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June 23, 2014

Mr. Craig Dierling, P.E.
Engineering Division
City of Lompoc
100 Civic Center Plaza
Lompoc, CA 93438

Subject: Seismic Evaluation
Fire Station #1
115 South G Street, Lompoc
ESH 14-011

Dear Mr. Dierling:

We have completed our seismic evaluation of Fire Station #1. This letter is the report of our findings. Our scope of work included reviewing the Additions and Alterations drawings (Hall and Visioni, 1977) and Foundation Exploration report (Pacific Materials Lab, 1977), reviewing the Project No. FY-90-F-1 Renovation drawings (Anton & Associates, 1990), observing the existing condition of the structure in areas exposed to view, reviewing the results of the masonry investigation report (Earth Systems Pacific, 5/1/2014), and completing a limited structural review and analysis based on Tier 1 procedures within ASCE 31 Seismic Evaluation of Existing Buildings. It is our understanding that the purpose of our work is to provide the City with cost and schedule information that can be used to apply for grant funding to design and construct necessary seismic upgrades to the facility. Our scope of work did not include evaluation of the impacts or costs associated with relocating Fire Department personnel and equipment during construction.

Executive Summary

In our opinion, the building is very likely to be partially or completely non-functional as a fire station if subjected to current building code design level earthquake forces. Although we have identified many potential deficiencies in the seismic force-resisting system, the most serious is the deficient connections of the wood-framed roofs (and second floor) to the masonry walls in all parts of the facility. Failure of these connections would likely lead to partial collapse of the roofs and walls.

Structure Description

The facility consists of three generations of buildings. The oldest is the "old jail", believed to have been built sometime between 1920 and 1950. It is a concrete building of 500 sf. It is located at the northwest corner of the property, and is used for storage.

The next building is the training room, restroom, and equipment bays, built in approximately 1957. It is approximately 2300 sf and has a wood-framed roof, reinforced 8" masonry block walls and concrete footings. The 1990 renovation project work included: indoor remodeling, adding sloped framing above the roof to improve drainage, and adding a roof at the western-most bay, which is connected to the sloping roof of the old jail.

The newest building is the 6500 sf front building, built in 1977. It includes the one-story apparatus bay, hose tower, and two-story offices and living quarters. It is separated from the adjacent building by a 2 inch wide seismic joint. It has a wood-framed roof and second floor, reinforced 8" masonry block, and concrete footings. The roofs are mostly flat, with sloping roofs along the front of the building and at the hose tower.

The emergency generator is located within a shed structure with masonry walls and a wood-framed roof, located directly south of the old jail. The generator fuel tank is located directly south of the generator shed.

Condition Survey

A visual survey of the framing was completed by walking through the structure and looking at exposed roof framing in most areas. In areas with suspended ceilings, tiles were removed to view the framing. Assessments of structural integrity are qualitative in nature and were made using engineering judgment. Structural analysis of the existing framing to evaluate load carrying capabilities was not performed. The buildings appear to be well maintained and in good condition.

The old jail was observed to have concrete walls and roof. Reinforcing steel is presumed to exist (based on the needed resistance to inmate escapes) but was not investigated due to the high likelihood of the detailing being insufficient to provide the ductility necessary in an Immediate Occupancy structure.

The middle building's wood-framed roofs were observed from below and significant deterioration of plywood or framing was not noted. Roof-to-wall connections were observed to be present in some areas but were noted to be mis-installed or of outdated design and strength. Masonry walls were confirmed to be reinforced and solid grouted. Concrete foundations were not observed but are presumed to be reinforced due to the era of construction.

The front building's wood-framed roofs and second floor were observed from below and significant deterioration of plywood or framing was not noted. Connections shown on the original construction drawings were spot-checked in many locations and no discrepancies were found. In accordance with the drawings, masonry walls were confirmed to have grout only in cells with reinforcing.

ASCE 31 Tier 1 Evaluation

ASCE 31, Seismic Evaluation of Existing Buildings, is a national consensus standard for the seismic evaluation of buildings. In accordance with this standard, a Tier 1 evaluation of the primary structural systems, site geologic hazards, and nonstructural components was used to seismically evaluate the 1957 and 1977 buildings.

Tier 1 Evaluation Check List: The buildings have been evaluated using Checklists required by ASCE 31 Table 3-2 for High Seismicity and Immediate Occupancy performance. The checklists are: Basic Structural, Supplemental Structural, Geologic Site Hazard and Foundation, Basic Nonstructural, Intermediate Nonstructural, and Supplemental Nonstructural.

Tier 1 Noncompliant Statements: The statements listed below were identified as non-compliant.

1. ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy.

   Explanation: The 2 inch seismic joint may not be enough to prevent the buildings from impacting each other during an earthquake.

   Mitigation: Fill the gap with grout and tie the buildings together.

2. SOFT STORY: The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety or Immediate Occupancy.

   Explanation: This occurs at the north wall of the front building.

   Mitigation: Additional structural analysis will likely show that this item does not need to be mitigated.

3. TRANSFER TO SHEAR WALLS: Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy.

   Mitigation: Install additional ledger bolts.

4. CROSS TIES: There shall be continuous cross ties between diaphragm chords.

   Mitigation: Install additional straps and blocking.

5. OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy.

   Mitigation: Install additional ledger bolts, straps and blocking, and through-bolts to tie the two adjacent block walls together at the south-side of the stair opening.

6. OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy.

   Mitigation: Install additional ledger bolts, straps and blocking, and through-bolts to tie the two adjacent block walls together at the south-side of the stair opening.

7. PLAN IRREGULARITIES: There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only.

   Mitigation: Install new drag members and connections.

8. DIAPHRAGM REINFORCEMENT AT OPENINGS: There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only.

   Mitigation: Install straps and blocking.

9. UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy.

   Mitigation: Install flat blocking at unsupported plywood edges on roofs and second floor.

10. STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors.

    Mitigation: Install additional wall anchors with straps and blocking at roofs and second floor.

11. EMERGENCY LIGHTING: Emergency lighting shall be anchored or braced to prevent falling during an earthquake.

Mitigation: Install bracing.

12. TALL NARROW CONTENTS: Contents over 4 feet in height with a height-to-depth or height-to-width ratio greater than 3-to1 shall be anchored to the floor slab or adjacent structural walls. A height-to-depth or height-to-width ration of up to 4-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2.

    Mitigation: Anchor to walls.

13. ATTACHED EQUIPMENT: Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced.

    Mitigation: Brace to walls or roof.

14. FLEXIBLE COUPLINGS: Fluid, gas, and fire suppression piping shall have flexible couplings.

    Mitigation: Install flexible couplings.

15. INTEGRATED CEILINGS: Integrated suspended ceilings at exits and corridors or weighing more than 2 pounds per square foot shall be laterally restrained with a minimum of four diagonal wires or rigid members attached to the structure above at a spacing equal to or less than 12 feet.

    Mitigation: Replace suspended ceiling.

16. INDEPENDENT SUPPORT: Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures.

    Mitigation: Replace with ceiling.

17. TOPS: The tops of framed or panelized partitions that only extend to the ceiling line shall have lateral bracing to the building structure at a spacing equal to or less than 6 feet.

    Mitigation: Brace second floor partitions to roof.

18. EDGES: The edges of integrated suspended ceilings shall be separated from enclosing walls by a minimum of 1/2 inch.

    Mitigation: Install new suspended ceiling system.

19. GLAZING: All exterior glazing shall be laminated, annealed or laminated heat-strengthened safety glass or other glazing system that will remain in the frame when glass is cracked.

    Mitigation: Install laminated glass or safety film.

20. FILE CABINETS: File cabinets arranged in groups shall be attached to one another.

Mitigation: Interconnect cabinets.

21. HEAVY EQUIPMENT: Equipment weighing over 100 pounds shall be anchored to the structure or foundation.

    Mitigation: Anchor all equipment.

22. DOORS: Mechanically operated doors shall be detailed to operate at a story drift ratio of 0.01.

    Mitigation: Replace apparatus bay roll-up doors.

23. GAS CYLINDERS: Compressed gas cylinders shall be restrained.

    Mitigation: Install restraints at bottom of cylinders.

Construction Costs

The Rough Order of Magnitude cost estimate is based on the seismic deficiencies indicated by the Tier 1 review. Significant deficiencies are recommended to be mitigated, and costs for removal and replacement of architectural materials and finishes are also included. The old jail is included as a demo and rebuild item due to the unknown detailing of the (presumably) reinforced concrete roof and walls, which is unlikely to provide the strength and ductility required for an Immediate Occupancy structure. Replacement of the Generator Shed is included due to its proximity to the rebuild of the old jail.

Allowances (limited budget inclusions) are included for hazardous material abatement, ADA compliance, and nonstructural equipment anchorage. These allowances are based on our team's experience but are subjective in nature.

The Design Contingency of 20% is an allowance which is intended to account for the fact that the budget is based on preliminary structural analysis but the final retrofit design may include items not currently identified.

Estimated professional design fees, inspection and testing costs, and the City's construction management costs are included in the estimate. Also, an Owner's contingency of 10% has been included at the request of the City.

Based on the information above, the Rough Order of Magnitude total project cost estimate is $3,266,514.

Conclusions

In conclusion, we believe that the seismic deficiencies identified by the Tier 1 review should be corrected in order for the Fire Station #1 to remain operable after a design-level earthquake. The urgency of the upgrades, or acceptability of the continued use without upgrades, are questions which are beyond the scope of work done to prepare this report and are risk management decisions that must be made and accepted by the City of Lompoc.

Limitations

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers practicing in the structural field in this or similar localities at this time. No other warranty, expressed or implied, is made as to the professional opinions and advice included in this report. This report has been prepared for the City of Lompoc to be used solely in its evaluation of the structure. The report has not been prepared for use by other parties and may not contain sufficient information for purposes of other parties or other uses.

We appreciate this opportunity to be of service to the City of Lompoc. We would be pleased to meet with you to discuss our findings in more detail and to answer any questions that you may have. In the meantime, should you have any questions or need further information, please do not hesitate to call us.

Very truly yours,

EHLEN SPIESS & HAIGHT, INC.

a California corporation

Jeffrey E. Haight S.E. 4313

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Attachments:

1. ROM Budget Summary
2. Budget Assumptions and Clarifications
3. ROM Baseline Schedule