

**BRT Bus Station Location and Traffic
Flow Enhancement Study
Project ID: CEEEn_2016CPST_009**

by

**Triple J Engineering
Ryan Egbert
Josh Gibbons
Jenny Blonquist
Jordan Williams**

A Capstone project submitted to

**Andy Powell
AECOM**

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

14 November, 2016

Introduction

PROJECT TITLE: BRT Bus Station Flow Enhancement Study
PROJECT ID: CEEEn-2016CPST-009
PROJECT SPONSOR: AECOM
TEAM NAME: Triple J Engineering

This project will focus on locating two BRT side stations south of BYU campus on 900 North. With the addition of the BRT stations, the intersection at 700 East and 900 North will need to be designed to maintain a direct flow of traffic. Local bus stops will be accommodated for in the design. Consideration will be taken so that the nearby private properties are not impacted physically by this project.

Three design solutions/alternatives will be chosen from all the possible options discussed. The project team will consult with BYU professors who specialize in transportation engineering and planning about these design solutions. After the designs have been refined, the project team will present concept drawings of the three alternatives to the client. A meeting will be held so the client can review the designs and provide feedback. Once any necessary changes are made, the final product of the preferred alternative will be presented to the client, BYU, and Provo City. During this time, monthly reports will report the status of the project. These reports will be sent to the client. A more detailed timeline is provided in the schedule section of this proposal.

Deliverables will consist of a final report with cost and environmental details for each of the three alternatives. A poster will also be made that shows a summary of the project with the chosen final design. A PowerPoint presentation will be made discussing the process and final results of this project. This presentation will take place during the Final Layout Review Meeting at the end of March.

Proposed Work Plan

The project description provided in the request for proposal is as follows:

Locate two BRT side stations on 900 North between 700 East and East Campus drive in Provo, UT. Accommodate local bus stops outside of the BRT stations. There are dedicated bus lanes on the outside of 900 North beginning at the stations and extending to 900 East. Accommodate a direct flow of traffic from 700 East to 900 North with Campus Drive “T-ing” into this reconfiguration. Minimize impacts to existing parking lots with no impacts to any other private property.

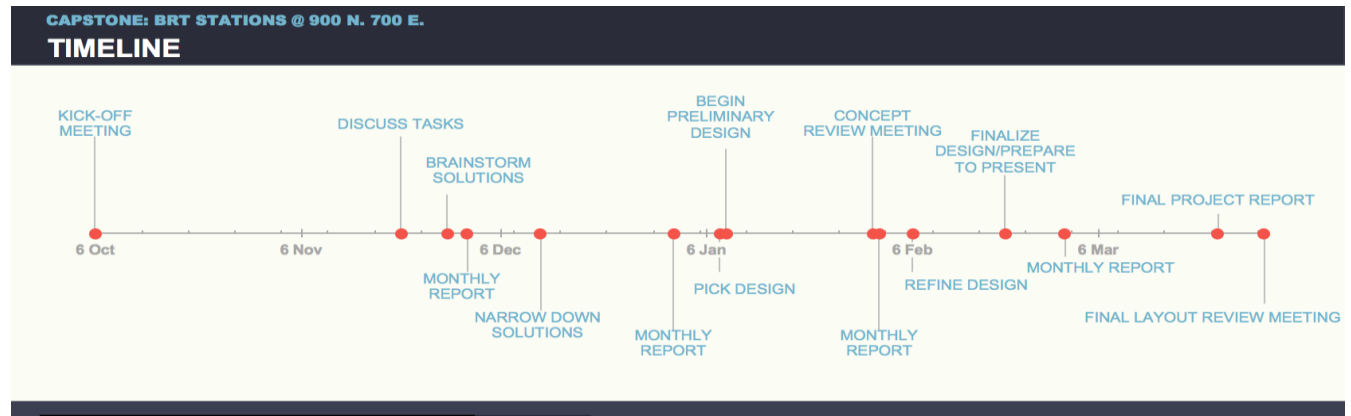
In discussions with the client, it was also mentioned that BYU would prefer that the BRT stations be located west of the 900 North / Campus Drive intersection to provide easy access for BYU students that use the BRT. Also, the client said that the concrete sidewalk ramps south of the 900 North / Campus Drive intersection do not meet ADA standards. This will be taken into account when determining the location and design of the stations.

The following are the individual tasks that will be done to accomplish the goals of the project:

1. **Hold one site visit with the owner, if necessary.** The purpose of this site visit will be to discuss the physical scope of the project, including requirements and limitations.
2. **Discuss all possible station design options, and choose three alternatives as the best alternatives.** The project team will consult with the client, BYU professors, and others to ensure that project needs are met with each design. The project team plans to consult with BYU professors Dr. Grant Schultz and Dr. Mitsuru Saito, who specialize in transportation engineering and planning.
3. **Create preliminary concept drawings of the three alternatives, and present them in a review meeting where a preferred solution will be identified by the client.** AutoCAD or a similar software will be used to create the drawings of the three alternatives. It is anticipated that this meeting will be held at the end of January 2017.
4. **Prepare final layout drawings of the preferred alternative to present to the client, BYU, and Provo City.** This will also be done using AutoCAD software. It is anticipated that the final layout will be reviewed in a meeting at the end of March 2017.
5. **Summarize the project process and findings in a professional report, which will be presented to the client.**

Schedule

The following is a timeline of the proposed project milestones, with the project details listed below:



PROJECT DETAILS

**Additional meetings with client will be held when requested*

| DATE | MILESTONE |
|----------|------------------------------------|
| 10/6/16 | Kick-off meeting |
| 11/21/16 | Discuss Tasks |
| 11/28/16 | Begin brainstorming Solutions |
| 12/1/16 | Monthly Report |
| 12/12/16 | Narrow down solutions |
| 1/1/17 | Monthly Report |
| 1/8/17 | Pick design |
| 1/9/17 | Begin Preliminary Design |
| 1/31/17 | Concept Review Meeting |
| 2/1/17 | Monthly Report |
| 2/6/17 | Refine Design |
| 2/20/17 | Finalize Design/Prepare to Present |
| 3/1/17 | Monthly Report |
| 3/24/17 | Final Project Report |
| 3/31/17 | Final Layout Review Meeting |

Facilities, Tools, Data and Equipment

Data: The data on said BRT stations specifications will be provided by the client along with surveying and mapping and traffic data.

Facilities: The facilities used for design will be on campus at BYU.

Tools: Tools and equipment will once again be provided by BYU. The main program to be utilized for conceptual design will be AutoCad Civil 3D.

Project Budget

The following is a budget of the estimated number of hours that will be required for each task, with the hours being total hours worked as a project team:

| DATE | MILESTONE | ESTIMATED HOURS |
|-----------------|------------------------------------|------------------------|
| 10/6/16 | Kick-off meeting | 4 |
| 11/21/16 | Discuss Tasks | 4 |
| 11/28/16 | Brainstorm Solutions | 15 |
| 12/1/16 | Monthly Report | 2 |
| 12/12/16 | Narrow down solutions | 8 |
| 1/1/17 | Monthly Report | 2 |
| 1/8/17 | Pick design | 5 |
| 1/9/17 | Preliminary Design Work | 20 |
| 1/31/17 | Concept Review Meeting | 4 |
| 2/1/17 | Monthly Report | 2 |
| 2/6/17 | Refine Design | 20 |
| 2/20/17 | Finalize Design/Prepare to Present | 30 |
| 3/1/17 | Monthly Report | 2 |
| 3/24/17 | Final Project Report | 30 |
| 3/31/17 | Final Layout Review Meeting | 4 |
| TOTAL | | 152 |

Deliverables

The following will be provided to the client as a result of the project:

- **Monthly status reports** from the project team to the client regarding progress during the previous month. The monthly report will also include a discussion on the challenges met, solutions found, design progress, and a work plan for the next month. The reports will be a one-page documents of PDF format and will be emailed to the client.
- A **final report** with three design alternatives that include economic and environmental considerations. The final report will include a discussion on the project process. The three concept alternatives will be presented along with benefits and costs related to each. One of the three concepts will be presented as the recommendation by the project team. The report will be in PDF format and will be emailed to the client.
- A **final layout of the preferred alternative**. The layout will be drawn using CAD software. Supplementary concept drawings will be included as needed. The CAD files will be provided to the client along with other supplementary files.
- A **poster** giving a brief overview of the project and its results. This poster will be presented in a poster session of capstone projects to students and faculty at BYU. It is anticipated that this poster will be kept by Brigham Young University at the conclusion of the project.
- A **PowerPoint presentation** summarizing the project process and results. This presentation will be given to the client at the conclusion of the project. It is anticipated that this presentation will take place at the end of March 2017, as shown in the schedule.

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.

Statement of Qualification

The project team consists of graduate and undergraduate students from Brigham Young University. Resumes for each respective team member are included in the Appendix. The project team includes the following personnel:

Ryan Egbert – Project Manager

Ryan is a graduate student at BYU. He is currently working on research for Dr. Jim Nelson about the Food Energy Water Nexus. He has experience as an engineering intern at Spanish Fork City and the Jordan Valley Water Conservancy District. He has had the opportunity to be the project manager on several projects including a \$3 million dollar piping project for the district this summer. He plans to complete his master's degree in August of 2017.

Ryan will be the project manager for this project. He will be in charge of overseeing the project, working with the client, and helping the team with any questions they have.

Josh Gibbons – Team Lead

Josh is a senior undergraduate student at BYU. He is currently working as a research assistant for Dr. Schultz doing traffic and safety research for UDOT and as an intern at Hales Engineering, a traffic engineering consultant in Lehi, Utah. He plans to complete a master's degree at BYU after graduation in April 2017 and will continue doing research for UDOT as part of his thesis.

Josh will be the team lead for this project. His responsibilities will include organizing meetings with the project team and review meetings with the client. He will organize the efforts of the project team to ensure a quality product as a result of the project. He will use his past experience and knowledge of traffic flow and roadway design to assist in creating possible designs for the BRT stations.

Jenny Blonquist – Reports and Presentations

Jenny is a senior undergraduate student at BYU. She is currently a research assistant for Dr. Franke using UAV's to create 3D models for analysis in various Engineering applications as part of the Center of Unmanned Aircraft Systems (C-UAS). She is also an intern at York Engineering, a structural engineering firm in Murray, Utah. She previously participated in a Global Engineering Outreach team that designed and developed a tea packaging machine that improved the business for a community in Porcon, Peru. She was responsible for organizing and compiling reports and presentations presented at design reviews. After graduation in April 2017, she plans to complete a master's degree at BYU.

Jenny will be responsible for organizing reports and presentations. She will document and compile necessary resources to be included in the final product. She will also contribute to the design and development of BRT station solutions.

Jordan Williams – AutoCAD Designer

Jordan is a senior undergraduate student at BYU scheduled to graduate in April. He currently works for a Civil Engineering firm based in Arizona called R.B. Williams & Associates, Inc. He has worked with said firm for the past two years specializing in construction drawings.

Jordan will be mainly responsible for the design work of the BRT stations using AutoCad software. He will contribute to the process of selecting a solution based on his experience working as a designer for a civil engineering firm.

The project team has collectively taken the following applicable coursework at BYU:

- CE EN 113 – Engineering Measurements (Surveying and GIS)
- CE EN 270 – Computational Methods
- CE EN 361 – Introduction to Transportation Engineering
- CE EN 461 – Geometric Design of Highways
- CE EN 562 – Traffic Engineering
- CE EN 565 – Urban Transportation Planning
- ENGL 316 – Technical Communication/Writing

The project team plans to consult with the following individuals for the project:

- Dr. Grant Schultz
- Dr. Mitsuru Saito

Appendix

The resumes of each project team member can be found on the following pages.

RYAN JAMES EGBERT

ryanegbert12@gmail.com (801)518-8895

Current Address: 466 North 750 East, Provo, UT 84606

Permanent Address: 10363 Calla Lily Way, Sandy, UT 84092

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| OBJECTIVE | Employment in the field of civil/construction engineering that utilizes my problem solving and leadership skills. | |
| EDUCATION | Brigham Young University, Provo, UT | |
| | Major in Civil Engineering with Minor in Spanish, Magna Cum Laude April 2016 | GPA: 3.96/4.0 |
| | Hillcrest High School, Midvale, UT | |
| | High School Diploma June 2009 | GPA: 3.94/4.0 |
| WORK EXPERIENCE | Jordan Valley Water Conservancy District, West Jordan, UT | March 2015-present |
| | Engineering Intern | |
| | <ul style="list-style-type: none"> • Working with senior engineers to create designs for buildings and water projects. • Preparing bid forms, receiving bids, and overseeing contractors during construction. • Performing site inspections and working with management to negotiate change orders. | |
| | Brigham Young University, Provo, UT | May 2013-August 2015 |
| | Research Assistant | |
| | <ul style="list-style-type: none"> • Assisted Dr. Rollin Hotchkiss with Civil Engineering grant funded projects. • Actively contributed on a research team comprised of professor, and graduate and undergraduate students. | |
| | Teaching Assistant | August 2013-April 2015 |
| | <ul style="list-style-type: none"> • Assisted with curriculum and learning activity development, graded papers, and held review sessions. | |
| | Spanish Fork City Engineering Department, Spanish Fork City, UT | April-September 2014 |
| | Engineering/Surveying Intern | |
| | <ul style="list-style-type: none"> • Worked on a team for water, sewer, roadway, and construction projects. • Designed and drafted plans for projects using AutoCAD Civil 3D and ArcGIS. • Performed surveying for projects, collected points and then loaded them in AutoCAD. | |
| PROJECTS | BLM Project | May-October 2013 |
| | <ul style="list-style-type: none"> • Researched potential use of abandoned coal mines as underground reservoirs in Utah. • Collaborated with Bureau of Land Management, a private engineering firm, and site community. • Coauthored <i>Use of Wasatch Plateau and Book Cliffs Mine Water for Beneficial Purposes: Case Study for Emery Utah</i> by David Merrell, Ryan Egbert, Rollin H. Hotchkiss, Ph.D., P.E., D.WRE, F.ASCE Department of Civil and Environmental Engineering BYU. • Presented project report at Coal Symposium in Castle Dale, UT on October 24, 2013. | |
| | Maya Water Project | Dec 2013-August 2015 |
| | <ul style="list-style-type: none"> • Preliminary research and planning for exploration of ancient Maya water systems found in Northern Guatemala and Southern Mexico. | |
| | Dominican Republic Capstone Project | January-April 2015 |
| | <ul style="list-style-type: none"> • Collaborated with INDRHI (National Hydraulic Resources Institute) and local engineering students from INTEC • Performed site visits and investigated potential locations for building a dam. | |
| LEADERSHIP AND SKILLS | Golden Key International Honour Society | January 2013-present |
| | Honorary Members Chair (1/13 to 6/13) and Interclub Liaison (7/13 to present) | |
| | Language: Fluent in Spanish | |
| | Software: Microsoft Office, AutoCAD, REVIT, ArcGIS, HydroDesktop, JobView Accounting | |
| ACTIVITIES & HONORS | Student Speaker at Fulton College School of Engineering Graduation, April 22, 2016 | |
| | Authored BYU ASCE Ridgeway Award Winning Report, 2015-2016 | |
| | Tau Beta Pi Honor Society, 2014-2015 | |
| | Centro Hispano, Volunteer ESL Teacher, 2013-2015 | |
| | Weidman Center Global Student Scholar, 2013-2014 | |
| | LDS Missionary Service, Long Beach California--Spanish Speaking, 2010-2012 | |
| | Eagle Scout, 2007 | |

Josh Gibbons

876 N University Ave
Apt. 2
Provo, UT 84604

801-889-4218
jdgibbons19@gmail.com

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- EDUCATION** Bachelor of Science, Brigham Young University; Provo, UT – April 2017
- 3.78 GPA
 - Civil Engineering; ACTFL Spanish Certificate
 - Member of ASCE and ITE
 - Planning to complete a Master's degree after graduation

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- WORK EXPERIENCE** Transportation Engineer Intern, Hales Engineering; Lehi, UT – April 2016-Present
- Complete traffic impact studies, parking studies, and safety studies for clients in both the private and public sector
 - Assist in development of transportation master plans
 - Participate in data collection processes using Jamar technology
 - Create a new company website to improve marketing efforts
- Research Assistant, Brigham Young University; Provo, UT – July 2015-Present
- Work with a team of students and faculty researching traffic and safety for the Utah Department of Transportation
 - Use VBA code in Microsoft Excel to automate data manipulation processes to save client several hours of time
 - Write a manual with clear instructions of how to use the Excel spreadsheets
- Project Engineer Intern, Okland Construction; Lehi, UT – August 2014-August 2015
- Managed the digital plans of over 10 projects on site including hyperlinks, revision updates, and historical plan sets
 - Lead a structural and architectural takeoff worth over \$250,000
 - Prepared and submitted RFI's and submittals daily to the design team and owner
 - Created several Excel spreadsheets using VBA code to automate data entry processes

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- SKILLS & ABILITIES** Proficient in Synchro/SimTraffic, Bluebeam Revu and AutoCAD
- Highly skilled in VBA coding in Microsoft Excel
- Trained in surveying techniques and 3D scanning
- Strong problem-solving and analytical skills
- Spanish Language – Read, write, and speak fluently

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- OTHER EXPERIENCE** LDS Mission to Oaxaca, Mexico – March 2011-April 2013
- Led up to 20 other missionaries at a time in leadership positions
 - Trained fellow missionaries on a weekly basis
 - Worked in mission office organizing dozens of new member records
- Extra-curricular Activities
- Team captain of high school cross country team
 - Music
 - Performed in 2 large concerts accompanied by an orchestra
 - Taught piano lessons to 10 students at a time

JENNY LEE BLONQUIST, EIT

1269 North Riverside Avenue #24 • Provo, UT 84604 • (801) 592-5665 • jenny@blonquist.com

EDUCATION

COLLEGE OF ENGINEERING, BRIGHAM YOUNG UNIVERSITY **PROVO, UTAH**

Bachelor of Science in Civil and Environmental Engineering **April 2017**

- FE exam passed: August 2016

EXPERIENCE

YORK ENGINEERING **MURRAY, UTAH**
Structural Engineering Intern **August 2016-Present**

- Perform structural analysis and design of light framed construction projects.

CIVIL ENGINEERING DEPARTMENT, BYU **PROVO, UTAH**
Teaching Assistant for CE EN 341: Soil Mechanics **August 2016-Present**

- Instruct students how to perform various geotechnical laboratory tests.

CENTER FOR UNMANNED AERIAL SYSTEMS (C-UAS) AT BYU **PROVO, UTAH**
Research Assistant **January 2016-Present**

- Participate in progressing research of UAV applications in the Civil Engineering field.
- Generate and analyze data from 3D models that is used for technical papers using various modeling software.

MISSIONARY TRAINING CENTER INFORMATION TECHNOLOGY **PROVO, UTAH**
Information Technology Desk Analyst **April 2015-September 2015**

- Worked efficiently with Active Directory, computer imaging processes; managed inventory; fixed hardware of Dell computers, laptops, iPads, and managed MTC applications.
- Provided 1st tier technical computer support for over 2,500 employees and service volunteers.
- Created trusting relationships by quickly responding to and fixing each individual's tech problems.

NEW YORK NEW YORK NORTH MISSION **NEW YORK, NEW YORK**
Volunteer for the Church of Jesus Christ of Latter-day Saints **February 2013-August 2014**

- Trained new individuals to work effectively using Mandarin and/or English.
- Created strong relationships of trust with the community.

OTHER

GLOBAL ENGINEERING OUTREACH **PROVO, UTAH / PERU**
Member of Tea Packaging Process team **August 2015-May 2016**

- Worked with a team consisting of different engineering disciplines to create and develop designs to increase the profitability of a Peruvian Community's business.

- Fluent in English and Mandarin.
- Experience in NX, Visual Basics, ArcGIS, Adobe Photoshop, Agisoft PhotoScan, Maptex I-Site, Cloud Compare, and AutoCad Civil 3D.

Jordan Williams

210 S. 200 E.
Provo, UT 84606

480-993-4627
Jordan@rbwilliams.com

Education

Bachelor of Science in Civil Engineering, Brigham Young University

April 2017

- GPA 3.5

Relevant Work Experience

Civil AutoCAD Designer, R.B. Williams & Assoc., Inc.

January 2015-Present

- Grading and Drainage Plans
Designed and prepared more than two dozen Grading and Drainage plans, eight of which were preliminary plans that required revision after initial review.
- ALTA/NSPS Land Survey Plans
Prepared ten ALTA/NSPS Land Survey Plans which have been submitted and approved of by the appropriate city.
- Construction Drawings
Designed and prepared both residential and commercial construction drawings for multiple clients. The projects included grading/drainage, paving, and utility design and plan preparation.
- Utility and Paving drawings
- Knowledge of Construction Equipment and Techniques
Made many site visits to verify that the construction and or excavation was being performed correctly and with the proper equipment.
- Survey Crew member
Opportunity to understand process by which plans are designed, prepared, implemented and inspected.

Other Work Experience

Sales Representative, Fibernet

April 2014-December 2015

Was head member of many projects, one of which the whole team traveled to San Francisco for a sales event in which we were successful in obtaining many new clients.

Real Estate Agent, Rock Canyon Real Estate

March 2013-March 2015

Had success finding properties for prospective clients and helped them purchase said properties.

Other Experience

- Eagle Scout
- National Honor Society (BYU and High School)
- Two year service mission in Brazil (Fluent in Portuguese & basic knowledge of Spanish)
- Grew up working in construction and have a firm understanding of the construction process