

**ARROWHEAD CENTER
STRUCTURAL/GEOTECHNICAL
CEEn_2017CPST_001**

by

**KADD Engineering
Daniel Schwicht/Project Manager
Kendl Hansen
David Davies
Austin Burton**

A Capstone project submitted to

**Bob Tandler
Fritzi Realty**

**Department of Civil and Environmental Engineering
Brigham Young University**

October 30th, 2017

Introduction

PROJECT TITLE: Arrowhead Center Structural/Geotechnical Proposal

PROJECT ID: CEEEn-2017CPST-001

PROJECT SPONSOR: Bob Tandler – Fritzi Realty

TEAM NAME: KADD Engineering

The objective of this report is to establish the requirements, expectations, and objectives of the Arrowhead Center project site, located in Spanish Fork, Utah. We will propose options for the use of the four main plots of land to be developed based on plot location, pre-existing structures, surrounding developments, and local demand/need. In order to determine the best use of the land for both Spanish Fork City and the developer, Fritzi Realty, a number of analyses must be done on both the geotechnical status of the land and the structural stability of the existing building(s).

This report will outline the tasks involved with the geotechnical and structural analyses and how they will be completed along with an estimated timeline for each task. By December 2017, we hope to have generated several options for land use so that the analyses being performed may more directly cater to the desired outcome. Our vision is to dive deeper into the originally planned residential development that has been established for these plots and compare it alongside alternative options, such as a multi-use complex/community center.

By February-March of 2018 we will have a cost/revenue analysis on each option in order to perform a side-by-side comparison and move forward with the option best suited for all parties. By April 2018, a formal presentation will be prepared for both Spanish Fork City and Bob Tandler of Fritzi Realty to present our findings and analyses to help move forward with the construction of the chosen project.

Proposed Work Plan

In order to determine the best use of the proposed plots of land for the Arrowhead Center project, detailed structural and geotechnical analyses must be performed. These analyses will then help determine the required retrofits, structures, and foundational designs that must be incorporated into the cost analysis of the project. The first step in establishing this information is to gather the data and information that has already been provided in past plans, geotechnical reports, and property information that has been compiled. With that information, we will then determine what data is still needed on both the geotechnical and structural fronts.

The next step in the development of our plan will be a preliminary site visit (by mid-November) to establish a better understanding of existing surroundings and developments, estimate future land use of perimeter plots, and to physically observe the structural status of the existing building. With that information, we will establish a better idea of both the community needs that should be met and the realistic possibilities of updating the existing structure(s) to the latest building code standards.

With the information gathered in our preliminary site visit, we will also begin to establish structural retrofits needed to update the building accordingly, and whether or not those retrofits will be cost effective to both the city of Spanish Fork and to Fritzi Realty. Should the existing structure be determined to remain, we can then establish its integration into the proposed options for plot use. At this point we will also determine the loads involved with both the pre-existing residential development plan and other proposed options, such as a multi-use complex/community center. Those loads, along with compiled geotechnical data, will allow us to determine the types of footings/foundations necessary to support such structures and the cost involved in doing so. We will also compare our proposed ideas with similar projects in the surrounding areas of Salt Lake and Utah Counties and consult with engineers who worked on said projects. These analyses will be performed from December 2017-March 2018.

Once we are able to compile a firm idea of dimensions, size, and placement of structures to be constructed in addition to, or replacing, the existing structure(s), we will perform another site visit to mark off the proposed sites, solidify any lingering questions of land use, and gather any last data/photos of the existing site. With the final data compilation, we will do a final financial analysis for each option and prepare the final report and formal PowerPoint presentation to be provided for the approval of both Bob Tandler of Fritzi Realty and Spanish Fork City by April 2018.

Schedule

October 27, 2017 – Team meeting discussing goals, expectations, and proposal tasks. Review photos and documents from Bob Tandler.

November 8, 2017 – Preliminary site visit, gathering information about surrounding area and interior structural information.

November 13, 2017 – Finalize and turn in initial project proposal.

December 2017 – Inspection of structural efficiency. Take measurements of structural members, determine safety and quality of building.

January 2017 – Determine loads and building requirements for multi-use complex and residential development. Determine required footing for both options based on loads and geotechnical reports.

February-March 2017 – Analyze structure, determine possible retrofit options. Begin initial cost analysis of retrofit requirements.

March 2017 – Analyze cost efficiency of retrofitting the building, or demolishing building and starting over. Discuss findings with other arrowhead groups. Determine the best option for the facility.

April 2017 – Finalize report and formal presentation.

Facilities, Tools, Data and Equipment

- Calipers and 25' Tape Measure – Used to determine structural members used to support existing buildings, especially load bearing I-beams, steel purlins and trusses, wood rafters, and the exposed wall structure.
- 100' Tape measure – Used to take dimensions of entire building and distances between load bearing members.
- Geotechnical Reports – Used to determine necessary foundation requirements for building.
- Computer programs such as AutoCAD, RISA, REVIT, etc. – Used to analyze structure and determine retrofits and upgrades.

Project Budget

Team meetings – Weekly, 1 hour.

Preliminary site visit – 3 hours for total travel time, building inspection, and survey of surrounding area.

Site visit – 8 hours for taking measurements, pictures, specific notes on structural concerns.

Determining loads and building requirements - 20 hours (split between group members).

Structural analysis – 50 hours (split between group members).

Cost analysis – 20 hours (split between group members).

Report – 15 hours (split between group members).

Deliverables

- Monthly status reports with the following information
 - Challenges encountered during the project
 - Determined actions to overcome challenges
 - Progress in overcoming challenges
 - A status report
 - Current progress
 - Is the project on schedule?
 - Any schedule adjustments due to unforeseen challenges
- A report with the following information to support recommendations and decisions
 - Important information from the geotechnical report provided by AVEC
 - Load requirements for proposed building types
 - Use of the geotechnical report to determine necessary foundation types and costs
 - Recommendations for potential site uses along with cost estimates and potential impacts
 - Structural drawings for existing historic building
 - Structural analysis of existing historic building
 - Recommendations for potential retrofit options or demolition for existing historic building along with cost estimates and potential impacts
- A PowerPoint presenting a condensed version of the report for presentation to Bob Tandler
- A poster summarizing the scope and results of the projects to be seen by interested faculty, students, and other interested individuals

Performance Standards

Team will provide work for this Capstone project “as is” using best practices and with best effort. Project results cannot be construed as work performed by licensed professionals and cannot be used as “stamped deliverables” without first being reviewed, approved and stamped by a qualified and relevant license professional engineer.

Each team member will provide his best work and put in the allotted number of hours per week to ensure a quality report, recommendations, and presentation as a result of the project. The team will communicate on at least a weekly basis to discuss any challenges, opportunities, or adjustments as the project progresses. The team will do whatever necessary to ensure timely accomplishment of the project and to keep to the proposed schedule. Any schedule adjustments must be fully justified and conform to the final deadline of the project. The team will hold to engineering ethical values, including, but not limited to, presentation of all determined site conditions without distortion, presenting the best possible work without taking shortcuts, and presenting only information that conforms to the qualifications of the team members.

Statement of Qualification

Geotechnical reports have been provided by AVEC, an experienced and licensed engineering firm qualified to do site analyses such as the said geotechnical report. The team's graduate mentor, Daniel Schwicht, is currently pursuing a graduate degree in geotechnical/foundation engineering and will thus be able to provide valuable recommendations to the team on how to interpret and use the data obtained from AVEC. These resources will help the team to present the best possible information regarding potential foundations needed for proposed site uses and related cost estimates.

All three members of the team currently have internships with structural engineering firms. Austin works for Dean L. Webb & Associates as a draftsman and will thus be able to proficiently create structural drawings of the historical building and any necessary site plans. Kendl and David both work for Vector Engineering performing roof load analyses and creating retrofit designs to accommodate increased loads due to solar panels. These skills will be valuable when analyzing the existing historical structure and recommending possible retrofit options and costs.

The qualifications of the team members and mentor should be sufficient for accomplishment of the project. Daniel will help facilitate discussion and analysis of geotechnical data, Austin will take the lead in necessary drawings, and Kendl and David will take the lead in the structural analyses. All team members will perform site visits together as possible and collaboration will take place in all aspects of the project. Educational knowledge obtained from classes in geotechnical, foundation, structural analysis, and engineering economic courses by members of the team will help pull all the information together and present knowledgeable reports and recommendations to Bob Tandler as a result of the project.

Appendix A

Kendl Hansen

632 W 1925 N Provo, UT 84604

Phone: 951-805-0474 E-Mail: kendlhansen92@gmail.com

Objective

Show experience and qualification in skills and education for Civil Engineering.

Experience (Reference contact info upon request)

BYU Men's Tennis Team – Assistant Coach

Fall 2014-Fall 2015

- Assisted in running practices, developing the games of our players from a technical and strategic approach. I also coached on court during our intercollegiate matches, helping to keep the players focused and developing the right strategies to win.

Riverside Country Club

Spring 2015-Present

- Designed and scheduled the tennis program at RCC as the head tennis professional.
- Led many groups of tennis players from competitive juniors, to recreational seniors and everywhere in between (ages 3-60+) My skills in communication helped me to adapt to all ages and skill levels leading to the most success Riverside Country Club's tennis program has ever experienced.
- Oversaw the hiring of a second coach to help bear the burden of the popularity of the program.

Vector Structural Engineers

Spring 2017-Present

- Analyzing a variety of roof structures to determine adequacy for solar installation.
- Performing foundation designs for ground-mounted solar arrays.
- Train new interns on methods for producing quality analyses on structures in order to determine adequacy for solar installation, both roof and ground mounted.
- Develop retrofit designs to enhance structural adequacy for increased loading by solar arrays.

Education

- Graduated from McKinney Boyd High School in 2010.
- Furthered my education at BYU, where I'm currently studying Civil Engineering, projected to graduate in April of 2018 with a Bachelor's degree in Civil Engineering.

Skills

I have found that many of the skills I have acquired through my tennis career transfer directly to engineering. I work very well with people, and help to unify and include individuals working toward a specific goal. I also have a strong background in mathematics and physics directly relating to structural analysis, and am able to assess basic problems. I have an entry-level understanding of engineering software such as CAD design, Revit, and RISA 3D. I am proficient in Microsoft Office, VBA, and Bluebeam.

David G. Davies

(385) 321-7704 • dgdavies33@gmail.com

EDUCATION

Brigham Young University- Ira. A Fulton College of Engineering & Technology

Pursuing a Bachelor of Science in Civil Engineering

EXPERIENCE

Project Manager (Internship)

Vector Structural Engineers

Sandy, UT · May 2016 – Present

- Perform structural analysis on roofs for solar panel set-up, residential and commercial.
- Perform structural analysis on foundations for ground-mounted solar panels.
- Study different design systems and decide which to implement based on safety, practicality, and cost efficiency.
- Work directly with clients: provide engineering letters, list retrofit options, answer questions, email, etc.
- Train new employees in solar analysis, RISA 3D analysis, office policies, using Bluebeam, etc.
- Design retrofitted roof systems to support excess loads using excel programs, AutoCAD, and RISA 3D.
- Design preliminary setup of monopole/monopine using tnxTower.

Teaching Assistant

Brigham Young University

Provo, UT · August 2015 – May 2016

- Work with 150+ students to understand key concepts of mechanics for statics (course ID: CEEEn 103).
- Prepare students for exams by giving review lectures and answer conceptual questions.
- Grade weekly homework and exams for 50+ students.

Construction Worker

Cornerstone Concrete LLC.

Lehi, UT · May 2014 – September 2015

- Learned firsthand how to develop strong foundations and use necessary and cost-efficient materials for various sizes of structures.
- Teamed with other employees to complete various tasks (set up job site, designed and put together concrete forms, etc.).

SKILLS

- Proficient in building design software (RISA 3D, AutoCAD, Revit, tnxTower), Excel (Visual Basic), Word, and Bluebeam.

Austin Burton

488 N 100 E #1, Provo, UT 84606 | 435-590-1290 | austin.burton47@gmail.com

Objective

Present related experience and qualifications in civil engineering

Education

Civil and Environmental Engineering
Brigham Young University

January 2015-Present
Expected Graduation June 2018

- Current GPA 3.95/ 4.0
- Pursuing a degree in Civil and Environmental Engineering with a structural emphasis
- Related Coursework
 - Educated in Statics, Structural Analysis, Mechanics of Materials
 - Programming and Calculations in Excel and VBA
 - Modelling in CAD and Revit
- Participated in ASCE and SEAU in order to learn more about the civil engineering field as well as use my knowledge and skills to serve others

Experience

Structural Drafting

February 2017-Present

Dean L. Webb & Associates

- Created structural/architectural drawings in AutoCAD
- Accompanied and aided engineers on site visits
- Worked closely under structural engineers

Construction

Summer 2012

Private Contracting

- Aided in the construction of a cabin, including detail work
- Learned practical construction skills to better perform my tasks
- Labored closely alongside an experienced private contractor, providing a quick learning experience

Custodian- Lead Student

January 2015-February 2017

Brigham Young University

- Cleaned and maintained the chemistry building on campus
- Trained new employees to help them understand their assignments
- Early hours (4:30 a.m.)

DANIEL SCHWICHT

dewschwicht@gmail.com | 385.204.3852

EDUCATION

- **Civil Engineering Master of Science** (Anticipated) April 2018
Brigham Young University, mentored by Dr. Kyle Rollins
- **Civil Engineering Bachelor of Science** June 2017
Brigham Young University; 3.01 GPA

RELEVANT EMPLOYMENT

- **High-speed Rail Abutment Graduate Research Assistant** 2017 - present
Brigham Young University, mentored by Dr. Kyle Rollins
 - Organized and reported data for large-scale testing of earthquake loading of abutment
 - Reported findings for immediate implementation by Caltrans
- **Materials Testing Technician** 2016
RBG Engineering; Provo, UT
 - Performed gradations (grain size), field and lab concrete tests, nuclear density tests, asphalt burn and rice tests, Atterbergs, etc.
 - Trained new employees in ASTM standards and lab and field procedures
- **Geotechnical Engineering, Materials Testing, and AutoCAD Intern** 2013 - 2015
Hattenburg Dilley & Linnell Engineering Consultants; Anchorage, AK
 - Worked in certified lab, geotechnical drilling, and in field
 - Corrected and verified drawings in Autodesk, ArcGIS

VOLUNTEER AND LEADERSHIP EXPERIENCE

- **Full-time Religious and Service Missionary** 2010 - 2012
Baltimore, MD
 - Two full years of unpaid, voluntary teaching and community service
 - Developed contacts by word of mouth and referrals
 - Trained other missionaries in teaching, contacting, etc.

AWARDS AND ACCOMPLISHMENTS

- **Benjamin B. Talley engineering scholarship recipient** 2014
Society of American Military Engineers, Anchorage Alaska chapter
- **Eagle Scout** 2009
Boy Scouts of America, Great Alaska Council
 - Coordinated Eagle Scout service project landscaping at Blood Bank of Alaska
 - Directed over 500 man hours of service and solicited donations of construction materials

SKILLS AND CERTIFICATIONS

- Professional experience with Autodesk, ArcGIS, Excel, Word, and some Visual Basic (VBA)
- Troxler Nuclear Gauge Operator certified, HAZMAT certified, 2013
- American Concrete Institute (ACI) Concrete Strength Testing certified, 2013
- ACI Concrete Field Testing certified, 2013
- Spanish translation experience, 2010 - 2012