SPRINGVILLE PERFORMANCE EVALUATION & PAVEMENT DESIGN FOR MINOR COLLECTORS

Project ID: CEEn_2018CPST_013

Springville Performance Evaluation & Pavement Design for Minor Collectors

by

MagiCAP
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Alec Escamilla
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A Capstone Statement of Work

Submitted to

Dr. Spencer Guthrie, PhD
Representing the City of Springville

Department of Civil and Environmental Engineering
Brigham Young University

08 October, 2018

Introduction

PROJECT TITLE:	Springville Performance Evaluation & Pavement Design for Minor Collectors
PROJECT ID:	CEEn_2018CPST_013
PROJECT SPONSOR:	City of Springville
TEAM NAME:	MagiCAP

A recently completed study of pavement performance in Springville City indicates that minor collectors are failing prematurely. Evaluations of selected minor collectors are needed to determine the cause(s) of premature failure, and a new pavement design is likely warranted. Completion of the project will require field work and will allow team members to learn more about pavement design.

The desired outcomes of the project include an explanation(s) for the premature failure observed on selected minor collectors and, if warranted, a new pavement design for minor collectors in the city.

The timeline to complete this project is explained in further detail in the "Schedule" section of this Statement of Work. The field work aspect of the project will be completed before November 15, 2018. The required laboratory work will be completed by the end of January, 2019. A physical report will be completed by the end of February, 2019. A poster summarizing the project, findings, and recommendations will be completed by the March 15, 2019.

There are two key deliverables for this project. The first will be a report explaining the premature failure observed and may include a new pavement design. The second is the poster described in the previous paragraph.

Proposed Work Plan

This project will be approached in four stages: field work, laboratory work, report preparation, and poster design. Each stage will be critical in gathering, synthesizing, and sharing the results found by this project.

The field work will occur before November 15, 2018. After this date, weather is typically unsuitable for working outdoors. This is a standard date used by the Utah Department of Transportation. The work done will include taking sample core from several minor collectors in Springville. Samples of the different layers of soil beneath those same minor collectors will also be taken. In addition to the minor collectors that are failing, several cores and soil samples from similar minor collectors that are not failing in Springville may be taken to compare with the failing samples.

The specific experiments that will be done in the laboratory portion of this project are still to be determined. Possible experiments to be run include freeze-thaw testing, gradation analysis, and various data collection via advanced sensing equipment. These tests will all be performed in the materials research laboratory at Brigham Young University. The purpose of these experiments is to determine the possible causes of premature failure of the determined minor collectors in Springville.

The report preparation stage of this project will allow the team to analyze the data collected in the laboratory experiments and create a detailed report for the city. This stage may also include a new pavement design for the failing minor collectors or a new specification for those roads to be delivered to the client. This may be done in a variety of locations, but most of the work will be done on the Brigham Young University campus.

The final stage of the project is creating a visual presentation. This will be done to summarize the important findings and recommendations of this project. The visual will provide an easily digestible resource that highlights the work done and the value added to the client.

Schedule

At Risk	Task Name	Status	Start Date	End Date	Assigned To	% Complete	Notes
	Section 1 - Preliminary Groundwork		**09/25/18**	**12/10/18**		**36%**	
	Regular Status Report 1	Complete	10/05/18	10/10/18		100%	
	Define Lead Measures for WIGS	Complete	10/10/18	10/11/18	P paolo	100%	
	Draft SOW for Dr. Guthrie	In Progress	10/12/18	10/13/18	A Alec	75%	
	Schedule Field Testing w/ Dr. Guthrie	In Progress	09/25/18	10/13/18	C Craig	0%	
	Regular Status Report 2	In Progress	10/08/18	10/15/18	P paolo	25%	
	Regular Status Report 3	Not Started	10/15/18	10/22/18	A Alec		
	Regular Status Report 4	Not Started	10/22/18	10/29/18	C Craig		
	Regular Status Report 5	Not Started	10/29/18	11/05/18	P paolo		
	Regular Status Report 6	Not Started	11/05/18	11/12/18	A Alec		
	Regular Status Report 7	Not Started	11/12/18	11/19/18	C Craig		
	Regular Status Report 8	Not Started	11/19/18	11/26/18	P paolo		
	30% Completion Report	Not Started	10/08/18	12/10/18			
	Section 2 - Field Testing & Lab Work		**10/12/18**	**01/31/19**			
	Collect Samples	Not Started	10/20/18	11/15/18			
	Meeting with Dr. Guthrie	In Progress	10/12/18	10/12/18		50%	
	Perform and Analyze Test	Not Started	10/20/18	01/31/19			
	Section 3 - Deliverables		**01/31/19**	**03/15/19**			
	Compile Report	Not Started	01/31/19	02/28/19			
	Construct Visual Aid	Not Started	02/28/19	03/15/19			

Figure 1: Grid view of scheduled tasks.

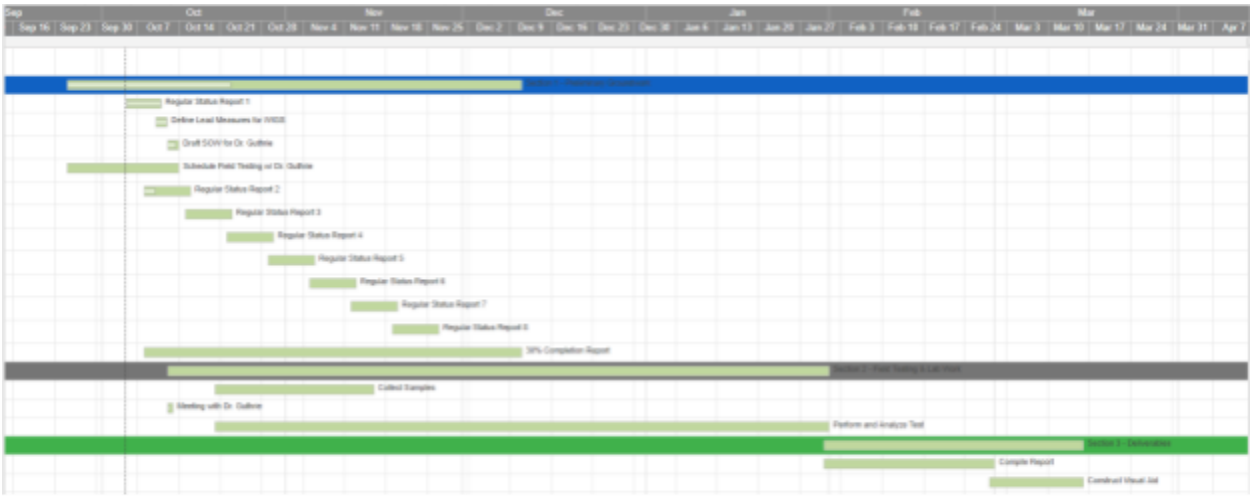

Figure 2: Project timeline for the Springville Performance Evaluation & Pavement Design for Minor Collectors.

Facilities, Tools, Data and Equipment

Facilities:

- Springville minor collectors
- Brigham Young University Materials Laboratory

Tools:

- Analysis software

Equipment:

- Coring machine: Used to retrieve cores from various minor collector sights.
- Universal Testing Machine: Used to perform shear tests on base materials.
- Compression loading machine: Used to test marshall, as applicable
- Water Bath: For testing of asphalt samples
- Oven: To obtain moisture content
- In-situ sensory equipment: Test in-situ conditions.

Data:

- Varies based on laboratory tests performed
- Moisture Content
- Ambient Temperature
- Pressure

This is not an exhaustive list of the tools, equipment, and data that will be used during the project, but it is sufficient to show the level of complexity that the team will undertake to complete the project.

Project Budget

Total Budget: $200

Estimated Expenditures:

- Food for long field work days
- Cold Patching Asphalt to fill road cores
- Visual Presentation Materials
- Fuel for generator
- Gypsum cap compound

Many of the materials, tools, and equipment required to complete this project will be provided by the faculty sponsor. These will not affect our budget. An expense log will be created to track purchase and ensure that the project is completed under budget.

Deliverables

There are three main deliverables for the completion of this project.

- A final report summarizing the reasons for minor collector failure with design alternatives for the project that include economic and environmental considerations.
- A poster reflecting a summary of the project to be presented to student, faculty, and other interested individuals in the final undergraduate seminar.
- A presentation summarizing the project to be presented to the sponsor (client).

There are also weekly status reports that will document challenges, solutions, and progress. There will be approximately 16 total status reports of this kind that will answer the following questions.

- What challenges have the team encountered in the Capstone project?
- What actions did the team decided to do to overcome these challenges?
- Any progress in overcoming these challenges?
- Is project on schedule?

The deliverables will come in a variety of forms. The final report will be submitted as a PDF document. The poster will be both a physical copy and a PowerPoint slide. The status reports will all be PowerPoint slides. The final presentation will be given in undergraduate seminar and a copy of the presentation and speaking notes will be delivered through PowerPoint.

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 licensed professional engineer.

Statement of Qualification

Key Personnel:

Name	Qualifications	LinkedIn Profile URL
Key Personnel		
Craig Staples	BYU Civil Engineering Student. Research Assistant. Acute. RB&G Engineering, ASCE Secretary.	https://www.linkedin.com/in/craigastaples/
Alec Escamilla	BYU Civil Engineering Student. Research Assistant. W.W.Clyde. Intertek PSI. ASCE President.	https://www.linkedin.com/in/aleczander-escamilla-28061512a/
Paul Andersen	BYU Civil Engineering Student. Research Assistant. Acute. Qualtrics. South Valley Sewer District.	https://www.linkedin.com/in/paul-jw-andersen/
Outside Consultants		
Dr. W. Spencer Guthrie		https://www.linkedin.com/in/w-spencer-guthrie-0425646/
Robert Stevens		https://www.linkedin.com/in/robert-stevens-b08366b2/
Tenli Waters		https://www.linkedin.com/in/tenli-waters-5676bb87/
Capstone Committee		
Dr. Wayne Lee		https://www.linkedin.com/in/wayne-lee-9550aa170/
Dr. Rollin Hotchkiss		https://www.linkedin.com/in/rollin-hotchkiss-48629934/

Resumes attached in Appendix A.

Appendix A

Aleczander N. Escamilla

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EDUCATION

Brigham Young University — **Provo, UT**
B.S. Civil Engineering; Minor: Business Management — Apr 2020
- GPA: 3.94/4.00; ACT: 29/36 (92nd percentile)
- Harvard Business School Peek Weekend Ambassador
- Marigold N. Saunders merit-based scholarship and W. Don Budge Civil Engineering merit-based scholarship recipient

EXPERIENCE

PricewaterhouseCoopers — **Dallas, TX**
Start Advisory Intern — Jun 2018 – Jul 2018
- Created a best-in-class client deliverable that visually connects PwC's service offerings to their 6 FY19 platforms
- Enhanced the ability of sales teams to bring the One Firm methodology to the client
- Developed strong relationships while balancing multiple projects and allowed for greater focus on high impact work

Brigham Young University — **Provo, UT**
Research Assistant in Department of Civil and Environmental Engineering — Oct 2016 – Present
- Perform 20+ unconstrained shear testing using a Universal Testing Machine to determine effectiveness of geogrid
- Work directly with a Master's student to publish a thesis through BYU and in an academic journal
- Work independently and collaboratively on preparing, compacting, and testing 20+ different soil samples

W.W. Clyde & Co. — **Orem, UT**
Engineer Intern — May 2017 – Dec 2017
- Drove over $60,000 in savings on a $19 M project by finding value engineering opportunities
- Created a production schedule using Excel in order to keep the project profitable and to meet established goals
- Verified accuracy of reported quantities for payment and created 15+ submittals for various project phases
- Managed the purchasing and supervised the installation of 3,000+ yards of storm drain
- Identified design deficiencies and worked with owners, designers, and subcontractors to correct them

Intertek PSI — **Oklahoma City, OK**
Engineer Intern — May 2016 – Aug 2016
- Supervised the pouring and performed quality control testing of concrete on 20+ projects, often between 1 am-6 am
- Ran a variety of lab tests including Atterberg Limits, California Bearing Ratios, Proctors, and Resistivities
- Demonstrated ability to learn and fill multiple roles including as a driller's assistant, boring twenty 15-45 foot deep holes
- Certified American Concrete Institute 1 technician with only a few days of training

Brigham Young University — **Provo, UT**
Residence Assistant — Jan 2016 – Apr 2016
- Helped create and supervise a healthy community directly with 38 residents and upwards of 150 indirectly
- Planned, organized, and ran 4 events to encourage development of healthy life habits available to hundreds of students
- Met weekly with about 20 residents to lead discussions on community standards and life skills

SERVICE AND LEADERSHIP

Cougar Consulting Group — **Provo, UT**
Engagement Manager and Founding Team Member — Mar 2018 – Present
- Developed a quantifiable, data-driven strategy to determine an international office location for a fast-growing SAAS client

Engineers Mean Business Club — **Provo, UT**
Treasurer and former Vice President of Events — Jan 2017 – Present
- Planned, organized, and coordinated events that would increase members professional networks and their business skills
- Worked directly with professionals in engineering, entrepreneurship, tech, and others to inspire club members

American Society of Civil Engineers BYU Student Chapter — **Provo, UT**
President, Concrete Canoe Team Member, and Heavy Civil Construction Management Case Competitor — Aug 2017 – Present
- Coordinate the efforts of 14 other officers to provide service, leadership, and networking opportunities to over 200 students
- Authored and presented a non-technical paper that won 1st place overall at the ASCE Rocky Mountain Conference
- Helped build a canoe made out of concrete that not only floats but is used for several different races against other schools
- Led a team of 6 to analyze, schedule, bid, and present a construction management case competition in 24 hours

The Church of Jesus Christ of Latter-day Saints — **Oaxaca, Mexico**
Bilingual Service Representative — Aug 2013 – Jul 2015
- Coordinated the daily efforts of over 30 other representatives to improve the lives of the people in Oaxaca
- Organized and presented weekly and bi-monthly leadership training conferences that focused on interpersonal skills
- Adapted to an international environment by working with local leaders and immersing myself in the culture

PERSONAL

- Starting to learn Finnish
- Inner tube water polo goalie

CRAIG STAPLES

469 Wymount Terrace, Provo, UT 84604 ♦ 530-635-4475 ♦ castaples14@gmail.com

Objective: Seeking opportunities in field engineering, specializing in material testing.

EDUCATION

APRIL 2019 EXPECTED — **Brigham Young University** — **Provo, UT**

BS CIVIL ENGINEERING 3.83 GPA Civil Engineering Scholarship ASCE National Member

KEY UNIVERSITY COURSE WORK:

Elementary Soil Mechanics, Statics and Dynamics, Geomatics and GIS, Hydraulics, Structural Analysis, Differential Equations, Calculus

EXPERIENCE

AUGUST 2017-PRESENT — **Brigham Young University Civil Engineering Department** — **Provo, UT**

SOIL MECHANICS LABORATORY INSTRUCTOR

- Guided 7 students on a weekly basis through real-world laboratory exercises
- Critiqued weekly technical writing on laboratory group reports and gave quality feedback
- Assisted students during weekly office hours with university soil mechanics coursework

SUMMER 2017 — **RB&G Engineering** — **Provo, UT**

LABORATORY TECHNICIAN

- Sampled, tested and provided quality assurance work on 300+ soil samples
- Completed rice, gyratory, Marshall, and burnoff tests on 300+ asphalt samples
- Performed slump, air and compressive tests for airport hangars at the Salt Lake City International Airport

SUMMER 2015 — **Clark Pacific Engineering Firm** — **Woodland, CA**

HEALTH AND SAFETY INTERN

- Worked closely with 4+ civil engineers, monitoring high danger area safety concerns
- Implemented and conducted daily safety inspections, identifying and mitigating safety concerns for 100+ employees to ensure safe working conditions
- Evaluated reported injury data using Microsoft Excel and Word to reduce employee injury

VOLUNTEER/SERVICE

APRIL 2017-PRESENT — **BYU American Society of Civil Engineers (ASCE)** — **Provo, UT**

CLUB SECRETARY

- Documented weekly officer meting minutes with assignment follow up
- Conducted weekly club meetings for 250+ students

2011-2013 — **The Church of Jesus Christ of Latter-day Saints** — **Paris, France**

VOLUNTEER REPRESENTATIVE

- Trained 6 missionaries in essential French speaking, teaching, and planning skills
- Prepared weekly trainings for 8 missionaries during a two-month period

SKILLS AND ACHIEVEMENTS

- Computer skills:
  - Excel (including VBA)
  - AutoCAD, Revit
  - ArcMap/GIS
  - Google Docs and Sheets
  - Microsoft Word, PowerPoint, Photo shop
- OSHA 10 Hour Trained
- Eagle Scout, Boy Scouts of America

Paul JW Andersen

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385-207-9395 * paolo.andersen@gmail.com

Education

Brigham Young University Apr 2019
BS Civil & Environmental Engineering Provo, UT

- 3.79 cumulative GPA, member of Tau Beta Pi Engineering Honor Society
- Minor: Business
- Relevant Coursework: Design of Wood Structures, Structural Steel Design, Reinforced Concrete Design, Geotechnical Engineering, Geology for Engineers, Fluid Mechanics, etc.

Work Experience

Acute Engineering Nov 2017 - Present
Structural Engineering Intern Orem, UT

- Provided light-frame engineering in accordance with ASCE 7-10, NDS, SDPWS, IBC, IRC and local code
- Institutionalized universal shallow foundation details for projects outside of Utah County

Brigham Young University May 2018 - Present
Field Research Assistant to Dr. Kyle Rollins Provo, UT

- Collaborated with professors from BYU and Università di Bologna, in a ground improvement study using rammed aggregate piers to mitigate liquefaction potential in susceptible soils (sponsored by Geopier Foundation)
- Assisted with field testing at site in Bondeno, Italy and post-experiment data analytics using Excel and VBA

South Valley Sewer District Jun 2017 - Aug 2017
Wastewater Engineer Intern Bluffdale, UT

- Reviewed and revised all sewage plans with district and staff engineers for all new construction projects within the largest utility district in Utah
- Programmed with VBA to reduce regular data entry time from 15 hours to 1 hour

Qualtrics, LLC. Dec 2016 - Nov 2017
Project Manager Provo, UT

- Managed research studies across numerous industries, utilizing Qualtrics software and strategic sampling

Product Specialist Sep 2013 - Dec 2016

- Provided customer service to companies such as Bain & Co., Google, PWC, Allianz, etc.
- Promoted internally resulting in a doubling of personal hourly pay (starting $8/hr., end $17.50/hr.)

Carescape Sprinkler and Landscape Gurus Jun 2013 - Sep 2013
Operations Manager Heber City, UT

- Led team of 4 and managed plans, materials, equipment to efficiently install automated home irrigation systems
- Operated heavy equipment such as trenchers, skidsteers and excavators safely

Volunteer and Other Experience

Church of Jesus Christ of Latter-day Saints Mar 2011 - Mar 2013
Full-time Representative Southern Italy, and Malta

- Developed leadership, training, public speaking, and managerial skills while providing full-time volunteer service
- Coordinated efforts of 26-50 volunteers spread across the regions of Calabria and Sicily

BYU Y-Serve: Self Help Homes Jan 2015 - Apr 2016
Program Director Heber City & Elk Ridge Utah

- Collaborated with constructional professionals to provide skill training to volunteers, resulting in our program's community contact receiving the Community Service Provider of the year award from BYU

Utah's Hogle Zoo Jun 2016
Animal care intern SLC, UT

- Selected as hoof-stock caretaker, responsible for husbandry of 4 giraffes, 3 zebras and 2 ostriches

Other Skills & Certifications

- Software: Basic knowledge of Autodesk's CAD and Revit, VBA Programming, Microsoft Office
- Passed Fundamentals of Engineering (FE) exam. Registered EIT