

**SEWER SYSTEM CONSOLIDATION
PROJECT ID: CEEN_2018CPST_009**

by

**Team Invictus
John Jensen
Jordan Kersey
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A Capstone Project 30% Completion Report

Submitted to

**Chad Coleman
Coleman Engineering**

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

December 10, 2018

Executive Summary

PROJECT TITLE: SEWER SYSTEM CONSOLIDATION
PROJECT ID: CEEEn_2018CPST_009
PROJECT SPONSOR: Coleman Engineering
TEAM NAME: Team Invictus

Team Invictus is tasked to perform the analysis required to determine the best options for consolidating the Castle City Mobile Home Park Sewage System into the South Placer Municipal Utility District System. From information provided to Team Invictus, the team will provide recommendations regarding sewer force main pipe alignments, multiple existing sewer lift station upgrades, and multiple new sewer lift station option. This document outlines the thirty percent of the project that has been completed as well as the work that will be completed over the next semester. The team will also provide lessons learned thus far working on the project and recommendation for Coleman Engineering in how they may contribute to the project.

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Introduction

Team Invictus will perform a preliminary design of sewer system infrastructure to consolidate two existing systems. The Castle City Mobile Home Park has its own collection system and treatment and disposal ponds, but these ponds are over 40 years old and have lost percolation capacity resulting in a loss of disposal capacity. The project will evaluate multiple sewer force main pipe alignments, multiple existing sewer lift station upgrades, and multiple new sewer lift station options to determine the most economical solution. A recommended option will be presented, with preliminary reports from Coleman Engineering advising towards consolidating the system into the neighboring South Placer Municipal Utility District system.

During the Fall semester of 2018, Team Invictus – comprising of John Jensen, Jordan Kersey, Christian Lundskog, and Camille Lunt – set out to learn as much as possible about how the program WaterCAD works. The team also began a study of the proposed pipework system, which involved researching estimated costs, terrain type, and alternative mapping programs. On a weekly basis, the team met to share findings and readjust efforts to complete the project objective. Although meetings were often, challenges were met when team members faced personal obstacles that interfered with regularly scheduled meetings and being out of town.

Team Invictus feels that it has accomplished the Fall semester goal of completing 30 percent of the project by December 2018 and expects to meet the project completion deadline in April 2019. The team expects that further communication with Coleman Engineering will increase the learning and application of WaterCAD, and that the team's talents in alternative programs will help the project greatly in the following months. With the tools at hand, the team will utilize the winter break in facilitating growth and knowledge of WaterCAD and begin making headway into designing the best options of pipework that will solve the problem for the community of Newcastle, California. The option to be recommended will include factors such as cost, productiveness, ease of installment, and if it meets the criteria of completing the goals for the sewer system.

Schedule

A schedule has been made to keep Team Invictus on task and to reach the goals by April 2019.

Table 1: Schedule for Team Invictus

Team Invictus Schedule			
Date	Days	Time	Tasks
Every Week Besides 3-Dec	M	4:00-6:00	Class
17-Sep to 21-Sep	M-F	-	Five Dysfunctions Homework; Read Project Information
Every Week During Semester	W	3:30-4:30	Team Meeting
24-Sep to 28-Sep	M-F	-	Define Lead Measures for WIG's; Status Report 1
1-Oct to 5-Oct	M-F	-	Upload Resumes; Statement of Work
12-Oct	F	3:00-5:00	Meeting with Sponsor, Chad Coleman
Once a Month	-	-	Meet with Sponsor in person or by phone
8-Oct, 22-Oct, 5-Nov	M	5:00-6:00	Engineering Economics
8-Oct to 12-Oct	M-F	-	Revised Lead Measures
8-Oct to 23-Nov	M-F	-	Status Reports 2-8 on weekly basis
22-Oct to 26-Oct	M-F	-	Team Scoreboard
26-Nov to 7-Dec	M-F	-	30 % Completion Report
7-Jan to 19-Apr	M-F	-	Status Reports 9-16 on weekly basis
18-Mar to 22-Mar	M-F	-	Poster
25-Mar to 29-Mar	M-F	-	Presentation
1-Apr to 12-Apr	M-F	-	100% Completion Report

Assumptions & Limitations

Coleman Engineering outlined two options for the new pipeline system for Team Invictus to investigate. Analyzing these two different options will be the team's focus for much of the Winter 2019 semester. Some limitations involved in these two options include:

Existing Topography – The project location is in hilly terrain near a small community of houses. Team Invictus must work within the elevation constraints that the terrain provides, as well as the location of existing infrastructure (i.e. houses and buildings should not be affected by the construction of the new pipeline).

Detail of Elevation Data – Elevation data can only be accurate to a certain degree. It is not feasible to have elevation data that is accurate to within one inch. With this limited degree of accuracy, Team Invictus will do its best to model the pipe network in WaterCAD and in calculations for design costs.

Connection to the Existing Pipe Network – The installation of a new pipeline system should not require upgrading or reconstructing any of the existing systems. The only exception to this is the Kentucky Greens Force Main, which according to Coleman Engineering, will most likely need to be upgraded in the case of Option 1 given by Coleman Engineering.

Budget – Design considerations that will affect the budget include the length of new pipe, number and power of new pumps needed, as well as boring costs underneath the interstate for Option 1.

Design, Analysis & Results

The design process begins by understanding WaterCAD and modeling the current pipe system. Two different designs will be studied, with one following Option 1, and the other Option 2. Once Team Invictus and Coleman Engineering agree that the design is accurate, analysis can begin. Analysis in the pipe networks will include: costs of pipe length, pumps, feasibility, and solving the problem statement in the project. Results from the analysis will include recommendations for which Option should be used and a total budget given for the project's implementation. As this is a 30 percent completion report, much of the design has yet to be completed, and this will be the bulk of work in the month of January.

The layout of Options 1 and 2 and the pipe system to which they connect can be found in the Appendix (see Figure 1). Coleman Engineering provided the team with this layout.

Lessons Learned

As Team Invictus we have worked together to accomplish thirty percent of the design for our Capstone Project, yet each step of this process has stretched our team and taught us valuable lessons. As university students we have been taught the basic principles of Civil Engineering. This project is an opportunity for us to apply these principles as well as the social and communication skills that will aid us in becoming influential engineers. Lessons learned by Team Invictus include, but are not limited to, the importance of contacting the right people with the right resources, establishing clear communication between team members and our sponsor, and how to adapt to unforeseen factors of health.

The importance of contacting the right people with the right resources is a lesson that we learned early on. As part of our Capstone project we have been tasked with using WaterCAD, by Bentley, to perform hydraulic modeling. Much of what we have learned has been self-taught. We have discovered that the knowledge of others has been a great resource to us in the learning process. We have networked to learn more and consulted YouTube tutorials to advance our understanding of WaterCAD.

At the start of the project we recognized the importance of good communication but have found that good communication is not enough. Strong communication between team members is still a goal for us, but we believe that clear communication has made an influence for our team. One of our lead measures for our team is to have each team member contribute to a group chat to ensure that we are working equally on our project. We have found in the process of using this group chat that the clearer we are with the questions we have and the things we need done, the more successful we are. The weeks that we have been the least effective with our communication are the weeks that we have had the worst results with project.

Clear communication has also been a great help as our team members have experienced unforeseen factors of health. During the first semester multiple team members experienced challenges with a roommate passing away, loved ones having surgery, and personal health challenges. Through the use of facetime, email, and text messages we have been able to support each other to complete the task of the project as well as strengthen and support one another. Life is full of unexpected turns and bumps in the metaphorical road. The more people we have to support us the easier the unforeseen challenges become. This is one way we are becoming more like our namesake, Invictus - meaning unconquerable or undefeated.

Conclusions

Team Invictus has had an eventful semester with the challenges, both technical and non-technical, encountered. However, it has also been a semester of growth and accomplishment. The team members have learned to rely on each other's strengths and to support one another when things don't go as planned. Above all, the team is happy to report that they are on schedule and that they have a vision for the future. Team Invictus is looking forward to the completion of this project next semester (April 2019) and is ready to continue the work needed to provide Coleman Engineering with a finished analysis of the sewer consolidation system.

Recommendations

We recognize that our communication with Coleman Engineering has been sporadic. It is our hope that Coleman Engineering will renew the correspondence when we again reach out to Chad. As part of this renewed communication we also recommend a monthly skype meeting.

Appendix A

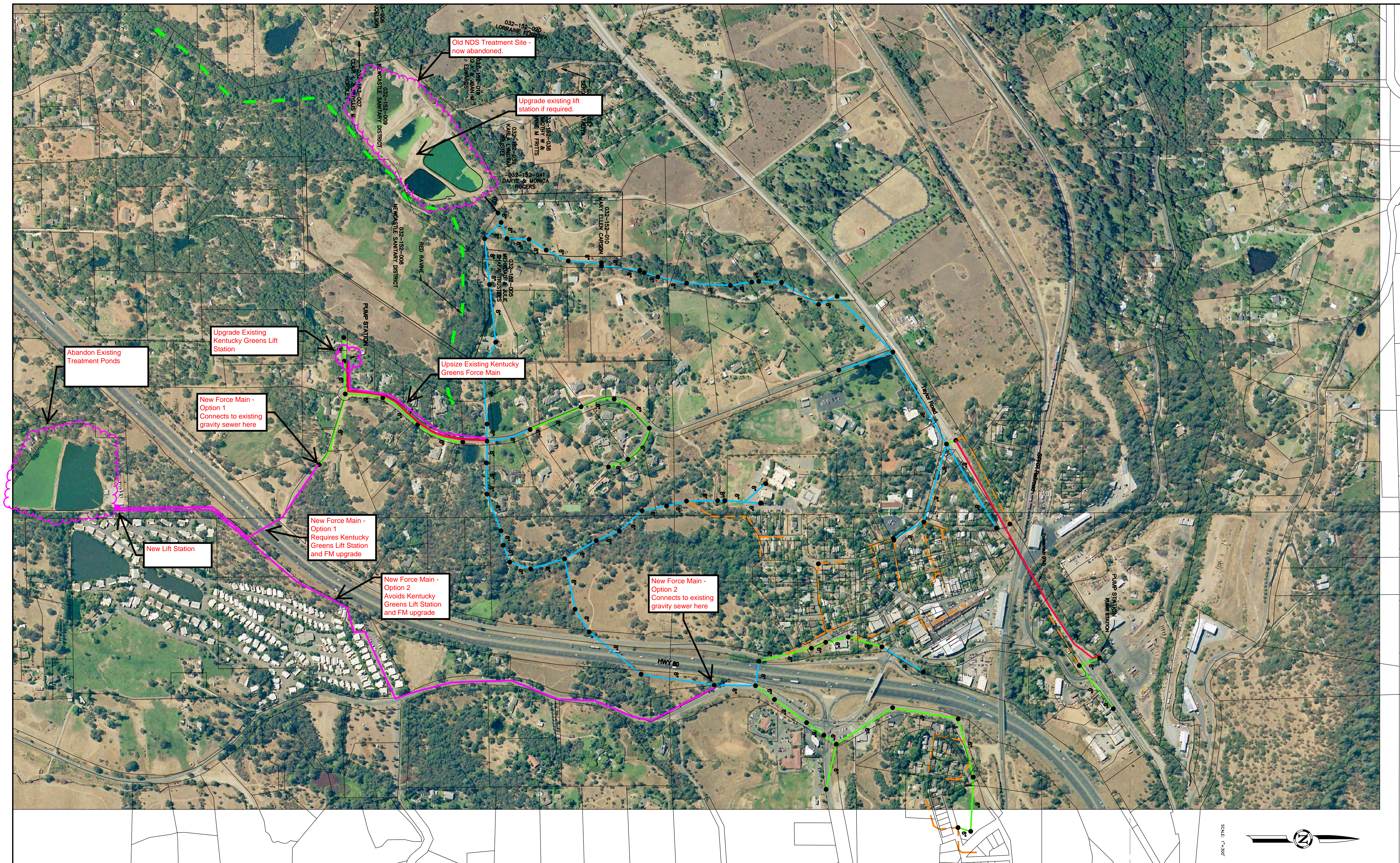


Figure 1: Map layout of existing pipe network and Options 1 and 2.

John Henry Jensen

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Objective

- Eager to learn more and gain valuable experience in Civil Engineering

Education

BACHELOR OF SCIENCE | ANTICIPATED APRIL 2019 | BRIGHAM YOUNG UNIVERSITY

- Major: Civil and Environmental Engineering
- Minor: Mathematics
- Related coursework: Reinforced Concrete Design, Fluid Mechanics, Structural Steel Design, Auto CAD, Introduction to Earthquake Engineering, Soil Mechanics and Structural Analysis
- Special interests: Geo-Technical, Transportation and Structural Civil Engineering

Skills & Abilities

CREATIVE

- Used Excel to develop inventory tracking spreadsheet for a small local business
- Created spreadsheet to predict outcome of NCAA March Madness Bracket based on the outcome of every tournament since 1975 using VBA (Virtual Basic)

PROBLEM-SOLVING

- Investigated problems with decreased BYU Engineering student attendance at Devotionals
- Increased attendance by over 400% through collaborative work

COMMUNICATION

- As a Latter-day Saint Missionary in Chile, developed effective communication and presentation skills through community service and teaching daily which included weekly English lessons and tutoring children in Mathematics

LEADERSHIP

- Researched and constructed surveys sent to BYU's College of Engineering to increase Devotional attendance

Experience

ENGINEERING INTERN | SUNRISE ENGINEERING INC. | WASHINGTON, UTAH

- Wrote Master Plans for both Secondary Irrigation Water and Transportation
- Surveyed under the direction of Project Engineers' at job-site locations

STUDENT EMPLOYEE | BYU GROUNDS

- Performed daily tasks in landscaping and maintenance
- Promoted to student lead position after one year of work
- Supervised tasks for 6-10 students and oversaw completion

Jordan M. Kersey

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EDUCATION

B.S. in Civil Engineering

Brigham Young University

April 2019

Provo, UT

- Elected as Secretary in the student chapter of the American Society of Civil Engineers (ASCE)
- Skills: AutoCAD, WaterCAD, ArcGIS Pro, Microsoft Office
- GPA: 3.17

WORK EXPERIENCE

BYU Civil Engineering

Statics Teaching Assistant

Sept. 2018-Present

Provo, UT

- Mentor & teach 50+ students daily in basic Statics & Physics concepts
- Correct & provide constructive feedback for 50+ homework sheets bi-weekly
- Collaborate with faculty & other TA's weekly on facilitating class

Aptive Environmental

Pest Control Applicant

May 2017-Aug. 2018

Livermore, CA; Trooper, PA

- Operated & performed safety inspections on company vehicle and equipment for 200+ business days
- Negotiated with 1600+ clients in English, Spanish, and Chinese

BYU Sprinkler Shop

Sprinkler Technician

July 2016-Apr. 2018

Provo, UT

- Renovated 10+ irrigation systems weekly through digging, removal and installation of PVC pipe
- Participated in a variety of weekly team projects that included pipes, controllers, and wires

BYU Physical Facilities

Custodian

Aug. 2015-Jun. 2016

Provo, UT

- Learned to be self-driven and work independently on weeklong projects
- Actively identified problems and utilized available solutions to resolve them

Dreamscapes, Lawn Care Specialists

Maintenance Technician

Apr. 2012-Aug. 2015

Dixon, CA

- Analyzed and performed improvements needed for 100+ lawns to become beautiful landscapes
- Maintained & operated 4 large machines daily

VOLUNTEER EXPERIENCE

Coleman Engineering

Capstone Team Member

Sept. 2018-Present

Provo, UT

- Comparing three options for replacing an old wastewater system in Newcastle, CA
- Utilizing WaterCAD to analyze potential wastewater pipelines to improve flow in system
- Collaborating on a team to consult company on potential options

Lifey App

On-Campus Intern

Sept. 2018-Present

Provo, UT

- Expanding the usage of a new educational video-help app to 1000+ users

Church of Jesus Christ of Latter-Day Saints

Full-Time Representative

Oct. 2012-Oct. 2014

Managua, Nicaragua

- Oversaw online purchases, postal services, and delivery routes for 170+ members of the organization
- Organized an essential storage facility that held 1000+ items of significance



Christian Lundskog

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Education

Brigham Young University

B.S. of Civil and Environmental Engineering

Anticipated Graduation: *December 2019*

Current Member of BYU ASCE Student Chapter

Capstone Project to Consolidate two Sewer Systems

GPA: 3.27

Utah Valley University

Received Generals Associates in 2015

GPA: 3.59

Experience

Teachers Assistant – *Fluid Mechanics*

August 2018 - Current

- Assist 35 students in understanding and applying challenging fluid mechanics concepts *Provo, Utah*
- Complete 3 to 5 tasks for professor as assigned on a weekly basis
- Coordinate with fellow teacher assistants daily to discuss effective teaching methods and tasks to be completed

Berg Engineering – *Civil Engineering Intern*

May 2018 – August 2018

- Prepared concept designs for clients seeking preliminary subdivision property plans *Midway, Utah*
- Compiled site plans for clients to be submitted to city and contractors for construction
- Updated engineering plans to match installed utilities for city records asbuilts plans

Stein Eriksen Lodge (5 Star Hotel) – *Grounds Tech*

May 2017- August 2017

- Interacted with hotel guests, assisting them to navigate the property *Park City, Utah*
- Maintained grounds and landscaping of flowerbeds, grass, watering systems, etc.
- Translator and leader for Spanish speaking team members

Vinyl Fence Installation – *Client Contracted*

September 2016

- Independently planned and implemented installation of vinyl fence *Heber City, Utah*

Vivint Solar – *CAD Technician*

June 2014 - January 2016

- Mass produced custom roof top solar array designs in a timely manner *Provo, Utah*
- Verified design quality for fellow designers to ensure quality designs for customers
- Collaborated with Sales Representatives on an individual basis to meet customer expectations

Skills

- Fluent in Spanish
- Proficient in computer aided drafting (Autodesk CAD and Revit)
- Proficient in Photoshop, Microsoft Word, Excel, Publisher, and PowerPoint
- Experienced in basic residential construction and landscaping (roof layout, framing, grounds maintenance)

Volunteer Service

Church Mission, Neuquén Argentina

BSA Eagle Scout

BYU ASCE

Camille Lunt

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EDUCATION

Pursuing BS in Civil Engineering, Brigham Young University

Anticipated Graduation: December 2019

- Cumulative GPA of 3.99
- Member of ASCE, ITE, and AREMA BYU student chapters
- Relevant coursework: geometric design of highways, basics of transportation engineering, VBA
- Successfully qualified for and retained a university academic scholarship for 3 years in a row

INTERNSHIP

Traffic Safety Intern, Arizona Department of Transportation

May 2018 - August 2018

- Analyzed 2 large data sets to assess the effectiveness of ITS implementations
 - Presented findings to upper-level management
 - Created a nearly-automated process to update travel time analyses with new data
 - Wrote informal instruction manual on how to repeat analysis of speed feedback sign data
- Performed a variety of crash analyses including:
 - Statewide highway pedestrian crash review
 - Holiday weekend interstate travel crash analysis
 - Disabled highway vehicles crash review
- Performed a Road Safety Assessment (RSA) with a team
- Improved time required to create crash summary reports from 60 minutes to 10 minutes by writing macros

RESEARCH

Intersection Safety Research Assistant, Grant G. Schultz Ph.D., P.E., PTOE

September 2017 - present

- Performs virtual site visits and analyzes crash data to complete reports for 60 identified hotspot segments
- Analyzes over 200 Utah state road junctions via Google Earth to improve an intersection safety analysis model
- Prepares ideas for the next section of research: a segment safety analysis model
- Coordinates with fellow research students on a weekly basis

LEADERSHIP EXPERIENCE

Treasurer, ASCE BYU student chapter

January 2018 - present

- Oversees income and outcome of club funds
- Participates in planning events for the club

Field Trip Coordinator Assistant, ASCE BYU student chapter

September 2014 - April 2015

- Contacted professional engineers via email and phone calls to ask to tour their firms
- Coordinated transportation and times to visit and reported the organized tour information to my department

New Student Orientation Leader, Brigham Young University

August 2015 and August 2018

- Led 30 new BYU students for 2 days in their orientation to the university
- Gave tours, answered questions, and counseled students on study habits
- Encouraged the students throughout the semesters that followed

Religious Volunteer in Taiwan, The Church of Jesus Christ of Latter-day Saints

April 2016 - August 2017

- Trained 2 new volunteers one-on-one for extended periods of time
- Taught weekly English class
- Learned 2,000 Chinese characters with no formal training, could comfortably communicate with natives

SKILLS

- Visual Basic for Application (Excel VBA)
- ArcGIS
- Microsoft Office; Adobe PDF
- Some familiarity with Civil 3D and Microstation
- Mandarin Chinese: conversationally fluent, intermediate Chinese reading and writing