Seismic Retrofit and Structural Improvement of a Camp Facility for Children with Life-Altering Medical Conditions

Introduction
Camp X (also called Lodge) provides year-around programs for children impacted by life-altering medical conditions. The organization requested us to assess their facility for seismic performance and to make non-seismic, structural improvements. A team of four civil engineering seniors at the guidance of a faculty member and three professional engineers (an SE and 2 PEs) completed the work as a capstone project.

Camp X Details
- Original structure built in 1968 as a student project by architecture students from a local university
- It is a 3-storey timber structure
- Annex added in 1994
- In 2000 a family that lost its child to cancer started Camp X at this facility.
- Current square footage is 7,000 sq. ft

Project Scope
Camp X requested that the team:
- Develop engineering drawings from field measurements.
- Evaluate the building for seismic performance.
- Make non-seismic, structural improvements to the lodge making it universally accessible.
- Perform a cost analysis for the improvements.

Existing Camp X Facility

Seismic Retrofits
Lodge has several narrow shear walls (shear walls resist seismic forces). Shear walls that do not meet a certain aspect ratio (ie. height to width ratio) may overturn in an earthquake. Team designed shear walls to foundation anchors.

- Simpson Strong-Tie HDU Holdowns to be installed at ends of shear walls and attached to foundation using Set 3G epoxy anchors

Non-seismic Structural Improvements
A flight of stairs leads from the entry way to the main floor. The team designed a chair lift to make the main floor universally accessible.

- Example ADA Lift
- Bathroom entryway too narrow for a wheelchair, shower stalls not ADA compliant, and toilets are congested. The team designed a new layout for the bathroom to make it universally accessible.

Design and Recommendations

- Roof chords that span > 20 ft could experience large deflections during a seismic event. The team identified the roof chords longer than 20 ft and designed a strap using Simpsons Strong-Tie to strengthen them.

- Roof chords with joints
- Retrofit Design

- Plan view of Roof Framing

Other Retrofits (Details of it presented in the Project Description portion of submittal)
- Attach Mezannine to wall to improve its seismic performance
- Secure wooden wall to foundation using Titan screws

- Other Improvements:
The kitchenette was converted into a full-size kitchen. Details of it presented in the project description portion of submittal.

Professional Engineers and Allied Professional Participation
- A faculty member (PE) taught the capstone course
- Three professional engineers (one SE and two PEs) from industry guided and mentored the team on technical work
- Two Architects (one an AIA member) assisted the team with non-seismic improvements
- An individual from a construction company guided the team through cost estimation
- Team presented their project to the civil engineering advisory board consisting of a dozen PEs
- Team participated in the local ASCE presentation competition which was judged by a panel of five Engineers (4 PEs and 1 EIT)

Knowledge and Skills Gained
- Technical expertise
  - Working knowledge of various design codes
  - Effective use of design and drafting software
- Communication and Collaboration
  - Honing public speaking and technical writing skills
  - Interpersonal communication with a non engineering client, professional engineers, architects and a contractor
  - Working in a hybrid environment
- Professional skills
  - Project Management skills: running meetings, preparing meeting agenda, following up on action items, scheduling and professional responsibility
  - Ability to be team players
  - Appreciation for human-centered engineering, public safety and welfare

Health, Safety and Welfare Issues
- Safety and welfare of the campers were the primary motivating force for the project.
- Seismic upgrades enhances safety.
- Making building universally accessible considers welfare of camp users.