

**TIER 1 SEISMIC EVALUATION**  
Life Safety Structural Performance Level  
**Campbell City Hall**  
Campbell, California



**Final Report**

Prepared For:  
**City of Campbell**  
70 North First Street  
Campbell, California



Prepared By:  
**Biggs Cardosa Associates, Inc.**  
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December 16, 2015

BCA Job No. 2015274



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## **EXECUTIVE SUMMARY**

Biggs Cardosa Associates has been retained by the City of Campbell to provide a Tier 1 seismic assessment and conceptual seismic retrofit recommendations for the Campbell City Hall. This report contains the structural and seismic findings based on our Tier 1 assessment as well as our experience with buildings of similar size, age and construction.

The Campbell City Hall is a 2-story, 32,600 sf structure that was constructed in 1970. The City Hall consists of wood-framed roof and second floor, with steel columns, and concrete masonry wall at the 1<sup>st</sup> story and wood-framed walls at the 2<sup>nd</sup> story. The building is constructed with two rectangular wings that are connected with a smaller rectangular lobby. Foundations consist of isolated spread footing below columns and continuous footings below walls. The lateral system comprises of plywood roof and floor diaphragms, plywood shear walls at the 2<sup>nd</sup> story and masonry walls at the 1<sup>st</sup> story. The first floor is slab-on-grade.

Overall, the building is currently in good structural condition. The Campbell City Hall contains a complete vertical load-carrying system with no observed evidence of any significant structural damage, distress or deterioration. There were no visible indications that the building has undergone any significant settlement or differential settlement.

The deficiencies identified were based on a review of the available drawings, a limited walk-through of the building, completion of Tier 1 assessment checklists, and our experience with structures of similar size, age and construction type. No destructive investigation was undertaken to either verify the existing conditions shown in the available documents, to identify unknown conditions, or to ascertain the extent of damage where evidence of potential structural damage was present.

Since the building houses the City of Campbell Police Department, it is therefore, by code, an Essential Service Building. For this type of building, the primary structural elements are required to meet the Immediate Occupancy Performance Level as described in ASCE/SEI 41-13. However, as directed by the City of Campbell, this seismic evaluation is performed using the Life Safety seismic performance criteria based on the assumption that the police station is expected to be relocated to a new facility. The Life Safety performance level is suitable for most buildings (including office buildings), is less strict than the Immediate Occupancy performance level, and generally requires relatively less seismic retrofit work to upgrade an existing building to current seismic standards.

The findings of this assessment indicate that while the building apparently has a complete lateral load-resisting system, it may have deficiencies in the required continuity and/or strength for some of its structural elements that are necessary for satisfactory seismic behavior. The building may be vulnerable to seismic damage but is likely to maintain its gravity load-carrying system after the design level earthquake. The existing Campbell City Hall, however, does not fully meet the requirements for the Life Safety performance level.

The order-of-magnitude conceptual cost estimate for the required seismic retrofit work identified through this Tier 1 evaluation to meet the Life Safety performance level is **\$393,575**. Although it is beyond the scope of this report, if the building is required to meet the Immediate Occupancy performance level, the retrofit costs are expected to be higher.

Further evaluation of the structure using ASCE 41 Tier 2 Deficiency-Based procedure as well as field verification of various as-built conditions are required and recommended before finalizing the seismic retrofit program for the building.

## **PROJECT OVERVIEW**

Biggs Cardosa Associates has been retained by the City of Campbell to provide a Tier 1 seismic assessment (using ASCE 41-13 methodology) and conceptual seismic retrofit recommendations for the existing Campbell City Hall. This report contains the structural/seismic findings based on our Tier 1 assessment, our limited observation of existing field conditions, and our experience with many buildings of similar size, age and construction type. Potential seismic deficiencies are identified and conceptual recommendations are outlined for remedial work. A conceptual cost estimate is provided for the proposed seismic retrofit.

This report outlines the findings and recommendations of our Tier 1 assessment of the existing City Hall building's primary lateral load-resisting system. This assessment does not cover seismic anchorage and/or bracing of non-structural items such as electrical/mechanical equipment, ceilings, partitions, or other architectural elements. Further, an assessment of other building systems/features such as mechanical, electrical, plumbing, fire protection, accessibility, egress, drainage, waterproofing, etc. is beyond the scope of this report.

The scope of services for the structural/seismic assessment described in this report is summarized below:

1. Review available as-built structural drawings, previous seismic assessment reports, geotechnical reports, etc. for the building.
2. Perform a site visit to observe the existing structural conditions of the building, including the nature and layout of the primary lateral load-resisting system, physical condition of structural members and connections, and damage or deterioration of existing structural framing/connections. [Building finishes will not be disturbed during the site visit and our observation will be limited to the readily visible framing elements].
3. Perform a Tier 1 seismic assessment of the building based on the methodology outlined in ASCE41-13.
4. Identify structural/seismic deficiencies in the building's framing system based on our field observations and the Tier 1 seismic assessment.
5. Prepare qualitative conceptual recommendations for the required retrofit work to remedy the identified structural/seismic deficiencies and for the repair/replacement of the damaged or deteriorated structural framing observed during our site visit.
6. Prepare a conceptual-level construction cost estimate for the proposed structural/seismic retrofit work.
7. Prepare a brief letter report describing the findings of structural/seismic assessment, recommendations for seismic retrofit/repair, and conceptual construction cost estimate for seismic retrofit work.

### **AVAILABLE DOCUMENTS**

The City researched its records for available documents – structural drawings, geotechnical reports, previous seismic assessment reports, etc. – and provided us the following drawings to review for this seismic assessment:

- Accessibility Modifications, S-1 to S-3, Steven Duquette, SE and Starks Miers Scott, Architects, dated Aug. 1, 1994.
- Partial Roofing Framing Details, S1, Duquette Engineering, dated July 2004
- Police Station Renovations, A2.01, A4.01, and A5.01, Stowers Associates Architects, date Aug. 20, 2004
- City Hall Remodel – New Steel Rigid Frame, S1 and S2, Duquette Engineering, dated April 14, 2005
- Original design drawings (architectural and structural) for “Campbell City Hall.” This set included:
  - Six architectural drawings (sheets 7-12), prepared by William W. Hedley, Jr. Architects, dated March 23, 1970, and
  - Thirteen structural drawings (sheets S1-S13), prepared by Donald R. James, Civil Engineer, dated March 13, 1970.

The findings and conclusions in this report are based on the available drawings and our site visit on October 22, 2015. While most of the structural framing and detailing of the City Hall is covered up by architectural finish materials and cannot be observed directly, areas that could be observed suggest that the building’s construction appears to conform with the original design drawings, although this needs to be verified as the project develops.

### **BUILDING DESCRIPTION**

The 2-story Campbell City Hall was constructed in the early 1970’s and houses the following city services and departments:

- Construction Division
- City Clerk
- City Manager
- Code Enforcement
- Finance Department
- Human Resources
- Police Department
- Public Works

The building has administrative offices, meeting rooms, council chambers, staff facilities, and public areas.

Since the building houses the City of Campbell Police Department, it is therefore, by code, an Essential Service Building. For this type of building, the primary structural elements are required to meet the Immediate Occupancy Performance Level as described in ASCE/SEI 41-13. However, as directed by the City of Campbell, this seismic evaluation is performed using the Life Safety seismic performance criteria based on the assumption that the police station is expected to be relocated to a new facility. The Life Safety performance level is suitable for most buildings (including office buildings), is less strict than the Immediate Occupancy performance level, and generally requires relatively less seismic retrofit work to upgrade an existing building to current seismic standards.

The existing Campbell City Hall building is a 2-story, 32,600 sf structure constructed in the early 1970's. The structure is divided in three areas; the North Wing, which is 15,400 sf; the South Wing, which also is 15,400 sf; and the Central Lobby which is located between the two wings and is 1,800 sf.

The building is located on a relatively flat site but has been graded so that the South Wing has full basement walls on south, east and west sides and a partial basement wall on the north side next to the Central Lobby. The North Wing has a full basement wall on the east side and partial basement walls on the south side, next to the Central Lobby, west side and north sides which leads to the fenced in parking lot for police vehicles and equipment.

Access to the building is available on all four elevations with the primary access for the public through the East and West elevations of the Central Lobby.

## **DESCRIPTION OF STRUCTURE**

The building is constructed with two 70-ft x 110-ft rectangular wings that are offset by 30 feet in the east west direction. These two wings are separated by a 30-ft x 30-ft central lobby area. The floor-to-floor height of the basement is 12'-4" while the second level floor-to-roof heights are divided into two heights of either 12'-0" for the lower roof framing and 19'-4" for the upper roof framing.

The roof and second floor of the building are primarily wood-framed construction, with the second floor constructed with wood framed exterior walls and steel tubular columns located at the interior and at the exterior perimeter walls. The basement (and partial basement), which serves as the 1<sup>st</sup> floor level, is constructed with concrete masonry block walls with some cast-in-place concrete sections and with interior steel tubular columns.

The upper roof which is located over the central lobby and the main corridor, which ties the North and South Wings together, has built up roofing on ½" plywood sheathing supported on 2x6 rafters spaced at 24" oc. The 2x6 rafters are supported on either 4x8 or 6x8 timber

beams. The 4x and 6x beams are supported on 5x5 steel tubular steel columns located along the outside walls of the corridor. These steel corridor columns are supported at the second floor level.

The low roof, which comprises a major portion of the roof, has built-up roofing installed over either  $\frac{3}{4}$ " or  $\frac{1}{2}$ " plywood sheathing. The  $\frac{3}{4}$ " sheathing spans a maximum of 48" between fabricated truss-joists while the  $\frac{1}{2}$ " plywood spans a maximum of 24" between 2x rafters. The truss-joists and rafters are supported on either sawn timber beams, glue-laminated beams or steel wide flange beams. These roof beams are supported on tubular steel columns which are located on the interior of the building and at the exterior perimeter walls.

The second floor framing has a 2-inch cellular concrete topping slab poured over 5/8" T&G (tongue and groove) plywood sheathing supported on 2x floor joists spaced at 16" oc. Depending on the span length of the floor joists, 2x6, 2x8, 2x12 and 2x14 floor joists are used. The floor joists are supported on either interior glue-laminated beams of various sizes, 4x sawn timber beams, built-up 2x beams or on the perimeter basement walls of the North and South wings. The perimeter basement walls are 8 inch fully-grouted reinforced concrete masonry block with, in some locations, a cast-in-place reinforced concrete beam located at the top of the concrete masonry block walls. The various size floor beams are supported on interior 5x5 steel tubular columns located in the basement.

The basement floor is a 4" slab-on-grade with welded wire mesh reinforcement. The slab is placed on a prepared subgrade consisting of 2" sand layer, membrane vapor barrier and 4" crushed rock layer. The building foundation system consists of continuous reinforced concrete footings below basement masonry walls and isolated reinforced concrete spread footings below steel tube columns.

The building was designed to resist both wind and seismic loads using the plywood sheathing at the high and low roof levels and at the second floor as horizontal diaphragms. The high roofs are laterally braced using the flexural strength of the 5x5 steel tubular columns which transfer lateral loads to the larger lower roof. The lower roof is laterally supported with either plywood shear walls, which are located at the perimeter of each wing of the building, interior plywood shear walls, which are located on each side and at each end of the main corridor of the building and one steel rigid frame that replaced one of the corridor shear walls in the North Wing during a remodeling project. The second floor diaphragm is laterally braced with the reinforced masonry block basement walls at the perimeter of each wing of the building and interior plywood shear walls at the same approximate locations as the second floor plywood shear walls.

There are four entrances to the building at the first story. At grade doors at the north and south ends provide access to finished grade, while a long sloping ramp provides access to both floors near the main entrance located on the east and west sides of the building. The second story has two entrances at each wing of the building and as well as access at the

sloping ramps. The roof overhangs the perimeter walls by approximately 3-ft and is supported by exterior steel columns.

Selected recent photos of the building are included in Appendix 1.

### **EXISTING CONDITIONS**

In order to perform a Tier 1 seismic assessment of the Campbell City Hall, the nature of construction and layout of the current structure had to be determined. The available drawings (noted above) and our site visit on October 22, 2015 provided the basic information to accomplish this task.

No destructive investigation or physical testing of existing conditions or materials was performed as part of this assessment. As most of the structural framing is concealed by architectural finishes, not all structural elements of the building were visible during the site visit and not all of the building components relevant for this assessment were able to be verified. The available structural drawings were used to ascertain various details, materials and components. For final design of the retrofit work, a field investigation requiring the removal of finishes in selected areas of the building may be required to verify additional existing conditions and materials.

Overall the building appears to be in good physical condition. The wood framing observed at the second floor and roof showed no signs of moisture-related damage or any other type of deterioration. The steel columns and steel connection hardware showed no signs of corrosion. There were no visible indications (cracks in walls, slabs, sidewalks, etc.) that the building has undergone any significant settlement or differential settlement.

The masonry walls appeared to be in good structural condition. No significant visible cracks were present during the site visit although the masonry wall has been painted and this could obscure small cracks.

The presence of steel clips, wood blocking, and other details indicate that the City Hall building was originally designed considering seismic loads. There have been several modifications to the building since its original construction. An existing wood-framed shear wall was removed at the first floor to modify the interior office space. In order to replace the strength of the removed shear wall a new steel moment frame was constructed in a nearby location. Based on the reviewed structural drawings, the moment frame appears to have adequately detailed and constructed to resist seismic loads. Several other non-seismic modifications were made to the building, including new access doors and roof framing strengthening for new rooftop mechanical equipment.

## **SEISMIC EVALUATION AND FINDINGS**

### **Evaluation Basis**

The purpose of this evaluation was to determine whether significant seismic deficiencies exist, to determine the potential seismic risk, and to provide general conceptual recommendations for reduction of seismic risk through mitigation. The Tier 1 methodology of ASCE/SEI 41-13 was used for this preliminary assessment; a full ASCE 41 compliance review using more advanced procedures (such as Tier 2 or Tier 3) was neither intended nor performed. The ASCE 41 Basic Configuration and Structural Checklists for Life Safety performance level were completed to help identify the potential seismic deficiencies in the City Hall building's lateral load-resisting system. See Appendix 4.

The performance criteria used to evaluate a building varies based on the occupancy use of the building. If a building houses a facility such as a police station, fire station, hospital etc. the building is classified as an essential facility and is required to remain operational in an extreme event such as an earthquake. In order to remain operational under earthquake loads, a more stringent performance criteria is required. For instance, if a new building was designed to meet the current building code as an essential facility, the design seismic loads would be 50% higher than a building designed for standard office use. The evaluation methodology of ASCE41 requires an essential facility to be evaluated to the Immediate Occupancy performance standard. For purposes of this evaluation, as directed by the City of Campbell, the Life Safety performance criteria is used to assess the building's seismic risk since the police station currently housed in the City Hall is expected to be relocated to a new facility.

The analysis methodology of ASCE 41 includes three levels of analytical procedures for seismic assessment of existing structures: a quick check procedure (Tier 1) intended to serve as an aid in quickly identifying high seismic risk structures; a more intensive deficiency-based analysis procedure (Tier 2), and a systematic analysis procedure (Tier 3).

The Tier 1 quick check employs a set of checklists for each building type, which contain evaluation statements that help identify areas of concern with regard to the structure's ability to adequately transmit earthquake forces to the foundation and supporting grade. This evaluation utilized the Tier 1 checklists, along with the Quick Checks required under this procedure.

It should be noted that with each building code cycle (every three years), building codes for new design are modified to enhance structural performance during seismic events. However, engineering standards developed to evaluate existing buildings have lagged behind in development. Revisions to ASCE 41 Seismic Evaluation and Retrofit of Existing Buildings were recently completed and this document is intended to replace previous evaluation guidelines as the standard of practice for the seismic evaluation of existing buildings. One of the primary goals of this document is to include lessons learned from past earthquakes.

For the Campbell City Hall, only a structural seismic evaluation was done per ASCE 41. The building was not evaluated for fire protection, egress, accessibility, mechanical, electrical, plumbing, waterproofing or drainage requirements. The Campbell City Hall may require these other improvements to meet the code requirements, but an assessment of these systems is beyond the scope of this report.

### **Lateral Load-Resisting System**

Lateral loads for buildings result primarily from earthquake inertia forces acting on structural and non-structural elements. Out-of-plane forces acting on interior and exterior walls are transferred to the roof and floor diaphragms, then to seismic system elements (shear walls, braced frames, etc.) parallel to the direction of the earthquake or wind loads. These elements then transfer the forces to the foundations.

At the high roof of the City Hall, the plywood roof diaphragm transfers lateral forces through the steel cantilevered columns into the lower roof diaphragm. At second story the plywood roof diaphragm transfers lateral forces into the perimeter plywood shear walls. At the first story, the plywood second floor diaphragm transfers lateral forces into the masonry shear walls at perimeter of the building. The forces from the second-story plywood shear walls are transferred directly into the first-story masonry shear walls, which then transfer the combined lateral forces to the foundations.

### **Seismic Evaluation Results**

Our assessment of Campbell City Hall was based on ASCE 41 Tier 1 analysis, our field observations, our review of the structural drawings, and our experience with buildings of similar size, age and construction type. Our findings indicate that while the building apparently has a complete lateral load-resisting system, it may have deficiencies in the required continuity and/or strength for some of its structural elements that are necessary for satisfactory seismic behavior. The building may be vulnerable to seismic damage but is likely to maintain its gravity load-carrying system after the design level earthquake. The existing Campbell City Hall building, however, does not fully meet the requirements for the Life Safety performance level.

Based on the original structural drawings, the masonry shear walls at the first story are fully grouted and reinforced and appear to be adequate for transferring the in-plane seismic loads to the foundations. The in-plane shear connection between the second floor diaphragm and the masonry walls below consists of wood blocking and steel angle clips attached to a continuous wood sill plate with anchor bolts embedded into the masonry wall at each joist. This connection appears to be sufficient for transferring the seismic loads.

The plywood shear walls at the second story appear to be inadequate for transferring the in-plane seismic loads at the Life Safety performance level. Additional shear walls or other

seismic resisting elements will be required. Holdowns at the ends of plywood shear walls, while present on the drawings, were concealed by architectural finishes and could not be observed during our site visit.

The shear capacities of the roof and second floor plywood diaphragms appear to be adequate for transferring the seismic forces to the shear walls; the details and capacities of the roof diaphragm chords/collectors, however, need strengthening. The steel cantilever columns supporting the high roof appear to be adequate for transferring the seismic forces into the main roof diaphragm.

Based on the evaluation performed, we believe the Campbell City Hall may have the following potential seismic deficiencies:

1. At low roof level, collectors along shear wall lines are inadequate for transferring the diaphragm load to the shear walls. Addition of new steel straps with blocking between joists is required.
2. At second floor level, building cross-ties are inadequate for transferring out-of-plane masonry wall loads into the floor diaphragm. Addition of new horizontal steel straps or steel rods with holdowns is required at beam splice locations (typically at columns).
3. At the second floor level, the wood shear walls are inadequate to transfer in-plane seismic loads. Addition of new plywood at the existing shear walls along with steel straps, and steel rods with holdowns are required.

## **RECOMMENDATIONS**

Based on the seismic deficiencies identified through this preliminary assessment, we believe that the Campbell City Hall requires, at a minimum, the following retrofit work:

1. At low roof level, provide new collectors along shear wall lines by adding new steel straps over plywood sheathing, with new blocking between the joists. [See Deficiency 1 above].
2. At second floor level, provide building cross-ties by adding new horizontal steel straps or steel rods with holdowns at beam splice locations (typically at columns). [See Deficiency 2 above].
3. At second floor level, provide new plywood at several existing shear walls along with new steel straps and steel rods with holdowns. [See Deficiency 3 above].

Refer to Appendix 2 for conceptual seismic retrofit plans showing the extent of this seismic retrofit work.

### **CONCEPTUAL COST ESTIMATE**

As detailed in Appendix 3, the order-of-magnitude conceptual construction cost estimate for the retrofit work outlined above is **\$393,575**. If the police station were to remain at its current location then the Immediate Occupancy criteria will be triggered, requiring additional retrofit work.

### **FURTHER ACTIONS**

As indicated by the potential seismic deficiencies in the Campbell City Hall building outlined above - most of which need further field work, analysis and verification – we recommend the following further steps to fully define the scope of required seismic retrofit:

1. Perform an investigative field verification of existing conditions to determine the necessary information on pertinent structural framing and connection details.
2. Perform a detailed ASCE 41 Tier 2 Deficiency-Based Seismic Evaluation of the building using the deficiencies outlined above to allow a more accurate verification and definition of the building's seismic retrofit needs. Develop retrofit concepts.
3. Review architectural and mechanical plans for other improvements proposed for renovation of the City Hall building. Develop conceptual structural details for proposed building modifications.

The implementation of these actions will help determine the full extent of structural upgrade required for the building and ensure that the City Hall facility meets the seismic safety requirements.

### **LIMITATIONS AND DISCLAIMERS**

The evaluation, findings, conclusions and recommendations outlined in this report were based on limited information. This report has been prepared using the same degree of care and skill ordinarily exercised for this type of professional service by structural engineers practicing in this area at this time. No other warranty, expressed or implied, is made as to the professional advice in this report.

This report has been prepared for exclusive use of the City of Campbell and may not be used by any other individual or entity without the express written approval of Biggs Cardosa Associates, Inc.

## **Appendix 1**

### **Photos**



Photo 1 – West elevation view



Photo 2 – West elevation view (north end)



**Photo 3 – South elevation view**



**Photo 4 – East entrance view**



Photo 5 – North elevation view



Photo 6 – Ramp at East entrance



**Photo 7 – High roof with steel cantilevered columns**



**Photo 8 – Broken tiles at upper roof**



Photo 9 – Interior steel columns at second floor



Photo 10 – Interior open roof framing below upper roof



Photo 11 – Bolted wood sill plate at masonry wall



Photo 12 – Wood floor joists



Photo 13 – Wood blocking at plywood diaphragm



Photo 14 – Simpson steel clips at floor framing



Photo 15 – Ramp at West elevation



Photo 16 – Wood ledger at concrete vault

## **Appendix 2**

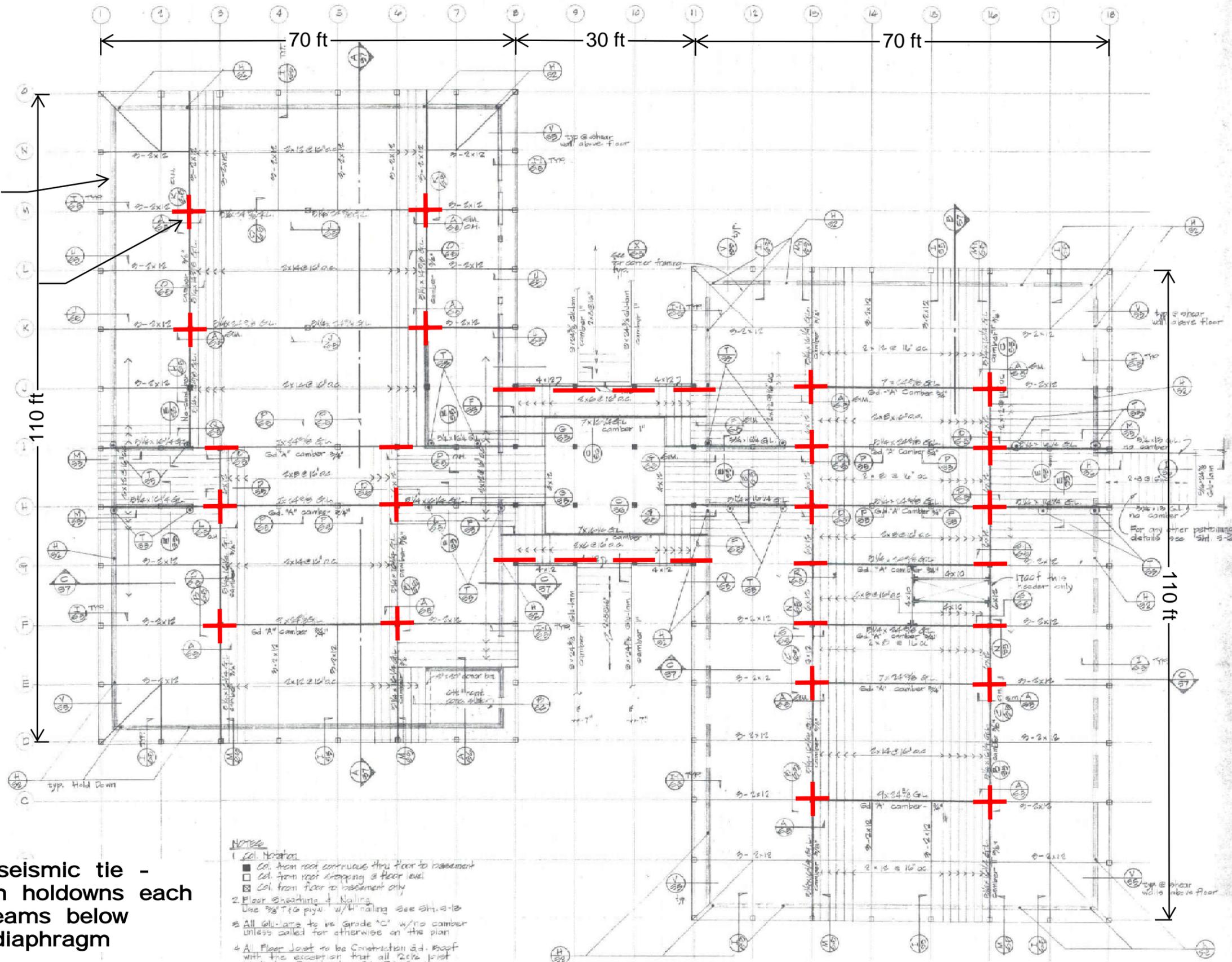
### **Conceptual Seismic Retrofit Plans**

(E) Concrete masonry shearwall below, typ

Holdowns with steel rods, typ

N

— Indicates (N) seismic tie - steel rods with holdowns each side of (E) beams below second floor diaphragm



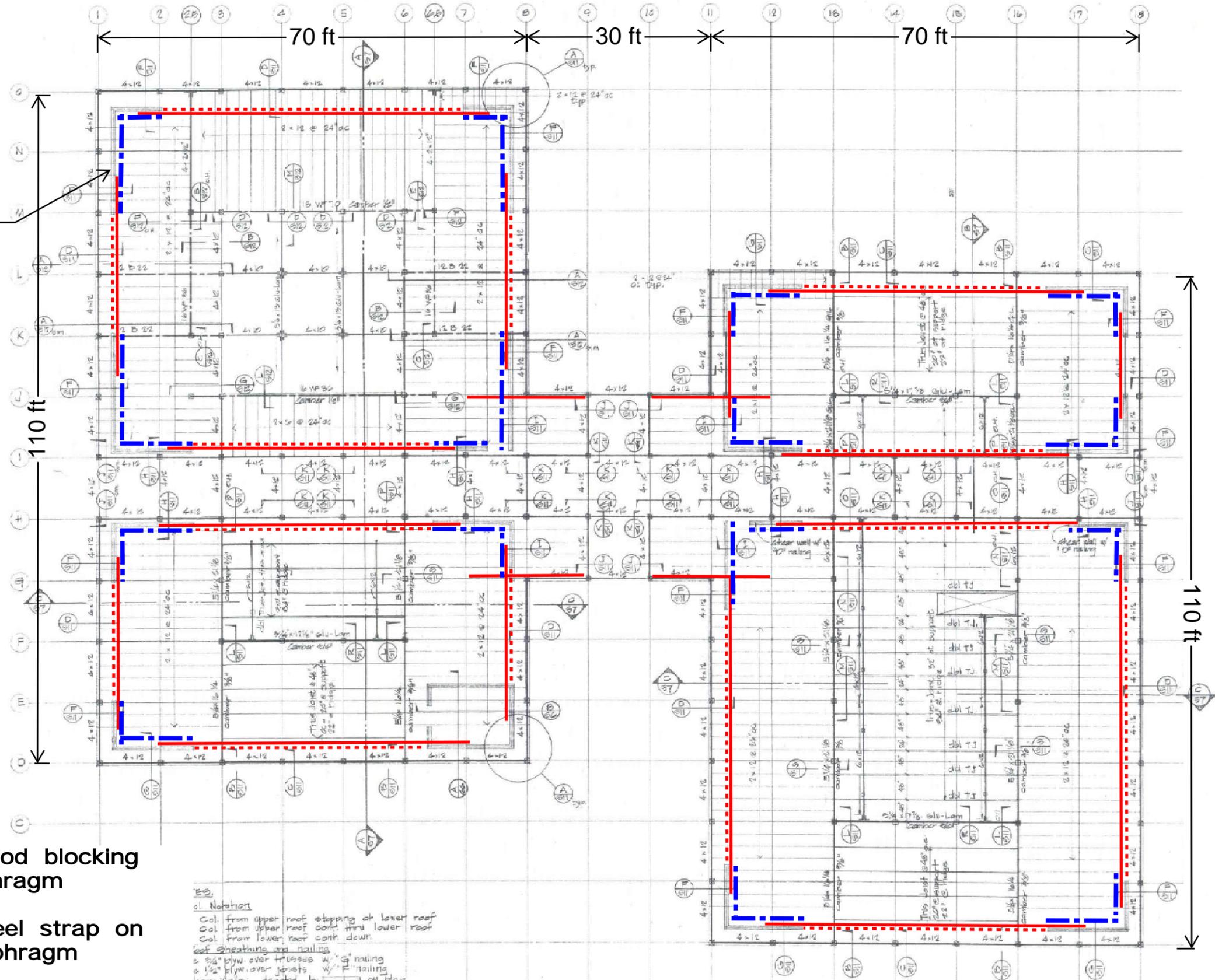
- NOTES**
1. Col. Anchor
    - Col. from roof continuous thru floor to basement
    - Col. from roof stopping @ floor level
    - Col. from floor to basement only
  2. Floor Sheathing & Nailing
    - Use 3/8" T&G ply. w/ 4" nailing see Sht. 2-12
  3. All columns to be grade "C" w/ no camber unless called for otherwise on the plan
  4. All floor joist to be Construction 2d. Roof with the exception that all 2x12 joist shall be Construction 2d. 1705F

**SECOND FLOOR PLAN**

**Campbell City Hall**  
 70 N. First St, Campbell, CA  
 November 12, 2015

JOB NO. 100-15	DATE 8-10-70	DRAWN I.H.	CHECKED	APPROVED
REVISIONS				
DONALD R. JAMES CIVIL ENGINEER 211 1/2 AVENUE SAN JOSE, CALIFORNIA 95128				
THE OFFICE OF WILLIAM W. HEDLEY JR. a.i.a. Architect 245 E. CAMPBELL AVE. CAMPBELL, CALIFORNIA 95008				
CAMPBELL CITY HALL CAMPBELL, CALIFORNIA				
SHEET NO. 34				
OF 15				

(E) Wood shearwall below, typ



- ..... Indicates (N) wood blocking below roof diaphragm
- Indicates (N) steel strap on (E) plywood diaphragm
- - - - - Indicates additional (N) plywood at (E) shearwalls with steel straps and holdowns

**Notes**

1. Notation  
 Col. from upper roof stopping at lower roof  
 Col. from upper roof cont thru lower roof  
 Col. from lower roof cont down.

2. Sheathing and nailing  
 a. 3/4" plyw over trusses w. 1" nailing  
 b. 1/2" plyw over joists w. 1" nailing  
 near walls: denoted by [ ] on plan  
 roofly "B" nailing unless shown otherwise on plan  
 c. Lams to be grade "C" w/ no Camber  
 less. call out for otherwise on plan

**LOWER ROOF PLAN**

**Campbell City Hall**  
 70 N. First St, Campbell, CA  
 November 12, 2015

JOB: 15-001-00	DATE: 11-12-15	DRAWN: JPB	CHECKED:	APPROVED:
REVISIONS				
THE OFFICE OF <b>WILLIAM W. HEDLEY JR.</b> a.i.a. architect 348 E. CAMPBELL AVE. CAMPBELL, CALIFORNIA 95008 415-988-4141 415-985-2100/2101				
<b>DONALD R. JAMES</b> CIVIL ENGINEER 1515 HARRIS AVE. SAN JOSE, CALIFORNIA 95128 408-255-1100				
CAMPBELL CITY HALL CALIFORNIA CAMPBELL				
SHEET NO. <b>68</b> OF 15				

## **Appendix 3**

# **Conceptual Cost Estimate**

# Campbell City Hall

## Tier 1 - Seismic Evaluation

Campbell, CA

### Rough Order of Magnitude Cost Estimate (DRAFT)

November 12, 2015



## INTRODUCTION

This opinion of probable cost has been prepared to reflect the anticipated construction cost for the proposed Tier 1 Seismic Evaluation for Campbell City Hall, Campbell, California.

This document is based on the measurement and pricing of quantities wherever information is provided and/or reasonable assumptions for other works not covered in the drawings and programs as stated in this document. The unit rates reflected herein have been obtained from historical records and discussion with subcontractors and suppliers. All unit rates relevant to subcontractor works include the subcontractors' overheads and profit.

### **Project Scope**

The proposed Tier 1 Seismic Evaluation covers 2 levels that includes seismic ties using steel rods and hold downs at existing glu-lam beams below the second floor diaphragm. The work on the lower roof plan consists of wood blocking, steel straps and new plywood at perimeter walls.

### **Documentations**

Faithful+Gould received the following documents from Biggs Cardosa Associates, Inc. for the preparation of this estimate:

#### Drawings

Marked-up existing second floor and lower roof plans dated November 12, 2015.  
Photographs extracted from Draft Report Tier 1 Seismic Evaluation Campbell City Hall dated November 12, 2015.

#### Reports

No reports or narratives are available

#### Additional Documents

Sketches of proposed work

### **Phasing and Temporary Works**

No phasing or temporary works have been included in the cost estimate.

### **Design Contingency**

A design contingency of 20% is included for the development of the design drawings to 100% CD set.

### **Escalation**

No escalation has been included in the cost estimate.

### **Exclusions**

Legal and accounting fees  
Relocation of existing owner's furniture, furnishings and equipment  
Removal of unforeseen obstructions behind walls  
Overtime and weekend work  
Hazardous material abatement  
Temporary swing space and temporary accommodation for the various functional spaces while under construction.  
Design-build procurement delivery  
Phased work is excluded.  
Escalation  
Fire inspection fees  
Special inspection fees  
Permits, expediting and filing

## **INTRODUCTION**

### ***Items that may affect the cost estimate***

- Modifications to the scope of work included in this estimate.
- Unforeseen sub-surface conditions.
- Restrictive technical specifications or excessive contract conditions.
- Non-competitive bid/market situations.

### ***Recommendation for Cost Control***

Faithful+Gould recommends that the owner, architect and engineers carefully review this document, including line item descriptions, unit prices, clarifications, exclusions, inclusions and assumptions, contingencies, escalation, and markups. If the project is over budget, or if there are unresolved budgeting issues, alternative systems/schemes should be evaluated before proceeding into the Bidding phase.

Requests for modifications of any apparent errors or omissions to this document must be made to Faithful+Gould within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

### ***Opinion of Probable Cost***

This opinion has been based on a competition open bid situation with a recommended 5 - 7 reputable bids from general contractors and a minimum of 3 bidders for all items of sub-contracted work. Experience indicates that a fewer number of bidders may result in higher bids, conversely an increased number of bidders may result in more competitive bids.

Since Faithful+Gould has no control over the cost of labor, materials, or equipment, or over the contractor's method of determining prices, or over competitive bidding or market conditions, the opinion of probable construction cost provided for herein is made on the basis of professional experience and qualifications. The opinion represents Faithful + Gould's best judgment as a professional construction consultant familiar with the construction industry. However, Faithful+Gould cannot and does not guarantee that proposals, bids, or the construction cost will not vary from opinions of probable cost prepared by them.

**Area Tabulation**

<b>Location</b>	<b>Wing (SF)</b>	<b>Central Lobby (SF)</b>	<b>Total Area (SF)</b>
First Floor	15,400	900	16,300
Second Floor	15,400	900	16,300
<b>Total</b>	<b>30,800</b>	<b>1,800</b>	<b>32,600</b>

**COST SUMMARY**

Descriptions	\$	32,600 SF	
1 General Requirements		0.00	
2 Existing Conditions	71,179	2.18	
3 Concrete		0.00	
4 Masonry		0.00	
5 Metals	52,082	1.60	
6 Woods and Plastics	35,750	1.10	
7 Thermal Moisture and Waterproofing	7,500	0.23	
8 Doors and Windows		0.00	
9 Finishes	92,206	2.83	
10 Specialties		0.00	
11 Equipment		0.00	
12 Furnishings		0.00	
13 Special Construction		0.00	
14 Conveying Equipment		0.00	
21 Fire Suppression		0.00	
22 Plumbing		0.00	
23 Heating, Ventilating and Air-conditioning (HVAC)	2,500	0.08	
25 Integrated Automation		0.00	
26 Electrical	5,000	0.15	
27 Communications		0.00	
28 Electronic Safety and Security		0.00	
31 Earthwork		0.00	
32 Exterior Improvements		0.00	
33 Utilities		0.00	
<b>TOTAL Building and Siteworks</b>	<b>266,217</b>	<b>8.17</b>	
18 Phasing and Temporary Works	0.00%	0	0.00
19 General Conditions, Insurance and Bond	12.00%	31,946	0.98
20 Overhead and Profit	10.00%	29,816	0.91
<b>BASIC CONSTRUCTION ESTIMATE</b>	<b>327,979</b>	<b>10.06</b>	
21 Design Contingency	20.0%	65,596	2.01
<b>TOTAL CONSTRUCTION COST (Present)</b>	<b>393,575</b>	<b>12.07</b>	
22 Escalation (Excluded)	0.00%	0	0.00
<b>I. TOTAL CONSTRUCTION COST (Future)</b>	<b>393,575</b>	<b>12.07</b>	
A. Architect and Engineering Fees	0.00%	0	0.00
B. Project Management Fees	0.00%	0	0.00
C. Miscellaneous Consulting Services	0.00%	0	0.00
D. Project/Construction Contingency	0.00%	0	0.00
<b>II. TOTAL SOFT COST</b>	<b>0</b>	<b>0.00</b>	
<b>GROSS TOTAL (I+II (Future Cost))</b>	<b>393,575</b>	<b>12.07</b>	

**DETAILED ESTIMATE - B1**

	<i>Description</i>	<i>Qty</i>	<i>Unit</i>	<i>Rate</i>	<i>Total</i>
<b>1</b>	<b><u>GENERAL REQUIREMENTS</u></b> Not Applicable				
	<b>TOTAL GENERAL REQUIREMENTS</b>				
<b>2</b>	<b><u>EXISTING CONDITIONS</u></b>				
	<b><u>Selective Demolition</u></b>				
	Open up ceiling soffits to access work areas				
	- hard ceiling (25% assumption)	608	SF	25.00	15,188
	- suspended ceiling (75% assumption)	1,823	SF	10.00	18,225
	Remove built up roofing tile for new metal strap	750	LF	10.00	7,500
	Remove existing finishes and prepare for new plywood wall lining	3,850	SF	5.00	19,250
	<b><u>Miscellaneous</u></b>				
	Miscellaneous demolition	1	LS	6,016.25	6,016
	Haul and dispose	1	LS	5,000.00	5,000
	<b>TOTAL EXISTING CONDITIONS</b>				<b>71,179</b>
<b>3</b>	<b><u>CONCRETE</u></b> Not Applicable				
	<b>TOTAL CONCRETE</b>				
<b>4</b>	<b><u>MASONRY</u></b> Not Applicable				
	<b>TOTAL MASONRY</b>				
<b>5</b>	<b><u>METALS</u></b>				
	Seismic tie comprising steel rods with hold-downs each side of glu-lam beams where indicated				
	- intersecting cross beams	18	LOC	649.20	11,686
	- longitudinal beams at interior walls	6	LOC	424.60	2,548
	- longitudinal beams at exterior walls	8	LOC	262.30	2,098
	Prepare existing plywood roof diaphragm and install steel straps	750	LF	21.00	15,750
	Allowances for metal accessories at plywood wall lining	30	LOC	500.00	15,000
	Scaffold allowance	1	LS	5,000.00	5,000
	<b>TOTAL METALS</b>				<b>52,082</b>

**DETAILED ESTIMATE - B1**

	<i>Description</i>	<i>Qty</i>	<i>Unit</i>	<i>Rate</i>	<i>Total</i>
<b>6</b>	<b><u>WOODS AND PLASTICS</u></b>				
	2 x Wood blocking between roof joists	540	LF	25.00	13,500
	1/2" thick plywood wall sheathing	3,850	SF	5.00	19,250
	Miscellaneous rough carpentry etc	1	LS	3,000.00	3,000
	<b>TOTAL WOODS AND PLASTICS</b>				<b>35,750</b>
<b>7</b>	<b><u>THERMAL MOSITURE AND WATERPROOFING</u></b>				
	Patch built up roofing	750	LF	10.00	7,500
	<b>TOTAL THERMAL MOSITURE AND WATERPROOFING</b>				<b>7,500</b>
<b>8</b>	<b><u>DOORS AND WINDOWS</u></b>				
	Not Applicable				
	<b>TOTAL DOORS AND WINDOWS</b>				
<b>9</b>	<b><u>FINISHES</u></b>				
	<u>Wall Finishes</u>				
	Patch and paint gypsumboard wall sheathing	3,850	SF	10.00	38,500
	Allowance for wall tiles in restroom walls	481	SF	15.00	7,219
	<u>Ceiling Finishes</u>				
	Patch and paint gypsumboard ceiling soffits	608	SF	35.00	21,263
	Replace suspended ceiling tiles	1,823	SF	10.00	18,225
	<u>Miscellaneous</u>				
	Make good adjacent finishes, allowances	1	LS	7,000.00	7,000
	<b>TOTAL FINISHES</b>				<b>92,206</b>
<b>10</b>	<b><u>SPECIALTIES</u></b>				
	Not Applicable				
	<b>TOTAL SPECIALTIES</b>				
<b>11</b>	<b><u>EQUIPMENT</u></b>				
	Not Applicable				
	<b>TOTAL EQUIPMENT</b>				

**DETAILED ESTIMATE - B1**

	<i>Description</i>	<i>Qty</i>	<i>Unit</i>	<i>Rate</i>	<i>Total</i>
<b>12</b>	<b><u>FURNISHINGS</u></b> Not Applicable				
	<b>TOTAL FURNISHINGS</b>				
<b>13</b>	<b><u>SPECIAL CONSTRUCTION</u></b> Not Applicable				
	<b>TOTAL SPECIAL CONSTRUCTION</b>				
<b>14</b>	<b><u>CONVEYING EQUIPMENT</u></b> Not Applicable				
	<b>TOTAL CONVEYING EQUIPMENT</b>				
<b>21</b>	<b><u>FIRE SUPPRESSION</u></b> Not Applicable				
	<b>TOTAL FIRE SUPPRESSION</b>				
<b>22</b>	<b><u>PLUMBING</u></b> Not Applicable				
	<b>TOTAL PLUMBING</b>				
<b>23</b>	<b><u>HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)</u></b>  Allowances for diffuser removal and relocation etc	1	LS	2,500.00	2,500
	<b>TOTAL HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)</b>				<b>2,500</b>
<b>25</b>	<b><u>INTEGRATED AUTOMATION</u></b> Not Applicable				
	<b>TOTAL INTEGRATED AUTOMATION</b>				
<b>26</b>	<b><u>ELECTRICAL</u></b>  Allowances for light fixture removal and relocation etc	1	LS	5,000.00	5,000
	<b>TOTAL ELECTRICAL</b>				<b>5,000</b>
<b>27</b>	<b><u>COMMUNICATIONS</u></b> Not Applicable				
	<b>TOTAL COMMUNICATIONS</b>				

**DETAILED ESTIMATE - B1**

	<i>Description</i>	<i>Qty</i>	<i>Unit</i>	<i>Rate</i>	<i>Total</i>
28	<b><u>ELECTRONICS SAFETY AND SECURITY</u></b> Not Applicable				
<hr/>					
	<b>TOTAL ELECTRONICS SAFETY AND SECURITY</b>				
31	<b><u>EARTHWORK</u></b> Not Applicable				
<hr/>					
	<b>TOTAL EARTHWORK</b>				
32	<b><u>EXTERIOR IMPROVEMENTS</u></b> Not Applicable				
<hr/>					
	<b>TOTAL EXTERIOR IMPROVEMENTS</b>				
33	<b><u>UTILITIES</u></b> Not Applicable				
<hr/>					
	<b>TOTAL UTILITIES</b>				

## **Appendix 4**

### **ASCE 41 Tier 1 Checklists**

## APPENDIX C SUMMARY DATA SHEET

### BUILDING DATA

Building Name: Campbell City Hall Date: 11/6/15  
 Building Address: 70 N First Street, Campbell, CA  
 Latitude: 37.288 N Longitude: 121.944 W By: \_\_\_\_\_  
 Year Built: 1970 Year(s) Remodeled: \_\_\_\_\_ Original Design Code: UBC 1967  
 Area (sf): 32,600 Length (ft): 170 Width (ft): 140  
 No. of Stories: 2 Story Height: 12 Total Height: 31.83

USE  Industrial  Office  Warehouse  Hospital  Residential  Educational  Other: \_\_\_\_\_

### CONSTRUCTION DATA

Gravity Load Structural System: Plywood roof on glu-lam beams over steel columns  
 Exterior Transverse Walls: Wood framed / Masonry Openings? \_\_\_\_\_  
 Exterior Longitudinal Walls: Wood framed / Masonry Openings? \_\_\_\_\_  
 Roof Materials/Framing: Plywood / 2x wood joists / Glu-lam beams  
 Intermediate Floors/Framing: Plywood / 2x wood joists / Glu-lam beams  
 Ground Floor: Slab on grade  
 Columns: Steel tubes Foundation: Spread footings  
 General Condition of Structure: Good  
 Levels Below Grade? 0  
 Special Features and Comments: \_\_\_\_\_

### LATERAL-FORCE-RESISTING SYSTEM

	First Story -Longitudinal--	Second Story -Transverse--
System:	<u>Concrete-masonry shear walls</u>	<u>Wood shear walls</u>
Vertical Elements:	<u>CMU Walls / Steel Columns</u>	<u>Stud walls / Steel Columns</u>
Diaphragms:	<u>5/8" Plywood</u>	<u>3/4" Plywood</u>
Connections:	<u>Sill plate and anchor bolts</u>	<u>Wood Blkg and nails</u>

### EVALUATION DATA

BSE-1N Spectral Response Accelerations:  $S_{D1} =$  1.059  $S_{D1} =$  0.602  
 Soil Factors: Class = D  $F_a =$  1.0  $F_v =$  1.5  
 BSE-1E Spectral Response Accelerations:  $S_{X1} =$  1.01  $S_{X1} =$  0.548  
 Level of Seismicity: High Performance Level: Life Safety  
 Building Period:  $T =$  0.254 sec  
 Spectral Acceleration:  $S_a =$  1.01  
 Modification Factor:  $C_m C_1 C_2 =$  1.2 Building Weight:  $W =$  1465 kips  
 Pseudo Lateral Force:  $V =$  1.21 W  
 $C_m C_1 C_2 S_a W =$  1773 kips

### BUILDING CLASSIFICATION:

#### REQUIRED TIER 1 CHECKLISTS

	Yes	No
Basic Configuration Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Building Type _____ Structural Checklist W2 / RM1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nonstructural Component Checklist	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### FURTHER EVALUATION REQUIREMENT:

Project: Campbell City Hall  
Completed by: GJT

Location: Campbell, CA  
Date: 11/15

## 16.1.2LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

### Low Seismicity

#### Building System

##### General

- NC N/A U **LOAD PATH:** The structure shall contain 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. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)
- NC N/A U **ADJACENT BUILDINGS:** The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)
- 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. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)

##### Building Configuration

- 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. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)
- 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. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)
- NC N/A U **VERTICAL IRREGULARITIES:** All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)
- 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. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)
- NC N/A U **MASS:** There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)
- 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. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

### Moderate Seismicity: Complete the Following Items in Addition to the Items for Low Seismicity.

#### Geologic Site Hazards

- NC N/A U **LIQUEFACTION:** Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)
- NC N/A U **SLOPE FAILURE:** The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)
- NC N/A U **SURFACE FAULT RUPTURE:** Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)

### High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.

#### Foundation Configuration

- 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  $0.6S_w$ . (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)
- 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. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)

Project: Campbell City Hall

Location: Campbell, CA

Completed by: GJT

Date: 11/15

### 16.3LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPE W2: WOOD FRAMES, COMMERCIAL AND INDUSTRIAL

#### Low and Moderate Seismicity

##### Lateral Seismic-Force-Resisting System

- C NC N/A U REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)
- C  NC N/A U SHEAR STRESS CHECK: The shear stress in the shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the following values (Commentary: Sec. A.3.2.7.1. Tier 2: Sec. 5.5.3.1.1):
- |                            |             |
|----------------------------|-------------|
| Structural panel sheathing | 1,000 lb/ft |
| Diagonal sheathing         | 700 lb/ft   |
| Straight sheathing         | 100 lb/ft   |
| All other conditions       | 100 lb/ft   |
- C NC N/A U STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multi-story buildings do not rely on exterior stucco walls as the primary seismic-force-resisting system. (Commentary: Sec. A.3.2.7.2. Tier 2: Sec. 5.5.3.6.1)
- C NC N/A U GYPSUM WALLBOARD OR PLASTER SHEAR WALLS: Interior plaster or gypsum wallboard is not used as shear walls on buildings more than one story high with the exception of the uppermost level of a multi-story building. (Commentary: Sec. A.3.2.7.3. Tier 2: Sec. 5.5.3.6.1)
- C NC N/A U NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)
- C NC N/A U WALLS CONNECTED THROUGH FLOORS: Shear walls have an interconnection between stories to transfer overturning and shear forces through the floor. (Commentary: Sec. A.3.2.7.5. Tier 2: Sec. 5.5.3.6.2)
- C NC  N/A U HILLSIDE SITE: For structures that are taller on at least one side by more than one-half story because of a sloping site, all shear walls on the downhill slope have an aspect ratio less than 1-to-1. (Commentary: Sec. A.3.2.7.6. Tier 2: Sec. 5.5.3.6.3)
- C NC  N/A U CRIPPLE WALLS: Cripple walls below first-floor-level shear walls are braced to the foundation with wood structural panels. (Commentary: Sec. A.3.2.7.7. Tier 2: Sec. 5.5.3.6.4)
- C NC  N/A U OPENINGS: Walls with openings greater than 80% of the length are braced with wood structural panel shear walls with aspect ratios of not more than 1.5-to-1 or are supported by adjacent construction through positive ties capable of transferring the seismic forces. (Commentary: Sec. A.3.2.7.8. Tier 2: Sec. 5.5.3.6.5)

##### Connections

- C NC N/A U WOOD POSTS: There is a positive connection of wood posts to the foundation. (Commentary: Sec. A.5.3.3. Tier 2: Sec. 5.7.3.3)
- C NC N/A U WOOD SILLS: All wood sills are bolted to the foundation. (Commentary: Sec. A.5.3.4. Tier 2: Sec. 5.7.3.3)
- C NC N/A U GIRDER/COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)

**High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.**

**Diaphragms**

- (C) NC N/A U DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)
- (C) NC N/A U ROOF CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Commentary: Sec. A.4.1.3. Tier 2: Sec. 5.6.1.1)
- C NC (N/A) U DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5)
- C NC (N/A) U STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)
- (C) NC N/A U SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. Wood commercial and industrial buildings may have rod-braced systems. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)
- 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 and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)
- (C) NC N/A U OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)

**Connections**

- (C) NC N/A U WOOD SILL BOLTS: Sill bolts are spaced at 6 ft or less, with proper edge and end distance provided for wood and concrete. (Commentary: A.5.3.7. Tier 2: Sec. 5.7.3.3)

Project: Campbell City Hall  
Completed by: GJT

Location: Campbell, CA  
Date: 11/15

**16.15LS LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS**

**Low and Moderate Seismicity**

**Seismic-Force-Resisting System**

- NC N/A U REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)
- NC N/A U SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in.<sup>2</sup>. (Commentary: Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1)
- NC N/A U REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (Commentary: Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3)

**Stiff Diaphragms**

- C NC  N/A U TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Commentary: Sec. A.4.5.1. Tier 2: Sec. 5.6.4)

**Connections**

- NC N/A U WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm 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 shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)
- NC N/A U WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Commentary: Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3)
- NC N/A U TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)
- C NC  N/A U TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (Commentary: Sec. A.5.2.3. Tier 2: Sec. 5.7.2)
- NC N/A U FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)
- NC N/A U GIRDER-COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)

**High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.**

**Stiff Diaphragms**

- 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. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)
- C NC  N/A U OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)

**Flexible Diaphragms**

- C  NC N/A U CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)
- 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. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)
- C NC  N/A U OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)

- C NC (N/A) U STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)
- (C) NC N/A U SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)
- 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 and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)
- (C) NC N/A U OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)

**Connections**

- (C) NC N/A U STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (Commentary: Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2)