City Hall Subcommittee

Meeting #2 Topic: Structural Analysis

9/01/2022

CUPERTINO

Upcoming Meeting Agendas

- SEPT. 1: **Structural Analysis** – Compelling reasons for the project (a.k.a. Seismic & MEP Deficiencies)
- SEPT. 22: **EOC** – cost drivers, location options, and justifications
- OCT. 13: **Programming** – Staff & Community program requirements in the space (a.k.a. Space Planning)
- OCT. 27: **Parking** – use analysis and code requirements
- NOV. 10: **Funding** & **Recommendations** for Council

SEPTEMBER 1 Agenda

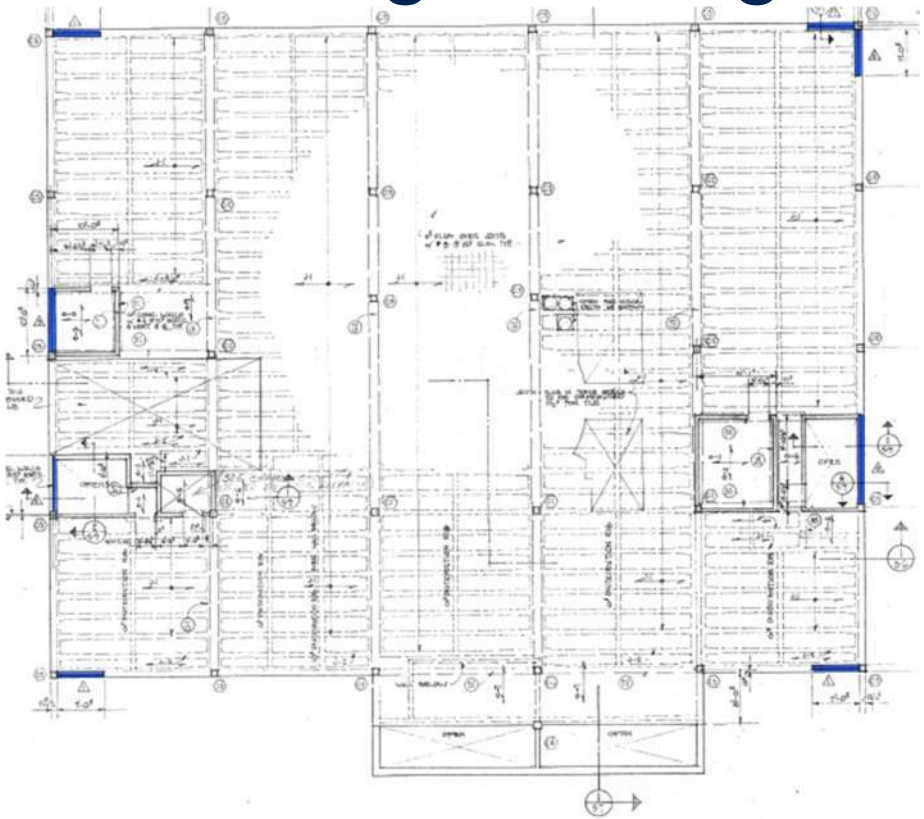
TOPIC: Structural Analysis – Compelling reasons for the project (a.k.a. Seismic & MEP Deficiencies)

1. 2005-06 Structural Analysis: review of the1965 and 1986 design and construction
2. 2011 Structural Analysis and 2012 Essential Facility Analysis
3. 2014 City Hall Alternates Study: Structural Evaluation
4. 2021 Seismic Evaluation – Tier 1
5. Summary and Recommendations

2005 – 2006 Structural Analysis

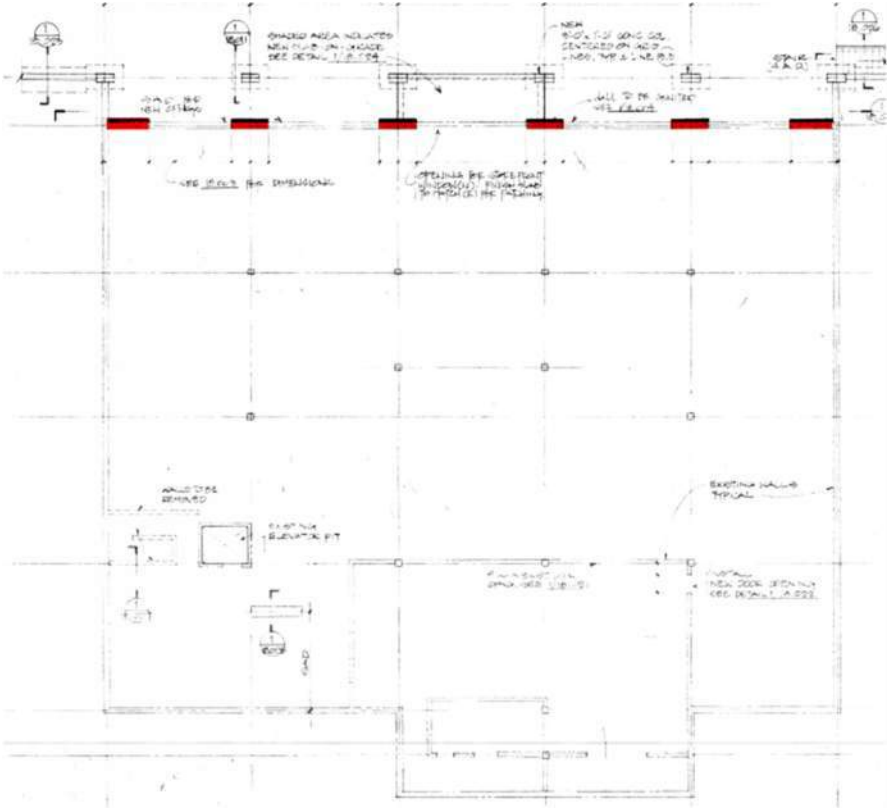
1965 & 1986 Construction Documents

1965 Original Design & Construction



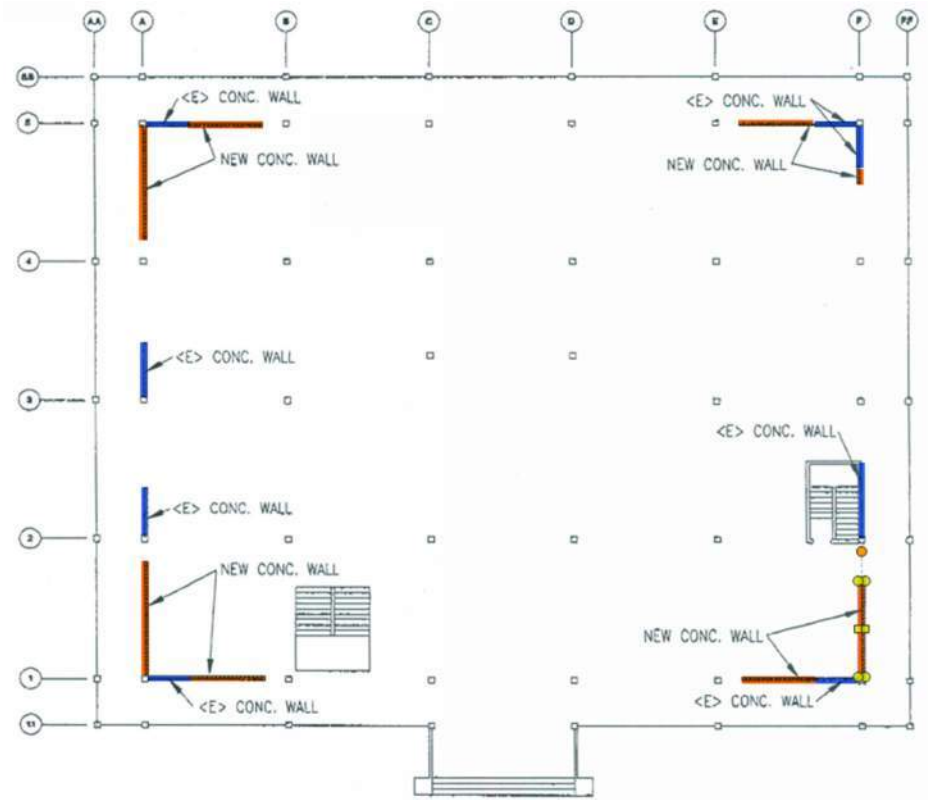
- 24,233 SF
- Type 5, B-2 (1hr)
- Council Chambers on main floor, and an open basement which housed mechanical and electrical equipment

1986 Renovation



- Upgrade to Essential Facility for EOC
- Renovation of the lower level to accommodate workplace
- Opened the lower level to the excavated exterior terrace

2005/06 Structural Report

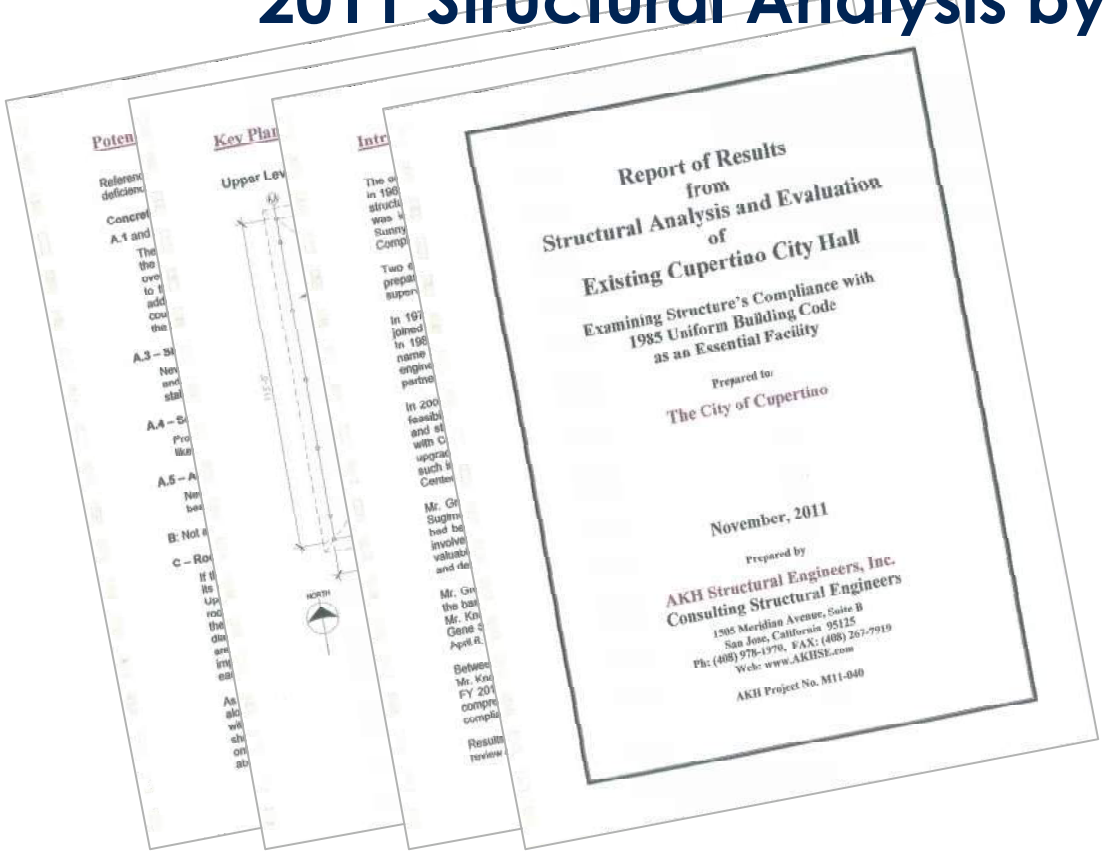


2005/06 Structural Analysis determined the need for additional shear walls, reinforcement of the existing shear walls, and improvements to the roof to lessen the loading and strengthen the diaphragm.

2011 – 2012 Reports

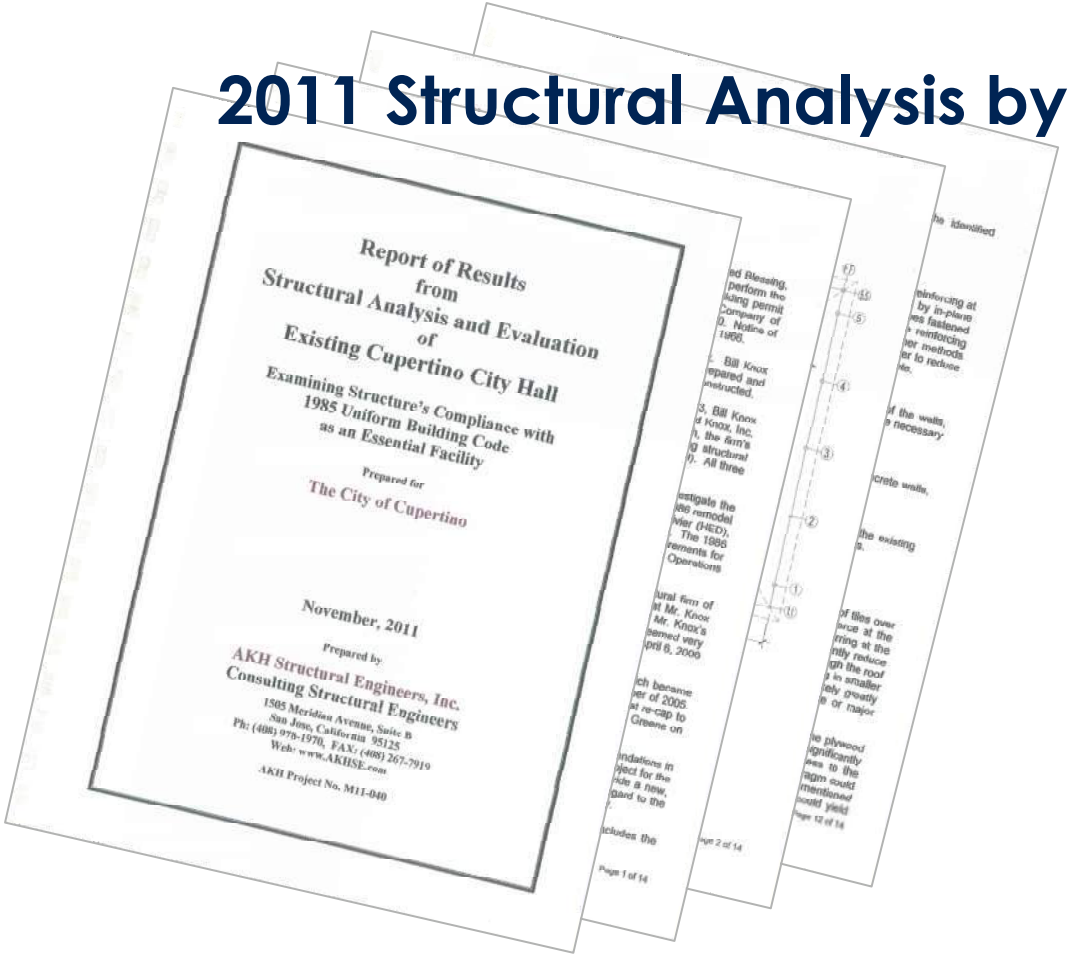
Examining Structural Compliance with 1985 UBC "Essential Facility" Requirements

2011 Structural Analysis by AKH: Deficiencies



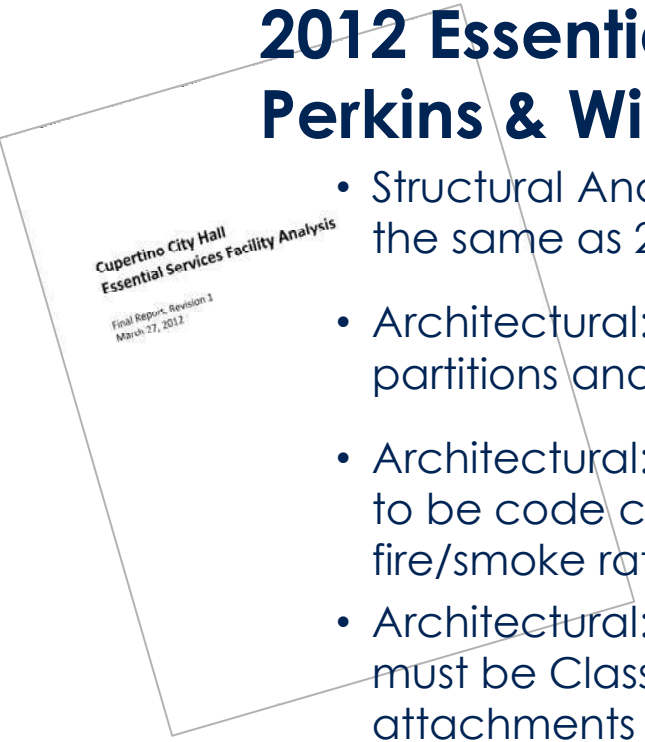
- The loading of the upper level was underestimated by approximately 45 – 59%
- The loading of the lower level was underestimated by approximately 24%
- Overall the building's loading was underestimated by approximately 34%
- The concrete is code compliant, but steel reinforcing and anchoring requires improvement

2011 Structural Analysis by AKH: Remedies



- Improvements to the shear walls: Steels reinforcement, added plywood, anchoring, etc.
- Add shear walls at upper level
- Remove heavy roof tiles and improve roof diaphragm
- Improve diaphragm chord connections by welding plates to beam webs
- Add steel and/or carbon fiber 'jackets' to concrete columns and improve column ties

2012 Essential Services Facility Analysis by Perkins & Will, AKH and PAE: Deficiencies



- Structural Analysis is essentially the same as 2011 report.
- Architectural: add one FR partitions and smoke partitions
- Architectural: change out finishes to be code complaint for fire/smoke ratings
- Architectural: Roof assemblies must be Class A. The equipment attachments are not compliant.
- HVAC equipment and infrastructure is 25 years past its life time.
- HVAC system is terribly inefficient and costly to operate. The controls are severely outdated.
- Electrical equipment, fixtures, main switchboard and distribution system installed in 1965, are beyond their useful life.
- Emergency power system requires full upgrade from 1965 system

2012 Essential Services Facility Analysis by Perkins & Will, AKH and PAE: Remedies

The report presented four scenarios for each system's remedies:

a. No Building Upgrade (EOC relocation)

b. Seismic Upgrade - Minimum scheme (EOC incorporation)
   - Shear walls & Concrete walls improvements
   - Roof tile & equipment rework, with possible adjustment to roof profile
   - Seismic supports for HVAC equipment and ductwork
   - 20% of cost for ADA upgrade

c. Infrastructure Upgrade – Moderate Scheme
   - Includes all items from Seismic Upgrade
   - Fire & Life Safety upgrade to meet current codes
   - MEP upgrade to meet operation requirements as Essential Services Facilities
   - Energy efficiency improvements to HVAC and enclosure systems
   - Full ADA/Accessibility upgrade

d. Building Replacement

2014 City Hall Alternates Study

Structural Evaluation as part of the Civic Center Master Plan

2014 Structural Analysis by Tipping Mar

At the 8/19/2014 meeting, Council requested a high-level feasibility study of the existing City Hall prior to determining a preferred Civic Center Master Plan. The Council directed staff to bring forward Master Plan alternatives and cost estimates for the following elements:

- City Hall options including: seismic retrofits with and without an Emergency Operations Center (EOC), a remodel of City Hall, and a potential new City Hall;
- Parking solutions for the existing and projected parking deficit including under Library Field, behind the Library, and under a potential new City Hall;
- Library Program Room expansion options.

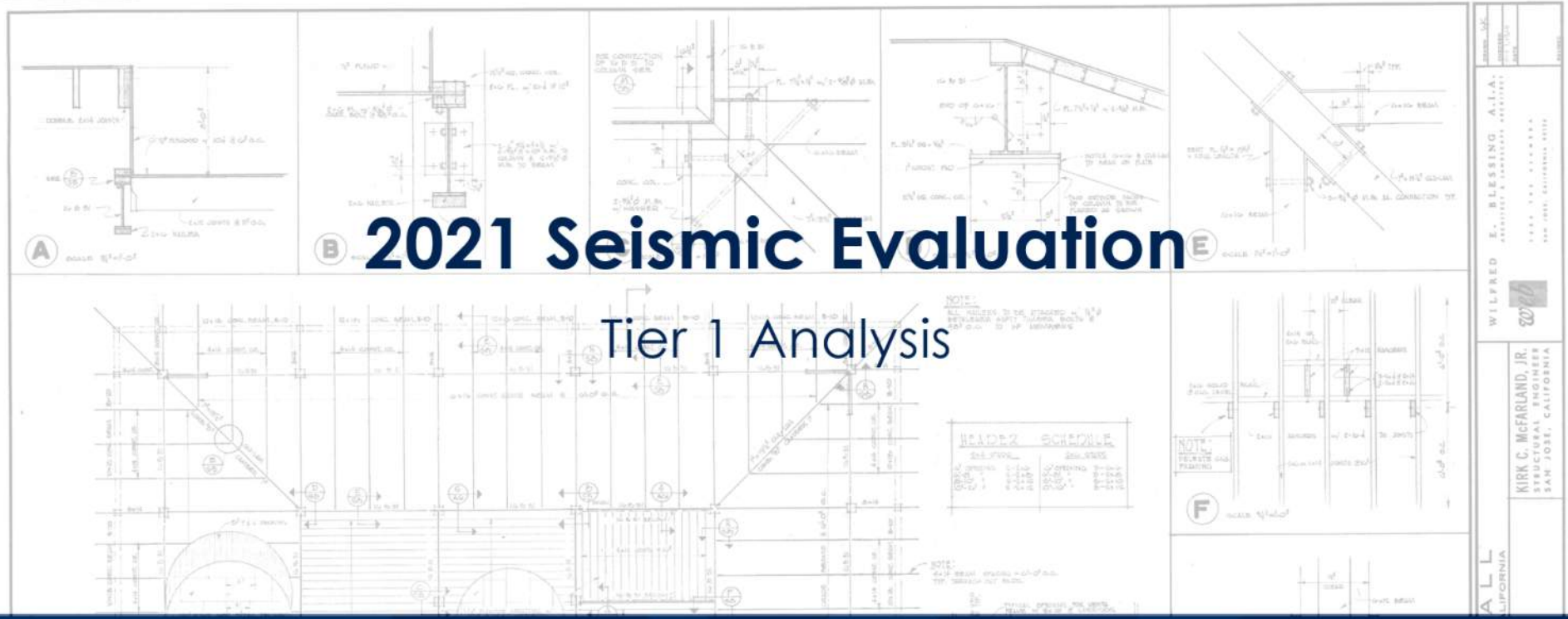
2014 Structural Analysis by Tipping Mar

Five design options were under consideration for City Hall; the first three options consider structural strengthening of the existing building.

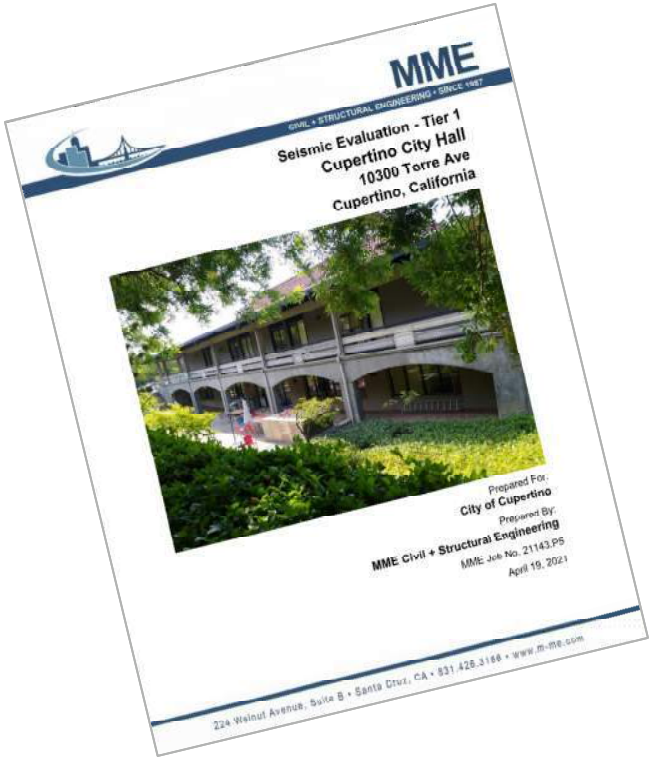
- Option A: Seismic Strengthening, non-Essential Services Facility (EOC Relocation). Includes:
  - **All recommendations from 2012 report**. Noted that Column 'jackets' could be replaced with the addition of steel columns.
  - Seismic improvements to **non-structural elements** such as suspended ceilings, partition walls, and glazing systems
- Option B: Seismic Strengthening, Essential Services Facility (EOC Incorporation). Includes:
  - All structural recommendations from Option A.
  - Seismic improvements to non-structural elements …to meet Essential Services Facility performance requirements
- Option C: Complete architectural remodel. Includes:
  - All structural recommendations from Option A and B.
  - New large light court at building's center

2021 Seismic Evaluation

Tier 1 Analysis



2021 Structural Analysis (MME): Scenarios

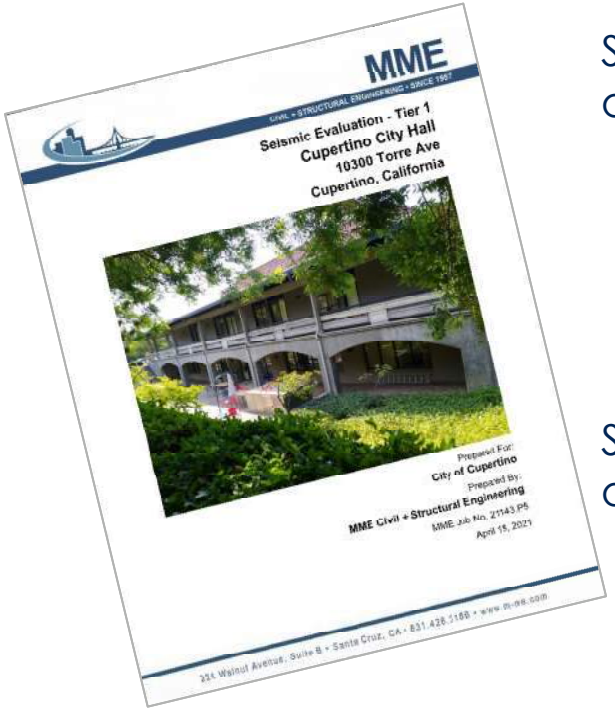


Two scenarios were considered:

- Scenario One: "Essential Facility" Risk Category IV, available for Immediate Occupancy following a BSE-1E seismic event, and available for Life Safety following a BSE-2E seismic event. The performance requirements address structural and non-structural elements.

- Scenario Two: Typical Office Building, Risk Category II (EOC relocated) with the performance criteria of "Collapse Prevention" following a BSE-2E seismic event.

2021 Structural Analysis: Remedies



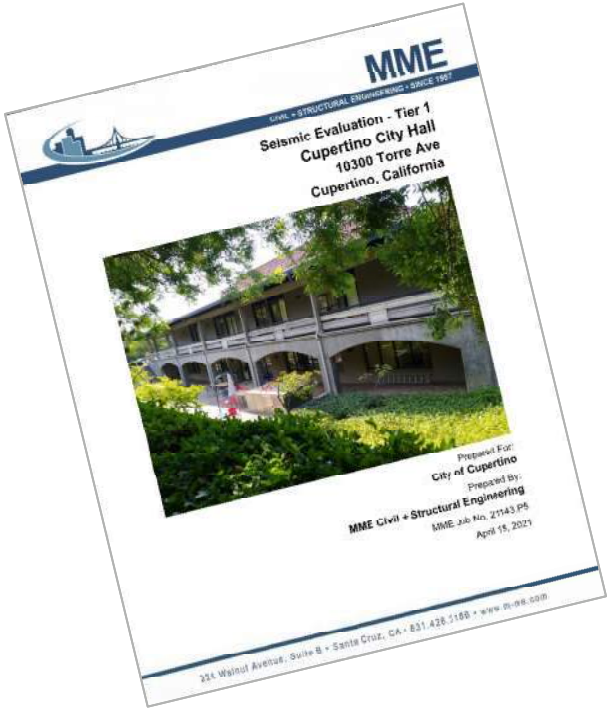
Seismic Remediations required for Essential Facility (IV) occupancy:

- Improve Roof Diaphragm Shear capacity (nailing, loading)
- Improve the Roof Diaphragm Collector Splice Capacity
- Improve the Anchor Bolt Connections at top of Shear Walls
- Improve the Upper Floor Concrete Shear Wall Flexural Capacity and add Boundary members

Seismic Remediations required for both Essential Facility (IV) occupancy and Office Building (II) occupancy:

- Upgrade the Out of Plane Connection of Veranda Beam
- Improve the Upper Floor Concrete Shear Wall Shear Capacity

2021 Structural Analysis: Remedies



The following structural scopes require additional evaluation to confirm the requirements, but we believe this work is also required.

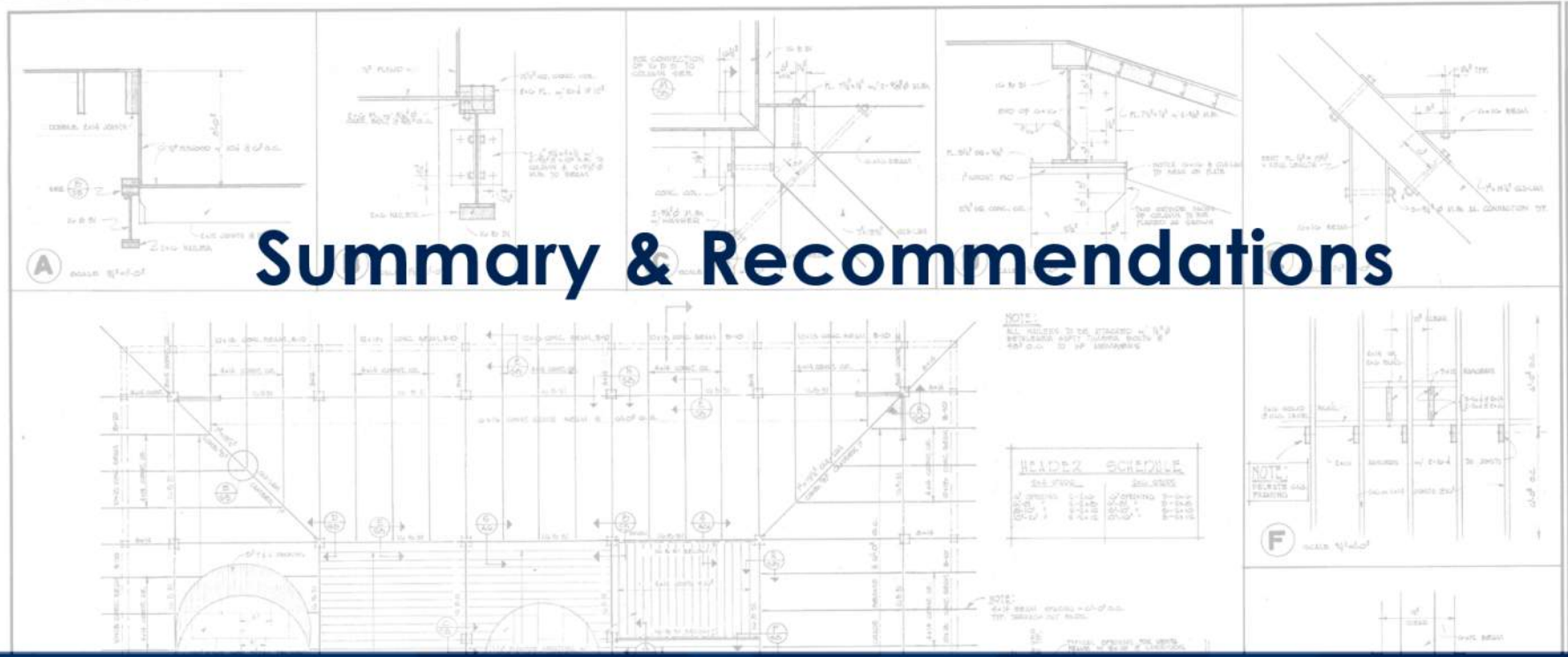
Seismic Remediations required for Essential Facility (IV) occupancy:

- Ground floor Wall [Horizontal] Reinforcing at Openings
- Improve Columns Reinforcement ties for Confinement
- Improve Foundation Dowels' capacity

Seismic Remediations required for both Essential Facility (IV) occupancy and Office Building (II) occupancy:

- Add Continuous Cross Ties at Upper Floor Shear Wall
- Repair Upper Floor Concrete Shear Wall adjacent to diaphragm openings
- Repair Column Splices and Girder Stirrups

Summary & Recommendations



Summary

While the focus of the reports may vary, the findings are consistent regarding the status of the structural system:

- 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.

- The building does not comply with either the Essential Services Facility requirements or [Regular Building] evaluation criteria unless a seismic strengthening is undertaken. **The 2021 findings are similar to the findings in the previous reports.**

Scope of Work Scenarios

Aspects to consider

1. Seismic Upgrade of the building: will trigger some additional work, like ADA/Accessibility improvements.

2. HVAC and other Infrastructure systems: how can you not replace these systems that are 50+ years old?

3. Seismic + HVAC/Infrastructure + Accessibility/ADA work will affect over 75% of the building, which leads us to consider a full interior renovation project.

Comments & Consensus?