

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.

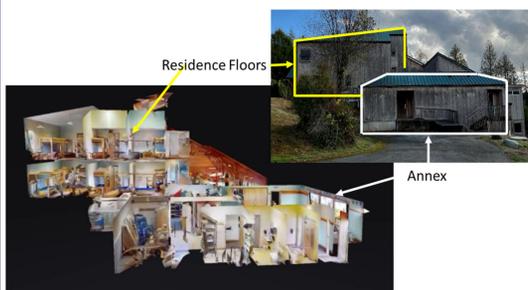
Existing Camp X Facility



Main Floor and Mezzanine Level



Annex and Residence Floors

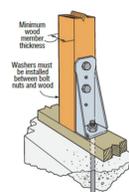


Health, Safety and Welfare Issues

- **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.

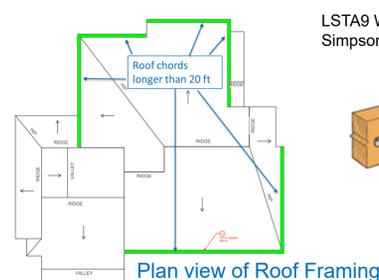
Seismic Retrofits

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.

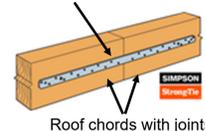


Simpson Strong-Tie HDU Holdowns to be installed at ends of shear walls and attached to foundation using Set 3G epoxy anchors

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.



LSTA9 W/8 16d x 2 12" Simpson Strong-Tie Fasteners



Roof chords with joints
Retrofit Design

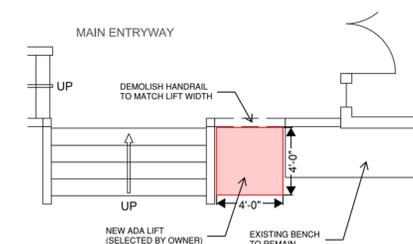
Other Retrofits (Details of it presented in the Project Description portion of submittal)

- Attach Mezzanine to wall to improve its seismic performance
- Secure wooden wall to foundation using Titan screws

Design and Recommendations

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.



Engineering Drawing
Plan View showing Modifications



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.



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