TIER 1 SEISMIC EVALUATION

Immediate Occupancy Structural Performance Level

Campbell Library

Campbell, California

Final Report

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

Prepared By:
Biggs Cardosa Associates, Inc.
101 California Street, Suite 875
San Francisco, California

December 21, 2017

BCA Job No. 2015098.2

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
PROJECT OVERVIEW 3
AVAILABLE DOCUMENTS 4
BUILDING DESCRIPTION 5
EXISTING CONDITIONS 6
SEISMIC EVALUATION AND FINDINGS 7
Evaluation Basis 7
Lateral Load-Resting System 8
Seismic Evaluation Results 9
RECOMMENDATIONS 10
CONCEPTUAL COST ESTIMATE 11
FURTHER ACTIONS 11
LIMITATIONS AND DISCLAIMERS 12

APPENDICES

Appendix 1 Photos
Appendix 2 Conceptual Seismic Retrofit Plans
Appendix 3 Conceptual Cost Estimate
Appendix 4 ASCE 41 Tier 1 Checklists

EXECUTIVE SUMMARY

Biggs Cardosa Associates has been retained by the City of Campbell to provide a Tier 1 seismic assessment of the Campbell Library in order to upgrade the existing building as an Essential Facility. As prescribed in ASCE 41-13, the reference document used for this seismic evaluation, the lateral load-resisting system of an Essential Facility must comply with requirements of the Immediate Occupancy Structural Performance Level. This report contains the structural/seismic findings, qualitative conceptual seismic retrofit recommendations and an order-of-magnitude construction cost estimate for the required retrofit work based on our Tier 1 seismic assessment (using the Immediate Occupancy performance level) as well as our experience with buildings of similar size, age and construction type.

The Campbell Library is a 2-story, 24,000 sf structure that was constructed in the early 1970's and opened to the public in 1975. The facility houses library functions on both floors as well as the City of Campbell's Emergency Operations Center (EOC) at the first floor. The Library building consists of wood-framed roof and second floor, with steel columns, and concrete masonry wall at 1st story and wood-framed walls at 2nd story. The rectangular shaped structure is symmetrical in plan. Foundations consist of isolated spread footing below columns and continuous footings below walls. The lateral system comprises of plywood roof and floor diaphragms, plywood shearwalls at 2nd story and masonry walls at 1st story. The first floor is a slab-on-grade.

Overall, the building is currently in good structural condition. The Campbell Library 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, including drawings of a similar adjacent building (City Hall), 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. No structural drawings were available for review for the building and many details were inferred from the adjacent City Hall building.

Since the first floor of the Campbell Library houses the City's Emergency Operations Center (EOC), the building is therefore, by code, an Essential Service Building. For this type of building, the primary structural elements are required to meet the Immediate Occupancy Structural Performance Level as described in ASCE 41-13. However, originally as directed by the City, a seismic evaluation was performed using the Life Safety seismic performance criteria based on the assumption that the EOC would be relocated to a new facility. The

findings and recommendations of the Life Safety seismic evaluation were summarized in our "Tier 1 Seismic Evaluation (Life Safety)" report, dated June 19, 2015.

As per current direction from the City, the building is likely to continue housing the EOC and/or the relocated Campbell Police Department currently located in the nearby City Hall building. As either one of these occupancies would make the Campbell Library building an essential facility, a seismic evaluation needs to be performed using the Immediate Occupancy performance criteria. An Immediate Occupancy performance level is significantly more stringent than the Life Safety performance level, and thus requires considerably more seismic retrofit work to upgrade an existing building due to the much higher seismic demands.

The findings of this Tier 1 seismic assessment indicate that while the exiting Campbell Library building apparently has a complete lateral load-resisting system, it may have significant deficiencies in the required continuity and/or strength for many of its structural elements/connections that are necessary for satisfactory seismic behavior under the design earthquake. The building is likely to maintain its gravity load-carrying system after the design level earthquake but may experience significant structural damage. Continued post-earthquake building operations may not be possible and the repair costs may be too high to be economically feasible. The existing Campbell Library, therefore, does not meet the seismic resistance requirements for the Immediate Occupancy Structural Performance Level and would require considerable seismic retrofit work to reliably serve as an Essential Facility.

The order-of-magnitude conceptual cost estimate for the required seismic retrofit work identified through our Tier 1 seismic evaluation to meet the Immediate Occupancy performance level is **$1.8 million** (refer to Appendix 3 for details and assumptions). This estimate only includes retrofit costs directly related to structural strengthening of the building's primary lateral load-resisting system. Potential costs of all other improvements (related to non-structural elements, MEP equipment and systems, furnishings, utility services, etc.) required to upgrade the building as an Essential Facility are excluded.

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

Continued post-earthquake use of a building is not limited just by the extent of earthquake damage to its structural system but, more often than not, might be limited by damage or disruption to non-structural elements of the building, furnishings, MEP components and systems, and availability of utility services. A seismic evaluation of these items is recommended to ensure that all non-structural items of the Campbell Library are also adequately upgraded to comply with the Essential Facility requirements.

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 Library in order to upgrade the building as an Essential Facility. As outlined in ASE 41-13, the appropriate seismic performance level for essential facilities is the Immediate Occupancy Structural Performance Level.

The 24,000 sf, 2-story Campbell Library was constructed in the early 1970's and opened to the public in 1975. The facility houses library functions on both floors as well as the City of Campbell's Emergency Operations Center (EOC) at the first floor.

Since first floor of the Campbell Library houses the City of Campbell's EOC, the building is therefore, by code, an Essential Service Building. For this type of building, the primary structural elements are required to meet the Immediate Occupancy Structural Performance Level as described in ASCE 41-13. However, originally as directed by the City, a seismic evaluation was performed using the Life Safety seismic performance criteria based on the assumption that the EOC would be relocated to a new facility. The findings and recommendations of the Life Safety seismic evaluation were summarized in our "Tier 1 Seismic Evaluation (Life Safety)" report, dated June 19, 2015.

As per current direction from the City, the building is likely to continue housing the EOC and/or the relocated Campbell Police Department currently located in the nearby City Hall building. As either one of these occupancies would make the Library building an essential facility, a seismic evaluation needs to be performed using the Immediate Occupancy performance criteria. An Immediate Occupancy performance level is significantly more stringent than the Life Safety performance level, and thus requires considerably more seismic retrofit work to upgrade an existing building due to the much higher seismic demands.

This report contains the structural/seismic findings based on our Tier 1 seismic assessment (using the Immediate Occupancy performance level), our limited observation of existing field conditions, and our experience with buildings of similar size, age and construction type. Potential seismic deficiencies are identified and qualitative conceptual recommendations are outlined for remedial work. An order-of-magnitude conceptual cost estimate is provided for the proposed seismic retrofit work.

The findings and recommendations of our Tier 1 assessment outlined herein pertain only to the existing Campbell Library 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, utility services, etc. is beyond the scope of this report.

The scope of services for the Tier 1 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, using the Immediate Occupancy performance level.
4. Identify structural/seismic deficiencies in the building's framing system based on our field observations during the site visit(s) and the Tier 1 (Immediate Occupancy) seismic assessment.
5. Prepare qualitative conceptual recommendations for the required retrofit work to remedy the identified structural/seismic deficiencies in order to upgrade the building to the Immediate Occupancy performance level as well as for the repair/replacement of the damaged or deteriorated structural framing observed during the site visit.
6. Coordinate with our cost estimating subconsultant, Faithful + Gould (F+G), to prepare an order-of-magnitude 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.

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:

- Drawings for "Campbell Library Remodel," prepared by Jensen, Johnson & Associates, dated August 28, 1987. This drawing set was prepared for non-structural remodeling work and included one cover sheet (C), four architectural sheets (A1-A4), four electrical sheets (E1-E4), and two mechanical/plumbing sheets (MP-1 & MP-2). No structural

modifications to the building appeared to have been be made as part of this remodeling work.

- 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 original as-built structural plans for the Campbell Library building were not available.

The existing City Hall is located on a nearby site, just west of the Library. We understand the two buildings were designed by the same design team, were built during the same period in the early 1970's, and utilize similar construction materials, framing and details.

The findings and conclusions in this report are based on the available drawings and our site visits on April 14, 2015 and July 18, 2017. With no structural drawings available for the Library, we have assumed that the structural framing and detailing of the Library are similar to those shown on the plans for the City Hall. While most of the structural framing and detailing of the Library is covered up by architectural finish materials and cannot be observed directly, areas that could be observed suggest that this is a reasonable assumption, although this needs to be verified as the project develops.

BUILDING DESCRIPTION

The Campbell Library is a 2-story, 24,000 sf structure of primarily wood-framed construction, with selected structural elements constructed of steel, concrete or masonry. The building is rectangular in plan (approximately 146-ft L x 86-ft W) and has a story height of 12-ft at both levels. It was built in the early 1970's and opened to the public in 1975. The facility houses library functions on both floors as well as the City of Campbell's Emergency Operations Center (EOC) at the first floor.

The building is located on a flat site. The first story is partially depressed below grade with the exterior masonry walls retaining soil up to approximately their mid-height. There is a short (2 to 3-ft height) masonry retaining wall approximately 10-ft away from the building footprint enclosing the entire perimeter of the building. The finished grade slopes down several feet from this retaining wall to a level just below the windows in the masonry walls at the building perimeter, resulting in surface runoff draining toward the building. See Photos 1 through 5.

There are three entrances to the building at the first story. Stairways 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 side of the building. The second story is symmetrical in plan with entrances on all four sides of the building. The roof overhangs the perimeter walls by approximately 3-ft (see Photo 6) and is supported by exterior steel columns spaced evenly around the building. The flat roof contains two large mechanical units protected from view by a continuous roof screen.

The first story consists of 8" fully-grouted, reinforced concrete masonry perimeter walls and interior steel columns supporting a wood-framed floor. The masonry wall is essentially continuous along the north end (with just one opening for door leading to the stairs) and has window openings along the other three sides. The wood-framed floor consists of 5/8" plywood sheathing and non-structural concrete topping supported by 2x wood joists at 16" on center that span between glu-laminated wood beams. The beams are supported by the interior 5-in square steel tube columns and perimeter concrete-masonry walls that are continuous to the foundation. The wood framing supported by the masonry walls sits on a continuous sill plate with anchor bolts spaced at 48" on center (or 32" oc where plywood shear walls occur above).

The second story consists of steel columns supporting a wood-framed roof. Exterior wood framed walls are non-load bearing shear walls, sheathed with ½" plywood. The ½" thick plywood roof is supported by 2x wood joists at 16" on center that span between glu-laminated wood beams supported by the interior steel columns and perimeter stud walls. The stud walls are supported by the masonry walls below. The interior steel columns align with the columns below and are continuous to the foundation.

The first 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, visqueen membrane (vapor barrier) and 4" crushed rock layer. The building foundation system consists of continuous footings below masonry walls and isolated spread footings below steel tube columns.

The building's lateral load-resisting system consists of plywood roof and second floor diaphragms and the plywood/masonry shear walls at its perimeter – plywood shear walls at the second story and concrete masonry shear walls at the first story. Inferring from the City Hall drawings, the second-story plywood shear walls are anchored into the masonry walls below with Simpson hold-downs at each end (but this needs to be field verified).

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 Library, the nature of construction and layout of the current structure had to be determined. The available drawings (noted above) and our site visits on April 14, 2015 and July 18, 2017 provided the basic

information to accomplish this task. No specific information on the building's structural framing system or details has been available.

No destructive investigation or physical testing of existing conditions or materials was performed during the site visit. As most of the structural framing is concealed by architectural finishes, not all structural elements of the building were visible during the site visits and not all of the building components relevant for this assessment were able to be verified. Since the adjacent City Hall building was constructed around the same time as the Library and has very similar visible finishes, materials and layout, the available structural drawings for the City Hall were used to infer the various details, materials and components. A field investigation requiring the removal of finishes in selected areas of the building may be required to verify the existing conditions and materials.

Overall the building appears to be in good physical condition. While signs of minor water intrusion were observed at several locations (see Photos 15 & 16), 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 visible cracks were present during the site visits although the masonry wall has been painted and this could obscure small cracks. Signs of previous water seepage through the masonry walls were observed at several locations, suggesting that a waterproofing/drainage system on the soil-side of masonry walls either was not originally installed or may have been compromised if installed. [The City Hall drawings show that a waterproofing membrane and a gravel backfill with weep holes at wall base were installed on soil-side of masonry walls in that building.]

The presence of steel clips and other details appear to provide an indication that, like the City Hall structure, the Library building was originally designed by considering seismic loads. There was no indication that the building has been modified or seismically retrofitted since its original construction.

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 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 Immediate

Occupancy performance level were completed to help identify the potential seismic deficiencies in the Library 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 after an extreme event such as a major earthquake. The evaluation methodology of ASCE 41 requires an essential facility to be evaluated to the more stringent Immediate Occupancy performance standard. This performance level increases the seismic forces on the structure by a factor of two over the Life Safety criteria (which is commonly used for standard office occupancy buildings). This results in several additional retrofit measures that need to be implemented in order for the building to meet the Immediate Occupancy performance criteria.

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. See Appendix 4.

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 Campbell Library, only a structural seismic evaluation of the primary lateral load-resisting system was done per ASCE 41. An assessment of non-structural elements, fire protection, egress, accessibility, mechanical, electrical, plumbing, utility services, waterproofing or drainage requirements was not performed. The Campbell Library would require these other improvements to meet the Essential Facility code requirements, but an assessment of these systems was beyond the scope of this report.

Lateral Load-Resting 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 parallel to the direction of the earthquake or wind loads. These elements then transfer the forces to the foundations.

At second story of the Campbell Library, the plywood roof diaphragm transfers forces into the perimeter plywood shearwalls. At the first story, the plywood second floor diaphragm transfers forces into the masonry shearwalls at perimeter of the building. The forces from the second-story plywood shearwalls are transferred directly into the first-story masonry shearwalls, which then transfer the combined lateral forces to the foundations.

Seismic Evaluation Results

Our assessment of Campbell Library was based on ASCE 41 Tier 1 analysis, our field observations, our review of the structural drawings for the adjacent City Hall (which has similar construction), and our experience with buildings of similar size, age and construction type.

The findings of our Tier 1 seismic assessment indicate that while the Library building apparently has a complete lateral load-resisting system, it may have significant deficiencies in the required continuity and/or strength for many of its structural elements/connections that are necessary for satisfactory seismic behavior under the design earthquake. The building is likely to maintain its gravity load-carrying system after the design level earthquake but may experience significant structural damage. Continued post-earthquake building operations may not be possible and the repair costs may be too high to be economically feasible. The existing Campbell Library, therefore, does not meet the seismic resistance requirements for the Immediate Occupancy Structural Performance Level and would require considerable seismic retrofit work to reliably serve as an Essential Facility.

Inferring from the City Hall drawings, the masonry shearwalls at the first story are presumably 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 approximately 4’-0” on center. This connection appears to be insufficient for transferring the seismic loads. New anchor bolts will need to be drilled and epoxied through the wood sill and into the masonry walls.

The plywood shearwalls at the second story appear to be inadequate for transferring the in-plane seismic loads. New plywood will need to be added to the existing shearwalls. Holdowns at the ends of plywood shearwalls, if present, were concealed by architectural finishes and could not be observed during our site visits. The drawings for the adjacent City Hall building indicate holdowns at several wood shearwalls, but unless holdowns are field verified and their strength is adequate, they will need to be added to the existing walls.

The shear capacity of the second floor plywood diaphragm appears to be inadequate for transferring the seismic forces to the shear walls. Additional nails and new wood blocking will need to be added to the existing plywood diaphragm. The shear capacity of the roof diaphragm appears to be adequate for transferring the forces to the shear walls; the details and capacities of the roof diaphragm chords/collectors, however, need verification.

Based on the Tier 1 evaluation performed (using the Immediate Occupancy performance level), we believe the Campbell Library may have the following potential seismic deficiencies:

1. At roof level, wood wall-to-roof connections appear to be adequate for out-of-plane wall loads but their details and capacities need verification. If found deficient, new closely-spaced steel straps will need to be added.
2. At roof level, building cross-ties are inadequate for transferring out-of-plane wall loads into the roof diaphragm. Addition of new horizontal steel straps or steel rods with holdowns is required at beam splice locations (typically at columns).
3. At roof level, collectors along shearwall lines are inadequate for transferring the diaphragm load to the shearwalls. Addition of new steel straps with blocking between joists is required.
4. At roof level, diaphragm chords appear to be adequate but their details and capacities need verification.
5. Holdowns at the ends of second story plywood shearwalls, if present, were not visible during the site visit. Holdowns will need to be added to the existing plywood shearwalls unless holdowns are field verified and their strength is found to be adequate.
6. The plywood shearwalls at the second floor appear to be inadequate for in-plane seismic loads. Addition of new plywood will be required at the existing shearwalls.
7. The plywood diaphragm at the second floor appears to be inadequate for transferring seismic loads to the shearwalls. New nails and blocking will be required at the second floor diaphragm.
8. At second floor level, masonry wall-to-floor connections appear to be inadequate for both in-plane and out-of-plane wall loads. Addition of new anchor bolts will be required.
9. 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).

RECOMMENDATIONS

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

1. At roof level, provide building cross-ties by adding new horizontal steel straps at beam splice locations (typically at columns). These straps will be installed over the roof plywood sheathing, directly above the beams below. [See Deficiency 2 above].
2. At roof level, provide new collectors along shearwall lines by adding new steel straps over plywood sheathing, with new blocking between the joists. [See Deficiency 3 above].
3. At second floor level, provide new nailing and wood blocking at the plywood diaphragm. [See Deficiency 7 above].
4. At the second floor level, provide new anchors bolts drilled through the existing wood sill plate and epoxied into the top of the existing masonry walls. [See Deficiency 8 above].
5. 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 9 above].

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

CONCEPTUAL COST ESTIMATE

The order-of-magnitude conceptual cost estimate for the required seismic retrofit work identified through our Tier 1 seismic evaluation to meet the Immediate Occupancy performance level is **$1.8 million** (refer to Appendix 3 for details and assumptions). This estimate only includes retrofit costs directly related to structural strengthening of the building's primary lateral load-resisting system. Potential costs of all other improvements (related to non-structural elements, MEP equipment and systems, furnishings, utility services, etc.) required to upgrade the building as an Essential Facility are excluded.

The estimate above also includes a small allowance for the installation of a new waterproofing membrane on the interior face of first-story masonry walls, although we believe this item needs to be evaluated by a firm that specializes in drainage and waterproofing.

FURTHER ACTIONS

As indicated by the potential seismic deficiencies in the Campbell Library 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. Continued post-earthquake use of a building is not limited just by the extent of earthquake damage to its structural system but, more often than not, might be limited by damage or disruption to non-structural elements of the building, furnishings, MEP components and systems, and availability of utility services. A seismic evaluation of these items is recommended to ensure that all non-structural items of the Campbell Library are also adequately upgraded to comply with the Essential Facility requirements.

The implementation of these actions will help determine the full extent of structural and non-structural upgrades required for the building and ensure that the upgraded Campbell Library meets the seismic safety requirements for Essential Facilities as well as help define the project's anticipated total construction costs.

Masonry Walls – Drainage & Waterproofing

We recommend that the City retain a drainage and waterproofing specialist firm to assess these issues as they pertain to the first-story masonry walls. Potential solutions to preventing water seepage through the walls may include removing all existing finish materials on interior face of wall, epoxy injection of cracks, and applying a coating/membrane to interior face of the wall, or alternatively repairing/installing the drainage and waterproofing system behind the wall.

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 – East elevation view

Photo 2 – North elevation view (from northeast corner)

Photo 3 – West elevation view

Photo 4 – South elevation view

Photo 5 – Exterior perimeter retaining wall and first story masonry walls.

Photo 6 – Exterior overhangs and steel columns

Photo 7 – Interior space at first floor with masonry shearwalls beyond

Photo 8 – Interior space at second floor

Photo 9 – Typical glulam beam to steel column connection

Photo 10 – Typical Joist to glulam beam connection

Photo 11 – Joist bridging and glulam beam to column connection beyond

Photo 12 – Bolted wood sill plate at masonry wall

Photo 13 – Bolt and Simpson steel clips at wood sill plate

Photo 14 – Typical floor framing at masonry wall

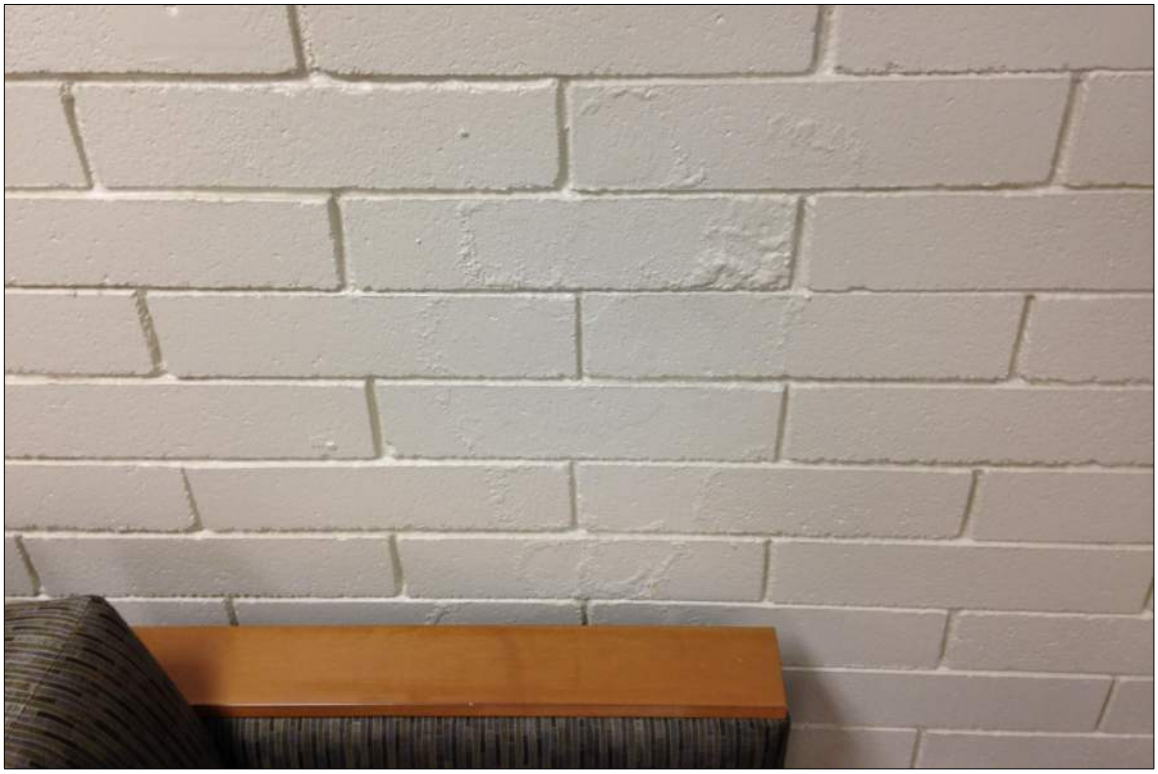
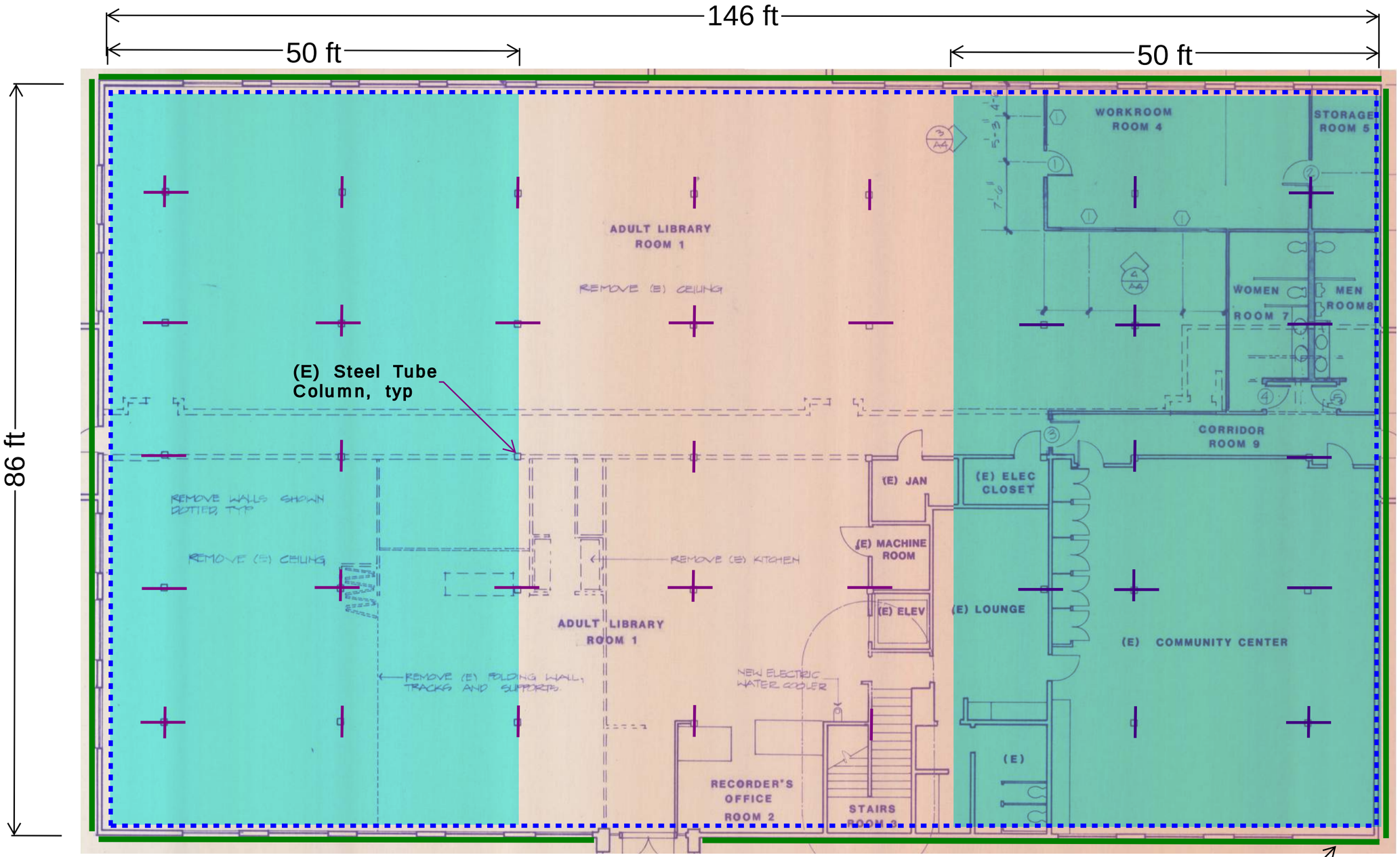


Photo 15 – Signs of water intrusion through masonry wall

Photo 16 – Water damage at ceiling tile

Appendix 2

Conceptual Seismic Retrofit Plans



Indicates (N) seismic tie - steel rod or strap on each side of (E) glu-lam beam.

Indicates (N) waterproofing on inside face of first story walls

Indicates (N) anchor bolts through (E) 2x wood sill epoxied into top of CMU walls @ 4'-0" on center

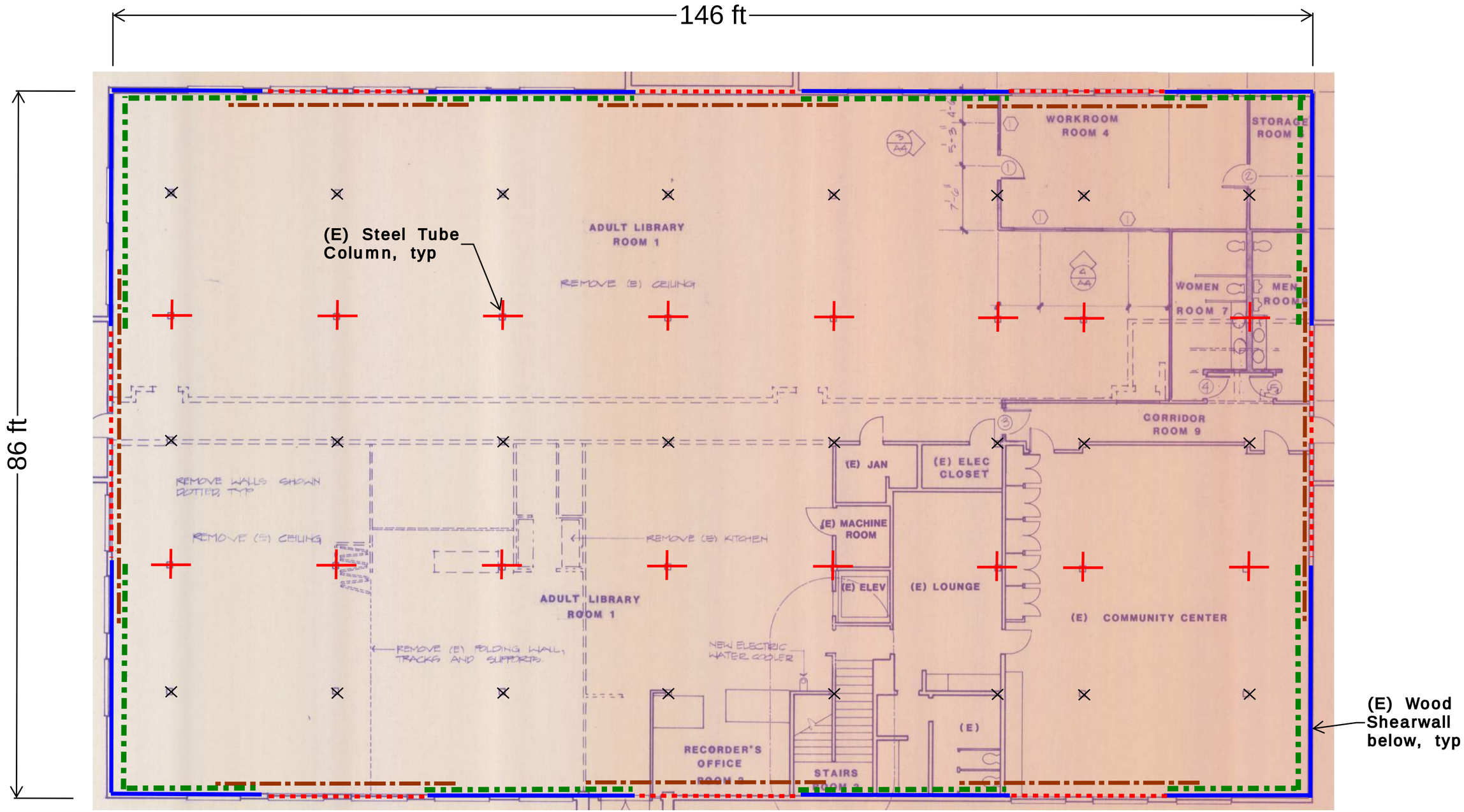
Indicates (N) nailing on (E) wood diaphragm

Second Floor Plan

→ N

(E) Concrete Masonry Shearwall below, typ

Campbell Library (Immediate Occupancy)
77 Harrison Ave, Campbell, CA
December 21, 2017



Indicates (N) steel strap on (E) plywood diaphragm

indicates (N) steel strap on (E) wood framing

Indicates (N) wood blocking

Indicates (E) Wood shearwall below

Indicates (N) plywood at (E) shearwalls with steel holdowns

Roof Plan

→ N

Campbell Library (Immediate Occupancy)
77 Harrison Ave, Campbell, CA
December 21, 2017

Appendix 3

Conceptual Cost Estimate

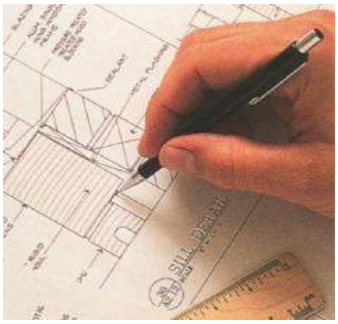
Campbell Library

Tier 1 - Seismic Assessment (Essential Facility)

Campbell, CA

Rough Order of Magnitude Cost Estimate (DRAFT)

August 15, 2017



Faithful+Gould
332 Pine Street, 5th Floor, San Francisco CA 94104
phone: 415.781 6677 fax: 415.781.0906

INTRODUCTION

This opinion of probable cost has been prepared to reflect the anticipated construction cost for the proposed seismic retrofit work based on a Tier 1 Seismic Assessment (Essential Facility) for Campbell Library, 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 seismic retrofit work covers 2 levels that includes seismic ties using steel rods and hold downs at existing glu-lam beams and anchor bolts to perimeter walls below the second floor diaphragm. In addition, the existing wood diaphragm requires new nailing and blocking. The perimeter masonry wall will also require waterproofing on the inside face. The work on the roof plan consists of steel straps on top of existing plywood diaphragm and existing wood framing over openings. The perimeter existing shear walls will need new plywood with steel rods and hold downs. Finishes are replaced only at locations where seismic work are needed.

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 roof plans dated August 10, 2017.

Reports

Tier 1 Seismic Evaluation Campbell Library Draft Report dated May 13, 2015.

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.

INTRODUCTION

Design-build procurement delivery
Phased work is excluded.
Escalation
Fire inspection fees
Special inspection fees
Permits, expediting and filing

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

Location	*SF*		*Total Area (SF)*
First Floor	12,556		***12,556***
Second Floor	12,556	-	***12,556***
Total	**25,112**	**-**	**25,112**

Campbell Library — *Rough Order of Magnitude Cost Estimate (DRAFT)*

Tier 1 - Seismic Assessment (Essential Facility) — *15-Aug-17*

Campbell, CA

COST SUMMARY

	Descriptions		$	25,112 SF
1	General Requirements			0.00
2	Existing Conditions		329,492	13.12
3	Concrete			0.00
4	Masonry			0.00
5	Metals		121,588	4.84
6	Woods and Plastics		122,566	4.88
7	Thermal Moisture and Waterproofing		137,500	5.48
8	Doors and Windows			0.00
9	Finishes		413,370	16.46
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)		5,000	0.20
25	Integrated Automation			0.00
26	Electrical		10,000	0.40
27	Communications			0.00
28	Electronic Safety and Security			0.00
31	Earthwork			0.00
32	Exterior Improvements			0.00
33	Utilities			0.00
	TOTAL Building and Siteworks		***1,139,516***	***45.38***
18	Phasing and Temporary Works	*0.00%*	0	0.00
19	Insurance and Bond	*2.00%*	22,790	0.91
20	General Requirements (6 months construction)		217,500	
21	Profit	*10.00%*	137,981	5.49
	BASIC CONSTRUCTION ESTIMATE		***1,517,787***	***51.78***
22	Design Contingency	*20.0%*	303,557	12.09
	TOTAL CONSTRUCTION COST (Present)		***1,821,344***	***63.87***
23	Escalation (Excluded)	*0.00%*	0	0.00
	I . TOTAL CONSTRUCTION COST (Future)		**1,821,344**	**63.87**
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
	II. TOTAL SOFT COST		**0**	**0.00**
	GROSS TOTAL (I+II (Future Cost)		***1,821,344***	***63.87***

DETAILED ESTIMATE - B1

	Description	Qty	Unit	Rate	Total
1	**GENERAL REQUIREMENTS**				
	See Summary				
	TOTAL GENERAL REQUIREMENTS				
2	**EXISTING CONDITIONS**				
	Selective Demolition				
	Open up ceiling soffits to access work areas				
	hard ceiling (25% assumption)				
	second floor soffit	2,150	SF	25.00	53,750
	perimeter concrete / CMU wall at second floor soffit	46	SF	25.00	1,150
	perimeter wall at second floor ceiling	232	SF	25.00	5,800
	- suspended ceiling (75% assumption)				
	second floor soffit	6,450	SF	10.00	64,500
	perimeter concrete / CMU wall at second floor soffit	138	SF	10.00	1,380
	below roof diaphragm at lower roof	696	SF	10.00	6,960
	Remove built up roofing for new metal strap	256	LF	10.00	2,560
	Remove existing finishes at perimeter wall and prepare for waterproofing membrane	2,784	SF	5.00	13,920
	Remove existing finishes at perimeter wall and prepare for new plywood wall lining	4,640	SF	5.00	23,200
	Remove floor finishes and concrete screed / topping on second floor	8,600	SF	7.50	64,500
	Temporary barricades and protection	1,720	SF	25.00	43,000
	Miscellaneous				
	Miscellaneous demolition	1	LS	23,772.00	23,772
	Haul and dispose	1	LS	25,000.00	25,000
	TOTAL EXISTING CONDITIONS				**329,492**
3	**CONCRETE**				
	Not Applicable				
	TOTAL CONCRETE				
4	**MASONRY**				
	Not Applicable				
	TOTAL MASONRY				

DETAILED ESTIMATE - B1

	Description	Qty	Unit	Rate	Total
5	**METALS**				
	Seismic tie comprising steel rods with hold-downs each side of glu-lam beams where indicated				
	- intersecting cross beams	10	LOC	1,089.39	10,894
	- longitudinal beams	25	LOC	704.70	17,617
	New anchor bolts including drilling through existing 2 x wood sill and epoxied into top of CMU / concrete wall	114	EA	75.00	8,513
	Prepare existing plywood roof diaphragm and install steel straps	256	LF	45.00	11,520
	Prepare existing perimeter roof beams and install steel straps	276	LF	45.00	12,420
	Hold downs at plywood wall lining	24	LOC	800.00	19,200
	Miscellaneous metals	1	LS	8,016.38	8,016
	Scaffolding, allowance	11,136	SF	3.00	33,408
	TOTAL METALS				**121,588**
6	**WOODS AND PLASTICS**				
	3 x Wood blocking between floor joists	1,075	LF	35.00	37,625
	Wood blocking over openings on second floor	180	LF	35.00	6,300
	Nailing at 2" o.c. at floor diaphragm	19,350	EA	0.84	16,254
	1/2" thick plywood wall sheathing	4,640	SF	10.00	46,400
	Miscellaneous rough carpentry etc	1	LS	15,986.85	15,987
	TOTAL WOODS AND PLASTICS				**122,566**
7	**THERMAL MOSITURE AND WATERPROOFING**				
	Waterproofing to inside face of perimeter walls (assume 6' high)	2,784	SF	25.00	69,600
	Patch built up roofing to match adjacent existing roofing	256	LF	20.00	5,120
	Caulking and sealants	25,112	SF	2.50	62,780
	TOTAL THERMAL MOSITURE AND WATERPROOFING				**137,500**
8	**DOORS AND WINDOWS**				
	Not Applicable				
	TOTAL DOORS AND WINDOWS				
9	**FINISHES**				
	Floor Finishes				
	Cement screed	8,600	SF	5.00	43,000
	Carpet tiles	8,600	SF	10.00	86,000

DETAILED ESTIMATE - B1

	Description	Qty	Unit	Rate	Total
	Interior Finishes				
	Wall Finishes				
	Patch and paint perimeter walls to ceiling height	9,280	SF	10.00	92,800
	Allowance for wall tiles in restroom walls	350	SF	25.00	8,750
	Ceiling Finishes				
	Patch and paint gypsumboard ceiling soffits	2,428	SF	35.00	84,980
	Replace suspended ceiling tiles	7,284	SF	10.00	72,840
	Miscellaneous				
	Make good adjacent finishes, allowances	1	LS	25,000.00	25,000
	TOTAL FINISHES				**413,370**
10	**SPECIALTIES**				
	Not Applicable				
	TOTAL SPECIALTIES				
11	**EQUIPMENT**				
	Not Applicable				
	TOTAL EQUIPMENT				
12	**FURNISHINGS**				
	Not Applicable				
	TOTAL FURNISHINGS				
13	**SPECIAL CONSTRUCTION**				
	Not Applicable				
	TOTAL SPECIAL CONSTRUCTION				
14	**CONVEYING EQUIPMENT**				
	Not Applicable				
	TOTAL CONVEYING EQUIPMENT				
21	**FIRE SUPPRESSION**				
	Not Applicable				
	TOTAL FIRE SUPPRESSION				

DETAILED ESTIMATE - B1

	Description	Qty	Unit	Rate	Total
22	**PLUMBING**				
	Not Applicable				
	TOTAL PLUMBING				
23	**HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)**				
	Allowances for diffuser removal and relocation etc	1	LS	5,000.00	5,000
	TOTAL HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)				**5,000**
25	**INTEGRATED AUTOMATION**				
	Not Applicable				
	TOTAL INTEGRATED AUTOMATION				
26	**ELECTRICAL**				
	Allowances for light fixture removal and relocation etc	1	LS	10,000.00	10,000
	TOTAL ELECTRICAL				**10,000**
27	**COMMUNICATIONS**				
	Not Applicable				
	TOTAL COMMUNICATIONS				
28	**ELECTRONICS SAFETY AND SECURITY**				
	Not Applicable				
	TOTAL ELECTRONICS SAFETY AND SECURITY				
31	**EARTHWORK**				
	Not Applicable				
	TOTAL EARTHWORK				
32	**EXTERIOR IMPROVEMENTS**				
	Not Applicable				
	TOTAL EXTERIOR IMPROVEMENTS				
33	**UTILITIES**				
	Not Applicable				
	TOTAL UTILITIES				

Appendix 4

ASCE 41 Tier 1 Checklists

APPENDIX C
SUMMARY DATA SHEET

BUILDING DATA

Building Name: Campbell Library Date: 7/31/17

Building Address: 77 Harrison Ave, Campbell, CA

Latitude: 37.288 N Longitude: 121.943 W By:

Year Built: 1975 Year(s) Remodeled: 1987 Original Design Code: UBC 1973

Area (sf): 27,0000 Length (ft): 150 Width (ft): 90

No. of Stories: 2 Story Height: 12 Total Height: 24

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:	Concrete-masonry shear walls	Wood shear walls
Vertical Elements:	CMU Walls / Steel Columns	Stud walls / Steel Columns
Diaphragms:	5/8" Plywood	1/2" Plywood
Connections:	Sill plate and anchor bolts	Wood Blkg and nails

EVALUATION DATA

BSE-1N Spectral Response Accelerations: S_{Ds} = 1.056 S_{D1} = 0.601

Soil Factors: Class = D F_a = 1.0 F_v = 1.5

BSE-1E Spectral Response Accelerations: S_{XS} = 1.010 S_{X1} = 0.548

Level of Seismicity: High Performance Level: Immediate Occupancy

Building Period: T = 0.91 sec

Spectral Acceleration: S_a = 1.01

Modification Factor: $C_mC_1C_2$ = 1.1 Building Weight: W = 936 kips

Pseudo Lateral Force: V= 1.11 W

$C_mC_1C_2S_aW$= 1039 kips

BUILDING CLASSIFICATION:

REQUIRED TIER 1 CHECKLISTS	Yes	No
Basic Configuration Checklist	☒	☐
Building Type _____ Structural Checklist W2 / RM1	☒	☐
Nonstructural Component Checklist	☐	☒

FURTHER EVALUATION REQUIREMENT:

Project: Campbell Library Location: Campbell, CA

Completed by: GJT Date: 7/17/17

16.1.2IO IMMEDIATE OCCUPANCY BASIC CONFIGURATION CHECKLIST

Very Low Seismicity

Building System

General

(C) 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)

(C) 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 need not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)

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. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)

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 shall not be less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)

(C) NC N/A U SOFT STORY: The stiffness of the seismic-force-resisting system in any story shall not be 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 stiffnessof the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)

(C) 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)

(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. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)

(C) 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)

(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. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

Low Seismicity: Complete the Following Items in Additionto 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 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)

(C) 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)

(C) 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)

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 $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)

(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. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)

Project: Campbell Library Location: Campbell, CA

Completed by: GJT Date: 7/17/17

16.3IO IMMEDIATE OCCUPANCY STRUCTURAL CHECKLIST FOR BUILDING TYPE W2: WOOD FRAMES, COMMERCIAL AND INDUSTRIAL

Very Low Seismicity

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-2. (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)

(C) NC N/A U HOLD-DOWN ANCHORS: All shear walls have hold-down anchors, constructed per acceptable construction practices, attached to the end studs. (Commentary: Sec. A.3.2.7.9. Tier 2: Sec. 5.5.3.6.6)

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)

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. (Commentary: Sec. 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 shall not exceed one story high. (Commentary: Sec. A.6.2.4)

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 NARROW WOOD SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 1.5-to-1 are not used to resist seismic forces. (Commentary: Sec. A.3.2.7.4. Tier 2: Sec. 5.5.3.6.1)

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 PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)

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 1-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 12 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 30 ft and aspect ratios less than or equal to 3-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 4 ft or less, with proper edge and end distance provided for wood and concrete. (Commentary: Sec. A.5.3.7. Tier 2: Sec. 5.7.3.3)

Project: Campbell Library Location: Campbell, CA

Completed by: GJT Date: 7/17/17

16.15IO IMMEDIATE OCCUPANCY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS AND RM1A: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS

Very Low Seismicity

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 reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in.^{2}. (Commentary: Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1)

(C) 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)

Connections

(C) 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)

C (NC) N/A U TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)

(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. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)

(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)

C (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)

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)

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)

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. (Commentary: Sec. 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 shall not exceed one story high. (Commentary: Sec. A.6.2.4)

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 REINFORCING AT WALL OPENINGS: All wall openings that interrupt rebar have trim reinforcing on all sides. (Commentary: Sec. A.3.2.4.3. Tier 2: Sec. 5.5.3.1.5)

(C) NC N/A U PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than 30. (Commentary: Sec. A.3.2.4.4. Tier 2: Sec. 5.5.3.1.2)

Diaphragms (Stiff or Flexible)

C NC N/A U OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% 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 4 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)

C NC N/A U PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)

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)

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 STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 1-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 12 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 30 ft and aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)

C NC N/A U 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 and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. Tier 2: Sec. 5.6.3)

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 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)