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DIALOG
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RE: BUSD Corp Yard at 1720 Oregon St: Structural Observations

Dong,

ZFA conducted a site walk on November 8, 2021 and November 19, 2021 to conduct visual observations of the structures at Berkeley Unified School Districts' (BUSD) Corp Yard located at 1720 Oregon St. ZFA was contracted to provide visual observations of structural material degradation and provide conceptual recommendations for remediation or repair, and consider any applicable code triggers.

BUILDING DESCRIPTION

BUSD's Corp Yard consists of two permanent structures around a central interior courtyard, 1720 Oregon St which is a U shape, and 1707 Russel Street which spans east to west and forms the final edge closing in the courtyard, see Figure 1 below. The structures total approximately 32,000 square feet each and are used for offices, storage, repair areas, restrooms, and mechanical/utility work spaces. The complex is not accessible or used by students.

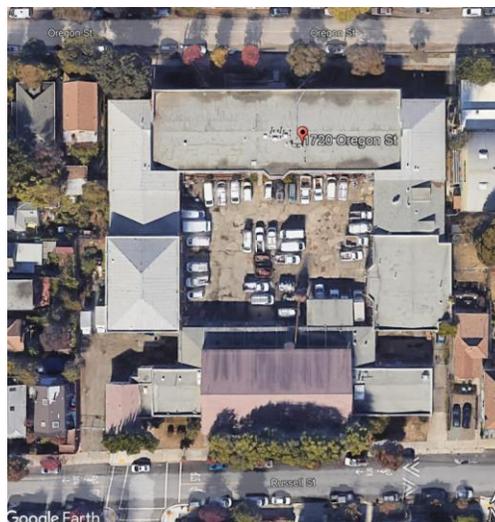


Figure 1: Aerial view of subject property from Google Earth

Both of these 1915 structures are formed of Unreinforced Masonry (URM) bearing walls, see Figure 2. This is also observed in the Facility Condition Assessment (FCA) by EMB Group dated October 23, 2018. The structures have wood-framed floors and roofs, and interior wood-framed walls. They were constructed as Edison Junior High School and used as such until 1933 when the Field Act was enacted. The Field Act, formally known as the Safety of Design and Construction of Public School Buildings Act, was California's first major earthquake safety policy. Students were moved out of the building at that time it has since been used for various purposes including housing BUSD's maintenance department.



Figure 2: Photos of the exterior URM bearing walls and the original construction year emblem

The 1720 Oregon St structure is a single-story with a two-story portion in its west wing, see Figure 3 below. The main central wing was originally a two-story structure, but the second floor was removed after Field Act was enacted and a fire event, and a wood roof now tops the single-story space. Both the East and West Wings were also originally constructed as two stories and were later mostly reduced to a single story. There is a remaining two-story portion of the West Wing on the south side accessed by exterior stairs. The East and West Wings also have basements that are not used due to water infiltration, see the Recommendations section for further information.



Figure 3: U-shaped 1730 Oregon St structure highlighting two-story portion

The 1707 Russel St structure was originally constructed as a double-height gymnasium space with shorter locker room wings off of each end, see Figure 4. The gymnasium space has a gabled roof supported by wood trusses and currently houses a shop and storage mezzanines.



Figure 4: 1707 Russel St

STRUCTURAL CONDITION FINDINGS/RECOMMENDATIONS

The following recommendations and findings are based on ZFA's site walks on November 8, 2021 and November 19, 2021. The recommendations and findings are based solely on visual observations and reasonable assumptions based on previous experience with similar construction. No destructive testing took place, and existing drawings were not available for review. The following documents were made available for ZFA's review:

- *Building and Site Assessment for the Oregon/Russel Street Facility* dated March 10, 2005 by Baker Vilar Architects
- *Facility Condition Assessment for Plant O and M* by EMG dated October 23, 2018
- Entry for the subject property, formerly called Edison Junior High School, in the Alameda County's Historic Properties Directory
- Entry for the subject property in the State of California's Resource Agency Department of Parks and Recreations' Historic Resources Inventory

Following are the findings and recommendations based on ZFA's structural observations. These recommendations and findings are generally limited to structural elements. Accessibility, Fire Life Safety, weatherproofing, and other areas outside of our expertise is not included in our scope. Where we do identify such items that appear obvious based on our limited knowledge, we recommend further study by the appropriate subject matter expert.

1. **Finding:** Precast elements that are let into the exterior URM walls are cracked and falling, see Figure 5 below.



Figure 5: Photos of cracked and falling precast elements at windows

Recommendation: On site, the hazard was identified, and recommendations were provided to either restrict access to locations subject to falling hazard with a physical barrier or provide plywood shoring over these locations. Further, ZFA recommended removing loose concrete and protect area from water damage until permanent action can be taken. As observed in a subsequent site visit, the loose segments have been removed. While the hazard has temporarily been removed, other precast elements will likely deteriorate and the removal of the precast comprises the exterior envelope, hence the “temporary” status qualifier. We recommend continued monitoring and mitigation of these deteriorating elements until permanent action is taken.

2. **Finding:** The exterior egress stairs at the West Wing on the south side are unstable due to material deterioration and unsafe to walk on.



Figure 6: Exterior egress stairs at the West wing on the South side

Recommendation: Provide barrier restricting access to these stairs/the second floor or provide supplemental support. It is our understanding that this second floor space is not used often, so we do not expect that restricting access will have operational effects. Additional wood framing supports were observed in a subsequent site visit; hazard has been temporarily mitigated.

3. **Finding:** At the access door to the carpenter shop, there is an opening which used to have a brick arch. This arch was removed, but the concrete bond beam was left hanging, see Figure 7.



Figure 7: Remaining concrete bond beam at removed arch at Carpenter Shop entrance

Recommendation: While not an imminent hazard, this is a structural concern. It needs to be determined if the arch is historic and needs to be replaced, or if the structure can remain without the arch. If remaining in the current condition is architecturally and historically acceptable, the gravity loading to the bond beam will be analyzed and it is likely that a replacement concrete or steel beam will be provided. Therefore, there is no imminent hazard but there is a created structural deficiency that should be corrected.

4. **Finding:** The historic furnace is used now used as an exhaust point, see Figure 8. When air blows through, it vibrates the brick structure. This brick structure has extensive and structurally significant cracks – it is structurally compromised and ongoing use will lead this to become an imminent hazard.



Figure 8: Historic furnace

Recommendation: This furnace is located in an accessible area of the courtyard adjacent to regularly used parking. Due to extensive cracking, the URM will eventually pose an imminent falling hazard. If furnace is to remain for historic purposes, the brick walls will need to be repointed and mortar replaced, fixing the bricks. More importantly, provide a steel or concrete structure on the brick's interior (possibly exterior if permitted) to reliably support the structure.

5. **Finding:** Door jamb has localized damage: missing bricks and damaged mortar.



Figure 9: Localized damage at existing door jamb

Recommendation: This is not an imminent hazard but serves as further evidence of the URM's deterioration. During future building work, fix this and several other localized damaged areas.

6. **Finding:** In the main workshop area of 107 Russel St, one of the supporting diagonals of one of the trusses was cut, see Figure 10.



Figure 10: Missing truss diagonal shown in on the right, and truss with both diagonals on the left

Recommendation: Replace the removed supporting diagonal in kind. However, this will need to be coordinated with other mandatory strengthening requirements, as discussed later.

7. **Finding:** There is an aged heater hanging over a work area in the main workshop area, see Figure 11.



Figure 11: Unbraced hanging heater at the main workshop area

Recommendation: Remove the heater if it's not functional, otherwise brace as part of the mandatory upgrade requirements/best practices. Bracing to likely include either Unistrut or cable bracing and hangers.

8. **Finding:** There is evidence of extensive water damage in all buildings, see Figure 12 and 13.



Figure 12: Water damage at ceiling



Figure 13: Evidence of water damage and peeling paint

Recommendation: Identify and remedy the source of the water leak. Remove existing finishes and any damaged structural members and replace in kind. Engage an expert to identify interior mold and/or other hazardous material issues and provide recommendations for repairs. Coordinate this work with mandatory strengthening requirements discussed later.

9. **Finding:** There is an electrical box directly adjacent to an opening in a structural URM wall, see Figure 14. This is an example of several created structural deficiencies not

permitted by code. Other items include penetrations created in basement walls that are not reinforced and compromise the wall's structural integrity.



Figure 14: Electrical box immediately adjacent to opening in URM wall

Recommendation: This electrical box was inset into an existing URM wall, making that wall too thin to be able to span from floor to roof framing in the out-of-plane direction. While not more of an imminent hazard than the entire building being URM, this is a structural deficiency and should be addressed in future work on the building. Again, coordinate with mandatory strengthening requirements.

10. Finding: There is significant water ingress from various sources in the subterranean basement, see Figure 15 and 16. This has been an ongoing issue for at least 16 years as the 2005 Assessment notes also that “the basement is not used due to continual flooding from an unknown source.”



Figure 15: Significant water ingress at basement



Figure 16: Basement after water drained, previous water level can be seen on concrete basement wall

Recommendation: As this area is not intended for use nor has it been used in over a decade due to longstanding water infiltration issues, we recommend mitigating the water ingress by filling the basement with Cell-Crete (cellular concrete). Cell-crete is an engineered lightweight foam concrete often used for bulk filling of disused subterranean structures and pipes, approaches to bridges and other civil applications. This Cell-Crete would extend to slightly above the elevation of the sill of the window shown in Figure 15 above so that the basement will no longer fill with water. The source of the water should also be considered and investigated as part of any and all civil works at the site.

11. Finding: A large opening was created in the concrete basement wall, see Figure 16 above.

Recommendation: The opening results in a reinforced concrete girder beam above the opening that was not designed for these loads nor does it have appropriate bottom reinforcement. Repair of this created structural deficiency should be coordinated with the mandatory requirements noted below. Wood posts have been installed to support the girder; there is no imminent hazard due to the implementation of temporary supports.

12. Finding: There are numerous penetrations in the brick walls for old pipes.

Recommendation: This is not an imminent hazard but serves as further evidence of existing issues with the URM walls. During future work, the brick wall around these penetrations should be repaired and strengthened.

13. Finding: Significant deterioration of existing URM bearing walls. In general, the URM bearing walls appeared in poor to fair condition. As noted in both previous assessments, a significant portion of the mortar and brick appeared deteriorated throughout the buildings.

Recommendations: Not only are the URM walls deteriorated, but URM buildings are a known seismic hazard. Therefore, it is prudent to consider the immediate safety of the building's occupants in such a seismically defective structure, and also the possible structural retrofit requirements that may come to light during or be triggered by other repairs at the site. Further recommendations are described below.

URM BUILDINGS: PERFORMANCE AND CODE REQUIREMENTS

The primary cause of the poor URM building performance lies in the inherent brittleness of masonry elements and the lack of tensile strength and ductility. Earthquake forces oscillate, and after a crack occurs in brittle masonry without reinforcing, subsequent earth pulses can cause them to widen and can eventually lead to uncontrolled displacement and collapse of masonry elements. The low mortar cohesion also makes them prone to shedding masonry off of the tops of walls and the separation of the walls from the floor and roof diaphragms. For these reasons, **URM buildings can pose more significant life loss and economic risks than other structures.**

Accordingly, both Berkeley's Municipal Code and California legislature address Unreinforced Masonry Buildings specifically. In 1986, California enacted a comprehensive URM Law that required local governments in high seismicity regions to identify URM buildings and establish risk reduction programs¹. This law also required unretrofitted URM Buildings to have warning placards at each entrance, one of which can be seen at the main entrance to the subject building in Figure 17 below.



Figure 17: Placard at entrance indicated the building does not meet structural standards for earthquake safety

In accordance with the state law, the City of Berkeley adopted Chapter 19.38 titled Seismic Hazard Mitigation Program for Unreinforced Masonry Buildings². In this law, potentially hazardous URM buildings are:

1. A building which was constructed prior to 1956, with masonry bearing walls containing seismic reinforcement at a level less than the minimum prescribed in the City of Berkeley "Standards for the Seismic Analysis of Unreinforced Masonry Buildings," and is approved for commercial or mixed use occupancy, or contains five or more living units; OR
2. A building which is located on a street in a high pedestrian traffic corridor and
 - a. Contains at least one brick in-fill wall; OR
 - b. Has a brick veneer ten feet in height or greater (measured from the adjoining grade); OR
3. Has an unreinforced parapet that exceeds a one and one-half height/depth ratio.

¹ Ca.Gov. The Unreinforced Masonry Building Law, State of California Statutes, Government Code Section 8875, 1986. https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=GOV§ionNum=8875

² See the City of Berkeley's website for more information:

https://www.cityofberkeley.info/Planning_and_Development/Building_and_Safety/Unreinforced_Masonry_Buildings.aspx

The subject property fits into category 1. However, it is not currently on the inventory list of URM buildings in Berkeley, which could be an administrative oversight that dates back to 1973 when the building complex was converted from educational to administrative and plant operations functions and moved from under the Division of State Architecture (DSA) to the local (City of Berkeley) jurisdiction. In Chapter 19.38, it explicitly states that the “inventory shall be maintained and revised as necessary by the building official,” so should the building official become aware of this URM building, we would expect it to become a member of the inventory and thus subject to the provisions of this chapter. Additionally, as it stands, even if the building official decides not to add the structure, URM buildings are known to pose a significant life safety hazard in the event of an earthquake and have a strong likelihood of failing, so structural retrofit is best practice. Subject to verification of these findings, due to the building’s condition and the URM hazard, **this building does not meet current code and should not be occupied.**

For a building that does not meet prescriptive standards, this Chapter 19.38 requires submittal of a seismic evaluation report, a building permit, written notice to building tenants, and a seismic upgrade each building. As this building may be a contributor to historic resources, Chapter 19.38 states it shall be retrofitted in accordance with the State Historical Building Code. The seismic retrofit of URM structures is likely to involve either steel framing or concrete shear walls. Interior steel moment and/or braced frames could be added for seismic loading and also used as a secondary gravity support system. The steel frame would allow the historic brick aesthetic to remain while necessary structural support is provided. If preferred, concrete shear walls are an alternative to steel framing but would cover historic brick on the interior side, preserving the exterior aesthetics. In addition, a retrofit is likely to include diaphragm strengthening and an extensive survey of the existing brick, and repairs would be as needed at deteriorated or missing masonry (injecting cracks with epoxy, repointing of bricks, and possibly rebuilding at select locations). Therefore, the extensive retrofit scope and cost for URM buildings are typically on the high end of the spectrum. While cost estimating is outside of ZFA’s area of expertise, purely structural retrofit costs for buildings of a similar age and structure have been on the order of up to a \$100 per square foot (before the 2020 coronavirus pandemic).

FINAL RECOMMENDATIONS AND NEXT STEPS

While there are a number of smaller scope repairs identified in this letter that should be addressed, the deficiencies of the superstructure itself outweigh these concerns. Based on our review of the applicable building codes, the current state of the structure, and the widespread knowledge of the significant seismic hazards associated with unretrofitted URM buildings, we state and strongly recommend that this building complex does NOT meet current code (with consideration of grandfathering provisions). Further, they are not in conformance with original code, have not been strengthened in accordance with mandatory upgrades, and therefore, should not be occupied until structural seismic retrofit has occurred. We have assisted staff in mitigating imminent hazards and recommend localized and sorely needed repairs only be completed in conjunction with a seismic retrofit.

Should you have questions, please contact the undersigned.

Regards,

A handwritten signature in black ink, appearing to read "Mark A. Moore". The signature is fluid and cursive, with the first name "Mark" and last name "Moore" clearly distinguishable.

Mark A. Moore, SE
ZFA STRUCTURAL ENGINEERS
Executive Principal