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December 5, 2024

Katie Albers
New Underwood School District
PO Box 128
New Underwood, SD 57761

RE: Modular Classroom Units
Structural Review
New Underwood, South Dakota
Albertson Engineering File #2024-385

Dear Katie,

Albertson Engineering Inc. (AEI) has completed a limited structural review of the structural framing of the modular classroom units that are currently present at Canyon Lake Elementary School. This structural assessment was initiated to visually review the condition of the units and their framing to determine if any signs of distress or deterioration were apparent. Please note this assessment was based strictly upon visual evidence that was observed at the time of our site visit. No measurements of material strengths were taken. This assessment should be not considered an exhaustive technical evaluation. No guarantee of condition or warranty is implied.

BUILDING BACKGROUND

There are four modular classroom units at Canyon Lake Elementary School in Rapid City, SD. These units were all installed circa the early 1980's. The New Underwood School District recently purchased the units with the intent of relocating them to New Underwood to serve as additional classroom space.

On Thursday, November 14th, 2024, Stephen Kilber, PE and David Julius, EIT of AEI performed the site assessment. They documented the floor and roof systems with both field notes and photographs. Their observations were limited to visual surveys from the crawlspace and the attic. The assessment items listed below were limited to the visible areas that could be readily observed. Each of the units has 20" deep pre-engineered wood floor trusses and gable pre-engineered roof trusses. Each of the units is situated over a crawlspace.

STRUCTURAL ASSESSMENT

Photograph 1 shows an annotated aerial image of the four Units currently located at Canyon Lake Elementary School. These Buildings are labeled 1-4 for ease of reference. The structural observations focused mainly on the interior condition of the Buildings since the exterior issues were typically architectural items as shown in Photograph 2. No signs of moisture infiltration were observed on the interior spaces.

Interior Observations

The interior observations were:

- The crawlspace areas and the dirt floors varied from dry to damp with mud present. Despite the damp air below some of the units, no signs of mold were readily apparent. No vapor barrier was observed in the crawl space. Depth from bottom of floor truss to crawl space grade was approximately 24".
- The floor trusses in Buildings 1-4 were found in fair condition with no signs of mold or deterioration observed. Photographs 3 and 4 show the typical truss layouts with Units 1 and 2 having the same floor truss configuration and Units 3 and 4 sharing a truss configuration.
    - No signs of water damage were observed at the truss bearing locations.
- The roof trusses in Buildings 1-4 were found in fair condition with no signs of mold or deterioration observed. Photograph 5 shows a typical roof truss arrangement applicable to all the Units.
    - Photograph 6 shows a typical classroom space within the Buildings. No signs of moisture damage of water staining were noted on the ceiling finishes.
- Buildings 1 and 2 both had extra beams installed under the floor trusses as shown in Photographs 7 and 8.
    - The Building 1 support beam is supported by three pipe jacks that bear on top of sheets of plywood in direct contact with the dirt floor.
    - The Building 2 support beam is also supported by three pipe jacks that bear on small concrete footings.
    - The reason for these support beams is unknown. The supported floor trusses in each building do not appear to show signs of distress when compared to the other non-supported trusses.

STRUCTURAL ANALYSIS

The structural analysis was limited to a review of the pre-engineered floor trusses. The capacity (strength) of the existing trusses was compared to the applied loads (stresses). The applicable design codes and design loads referenced or used in the member analysis are defined in the following sub-sections. Analysis results are also provided.

The results listed in the following subsection are labeled as interaction values. An interaction value is simply a ratio of the applied load compared to the member's capacity, with an interaction value of 1.00 correlating to a structural element using its entire (full) strength capacity.

Design Codes

Listed below are design codes referenced in the truss analysis:

- 2021 International Building Code
- ASCE 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- NDS 2018 National Design Specification (NDS) for Wood Construction w/ 2018 NDS Supplement

Design Loads

Listed below are the design loads and any associated parameters used in the floor truss analysis:

Dead Loads

Dead loads for a building account for the material weight of the structural framing, roof and wall panels, insulation, and hung features such as mechanical/ electrical systems. These items are considered permanent in nature and are not readily moved or shifted. For this floor truss review, 12 psf was used for the applied floor dead load.

Live Loads

Live loads are specified based on the function and occupancy type of a building. With these units serving a classroom function, 40 psf is the applicable live load.

Floor Truss Materials and Truss Plates

From the field observations, timber material stamps were recorded on the pre-engineered floor truss elements to allow for a more accurate analysis.

Please note that no analysis was performed of the steel truss plates present at the truss element joints. These steel plates are proprietary connectors and require special software which is not readily available outside of the pre-engineered truss industry. For the field review the steel truss plates in Buildings 1-4, all appeared to be in fair condition with no signs of distress noted. However, the analysis results below only define the condition of the timber elements within a given truss configuration. No analysis or capacity rating of the truss plates is given within this report.

Results

The modular floor trusses were found to meet IBC code requirements with the applied loads listed previously. The floor analysis results for the two different floor truss configurations are attached at the end of this report. The interaction for the timber elements varies from 0.05-0.84. This means the timber elements have sufficient capacity to resist the applied loads.

DISCUSSION

As shown in the preceding section, the pre-engineered floor trusses were analyzed and their timber elements were found to have sufficient capacity to resist the applied loads. No analysis of the truss plate connectors was performed. No signs of distress at the plate connectors were visually observed.

It is unknown why Buildings 1 and 2 each have additional interior support beams present. The Rapid City Area Schools likely noted sagging in these buildings and took corrective action. However, no one with the district can provide a reason or information on when these beams were installed. AEI anticipates designing two new interior support beams as part of the new building foundations for the next phase of this project.

When these units are relocated, it is the responsibility of the building mover/contactor to sufficiently brace and support these units during transportation. It is important to note that the moving process will likely cause distress and/or cracking of the interior finishes. These cosmetic items will need to be addressed by the New Underwood School District after the Units are relocated and set on their permanent foundations. For the foundation system, we recommend the school consult with an architect for vapor barrier, insulation, and venting requirements in the crawlspaces.

CLOSING

The modular classroom units at Canyon Lake Elementary were visually reviewed. The areas of emphasis were the roof and the floor trusses. These structural elements were found to be in fair condition with no areas of distress observed. There was no apparent evidence of water damage in any of the structures.

Due to the limited scope of this review, we cannot attest to the existing structure's compliance with current building codes or accepted construction techniques. This report is prepared for your sole benefit. We appreciated the opportunity to be of service to you and if we can be of further assistance, please let us know.

Sincerely,

Albertson Engineering Inc.

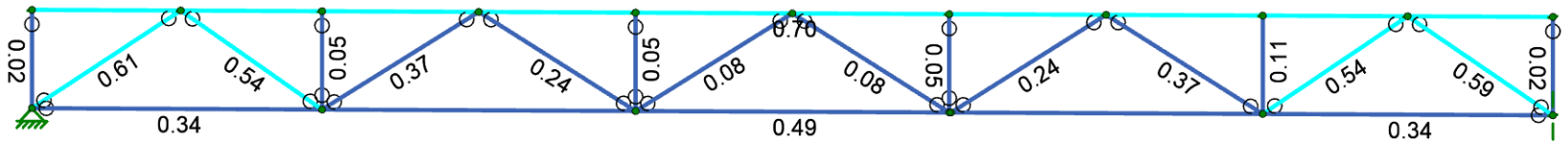
Written by:

David Julius, EIT
Engineering Intern

Reviewed by:

Stephen Kilber, PE
Associate Principal

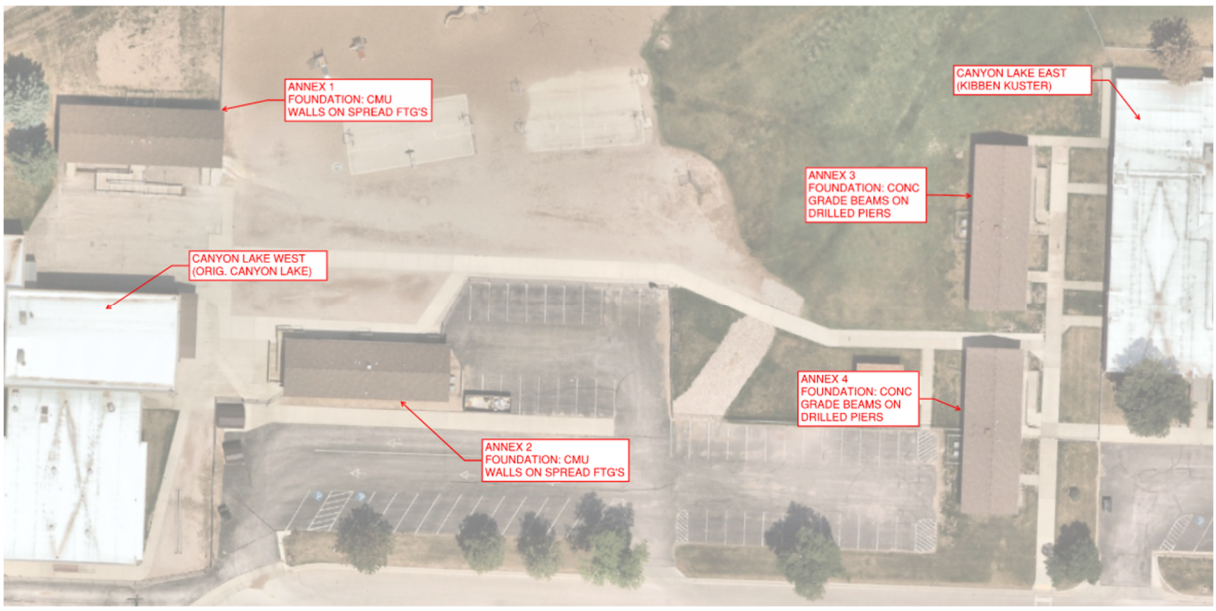
Interaction values for building 3 and 4 floor trusses.



Interaction values for building 1 and 2 floor trusses.

Member Code Checks Displayed (Enveloped)
Envelope Only Solution

RISA A NEMETSCHEK COMPANY	Albertson Engineering Inc.	New Underwood Modular Units	SK-1
	davidj		Nov 26, 2024 at 10:18 AM
	2024-385	Typical Floor Truss	Modular Unit Floor trusses.r3d



Photograph 1: Aerial image of the four units currently at Canyon Lake Elementary. The unit numbers are shown for reference.

Photograph 2: Siding blemishes on Building 4. Similar siding deterioration was noted on the other units.

Photograph 3: Typical floor trusses from Buildings 1 and 2.

Photograph 4: Typical floor trusses from buildings 3 and 4.

Photograph 5: Typical Roof truss applicable to Buildings 1-4.

Photograph 6: Typical classroom space. No signs of water staining were noted in the ceiling finishes.

Photograph 7: Beam under floor trusses in Building 1.

Photograph 8: Beam under floor trusses in Building 2.