October 26, 2022

David Rostrom
Director of Facilities Services
Jordan School District
7905 South Redwood Road
West Jordan, UT 84088

Reference: **West Jordan Elementary School Structural Evaluation**

Dear Dave,

Calder Richards Consulting Engineers (CRCE) was contracted by Jordan School District to provide a structural assessment of the existing West Jordan Elementary School building located at approximately 7220 South 2370 West in West Jordan, Utah. It is our understanding the district is working to determine future utilization of the building. The purpose of this report is to provide a summary of the structural findings and to offer recommendations that can aid the district in deciding how to proceed. CRCE's evaluation was qualitative in nature. This report is based on limited structural observations performed on site, as well as a review of record architectural and structural drawings that were provided by the district.

Description of the Existing Building's Structural System

An initial site visit was made on October 4th, and a more in-depth observation was completed on October 14th. The majority of time was spent observing the crawl space as it was reported to have some damage, which will be described in more detail later in this report. Some of the roof framing was also observed though it was mostly concealed by a layer of sheetrock. The remainder of the structural elements were obscured by finishing materials and unobservable. All other information about the building was obtained from a review of record drawings provided by the district.

It is our understanding that the original building was constructed in 1982. The existing structure was built utilizing two different building types in two phases. The first is the center core that houses the cafeteria and kitchen, which consists of a steel roof deck and open-web steel roof joists supported by reinforced masonry bearing walls and conventional concrete foundation walls on footings. The second phase is the remainder of the structure surrounding the core on three sides, which is made up of modular structures connected together. Each module has a roof of plywood sheathing and 2x8 wood joists supported by open-web steel trusses or wood stud bearing walls. The roof and walls are supported by a floor system consisting of 2x6 wood joists with plywood sheathing, all supported by steel wide flange beams. The steel beams are supported predominantly on steel jacks on concrete footings, while some were bearing on small masonry piers over concrete footings.

No structural damage was observed in the center core structural elements, although it should be noted that only the masonry walls and some portions of the foundation were visible. Assuming there has been no damage to this area (e.g., from water damage to the roofing system), it is very plausible that this portion of the structure is still in good condition. Should the district decide to continue using this core area, we recommend they do an assessment of the roof elements to determine whether they have been damaged in any way. While the structural elements of the core appear to be, and may be entirely, in good condition, this does not mean that these elements meet current building code requirements. In particular, there may be some inadequacies with respect to the lateral-force resisting system (LFRS) of the building that is required to support the building as a whole during a major seismic event.

Damage was observed in several areas of the surrounding modular structures of the building. The damage was mainly confined to the floor framing and foundation systems near the exterior of the building, and predominantly near the entrances. It is our understanding that most, if not all, the damage is due to a buildup of, and long-term exposure to, moisture from above. It is likely that the buildup of moisture resulted from occupants leaving water in and near the vestibules after picking it up from outside and entering the building during the rain and snow filled seasons. Structural elements that have been damaged from moisture accumulation include the plywood floor sheathing, 2x6 floor joists, the steel girders below, as well as some of the steel jacks (see attached photos). Some of the damaged elements appear to have been replaced. However, there is a significant amount of these that remain damaged. The upper walls and roof framing of the modular structures appeared to be in good condition from areas that could be observed.

Options for Possible Modifications and Continued Use

It is our understanding the district is weighing several options that can be summarized below. Each option will be addressed from a structural standpoint.

- Option 1 – Keep the center core area (kitchen/gym/cafeteria) as well as the surrounding modular structures (administrative rooms/classrooms/etc.) and only repair the observed elements that have been damaged or are in disrepair.
- Option 2 – Keep the center core area. Demolish the surrounding modular structures and rebuild these spaces using more conventional structural systems.
- Option 3 – Demolish the entire building and rebuild it using more conventional structural systems.
- Option 4 – Demolish the entire building and relocate the students and faculty to another school(s).

Before addressing each option in detail, a brief explanation of requirements from the International Building Code (IBC) as well as the International Existing Building Code (IEBC) will be given as background. Alterations made to the existing school will be governed by both the IBC and, in particular, the IEBC. The various options will trigger different requirements from the codes based on what is being done and how it affects the remaining structural elements.

Option 1

The first option includes keeping the structure as a whole and only repairing damaged elements as needed. As the occupancy type will not change and because the alterations are confined to repairing existing elements that are damaged, the building will not require extensive structural analysis or design, only that necessary to make adequate repairs. It is clear from the attached photos that there is significant corrosion in the steel beams and steel jacks that support the floor system. Some of the wood framing and sheathing, which was covered, may also have significant deterioration as some of these were previously replaced. A more detailed assessment of the extent of the damage will be necessary to determine which elements require replacement, but the undamaged portions of the structure may remain as is. Should this option be chosen, CRCE recommends making these modifications as soon as possible to avoid further deterioration and any accidents that could result from a structural failure of the affected members. We also recommend exploring methods to inhibit moisture from reaching the structural elements in the future to avoid continual deterioration.

It should be noted that making repairs alone to these specific locations will not affect the building's ability to adequately resist movement during a major seismic event and will not bring the building up to current code requirements. The LFRS of modular portions of the building are unconventional for the seismicity along the Wasatch Front, especially the foundation system of steel jacks supporting the floor framing. The ability of the steel jacks to resist horizontal and vertical movement from a major seismic event are suspect and the jacks to not appear to have a positive attachment to either the footings below or the steel beams above – the framing is simply bearing on the jacks and the jacks are resting on the footings. It is our opinion the modular portions of the building may not fair well during a significant earthquake. The center core will likely fair better than the modular areas in an earthquake, though it would require a complete analysis to determine its ability to resist current code prescribed seismic forces.

The district can elect to make upgrades to the seismic LFRS. Under option 1, making such upgrades would be voluntary and the district could choose the extent of what upgrades they would like to make. Depending on the options chosen, these upgrades could be done all at once or over a period of time. However, most of the upgrades will likely involve the foundation system and constructing these in the crawl space of an existing structure will be challenging and likely expensive.

<u>Option 2</u>

The second option involves demolishing the existing modular structures, leaving the core area in place, and rebuilding the necessary rooms around the core using more conventional structural systems. Proceeding with this option solves the problem with the damage to the modular structures' floor and foundation elements. The new construction may be attached to the core structure, though doing so will likely trigger a complete analysis of the existing masonry structure and may require some retrofit design and construction. As an alternative, the new construction may be completed separate from the existing core utilizing an expansion joint. Keeping the new and existing construction separate will allow for more flexibility in the new construction and precludes the need for further structural analysis and modifications to the core.

While no building is "earthquake proof," designing and constructing the new portions using conventional methods will provide a more resilient and safe building and will meet all current code requirements of the IBC. As stated in Option 1, the remaining core area will likely not meet current code requirements and if no modifications are made, it is unclear how this remaining portion of the building will fair. Again, the district may make voluntary upgrades to the core to increase its strength and resiliency.

<u>Options 3 and 4</u>

As part of both Options 3 and 4, the existing building will be demolished in its entirety and either rebuilt, or not. The new building will be required to meet all current requirements under the IBC, will meet the current standards of practice both in design and construction, and will produce a building that has the best chance of resisting forces due to a major seismic event relative to the current body of knowledge.

Summary

There is significant deterioration in the floor framing elements and the steel jacks that support them. Should Option 1 be chosen, and most of the existing structure including the modular portions remain, the damaged portions should be addressed as soon as possible to avoid accidental injury or property damage. Option 1 will not require additional upgrades to the building, though CRCE recommends that this be considered as the existing building does not meet all current building code requirements as they relate to the building's ability to withstand a major seismic event and we have concerns specifically with how the modular portions will behave during an earthquake. Option 2 will alleviate the issues of the damaged floor and foundation system and will require the classrooms and administrative areas surrounding the core to be designed and constructed to meet current code requirements. Option 2 may not require upgrades to the existing core, though CRCE recommends that the remaining portion at least be analyzed to determine it adequacy. Demolishing the entire existing building (Options 3 and 4) will solve the issues related to the damaged structural elements, and Option 3, should it be chosen, will also require a new building that will be designed and constructed to meet current building code requirements.

We appreciate the opportunity to provide the district with a rudimentary analysis and the findings contained in this report. Should you or the district have any questions or further concerns, please do not hesitate to reach out to us.

Respectfully,

Nolan Balls

Nolan Balls P.E., S.E.

PROFESSIONAL STRUCTURAL ENGINEER
NOLAN K. BALLS
#5148296
10-26-22
STATE OF UTAH

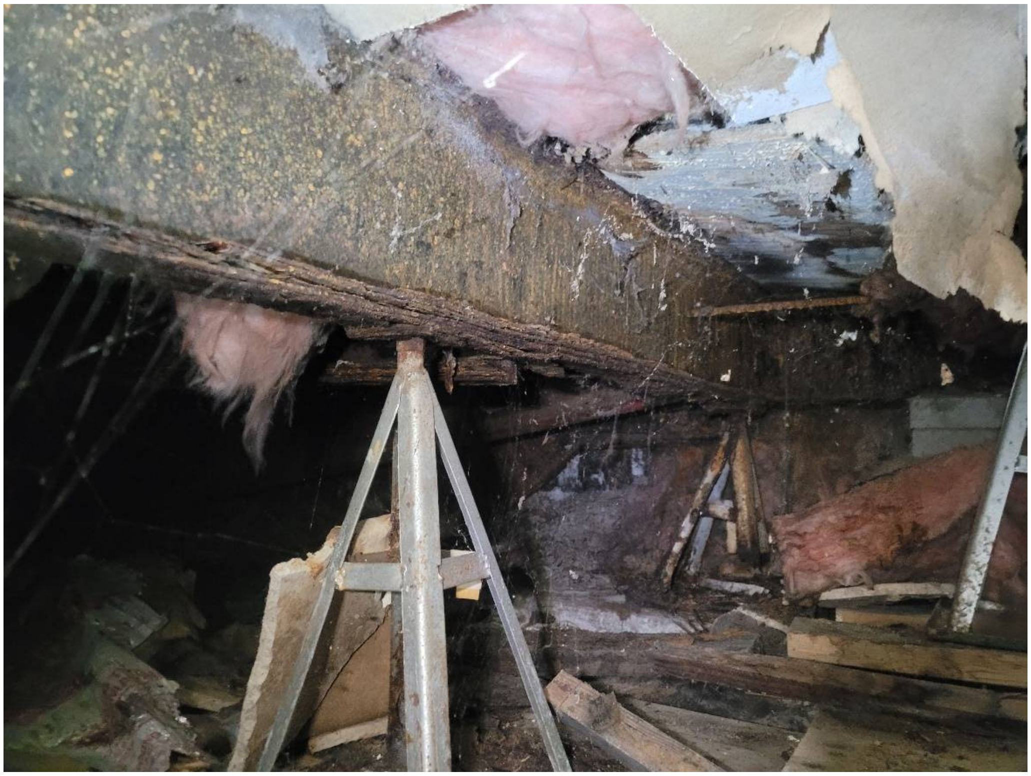

Figure 1 – steel jack supporting a steel beam, both of which have considerable corrosion. The wood framing above is unobservable, though the damage to the sheet rock may indicate water damage to the wood framing as well.

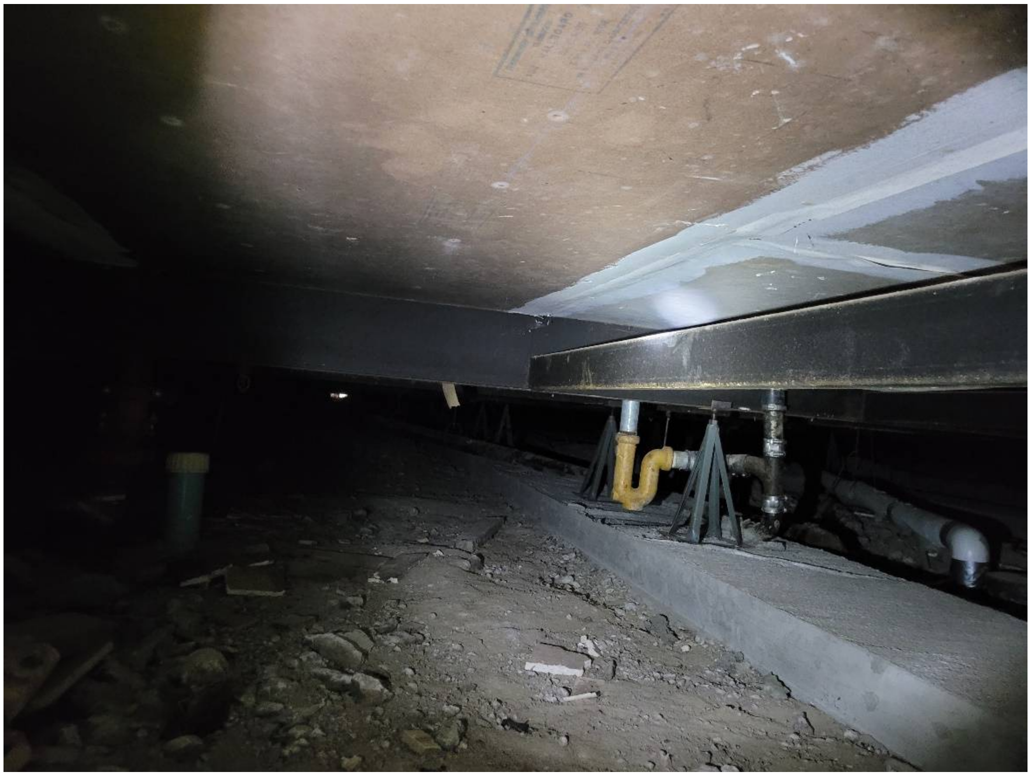

Figure 2 – an area away from the entrances where the steel framing and jack supports are in considerably better condition, though some light corrosion is observable in the top and bottom of the steel beam to the right.

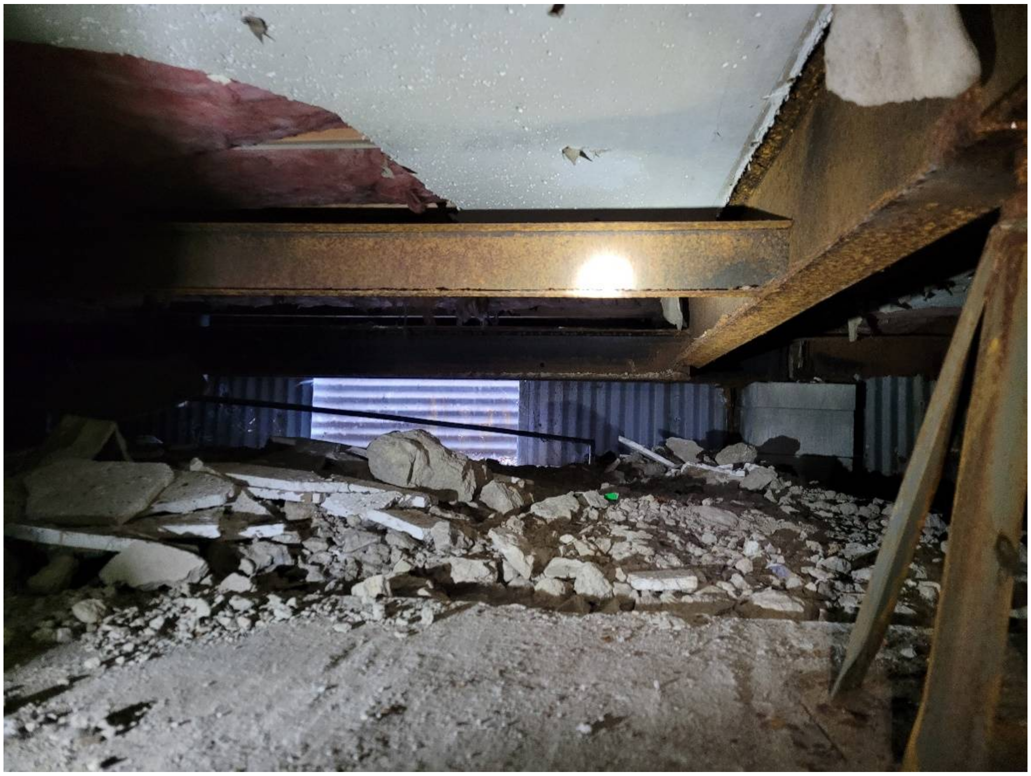

Figure 3– another area close to an entryway with considerable corrosion.

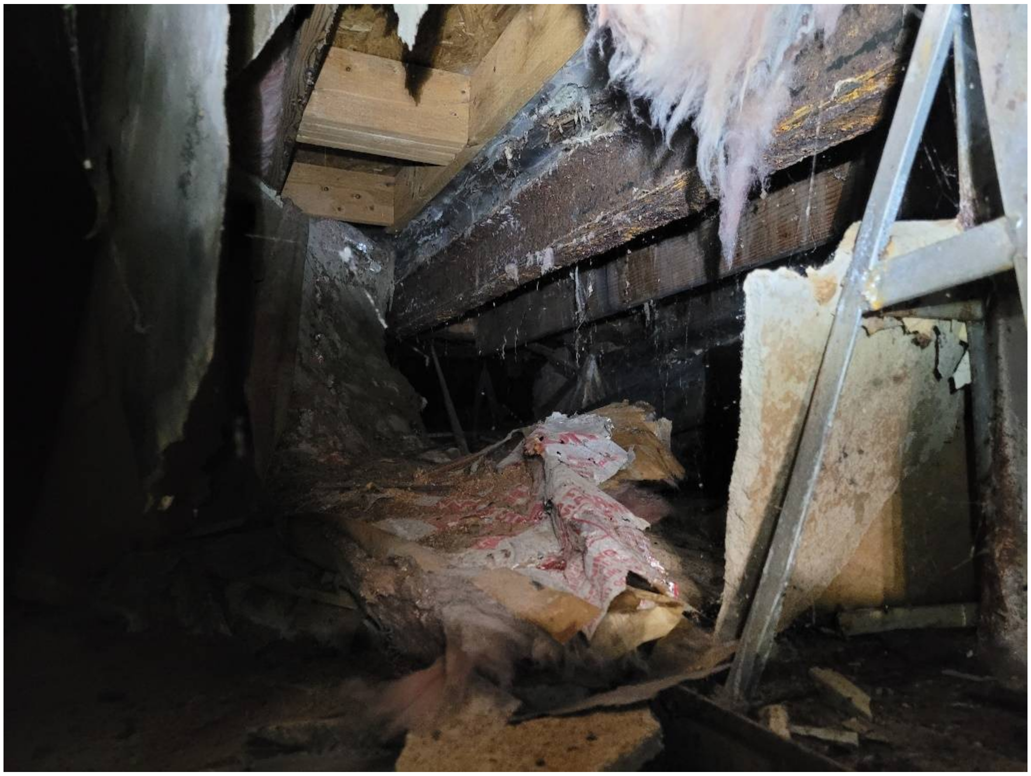

Figure 4 – an area near the entrances where the wood joists have considerable deterioration.