
POWER TRANSMISSION FOUNDATION DESIGN

Project ID: CEEEn-2016CPST-005

by

MDT Engineering

McKay Harper

Todd Weichers

Daniel Pope

Mikayla Hatch

A capstone project submitted to

Jeremy Decker

Kiewit Infrastructure Engineers Co.

Department of Civil and Environmental Engineering

Brigham Young University

14 November 2016

MDT Engineering
Brigham Young University
Provo, UT 84606
14 November 2016

Kiewit Infrastructure
3555 Farnam St.
Omaha, NE 68131

To whom it may concern,

MDT Engineering is pleased to submit this proposal for the Power Transmission Foundation Design, located in East Hanover, NJ. Our team intends to perform the proper analysis and design needed to provide the highest quality and constructability.

Our work ethic, as well as internship experiences and technical skills, qualify us to produce the best possible design as well as provide the best construction strategy to efficiently and safely provide the product. We will work with Dr. Rollins, faculty advisor, and Mikayla Hatch, graduate mentor, to complete this project.

This proposal contains an executive summary, work plan, schedule, budget, statement of qualifications, and a list of deliverables. We are excited to work on this project. If there are any questions, please contact us at 801-921-0746.

Best Regards,

Daniel Pope
TJ Weichers
McKay Harper

MDT Engineering

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Executive Summary

PROJECT TITLE: Power Transmission Foundation Design
PROJECT ID: CEEEn-2016CPST-005
PROJECT SPONSOR: Kiewit Infrastructure Engineers Co
TEAM NAME: MDT Engineering

In response to the RFP submitted by Kiewitt Infrastructure Engineers Co., MDT Engineering will be designing two foundations for power transmission lines located in East Hanover, NJ. Keiwitt has previously designed and installed the foundations for 16 Lattice Towers and eight monopoles located in meadowlands and an existing rail yard of East Hanover. MDT Engineering will complete their own design of one monopole foundation in the meadowlands and one lattice structure foundation in the rail yard. As part of the designs, MDT will provide erection plans aided to guide the construction.

The loadings and dimensions for the monopole and lattice tower have been provided in the RFP, along with the expected design codes, elevations, design basis, and a geotechnical report for each location.

MDT Engineering will review the provided design basis, design codes, power transmission dimensions and loads, and each site's geotechnical data to develop parameters for each tower foundation. These designs will include details for deep foundations, pile caps, steel connections, and concrete reinforcement as required. The final deliverables will include detailed plans and calculations for each tower as well as code checks, design approaches, construction schemes, and a bill of materials. A presentation of the completed project will be given to Keiwitt along with a report and poster reflecting a summary of the designed project.

The project will start 2 January 2017 and is expected to end 10 April 2017. To meet this deadline, MDT has created a project timeline with important milestones. The team will meet for three hours a week, and each member will work outside the meetings for five hours a week. Progress will be reported on the last week of each month in a monthly progress report. The monthly report will include the current status of the project, challenges and actions to resolve the challenges, and the progress overcoming the challenges.

MDT Engineering is dedicated to provide the results needed for success. The team's combined experience with construction, computer design programs, and academic competence makes MTD Engineering the perfect team to design the power transmission foundations on time while meeting every need of Kiewitt Infrastructure Engineers Co.

Proposed Work Plan

As part of our core values, we provide quality deliverables by focusing on the expectations of our client. This project consists of the design and construction for replacing six miles of power transmission lines in East Hanover, NJ. A total of 24 towers were replaced, including 16 lattice structures and eight monopole towers. Kiewitt Infrastructure Co. completed this project in 2014. Our role is to provide original foundation designs for one lattice structure and one monopole tower located in an existing rail yard and in meadowlands respectively.

Our analysis phase will begin with analyzing geotechnical boring data for each site to determine the proper foundation parameters for the in-place soil type. Load demands for each foundation will be calculated based on the given lattice tower and monopole load charts. We will provide design calculations to meet local and national codes and to achieve a minimum 80-year design life for each foundation. These calculations will be performed by McKay Harper and Todd Weichers and reviewed by Daniel Pope in order to provide the highest quality design. Once the analysis phase is complete, we will begin the design phase. During the design phase, we will develop detailed plans for each foundation, pile caps, bill of materials, and detailed construction schemes. Throughout the project we will examine and propose innovative ideas to reduce costs and ensure quality results.

Our team will meet three hours each week to coordinate and discuss progress, challenges, and plans to approach the next phase of work. Team meetings will be held on the campus of Brigham Young University (BYU) where we will have access to resources including computer programs and our faculty advisor, Dr. Rollins. Each member of the team will individually contribute at least five hours each week towards the completion of this project; the work will be completed by 10 April 2017. On the last Friday of every month, monthly reports on progress, challenges, and innovative ideas will be sent to our graduate mentor, Mikayla Hatch, and sponsor contact, Jeramy Decker. At the completion of the project, we will summarize our results and present our recommendations in a final report, poster, and presentation to Kiewitt.

To maximize our efficiency and to provide clear communication between our team and Kiewitt, we have divided the project tasks between each team member according to their expertise. The division of work is as follows:

Name	Role	Description
McKay Harper	Team Liaison	Intermediary between team members, Kiewit Engineering, Mikayla Hatch, and Dr. Rollins to standardize and simplify communication efforts.
	Construction Specialist	Organize the creation of all construction schemes
Todd Weichers	CAD Specialist	Head and organize creation of all CAD files
	Project Manager	Organize team meetings, establish deadlines, and lead the creation of progress reports.
Daniel Pope	Quality Assurance Supervisor	Organize quality assurance efforts between team members, ensuring accurate calculations and results
	GIS Specialist	Head and organize creation of all GIS maps for the use of construction schemes and CAD files

Schedule

Team Work Schedule

Each team member will invest at least five hours each week in addition to our weekly team meeting. A breakdown of our weekly schedule is shown below:

	Monday	Tuesday	Wednesday	Thursday	Friday
7:00 AM					
8:00 AM					
9:00 AM					
10:00 AM		McKay, Daniel			
11:00 AM					
12:00 PM					
1:00 PM					
2:00 PM	TJ				
3:00 PM			Team Meeting		McKay, Todd, Daniel
4:00 PM	Class				
5:00 PM					
6:00 PM					



Project Timeline

To ensure that the team remains on schedule we have included a project timeline. Intermediate milestones have been given deadlines to ensure timely project completion.

	January					February				March				April	
	2	9	16	23	30	6	13	20	27	6	13	20	27	3	10
Preparation and Analysis															
Geotechnical Analysis for Monopole Location	■	■													
Geotechnical Analysis for Lattice Structure Location		■	■	■											
Monopole Foundation Calculations			■	■	■	■	■								
Lattice Tower Foundation Calculations				■	■	■	■	■							
Load Demand Calculations for Monopole					■	■	■	■							
Load Demand Calculations for Lattice Structure					■	■	■	■							
Design															
Monopole Foundation Design						■	■	■	■						
Lattice Tower Foundation Design						■	■	■	■						
Pile Cap 1 Design							■	■	■	■					
Pile Cap 2 Design							■	■	■	■					
Construction Schemes										■	■	■			
Report															
Monthly Progress Reports					■				■					■	
50% Complete Status Report							■	■							
Report Complete											■	■	■		
Poster Complete											■	■	■		
Presentation															■

Facilities, Tools, Data and Equipment

The scope of this project requires the use of various engineering design and analysis programs. We expect to use computer programs such AutoCad, ArcGIS, and LPILE to analyze, produce, and present our design and final results. Any other programs, tools, or methods used will be included in our final report. Our work will take place in the BYU CAEDM (Computer Aided Engineering Design and Manufacturing) laboratory. All other documents, reports, and presentation will be created using Microsoft Office.

Kiewit Infrastructure Co. has provided us with the necessary data to complete the foundation design. The data includes design codes, elevations, design basis, and a geotechnical report for each location. Any additional resources needed from the sponsor will be requested, understanding that responses will be provided according to a one week time-lapse. We will use video conference software to facilitate meetings with our project sponsors.

Project Budget

The table provided below shows the cost to produce the required deliverables and quality design. There will be no financial compensation for this project. The purpose of this budget is to provide a cost estimate if it were to be completed by a licensed engineering firm.

Deliverables

Work will be performed with final deliverables in mind. Monthly status reports will include challenges the team is facing, our plans for overcoming these challenges, and current progress. We will also report on our adherence to the established schedule and plans to accelerate the schedule where possible.

Our final report will include a summarization of calculations, design details, constructability, and environmental considerations. Our final presentation to our sponsor will be a report presented in a PDF format and a slide presentation. We will create a summary poster which will be presented to students and faculty at BYU as part of our project completion criteria.

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

Our team consists of dedicated students who have past experience working together as a team. We have practical experience from internships, jobs, and university courses that will enable us to provide the required technical computations. As a team we have completed or are enrolled in the following relevant courses:

- Elementary Soil Mechanics
- Engineering Applications of GIS
- Structural Analysis
- Technical Writing
- Engineering Drafting w/CAD aps

Technical skills include:

- 5 years CAD experience
- 1 year BIM experience
- Decade of on-the-job foundation construction experience
- 3 years of Foreman experience
- 2 years Programming experience, VBA
- 2 years ArcGIS experience
- 4 months Soils Lab Technician experience

McKay Harper

Team Liaison/Construction Specialist

For over a decade, McKay has placed and poured footings, framed, roofed, and finished dozens of homes which taught him how machinery functions and the process of construction. He has also been the foreman of a 10 man paving crew for the last (2) summers giving him leadership skills and experience with government work. Currently, others seek McKay for his advice and labor to organize remodels for their homes and plan their construction projects. His engineering curriculum has added depth to his experience by allowing him to better communicate his ideas through design and programs such as AutoCAD and REVIT.

Todd Weichers

Project Manager/AutoCAD Specialist

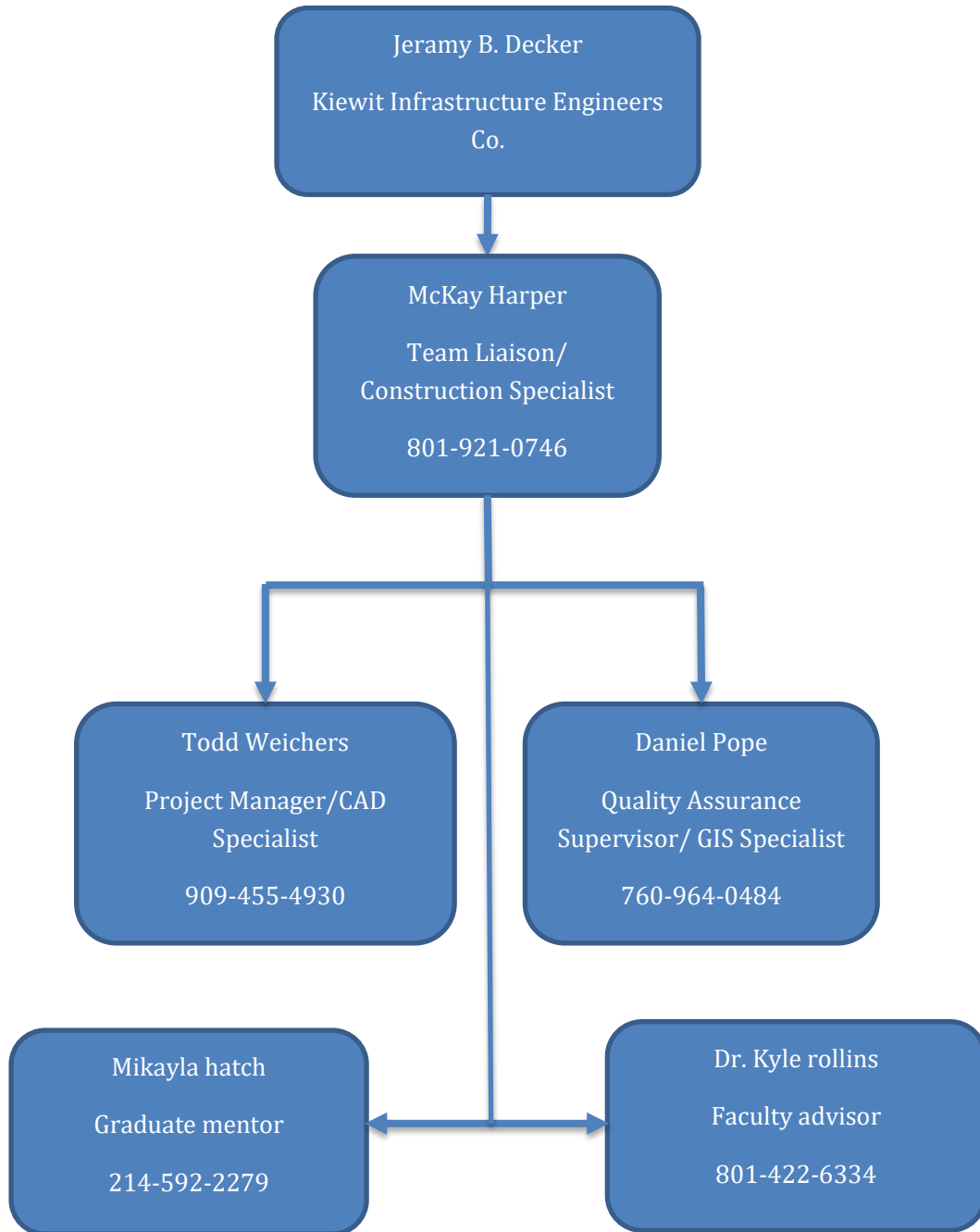
In the past two (2) years Todd has had the opportunity to work for four (4) different engineering design firms which has given him great experience on AutoCAD. During this time, he has also worked on and supervised multiple construction jobs. This experience included design and managing many crane projects and projects with deep foundations. Todd's first internship was with a firm that did soil and materials testing; as such he spent many hours in the lab learning about soils testing and the results that come from the tests. Todd has great experience that will help prepare him for the tests that come from this project.

Daniel Pope

Quality Assurance Supervisor/GIS Specialist

Daniel has significant work and school experiences which have prepared him to contribute to this project. As a crew leader for a construction company, Daniel gained valuable knowledge of the quality control process and cost estimation process. As a cadet in the Reserved Officer Training Corps he has learned valuable skills in leadership and attention to detail. Two semesters of GIS training, have helped Daniel develop technical analysis skills that will be applied to this project.

Organization Chart



Appendix A

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Daniel J. Pope

14513 S Fox Creek Drive, Herriman, Utah 84096
(760) 964-0484 dannyjp90@gmail.com

EDUCATION

Brigham Young University

Provo, UT

Bachelor of Science, Civil Engineering

April 2017

- Relevant coursework in Materials Science, Fluid Mechanics, Chemistry, Geology, Surveying, and Environmental Science
- Member of Air Force Reserve Officer Training, extensive military professional leadership training

EXPERIENCE

Missionary Training Center

Provo, UT

Facility Services Student Supervisor

Aug 2014 - Present

- Efficiently manage facilities coordination for international and religious dignitaries, improving processes and saving thousands of dollars for event budget expenditures
- Promoted to supervisor over 20+ employees and 19 buildings after 3 months on the job
- Provides policy and HAZCOM training for new employees each month

Merrill Construction

Apple Valley, CA

Construction Crew Leader

Nov 2011 - Aug 2012

- Led a three-man crew to renovate and repair six residential homes in the Apple Valley area
- Provided on the job training for new employees
- Provided regular maintenance for 38 properties across the valley

Jake's Archery

Orem, UT

Sales Associate and Technician

April 2013 - Aug 2014

- Provided quality customer service to a global list of clients via email and telephone communication
- Assessed and repaired damaged hunting equipment for a variety of customers
- Managed the daily shipping of hundreds of packages across the country

VOLUNTEER SERVICE

Provo City School District

Provo, Utah

Volunteer Tutor

Jan 2013 – April 2013

- Worked with elementary school students in need of reading, writing, and math tutoring 2 hours per week

The Church of Jesus Christ of Latter-day Saints

Winnipeg, Canada

Volunteer Representative

Oct 2009- Oct 2011

- Adapted to a new culture in order to provide quality service to the local people
- Executed various humanitarian work projects including a soup kitchen
- Maintained 70-hour work weeks providing service and leading 6 other volunteers

SKILLS AND INTERESTS

- Proficient in VBA, Microsoft Excel, and Microsoft Word experience designing sheets for open channel flow
- Basic in GIS mapping and analysis software, experience in educational setting designing multiple analysis maps
- Proficient in Structural Analysis (statics, flexibility method, stiffness method, and moment distribution)
- Certified HAM radio operator, trained by red cross for communications in natural disasters

Todd L. Weichers II

786 Wymount Terrace Provo, UT 84604 (909) 455-4930 tjwicks2@gmail.com

EDUCATION

BS: Civil Engineering (Anticipated) June 2017

Brigham Young University Provo, UT

- GPA: 3.2/4.0
- Recipient of the California Highway Patrol 11-99 Foundation Scholarship for academic excellence
- Relevant Courses: AutoCAD, Hydrology, Fluid Mechanics, Hydrologic Modeling

AS: General Studies Dec. 2012

Brigham Young University-Idaho Rexburg, ID

- GPA: 3.8/4.0

EXPERIENCE

Technical Support August 2016- Present

Aquaveo Provo, UT

- Solve customers' questions about SMS, GMS, WMS and ArcHydro Groundwater software
- Communicate complex solutions and instructions through various forms of communication

Civil Engineer Analyst April 2016- August 2016

Kimley-Horn and Associates Las Vegas, NV

- Designed utility, grading, and general civil improvement plans
- Performed due diligence for project starts
- Maintained close relationships with local municipalities in order to progress client's needs

Crane Engineering Intern April 2015- August 2015

Mountain Crane Services Salt Lake City, UT

- Developed presentations for new client meetings
- Supervised multiple construction projects and crane jobs

Civil Engineering Intern Sept. 2014- Dec. 2014

Merrell Johnson Companies Apple Valley, CA

- Drafted AutoCAD Civil 3D drawings including: street plans, grading plans, and sewer improvement plans
- Tested samples of soil and concrete for strength and adequacy of foundations

McKay Harper

Civil Engineering with Construction emphasis

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Geneva Rock Products • Orem, UT

Paving Foreman and Intern (May 2015 – October 2015, May 2016-August 2016)

- Measured and calculated square yards of micro surfacing for billing and cost estimates
- Designed and planned paving processes, traffic control, and managed equipment for quick and efficient paving
- Managed a 6-man crew and truck drivers as well as communicating ideas with UDOT and other customers
- Took responsibility and made decisions for problems that arose among the crew and paving process

Harper Construction • Blackfoot, Idaho

Operator and Laborer (May 2006 - August 2010, June 2014 - Sep 2014)

- Proficient in operating heavy equipment such as track hoes, backhoes, dump trucks, and skid loaders, and lifts
- Framed, wired, plumbed, laid brick, and was involved with every aspect of building a home from start to finish
- Poured over 300 yards of concrete pads, foundations, curbs, gutters, and sidewalks and learned how to finish concrete
- Attended pre-bids and bids over 1.3 million dollars in behalf of company and learned about commercial construction

Harper Farms • Blackfoot, Idaho

Laborer and Manager (May 2006 - August 2010, June 2014 - Sep 2014)

- Moved and managed water irrigation on 500 acres daily and learned to complete, communicate, and delegate tasks
- Operated and repaired large heavy equipment and machinery such as tractors, loaders, and tractor cabs
- Expected to cut and bail 500 acres of hay with no supervision and learned to provide quality work and progress

The Church of Jesus Christ of Latter-day Saints • Kenya Nairobi Mission

Missionary and Mission Leader (June 2011 - June 2013)

- Assigned to lead 10 to 15 missionaries 600 miles away from Mission President and learned independence and trust
- Volunteered 2 years of service in teaching doctrine for the church and learned to give meaningful service

Brigham Young University • Provo, Utah (September 2013 - Expected Graduation: December 2016)

- Proficient in BIM design, Revit, and Auto-Cad as well as Excel and Word
- Provide service as a Current Honor student with a 3.86 GPA and member of ASCE
- Previously a member of the BYU Rugby team and currently in the BYU Barbershop club