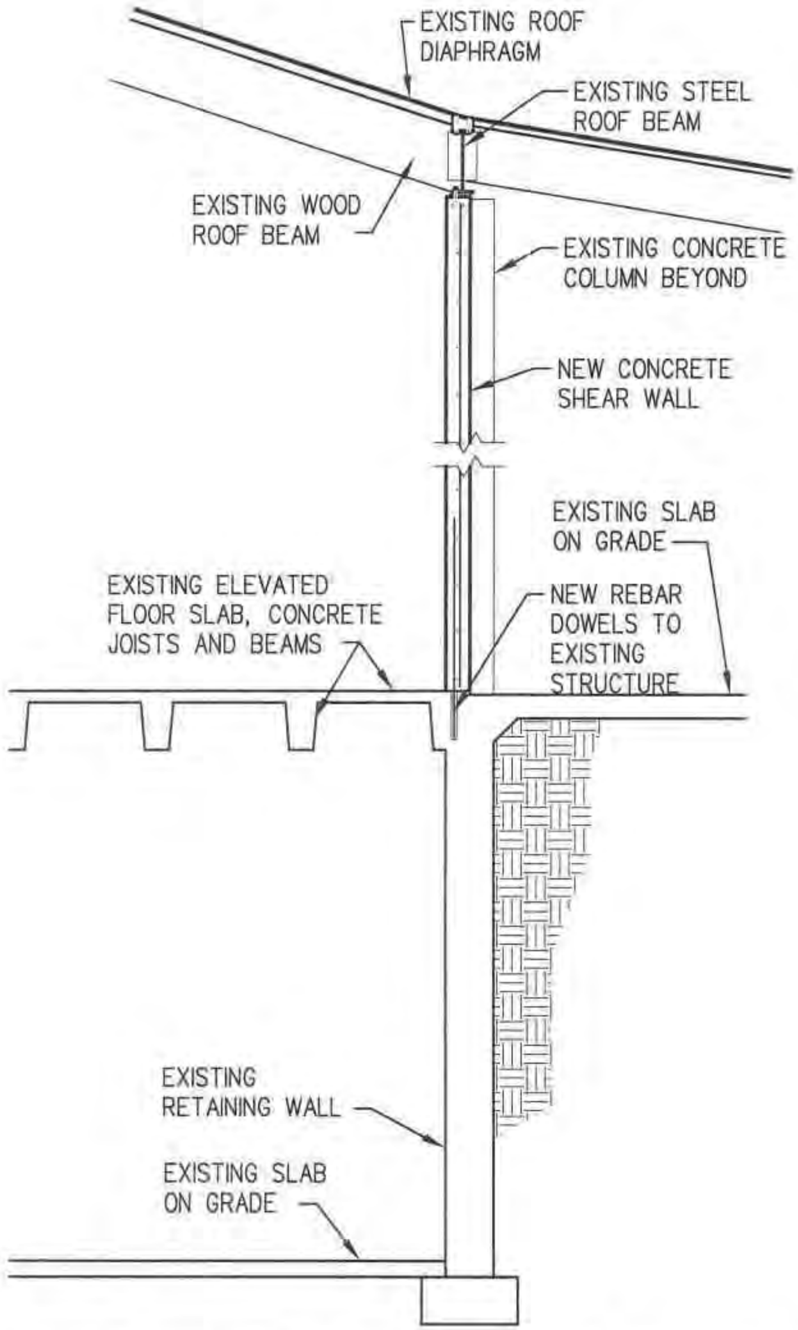


Figure 3.C: SECTION AT NEW SHEAR WALL

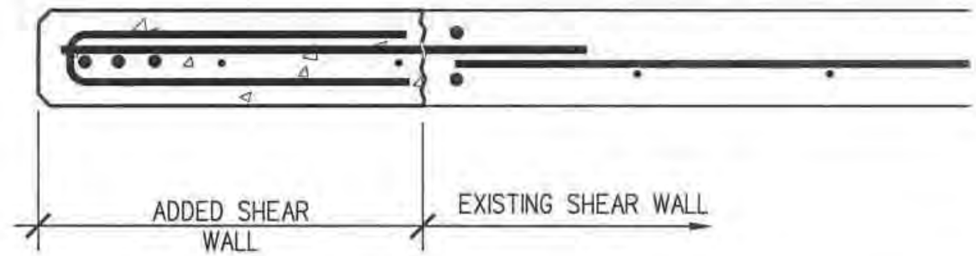


Figure 3.D: NEW SHEAR WALL AT EXIST. WALL

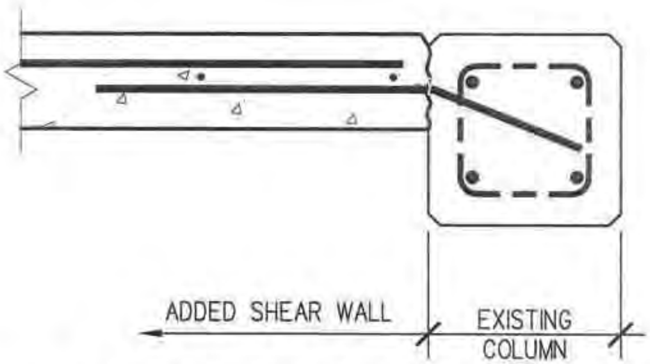


Figure 3.E: NEW SHEAR WALL AT EXIST. COL.

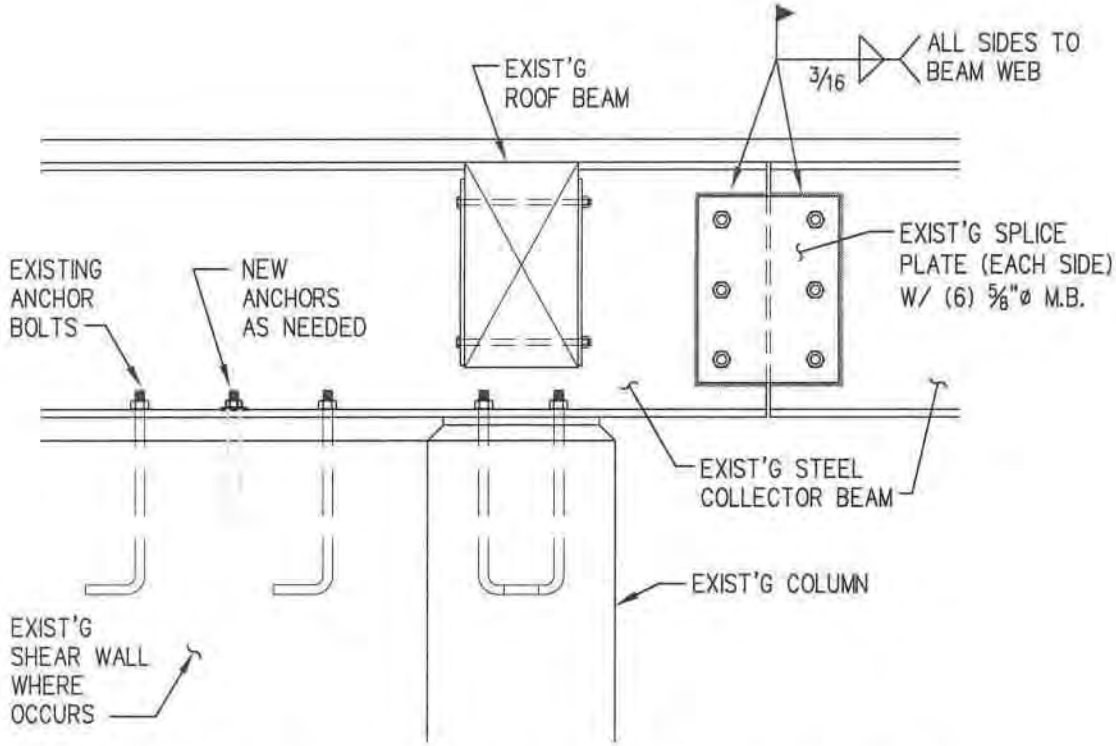


Figure 3.F: ELEVATION: EXISTING STEEL BEAM AT COLUMN AND SHEAR WALL

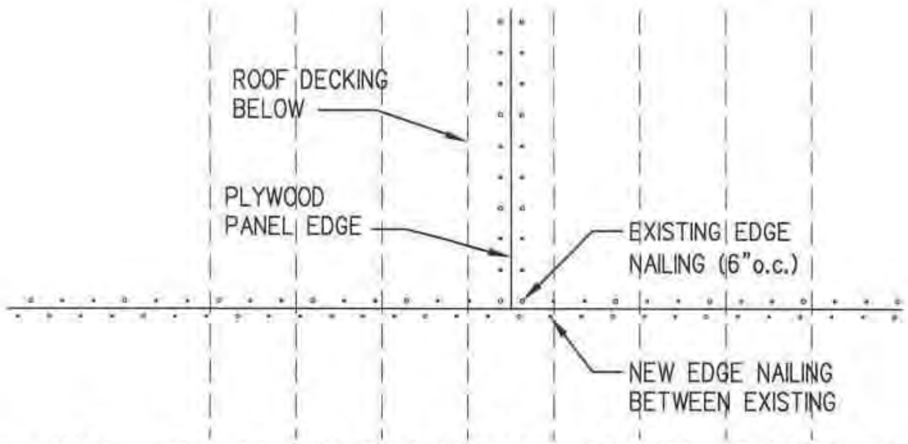
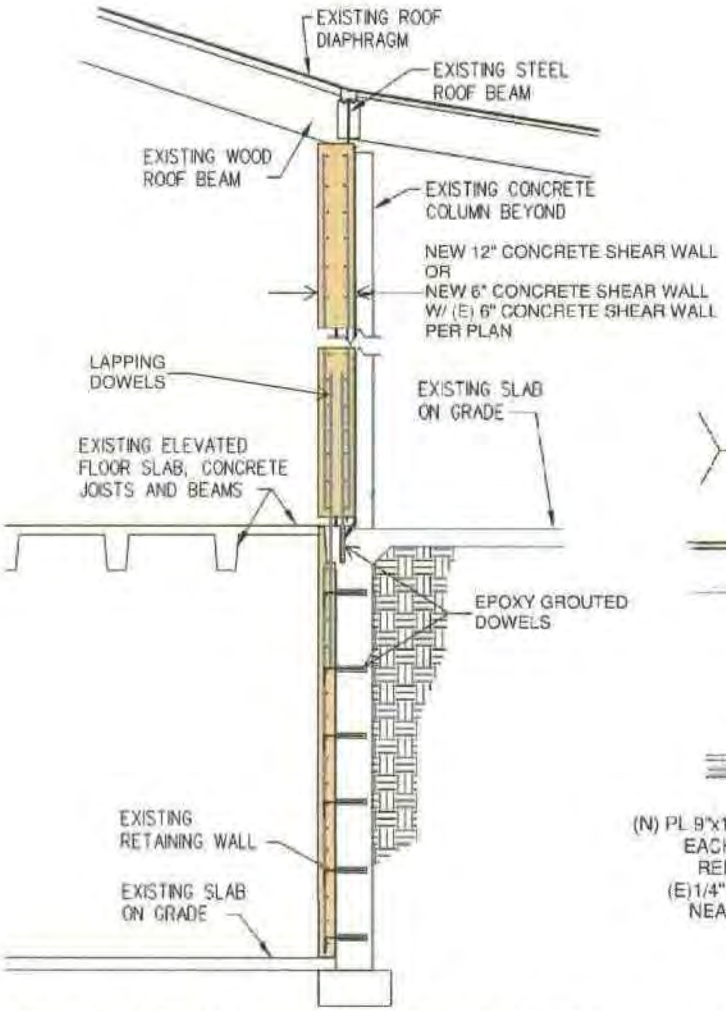


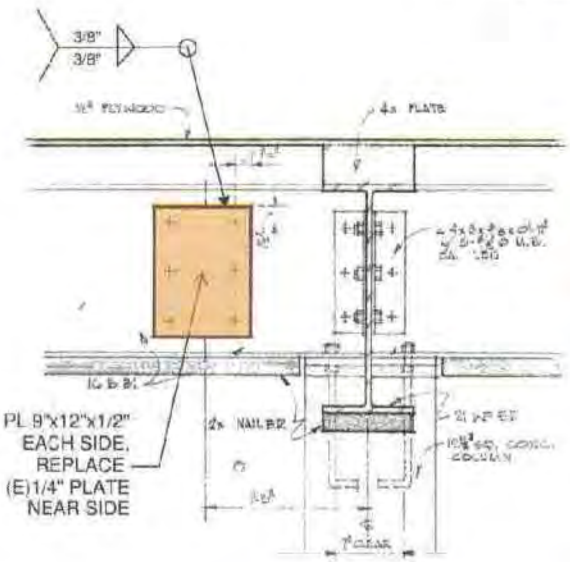
Figure 3.G: PLAN OF PLYWOOD PANEL EDGE NAILING

APPENDIX E - Tipping Mar Details

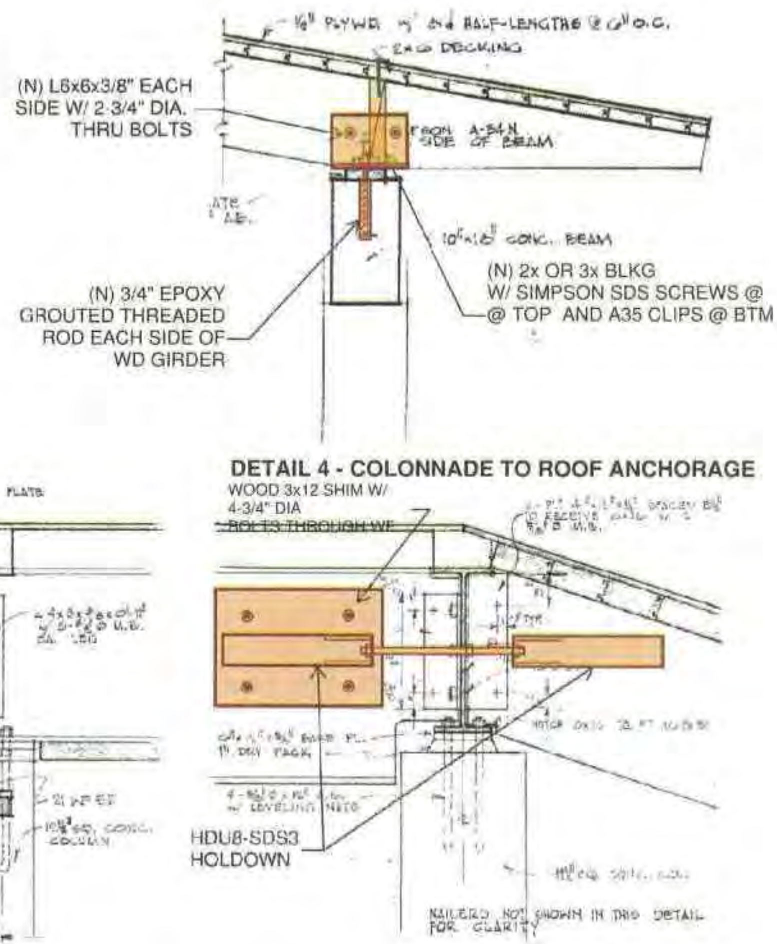
Retrofit Details From "Cupertino City Hall Essential Services Facility Analysis Appendix 11" by Tipping Mar



DETAIL 3 - SECTION AT NEW CONCRETE SHEAR WALL



DETAIL 2 - STEEL TO STEEL COLLECTOR SPLICE



DETAIL 4 - COLONNADE TO ROOF ANCHORAGE

DETAIL 1 - STEEL TO WOOD COLLECTOR CONN.

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave. Berkeley, CA 94704
510 549-1906 510 549-4912 fax

Cupertino City Hall | Option B
Cupertino, CA
TM Project: 2014,094 Scale: As Noted

Retrofit Details
September 29 2014
S3

APPENDIX F – Tier 1 Checklists

CIVIL + STRUCTURAL ENGINEERING

Project Name Cupertino City Hall
Project Number 21143.P5

Appendix C: Summary Data Sheet

BUILDING DATA

Building Name: Cupertino City Hall — Date: 10/12/2021
Building Address: 10300 Torre Ave, Cupertino, CA 95014
Latitude: 37.3188973 — Longitude: -122.0286498 — By:

Year Built: 1965 — Year(s) Remodeled: 19 — Original Design Code:
Area [ft² (m²)]: 23,040 — Length [ft (m)]: 120 — Width [ft (m)]: 96
No. of Stories: 2 — Story Height: 12'/17.1' — Total Height: 29.1

USE ☐ Industrial ☑ Office ☐ Warehouse ☐ Hospital ☐ Residential ☐ Educational ☐ Other

CONSTRUCTION DATA

Gravity Load Structural System:	Roof - Wood Framed & Floor - Concrete Slab and joists		
Exterior Transverse Walls:	Concrete Shearwalls	Openings?	Not in shearwalls
Exterior Longitudinal Walls:	Concrete Shearwalls	Openings?	Not in Shearwalls
Roof Materials/Framing:	Clay tile and built up - Wood framing		
Intermediate Floors/Framing:	Concrete Slab and joists		
Ground Floor:	Slab on Grade		
Columns:	Concrete	Foundation:	Concrete Perimeter
General Condition of Structure:	Good		
Levels Below Grade?	Ground floor is partially below grade		
Special Features and Comments:			

LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
System:	Concrete shearwall	Concrete Shearwalls
Vertical Elements:	Concrete Columns	Concrete Columns
Diaphragms:	Roof - Plywood and Floor - Concrete	Roof - Plywood and Floor - Concre
Connections:	Anchor Bolts	Anchor Bolts

EVALUATION DATA

BSE-1N Spectral Response Accelerations:	S_{DS} = 1.589	S_{D1} = .803
Soil Factors:	Class = D-Default	F_a = 1.2 F_v = 1.7
BSE-1E Spectral Response Accelerations:	S_{XS} = 1.048	S_{X1} = .623
Level of Seismicity:	High	Performance Level: Immediate Occupancy
Building Period:	T = .238	
Spectral Acceleration:	S_a = 1.048	
Modification Factor:	$C_mC_1C_2$ = 1	Building Weight: W = 3014.7
Pseudolateral Force:	$V = C_mC_1C_2S_aW$ = 3158.2	

BUILDING CLASSIFICATION: C2 Concrete Shear Walls (with Stiff Diahp) C2a (with Flexible Diaph)

REQUIRED TIER 1 CHECKLISTS	Yes	No
Basic Configuration Checklist	☑	☐
Building Type C2 Structural Checklist	☑	☐
Nonstructural Component Checklist	☐	☑

FURTHER EVALUATION REQUIREMENT: Tier 2 Deficiency Based Evaluation

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

17.1.2IO Basic Configuration Checklist

Table 17-3. Immediate Occupancy Basic Configuration Checklist

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Very Low Seismicity							
Building System—General							
C ☒	NC ☐	N/A ☐	U ☐	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	5.4.1.1	A.2.1.1	Load path exists, bu some are deficient in strength. IO checklist
C ☐	NC ☐	N/A ☒	U ☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.5% of the height of the shorter building in low seismicity, 1.0% in moderate seismicity, and 3.0% in high seismicity.	5.4.1.2	A.2.1.2	
C ☐	NC ☐	N/A ☒	U ☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure.	5.4.1.3	A.2.1.3	
Building System—Building Configuration							
C ☒	NC ☐	N/A ☐	U ☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above.	5.4.2.1	A.2.2.2	
C ☒	NC ☐	N/A ☐	U ☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above.	5.4.2.2	A.2.2.3	
C ☒	NC ☐	N/A ☐	U ☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	5.4.2.3	A.2.2.4	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
C ☒	NC ☐	N/A ☐	U ☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines.	5.4.2.4	A.2.2.5	
C ☒	NC ☐	N/A ☐	U ☐	MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered.	5.4.2.5	A.2.2.6	
C ☒	NC ☐	N/A ☐	U ☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension.	5.4.2.6	A.2.2.7	

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Low Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)							
Geologic Site Hazards							
C ☒	NC ☐	N/A ☐	U ☐	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building.	5.4.3.1	A.6.1.1	Reference: Cupertino GIS map https://gis.cupertino.org/propertyinfo/
C ☒	NC ☐	N/A ☐	U ☐	SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure.	5.4.3.1	A.6.1.2	Reference: Cupertino GIS map https://gis.cupertino.org/propertyinfo/
C ☒	NC ☐	N/A ☐	U ☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated.	5.4.3.1	A.6.1.3	Reference: Cupertino GIS map https://gis.cupertino.org/propertyinfo/

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Moderate and High Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)							
Foundation Configuration							
C ☒	NC ☐	N/A ☐	U ☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$.	5.4.3.3	A.6.2.1	
C ☐	NC ☐	N/A ☒	U ☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C.	5.4.3.4	A.6.2.2	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

17.12IO Structural Checklist for Building Types C2: Concrete Shear Walls with Stiff Diaphragms and C2a: Concrete Shear Walls with Flexible Diaphragms

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Very Low Seismicity				
Seismic-Force-Resisting System				
C NC N/A U ☐ ☐ ☒ ☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1	
C NC N/A U ☒ ☐ ☐ ☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1	
C NC N/A U ☐ ☒ ☐ ☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1	The shear walls supporting the roof are significantly overstressed
C NC N/A U ☒ ☐ ☐ ☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2	
Connections				
C NC N/A U ☐ ☐ ☐ ☒	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1	Some portions of connection and ability transfer loads will require additional investigation in Tier 2. Wall anchorage at veranda is undersized and requires repair
C NC N/A U ☐ ☐ ☐ ☒	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1	Diaphragms are connected to the shear-walls. Some portions of connection and ability transfer loads will require additional investigation in Tier 2.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
C ☐ NC ☐ N/A ☐ U ☒	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5	Walls are doweled into the foundations. Additional capacity checks required in Tier 2
Foundation System				
C ☐ NC ☐ N/A ☒ U ☐	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3	
C ☐ NC ☐ N/A ☒ U ☐	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4	

Status	**Evaluation Statement**	**Tier 2 Reference**	**Commentary Reference**	**Comments**
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)				
Seismic-Force-Resisting System				
C ☐ NC ☒ N/A ☐ U ☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2	Column bar splices are less than 50db. Girders do not have continuous stirrups
C ☐ NC ☐ N/A ☒ U ☐	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3	
C ☐ NC ☐ N/A ☒ U ☐	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3	
C ☒ NC ☐ N/A ☐ U ☐	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U	Item	Tier 1	Tier 2	Comments
☐	☒	☐	☐	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.	5.5.3.2.2	A.3.2.2.5	Spacing of ties is less than specified.
☐	☒	☐	☐	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6	No Top reinforcement above openings at ground level walls on north side
☒	☐	☐	☐	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7	
Diaphragms (Stiff or Flexible)							
☒	☐	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1	
☐	☒	☐	☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4	In two locations adjacent to stairway openings the concrete shear walls have an opening for the full length of the wall
☐	☐	☒	☐	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7	
☐	☐	☒	☐	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8	
Flexible Diaphragms							
☐	☒	☐	☐	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2	Continuous cross ties between chords are not present or detailed
☐	☐	☒	☐	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1	
☒	☐	☐	☐	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U			
☒	☐	☐	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
☐	☐	☒	☐	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
☒	☐	☐	☐	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1

Connections

C	NC	N/A	U			
☐	☐	☒	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Project Name Cupertino City Hall
Project Number 21143.P5 CP

17.12CP Structural Checklist for Building Types C2: Concrete Shear Walls with Stiff Diaphragms and C2a: Concrete Shear Walls with Flexible Diaphragms

Table 17-24. Collapse Prevention Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
Low and Moderate Seismicity				
Seismic-Force-Resisting System				
C ☐ NC ☐ N/A ☒ U ☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1	
C ☒ NC ☐ N/A ☐ U ☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1	
C ☐ NC ☒ N/A ☐ U ☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1	The shear walls supporting the roof are significantly overstressed
C ☒ NC ☐ N/A ☐ U ☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction.	5.5.3.1.3	A.3.2.2.2	
Connections				
C ☐ NC ☒ N/A ☐ U ☐	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1	Some portions of connection and ability transfer loads will require additional investigation in Tier 2. Wall anchorage at veranda is undersized and requires repair
C ☒ NC ☐ N/A ☐ U ☐	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls.	5.7.2	A.5.2.1	
C ☒ NC ☐ N/A ☐ U ☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation.	5.7.3.4	A.5.3.5	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Status				Evaluation Statement	Tier 2 Reference	Commentary Reference	Comments
High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)							
Seismic-Force-Resisting System							
C ☐	NC ☐	N/A ☐	U ☒	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components.	5.5.2.5.2	A.3.1.6.2	Tier 2 analysis is required
C ☐	NC ☐	N/A ☒	U ☐	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3	
C ☐	NC ☐	N/A ☒	U ☐	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning.	5.5.3.2.1	A.3.2.2.3	
Diaphragms (Stiff or Flexible)							
C ☒	NC ☐	N/A ☐	U ☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1	
C ☐	NC ☒	N/A ☐	U ☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length.	5.6.1.3	A.4.1.4	In two locations adjacent to stairway openings the concrete shear walls have an opening for the full length of
Flexible Diaphragms							
C ☐	NC ☒	N/A ☐	U ☐	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2	Continuous cross ties between chords are not present or detailed
C ☐	NC ☐	N/A ☒	U ☐	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered.	5.6.2	A.4.2.1	
C ☒	NC ☐	N/A ☐	U ☐	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2	
C ☐	NC ☐	N/A ☒	U ☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1.	5.6.2	A.4.2.3	
C ☐	NC ☐	N/A ☒	U ☐	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Connections

C	NC	N/A	U			
☐	☐	☒	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps.	5.7.3.5	A.5.3.8

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

APPENDIX G – Cupertino City Hall Essential Facility Analysis 2012

Cupertino City Hall
Essential Services Facility Analysis

Final Report, Revision 1
March 27, 2012

Table of Contents

1.0 Project Participants

Client:

City of Cupertino
10300 Torre Avenue
Cupertino CA 95014

Carmen Lynaugh	Public Works Project Manager
Terry Greene	Acting City Architect
Larry Squarcia	Senior Building Inspector
Albert Salvador	Building Official
Arnold Hom	Plan Check Engineer
Timm Borden	Director of Public Works
Chris Orr	Facilities Supervisor
Rick Kitson	Public and Environmental Affairs Director

Architect:

Perkins + Will
185 Berry Street, Suite 5100
San Francisco, CA 94107
Phone: 415.856.3000

Karen Alschuler	Project Principal
Susan Seastone	Project Manager
Haji Ishikawa	Project Architect

Structural Engineer:

AKH Structural Engineers Inc.
1505 Meridian Avenue, Suite B
San Jose, CA 95125
Phone: 408.978.1970

Tim Hyde	President

Mechanical, Electrical, Plumbing, Fire Protection Engineers:

PAE Consulting Engineers, Inc.
425 California St., Ste. 1200
San Francisco, CA 94104
Phone: 415.544.7500

Mike Lucas	Project Principal
Marco Alves	Mechanical Project Engineer
Hooshang Pakzadan	Electrical Project Engineer

2.0 Executive Summary

This scope of this project is an analysis of the Cupertino City Hall building and its compliance with current codes related to Essential Services Facility requirements. The objective of this study is to identify both deficiencies and potential improvements to the building necessary to achieve essential facility status by current codes.

Four alternative approaches were identified by the City of Cupertino representatives and the design team for the renovation of the existing City Hall facility. These approaches, described below, differ in their scope and anticipated construction cost. More detail for each item can be found in the body of the report.

Alt #1 No Upgrade: This alternate proposes no modifications to the existing City Hall building and a relocation of the existing Emergency Operations Center (EOC) to another facility.

Alt #2 Minimum Seismic Upgrade: This alternate proposes modifications to the building structure only to bring the facility to a code compliant Essential Services Facility status. No proposed plan changes are proposed in this alternate in order to maintain the ability to "grandfather in" the existing EOC in its current configuration. Only structural items triggered by I-factor improvements and maintenance are intended to be modified. Accessibility upgrade improvements may be triggered in this alternate.

Alt #3 Moderate Upgrade: This alternate proposes that all Alternate #2 items as well as additional plan modifications to address life safety code updates be implemented. Accessibility upgrade improvements would be triggered in this alternate.

Alt #4 Replacement – This alternate proposes a new City Hall building that aligns with ideas being proposed in the Civic Center Master Plan Study currently in process by Perkins + Will. This new facility would meet all current codes, incorporate sustainable features, and include Essential Services Facility requirements while at the same time address the specific needs and desires of the building occupants.

Following the completion of this report, the City of Cupertino and the design team will meet with a cost estimator designated by the city to identify order of magnitude costs for each alternative. After this process has been completed and an alternative is selected, the city may authorize the design team to proceed with the design and documentation of the selected alternative.

3.0 Structural Analysis (by AKH)

3.1 Scope

The scope of this section includes recommendations for mitigating structural deficiencies discovered in our assessment report dated November 11, 2011. The report has indicated that the heavy roof tile is a major factor in the deficiencies of the structure. The following recommendations are based on the assumption that the heavy tile roofing will be replaced by a lighter roofing material, and possibly with solar panels over some of the sloped roof areas.

3.2 Applicable Codes

The structure was recently assessed using seismic forces required in the 1985 Uniform Building Code (UBC), as this was the Code to which the 1986 alterations were designed. Recommendations within this report are based on seismic forces as dictated by the current 2010 California Building Code (CBC).

3.3 Deficiencies Identified

- Roof Diaphragm Shear Capacity
- Roof Diaphragm Collector Splice Capacity
- Anchor Bolt Connections at top of Shear Walls
- Upper Concrete Shear Wall Flexural Capacity
- Upper Concrete Shear Wall Boundary Members
- Upper Concrete Shear Wall Second Layer of Reinforcing
- Concrete Column Reinforcement for Confinement
- Equipment Anchorage Capacities Unknown

3.4 General Recommendations

This structure consists of concrete shear walls with heavy clay roof tiles on the sloped roof areas and heavy gravel ballast in the central area bounded by the upper mansard/screen wall. The roof tiles represent a significant portion of the building's mass at the upper level. The design seismic forces on a structure are based directly on a fraction or percentage of the total mass (weight) of the building. Thus, the roof tiles represent a significant amount of the seismic forces that the building's lateral force-resisting systems must resist. Our recommendations, therefore, include the replacement of the heavy tile roofing with a lighter material. This would also allow for the opportunity to install photovoltaic (PV) solar panels on the roof surface. As the weight of typical PV panels is small relative to the weight of the existing clay roof tiles, future improvements could include the addition of these PV panels while still reducing the building's mass and resulting seismic design forces.

Also, the upper story of this structure relies on two relatively narrow concrete shear walls on each of the four sides of the building. These shear walls comprise the building's entire lateral force resistance at the upper level, as the structure does not have any interior walls or structural frames that resist lateral forces. While the shear walls occur on each of the building's four sides, the walls are relatively narrow compared to their height, resulting in high in-plane shear stresses when resisting the seismic design forces, as well as relatively high tension and compression forces at the ends of the walls. Finally, the use of only two primary force-resisting elements on each side of the structure provides only minimal redundancy. Overall, the smaller number and length of walls result in a structural configuration that has historically performed less than optimally in resisting lateral, seismic forces in moderate and major earthquakes. Therefore we recommend that additional shear walls be added on each side of the structure. The included key plan of the building indicates where concrete walls can be added to the building, utilizing portions of existing solid exterior wall. These proposed locations would affect the building's current aesthetics and function to only a limited degree, if at all. See Fig. 3.A.

In general, if the clay roof tiles are replaced with lighter roofing materials (even including PV panels), the building's seismic mass would be reduced substantially, and the magnitude of most of the structure's noted deficiencies are reduced to levels that are more readily addressed.

3.5 Specific Recommendations

In addition to the general recommendations above, following are our specific recommendations for each of the deficiencies noted in the Section 3.3 above:

3.5.1 Roof Diaphragm Shear Capacity

The existing roof diaphragm is comprised of plywood sheathing with specific nailing along its panel edges to common framing members. Its shear capacity is affected by the type and thickness of plywood used, and the size and spacing of nailing used. The existing roof diaphragm shear capacity is exceeded even if the existing roof tile were to be removed and replaced with a lighter roofing material. The roof diaphragm forces would be reduced significantly with the replacement of the heavy clay roof tiles, although the calculated diaphragm shears would still exceed the diaphragm near the building's perimeter, which is where the diaphragm shear forces are highest. The plywood diaphragm can be strengthened as needed with added panel edge nailing near the perimeter of the building. This added nailing would be installed while the roofing is being replaced. See Figures 3.B and 3.G.

3.5.2 Roof Diaphragm Collector Splice Capacity

The existing roof diaphragm collectors consist of steel roof beams around the perimeter of the structure, and are aligned parallel to and above the upper-level concrete shear walls. These elements collect the seismic forces within the roof diaphragm and deliver the forces to the shear walls. Where splices occur in the lines of steel beams at approximately ten (10) locations, the connectors are currently not adequate to transfer the required seismic collector forces. Our recommendation to address this deficiency would be to provide welding around the splice plates to the beams at the splice connections. See Fig. 3.F.

3.5.3 Anchor Bolt Connections at top of Shear Walls

The collector beams mentioned in the previous section are connected to the top of the concrete shear walls with anchor bolts embedded in the walls and extending through the steel beam flange. This is the means through which the seismic forces are transferred from the roof to the shear walls. The current anchor bolts are insufficient to transfer the prescribed forces to the shear walls, even with added shear walls. Our recommendation is to provide adequate anchor bolts to any new walls and provide additional anchor bolts through the existing beams, between the existing anchor bolts, to strengthen the shear-transfer connections sufficiently. See Fig. 3.F.

3.5.4 Concrete Shear Wall In-Plane Flexural Capacity

In-plane flexure results from the shear walls bending when resisting seismic loads at their tops, tending to rotate and bend the wall over, causing tension and compression at wall ends. With the addition of upper-level new shear walls as recommended above, this flexural deficiency likely would no longer exist in the existing walls, as the forces resisted by the existing walls would be reduced, as well as the induced flexural forces. The added shear walls would be designed to have sufficient reinforcing to resist bending in the plane of the wall.

3.5.5 Concrete Shear Wall Boundary Members

Boundary members are required where the in-plane flexural forces generate high compressive forces at the wall ends. These compressive forces, when at a certain level, must be resisted by stronger column-type elements, containing internal confinement of the vertical wall reinforcing near the wall ends. The existing walls would require added boundary confinement to resist current Code-level forces. With the removal of the heavy roof tile and gravel, and depending on the lengths and locations of added shear walls as noted above, the compressive flexural forces would be reduced to a level where only the current Code's prescriptive requirements would be applicable. This could be accomplished in one of two possible means. First, a short length of reinforced wall could be added to the existing, which would move the highest compressive forces away from the existing bars, and would contain new bars and confinement complying with Code requirements. Second, if the wall length cannot be increased, a column element that is wider than the wall could be introduced, containing the required confining reinforcement.

3.5.6 Concrete Shear Wall Second Layer of Reinforcing

When calculated in-plane shear stresses within shear walls exceed a certain threshold, those walls must have two layers of internal reinforcing. The shear walls currently have one layer of reinforcing, comprised of vertical and horizontal rebar. With the removal of the heavy roof tile and addition of new perimeter shear walls as noted above, the shear stresses within the walls will likely be reduced to levels such that the second layer is not required.

3.5.7 Concrete Column Reinforcement for Confinement

The existing concrete columns throughout the structure, at both levels, contain longitudinal reinforcement running vertically and transverse, confining tie reinforcement around the longitudinal bars. The ties are of a specific size and occur at a specific spacing. In extreme cases, such as in moderate and major earthquakes, the lateral drift of the structure, combined with the axial forces from the supported structure, can induce extremely high compressive forces in the longitudinal (vertical) column bars. If not confined adequately by ties of sufficient size, at spacing that is close enough, the vertical bars can buckle outward, causing damage to the column, loss of support and possible collapse. Regardless of the calculated forces in the existing columns, the existing column ties do not conform to the current Building Code's prescriptive requirements for minimum confinement. Thus, supplemental confinement needs to be added for conformance to the current Code. This added confinement may be required only near the ends of some columns, or for the full height of the columns, depending on the calculated column loads. Where additional confinement is required, it is recommended that the columns be wrapped with designed layers of carbon fiber and resin. The total build-up of carbon fiber layers is relatively thin, and would not adversely affect the spaces where the columns occur.

As indicated in these descriptions, and in general, the noted deficiencies can be addressed and resolved only with a sufficient reduction of the building's mass through the removal of the heavy clay tile roofing, and with the addition of some lengths of new upper-level concrete shear walls. The recommended alterations combine to reduce the seismic forces acting on the structure, increase the strength and capacities of the load-resisting elements, including the shear walls and collector members. The following key building plan indicates the recommended locations for the proposed added shear walls, which would likely affect the building's aesthetics and functionality to only a minimal degree.

3.5.8 Equipment Anchorage Capacities Unknown

The capacity of the anchorage of the equipment throughout the building is unknown and warrants a survey of existing on-site conditions, as well as any drawings available that address the methods of anchorage and lateral bracing. The current Building Code excludes some equipment below certain weight limits from requiring anchorage, if the Component Importance Factor (Ip) for determining the anchorage design forces is no higher than 1.0. However, since the entire subject structure is considered an Essential Facility, housing the EOC, the Importance Factor for the overall building's seismic design, as well as the seismic Component Importance factor, Ip, is 1.50. Thus, the seismic anchorage of all significant equipment anchorage is governed by the Code. Equipment that should be considered, in particular, includes the following:

- Emergency Generator, including isolators
- Emergency Generator flexible connections for conduit, fuel and coolant piping
- Rooftop HVAC Equipment
- Elevator Equipment
- Electrical Transformers, Panels, Switchgear, Cabinets, etc.
- Suspended Light Fixtures
- Ductwork and Piping Supports and Bracing
- Electrical Conduits, Trapezes, Banks and Trays
- Fire Sprinkler Piping

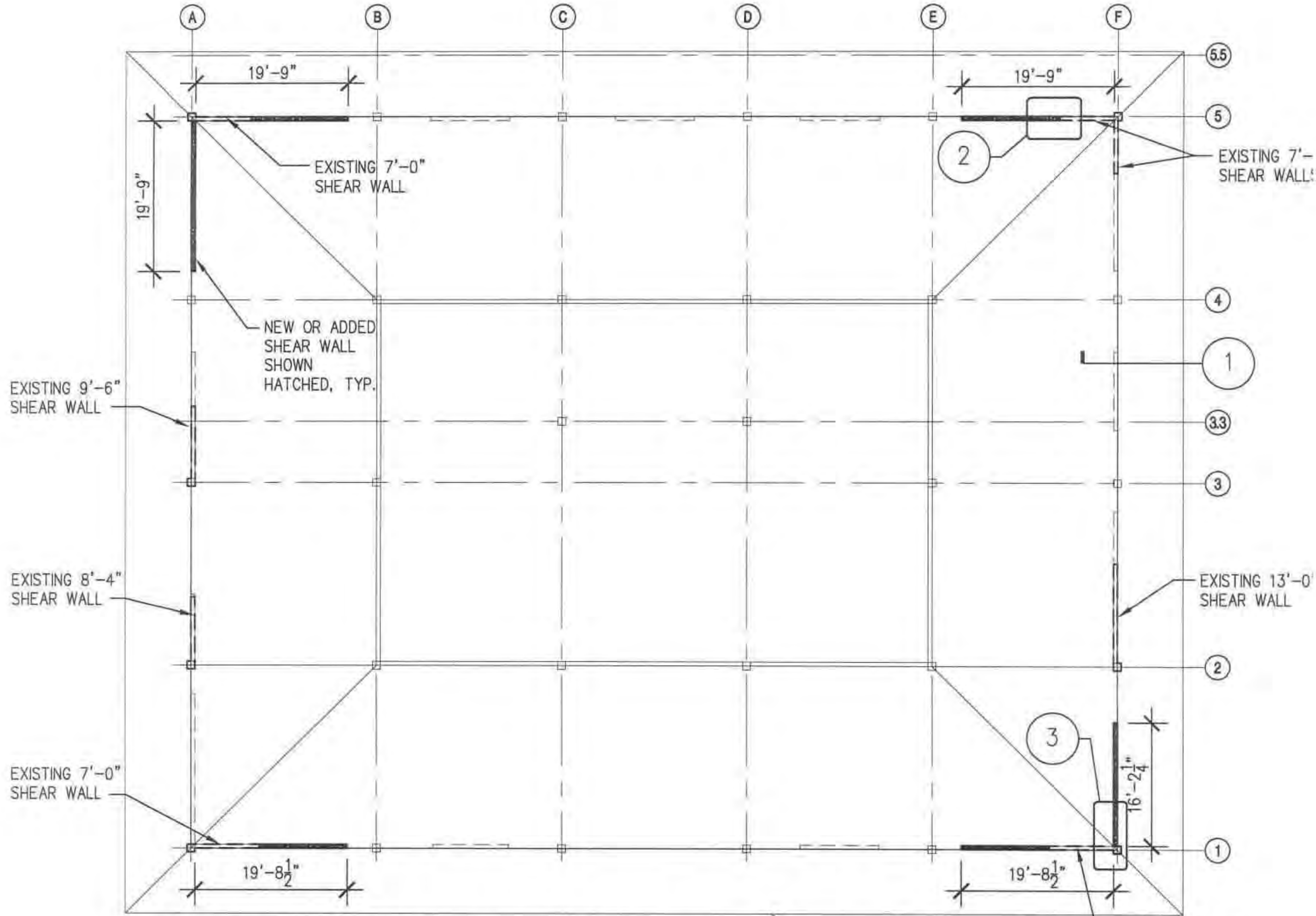


Figure 3.A: KEY STRUCTURAL BUILDING PLAN

(MAIN FLOOR WALLS SHOWN DASHED)

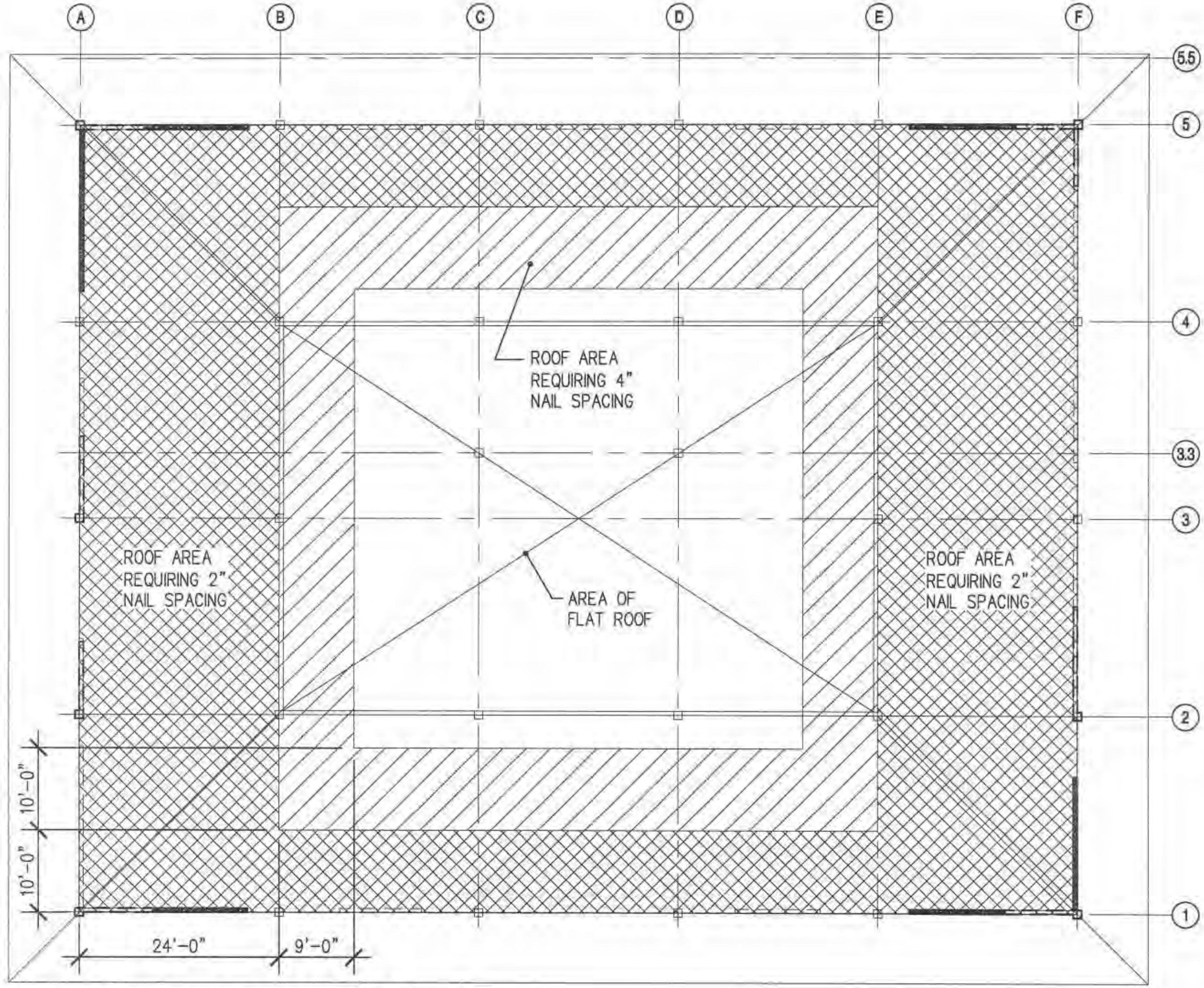


Figure 3.B: KEY ROOF PLAN

(MAIN FLOOR WALLS SHOWN DASHED)

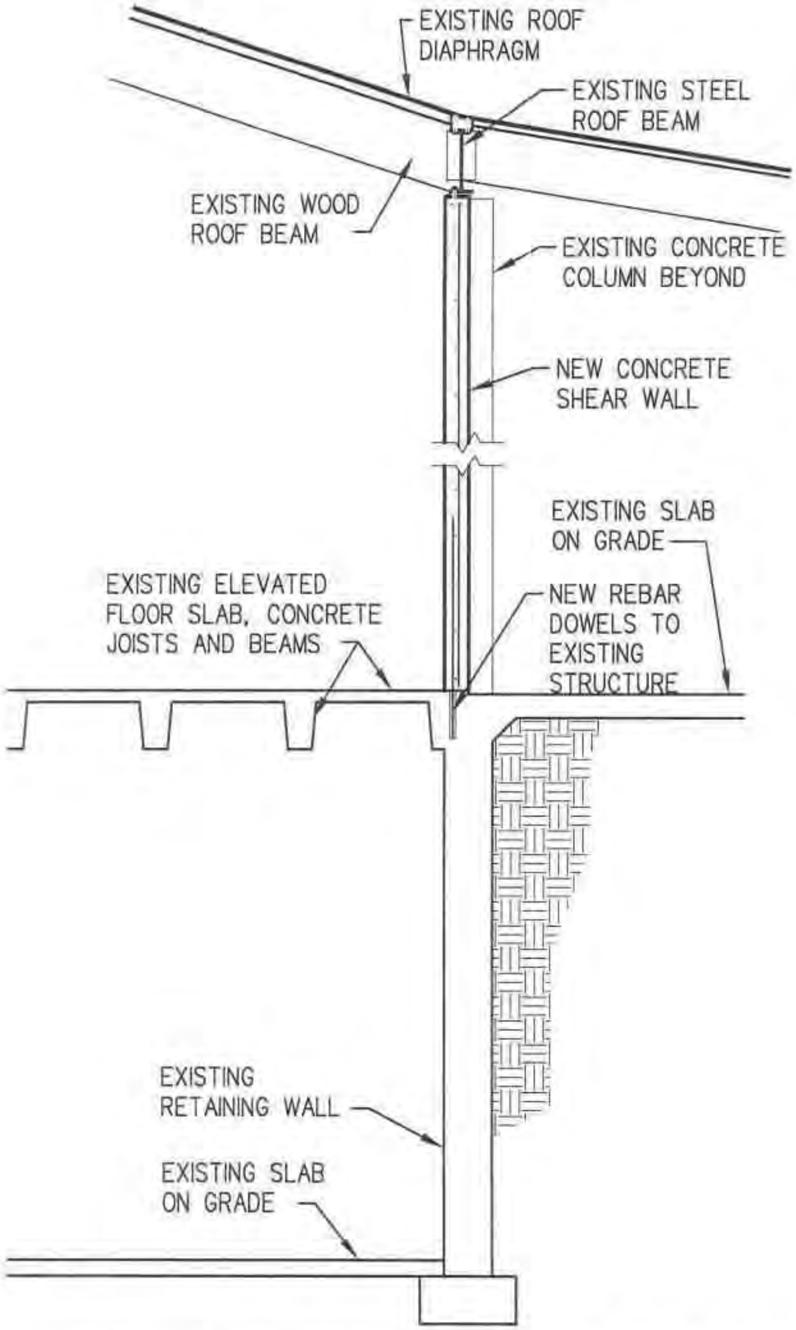


Figure 3.C: SECTION AT NEW SHEAR WALL

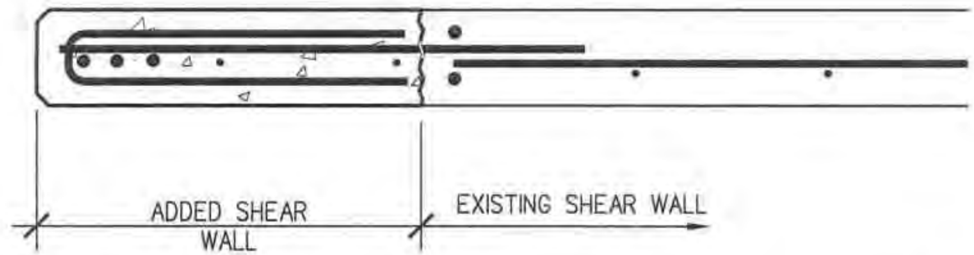


Figure 3.D: NEW SHEAR WALL AT EXIST. WALL

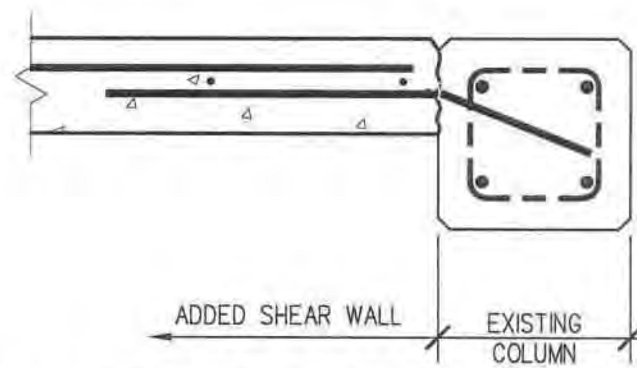


Figure 3.E: NEW SHEAR WALL AT EXIST. COL.

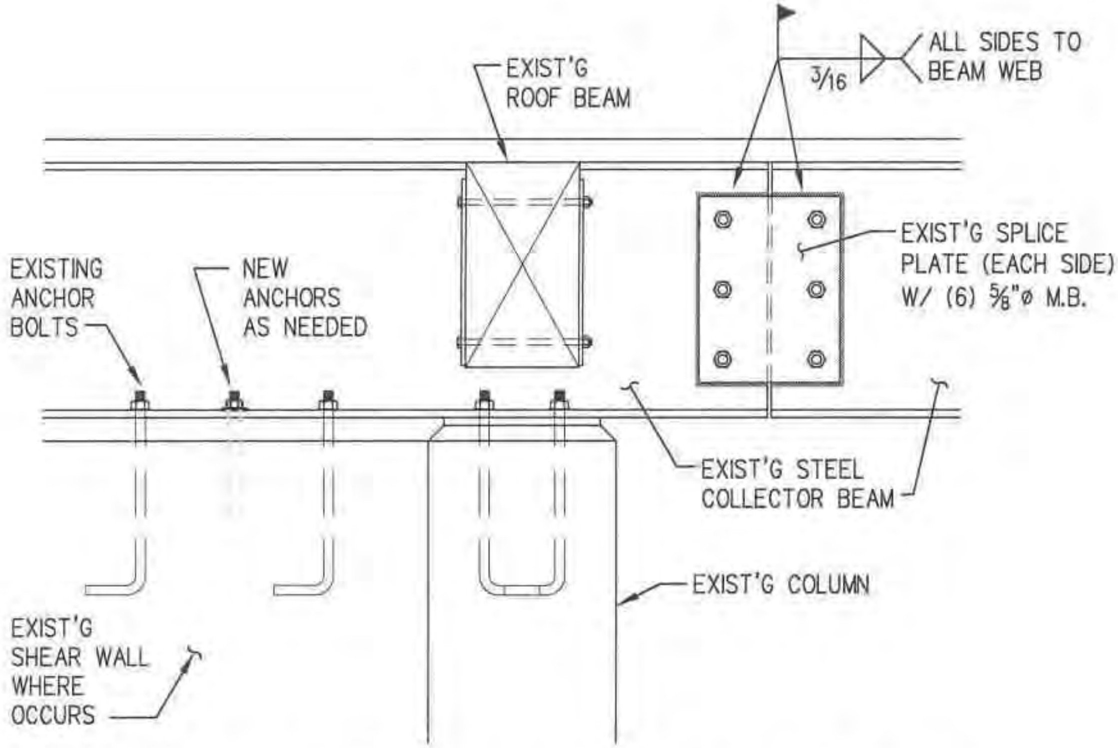


Figure 3.F: ELEVATION: EXISTING STEEL BEAM AT COLUMN AND SHEAR WALL

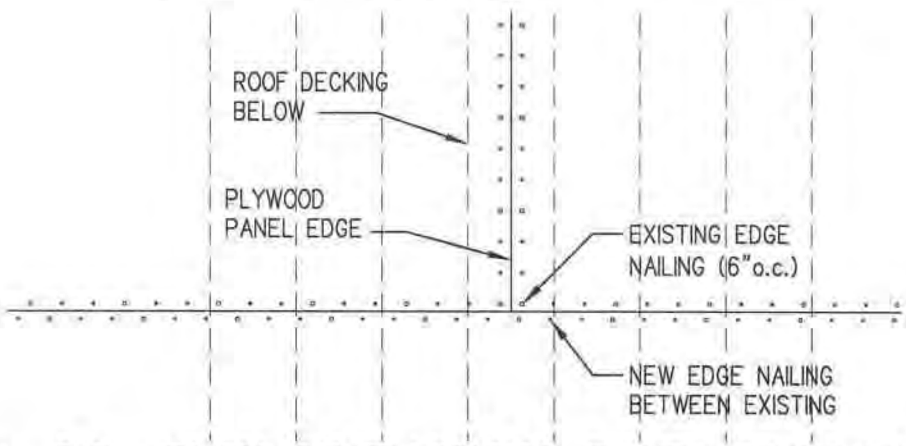


Figure 3.G: PLAN OF PLYWOOD PANEL EDGE NAILING

4.0 Architectural Analysis

4.1 Scope

The existing Cupertino City Hall building is a two-story structure containing city administrative and building department services as well as the City of Cupertino's Emergency Operations Center (EOC.) The original building was built completed in 1965 and later renovated in 1986.

This study is based on record documents listed below and received electronically from the city as well as a facility site walk on Feb 14, 2012.

- 1965 Drawings for Original Construction
- 1986 Drawings for Renovation (except single line Electrical plans)
- Current Exiting Diagram included the latest floor layout modifications

The architectural analysis primarily focuses on fire and life safety issues and includes a detailed code compliancy review of the existing City Hall building as an Essential Service Facility. The recommendations follow the analysis and include four alternatives outlined by city representatives and the design team.

The current code, the 2010 California Building Code (CBC), and the 1985 Uniform Building Code used for the renovation exhibit significant differences in all chapters. The first step of this analysis was to review the existing building against the 2010 CBC. Exhibit 4A provides the analysis in detail. Exhibits 4C and 4D show occupancy load calculations, exit occupancy calculations, and required rated wall locations.

The required scope of accessibility modifications for the existing building is also summarized to define the extent of potential renovation work. Exhibit 4B lists scope requirements from the 2010 CBC Chapter 11B.

4.2 Applicable Codes

The 2010 CBC was used to review code compliancy. The 2010 California Green Building Code (Cal Green) was not used for the analysis of the existing building. Currently, the City of Cupertino does not enforce the Cal Green for the remodel of existing buildings.
The requirements of 2010 ADA Standards for Accessible Design is applicable for local government facilities and was also used to review for compliancy.

4.3 Key Fire and Life Safety Issues

The key issues below are extracted from Exhibit 4A - Code Analysis Worksheet.

- **Occupancy Classification**

  The existing Council Room is approximately 1,300 sf (over 10% of the total floor area of the first floor) with an Occupancy Load of 86. The room cannot be considered an incidental accessory occupancy because it is too large. It needs to be considered an A3 Occupancy, a separate occupancy from rest of the building, which is a B Occupancy.

- **Type of Construction**
  The type of construction is Type VB with an automatic sprinkler system throughout.

- **Fire Resistive Separations**

  Interior Walls:

  A 1-hour Fire Barrier separation is required between A and B occupancies. The existing wall is shown as a 1-hour partition in the 1986 drawings. The wall construction above the ceiling needs to be further investigated. The doors in the 1-hour Fire Barrier need to have a 45-minute fire resistance rating. The existing two doors are labeled with 20-minute ratings. The label of the third door was covered by finish material and not legible. It will need to be replaced if it cannot be confirmed as compliant. See section 4.5.1 of the 2010 CBC.

  Although the 1-hour separation requirement of an incidental use area is exempted because the existing building is equipped with a sprinkler system, the Mechanical Room and Storage Rooms (over 100 sf) require smoke partitions. The 1986 drawings indicate the existing Mechanical Room is enclosed by a 1-hour partition. See section 4.5.2 of the 2010 CBC.

  Elevator Shaft Enclosure:

  The existing elevator shaft may be deficient. The drawing A2.1 (1986 Renovation) indicates "Carry shaft wall to underside of lobby ceiling". Fire Barriers need to extend to the underside of the roof sheathing per 707.5 or enclosed at the top with the same fire resistance rating per 708.12. See section 4.5.3 of the 2010 CBC.

  Exit Stair Enclosure:

  The exit stair enclosure wall needs to be a 1-hour Fire Barrier with a 1-hour rated opening. The existing door on the first floor is labeled as 60-minute. The rating of the door on the basement was not legible and will need to be replaced if it cannot be confirmed as complaint. See section 4.5.4 of the 2010CBC.

- **Corridors**
  The building's corridors are not required to be separated by fire or smoke partitions because the existing building is A and B Occupancies and equipped with a sprinkler system. The existing corridors open to the public area are rated per the 1986 drawings. The existing openings between the west corridor and the office area are allowed per the current code.

- **Interior Finishes**

  Wall and Ceiling:

  Corridors serving the egress of the EOC, West Corridor, Lobby, and South Corridor require Class B finishes on the walls and ceiling. The existing finish materials need to be further examined to confirm that they meet the ASTM E-84 Class B frame spread rating and the ASTM C 635 or C636 for suspended acoustical ceiling. See section 4.5.6 of the 2010 CBC.

  Floor:

  A Class I or II interior floor finish is required in all exit routes. The existing finishes need to be further reviewed and replaced if they cannot be confirmed as compliant. See section 4.5.6 of the 2010 CBC.

- **Means of Egress**

  Occupant Load:

  The Occupant Load of the existing building is calculated based upon the area under consideration divided by an occupant load factor per section 1004.1.1 of the 2010 CBC. See Exhibit 4A.

  Egress Width:

  All existing doors and corridors currently provide more than the required egress width. Exiting occupancies at the exit discharge are:

Basement Terrace	98
Main entrance	57 (113 / 2 exits)
South Corridor Door	35
North Door	29

  Accessible Means of Egress:

  Accessible means of egress are not required in alterations to existing buildings per section 1007.1 Exception 1 of the 2010 CBC.

  Panic Hardware:

  Mechanical Room and Transformer Room doors need panic hardware or fire exit hardware per section 1008.1.10 of the 2010 CBC. The existing doors do not have the required hardware.

  Vertical Exit Enclosures–Lobby Open Stairs to Basement:

  The analysis of the exiting occupancy revealed that the basement floor egress is not code compliant without using the open stairs as means of egress. The 2010 CBC allows for vertical openings in a stairway only if it is not part of means of egress per 708.2 Exceptions; therefore, in order to meet the requirements of the code the stair will require the installation of draft curtains and closely spaced sprinklers. These upgrades based on the interpretation above are believed to be more economical than converting the open stairway to an enclosed exit stair. See section 3.5.7 of the 2010 CBC.

- **Roof Assembly and Rooftop Structure**

  A roof assembly is required to meet Class A fire test exposure in accordance with the city ordinances. The existing roof equipment shows an incomplete attachment mechanism to the roof deck. See section 3.5.8 of the 2010 CBC.

4.4 Other Issues

4.4.1 Accessibility

The extent of the specific accessibility upgrades will require further study as well as design solutions after a solution is selected. Exhibit 4B describes accessibility requirements for existing buildings.

The 2010 CBC requires that accessibility upgrades apply only to the area of specific alteration. The 2010 ADA Standards (Chapter 2, 202) state "each altered element or space shall comply with the applicable requirements".

The 2010 CBC also outlines construction cost thresholds for specific levels of accessibility upgrades. For a project where the construction cost does not exceed $50,000, it requires accessibility compliance only in the area of the actual work and not in supporting areas. For a project where the construction cost does not exceed $128,410.86, it allows accessibility compliance to be limited to 20% of the cost of the project. Priority must be given to the accessible elements in the following order.

- sanitary facilities
- drinking fountains
- signs
- public telephone
- additional accessible elements such as parking, storage, and alarms

For a project where the construction cost exceeds $128,410.86, the facility must be made fully accessible.

4.4.2 OSHA

Access to all areas for building maintenance will need to meet Cal-OSHA standards. The metal ladder to the roof requires a safety upgrade.

4.4.3 Sustainability

A comprehensive sustainable strategy and specific sustainable solutions are not identified in this report; however, as the project moves to the next phase we would recommend incorporating a sustainable approach into the solution selected.

4.4.4 Architectural & Planning

Several architectural and planning issues were identified by the building representatives and design team during the Feb 14, 2012 site walk. These items were captured in the Meeting Minutes, item 2012-02-14.07, and should be addressed if Alternate #3 or Alternate#4 is selected for implementation.

4.5 Recommendations

Four alternative approaches were identified by the City of Cupertino representatives and the design team for the renovation of the existing City Hall facility. These approaches, described below, differ in their scope and anticipated construction cost.

Alt #1 No Upgrade: This alternate proposes no modifications to the existing City Hall building and a relocation of the existing EOC to another facility.

Alt #2 Minimum Seismic Upgrade: This alternate proposes modifications to the building structure only to bring the facility to a code compliant Essential Service Facility status. No proposed plan changes are proposed in this alternate in order to maintain the ability to "grandfather in" the existing EOC in its current configuration. Only structural items triggered by I-factor improvements and maintenance are intended to be modified. Accessibility upgrade improvements may be triggered in this alternate. The modifications include:

- Replacement of roof tile – as maintenance
- Possible adjustment of roof profile and equipment screen
- Connection of collector beam and concrete shear wall
- Additional concrete wall to the main level, if required. (The modification should not affect floor plan and egress)
- Ducts and equipment seismic support
- Accessibility upgrade for 20% of construction cost if required

Alt #3 Moderate Upgrade: This alternate proposes that all Alternate #2 items as well as additional plan modifications to address life safety code updates be implemented. Accessibility upgrade improvements would be triggered in this alternate. The modifications include:

- All Alt #2 items
- Fire and Life Safety upgrade to meet 2010 CBC
- MEP upgrades to meet operation requirements as Essential Services Facilities including replacement of HVAC equipment/control, water heater/plumbing pipe, adjustments of sprinkler system, and upgrade of the electrical system after testing and verifications.
- Minimum energy efficiency to meet performance of the existing building
- Accessibility upgrade

Alt #4 Replacement – This alternate proposes a new City Hall building that aligns with ideas being proposed in the Civic Center Master Plan Study currently in process with Perkins + Will. This new facility would meet all current codes, incorporate sustainable features, and include Essential Service Facility requirements while at the same time address the specific needs and desires of the building occupants.

These recommendations are based on the findings from the available drawings and observations of the accessible areas during the site walk. As highlighted above, some areas of the existing building have unknown conditions and will require further investigation after an alternate is selected:

- penetrations thru partitions
- above-ceiling conditions
- actual construction of the interior partitions
- storage rooms created during the recent renovation around the EOC
- renovated areas in locations where the record drawings were not available

Specific recommendations for the correction of items identified in the code analysis are outlined below. If Alternative #3 or Alternative #4 described above is chosen, all architectural code deficiencies must be integrated into the solution.

4.5.1 1-hour Fire Barrier at Council Room

The existing doors to the Council room need to be replaced with at least 45-minute fire resistance rated doors. The partition may need to be repaired or re-built to meet 1-hour Fire Barrier requirements. The existing rated partition enclosing Council room should be further field investigated.

4.5.2 Smoke Partitions to Mechanical Room and Storage Room

The existing doors to the Mechanical Room and Transformer Room need to be replaced with panic hardware. The existing wall and doors enclosing the Mechanical Room need to be rebuilt or repaired to meet smoke partition requirements.

Mechanical Room work space clearances and clear path of travel require further investigation near the 1600 Amp electrical panel. The room requires either 2 exits with panic hardware or 1 exit door with panic hardware and a clear unobstructed path from panel to exit door, or a single exit door with panic hardware and double the required working space around the panel.

Storage Rooms (areas exceeding 100sf) need to be enclosed by smoke partitions. The Storage Rooms north of Council Room that were recent additions/modifications exceed 100sf. These walls and doors need to be rebuilt or repaired to meet smoke partition requirements.

4.5.3 Elevator Shaft Enclosure

The construction of the existing elevator shaft enclosure needs further field investigation to verify if it meets the 1-hour Fire Barrier requirements. The shaft enclosure may either need to extend to the roof sheathing or be enclosed at the top of the shaft with 1-hour fire resistance rated assembly.

4.5.4 60-Minute Door to the Exit Stair at Basement

The exit access door to the existing exit stair should be confirmed as a 60 minute door or replaced with a 60 minute door. The construction of the existing exit stair shaft enclosure needs further field investigation to verify if it meets the 1 hour Fire Barrier requirements.

4.5.5 Interior Finishes

The finishes of West Corridor, Lobby, and South Corridor need further field investigation to confirm if they meet the current code classifications. The finishes may need to be replaced to meet the requirements.

4.5.6 Lobby Open Stairs to Basement

The existing open stairs from Lobby to the basement should be designated as non-exit stairs. In addition, the draft curtains and closely-spaced sprinklers per NFPA 13 need to be installed. The exit sign should be rearranged accordingly.

4.5.7 Roof Assembly and Rooftop Equipment

The attachment of the roof equipment to the roof deck must be secured following the I factor requirements for the Essential Services Facilities. Reroofing assembly is required to meet Class C roofing.

4.5.8 Replacement of Roof Tile (This item is for Alt #2)

As described in the Structural Section 3.4 General Recommendations, the heavy tile roofing should be replaced with a lighter material such as standing seam metal roofing system. A system can be selected to match the appearance of the adjoining buildings in the Civic Center. As the project proceeds an option to integrate photovoltaic panels or film at the roof should be investigated.

Exhibit 4A - Code Analysis Worksheet

This exhibit is prepared to review the code compliancy of the existing City Hall under 2010 California Building Code.

	Subject	CBC Reference	Notes
1.	**Building Description**		
	• 1 above grade story with 1 below grade basement	Table 503 See 7	OK
2.	**Building Height**		
	• Height to highest occupancy Story: 1.8 ft above finish grade (224.9 FG, 226.7 FF)		
	• Height to top of roof: 20'-11 ½" @ top of beam, 26' @ top of parapet	Table 503 See 7	OK
3.	**Building Separations**		
	• East: 174 ft		
	• West: 60+ ft (60 ft to PRW)		
	• North: 60+ ft (60 ft to PRW)		
	• South: 103 ft (to 1964 PL)		
	All exceeds 30' in Table 602 fire Separation distance	Table 602	OK
4.	**Occupancy**		
	<u>Building Area</u> — <u>Occupancy</u> First Floor — B (Except Concil room: A3, 1,300sf) Basement — B Note: EOC Room (former Council Room) will be separated Occupancy from the rest of the building because the area sqft of 1,300sf exceeds 10% of the building area of the floor (508.2.1). The occupant load of the EOC Room is 1,300/15 = 86. The two occupancies need to be separated by 1hr fire barrier (Table 508.4)	508.4	
5.	**Approximate Building Area**		
	Level 1: 11,520 sf <u>Basement: 11,520 sf</u> Total: 23,040 sf		
6.	**Type of construction**		
	Type V-B (fully sprinklered)		
7.	**Allowable Area and Height** – Type V-B (fully-sprinklered)		
	(B occupancy / A-3 Occupancy) <u>Allowable / Built</u> — <u>Allowable / Built</u> Story (above grade): 2 / 1 — 1 / 1 Height: 40ft / 26 ft — 40ft / 26 ft Floor Area / Story: 18,000sf / 11,520sf — 12,000sf / 1,300sf Per 508.4.2 11520/18000 + 1300/12000 = 0.748 < 1.00	Table 503 508.4.2	OK
8.	**Fire Resistive Requirements** – Type V (fully-sprinklered)		

	Subject	CBC Reference	Notes
	• Structural Frame: 0 hrs • Bearing Walls ○ Exterior: 0 hrs ○ Interior: 0 hrs • Non-bearing Walls ○ Exterior: 0 hrs ○ Interior: 0 hrs • Floors: 0 hrs 3" concrete floor • Roof: 0 hrs 6x6 beam, 2x6 T&G Deck, 5/16" Plywood	Table 601 & 602 603.1 & 717.5	OK
9.	**Fire Resistive Separations**		
	• 1-hr Fire Barrier separations between B and A1 occupancy	508.4	
	• Incidental Use Areas ○ Mech / Boiler Room (031 & 032) – ○ Storage over 100 sf (036, 038, New storage north of Council) 1-hr separation or provide automatic fire extinguishing system – OK w/ Fully sprinklered bldg Smoke Partition (711; Full ht solid walls w/self-closing solid drs) is still required	508.2 508.2.5.2	OK
10.	**Exterior Walls**		
	• Opening Allowed in exterior walls		
	• Max area of exterior wall openings allowed: No Limit Fire Separation distance is > 30'	Table 705.8	OK
	• Parapets: not required – exterior wall is not required to be rated	705.11	OK
11.	**Interior Walls**		
	• Fire Barriers – separating B & A3 occupancy around fmr. Council Room	707	
	○ Extend from the top of the floor 0 ceiling assembly below to the underside of the floor or roof sheathing. ○ Openings are limited to 25 % of length of wall ○ Openings are not limited to 156sf if fully-sprinklered ○ Opening protection <u>Wall Type</u> <u>Opening Rating</u> 1-hr shaft / exit enclosures 1 hour 1-hr fire barrier 45 min.	707.5 707.6 707.6 exc 1 Table 715	dr & glazing need upgrade to 45 min assembly
	• Shaft Enclosures – exit stairs, elevator hoist way	708	
	○ Enclosures to have fire barrier with 1-hr fire resistance rating ○ Openings limits are not applicable for for exit enclosures ○ Opening protection – see above	708.4 707.6	Visually inaccessibl e, Need further investigatio n of shaft termination above ceiling
	• Corridors – Not req'd to be separated by fire or smoke partitions in A and B occupancy if fully sprinklered.	Table 1018.1	OK
	• Enclosed Elevator Lobby		

	Subject	CBC Reference	Notes
	○ not required not mre than 3 stories in Group B	708.14.1	OK
	○ not required for A where the building is fully-sprinklered	708.14.1 Ex 4	OK
12.	**Penetrations**		
	• Thru penetration fire stop systems protecting wall penetrations shall have an F rating equal to the rated wall	713.3.1.2	Visually inaccessible, Need further investigation
	• Thru penetration fire stop systems protecting rated horizontal assemblies shall have an F and a T rating of 1 hour or equal to the rated assembly	712.4.1.1.2	Visually inaccessible, Need further investigation
13.	Interior Finish	803.1	
	• Wall and ceiling finishes per ASTM E-84, Class A, B & C / NFPA 286		
	• Flame spread Req <u>Area Served</u> <u>Rating</u> Exit Enclosures B Corridors Serving A Occupancy B Other rooms & corridors C	Table 803.9	
	• Suspended acoustical ceilings per ASTM C 635 or C636	808.1.1.1	?
	• Class I or Class II interior floor finish req'd in all exit route	804.4.1	?
14.	**Automatic Sprinkler system** – per MEP analysis	903.2.1.3	OK
15	**Means of Egress**		
	• Occupant load Is established in Figure 1 based upon the area under consideration divided by an occupant load factor	Table 1004.1.1	OK
	• Egress width	1004	
	○ Considered for floors individually	1004.4	OK
	○ Stairways – factor .3 in ○ Other egress component – factor .2 in	1005.1	OK
	• Lighting	1006.2	Noted in Elect Section
	○ 1 fc –at walking surfaces f exit access, exits, and exit discharge		
	○ 10 fc – at walking surface of stairs during use		
	○ Emergency power 90min min	1006.4	
	• Accessible means of egress	1007.1	
	○ Accessible means of egress are not required in alterations to existing buildings	1007.1 Ex 1	OK
	• Doors		
	○ Shall have a clear width of at least 32 in and no door leaf shall be greater than 48 in – all egress doors exceed required width	1008.1.1	OK
	○ With limitations, egress doors may include:	1008.1.4	OK

	Subject	CBC Reference	Notes
	▪ Revolving doors ▪ Power-operated doors ▪ Access-controlled doors		
	o Panic hardware is required on exit doors from ▪ A occupancies ▪ Elect rooms rated over 1200 A – check with Electrical.	1008.1.10	OK
	• Stairways		
	o Min width is 44 in unless serving fewer than 50 people, except accessible egress stairs o Handrails may extend 4 ½" from stair wall into req'd clear width	1003.3.3 1012.7	OK
	o At accessible egress stairs, the stairs are req'd to have a min clear width between handrails of 48 in min width is 44 in unless serving fewer than 50 people, except accessible egress stairs	7.2.12.2.3	n/a per 1007.1 Ex. OK
	o Min headroom clearance is 80 in	1009.2	OK
	o Riser height ▪ Min 4 in, Max 7 in	1009.3	OK
	o Ramps (for exiting) o Max slope – 1:12 o Max cross slope – 1:48 o Max vert rise – 30 in o Ramps with rise greater than 6 in shall have handrails on both sides	1010.3 1010.4 1010.8	n/a OK
	• Handrails and guards		
	o Shall be provided on both sides of stairs and ramps with risers grater than 6 in	1009.10	Need further review
	o Intermediate handrails to be provided so that all parts of egress capacity on stairs and ramps area within 30 in of a handrail	1012.8	
	o Guards required on elevated surfaces with an adjacent droop more than 30 in	1013.1	
	o Guards to be 42 in high min	1013.2	
	o Not allow a 4 in diameter sphere to pass	1013.3	
	• Exit Signs		
	o Not required in rooms or areas requiring only one exit	1011.1	OK
	o Required at exit and exit access doors and other areas so that no place in a corridor is more than 100 ft from an exit sign	1011.1	OK
	o Exit sign may be either internally or externally illuminated	1011.2	OK
	o Illumination required to be on emergency power with 90 min duration	1011.5	OK
	• Exit Access		
	o Egress shall not pass through adjoining rooms except where such rooms are accessory to the area served, are not high-hazard, and provide a discernible path to an exit	1014.2	OK
	o When two or more exits are required, they shall be separated by one third the diagonal dimension of the space ▪ fmr Council – 2 exits provided ▪ Mech room – 2 exits provided	1015.1 1015.1 1015.3	OK
	• Travel Distance		
	o Max allowable travel distance from any location to an exit		
	A3: 250 ft (w/ fully-sprinklered)	Table	OK

	Subject	CBC Reference	Notes
	B: 300 ft (w/ fully-sprinklered)	1016.1	
	• Common path of travel distance		
	○ The max allowable common path of travel distance from any location to a point where occupants have a choice between two separate exit paths is limited to 100 feet for Group B and S	1014.3	OK
	• Corridors in sprinkler protected B or S may be non-rated	Table 1018.1	OK
	○ Corridor width to be OL x 0.2 but not less than 44" ○ 36" with a required occupant capacity of less than 50	1005, 1018.2 1018.2 Ex	OK
	○ Dead ends may not exceed 50 feet in B		
	• Min number of exits		
	○ OL 1-500 – 2 exits required	1021	OK
	• Vertical Exit Enclosures		
	○ Required rating – 1-hr ○ A max of 50% of exit capacity is permitted to egress through areas in the level of discharge w/ three conditions check (1.2 floor rating of 3" conc) ○ Stairs to the building permit counter should not be used for egress, to be "communicating stair"	1022.1 1027.1 Ex	Adjust exit sign accordingly
	• Exterior Exit Stairs and Ramps		
	○ Exterior exit stairways can be used in a means of egress ○ Must be open at one side ○ Not required to have separation per exceptions	1026.2 1026.3 1026.6 Ex.	OK OK OK
	• Exit Discharge		
	○ A max of 50% of exit capacity is permitted to egress through areas in the level of discharge w/ three conditions check	1027.1 Ex	OK
16	Roof Assembly and Rooftop Structures		
	• Roofing Classifications – Class A is required per City of Cupertino Ordinances	Table 1505.1	Classification of (E) roof assembly is unknown.
	• Existing roof replacement – more than 50% of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair, or replacement of the roof of every existing structure shall be a fire–retardant roof covering that is at least Class C	1505.1.3	To be Class A per City of Cupertino Ordinances

Exhibit 4B - Accessibility for Existing Buildings

This Exhibit is prepared to summarize the required accessibility upgrade for the existing buildings per 2010 CBC.

	Subject	CBC Reference	Notes
1.	**Accessibility for Existing Buildings**	1134B	

	• Provisions apply to renovation, structural repair, alteration and addition to existing buildings
	• No decreased accessibility of existing buildings
	• Requirements shall apply only to the area of specific alteration structural repair of addition
	    ○ Primary entrance to the building
	    ○ Primary path of travel to the specific area of alteration, structural repair or addition
	    ○ Followings that serves the area of alteration, structural repair or addition
	        ▪ Sanitary facilities
	        ▪ Drinking fountains
	        ▪ Signs
	        ▪ Public telephone
		1134B.1
		
		1134B.2	

	Exceptions #1
	• Total construction cost does not exceed $128,410.86 (Jan 2010)
	• Unreasonable hardship is where exceeds 20% of the cost of the project without these features (disproportionate cost)
	• Access shall be provided to the extent that it can be within 20% of the cost of project
	• Priority is to these elements that will provide the greatest access following order
	    ○ An accessible entrance
	    ○ An accessible route to the altered area
	    ○ At least one accessible restroom for each sex
	    ○ Accessible telephones
	    ○ Accessible drinking fountains
	    ○ When possible, additional accessible elements; parking storage and alarms
	• 3 years duration of accumulated cost when there are many small work
	• Alterations after Jan 1992 shall be considered in determining if the cost of providing a accessible path of total is disproportionate
	Exceptions #2
	• n/a - Re: privately funded project
	Exceptions #3
	• Accessibility improvement work itself is limited to the actual work of the project
	Exceptions #4
	• Work limited to
	    ○ HVAC
	    ○ Re-roofing
	    ○ Electrical (not included switches and receptacles)
	    ○ Cosmetic work
		1134.2.1 Ex.	

	• Alternative uni-sex per floor will be permitted if technically infeasible	1134B.2.2	

Exhibit 4C First Floor Occupancy Load and Exit Diagram

Exhibit 4D Basement Floor Occupancy Load and Exit Diagram

5.0 Mechanical, Electrical, Plumbing, Fire Protection Analysis

5.1 Scope

The main goal of this report is to evaluate the MEP equipment and infrastructure serving the Cupertino City Hall and the EOC. The evaluation of the existing MEP systems is being performed according to the following overall facility improvement alternatives:

- Alt #1 No Upgrade - Relocation of EOC
- Alt #2 Min Seismic Upgrade – Duct, pipe, and equipment seismic support (per I factor change)
- Alt #3 Moderate Upgrade - Alt #2 items, Fire & Life Safety upgrade to meet 2010 CBC, MEP upgrade to meet operation requirements as Essential Services Facilities, Energy efficiency to meet performance of the existing building
- Alt #4 Replacement – New Building

5.2 Applicable Codes and Standards

Codes:

State of California Code of Regulations (CCR).

2010 California Building Code.

2010 California Electrical Code.

2010 California Mechanical Code.

2010 California Plumbing Code.

2010 California Fire Code.

2010 California Energy Code, Title 24 – 2008

2010 California Green Code, CALGreen

City of Cuppertino Municipal Code

Standards:

ASHRAE Standard 62.1-2010 – Ventilation

ASHRAE Standard 55-2010 – Thermal Comfort

ASHRAE Standard 90.1-2010: Energy Standard for Buildings except Low-Rise Residential Buildings

AMCA – Air Movement and Control Association International, Inc.

ANSI – American National Standards Institute.

ARI – Air Conditioning and Refrigeration Institute.

SMACNA – Fire and Smoke Damper Installation Guide.

SMACNA – Guidelines for Seismic Restraints of Mechanical Systems.

SMACNA – Standards for Duct Construction.

NEMA – National Electrical Manufacturer's Association.

NEMA - National Electrical Manufacturers Association.

NECA - National Electrical Contractors Association.

IEEE - Institute of Electrical and Electronic Engineers.

UL – Underwriters Laboratories.

NFPA - National Fire Protection Association.

NFPA 90A – Air Conditioning and Ventilating Systems.

NFPA 101 – Life Safety Code.

NFPA 13 – Standard for the Installation of Sprinkler Systems.

5.3 Mechanical HVAC Systems

5.3.1 Heating and Cooling Systems

The HVAC system for the Cupertino City Hall consists of a water-cooled chiller plant (70 Ton) with the cooling tower located on the roof and the chiller located on the lower level. A gas fired non-condensing boiler generates heating hot water. The boiler is from the 1965 original building construction and is well past its life time. Both of these systems provide chilled and heating hot water to the Air Handling Units (AHU's) located at the lower level that heat and cool the building through a VAV reheat design. All equipment was installed in ~1986 and is now 26 years old and at the end of its useful life. While the equipment appears to be well maintained, and the AHU's have been retrofitted with VFD's, the building operates inefficiently at a rate of $3.63/SF-Year and 106 kBTU/SF-Year (based on 2009 utility bills). A modern, energy efficient office building operates at $1.50/SF-Year and 50 kBTU/SF-Year.

The Cupertino City Hall has a small server room that is cooled by split system AC units, with air-cooled condensers located on the roof. The AC units for the server room appear to have been installed more recently that the rest of the HVAC equipment.

Figure 5A (Closed-Circuit 70 Ton Cooling Tower)

Figure 5B (Water-cooled 70 Ton Chiller)

In the lower level mechanical room, maintenance clearances and an exit pathway may not exist throughout the space. In addition, the combination of chiller, gas boiler, electrical gear, and generator equipment do not meet today's code requirement to have separate rooms for each of these pieces of equipment. The room is also not equipped with a refrigerant detection and exhaust systems currently required for chiller rooms, and the combustion air ducts in the boiler room need to be routed to an outdoor location.

Figure 5C (Gas Fired Boiler)

Figure 5D (Server room AC unit (1 of 2))

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Upgrade all duct, pipe, and equipment anchorage and seismic attachments to building structure. Replace duct and pipe connections with flexible joints where required.

Alt #3 Moderate Upgrade: Replace existing HVAC equipment with smaller, more efficient, better comfort equipment design.

Alt #4 Replacement: New HVAC systems for new building.

5.3.2 Ventilation

The existing AHU's air intake is located in an airwell that does not provide good air quality air for building occupants. The amount of fresh air brought into the building is not enough by today's standards and codes, and should be increased and improved.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: No work.

Alt #3 Moderate Upgrade: Obtain fresh air from a different location (i.e. roof louvers) and increase amount of fresh air.

Alt #4 Replacement: New HVAC systems for new building.

5.3.3 Controls

The existing control system is and outdated pneumatic system that does not allow for remote monitoring or the implementation of common energy efficiency strategies in modern buildings. In addition the pneumatic controls system requires more maintenance to upkeep the compressor, air filter, and other mechanical systems required to run the system.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: No work.

Alt #3 Moderate Upgrade: Replace existing system with modern DDC controls system.

Alt #4 Replacement: New HVAC systems for new building.

5.4 Plumbing Systems

5.4.1 Plumbing Fixtures

The existing plumbing fixtures are functioning and meet current code.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: No work.

Alt #3 Moderate Upgrade: No work.

Alt #4 Replacement: New plumbing systems and fixtures for new building.

5.4.2 Domestic Water System

The domestic water piping appears to be copper. An AO Smith boiler gas fires water heater provide domestic hot water to all building plumbing fixtures. The water heater appears to have been installed with the last 5 years.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Upgrade all plumbing pipe and equipment anchorage and seismic attachments to building structure.

Alt #3 Moderate Upgrade: Replace existing plumbing pipe (cold and hot water). Replace existing water heater with a high efficiency heat pump water heater.

Alt #4 Replacement: New plumbing systems and fixtures for new building.

5.5 Fire Protection Systems

5.5.1 Fire Sprinkler system

The bulling is fully sprinklered and testing station appears to be in proper operating condition given the test log dates.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Upgrade all fire protection pipe and equipment anchorage and seismic attachments to building structure.

Alt #3 Moderate Upgrade: Replace existing pipe and sprinkler heads inside building to match renovation intent.

Alt #4 Replacement: New fire protection system for new building.

5.6 ELECTRICAL

5.6.1 Electrical Systems Summary

This report is an evaluation of the Cupertino Essential Services building electrical systems, located at Rodrigues and Torre Avenue, in Cupertino, California. The data used to develop this report was collected during one site visit conducted on February 15, 2012, as well as interviews of the staff working at the building. During the field visit, we observed the site conditions and systems exposed to visual observation. No testing or destructive investigation was performed.

Additional information about the building's power distribution system was gathered by reviewing the building plan sets made available in PDF format. The walk through was intended to evaluate the effectiveness of the existing Electrical systems.

This report provides an overview of existing conditions of the electrical system, identification of potential weaknesses in the systems and suggested improvements to the systems.

All major electrical equipment appear to be original and in working condition. The main distribution equipment is nearly 47 years old and has past its expected useful life. The generator is nearly 34 years old and has passed its useful life.

The existing light fixtures are in serviceable condition. As a possible energy saving project, the building management may want to consider replacing the existing lights with more energy efficient T5, T8, LED, and compact fluorescent fixtures. Another energy saving technique would be to upgrade the lighting control system and incorporate occupancy sensors and/or daylight sensors in addition to using time clock controls.

The main service to the City Hall space is a rated at 1000A at 208V, 3-phase system and provides power for a load density of approximately 12.5 W (or 15.5 VA, using 0.8 power factor) per square foot for the entire building, which is adequate for the current loads.

5.6.2 Assessment of Existing Conditions

<u>Normal Power</u>

Utility Transformer

The building is fed from a utility transformer (PG&E) located outside the building.

Figure 1E (PG&E Transformer)

The secondary power from the transformer to the main switchboard is provided via (4) sets of 4" underground conduits.

The main switchboard is rated 1600A, 208/120V, 3-phase, 4-wire and is located inside the main electrical room.

General Condition

The transformer belongs to PG&E and was recently upgraded. It appears to be in good working condition.

Code Issues

No code issues.

Recommendation:

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Confirm with PG&E if the new transformer meets current Seismic code

Alt #3 Upgrade: No work. Transformer was recently upgraded.

Alt #4 Replacement: Transformer was recently upgraded.

Main Switchboard

The Main Switchboard is rated at 2000A, 120/208V, 3 phase, 4 wire with a 1600A main breaker manufactured by Industrial Electric Manufacturing, Inc. The main switchboard is feeding a distribution panel via a 1,000Amp breaker. This switchboard serves the City Hall.

The table below summarizes the load on each panel.

Table 5.1 (Panel Load)

Name	Size	Load Serving
MSB	2000A Section	Library, Future Public Safety Building, ATS for Generator
Panel DP	1000A Section	PANEL F, PANEL C, PANEL A, PANEL E, PANEL B, PANEL D, PANEL G (MCC) CHILLER, Future E.O.C. Panel
G (MCC)	600A	Pump 1, 2, 3, 4, 5, 6, Cooling Tower Fan A/C Fan Basement A/C Fan 1st Floor A/C Fan 1st Floor Remote Radiator Fuel Pump

Figure 5F (Main Switchboard)

General Condition

The main switchboard appears to be of the original construction and in working condition, although past its useful life. In general, the switchboard is adequately sized to support the existing loads.

Code Issues

Maintenance clearances and exit pathway are required to be investigated around the 1600 Amp electrical panel. Electrical panel is over 1200 Amps, thus requiring either (A) 2 exits with panic hardware, or (B) 1 exit door with panic hardware but a clear and unobstructed path from Panel to exit door, or (C) a single exit door with panic hardware but double the required working space around the Panel.

Recommendation

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Provide adequate support suitable for the seismic and earthquake condition.

Alt #3 Upgrade: The existing main distribution switchboard shall have regular preventative maintenance procedure per NETA (National Electrical Testing Association) standards.

Megger test existing feeders.

Test overcurrent protective devices in the switchboard for proper operation.

Alt #4 Replacement: In order to ensure reliable power distribution to the building and reduce service needs in the future, we recommend the main switchboard be replaced with a new model.

5.6.3 Emergency Power

The emergency power system consists of a generator rated at 125KW, 208/120V and is located inside the main electrical room. The fuel tank, with 1000 gallon capacity, is located outside the room. In the event of a power outage, the generator provides power to the panel DP via a 400A automatic transfer switch (ATS) located in the main electrical room. The generator also provides power to the Chiller but the pump must be "jump" to move chilled water. The generator does not serve the existing elevator. or the chiller, as confirmed by discussions with facility personnel.

Figure 5G (Indoor Generator)

General Condition

The generator was installed in 1978, making it nearly 34 years old, which has exceeded its useful life. It appears to be operational, as confirmed by facility personnel.

Code Issues

No code issues

Recommendation

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Provide adequate support suitable for the seismic and earthquake condition.

Alt #3 Upgrade: The generator should at the minimum be tested per manufacturer's recommendation to confirm its operation, and the batteries tested to confirm capacity and condition as well.

Alt #4 Replacement: The existing generator is currently loaded to its full capacity. In order to increase reliability and provide assurance of operation in the future, it is recommended that the generator be replaced with a new unit. We also recommend upsizing the generator to 175kW or above and its associated automatic transfer switch to 500A or above to provide capacity to serve additional loads such as the elevator and any future loads.

5.6.4 Grounding System

The service ground was not readily visible at the Main Switchboard. Feeder and branch circuit ground conductor sizes were not verified. Bonding to the building mechanical systems was not confirmed.

General Condition

No hazard has been identified with the current grounding system.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: No work

Alt #3 Moderate Upgrade: The grounding electrode resistance should be verified and supplemented as needed with additional ground rods. The mechanical and plumbing system bonding should be verified.

Alt #4 Replacement: Provide new grounding system to meet current code.

5.6.5 Lighting

Interior Lighting

The existing lighting system consists mostly of recessed and pendant mounted fluorescent linear T8 32/26 watts source fixtures, with additional recessed incandescent downlight fixtures.

Illumination levels were observed to be uniform and adequate in all common area corridors, offices, work areas, and equipment rooms. Emergency exit signs are provided throughout the building according to Code. Emergency and egress lighting is provided by selected normal fixtures fed by emergency circuits from the generator.Exit lights are LED with battery back-up. Bug-eye type supplemental emergency fixtures was provided in the boiler room.

General Condition

Light fixtures appear to date back to the original construction and are in fair condition, with no operational issues.

Code Issues

Perform functional testing of all existing emergency lighting and measure light levels for code compliance.

Install additional emergency lighting as necessary after the functional testing of the existing installation to provide current code required minimum egress illumination.

Recommendations

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Provide adequate support suitable for the seismic and earthquake condition.

Alt #3 Moderate Upgrade: If improvements to the lighting system are to occur, the existing outmoded T12 source fixtures should be replaced with new higher efficiency T8, T5 or LED source fixtures to reduce energy usage. Newer fixtures will also provide better light distribution and higher uniformity to increase occupant comfort. Any existing incandescent source fixtures should be replaced with higher efficiency compact fluorescent source fixtures.

Alt #4 Replacement: Similar to Alternative 3

5.6.6 Lighting Controls

The existing general lighting is controlled by local switches located within the corridors and at the each room. Lighting in the Kitchen, bathrooms, stairwell and conference room "A" is controlled by motion sensors. Relay control panels provide time schedule control for corridors and general areas, and dimming equipment provides dimming functionality to meeting rooms.

Recommendation

Alt #1 No Upgrade: No work.

Alt #2 Min Seismic Upgrade: Provide adequate support suitable for the seismic and earthquake condition.

Alt #3 Moderate Upgrade: Ceiling mounted occupancy sensors can be added to individual rooms to automatically switch on one-half or all of the fixtures when occupancy is detected and switch off all fixtures when no one is present, to take advantage of irregular occupancy intervals. A time delay of 30 minutes or less can be used to minimize nuisance switching.

To meet current code, reduce energy use, and increase the effectiveness and flexibility of the lighting installation, it is recommended that automatic and multilevel lighting controls be installed in every space.

Alt #4 Replacement: As the perimeter office areas receive good access to daylight, ceiling mounted photosensors may used to provide automated dimming of the perimeter fixtures according to the amount of daylight available, further reducing the lighting load. The existing fluorescent source fixtures within the perimeter daylight area will need to be provided with dimming ballasts in order to integrate with the photosensor input.

In addition, both occupancy sensing and daylight harvesting through photosensors can be employed together. This will keep lights off when the space is unoccupied and also dim the light output when sufficient daylight is available in order to maximize the energy saving potential.

This page intentionally left blank.

This page intentionally left blank.

APPENDIX A - 10

Cupertino City Hall: MEP Systems Alternatives Study
(PAE, Oct 2, 2014)

Cupertino City Hall: MEP Systems Alternatives Study

October 7, 2014

inspire interpret integrate

pae engineers.com
Portland | San Francisco | Seattle

This page intentionally left blank.

Contents

Project Directory

Owner	**City of Cupertino** 10300 Torre Avenue Cupertino, CA 95014 408-777-3200
Architect	**Project Architect** 2 Bryant Street, Suite 300 San Francisco, CA 94105 415-856-3000 **Karen Alschuler** *Principal-in-Charge* Karen.Alschuler@perkinswill.com **Geeti Silwal, LEED AP BD+C** *Associate Principal, Senior Project Manager* Geeti.Silwal@perkinswill.com
Mechanical & Electrical Engineer	**PAE Consulting Engineers, Inc.** 425 California Street, Suite 1200 San Francisco, CA 94104 415-544-7500 **Mike Lucas, PE, LEED AP** *Principal-in-Charge* michael.lucas@pae-engineers.com **Marco Alves, PE, LEED AP** *Project Manager* marco.alves@pae-engineers.com **Harj Sidhu, PE, LEED AP** *Electrical* harjot.sidhu@pae-engineers.com **Stuart Gregson, PE, LEED AP** *Mechanical* stuart.gregson@pae-engineers.com

1.0 Project Description

This report is a follow up to the "Cupertino City Hall Essential Services Facility Analysis" report produced on 3/27/2012 by Perkins + Will, AKH Structural Engineers, and PAE. Refer to the 2012 report for details information on existing systems.

At this time the design team is considering 5 options for the city hall building:

1. Option A – Upgrade city hall with life safety
2. Option B – Upgrade city hall with life safety + EOC
3. Option C – Gut and remodel city hall
4. Option D – New city hall building with basement parking
5. Option E – New city hall building with basement parking + council chambers

The following sections outline the Mechanical, Electrical, and Plumbing implications of each of the above options. TBD Consultants has been engaged to provide cost estimates of each of these options.

2.0 OPTION A - UPGRADE CITY HALL WITH LIFE SAFETY

2.1 Electrical

Existing Electrical equipment including Main Switchboard, panelboards, etc. are all well past their useful life. Replace all Electrical distribution equipment.

Existing wiring to be removed and new wiring to be pulled through new conduit.

Upgrade Fire Alarm to meet the latest Life Safety requirements.

Provide new lighting fixtures to meet the latest T24 requirements. Emergency power for egress fixtures, via local battery packs.

2.2 Mechanical

Demo existing 70-ton, 1986 vintage water cooled chiller in lower level mechanical room.

Demo existing 70-ton, closed circuit, 1986 vintage rooftop cooling tower.

Demo 1965 vintage gas fired non-condensing boiler in lower level mechanical room.

Demo lower level 1986 vintage VAV+ reheat air handling unit.

Add new 70 ton air-cooled chiller at roof/attic level.

Add (2) 400,000 Btu (input capacity) condensing boilers at basement level.

Add new pipe and pumps for chilled and hot water systems.

Add (2) new AHUs to basement level (15,000 cfm each).

Clean and reuse existing ductwork as much as possible.

Increase ventilation rate to today's standards, re-route ventilation air intake.

Demolish existing pneumatic VAV boxes.

Provide new VAV boxes with direct digital controls.

Provide new BMS with DDC controls for all equipment and terminal units with front end for basic control and monitoring functions.

2.3 Plumbing

Miscellaneous upgrades for ADA compliance per September 2014 ADA report, including repositioning toilet heights and correcting lavatory/drinking fountain access.

2.4 Fire Protection

Modify sprinklers for code updates.

2.5 Indirect Costs

Cost of building/locating the EOC elsewhere on campus. Council Chambers remains at the Community Hall. The operations of the facility is not included in the costing.

3.0 OPTION B - UPGRADE CITY HALL WITH LIFE SAFETY + EOC

3.1 Electrical

Existing Electrical equipment including Main Switchboard, panelboards, transformers etc. are all well past their useful life. Replace all Electrical distribution equipment.

Existing wiring to be removed and new wiring to be pulled through new conduit.

Existing Generator is well past it's useful life. Replace with new generator.

Evaluate Generator capacity versus the latest EOC requirements. Minimum generator size to be 125kW to match existing size.

Upgrade Fire Alarm to meet the latest Life Safety requirements.

Provide new lighting and lighting controls to meet the latest T24 requirements. Emergency power for egress fixtures, via local battery packs.

3.2 Mechanical

Same points as Option A, also including the following:

Upgrade all duct, pipe, and equipment anchorage and seismic attachments to building structure. Replace duct and pipe connections with flexible joints throughout. All large equipment shall be spring isolated.

AHU to be placed in attic level or roof. Preliminary selection indicates (2) AHU's at 7'W x 28'L x 5'H (10,000 lbs each).

Boiler to be placed at roof level.

Add HVAC heating to generator load (AHU, Boiler, Pumps, will be on emergency power, connected to the generator).

3.3 Plumbing

Miscellaneous upgrades for ADA compliance per September 2014 ADA report, including repositioning toilet heights and correcting lavatory/drinking fountain access.

Upgrade all plumbing equipment and pipe anchorage and seismic attachments to building structure.

3.4 Fire Protection

Modify sprinklers for code updates.

Upgrade fire sprinkler pipe anchorage and seismic attachments.

3.5 Indirect Costs

Cost of operating the Council Chambers at the Community Hall is separate.

3.6 Floodplain Considerations

We understand that FEMA stipulations require that emergency equipment shall not be located within Special Flood Hazard Areas Zones A, AE, and AO (which are areas within the 100 year floodplain). The attached FEMA map shows flood plain areas in the City of Cupertino and near the project location indicating that the project location is not within the 100 year floodplain zones.

FEMA's 2007 Design Guide for Improving Critical Facility Safety from Flooding and High Winds, publication 543 (located here: http://www.fema.gov/media-library-data/20130726-1557-20490-1542/fema543_complete.pdf) advises that emergency equipment should be located above the 500 year flood elevation. While this is a design guideline and not necessarily a FEMA requirement, PAE recommends that the project design should attempt to comply with this guideline. Consideration should be given to relocating the emergency generator to a level above grade to mitigate the risk of flooding due to storm conditions or piping malfunctions within the building.

The attached map indicates that the project is within the 500 year floodplain; however it does not designate the specific elevation of the 500 year flood. PAE recommends that a qualified firm/organization should be engaged to consult on specific floodplain elevations and recommendations for FEMA compliant locations for the emergency generator.

4.0 OPTION C - GUT AND REMODEL CITY HALL

4.1 Electrical

Existing Electrical equipment including Main Switchboard, panelboards, transformers etc. are all well past their useful life. Replace all Electrical distribution equipment.

Provide new Electrical Distribution throughout the building. This includes new Main Switchboards, panelboards, and transformers.

Provide new conduits to distribute power.

New wiring

Existing Generator is well past it's useful life. Replace with new generator.

Evaluate Generator capacity versus the latest EOC requirements. Minimum generator size to be 125kW to match existing size.

Upgrade Fire Alarm to meet the latest Life Safety requirements.

Provide new lighting and lighting controls to meet the latest T24 requirements. Emergency power for egress fixtures, via local battery packs.

4.2 Mechanical

Same points as Option B, also including the following:

New thermal zoning layout.

New distribution ductwork.

New distribution piping.

Design for mixed mode natural + mechanical ventilation, possibly engaging light wells or light court for transfer air.

All new mechanical system is likely to remain an air based VAV + reheat system.

4.3 Plumbing

Provide new high efficiency, condensing gas water heater.

Provide all new piping for the following systems:

a) Domestic Cold and Hot water piping

b) Vent piping

c) Gas piping

d) Storm piping

e) Waste piping

Provide new (water conserving) plumbing fixtures, ADA compliant.

4.4 Fire Protection

New sprinkler system.

4.5 Indirect Costs

Cost of operating the Council Chambers at the Community Hall is separate.

4.6 Floodplain Considerations

Same as Option B.

5.0 OPTION D - NEW CITY HALL BUILDING + BASEMENT PARKING

5.1 Electrical

New incoming service

New distribution

New Lighting

New Generator

New Fire Alarm

5.2 Mechanical

New central hydronic equipment: geothermal slinky field (60,000 sf area) below basement parking, served by water to water heat pump. Although the basement parking footprint area is planned to be 45,000 sf a 60,000 sf excavation area may be available due to shoring requirements. If needed the slinky field can extend further into (below) the site, or can be located in another location that may already be planned for excavation for other campus reasons. If desired, the slinky field can be piped so as to accommodate potential future expansion should the slinky field ever be desired for use as a campus system serving multiple buildings.

- Take advantage of federal tax savings for geothermal systems: 10% Tax Credit year 1, and 100% depreciation over 5 years.
- City of Cupertino to determine tax liability and eligibility for tax savings programs. One option may be a Thermal Purchase Agreement (TPA) in which a tax-liable 3rd party procures the geothermal system and secures the tax savings, and the City of Cupertino purchases the thermal energy from the 3rd party.

New indoor services, including radiant heating/cooling with dedicated outdoor air system.

Garage ventilation with CO sensor control.

5.3 Plumbing

New incoming/outgoing services for Fire, Gas, Domestic Cold Water, Storm Drain, and Waste.

New high efficiency condensing gas water heater and associated components (recirculating pump, storage tank, expansion tank, etc.)

New water conserving plumbing fixtures, ADA compliant.

New plumbing piping systems.

5.4 Fire Protection

New sprinkler system.

5.5 Indirect Costs

Cost of operating the Council Chambers at the Community Hall is separate.

5.6 Floodplain Considerations

Same as Option B.

6.0 OPTION E - NEW CITY HALL BUILDING + BASEMENT PARKING + COUNCIL CHAMBERS

6.1 Electrical

Same as Option D

6.2 Mechanical

Same as Option D, with higher ventilation rates and equipment capacities and geothermal slinky field (70,000 sf area to account for additional area of council chambers).

6.3 Plumbing

Same as Option D

6.4 Fire Protection

Same as Option D

6.5 Indirect Costs

Assume EOC included.

6.6 Floodplain Considerations

Same as Option B.

7.0 ENERGY BENCHMARKING

Based on 2013 utility bills, the existing facility operates inefficiently at an energy cost rate of \$3.65/sf-year and an Energy Use Intensity (EUI) of 92 kBTU/sf-year (based on a September 2014 study provided by the City). A modern, energy efficient new construction office building in this climate would operate at approximately \$1.20/sf-year and 35 kBtu/sf-year.

Based on PAE's project experience, Figures 1 and 2 on the next page illustrate potential reductions in energy use and energy cost associated with each of the options described in this report.

Figures 3 and 4 illustrate preliminary life cycle cost analysis and total cost of ownership for the mechanical systems described in Options A-E. In this case, the first cost of Options D and E was normalized on an area basis for equal comparison to Option A, B, and C. The Option D and E costs shown here are as if these options had the same project area as Option A, B, and C.

Figures 3 and 4 show that even though Options C, D, and E have higher first costs, the total cost of ownership over time is significantly less compared to Options A and B. The simple paybacks on Options D and E are less than 10 years, and the 30 year total cost of ownership for Options D and E are millions of dollars less than any other option. This is something to consider for the life of a project that is expected to last 30 years or more.

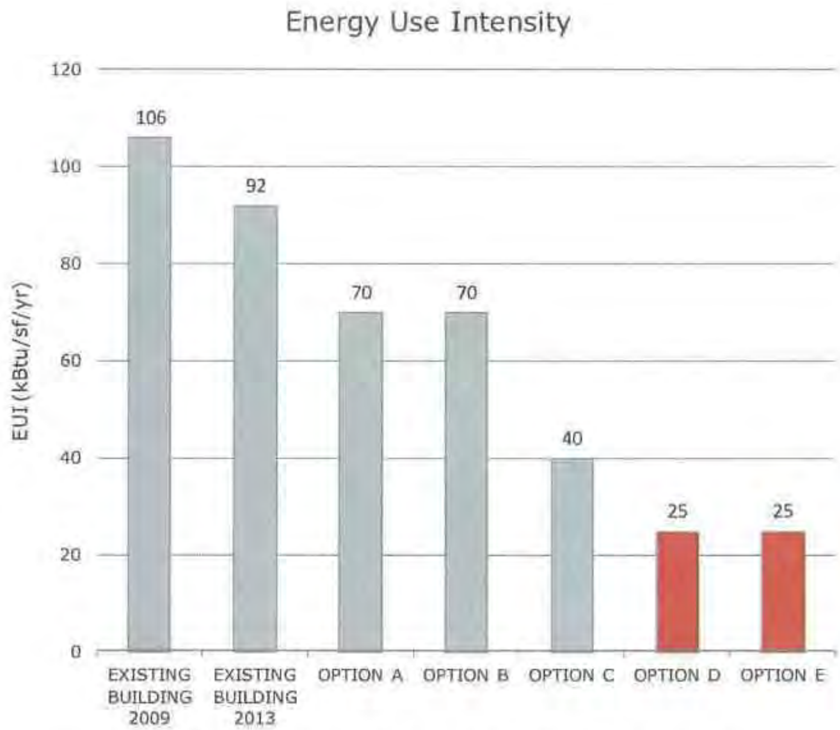


Figure 1. Energy Use Intensity (EUI) comparisons

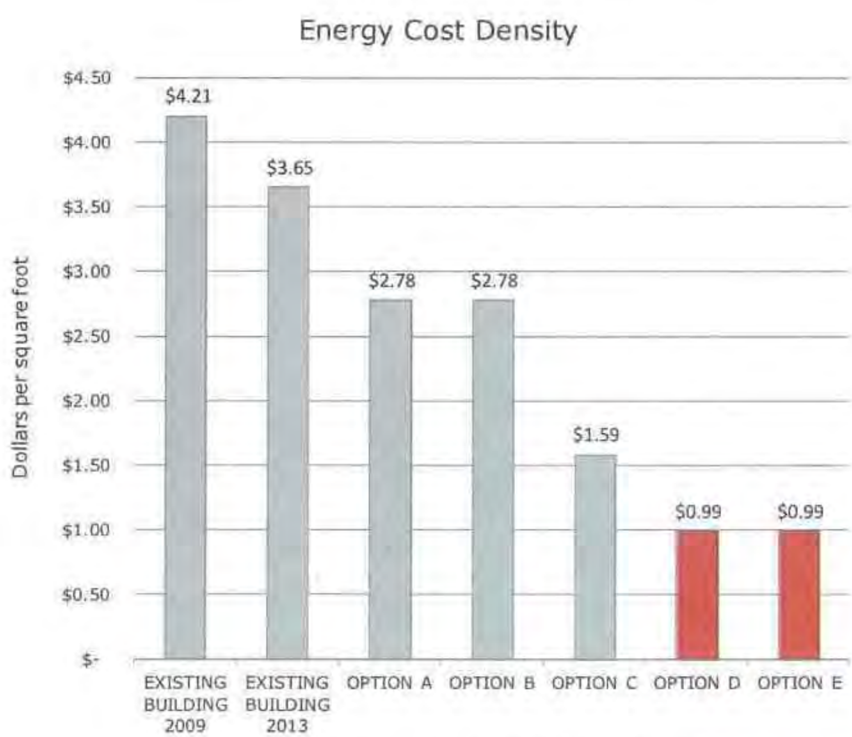


Figure 2. Energy Cost Density comparisons

LIFECYCLE COST ANALYSIS									
BASED ON 30 YEAR ANALYSIS - 2014 to 2043									
Options	OPTIONS	Capital Costs ($)2014	Avg. Annual Maint. Costs ($)	Avg. Annual Repla. Costs ($)	Year 1 Utility Costs ($)2014	Simple Payback Option A Base (Years)	15 Year Cost of Ownership ($)2028	30 Year Cost of Ownership ($)2043	Energy Use Index (kBtu/sf-yr)
A	Option A - UPGRADE CITY HALL WITH LIFE SAFETY	$2,725,421	$79,292	$40,003	$63,940	-	$5,268,795	$10,309,194	70
B	Option B - UPGRADE CITY HALL WITH LIFE SAFETY + EOC	$3,065,022	$79,292	$40,003	$63,940	N/A	$5,608,396	$10,648,795	70
C	Option C - 4.0 OPTION C - GUT AND REMODEL CITY HALL	$3,710,142	$47,575	$40,003	$36,570	16.7	$5,290,933	$8,523,976	40
D	Option D - 5.0 OPTION D - NEW CITY HALL BUILDING + BASEMENT PARKING	$3,750,927	$23,788	$26,884	$22,770	9.3	$4,754,949	$6,651,191	25
E	Option E - 6.0 OPTION E - NEW CITY HALL BUILDING + BASEMENT PARKING + COUNCIL CHAMBERS	$3,705,176	$23,788	$26,884	$22,770	8.9	$4,709,199	$6,605,441	25

Notes / Assumptions:

1. Capital Costs are based on reports from TBD consultants, dated 10/5/14 and 10/6/14, plus PAE estimates of controls costs. Capital costs of Options D and E are normalized by project area to create an even comparison with Options A, B, C. These are the costs if a new building was built with the same area as the existing building.

Figure 3. Life Cycle Cost Analysis Results

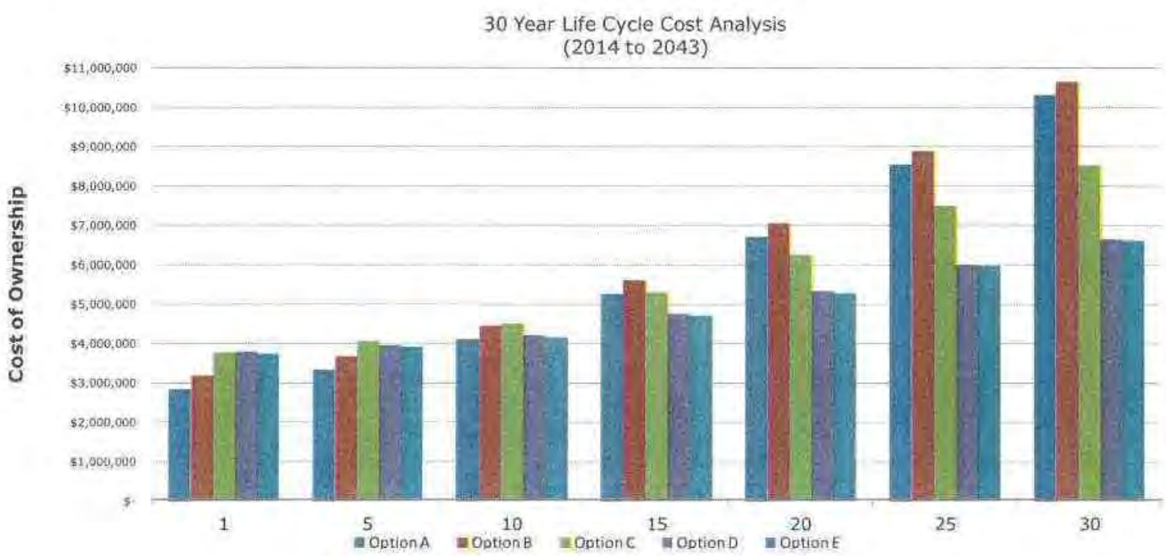


Figure 4. Total Cost of Ownership over 30 years

NOTES TO USERS

LEGEND

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0209H

FIRM
FLOOD INSURANCE RATE MAP

SANTA CLARA COUNTY,
CALIFORNIA
AND INCORPORATED AREAS

PANEL 209 OF 830

MAP NUMBER
06085C0209H

EFFECTIVE DATE
MAY 18, 2009

Federal Emergency Management Agency

This page intentionally left blank.

APPENDIX A - 11

Cupertino City Hall Alternatives Study, Structural Evaluation
(Tipping Mar, Sept 29, 2014)

Executive Summary

Five alternative options have been discussed for the future of the City Hall, with various degrees of improvement, from performing the minimum amount of architectural remodel and structural strengthening to a brand new replacement building with additional underground parking. The first three options involve the seismic strengthening of the existing structure. This report will focus primarily on those three options, evaluated under the reference standard ASCE41-13 "Seismic Evaluation and Retrofit of Existing Buildings".

The proposed strengthening scheme for Option A involves structural strengthening of the building's seismic force resisting system to satisfy a life safety performance objective and includes minimal architectural remodeling. The limited level of seismic strengthening associated with this option will require the emergency operations center (EOC) to be relocated to another location. As part of this retrofit option, we have confirmed that the strengthening recommendations contained in the "Cupertino City Hall Essential Services Facility Analysis", dated March 27, 2012, could be implemented. The only exception would be the concrete column strengthening could be less intrusively achieved with the addition of new adjacent steel columns in lieu of fiber wrap. The new steel columns would act as secondary support members in the event of seismic related damage to the existing concrete columns. Seismic improvements would also include non-structural elements such as suspended ceilings, partition walls, and glazing systems. These elements would require bracing to seismically strengthen their connections and the replacement of any non-tempered glazing.

The proposed strengthening scheme for Options B and C both involve retrofitting the existing city hall to an immediate occupancy performance objective. This performance objective would allow the EOC to be retained within the existing city hall building. Option B would involve less architectural remodeling, whereas Option C would entail a complete architectural remodel. Option C would allow for a new, large light court in the center of the building, thus requiring additional structural modifications to both the roof and floor level gravity framing systems. Seismically, the structural deficiencies for both of these options are the same as those for Option A above. All options require strengthening the existing roof diaphragm, roof girder collector splice connections, roof girder to shear wall connections, adding additional length of concrete shear wall from the first floor level to the roof, strengthening the exterior colonnade connection to the roof framing, and strengthening the existing concrete columns to withstand anticipated seismic displacements.

Options B and C will require a more extensive strengthening of these elements than Option A, given the more stringent performance objective. As with Option A, non-structural elements will also require strengthening. To achieve immediate occupancy, these element would have to be designed to have only minimal, limited damage after a seismic event. This may be difficult to achieve with the existing building materials to be retained in Option B. In Option C, these elements will be constructed anew, and can be explicitly designed for an immediate occupancy performance objective. Finally, it should be noted that any retrofit intended to achieve an immediate occupancy performance objective will be met using prescriptive code methods that merely increased the force level demands on seismic resisting elements. This prescriptive code based approach does not necessarily assure that the performance goals of uninterrupted operation and immediate occupancy will be met.

The construction of a new City Hall building, Options D and E, will offer the opportunity to design both the building's gravity and seismic force resisting systems for the specific performance objective of immediate occupancy. Options A, B, or C, aim to strengthen the old building by limiting damage to a structure that, even after a costly retrofit is undertaken, is still largely constructed in an antiquated manner. A new City Hall can be constructed with the latest state of the art seismic force resistance technologies, such as base isolation systems or passive energy dissipation devices which will result in a facility that is more earthquake resilient than a traditionally seismically retrofitted structure. Using state of the art, site specific, seismic modeling techniques and ductile detailing practices a greater degree of certainty regarding seismic performance can be intentionally built into the structure to assure that the city's critical service functions do not become interrupted after a large seismic event.

Existing City Hall Construction

The City Hall was originally built in the late 1960's as a one-story building with a full basement. The main roof is consisted of plywood sheathing over 3" tongue and groove decking over 6 and 8 inch timber beams. The timber roof beam are then supported by either steel or concrete girders. The roof framing for the central mechanical well is consisted of plywood sheathing over 2 in timber joists supported by steel beams. The central mechanical well is surrounded by 5' tall wood framed parapet. The main roof and the parapet are covered with clay roof tiles which represent a significant portion of the current roof's self weight and seismic mass. The structure was renovated as part of the Civic Center Improvements project in the mid 1980's. During the renovation, the north side of the basement was excavated to create a concrete terrace, approximately 20 wide, parallel to the building. Portions of the original north basement walls were removed to create new storefronts. An additional 6 inches of shotcrete was added to the remaining north basement wall. The current lateral force resisting system of the structure is 6 inch concrete shear walls above grade and 12 and 18 inch concrete shear walls in the basement. Concrete slab, joists, and girders make up the ground floor framing. Interior concrete columns extend from shallow pad footing foundations to the roof level. Perimeter concrete columns are supported by the basement walls. There is also a perimeter exterior colonnade framed with concrete columns and beams.

Structural Evaluation Methodology

The materials reviewed were the 1965 Cupertino City Hall structural drawings, 1986 Cupertino City Center Improvement architectural drawings, and the Cupertino City Hall Essential Services Facility Analysis Report dated March 27, 2012.

The methodology used to evaluate the existing City Hall structure and the associated reftrofit schemes were based on American Society of Civil Engineers Standard 41-13 "Seismic Evaluation and Retrofit of Existing Buildings" (ASCE 41-13). ASCE 41-13 is a nationally recognized Standard that can be used as a tool to evaluate existing buildings and develop corresponding retrofit schemes. Although the seismic evaluation and retrofit of the existing City Hall is voluntary and the application of ASCE 41-13 is not mandatory, the use of this Standard is more appropriate than design code CBC 2013 that is intended primarily for new building designs. ASCE 41-13 takes into consideration of existing building's material properties, construction details, expected structural component and systems performance, and evaluates them against a selected Performance Objective. The main focus of this study was to evaluate Options B and C at a Performance Objective of Immediate Occupancy under a 20% probability of exceedance in 50 years seismic hazard (Basic Safety Earthquake-1E). Options B and C are classified as a Risk Category IV Essential Facility. A Linear Static Procedure was used for the evaluation and retrofit design. Soil Site Class D was assumed as a geotechnical report was not available at this time.

Seismic Evaluation and Retrofit Recommendations

Retrofit Option A

The objective of Option A is to relocate the EOC to another facility and upgrade the City Hall to a Life Safety Performance Objective under Basic Safety Earthquake-1E. Based on our findings from the existing structure's evaluations at the Immediate Occupancy Performance Objective level and a review of the performance requirements at the Life Safety level, the recommended structural retrofit would be one that is similar to the scheme proposed by AKH Structural Engineers in the "Cupertino City Hall Essential Services Facility Analysis dated March 27, 2012.

As discussed earlier in the report, the existing concrete columns are susceptible to seismic damage due to the limited amount and size of the confinement ties around the longitudinal reinforcement. The lack of confinement ties can limit the column's ductility, or ability to sway and remain undamaged during a seismic event. This limited ductility could cause the column to lose its gravity loading carrying capabilities and ability to provide continued support of the roof framing members. The existing concrete columns should be either paired with secondary steel columns to provide redundant gravity support capabilities or strengthened with fiber reinforced polymer to address this deficiency. The exterior colonnade columns can be fiber wrapped with minimal interruptions to other architectural elements. Where the wrapping activity may not be feasible, such as in areas adjacent to exterior facades, supplemental steel 6x6 columns at the perimeter and steel 8x8 columns at the interior may be placed adjacent to the existing un-wrapped columns to serve as the back-up gravity system.

To satisfy the Life Safety Performance Objective for non-structural components and systems, it is likely a seismic safety film (designed to hold shattered glass in place) will need to be applied to any existing non-safety, non-laminated annealed glass or the glazing panes themselves should be replaced. Additional tie wires for suspended ceiling grids and additional bracing and anchorage for interior partitions should be added to prevent extensive falling of ceiling tiles and wide spread collapse of partition walls during an earthquake. Mechanical systems should also be provided with a minimum level of seismic bracing, if not already in place, to prevent duct work and piping from posing a falling hazard to occupants. Finally, new or existing roof mounted equipment should be properly anchored to roof framing. This may, in some instances of heavy equipment, require additional localized strengthening of the roof framing members themselves.

Retrofit Options B and C

Evaluation of Structural Components

The main structural deficiencies for the existing City Hall are discussed below. These deficiencies are common for both Options.

- Roof diaphragm shear capacity
- Roof collector splice capacity
- Collector to shear wall connection capacity
- Shear wall flexural capacity and seismic detailing
- Concrete column ductility
- Porch colonnade to roof connection

Recommendations for Structural Strengthening

Roof Diaphragm Strengthening Measures

The existing heavy clay roof tiles make up a significant portion of the existing roof's self weight. As the building's seismic force demand is directly proportional to the self weight, it is recommended that the existing clay roof tiles be removed and replaced with a lighter roofing material. Even with the mass of the roof significantly reduced, the force demand on the roof diaphragm is near the capacity limit state for a plywood diaphragm given the shear forces associated with an immediate occupancy performance criteria.

As such, a new High Load Diaphragm will be required for the roof area outboard of the central mechanical well. New 3/4" plywood will be provided over the existing 1/2" plywood and 3x tongue and groove blocking with two rows of 10d nails @ 2 1/2" o.c. along diaphragm boundaries and continuous panel edges, 4" o.c. at other panel edges, and 12" o.c. in field. The existing diaphragm at the central mechanical well will be strengthened with 1 row of 10d nails @ 2" o.c. along diaphragm boundaries and continuous panel edges, 3" o.c. at other panel edge, and 12" o.c. in field. New 4x6 blocking will be added at continuous panel edges perpendicular to joist framing direction.

Roof Level Collector Strengthening Measures

There are several types of collector connections at the roof level, all of which require strengthening to increase their load carrying capacity. Where the existing roof diaphragm collectors are wide flange steel roof beams, they are currently spliced to each other with machine bolts. Theses splices will need to be strengthened with additional new splice plates and new welding as shown in on Sheet S3, Detail 2, of the attached building retrofit drawings. Where existing roof collectors occur at steel wide flange to wood girder locations, additional horizontal Simpson Holdowns or CMST straps are required to strengthen the existing steel beam to timber girder connections, as shown in Detail 1 of Sheet S3. The porch colonnade on the exterior perimeter of the building is constructed of concrete beams and columns. The anchorage connections between these beams/columns and the wood roof framing and diaphragm currently lacks a clear load path and does not have adequate capacity. New connecting members should be installed to provide proper anchorage between the colonnade and the roof diaphragm, as shown in Detail 4 of Sheet S3. Finally, the collector connections anchoring the steel beams to the tops of the existing concrete shear walls need to be strengthened. Additional anchor bolts will be added between existing shear walls and collectors. New shear walls will also be connected to the existing steel roof beam collectors with new anchor bolts.

Additional Concrete Shear Walls

Additional shear walls extending from foundations to roof should be added to provide new/strengthened vertical seismic force resisting elements for the existing structure. The new shear walls will typically be 12" thick concrete walls from the top of existing basement walls to the underside of the roof and 6" thick concrete walls that are overlapped and connected to the face of the existing basement walls with reinforcement dowels, as shown in Detail 3 of Sheet S3. Where the wall length is limited at the north elevation within the basement level, two new new pile caps, with two micro-piles at each cap, should be provided to increase the shear wall overturning resistance along this line and protect the existing very lightly reinforced foundation from associate seismic damage.

Strengthening the Existing Concrete Columns

The concrete columns are connected to all floor levels and to the roof. As such, they will deform as they drift with the rest of the building during an earthquake. Bending moments and shear forces will be induced in these columns as they sway with the building during a seismic event. The long span and inherent flexibility of the wood roof diaphragm will also contribute to the anticipated seismic roof drift making these under-reinforced columns very susceptible to seismic damage. The existing concrete columns have limited confinement reinforcement ties around the longitudinal reinforcements, as noted earlier in this report. Sufficient lateral ties are required in modern building codes to properly confine the longitudinal bars and the concrete core in order for the columns to continue carrying gravity loads when the columns are displaced. The lack of confinement ties is likely to result in limited displacement ductility for the concrete column. The existing columns are to be wrapped and strengthened with fiber reinforced polymer. Wrapping the existing columns will increase the displacement ductility for gravity load carrying capacity.

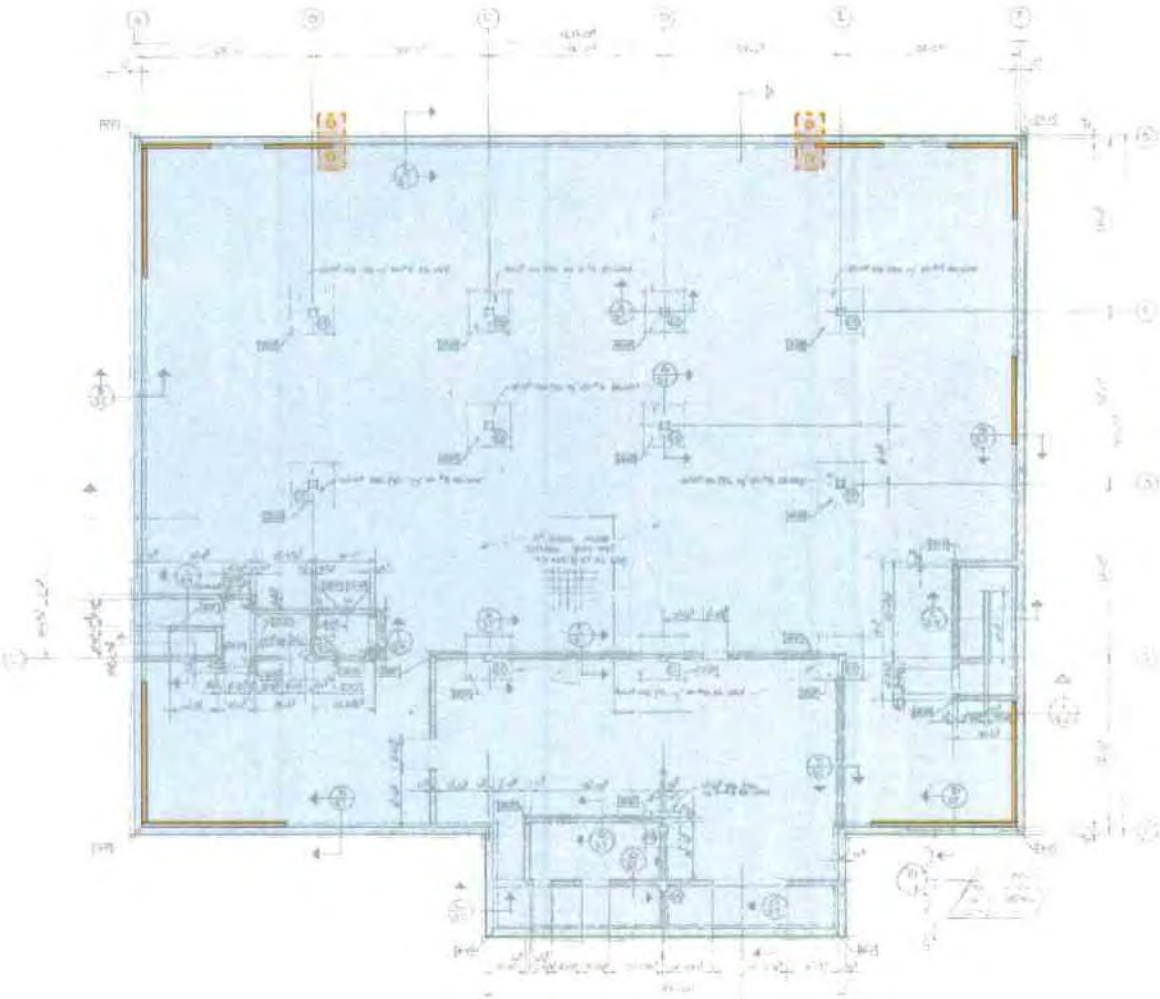
Structural Alterations for Option C

Additional gravity framing modifications also required for the installation of a large new light court and for the relocation of the building's elevator and stairs. Roof framing modifications such as new wood headers, blocking, and strapping are required around the new roof opening. Modifications to existing ground floor concrete framing will also be required to accommodate the new light court and various relocated stairs and elevators. These modification will include new concrete beams to support existing concrete joist framing that have had their existing support framing removed or modified. Retrofit support of gravity framing members often requires precision chipping of existing concrete surfaces, rebar coupling for reinforcment extensions, and welding of anchorage plates to properly anchor the ends of existing concrete members to new concrete supports.

Non-Structural Components and Systems for Options B and C

Existing anchorage and support details for the majority of the architectural, mechanical, electrical, and plumbing components are unknown. Additional as-built documents or site survey may be required to assess the building's non-structural components and systems conformance to the Performance Objective. The Nonstructural Performance Level for an Essential Facility should satisfy the ASCE 41-13 "Operational" Objective, where the nonstructural components and systems are able to perform the same functions they provided before the earthquake. Per ASCE 41-13, Tables C2-5 and C2-6, non-structural components, such as architectural, mechanical, electrical, and plumbing systems should have only negligible damage after a seismic event. There should be no loss of function to exterior cladding panels and they should remain weather-tight. There should not be any cracked or broken panes in the exterior glazing. There should only be negligible damage to interior partitions and ceilings with no impact on occupancy and functionality. Elevators will remain in operation. HVAC equipments, electrical distribution, and plumbing system remain operational if emergency power and other utilities are provided. Fire alarm systems and emergency lighting should remain operational. Ducts, fire suppression piping, and light fixtures should have only negligible damage.

It is likely the exterior cladding and glazing system needs to be replaced with a new system that can satisfy the Essential Facility performance objective. Anchorage and bracing for the existing suspended ceiling and interior partitions will also need to be strengthened and upgraded. Similarly, the same will apply to all of the existing mechanical, electrical, plumbing, and emergency systems if they remain. It may difficult to meet the operational performance objective for Option B where the existing building systems where not intentionally designed to remain in operation with only negligible damage after a major seismic event. Option C would allow these systems to be explicitly designed to satisfy the operational performance objective. Finally, new or existing roof mounted equipment should be properly anchored to roof framing. For moderate to heavy pieces of equipment, additional localized strengthening of the roof framing members should be anticipated.



Legend:

(N) Concrete Wall

(N) Pile Cap with Micropiles

Provide 4' wide x 6' long x 4' deep pile cap with 2 micropiles at each cap. Micropile capacity +/- 150 kip design load.

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave. Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option B

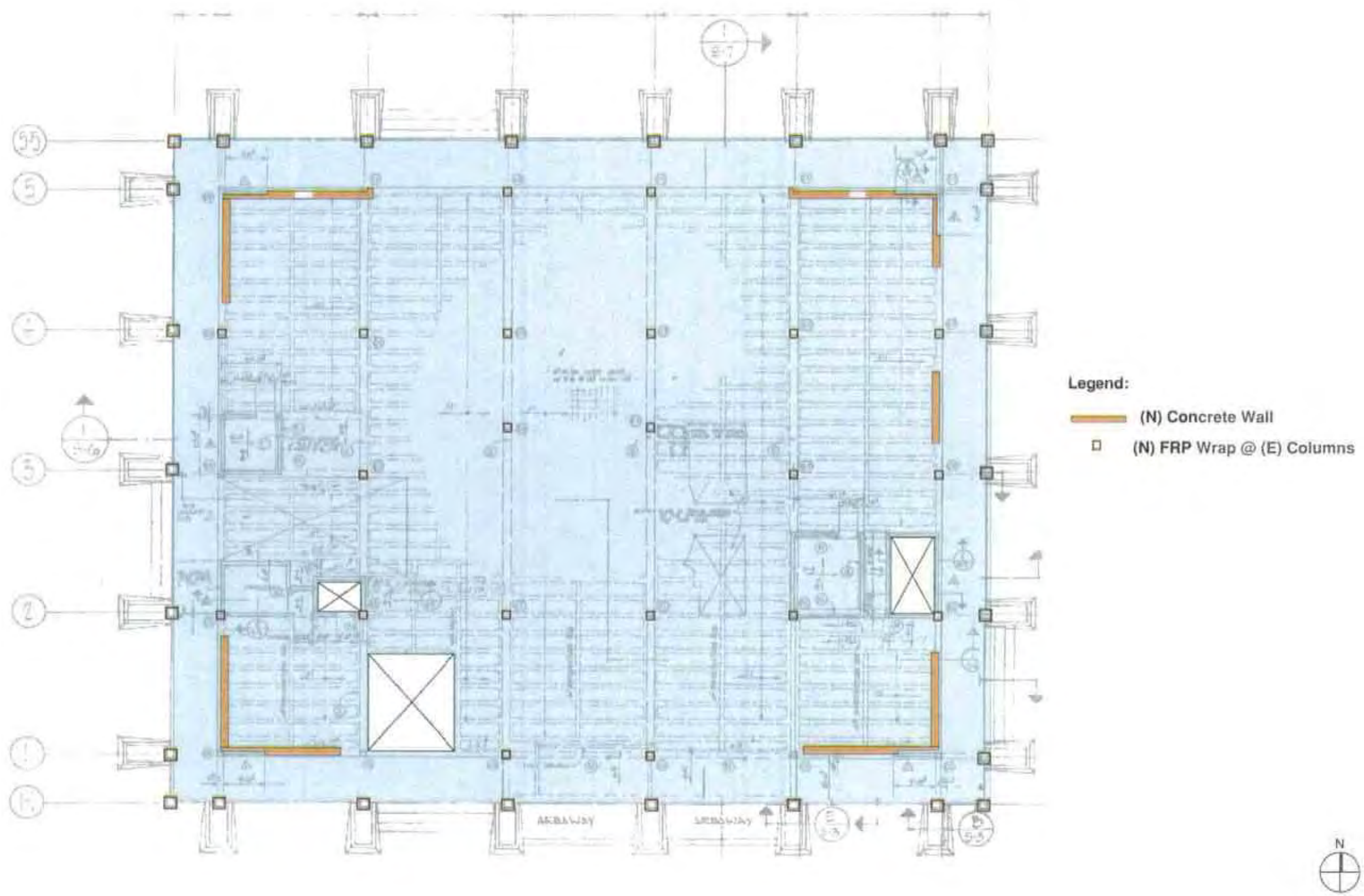
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

Terrace Level Plan

September 29 2014

S0



TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave. Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option B

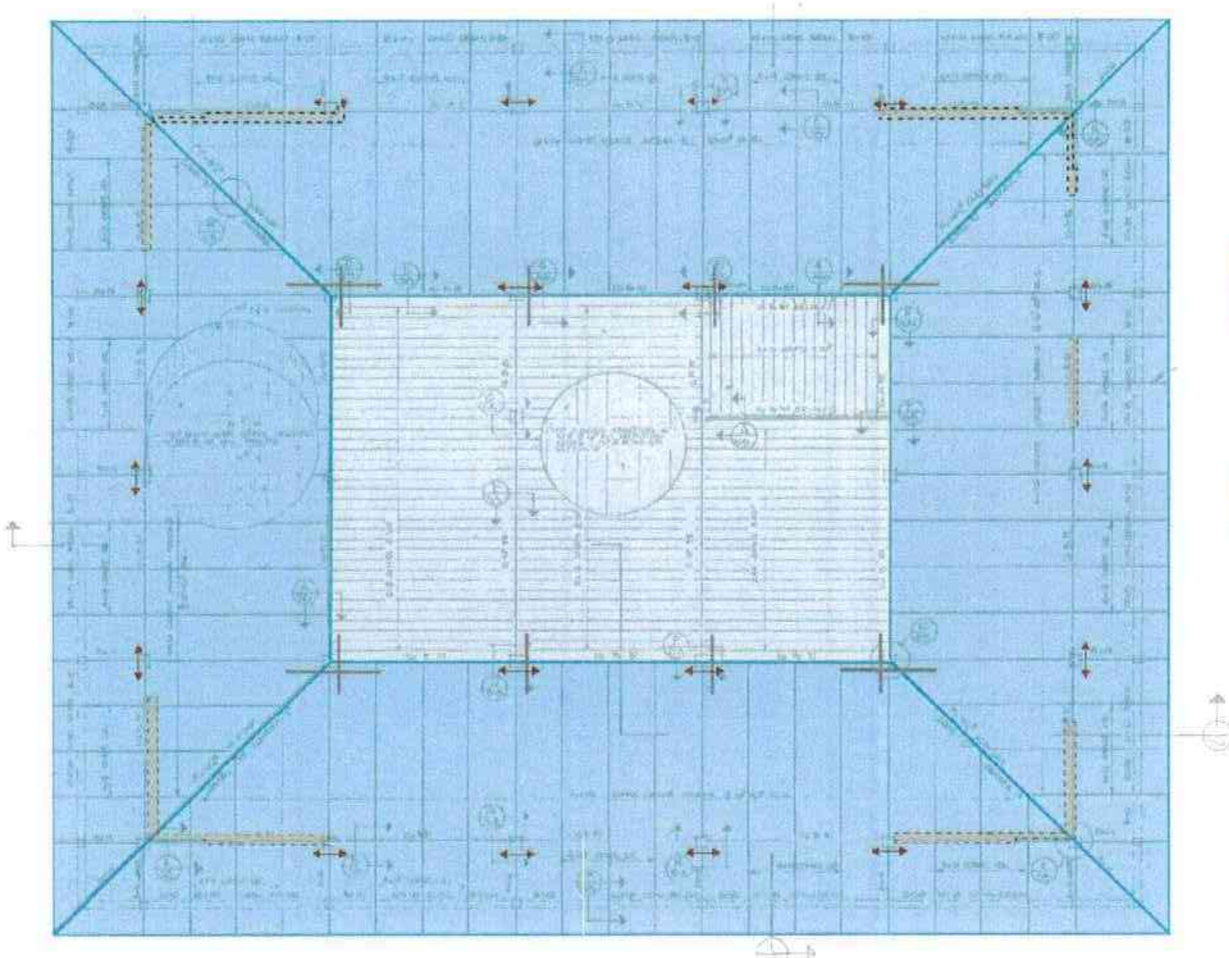
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

Ground Floor Plan

September 29 2014

S1



Legend:

(N) Concrete Wall Below

(N) High Load Diaphragm
Provide (N) 3/4" Plywood over (E) 1/2" Plywood and 3X T&G Blocking w/ 2 Rows of 10d Nails @ 2 1/2" o.c. along diaphragm boundaries and cont. panel edges, 4" o.c. at other panel edges, and 12" o.c. in field

(E) Reinforced Diaphragm
Reinforce (E) 1/2" Plywood w/ 1 Row of 10d Nails @ 2" o.c. along diaphragm boundaries and cont. panel edges, 3" o.c. at other panel edges, and 12" o.c. in field. Provide (N) 4x6 min. blocking @ cont. panel edges perpendicular to framing direction, typ.

(N) Simpson CMST strap or Simpson Holdown

Retrofitted WF Steel Collector Connection

N

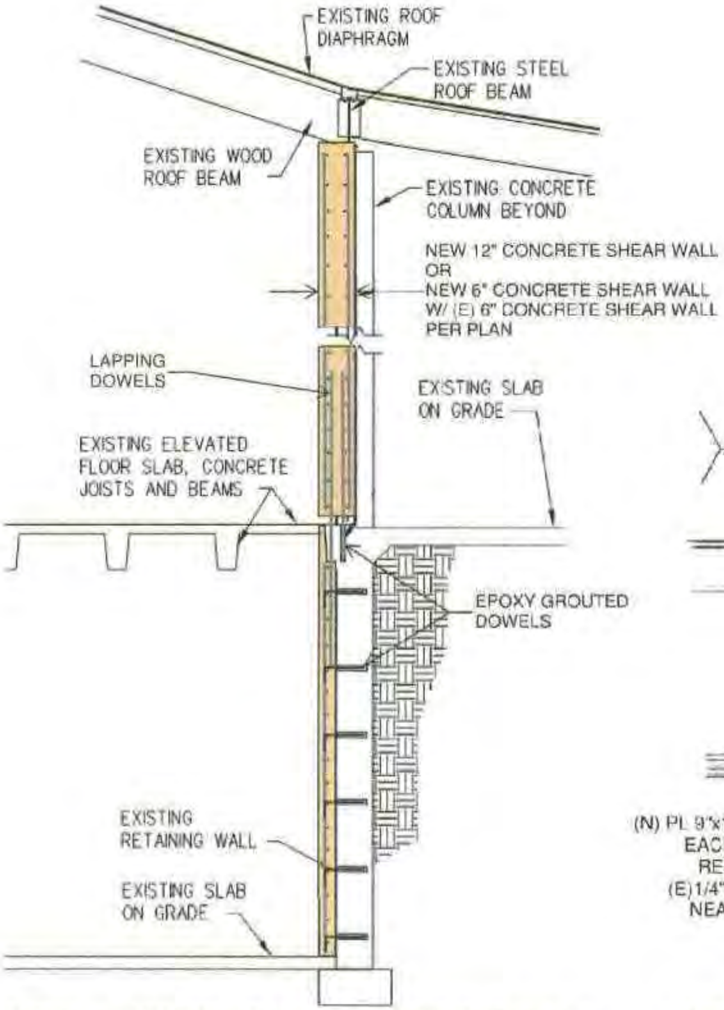
TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave. Berkeley, CA 94704
510 549-1906 510 549-1912 fax

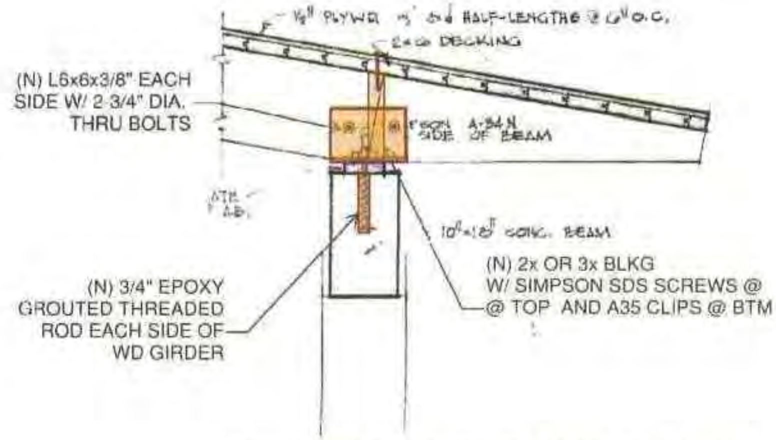
Cupertino City Hall | Option B
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

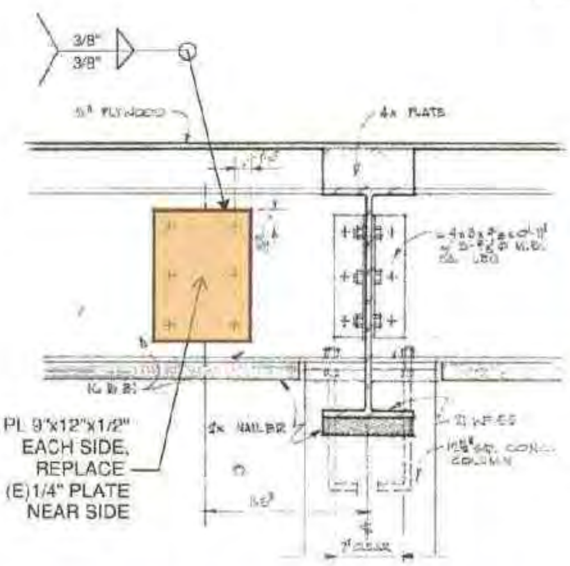
Roof Plan
September 29 2014

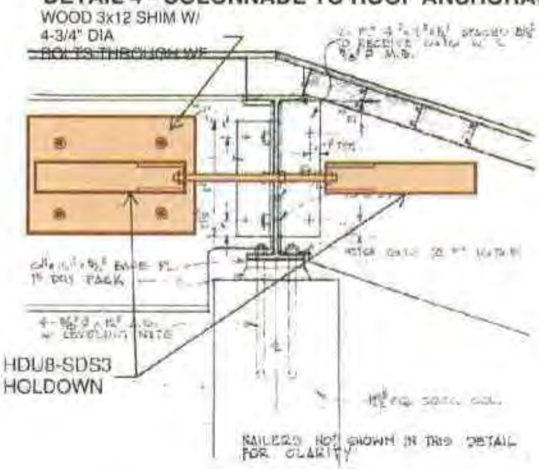
S2





DETAIL 4 - COLONNADE TO ROOF ANCHORAGE





DETAIL 3 - SECTION AT NEW CONCRETE SHEAR WALL

DETAIL 2 - STEEL TO STEEL COLLECTOR SPLICE

DETAIL 1 - STEEL TO WOOD COLLECTOR CONN.

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option B

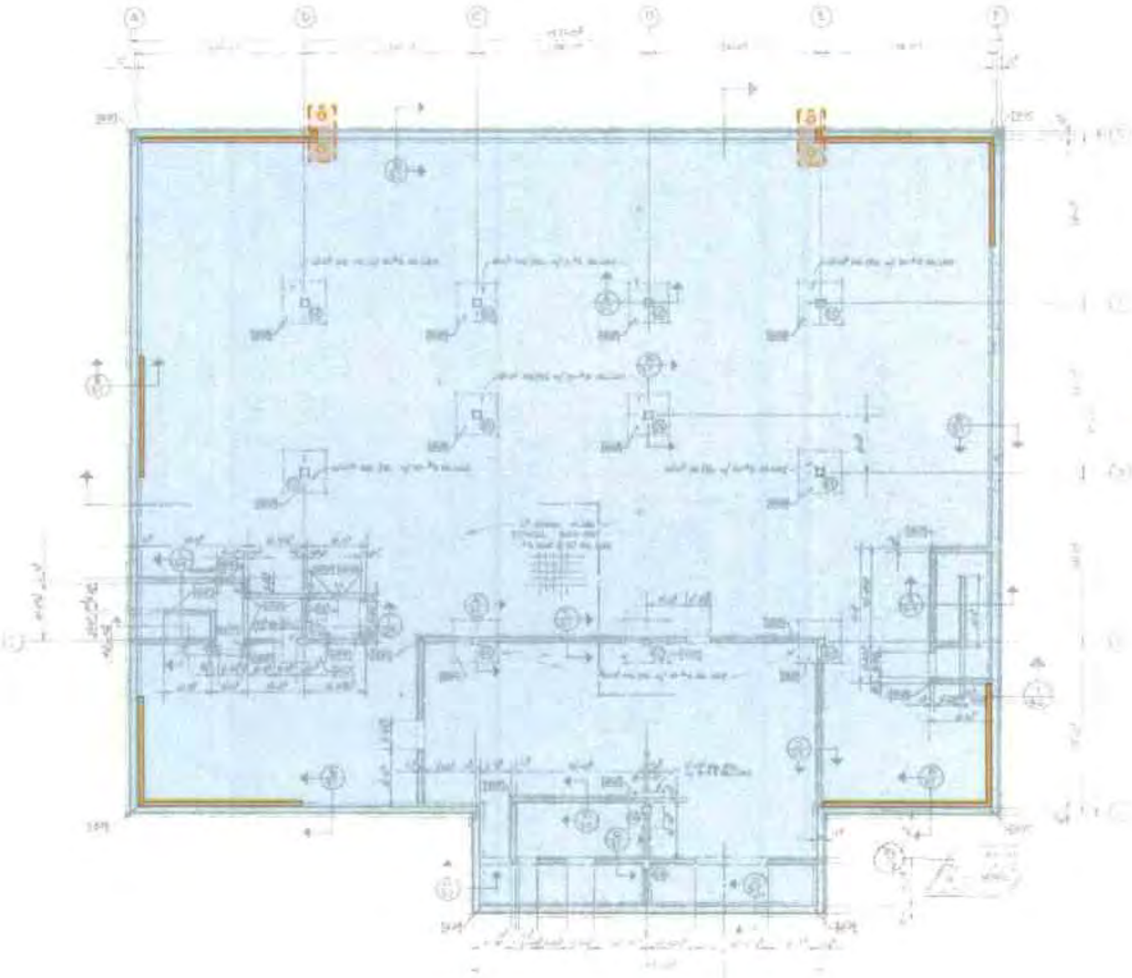
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

Retrofit Details

September 29 2014

S3



Legend:

(N) Concrete Wall

(N) Pile Cap with Micropiles

Provide 4' wide x 6' long x 4' deep pile **cap with** 2 micropiles at each cap. **Micropile** capacity +/- 150 kip design **load.**

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave. Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option C - Light Court

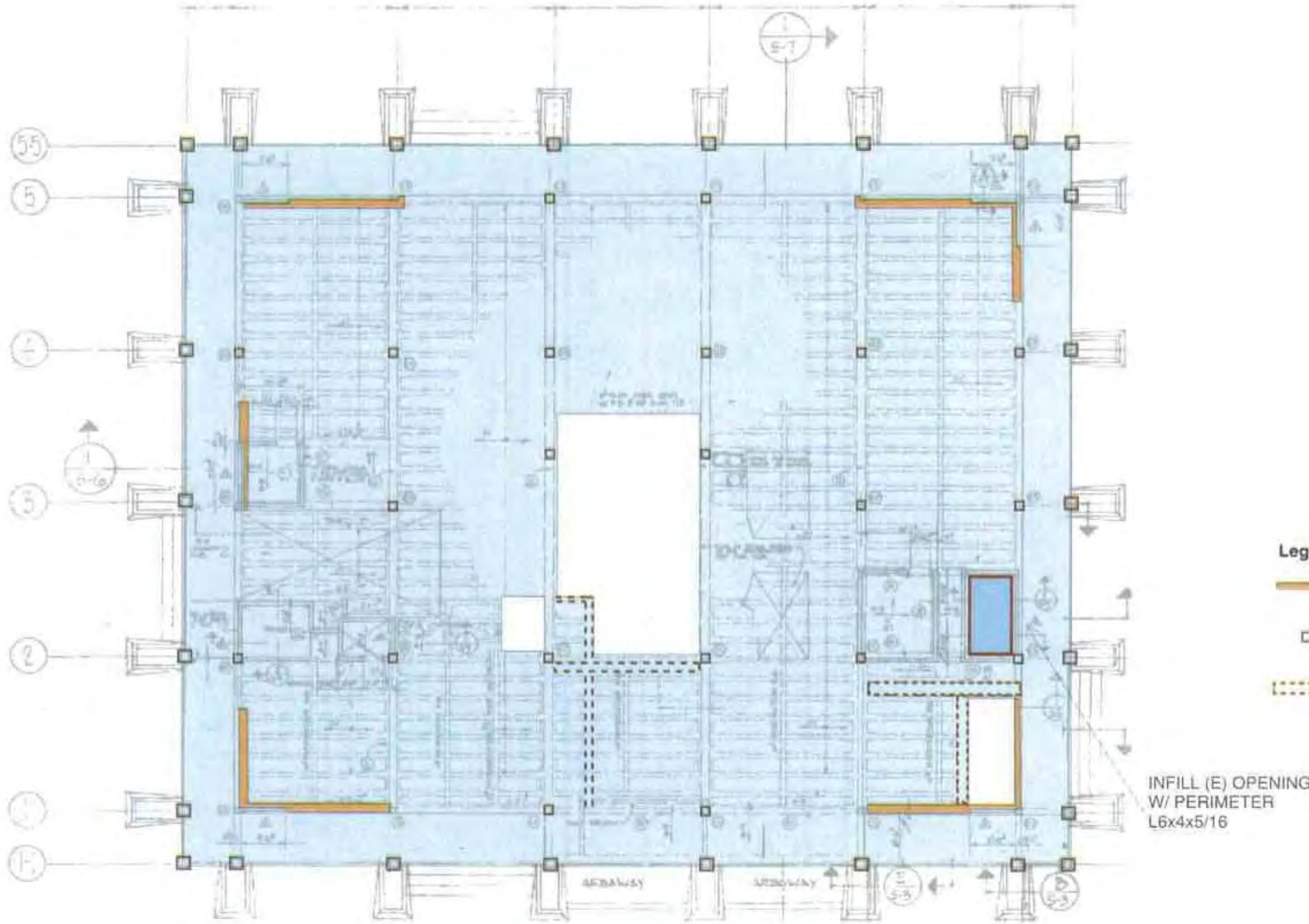
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

Terrace Level Plan

September 29 2014

S0



Legend:

- (N) Concrete Wall
- (N) FRP Wrap @ (E) Columns
- (N) Concrete Beam Below

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave, Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option C - Light Court

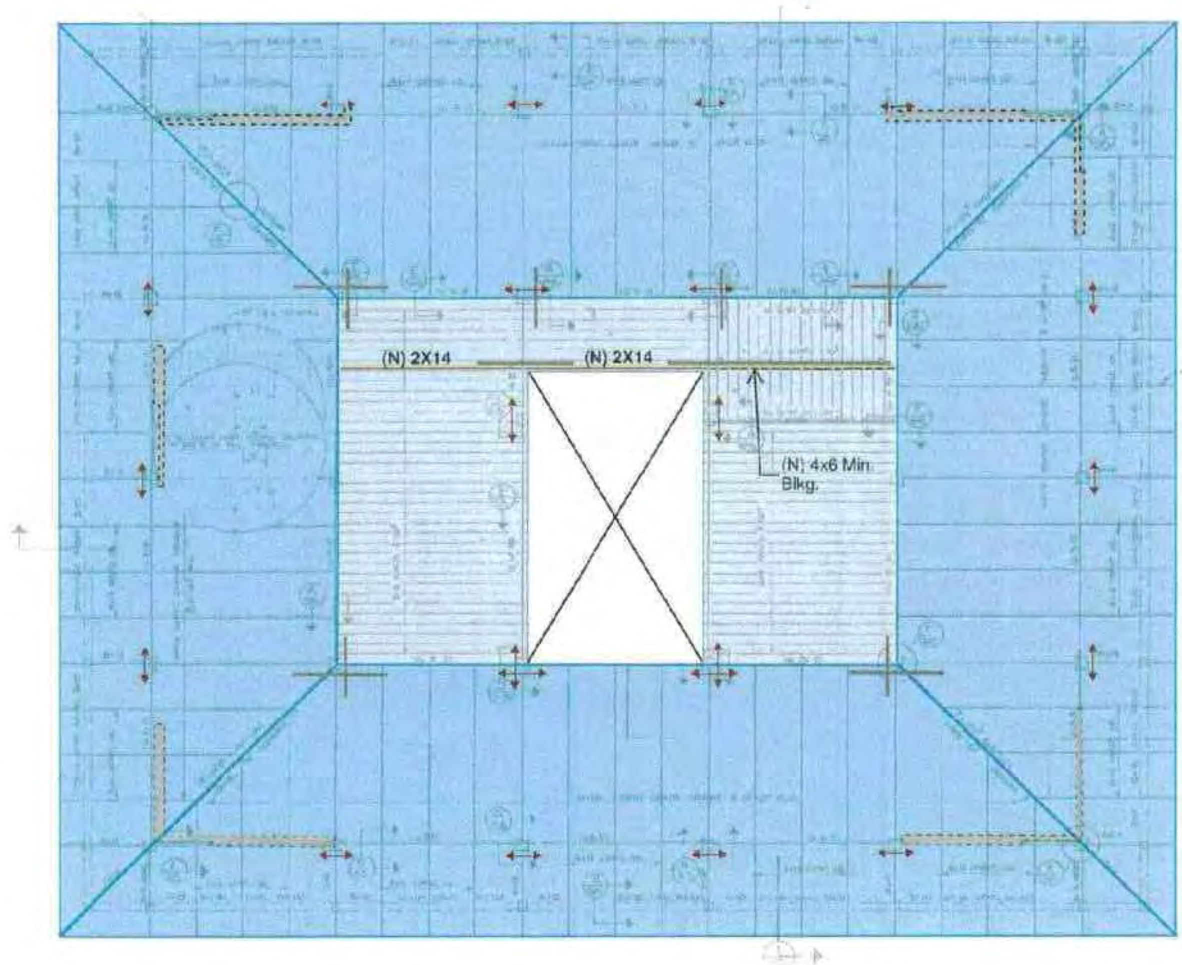
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

Ground Floor Plan

September 29 2014

S1



Legend:

- (N) Concrete Wall Below
- **(N) High Load Diaphragm**
  Provide (N) 3/4" Plywood over (E) 1/2" Plywood and 3X T&G Blocking w/ 2 Rows of 10d Nails @ 2 1/2" o.c. along diaphragm boundaries and cont. panel edges, 4" o.c. at other panel edges, and 12" o.c. in field
- **(E) Reinforced Diaphragm**
  Reinforce (E) 1/2" Plywood w/ 1 Row of 10d Nails @ 2" o.c. along diaphragm boundaries and cont. panel edges, 3" o.c. at other panel edges, and 12" o.c. in field. Provide (N) 4x6 min. blocking @ cont. panel edges perpendicular to framing direction, typ.
- (N) Simpson CMST strap or Simpson Holdown
- Retrofitted WF Steel Collector Connection

N

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave. Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option C - Light Court

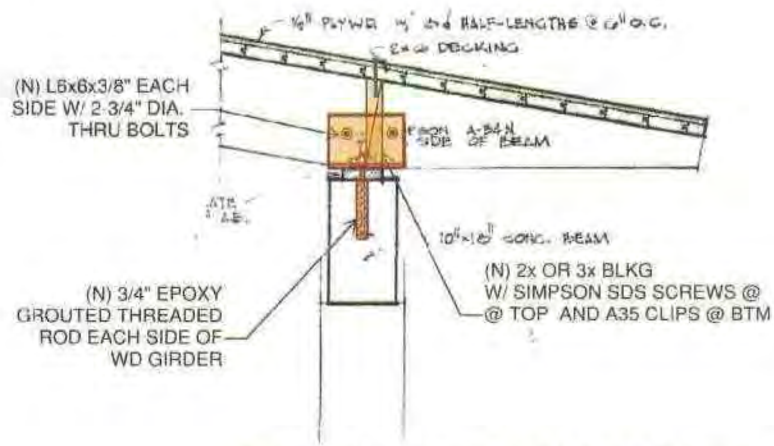
Cupertino, CA

TM Project: 2014,094 Scale: As Noted

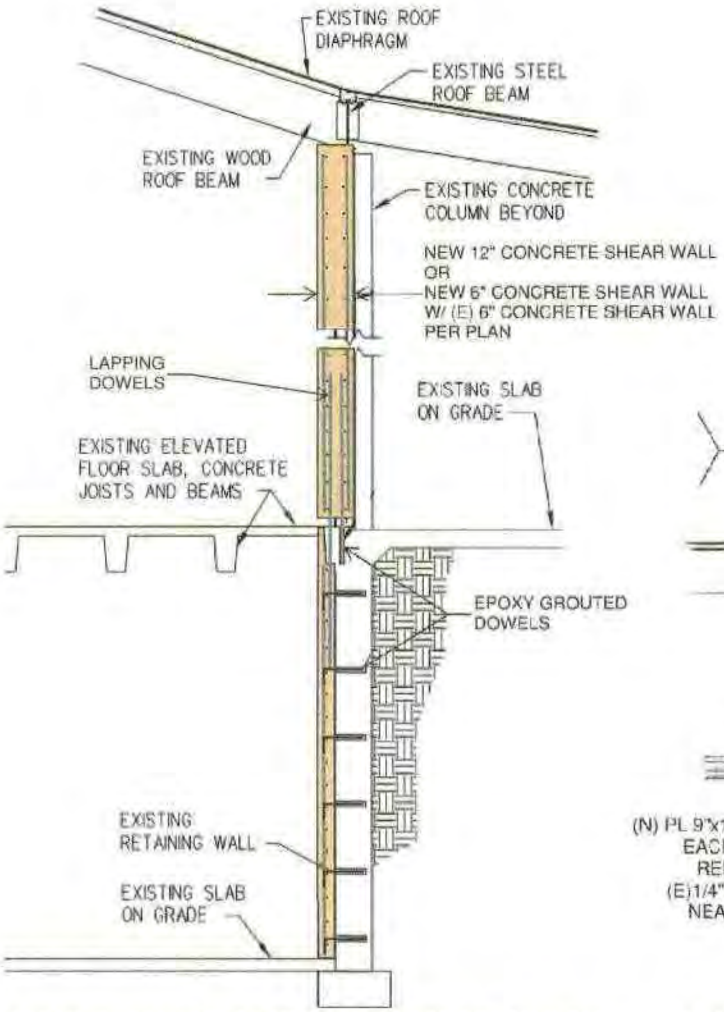
Roof Plan

September 29 2014

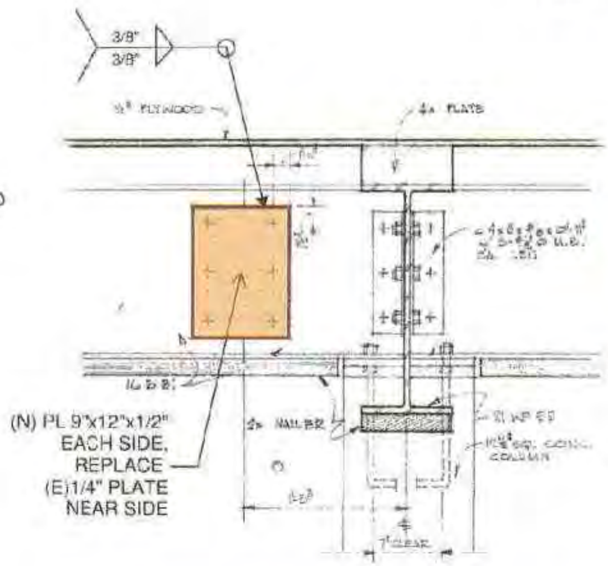
S2



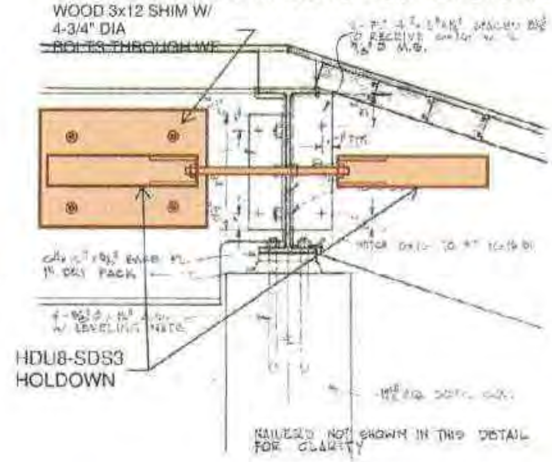
DETAIL 4 - COLONNADE TO ROOF ANCHORAGE



DETAIL 3 - SECTION AT NEW CONCRETE SHEAR WALL



DETAIL 2 - STEEL TO STEEL COLLECTOR SPLICE



DETAIL 1 - STEEL TO WOOD COLLECTOR CONN.

TIPPING | MAR
STRUCTURAL ENGINEERING
1906 Shattuck Ave Berkeley, CA 94704
510 549-1906 510 549-1912 fax

Cupertino City Hall | Option C - Light Court
Cupertino, CA
TM Project: 2014,094 Scale: As Noted

Retrofit Details
September 29 2014
S3

APPENDIX H – Cupertino City Hall MME Analysis 2021

MME
224 Walnut Ave
Santa Cruz, CA 95060
831-426-3186

LOADS

Floor	Superimposed		
	Carpet & 3/8" underlayment		2.3 PSF
	Suspended Tile System		1.8 PSF
	Plumbing, Mech, Elect - Office		4.0 PSF
	Fire Sprinklers		3.0 PSF
	Movable Partitions		15.0 PSF
	-		-
	-		-
	-		-
	Misc		3.9 PSF
	Dead Load	**Floor - Superimposed**	**30.0 PSF**
	Live Load - Offices		**50.0 PSF**
	Live Load - Offices - Lobbies and first-floor corridors		**100.0 PSF**
	Live Load - Decks - Office		**ıpancy Served**
	-		**0.0 PSF**
Floor	Structural		
	3" Concrete Slab		
	Concrete Joist 6x12@3'		25.0 PSF
	Concrete Dist. Rib 6x12@24'		3.2 PSF
	Concrete Girder 16X33@24'		23.0 PSF
	-		0.0 PSF
	-		0.0 PSF
	-		0.0 PSF
	-		0.0 PSF
	Misc		1.3 PSF
	Dead Load	**Floor - Structural**	**52.5 PSF**
	-		**0.00 PSF**
	-		**0.00 PSF**
	-		**0.0 PSF**
	-		**0.0 PSF**
Floor			
	-		
	-		-
	-		-
	-		-
	-		-
	-		-
	-		-
	-		-
	Misc		0.0 PSF
	Dead Load	**Floor -**	**0.0 PSF**
	-		**0.00 PSF**
	-		**0.00 PSF**
	-		**0.0 PSF**
	-		**0.0 PSF**

MME	Project # **21143**	Master Agreement for Engineering Services
224 Walnut Ave	Sheet	
Santa Cruz, CA 95060	Calculated by RR	DATE: 09/09/21
831-426-3186		

LOADS Angle = 18.4

Roof Sloped Super Imposed	**Slope= 4.0 : 12.00**	Slope Factor =		1.06
Spanish clay tile no mortor		19.00 PSF	1.06	20.1 PSF
3X Flat T&G		7.30 PSF	1.06	7.7 PSF
Plumbing, Mech, Elect - Commercial		4.00 PSF	1.06	4.2 PSF
Fire Sprinklers		3.00 PSF	1.00	3.0 PSF
Fiberglass Batt R-39 (12")		0.60 PSF	1.00	0.6 PSF
Suspended Tile System		1.80 PSF	1.00	1.8 PSF
-		0.00 PSF	1.06	0.00 PSF
-		0.00 PSF	1.06	0.00 PSF
Misc				**2.4 PSF**
Roof Dead Load				**40.0 PSF**
Roof Live Load - Ordinary Flat, Pitched, and curved				**20.0 PSF**
-				-

Roof Sloped Structural	**Slope= 4.0** :12	Slope Factor =		1.06
1/2" Plywood or OSB		1.67 PSF	1.06	1.8 PSF
6X16 @ 6'		3.30 PSF	1.06	3.5 PSF
W16x31 Perimeter		0.10 PSF	1.00	0.1 PSF
Concrete Beam 10x18 Perimeter		0.30 PSF	1.00	0.3 PSF
-	-			-
-	-			-
-	-			-
-	-			-
Misc				**2.3 PSF**
Roof Dead Load				**8.0 PSF**
Roof Live Load - Ordinary Flat, Pitched, and curved				**20.00 PSF**
-			-	

Roof	**Slope= 0.0** :12	Slope Factor =		1.00
-	0.00 PSF		1.00	0.0 PSF
-	-			-
-	-			-
-	-			-
-	-			-
-	-			-
-	-			-
-	-			-
Misc				**0.0 PSF**
Roof Dead Load				**0.0 PSF**
-			-	
-			-	

224 Walnut Ave		Project # 21143		Master Agreement for Engineering Services
Santa Cruz, CA 95060		Sheet		
831-426-3186		Calculated by	RR	DATE: 09/09/21

LOADS Angle = 0.0

Roof	Flat Super Imposed	Slope= 0.0 : 12.00	Slope Factor =	1.00
	Single Ply Roof Membrane	0.70 PSF	1.00	0.7 PSF
	Plumbing, Mech, Elect - Commercial	4.00 PSF	1.00	4.0 PSF
	Fire Sprinklers	3.00 PSF	1.00	3.0 PSF
	Roof Mechanical Units	3.00 PSF	1.00	3.0 PSF
	Fiberglass Batt R-39 (12")	0.60 PSF	1.00	0.6 PSF
	Suspended Tile System	1.80 PSF	1.00	1.8 PSF
	-	0.00 PSF	1.00	0.0 PSF
	-	0.00 PSF	1.00	0.0 PSF
	Misc			**1.9 PSF**
	Roof Dead Load			**15.0 PSF**
	Roof Live Load - Ordinary Flat, Pitched, and curved			**20.0 PSF**
	-			**0.0 PSF**

Roof	Flat - Framing	Slope= 0.0 :12	Slope Factor =	1.00
	1/2" Plywood or OSB	1.67 PSF	1.00	1.67 PSF
	2x14 at 16" OC	3.70 PSF	1.00	3.70 PSF
	W16x31 Perimeter	0.10 PSF	1.00	0.10 PSF
	W21x55 @ 24' OC	2.30 PSF	1.00	2.30 PSF
	-	-		-
	-	-		-
	-	-		-
	-	-		-
	Misc			**2.2 PSF**
	Roof Dead Load			**10.0 PSF**
	Roof Live Load - Ordinary Flat, Pitched, and curved			**20.00 PSF**
	-			**0.00 PSF**

Roof		Slope= 4.0 :12	Slope Factor =	1.06
	-	0.00 PSF	1.06	0.00 PSF
	-	0.00 PSF	1.06	0.00 PSF
	-	0.00 PSF	1.06	0.00 PSF
	-	0.00 PSF	1.06	0.00 PSF
	-	0.00 PSF	1.06	0.00 PSF
	-	0.00 PSF	1.06	0.00 PSF
	-	0.00 PSF	1.06	0.0 PSF
	-	0.00 PSF	1.06	0.00 PSF
	Misc			**1.4 PSF**
	Roof Dead Load			**1.4 PSF**
	Roof Live Load - Ordinary Flat, Pitched, and curved			**20.00 PSF**
	-			**0.00 PSF**

MME
224 Walnut Ave
Santa Cruz, CA 95060
831-426-3186

Project # 21143
Sheet
Calculated by RR

Master Agreement for Engineering Services
DATE: 10/06/21

LOADS

Wall Exterior	Typical		% of Wall	Total
Drywall - 5/8"		2.8 PSF	100%	2.8 PSF
Wood Plank siding (3/4")		2.1 PSF	100%	2.1 PSF
1/2" Plywood or OSB		1.7 PSF	100%	1.7 PSF
2x6 at 16" OC w/3 plates		2.4 PSF	100%	2.4 PSF
Wall Plumbing, Mech, Elect		0.5 PSF	100%	0.5 PSF
-		-		0.0 PSF
-		-		0.0 PSF
-		-		0.0 PSF
Misc				1.5 PSF
Dead Load	**Wall Exterior - Typical**			**11.0 PSF**

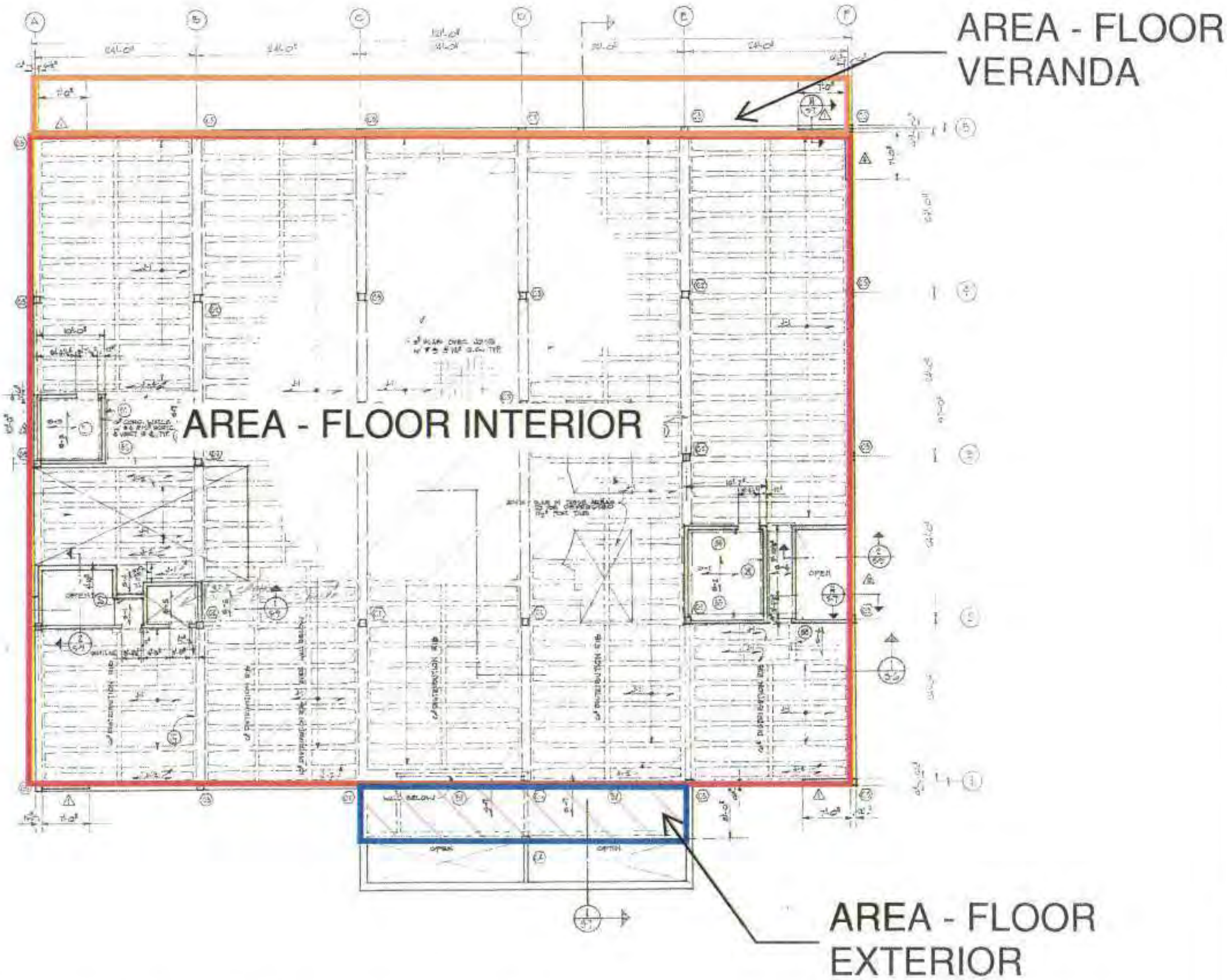
Wall Exterior	Shearwall		% of Wall	Total
Drywall - 5/8"		2.8 PSF	100%	2.8 PSF
Wood Plank siding (3/4")		2.1 PSF	100%	2.1 PSF
1/2" Plywood or OSB		1.7 PSF	100%	1.7 PSF
2x4 at 16" OC		1.0 PSF	100%	1.0 PSF
2x4 at 16" OC		1.0 PSF	100%	1.0 PSF
6" Concrete Slab or Wall		75.0 PSF	100%	75.0 PSF
-		-	100%	0.0 PSF
-		-		0.0 PSF
Misc				1.4 PSF
Dead Load	**Wall Exterior - Shearwall**			**85.0 PSF**

Wall Interior	Typical		% of Wall	Total
Interior Partition Movable (per floor area)		15.0 PSF	100%	15.0 PSF
-		0.0 PSF	100%	0.0 PSF
-		0.0 PSF	100%	0.0 PSF
-		0.0 PSF	100%	0.0 PSF
-		-		0.0 PSF
-		-		0.0 PSF
-		-		0.0 PSF
-		-		0.0 PSF
Misc				0.0 PSF
Dead Load	**Wall Interior - Typical**			**15.0 PSF**

Wall Interior	Wood Framed		% of Wall	Total
Drywall - 5/8"		2.8 PSF	100%	2.8 PSF
Drywall - 5/8"		2.8 PSF	100%	2.8 PSF
Wall Plumbing, Mech, Elect		0.5 PSF	100%	0.5 PSF
2x6 at 16" OC w/3 plates		2.4 PSF	100%	2.4 PSF
-		0.0 PSF	100%	0.0 PSF
-		-		0.0 PSF
-		-		0.0 PSF
-		-		0.0 PSF
Misc				1.5 PSF
Dead Load	**Wall Interior - Wood Framed**			**10.0 PSF**

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall EQ Eval
SHEET NO. OF
CALCULATED BY BR DATE -
CHECKED BY DATE
SCALE



AREA - FLOOR INTERIOR = 11548 SQ FT
AREA - FLOOR EXTERIOR = 396 SQ FT
AREA - FLOOR VERANDA = 940 SQ FT
AREA - FLOOR TOTAL = 11944 SQ FT

BELOW 1ST FLOOR

LENGTH OF EXT. 12" WALL = 145 FT
LENGTH OF EXT. 18" WALL = 37 FT
LENGTH OF EXT. 18" VERANDA WALLS = 12 FT
LENGTH OF INT. 6" WALLS = 180 FT
OF INT COLUMNS (BELOW) = (9) x 10.75 FT

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

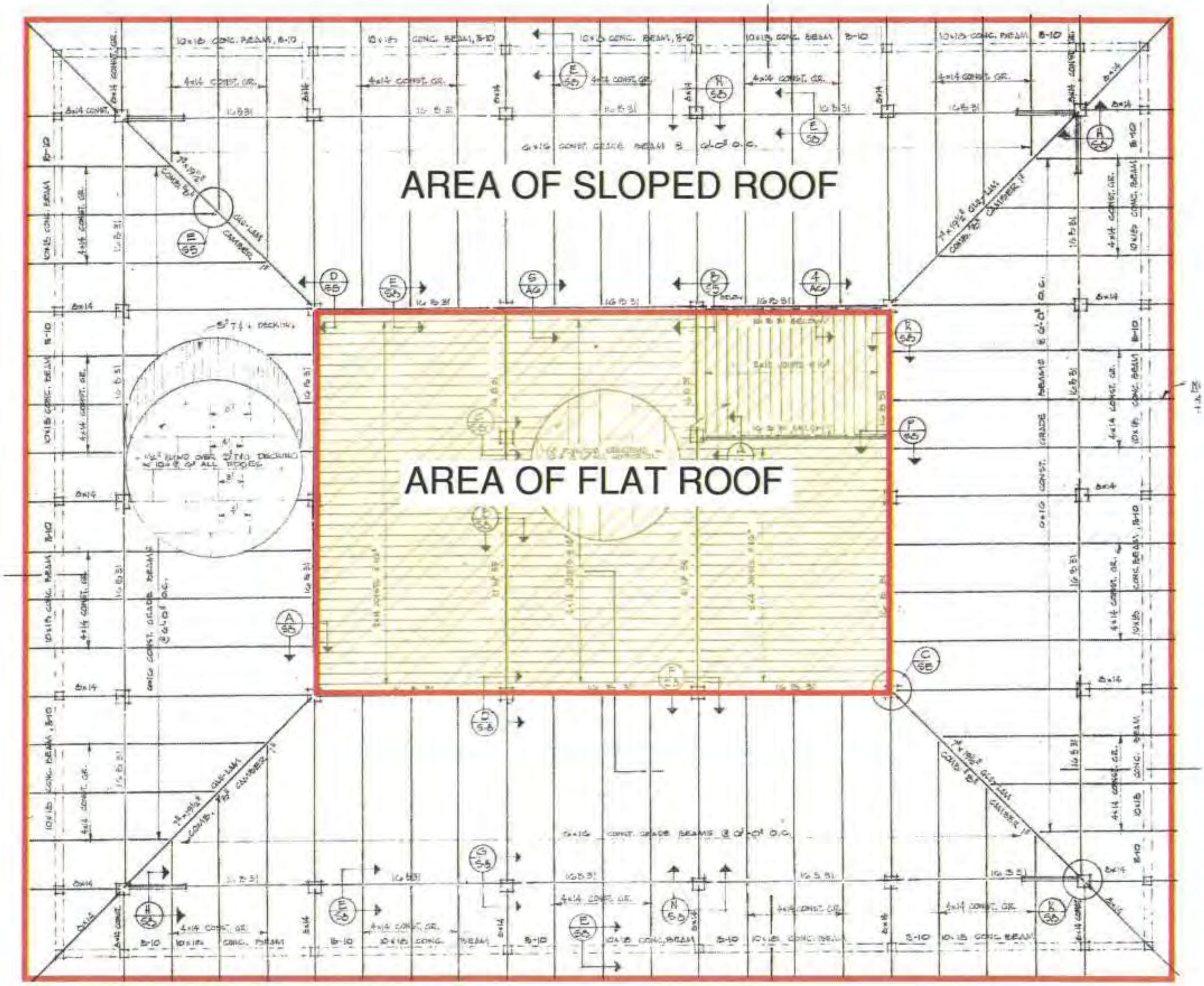
JOB 21143.P5 Cupertino City Hall EQ Eval

SHEET NO. ________ OF ________

CALCULATED BY BR DATE -

CHECKED BY ________ DATE ________

SCALE ________



AREA OF FLAT ROOF = 3582 SQ FT

AREA OF SLOPED ROOF = 13975 SQ FT

AREA OF ROOF TOTAL = 17292 SQ FT

LENGTH OF PARAPET = 244 FT

LENGTH OF VERANDA BEAM = 496 FT

LENGTH OF EXT. WALL TOTAL = 432 FT

LENGTH OF EXT. SHEARWALLS = 68 FT

LENGTH OF EXT. WALLS NON-SHEARWALLS = 364 FT

OF VERANDA COLUMNS = (26) x 8.5 FT

OF EXT COLUMNS = (18) x 11.75 FT

OF INT COLUMNS = (12) x 19.63 FT

ME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall

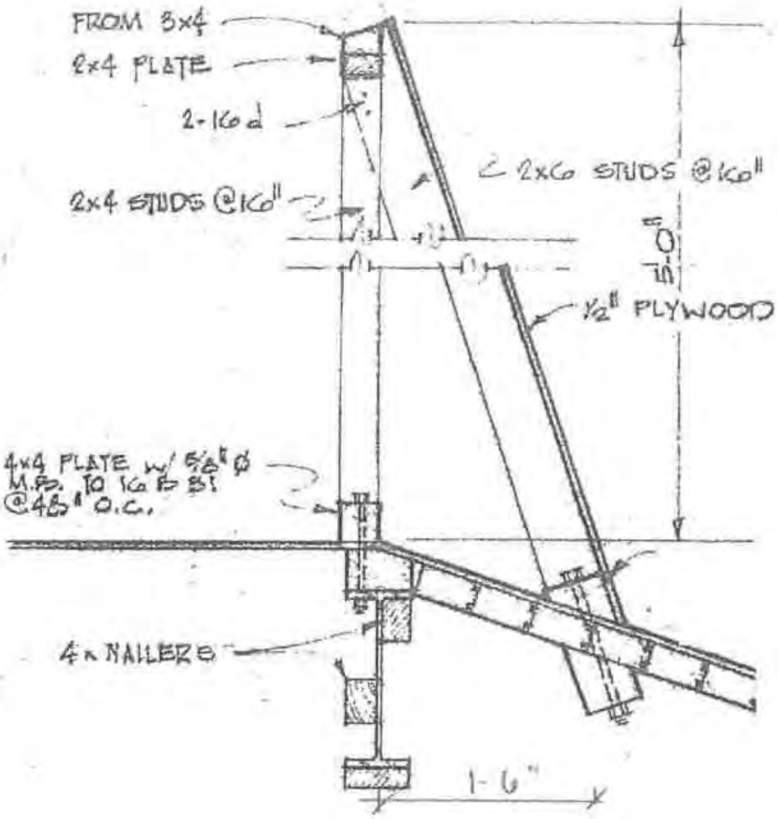
SHEET NO. ____ OF ____

CALCULATED BY BR DATE ____

CHECKED BY ____ DATE ____

SCALE ____

ROOF PARAPET

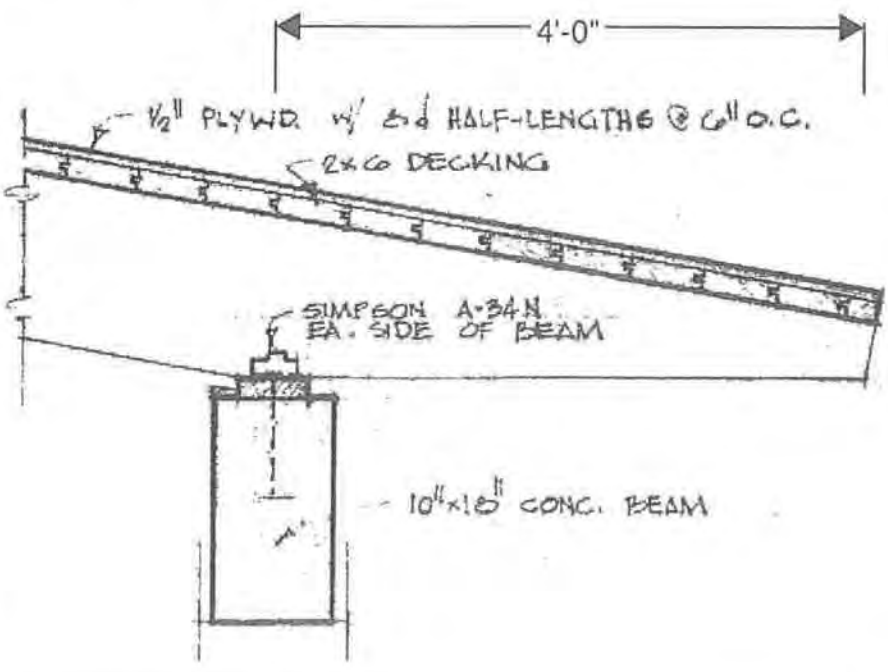


SLOPE 18:60 = 3.6:12

LINE LOAD

$W_{DL} = 26\#/ft(5') = 130\#/'$

ROOF OVERHANG



LINE LOAD

$W_{DL} = (47+8)(4') = 220\#/'$

MME
Civil + Structural Engineering
224 Walnut Avenue, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall

SHEET NO. OF

CALCULATED BY BR DATE

CHECKED BY DATE

SCALE

DEAD LOADS

COLUMNS $(12.5")(12.5")^{150}/_{144} = 163\ \#/'$

VERANDA BEAM $(10)(18)\ 150/144 = 188\ \#/'$

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

GROUND FLOOR

WALL HT = 10.75

WEIGHT 10 #/ft²

Area 1 Wall lengths total = 851'

Area 1 Partition Wts = 851' × 10.75' × 10 psf

= 91.5 kips

INTERIOR PARTITION

P_{FLOOR} = 91.5(.5) = 45.9

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. ______ OF ______
CALCULATED BY ______ DATE ______
CHECKED BY ______ DATE ______
SCALE ______

AREA 1 HT 20'

AREA 2 AVERAG HT = 16.4'

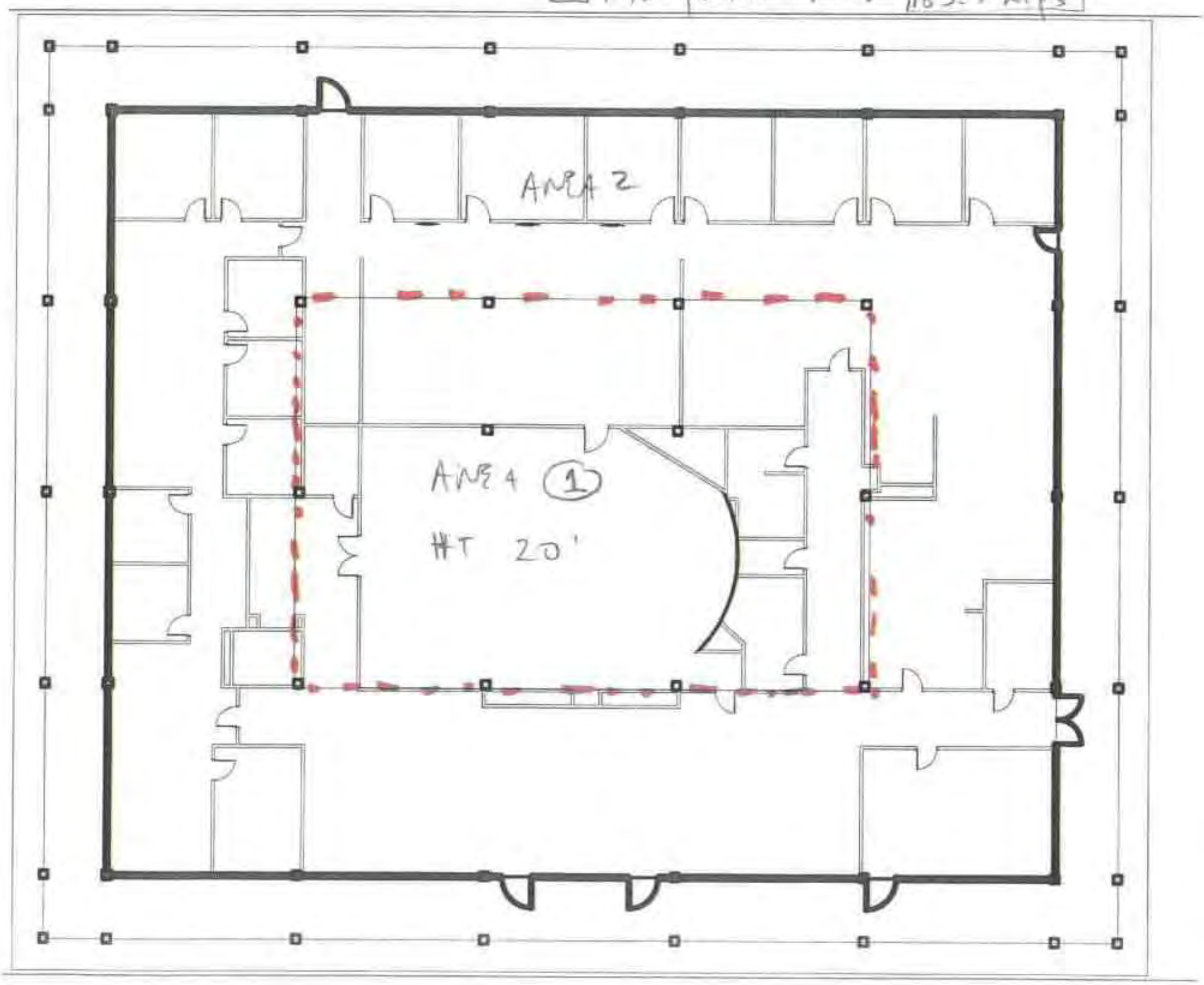
WT 10 #/'²

∴ INT & FLOOR PARTITION
P_{ROOF} 91.9 > 10 #/'²
P_{FLOOR} = 91.9

Area 1 wall lengths = 407'
Area 1 Partition wts = 407' × 20' × 10 psf
= 81.4k

Area 2 wall lengths = 624'
Area 2 partition wts = 624' × 16.4' × 10 psf
= 102.3k

Σ total partition wts. = $\boxed{183.7 \text{ kips}}$



MME
224 Walnut Ave, Santa Cruz
831-426-3186

JOB: **21143.P5** Cupertino City Hall
SHEET NO.: OF:
CALCULATED BY: BR DATE: 10/2021

Unit Weights

Description	Unit	Unit Weights
-	-	0
Ext - Wood Framed wall	#/ft^2	11
6" Ext Conc wall	#/ft^2	85
Columns - Veranda	L	163
Columns - Ext	L	163
Columns - Int	L	163
Interior - Walls	#/ft^2	15
Interior - Movable Partitions Above	#/ft^2	7.5
Interior - Movable Partitions Below	#/ft^2	7.5
Interior Walls - Roof	Each	91.9
Interior Walls - Floor Above	Each	91.9
Interior Walls - Floor Below	Each	45.8
Parapet	L	130
Veranda Beam	L	188
Ext Beam	L	31
Ext - Wood Framed wall	#/ft^2	11
6" Concrete Wall	#/ft^2	75
12" Concrete Wall	#/ft^2	150
18" Concrete Wall	#/ft^2	225
Roof Sloped	#/ft^2	48
Roof Flat	#/ft^2	25
Floor Interior	#/ft^2	120
Floor Exterior	#/ft^2	120
Floor Veranda	#/ft^2	75
Mech units	Each	5000

MME
224 Walnut Ave, Santa Cruz
831-426-3186

JOB: **21143.P5** Cupertino City Hall
SHEET NO.: OF:
CALCULATED BY: BR DATE: 10/2021

Weights		Units	Qty	Area or L	W or H	#/ft or #/ft^2	W/1000 (kips)
Roof	Roof Sloped	#/ft^2	1	13975		48	670.8
	Roof Flat	#/ft^2	1	3582		25	89.6
	Mech units	Each	1	1		5000	5.0
	-	-	1			0	0.0
	-	-	1			0	0.0
Walls							
	Roof Total						765.4
	Ext - Wood Framed wall	#/ft^2	1	364	5.9	11	23.6
	6" Ext Conc wall	#/ft^2	1	68	5.9	85	34.1
	Columns - Veranda	L	26	4.25		163	18.2
	Columns - Ext	L	18	5.9		163	18.0
	Columns - Int	L	12	9.8		163	19.2
	Interior Walls - Roof	Each	1	11548		91.9	1061.3
	Parapet	L	1	244		130	31.7
	Veranda Beam	L	1	496		188	93.2
	Ext Beam	L	1	432		31	13.4
	Walls Total						1206.1
	Roof & Walls						**1971.5**

MME
224 Walnut Ave, Santa Cruz
831-426-3186

JOB: **21143.P5** Cupertino City Hall
SHEET NO.: OF:
CALCULATED BY: BR DATE: 10/2021

Weights			Units	Qty	Area or L	W or H	#/ft or #/ft^2	W/1000 (kips)
Floor		Floor Interior	#/ft^2	1	11548		120.00	1385.8
		Floor Exterior	#/ft^2	1	396		120.00	47.5
		Floor Veranda	#/ft^2	1	940		75.00	70.5
		-	-				-	0.0
		-	-				-	0.0
	Floor Total							1503.8
Walls	Above	Ext - Wood Framed wall	#/ft^2	1	364	5.9	11	23.6
	Above	6" Ext Conc wall	#/ft^2	1	68	5.9	85	34.1
	Above	Columns - Veranda	L	26	4.25		163	18.2
	Above	Columns - Ext	L	18	5.9		163	18.0
	Above	Columns - Int	L	12	9.8		163	19.2
	Above	Interior Walls - Floor Above	Each	1	11548		91.9	1061.3
	Above	-	-				0	0.0
	Above	-	-				0	0.0
	Above	-	-				0	0.0
	Below	12" Concrete Wall	#/ft^2	1	145	5.4	150	117.5
	Below	18" Concrete Wall	#/ft^2	1	37	5.4	225	45.0
	Below	18" Concrete Wall	#/ft^2	1	12	5.4	225	14.6
	Below	6" Concrete Wall	#/ft^2	1	180	5.4	75	72.9
	Below	Columns - Int	L	9	5.4		163	8.1
	Below	Interior Walls - Floor Below	Each	1	11548		45.8	528.9
	Below	-	-				0	0.0
	Below	-	-				0	0.0
	Below	-	-				0	0.0
	Walls Total							1961.4
	Floor & Walls							**3465.2**

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

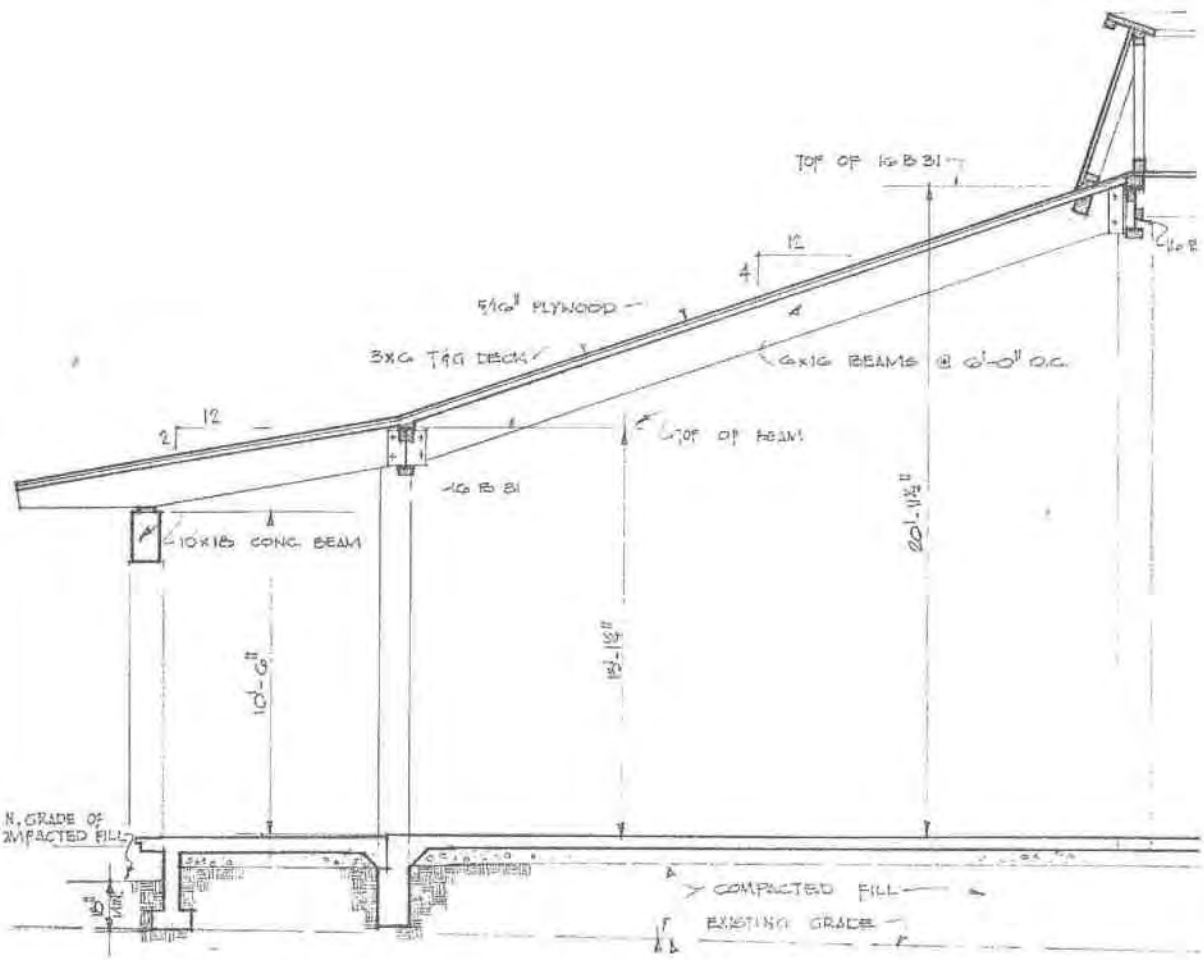
JOB 21143.P5 Cupertino City Hall EQ Eval

SHEET NO. ________ OF ________

CALCULATED BY BR DATE -

CHECKED BY ________ DATE ________

SCALE ________



Center of Gravity of Roof				#/ft			
		Units	Area or L	#/ft^2	W	H	W*H
Roof	Roof Sloped	#/ft^2	13975	48	670.8	16.3	10934.04
	Roof Flat	#/ft^2	3582	25	89.55	21.00	1880.55
	Parapet	L	244	130	31.72	23.5	745.42
					792.07		13560.01

C.O.G. = 17.12 feet

Ground floor = 12 feet

29.1 feet

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. ______ OF ______
CALCULATED BY BR DATE -
CHECKED BY ______ DATE ______
SCALE ______

ROOF SHEARWALL MAP

Roof Shearwalls

North South Direction

	Side	L1 (ft)	L2 (ft)	L Total (ft)	Thickness (ft)	Aw (in^2)
	East	8.3	9.3	17.6	0.5	1267.2
	West	12.9	7	19.9	0.5	1432.8
	Total					2700 in^2

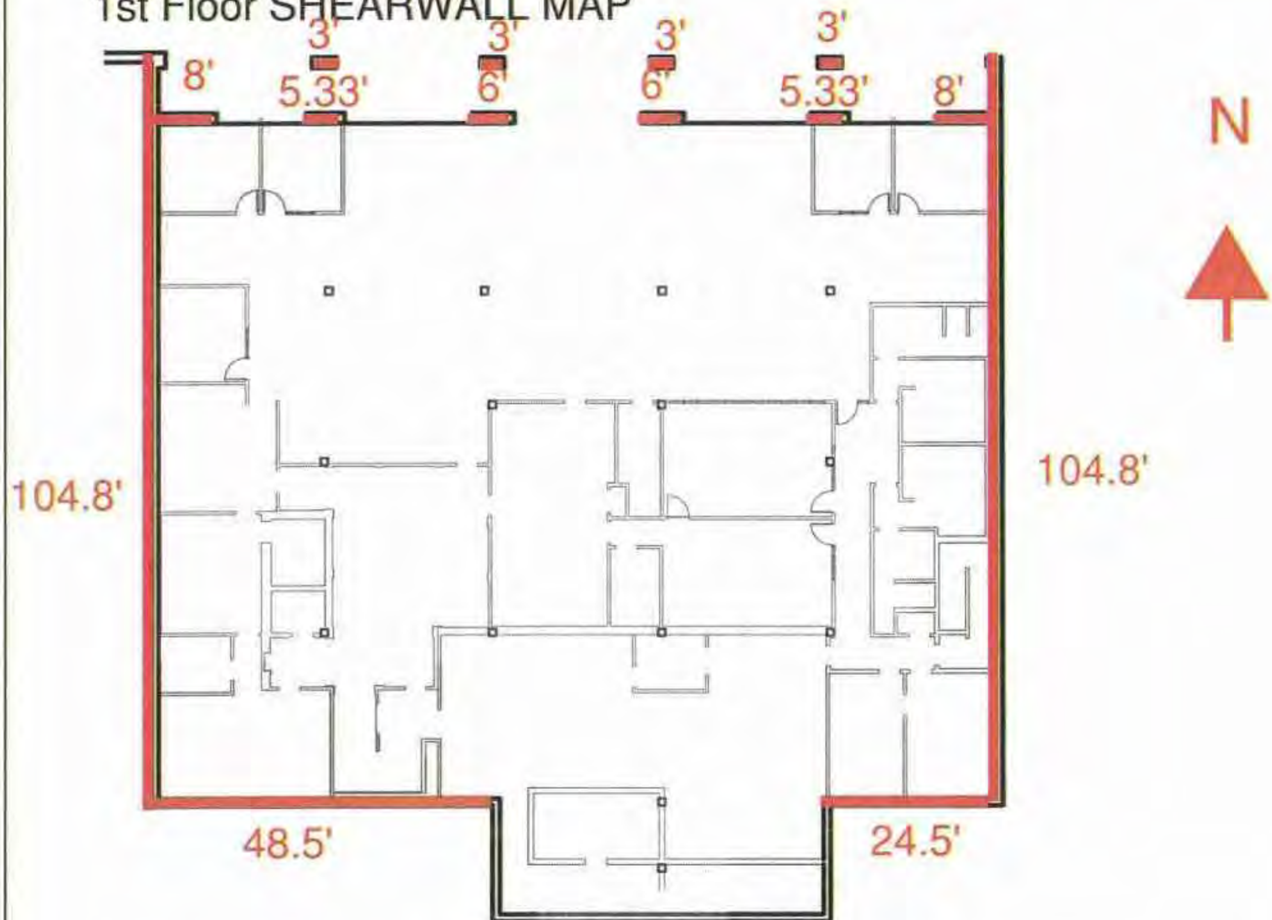
East West Direction

	Side	L1 (ft)	L2 (ft)	L Total (ft)	Thickness (ft)	Aw (in^2)
	North	7	7	14	0.5	1008
	South	7	7	14	0.5	1008
	Total					2016 in^2

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. OF
CALCULATED BY BR DATE -
CHECKED BY DATE
SCALE

1st Floor SHEARWALL MAP



1st Floor Shearwalls						
North South Direction						
	Side	**L1 (ft)**	**L2 (ft)**	**L Total (ft)**	**Thickness (ft)**	**Aw (in^2)**
	East	104.8		104.8	1	15091.2
	West	104.8		104.8	1	15091.2
	Total					30182 in^2
East West Direction						
	Side	**L1 (ft)**	**L2 (ft)**	**L Total (ft)**	**Thickness (ft)**	**Aw (in^2)**
	North	32.7	12	44.7	1.5	9655.2
	South	48.5	24.5	73	1	10512
	Total					20167 in^2

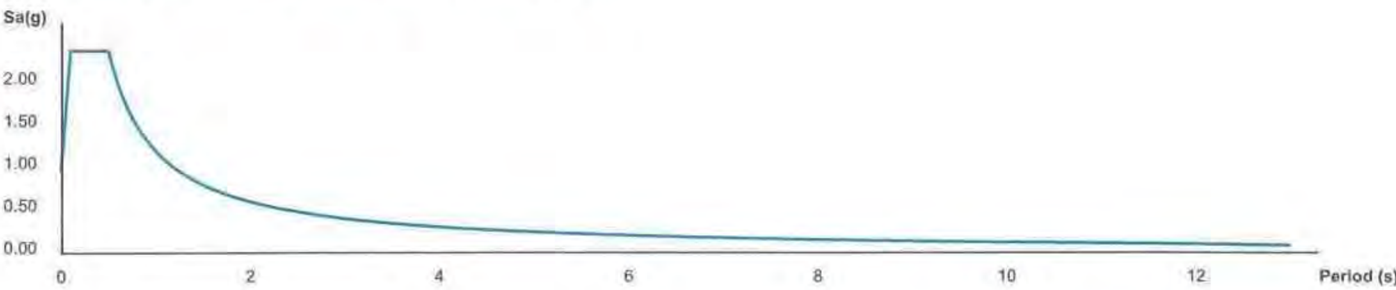
ATC Hazards by Location

Search Information

Address:	10300 Torre Ave, Cupertino, CA 95014
Coordinates:	37.3188973, -122.0286498
Elevation:	229 ft
Timestamp:	2021-08-25T20:50:54.215Z
Hazard Type:	Seismic
Reference Document:	ASCE41-17
Site Class:	D-default

Custom Probability:

Horizontal Response Spectrum - Hazard Level BSE-2N



Hazard Level BSE-2N

Name	Value	Description
SsUH	2.34	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
CR_S	0.923	Coefficient of risk (0.2s)
SsRT	2.159	Probabilistic risk-targeted ground motion (0.2s)
SsD	1.986	Factored deterministic acceleration value (0.2s)
S_S	1.986	MCE_R ground motion (period=0.2s)
F_a	1.2	Site amplification factor at 0.2s
S_{XS}	2.384	Site modified spectral response (0.2s)
S1UH	0.944	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
CR_1	0.904	Coefficient of risk (1.0s)
S1RT	0.854	Probabilistic risk-targeted ground motion (1.0s)
S1D	0.708	Factored deterministic acceleration value (1.0s)
S_1	0.708	MCE_R ground motion (period=1.0s)
F_v	1.7	Site amplification factor at 1.0s
S_{X1}	1.204	Site modified spectral response (1.0s)

Hazard Level BSE-1N

Name	Value	Description
S_{XS}	1.589	Site modified spectral response (0.2s)
S_{X1}	0.803	Site modified spectral response (1.0s)

Hazard Level BSE-2E

Name	Value	Description

S_S	1.687	MCE_R ground motion (period=0.2s)
F_a	1.2	Site amplification factor at 0.2s
S_{XS}	2.025	Site modified spectral response (0.2s)
S_1	0.656	MCE_R ground motion (period=1.0s)
F_v	1.7	Site amplification factor at 1.0s
S_{X1}	1.115	Site modified spectral response (1.0s)

Hazard Level BSE-1E

Name	Value	Description
S_S	0.873	MCE_R ground motion (period=0.2s)
F_a	1.2	Site amplification factor at 0.2s
S_{XS}	1.048	Site modified spectral response (0.2s)
S_1	0.313	MCE_R ground motion (period=1.0s)
F_v	1.987	Site amplification factor at 1.0s
S_{X1}	0.623	Site modified spectral response (1.0s)

T_L Data

Name	Value	Description
T_L	12	Long-period transition period (s)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

TIER 1 ANALYSIS (ASCE 41, SECTION 4.4)

Building - **Cupertino City Hall**
\# of Stories **2**

Hazard Level - **BSE-1E** **Immediate Occupancy**
Seismic Coeficients - **From ATC Hazard by Location Web site**
Ss= **0.873**
S1= **0.313**
Site Class= **D (default)** Fa = 1.2 Fv = 1.4
Sxs= 1.048 Sx1= 0.447

Period Determination Section 4.4.2.4

h_n= **29.1 feet** height above base to highest level of the structure

	Direction 1	Direction 2	
Structure type =	**All other structural systems**	**All other structural systems**	
Ct=	0.02	0.02	
β=	0.75	0.75	
$T = C_t h_n^{\beta}$=	0.251 sec	0.251 sec	Eq 4-4
T_L=	**12.0 sec**	**12.0 sec**	

Pseudo Sesimic Forces **Section 4.4.2.1**

V=(C * Sa) *W Eq 4-1
Sa = Sx1/T (but < Sxs) Eq 4-3

	Direction 1	Direction 2
C= Table 4.7	1.000	1.000
Sa= Sx1/T (but < Sxs) =	1.048	1.048
(C* Sa) =	**1.048**	**1.048**

Level	Seismic Weights	
4		
3		
2	**Roof**	**1002.0 Kips**
1	**Floor 1**	**2012.7 Kips**
	Total	**3014.7 Kips**

Direction 1	**V1=C*Sa*W =**	1.048 * 3014.7 =	**3158.2 Kips**
Direction 2	**V2=C*Sa*W =**	1.048 * 3014.7 =	**3158.2 Kips**

TIER 1 ANALYSIS (ASCE 41, SECTION 4.4)

Building Cupertino City Hall

Pseudo Sesimic Forces (Cont)

Vertical Distribution of Seismic forces **Section 4.4.2.2**

$F_x=C_{vx}V$

$Cvx=\dfrac{W_x h_x^K}{\sum W_i h_i^K}$ k= **1.0** **k= 1 for buildings 6 stories or fewer**

Strength Design Loads for Main Seismic Force-Resisting System

Level		W	Hx	$W_x h_x^K$	Cvx	N/S Story Shear $F_x=C_{vx}V$	E/W Story Shear $F_x=C_{vx}V$
4	-	0.0 Kips	0.0 feet	0	0.00	0 Kips	0 Kips
3	-	0.0 Kips	0.0 feet	0	0.00	0 Kips	0 Kips
2	Roof	1002.0 Kips	29.1 feet	29158	0.55	1727 Kips	1727 Kips
1	Floor 1	2012.7 Kips	12.0 feet	24152.4	0.45	1431 Kips	1431 Kips
	Total	3014.7 Kips		53311 Kips	1.00	3158 Kips	3158 Kips

Average Stress in Shearwalls

Ms= 1.5 Table 4-8 **Immediate Occupancy**

North South Direction

Level		ΣF_x	Shearwall Forces $Fsw = \Sigma F_x/Ms$	Aw	Shearwall Stress v avg = Fsw/A2	Vsw = 0.11 K/in^2
4		0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
3	-	0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
2	Roof	1727 Kips	1152 Kips	2700 in^2	0.427 Kips/in^2	NG
1	Floor 1	3158 Kips	2105 Kips	30182 in^2	0.070 Kips/in^2	OK

East West Direction

Level		ΣF_x	Shearwall Forces $Fsw = \Sigma F_x/Ms$	AW	Shearwall Stress v avg = Fsw/Lsw	Vsw = 0.11 K/in^2
4	-	0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
3	-	0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
2	Roof	1727 Kips	1152 Kips	2016 in^2	0.571 Kips/in^2	NG
1	Floor 1	3158 Kips	2105 Kips	20167 in^2	0.104 Kips/in^2	OK

MME
224 Walnut Ave
Santa Cruz, CA 95060
831-426-3186

JOB: **21143.P5 Cupertino City Hall Eval**
SHEET NO.: OF:
CALCULATED BY: BR DATE: 10/2021

TIER 1 ANALYSIS (ASCE 41, SECTION 4.4)

Building - **Cupertino City Hall**
# of Stories **2**

Hazard Level - **BSE-2E** **Life Safety**
Seismic Coeficients - **From ATC Hazard by Location Web site**
Ss= **1.687**
S1= **0.656**
Site Class= **D (default)** Fa = 1.2 Fv = 1.7
Sxs= 2.024 Sx1= 1.115

Period Determination Section 4.4.2.4

h_n= **29.1 feet** height above base to highest level of the structure

	Direction 1	Direction 2	
Structure type =	**All other structural systems**	**All other structural systems**	
Ct=	0.02	0.02	
β=	0.75	0.75	
$T = C_t h_n^{\beta}$=	0.251 sec	0.251 sec	Eq 4-4
T_L=	**12.0 sec**	**12.0 sec**	

Pseudo Sesimic Forces Section 4.4.2.1

V=(C * Sa) *W Eq 4-1
Sa = Sx1/T (but < Sxs) Eq 4-3

	Direction 1	Direction 2
C= Table 4.7	1.000	1.000
Sa= Sx1/T (but < Sxs) =	2.024	2.024
(C* Sa) =	**2.024**	**2.024**

Level	Seismic Weights	
4		
3		
2	**Roof**	**1002.0 Kips**
1	**Floor 1**	**2012.7 Kips**
	Total	**3014.7 Kips**

Direction 1	**V1=C*Sa*W =**	2.024 * 3014.7 =	**6103.0 Kips**
Direction 2	**V2=C*Sa*W =**	2.024 * 3014.7 =	**6103.0 Kips**

MME
224 Walnut Ave
Santa Cruz, CA 95060
831-426-3186

TIER 1 ANALYSIS (ASCE 41, SECTION 4.4)

Building Cupertino City Hall

Pseudo Sesimic Forces (Cont)

Vertical Distribution of Seismic forces **Section 4.4.2.2**

$F_x=C_{vx}V$

$Cvx = \frac{W_x h_x^K}{\sum W_i h_i^K}$ k= **1.0** **k= 1 for buildings 6 stories or fewer**

Strength Design Loads for Main Seismic Force-Resisting System

Level		W	Hx	$W_x h_x^K$	Cvx	N/S Story Shear $F_x=C_{vx}V$	E/W Story Shear $F_x=C_{vx}V$
4	-	0.0 Kips	**0.0 feet**	0	0.00	**0 Kips**	**0 Kips**
3	-	0.0 Kips	**0.0 feet**	0	0.00	**0 Kips**	**0 Kips**
2	Roof	1002.0 Kips	**29.1 feet**	29158	0.55	**3338 Kips**	**3338 Kips**
1	Floor 1	2012.7 Kips	**12.0 feet**	24152.4	0.45	**2765 Kips**	**2765 Kips**
	Total	3014.7 Kips		53311 Kips	1.00	**6103 Kips**	**6103 Kips**

Average Stress in Shearwalls

Ms= **3.0** Table 4-8 **Life Safety**

North South Direction

Level		ΣF_x	Shearwall Forces Fsw $=\Sigma F_x$/Ms	Aw	Shearwall Stress v avg = Fsw/A2	Vsw = **0.11 K/in^2**
4		0 Kips	0 Kips	**0 in^2**	0.000 Kips/in^2	**OK**
3	-	0 Kips	0 Kips	**0 in^2**	0.000 Kips/in^2	**OK**
2	Roof	3338 Kips	1113 Kips	**2700 in^2**	0.412 Kips/in^2	**NG**
1	Floor 1	6103 Kips	2034 Kips	**30182 in^2**	0.067 Kips/in^2	**OK**

East West Direction

Level		ΣF_x	Shearwall Forces Fsw $=\Sigma F_x$/Ms	AW	Shearwall Stress v avg = Fsw/Lsw	Vsw = **0.11 K/in^2**
4	-	0 Kips	0 Kips	**0 in^2**	0.000 Kips/in^2	**OK**
3	-	0 Kips	0 Kips	**0 in^2**	0.000 Kips/in^2	**OK**
2	Roof	3338 Kips	1113 Kips	**2016 in^2**	0.552 Kips/in^2	**NG**
1	Floor 1	6103 Kips	2034 Kips	**20167 in^2**	0.101 Kips/in^2	**OK**

MME
224 Walnut Ave
Santa Cruz, CA 95060
831-426-3186

TIER 1 ANALYSIS (ASCE 41, SECTION 4.4)

Building - **Cupertino City Hall**
# of Stories **2**

Hazard Level - **BSE-2E** **Collapse Prevention**
Seismic Coeficients - **From ATC Hazard by Location Web site**
Ss= **1.687**
S1= **0.656**
Site Class= **D (default)** Fa = 1.2 Fv = 1.7
Sxs= 2.024 Sx1= 1.115

Period Determination Section 4.4.2.4

h_n= **29.1 feet** height above base to highest level of the structure

	Direction 1	Direction 2	
Structure type =	**All other structural systems**	**All other structural systems**	
Ct=	0.02	0.02	
β=	0.75	0.75	
$T = C_t h_n^{\beta}$=	0.251 sec	0.251 sec	Eq 4-4
T_L=	**12.0 sec**	**12.0 sec**	

Pseudo Sesimic Forces Section 4.4.2.1

V=(C * Sa) *W Eq 4-1
Sa = Sx1/T (but < Sxs) Eq 4-3

	Direction 1	Direction 2
C= Table 4.7	1.000	1.000
Sa= Sx1/T (but < Sxs) =	2.024	2.024
(C* Sa) =	**2.024**	**2.024**

Level	Seismic Weights	
4		
3		
2	**Roof**	**1002.0 Kips**
1	**Floor 1**	**2012.7 Kips**
	Total	**3014.7 Kips**

Direction 1	**V1=C*Sa*W =**	2.024 * 3014.7 =	**6103.0 Kips**
Direction 2	**V2=C*Sa*W =**	2.024 * 3014.7 =	**6103.0 Kips**

TIER 1 ANALYSIS (ASCE 41, SECTION 4.4)

Building Cupertino City Hall

Pseudo Sesimic Forces (Cont)

Vertical Distribution of Seismic forces **Section 4.4.2.2**

$F_x = C_{vx} V$

$Cvx = \frac{W_x h_x^k}{\sum W_i h_i^k}$ k= **1.0** **k= 1 for buildings 6 stories or fewer**

Strength Design Loads for Main Seismic Force-Resisting System

Level		W	Hx	$W_x h_x^k$	Cvx	N/S Story Shear $F_x=C_{vx}V$	E/W Story Shear $F_x=C_{vx}V$
4	-	0.0 Kips	0.0 feet	0	0.00	0 Kips	0 Kips
3	-	0.0 Kips	0.0 feet	0	0.00	0 Kips	0 Kips
2	Roof	1002.0 Kips	29.1 feet	29158	0.55	3338 Kips	3338 Kips
1	Floor 1	2012.7 Kips	12.0 feet	24152.4	0.45	2765 Kips	2765 Kips
	Total	3014.7 Kips		53311 Kips	1.00	6103 Kips	6103 Kips

Average Stress in Shearwalls

Ms= **4.5** Table 4-8 **Collapse Prevention**

North South Direction

Level		ΣF_x	Shearwall Forces $Fsw = \Sigma F_x/Ms$	Aw	Shearwall Stress v avg = Fsw/A2	Vsw = 0.11 K/in^2
4		0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
3	-	0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
2	Roof	3338 Kips	742 Kips	2700 in^2	0.275 Kips/in^2	NG
1	Floor 1	6103 Kips	1356 Kips	30182 in^2	0.045 Kips/in^2	OK

East West Direction

Level		ΣF_x	Shearwall Forces $Fsw = \Sigma F_x/Ms$	AW	Shearwall Stress v avg = Fsw/Lsw	Vsw = 0.11 K/in^2
4	-	0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
3	-	0 Kips	0 Kips	0 in^2	0.000 Kips/in^2	OK
2	Roof	3338 Kips	742 Kips	2016 in^2	0.368 Kips/in^2	NG
1	Floor 1	6103 Kips	1356 Kips	20167 in^2	0.067 Kips/in^2	OK

SHEAR WALL SCHEDULE

MARK	WALL THICKNESS	A.B. @ BOT TO WALL		REBAR EA. END OF WALL		REMARKS
		AMOUNT	SIZE	AMOUNT	SIZE	
1	6"	7	7/8" φ x 12"	2	#8	TYP. WALL STEEL #4 @ 12" EA. WAY
2	6"	6	7/8" φ x 12"	1	#9	DO.
3	6"	8	7/8" φ x 12"	1	#10	DO.
4	6"	4	7/8" φ x 12"	1	#9	DO.
5	6"	10	7/8" φ x 12"	2	#8	DO.

NOTE:
REBAR @ EACH END OF WALL SHALL BE FULL HEIGHT w/ NO SPLICE @ TOP OF FOUNDATION. PROVIDE #5 DOWELS @ 6" FROM FOUNDATION FOR ENTIRE LENGTH OF WALL.

PER JO CHECKLIST
GREATER OF,

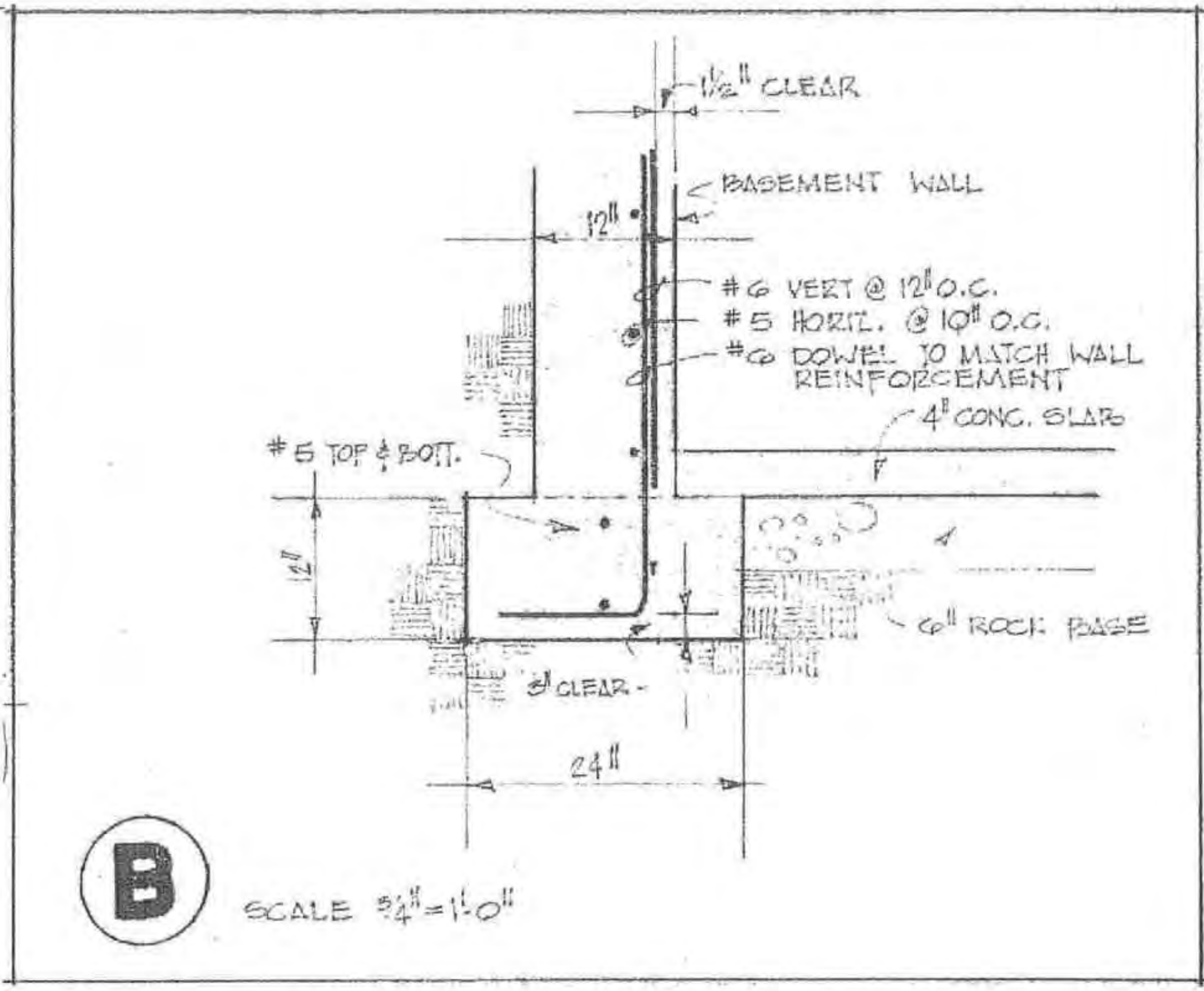
$V_{SW} = 100\ \#/in^2 = .1\ k/in^2$

OR $V_{SW} = 2\sqrt{f'_c} = 2\sqrt{3000} = 109.5\ \#/in^2$

USE $.11\ k/in^2$

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. ______ OF ______
CALCULATED BY BR DATE -
CHECKED BY ______ DATE ______
SCALE ______



M E
Civil + Structural Engineering
224 Walnut Avenue, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. OF
CALCULATED BY BR DATE
CHECKED BY DATE
SCALE

OVERTURNING 5.4.3.3

Sa 2.024 FOR BSE-2E
Sa = 1.048 FOR BSE-1E

HEIGHT = 27.1'

BASE DIM. = 96'

BASE/HEIGHT = 96/27.1 = 3.51

.6Sa = .6 (2.024) = 1.21

COMPLIANT BASE/HEIGHT > .6 Sa

REINFORCING STEEL AREA 5.5.3.1.3

VERTICAL DIRECTION #4 @ 12" t = 6"

Ag = (6)(12) = 72 in²

As = .2 in²

As/Ag = .2/72 = .002 > .0012 OK

HORIZ #4 @ 12

As/Ag = .002 ≥ .002 OK

M-ME
Civil + Structural Engineering
224 Walnut Avenue, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. ______ OF ______
CALCULATED BY BR DATE ______
CHECKED BY ______ DATE ______
SCALE ______

WALL ANCHORAGE 4.4.3.7
SHEATHING

$T_c = \psi S_{XS} W_p A_p$

$W_{p1} = 85\ \#/ft^2$

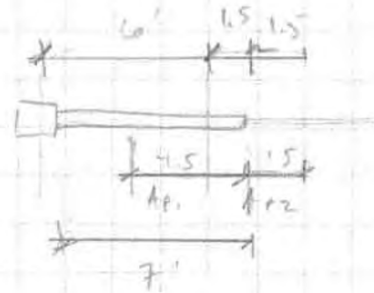
$W_p = 11\ \#/ft^2$

TMB WIDTH = 4.5 + 1.5

$A_{p1} = 4.5' (13.1' - 1.25')(.5) = 26.7$

$A_{p2} = 1.5 (13.1 - 1.25) .5 = 8.9$

$\psi = 1.8$ I.O

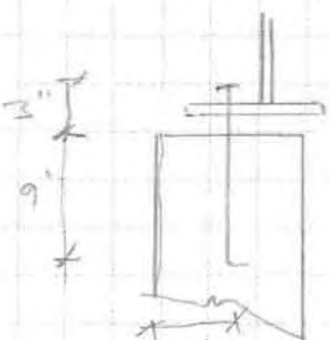


$S_{XS} = 1.048$

$T = 1.8 (1.048) [(85\ \#/ft^2)(26.7) + 11 (8.9)] = 4466^{\#} = 4.47^k$

SEE DETAIL H FOR ATTACHMENT TO S.W.
" " G " " OF RAFTER TO W-F
ON NEXT PAGE

WORST CASE (4) 7/8" Ø AB



T/BOLT = 1.72

\# TMB TO RAFTER $4.5 \left(\frac{4}{7'}\right) = 2.6$

f'c

SPACING = $7' - 1'/3 = 2'$ o.c.
(4) 5/8" Ø BOLTS

Ø = 1 PER 10.3.6.1

$T_{BOLT} = 4.47 / 2.6 = 1.72^k$

SEE FOLLOWING SHT FOR CONC.

$\phi V_{cb} = 1.793$ DCR $1.793/_{1.72} = 1.04$

4.47^k

EDGE DIST $3" - .5" = 2.5"$ MAX $\frac{2.5}{.625} = 4\phi$
$C_A = .5$ (CONSERVATIVE)

$Z = 2.77^k/\text{BOLT} (.5) = 1.39^k$ $(4) 1.39 = 5.54^k > 4.47$ ok

M E

Civil + Structural Engineering
224 Walnut Avenue, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall

SHEET NO. ______ OF ______

CALCULATED BY BR DATE ______

CHECKED BY ______ DATE ______

SCALE ______

WALL ANCHORAGE
@ VERANDA

COLUMN HT: 9'

COL W_pA_p: 163 #/, (9')(5) = 734 #
BEAM W_pA_p: 188 #/, (6') = 1128 #
1862 # 1.86 k

$T = \emptyset 5 x s W_p A_p = 1.8 (1.048)(1.86) = 3.51^k$

CONNECTION AF+PA 1996

A34N $Z_{ASD} = .64^k$ (ASD) NO Cd INCLUDED

$\lambda = 1.0$

$Z_{LRFD} = .64 (2.88) = 1.84^k$

$Z_c = \lambda \phi Z' = 1.0 (.63)(184) = 1.2^k$

(2) A34N G.F. $2Z_c = 2.4^k$

DCR $3.51/2.4 = 1.46 > 1$ N.G.

BOLT SPACING 4' O.C. 5/8" ϕ IN 2x4 SILL PL.

$Z = \phi\lambda Z = .75^k$

DCR $(\frac{4}{6}) 3.51/.75 = 3.1 > 1$ N.G.

Hilti PROFIS Engineering 3.1.1

www.hilti.com

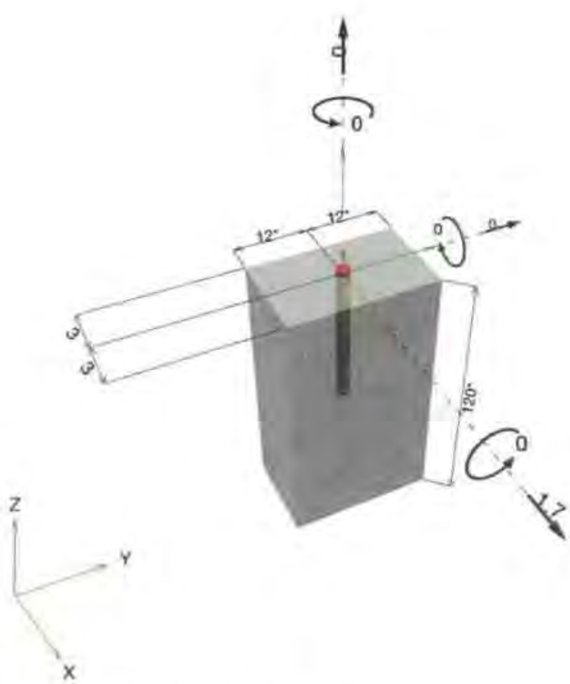
Company:	M-ME	Page:	1
Address:	224 Walnut Ave	Specifier:	
Phone I Fax:	831-426-3186 |	E-Mail:	bob@m-me.com
Design:	Concrete - Oct 7, 2021	Date:	10/7/2021
Fastening point:	Upper floor Shearwall to Diaphragm Conn		

Specifier's comments:

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 7/8**
Item number:	not available
Additional plate or washer (17.6.2.1.3):	d_{plate} = 0.100 in., t_{plate} = 0.100 in.
Effective embedment depth:	h_{ef} = 9.099 in., $h_{ef,17.6.2.1.3}$ = 0.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-19 / CIP
Stand-off installation:	
Profile:	
Base material:	cracked concrete, 3000, f_c' = 3,000 psi; h = 120.000 in.
Reinforcement:	tension: not present, shear: not present; edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.10.5.3 (d)) Shear load: yes (17.10.6.3 (a))

Geometry [in.] & Loading [kip, ft.kip]



Hilti PROFIS Engineering 3.1.1

www.hilti.com

Company:	M-ME	Page:	2
Address:	224 Walnut Ave	Specifier:	
Phone I Fax:	831-426-3186 |	E-Mail:	bob@m-me.com
Design:	Concrete - Oct 7, 2021	Date:	10/7/2021
Fastening point:	Upper floor Shearwall to Diaphragm Conn		

1.1 Design results

Case	Description	Forces [kip] / Moments [ft.kip]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0.000$; $V_x = 1.700$; $V_y = 0.000$; $M_x = 0.00000$; $M_y = 0.00000$; $M_z = 0.00000$;	yes	95

2 Load case/Resulting anchor forces

Anchor reactions [kip]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	1.700	1.700	0.000

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [ksi]
resulting tension force in (x/y)=(0.000/0.000): 0.000 [kip]
resulting compression force in (x/y)=(0.000/0.000): 0.000 [kip]

3 Tension load

	Load N_{ua} [kip]	Capacity ϕ N_n [kip]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	N/A	N/A	N/A	N/A
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	N/A	N/A	N/A	N/A
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

Company:	M-ME	Page:	3
Address:	224 Walnut Ave	Specifier:	
Phone I Fax:	831-426-3186 |	E-Mail:	bob@m-me.com
Design:	Concrete - Oct 7, 2021	Date:	10/7/2021
Fastening point:	Upper floor Shearwall to Diaphragm Conn		

4 Shear load

	Load V_{ua} [kip]	Capacity ϕ V_n [kip]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	1.700	10.450	17	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	1.700	8.068	22	OK
Concrete edge failure in direction x+**	1.700	1.793	95	OK

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa} = 0.6\ A_{se,V}\ f_{uta}$ ACI 318-19 Eq. (17.7.1.2b)
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [ksi]
0.46	58.000

Calculations

V_{sa} [kip]
16.078

Results

V_{sa} [kip]	ϕ_{steel}	$\phi\ V_{sa,eq}$ [kip]	V_{ua} [kip]
16.078	0.650	10.450	1.700

Company:	M-ME	Page:	4
Address:	224 Walnut Ave	Specifier:	
Phone I Fax:	831-426-3186 |	E-Mail:	bob@m-me.com
Design:	Concrete - Oct 7, 2021	Date:	10/7/2021
Fastening point:	Upper floor Shearwall to Diaphragm Conn		

4.2 Pryout Strength

$V_{cp} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b \right]$ ACI 318-19 Eq. (17.7.3.1a)

$\phi\ V_{cp} \geq V_{ua}$ ACI 318-19 Table 17.5.2

A_{Nc} see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-19 Eq. (17.6.2.1.4)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}} \right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.4.1b)

$\psi_{cp,N} = \mathrm{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}} \right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.6.1b)

$N_b = k_c\ \lambda_a\ \sqrt{f'_c}\ h_{ef}^{1.5}$ ACI 318-19 Eq. (17.6.2.2.1)

Variables

k_{cp}	h_{ef} [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
2	8.000	3.000	1.000

c_{ac} [in.]	k_c	λ_a	f'_c [psi]
∞	24	1.000	3,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kip]
144.00	576.00	0.775	1.000	29.745

Results

V_{cp} [kip]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi\ V_{cp}$ [kip]	V_{ua} [kip]
11.526	0.700	1.000	1.000	8.068	1.700

Company:	M-ME	Page:	5
Address:	224 Walnut Ave	Specifier:	
Phone I Fax:	831-426-3186 |	E-Mail:	bob@m-me.com
Design:	Concrete - Oct 7, 2021	Date:	10/7/2021
Fastening point:	Upper floor Shearwall to Diaphragm Conn		

4.3 Concrete edge failure in direction x+

$V_{cb} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ ACI 318-19 Eq. (17.7.2.1a)

$\phi\ V_{cb} \geq V_{ua}$ ACI 318-19 Table 17.5.2

A_{Vc} see ACI 318-19, Section 17.7.2.1, Fig. R 17.7.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ ACI 318-19 Eq. (17.7.2.1.3)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-19 Eq. (17.7.2.4.1b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-19 Eq. (17.7.2.6.1)

$V_b = 9\ \lambda_a\ \sqrt{f_c'}\ c_{a1}^{1.5}$ ACI 318-19 Eq. (17.7.2.2.1b)

Variables

c_{a1} [in.]	c_{a2} [in.]	$\psi_{c,V}$	h_a [in.]	l_e [in.]
3.000	12.000	1.000	120.000	7.000

λ_a	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
1.000	0.875	3,000	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [kip]
40.50	40.50	1.000	1.000	2.561

Results

V_{cb} [kip]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi\ V_{cb}$ [kip]	V_{ua} [kip]
2.561	0.700	1.000	1.000	1.793	1.700

Design Method	Load & Resistance Factor Design (LRFD)
Connection Type	Lateral loading
Fastener Type	Bolt
Loading Scenario	Single Shear - Concrete Main Member

Main Member Type	Concrete
Bolt Embedment Depth in Concrete	7 in.
Main Member: Angle of Load to Grain	0
Side Member Type	Redwood (open grain)
Side Member Thickness	1.5 in.
Side Member: Angle of Load to Grain	90
Fastener Diameter	5/8 in.
Time Effect Factor	☐ = 1.0
Wet Service Factor	C_M = 1.0
Temperature Factor	C_t = 1.0

Connection Yield Modes

Im	14175 lbs.
Is	749 lbs.
II	4213 lbs.
IIIm	4328 lbs.
IIIs	996 lbs.
IV	1407 lbs.

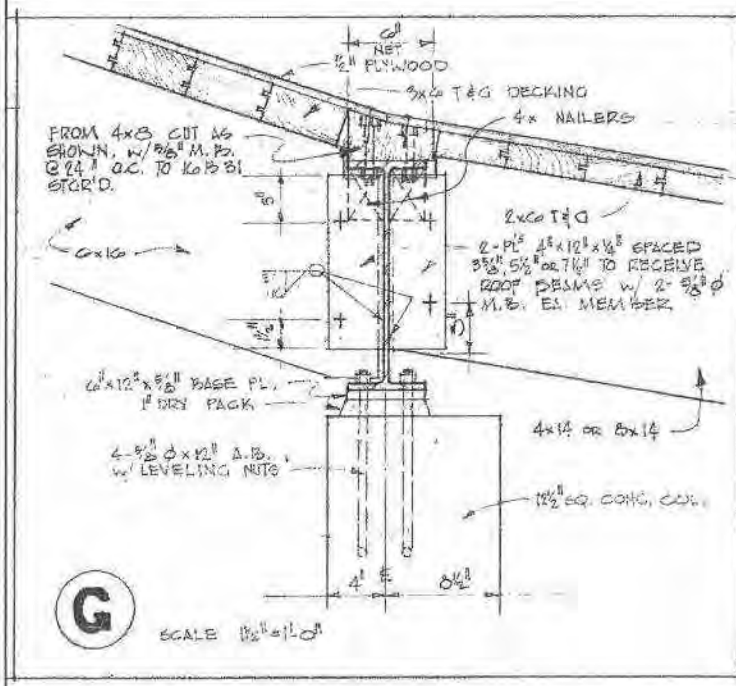
Adjusted LRFD Capacity	**749 lbs.**

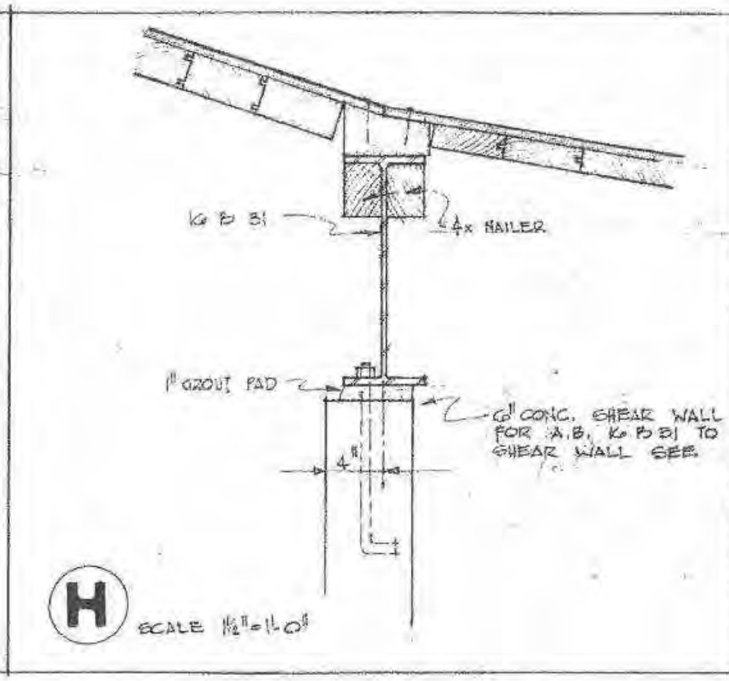
- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted LRFD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.

The Connection Calculator was designed and created by Cameron Knudson, Michael Dodson and David Pollock at Washington State University. Support for development of the Connection Calculator was provided by American Wood Council.

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

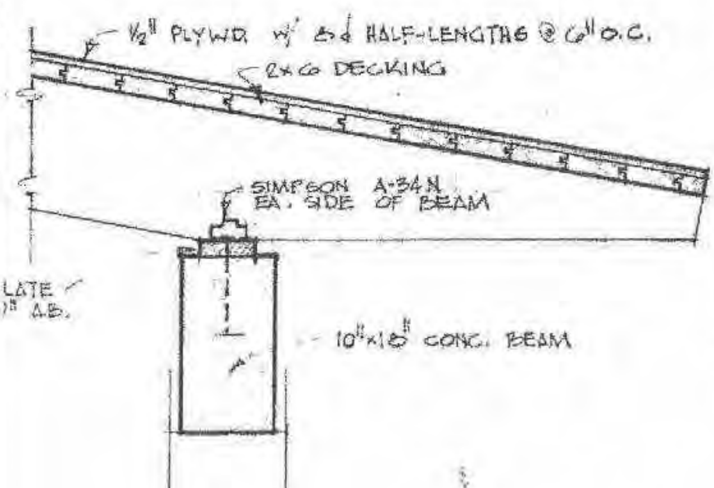
JOB 21143.P5 Cupertino City Hall
SHEET NO. ______ OF ______
CALCULATED BY BR DATE ______
CHECKED BY ______ DATE ______
SCALE ______

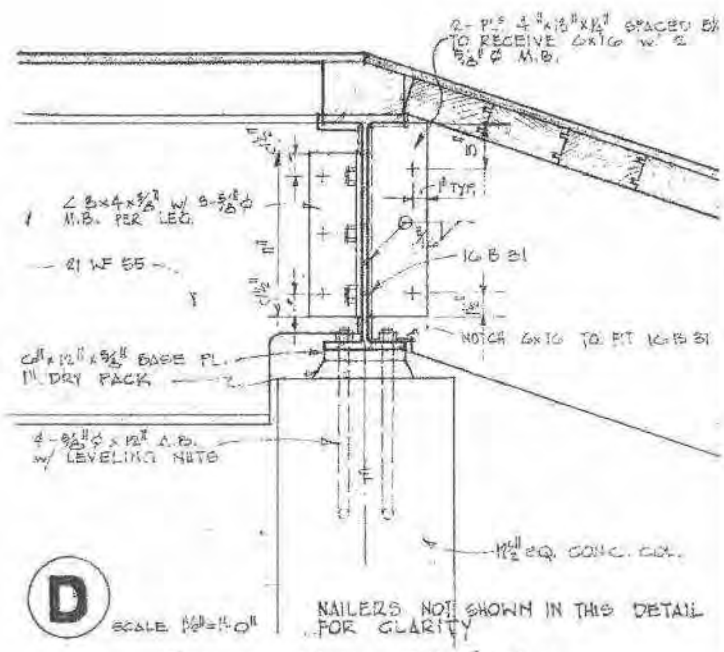




Connection at Exterior Wall Columns

Connection at Exterior Wall Columns





Connection at Veranda

Connection at Interior Columns

M-ME
Civil + Structural Engineering
224 Walnut Avenue, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. ____ OF ____
CALCULATED BY BR DATE ____
CHECKED BY ____ DATE ____
SCALE ____

GROUND FLOOR SHEARWALLS

ASSPECT RATIOS height $12'-1.25 = 10.8'$

NORTH WALL VERANDA

3' WIDE ASPECT RATIO $\frac{10.8}{3} = 3.6$

NORTH WALL

$5.\bar{3}$ ASPECT RATIO $10.8/5.\bar{3} = 2$

VERANDA WALL

SPACING OF TIES = 12" O.C.

$8 d_b = 8(.75) = 6"$ O.C.

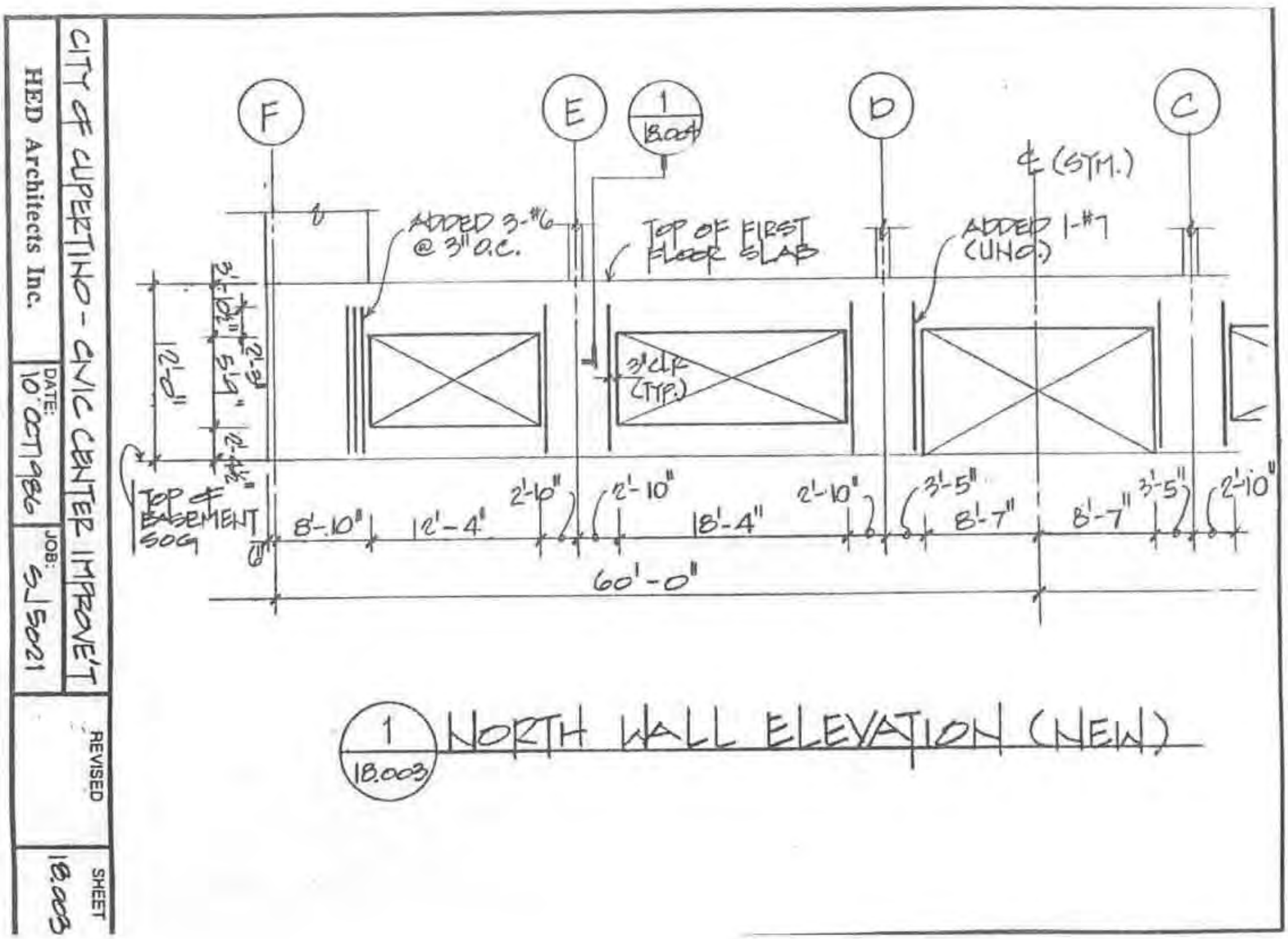
CONCRETE WALL THICKNESS.

UPPER FLOOR ht = 11.8'

$t_{min} = 11.8(12)/25 = 5.65"$ ok

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall
SHEET NO. BR OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE



MME

Civil + Structural Engineering
224 Walnut Avenue, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

JOB 21143.P5 Cupertino City Hall

SHEET NO. ______ OF ______

CALCULATED BY BR DATE ______

CHECKED BY ______ DATE ______

SCALE ______

COLUMN BAR SPLICES

TYPICAL BAR SPLICE: $40\,d_b < 50\,d_b$

TIE SPACING = 11" O.C. TYPICAL
6" O.C. @ BASE

TIE SIZE #2

BASEMENT BARS #6 TO #11 FIRST FLOOR #6 TYP

max $8\,d_b$ = .75 (8) = 6" #6

1.41 (8) = 11.3 #11

MME
Civil & Structural Engineering
224 Walnut Ave, Suite B
Santa Cruz, CA 95060
831.426.3186 | www.m-me.com

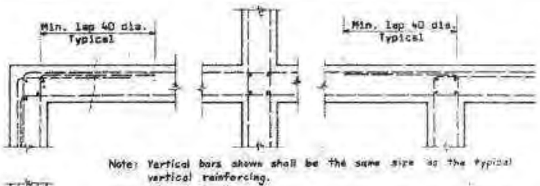
JOB 21143.P5 Cupertino City Hall

SHEET NO. ______ OF ______

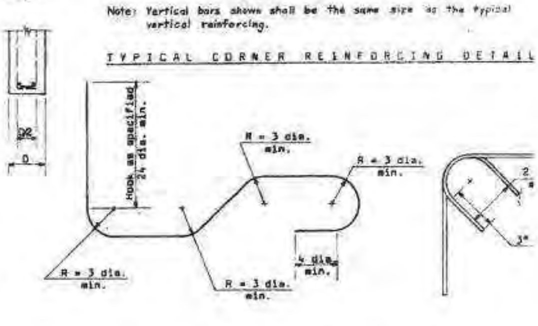
CALCULATED BY BR DATE -

CHECKED BY ______ DATE ______

SCALE ______



TYPICAL CORNER REINFORCING DETAIL

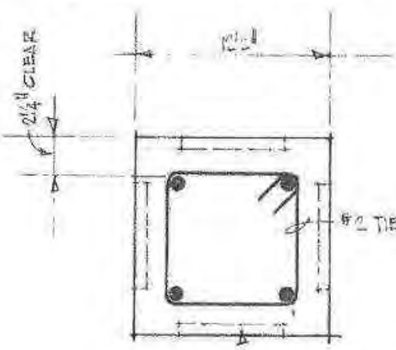


TYPICAL BAR BEND DETAILS

COLUMN SCHEDULE

	MARK ⬡	COL. SIZE	VERT. REINFORCE. AMOUNT	VERT. REINFORCE. SIZE	TIES SIZE	TIES SPACING
BASEMENT	C-1	12½" SQ.	4	#11	#2	11"
	C-2	12½" SQ.	4	#10	#2	11"
	C-3	12½" SQ.	4	#9	#2	11"
	C-4	12½" SQ.	4	#8	#2	11"
	C-5	12½" SQ.	4	#6	#2	11"
	C-6	12" SQ	4	#7	#2	12"
FIRST FLOOR	C-1	12½" SQ.	4	#6	#2	11"
	C-2	12½" SQ.	4	#6	#2	11"
	C-3	12½" SQ.	4	#6	#2	11"
	C-4	12½" SQ.	4	#6	#2	11"
	C-5	12½" SQ.	4	#6	#2	11"
	C-6	12½" SQ.	4	#6	#2	11"

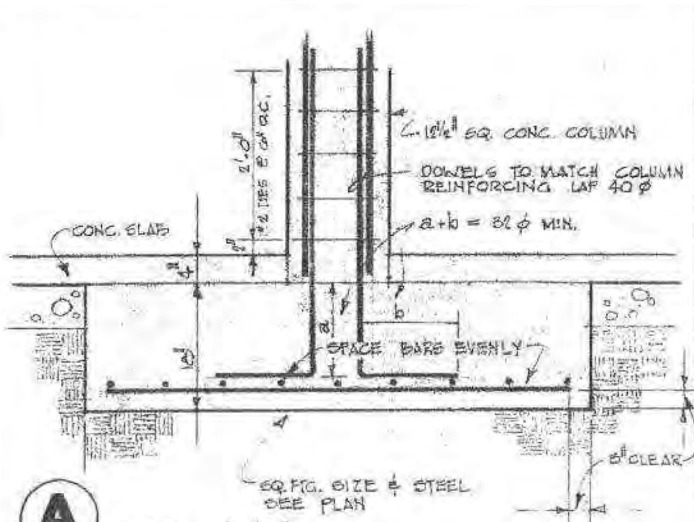
NOTE: PROVIDE #2 TIES @ 6" O.C. IN TOP & BOTT. 2'-0" OF COLUMN & 2'-0" ABOVE & BELOW 1ST FLOOR, LAP BARS 40φ



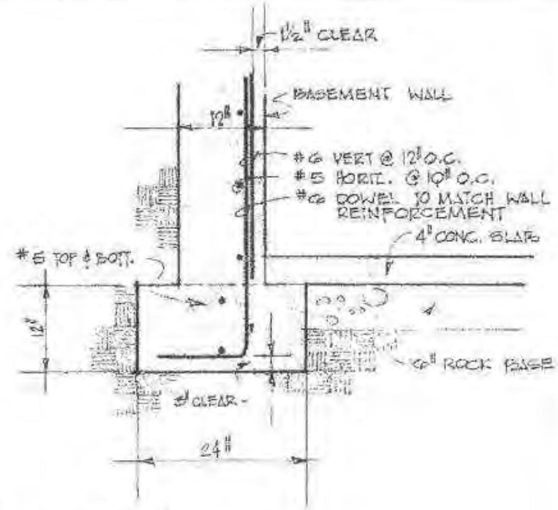
— ARCHITECTURAL REVEAL ¾" MAX.

TYPICAL COLUMN

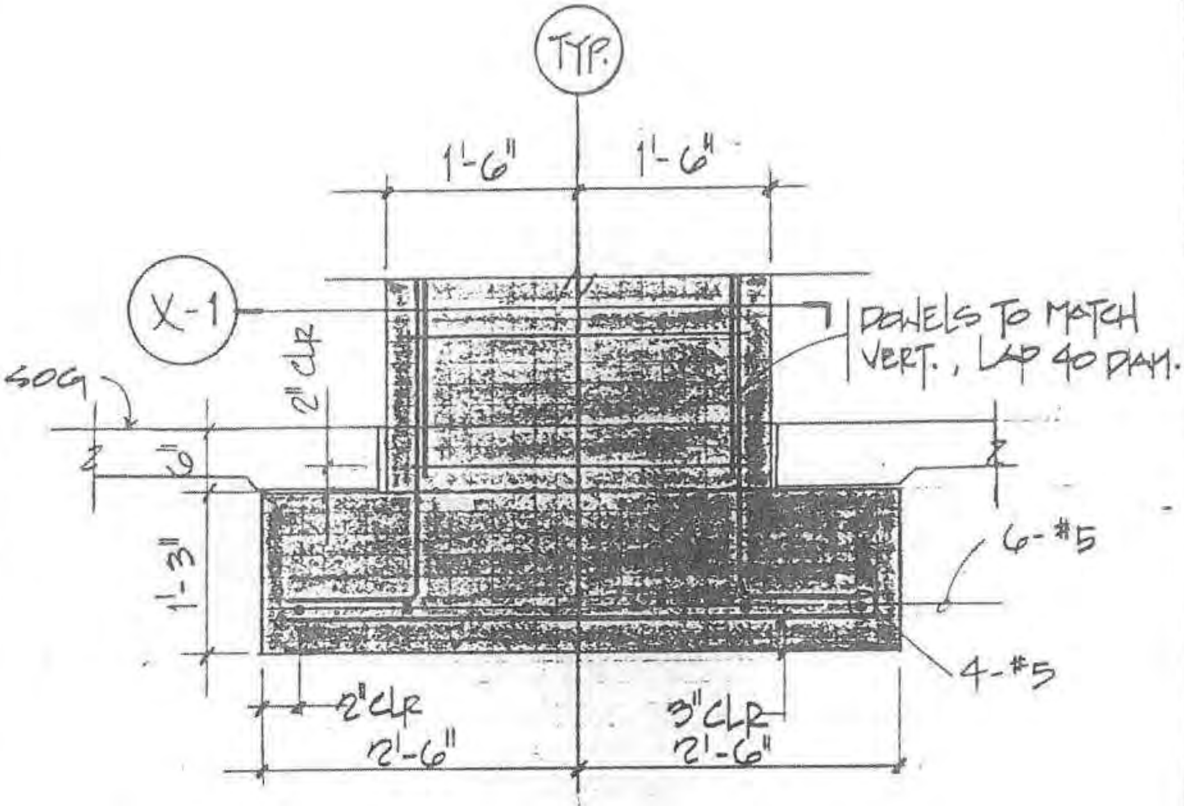
1½" = 1'-0"



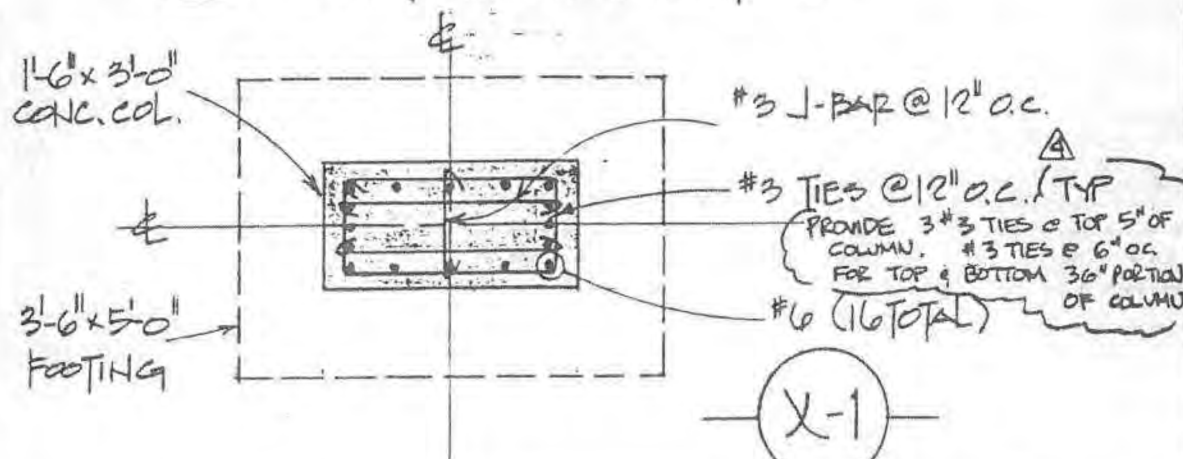
A SCALE ¾" = 1'-0"



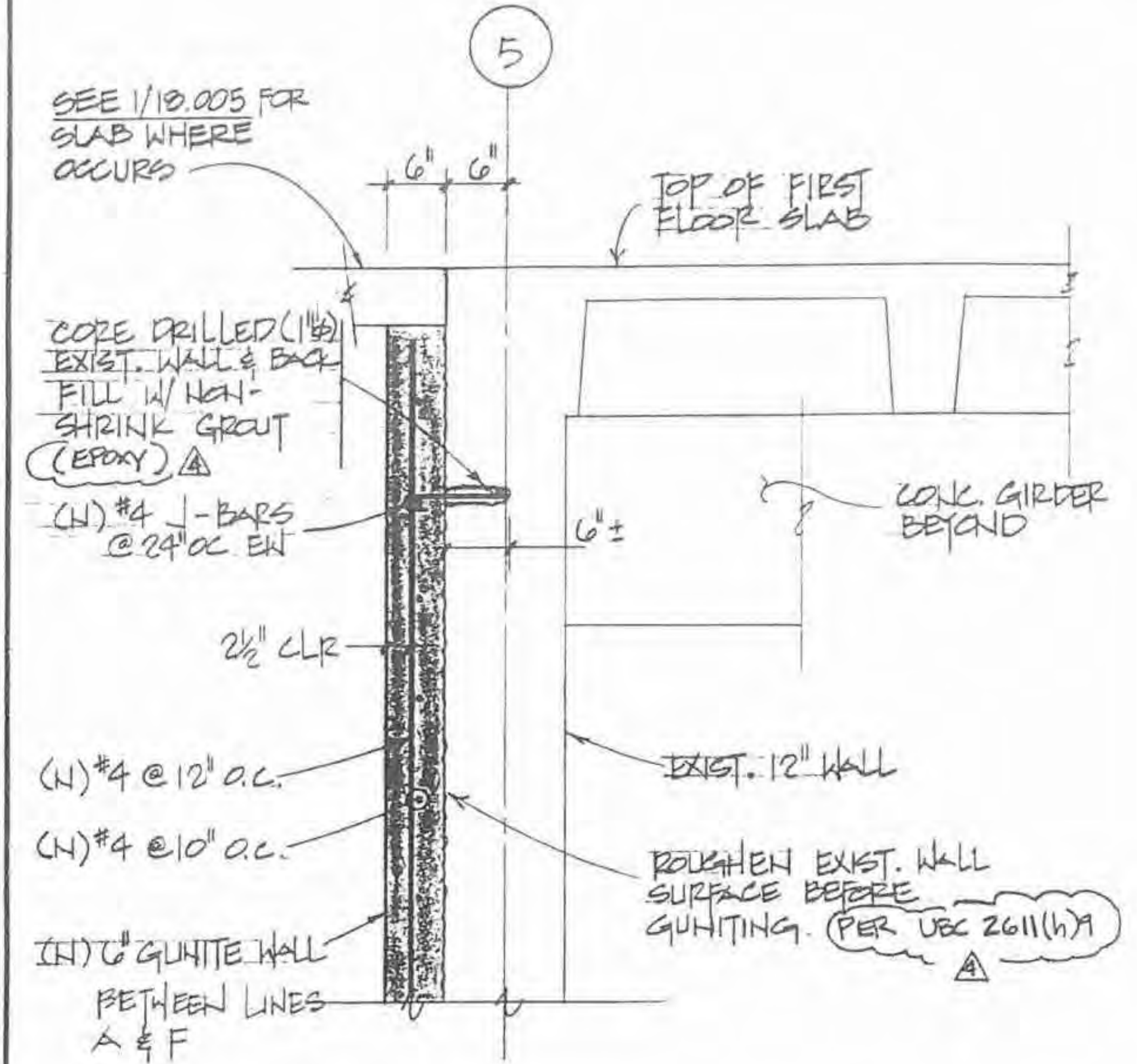
B SCALE ¾" = 1'-0"



1 / 18.011 NEW COLUMN & FOOTING REINFORCING DETAIL.

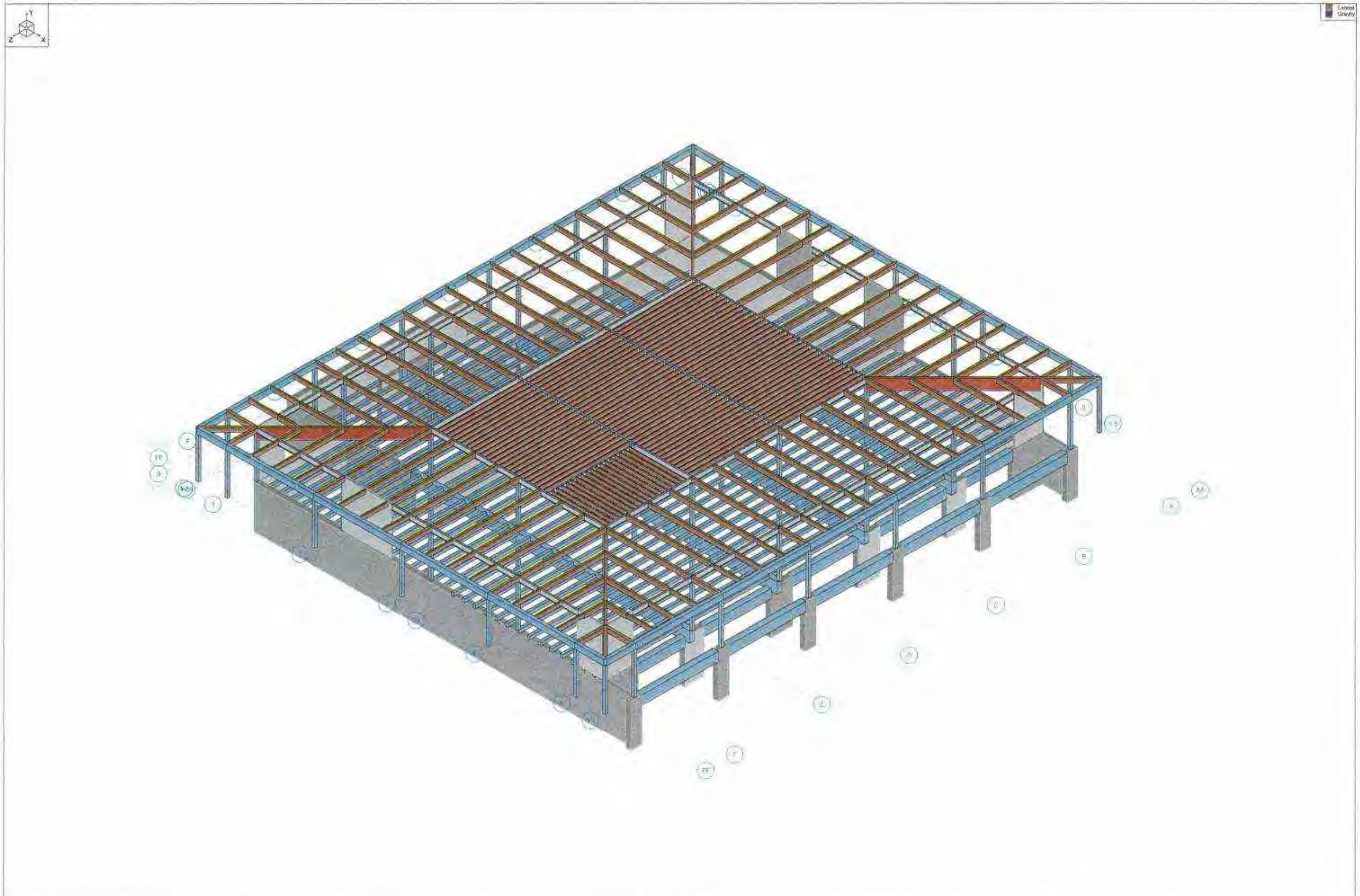


CITY OF CUPERTINO - CIVIC CENTER IMPROVE'T		REVISED: 4 3 DEC 86	SHEET: 18.011
HED Architects Inc.	DATE: 10 OCT 1986 / JOB: SJ 5021		

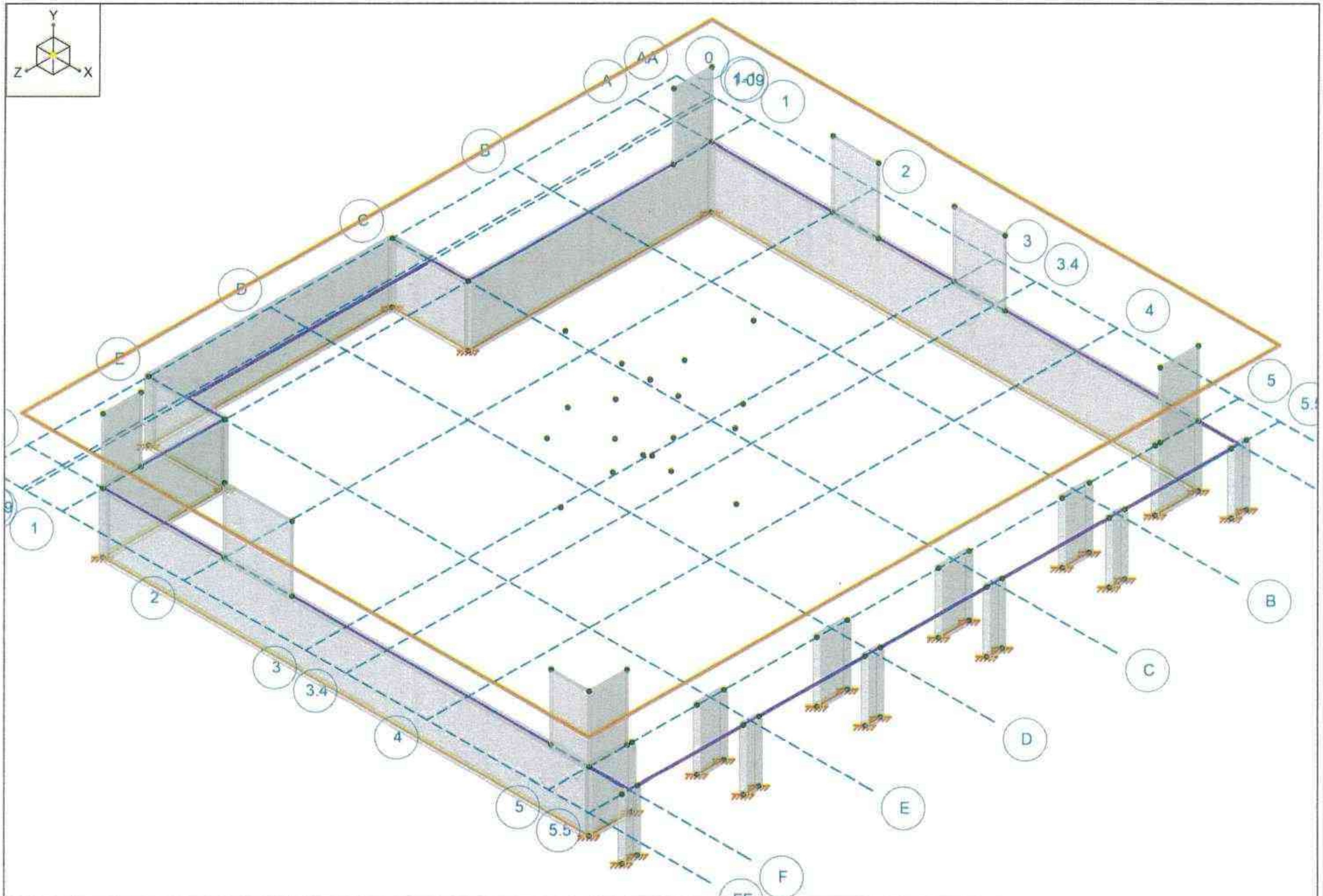


1 GUNITE WALL DETAIL
18.004

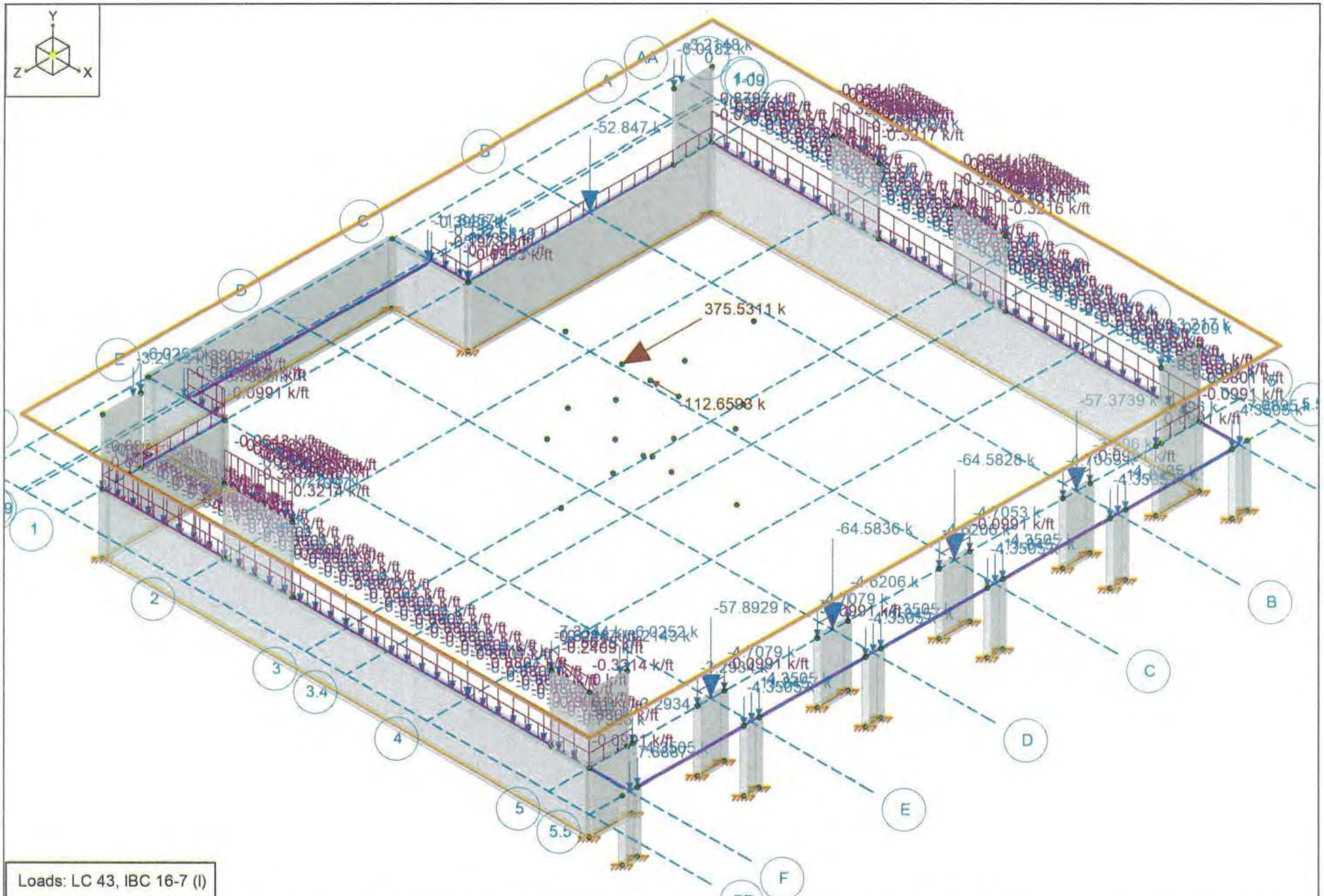
CITY OF CUPERTINO – CIVIC CENTER IMPROVE'T		REVISED	SHEET
HED Architects Inc.	DATE: 10 OCT 1986 JOB: SJ5021	4 3 DEC 86	18.004



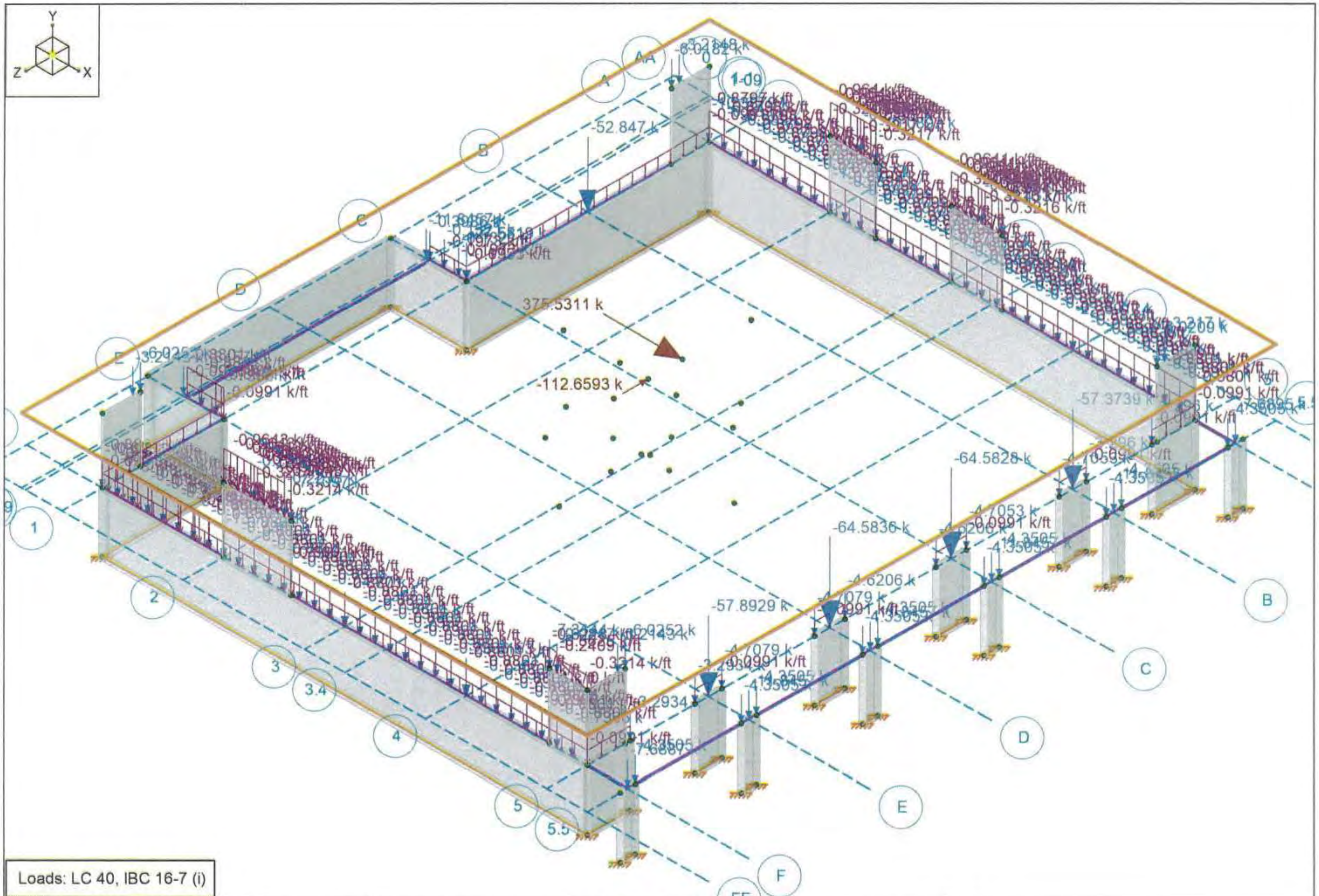
MME	Full Model	SK - 2
Bob Riley	Cupertino City Hall	Nov 30, 2021 at 8:09 AM
21143.P5		Cupertino City Hall.rfl



MME	Cupertino City Hall	SK-6
Bob Riley		Nov 30, 2021
21143.P5		Cupertino City Hall.rfl



MME	Cupertino City Hall	SK-5
Bob Riley		Nov 30, 2021
21143.P5		Cupertino City Hall.rfl



MME	Cupertino City Hall	SK-4
Bob Riley		Nov 30, 2021
21143.P5		Cupertino City Hall.rfl

Concrete Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e⁵°F⁻¹]	Density [k/ft³]	f'c [ksi]	Lambda	Flex Steel [ksi]	Shear Steel [ksi]
1	Conc3000NW	3156	1372	0.15	0.6	0.145	3	1	60	60
2	Conc3500NW	3409	1482	0.15	0.6	0.145	3.5	1	60	60
3	Conc4000NW	3644	1584	0.15	0.6	0.145	4	1	60	60
4	Conc3000LW	2085	907	0.15	0.6	0.11	3	0.75	60	60
5	Conc3500LW	2252	979	0.15	0.6	0.11	3.5	0.75	60	60
6	Conc4000LW	2408	1047	0.15	0.6	0.11	4	0.75	60	60

Wall Panel Data

	Label	A Node	B Node	C Node	D Node	Material Type	Material Set	Thickness [in]	Design Rule	Panel/Spacing
1	WP1	F1_N2	F1_N3	N47	N46	Concrete	Conc3000NW	18	WALL 18" GUNNITE	N/A
2	WP2	F1_N4	F1_N5	N49	N48	Concrete	Conc3000NW	18	WALL 18" GUNNITE	N/A
3	WP3	F1_N6	F1_N7	N51	N50	Concrete	Conc3000NW	18	WALL 18" GUNNITE	N/A
4	WP4	F1_N8	F1_N9	N53	N52	Concrete	Conc3000NW	18	WALL 18" GUNNITE	N/A
5	WP5	F1_N10	F1_N11	N55	N54	Concrete	Conc3000NW	18	WALL 18" GUNNITE	N/A
6	WP6	F1_N12	F1_N13	N57	N56	Concrete	Conc3000NW	18	WALL 18" GUNNITE	N/A
7	WP7	F1_N68	F1_N69	N59	N58	Concrete	Conc3000NW	18	WALL 18"	N/A
8	WP8	F1_N70	F1_N71	N61	N60	Concrete	Conc3000NW	18	WALL 18"	N/A
9	WP9	F1_N72	F1_N73	N63	N62	Concrete	Conc3000NW	18	WALL 18"	N/A
10	WP10	F1_N74	F1_N75	N65	N64	Concrete	Conc3000NW	18	WALL 18"	N/A
11	WP11	F1_N5	F1_N22	N66	N49	Concrete	Conc3000NW	18	WALL 12"	N/A
12	WP12	F1_N22	F1_N23	N67	N66	Concrete	Conc3000NW	18	WALL 12"	N/A
13	WP13	F1_N23	F1_N24	N68	N67	Concrete	Conc3000NW	18	WALL 12"	N/A
14	WP14	F1_N24	F1_N25	N69	N68	Concrete	Conc3000NW	18	WALL 12"	N/A
15	WP15	F1_N25	F1_N26	N70	N69	Concrete	Conc3000NW	18	WALL 12"	N/A
16	WP16	F1_N26	F1_N27	N71	N70	Concrete	Conc3000NW	18	WALL 12"	N/A
17	WP17	F1_N27	F1_N2	N46	N71	Concrete	Conc3000NW	18	WALL 12"	N/A
18	WP25	F1_N76	F1_N77	N73	N72	Concrete	Conc3000NW	18	WALL 18"	N/A
19	WP26	F1_N78	F1_N79	N75	N74	Concrete	Conc3000NW	18	WALL 18"	N/A
20	WP33	F2_N22	F2_N385	N76	F1_N22	Concrete	Conc3000NW	6	WALL 6"	N/A
21	SW34	F2_N5	F2_N393	N77	F1_N5	Concrete	Conc3000NW	6	WALL 6"	N/A
22	SW35	F2_N392	F2_N2	F1_N2	N78	Concrete	Conc3000NW	6	WALL 6"	N/A
23	SW36	F2_N2	F2_N391	N79	F1_N2	Concrete	Conc3000NW	6	WALL 6"	N/A
24	SW37	F2_N389	F2_P265	N81	N80	Concrete	Conc3000NW	6	WALL 6"	N/A
25	SW38	F2_N386	F2_N27	F1_N27	N82	Concrete	Conc3000NW	6	WALL 6"	N/A
26	SW39	F2_P95	F2_N396	N84	N83	Concrete	Conc3000NW	6	WALL 6"	N/A
27	SW40	F2_P110	F2_N394	N86	N85	Concrete	Conc3000NW	6	WALL 6"	N/A

Floor Diaphragms

	Elevation [ft]	Mass [k]	Mass MOI [k·ft²]	Center Of Mass [ft]	Plus X Eccentricity [ft]	Minus X Eccentricity [ft]	Plus Z Eccentricity [ft]	Minus Z Eccentricity [ft]	Inactive	Diaphragm	Type	Design Rule	SGAF	Material	Thickness [in]	No Wind/Drift
1	13	1757.7961	5.302e+6	47.993, 60.0291	%5	%5	%5	%5		D2	Flexible	N/A	N/A	N/A	N/A	
2	0	2538.7088	9.97e+6	47.3703, 60.7666	%5	%5	%5	%5		D3	Rigid	N/A	N/A	N/A	N/A	

SEISMIC GENERATION INPUT

Seismic Code: **ASCE 7-16** Risk Category: **IV** Seismic Weight LC: **LC 1: Deflection 1**

Base Elevation: **0** ft S_{D1}: **0.41** g S_{DS}: **0.69** g S_1: **0.313** g T_L: **12** sec

X-Direction Parameters

C_{TX}: **0.02** T_X: **Not Entered** sec
C_{TX_Exp}: **0.75** R_X: **5**

Z-Direction Parameters

C_{TZ}: **0.02** T_Z: **Not Entered** sec
C_{TZ_Exp}: **0.75** R_Z: **5**

SEISMIC GENERATION DETAIL RESULTS

Importance Factor: **1.5** Design Category: **D**

Period Determination:

X - Direction		Z - Direction	
T_{aX}: **0.1369** s		T_{aZ}: **0.1369** s	
$T_{X,LIMIT}$: **0.1917** s		$T_{Z,LIMIT}$: **0.1917** s	
T_X: 0.1369 s	*User Input*	**T_Z: 0.1369** s	*User Input*

Base Shear Determination

C_{SX}: **0.207** s		C_{SZ}: **0.207** s	
V_X: 375.5311 kips	*ASCE Eqn 12.8-2*	**V_Z: 375.5311 kips**	*ASCE Eqn 12.8-2*

SEISMIC GENERATION FORCE RESULTS

Floor Level	Height (ft)	Weight (kips)	Force X (kips)	Force Z (kips)	CG X (ft)	CG Z (ft)
Floor Plan 2	13	1757.7961	375.5311	375.5311	47.993	60.0291
Base		56.3639				
	Total:	**1814.16**	**375.5311**	**375.5311**		

SEISMIC GENERATION DIAPHRAGM RESULTS

Floor Level	Width (X) (ft)	Length (Z) (ft)	X Plus (ft)	X Minus (ft)	Z Plus (ft)	Z Minus (ft)
Floor Plan 2	112	136	5.6	5.6	6.8	6.8

Concrete Wall Seismic Design Rule

	Label	Wall Type	Diagonal Bar Size
1	SDR_Conc1	Ordinary	N/A

ACI 318-14 Wall Panel Concrete Code Checks (In-Plane)

	Wall Panel	Region	Max UC	LC	Shear UC	LC	Pn*phi[k]	Mn*phi[k-ft]	Vn*phi[k]
1	WP1	R1	1.3802	37	0.2608	25	-47.2317	594.8201	224.4069
2	WP2	R1	1.2432	49	0.2658	19	-44.887	598.0166	213.5245
3	WP3	R1	0.1081	5	0.0349	49	1596.9862	NC	210.0918
4	WP4	R1	0.1086	5	0.0368	13	1596.9862	NC	219.861
5	WP5	R1	0.1061	5	0.0415	37	1788.885	NC	236.5489
6	WP6	R1	0.1061	5	0.0417	37	1788.885	NC	236.5484
7	WP7	R1	0.0525	13	0.0122	37	887.5349	368.7764	130.6125
8	WP8	R1	0.0525	13	0.0122	37	887.5349	368.7764	130.6125
9	WP9	R1	0.0525	13	0.0122	37	887.5349	368.7764	130.6125
10	WP10	R1	0.0525	13	0.0122	37	887.5349	368.7765	130.6125
11	WP11	R1	0.0445	46	0.0752	13	NC	102891.8391	3521.1448
12	WP12	R1	0.0791	37	0.1739	37	NC	25205.6233	1760.2056
13	WP13	R1	0.1609	5	0.0874	28	NC	2897.3351	550.1789
14	WP14	R1	0.0055	31	0.0009	13	NC	27368.5913	1760.5724
15	WP15	R1	0.1028	55	0.0434	10	NC	2261.9337	550.1789
16	WP16	R1	0.2077	19	0.1399	25	NC	6059.8437	880.2862
17	WP17	R1	0.0359	19	0.0694	31	28762.9372	48373.7848	3521.1449
18	WP25	R1	0.068	37	0.0278	13	NC	321.3424	107.328
19	WP26	R1	0.0679	49	0.0274	25	NC	312.3962	105.4024
20	WP33	R1	4.1699	37	0.8427	37	NC	299.8617	111.4281
21	SW34	R1	4.1618	43	0.8411	43	NC	300.4652	111.6398
22	SW35	R1	3.6942	37	0.9763	43	-16.8404	242.6171	93.8212
23	SW36	R1	3.2381	34	0.8645	40	-13.8886	255.4613	95.37
24	SW37	R1	1.3477	40	0.5481	40	25.4337	1084.5816	198.3539
25	SW38	R1	4.1277	55	0.8416	55	NC	302.9365	111.5769
26	SW39	R1	2.7359	40	0.5487	40	10.3615	374.3138	137.175
27	SW40	R1	3.1426	40	0.7076	40	9.4561	460.4482	152.1494

ACI 318-14 Wall Panel Concrete Code Checks (Out-of-Plane)

	Wall Panel	Region	Max UC	LC	Shear UC	LC	Pn*phi[k/ft]	Mn*phi[k-ft/ft]	Vn*phi[k/ft]
1	WP1	R1	0.6346 (Int)	43	0.0211	25	-22.4531	NC	16.7062
2	WP2	R1	0.4216 (Int)	49	0.0197	13	-22.4552	NC	16.7748
3	WP3	R1	0.1081 (Int)	5	0.0008	34	299.6222	28.4641	15.4653
4	WP4	R1	0.1086 (Int)	5	0.0008	40	299.6222	28.4641	15.4687
5	WP5	R1	0.1061 (Int)	5	0.0007	52	298.1475	28.324	15.4672
6	WP6	R1	0.1061 (Int)	5	0.0007	34	298.1475	28.324	15.4671
7	WP7	R1	0.0491 (Int)	4	0.0008	16	330.4091	31.3889	15.8335
8	WP8	R1	0.0491 (Int)	4	0.0007	16	330.4091	31.3889	15.8335
9	WP9	R1	0.0491 (Int)	4	0.0006	10	330.4091	31.3889	15.8335
10	WP10	R1	0.0491 (Int)	4	0.0007	10	330.4091	31.3889	15.8335
11	WP11	R1	0.0573 (Int)	25	0.0086	37	NC	17.0313	8.8928
12	WP12	R1	0.0505 (Int)	19	0.0068	13	NC	17.0347	8.9899
13	WP13	R1	0.0616 (Int)	19	0.0225	25	NC	17.0313	8.9906
14	WP14	R1	0.0218 (Int)	28	0.0057	28	NC	17.0313	8.9532
15	WP15	R1	0.0456 (Int)	25	0.0222	13	NC	17.0313	8.9236
16	WP16	R1	0.0458 (Int)	31	0.0108	19	NC	17.0313	8.8506
17	WP17	R1	0.0539 (Int)	28	0.0063	31	NC	17.0313	8.9463
18	WP25	R1	0.0334 (Int)	4	0.0008	31	330.4091	31.3889	15.656

ACI 318-14 Wall Panel Concrete Code Checks (Out-of-Plane) (Continued)

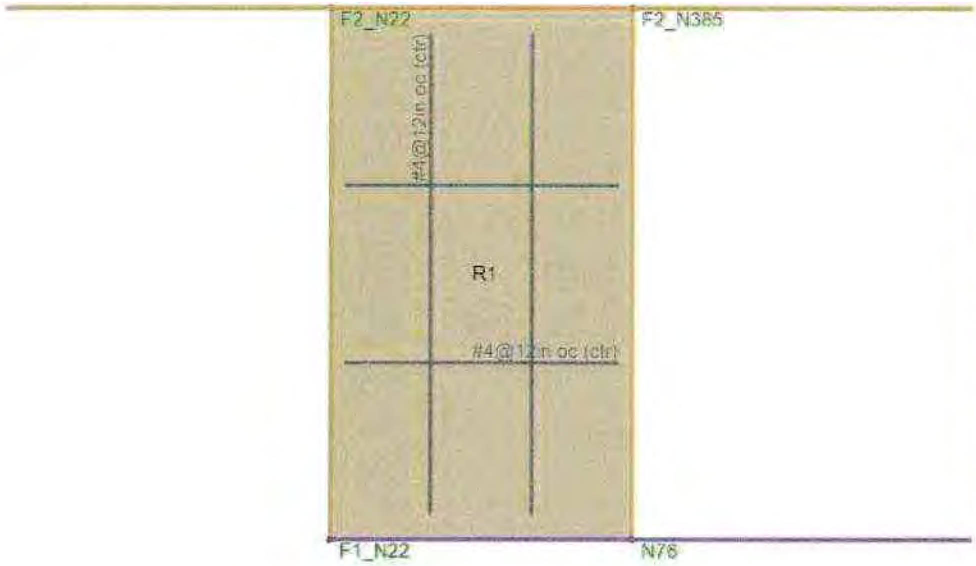
	Wall Panel	Region	Max UC	LC	Shear UC	LC	Pn*phi[k/ft]	Mn*phi[k-ft/ft]	Vn*phi[k/ft]
19	WP26	R1	0.0334 (Int)	4	0.0009	13	330.4091	31.3889	15.656
20	WP33	R1	0.0757 (Int)	6	0	25	NC	2.6372	3.0022
21	SW34	R1	0.0758 (Int)	6	0	19	NC	2.6325	3.0021
22	SW35	R1	1.461 (Int)	52	0.1207	46	-9.9091	0.3472	2.4503
23	SW36	R1	1.6314 (Int)	55	0.1819	55	-9.5688	0.4306	1.6752
24	SW37	R1	0.0644 (Int)	55	0.0001	13	NC	2.5958	3.0245
25	SW38	R1	0.0758 (Int)	6	0	19	NC	2.6339	3.0021
26	SW39	R1	0.0751 (Int)	7	0.0004	10	91.0654	5.9193	3.0454
27	SW40	R1	0.0705 (Int)	7	0.0004	10	91.0654	5.9193	3.039

Warning Log

	Message
1	Wall Panel WP1 is failing a reinforcement requirement. See detail report for more information.
2	Wall Panel WP2 is failing a reinforcement requirement. See detail report for more information.
3	Wall Panel WP11 is failing a reinforcement requirement. See detail report for more information.
4	Wall Panel WP12 is failing a reinforcement requirement. See detail report for more information.
5	Wall Panel WP13 is failing a reinforcement requirement. See detail report for more information.
6	Wall Panel WP14 is failing a reinforcement requirement. See detail report for more information.
7	Wall Panel WP15 is failing a reinforcement requirement. See detail report for more information.
8	Wall Panel WP16 is failing a reinforcement requirement. See detail report for more information.
9	Wall Panel WP17 is failing a reinforcement requirement. See detail report for more information.

Detail Report: WP33

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft³):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

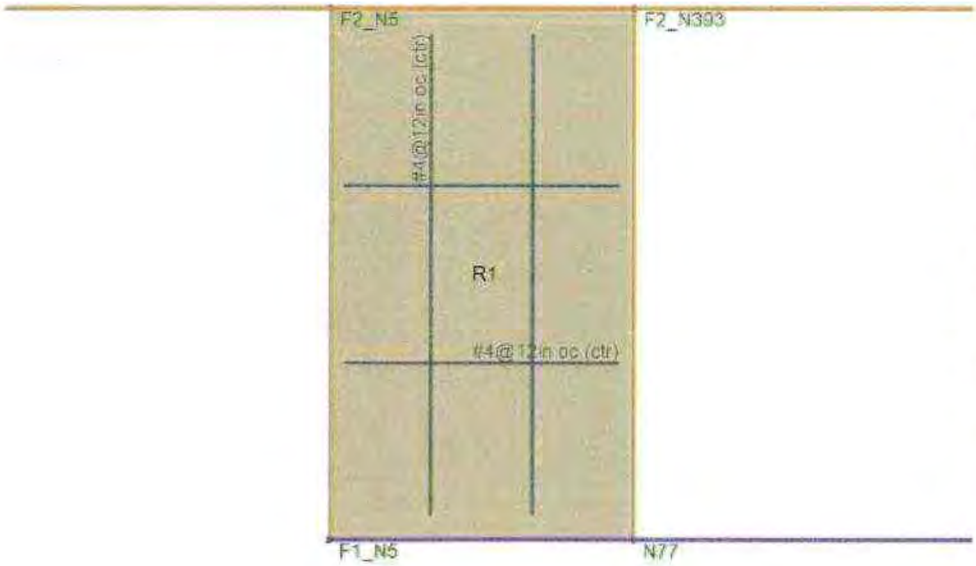
Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	7.49	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				4.1699	FAIL
UC Shear In-Plane				0.8427	PASS
Delta Max In-Plane					
UC Max Out-of-Plane				0.0757	PASS
UC Shear Out-of-Plane				0	PASS
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				4.1699	FAIL
Region R1 (Out-of-Plane)				0.0757	PASS

Detail Report: SW34

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft³):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

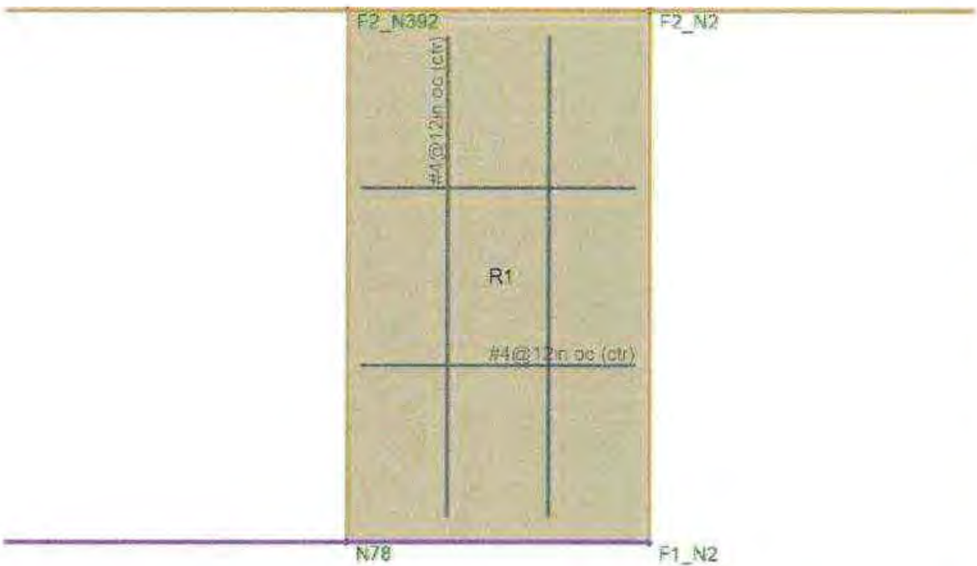
Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	7.5042	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				**4.1618**	**FAIL**
UC Shear In-Plane				**0.8411**	**PASS**
Delta Max In-Plane					
UC Max Out-of-Plane				**0.0758**	**PASS**
UC Shear Out-of-Plane				**0**	**PASS**
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				**4.1618**	**FAIL**
Region R1 (Out-of-Plane)				**0.0758**	**PASS**

Detail Report: SW35

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft³):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

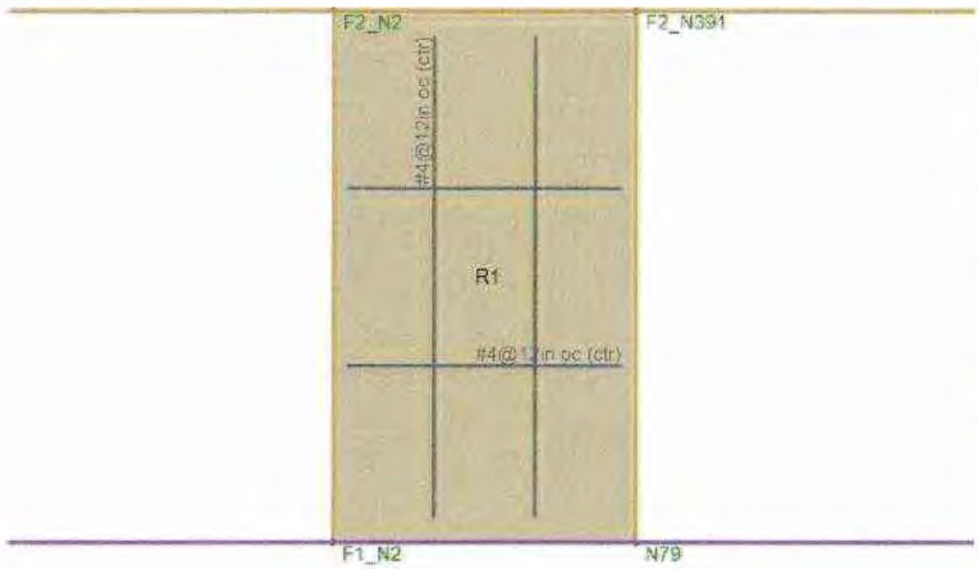
Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	7.5	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				3.6942	FAIL
UC Shear In-Plane				0.9763	PASS
Delta Max In-Plane					
UC Max Out-of-Plane				1.461	FAIL
UC Shear Out-of-Plane				0.1207	PASS
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				3.6942	FAIL
Region R1 (Out-of-Plane)				1.461	PASS

Detail Report: SW36

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft³):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

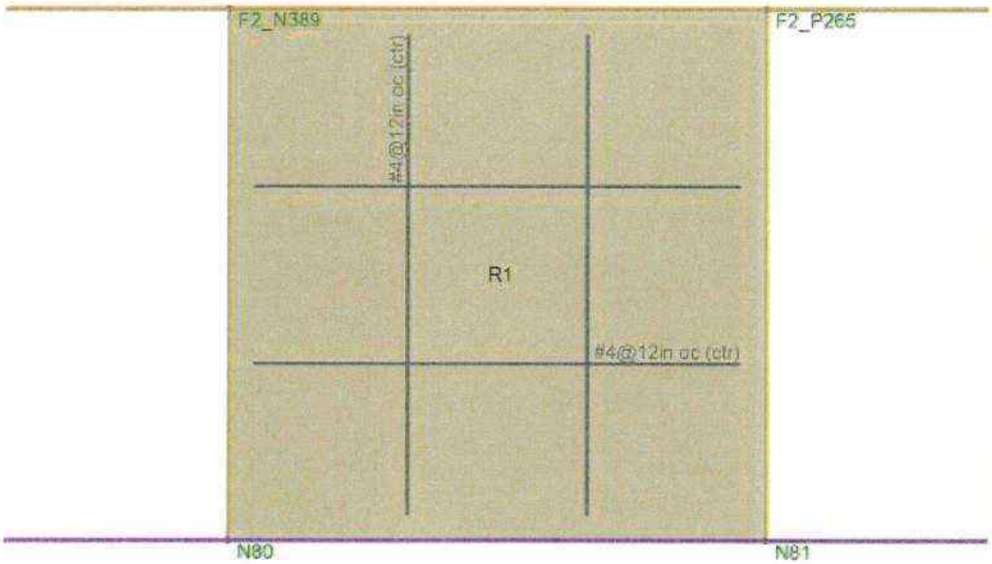
Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	7.5	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				3.2381	FAIL
UC Shear In-Plane				0.8645	PASS
Delta Max In-Plane					
UC Max Out-of-Plane				1.6314	FAIL
UC Shear Out-of-Plane				0.1819	PASS
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				3.2381	FAIL
Region R1 (Out-of-Plane)				1.6314	PASS

Detail Report: SW37

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft^3):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

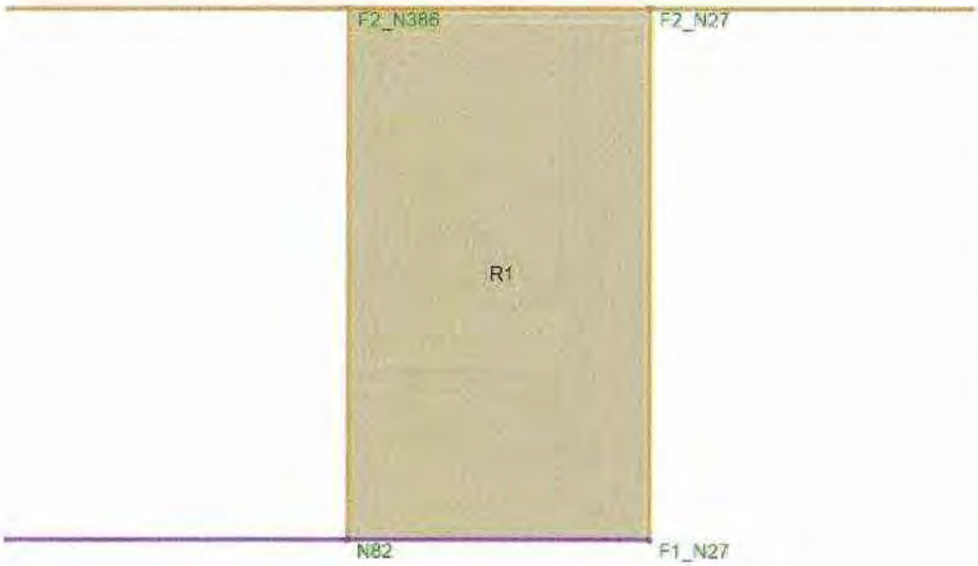
Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	13.333	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				1.3477	FAIL
UC Shear In-Plane				0.5481	PASS
Delta Max In-Plane					
UC Max Out-of-Plane				0.0644	PASS
UC Shear Out-of-Plane				0.0001	PASS
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				1.3477	FAIL
Region R1 (Out-of-Plane)				0.0644	PASS

Detail Report: SW38

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	SDR_Conc1
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft^3):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

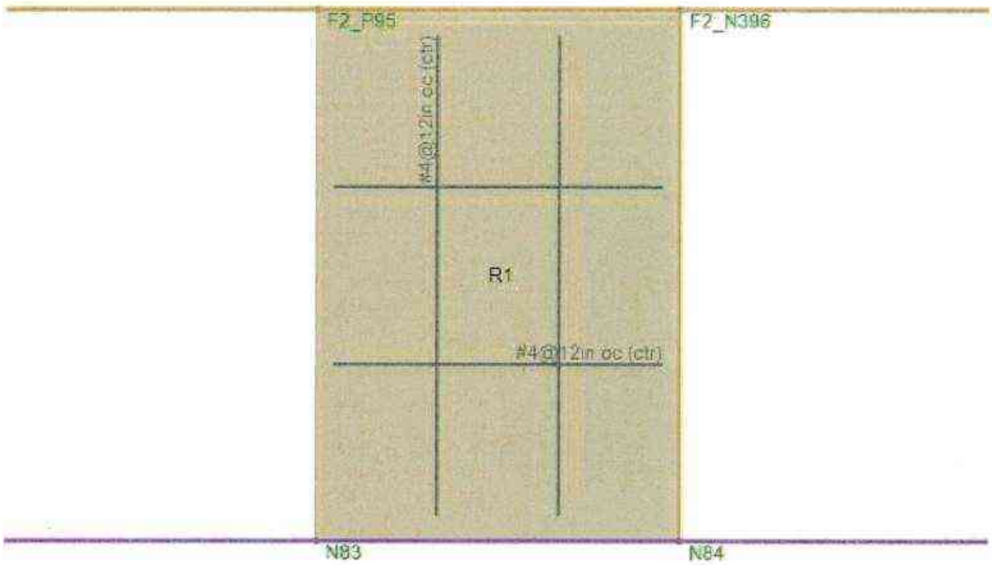
Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	7.5	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				4.1277	FAIL
UC Shear In-Plane				0.8416	PASS
Delta Max In-Plane					
UC Max Out-of-Plane				0.0758	PASS
UC Shear Out-of-Plane				0	PASS
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				4.1277	FAIL
Region R1 (Out-of-Plane)				0.0758	PASS

Detail Report: SW39

Enveloped Results



Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft^3):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	9	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				2.7359	FAIL
UC Shear In-Plane				0.5487	PASS
Delta Max In-Plane					
UC Max Out-of-Plane				0.0751	PASS
UC Shear Out-of-Plane				0.0004	PASS
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				2.7359	FAIL
Region R1 (Out-of-Plane)				0.0751	PASS

Detail Report: SW40

Enveloped Results

Input Data:

Code:	ACI 318-14
Design Rule:	WALL 6"
Seismic Rule:	None
Loc of r/f:	Centered
Outer Bars:	Vertical
Vert Bar Size:	#4
Horz Bar Size:	#4
Transfer In?:	Yes
Transfer Out?:	Yes
Group Wall?:	Yes

Material Properties:

Material Set:	Conc3000NW	Conc Density (k/ft^3):	0.145	Vert Bar Fy (ksi):	60
Concrete f'c (ksi):	3	Lambda:	1	Horz Bar Fy (ksi):	60
Concrete E (ksi):	3156	Conc Str Blk:	Rectangular	Steel E (ksi):	29000
Concrete G (ksi):	1372				

Geometry:

Total Height (ft):	13	Int Cover (-z, in):	1	Use Cracked ?:	Yes
Total Length (ft):	10	Ext Cover (+z, in):	1	In Icr Factor:	0.7
Thickness (in):	6	Cover Open/Edge (in):	2	Out Icr Factor:	0.35
K:	1				

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
UC Max In-Plane				**3.1426**	**FAIL**
UC Shear In-Plane				**0.7076**	**PASS**
Delta Max In-Plane					
UC Max Out-of-Plane				**0.0705**	**PASS**
UC Shear Out-of-Plane				**0.0004**	**PASS**
Delta Max Out-of-Plane					
Wall Reinforcement					
Region Design					**Result**
Region R1 (In-Plane)				**3.1426**	**FAIL**
Region R1 (Out-of-Plane)				**0.0705**	**PASS**