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EE/CprE/Se 491 WEEKLY REPORT 07

October 28, 2018- November 3, 2018

Group Number : sdmay19-17

Project Title: Substation Design

Client: Burns & McDonnell

Advisor: Craig Rupp

Team Members:

Jacob Heiller- Controls Engineer

Rebecca Franzen- Studies Engineer

Connor Mislivec- Quality Control Specialist

Riley O'Donnell- Administrator

Tom Kelly- Project Manager

Wilson Pietruszewski- AutoCAD Engineer

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### **Weekly Summary:**

This week, the entire group came together to help create the preliminary plan view of the Cyclone Substation. We first met as a group to create a plan for this layout. Since none of us had designed a layout of a substation from scratch, we took a lot of time reviewing sample plan view and elevation drawings given to us by Burns and McDonnell. After we were familiar with these drawings, we compared them all to determine the equipment that was consistent throughout all of the drawings to determine what we would need to include in our plan drawing. While discussing our plan, we also took some time to consider how we would incorporate design constraints such as height and future expansion. After talking with our client, they recommended that we take a look at IEEE Standard 1427 and ANSI Standard 37.32 for determining minimum clearances and heights within the Cyclone Substation.

After determining the location of all equipment and ensuring that everything met industry standards, we began the AutoCAD work to create the preliminary plan view design. This AutoCAD work involved finding the equipment that we determined should be incorporated in our design, sizing it accordingly, and placing it in the correct spot while looking at the block diagram created during the planning process. After the AutoCAD portion of the design was completed, we were ready to send the preliminary design to Burns and McDonnell for feedback. We scheduled a meeting with our client to receive feedback, answer questions, ask questions and determine if we were on the right track with design.

## Past Week Accomplishments:

- Determined plan for plan view drawing for physical design- Everyone
  - Reviewed example plan view and elevation view drawings given to us by Burns and McDonnell
  - Referenced other substation designs that were typical in industry
  - Discussed major equipment necessary in the substation for service power and future equipment
  - Determined how to model different configurations on the layout, specifically a ring configuration
  - Created basic block diagram of substation layout
  - Discussed how we would consider design constraints such as height and future expansion
  - Discussed the correct placement of the control enclosure to ensure it met industry standards when placed near breakers
  - Considered accessibility for repairs via work trucks
- AutoCAD for preliminary plan view for Physical Design- Wilson and Jake
  - Created a 400' x 400' preliminary perimeter to fit all equipment
  - Added (4) 138 kV breakers with corresponding disconnects in a ring configuration
  - Added the transformer to the center of the design
  - Added the 69 kV breaker without the corresponding disconnects
  - Added the bus for both 138 kV and 69 kV breakers
  - Included an extra bay of 138 kV disconnects parallel to the original 138 kV added to utilize for future expansion
  - Added the control enclosure
- Discussed preliminary plan view with Burns and McDonnell-Everyone
  - Reviewed comments from Burns and McDonnell
  - Justified chosen design
  - Discussed various considerations when designing the substation
- Reviewed ANSI 37.32 Standard for High Voltage Switches, Bus supports, and accessories schedules of preferred ratings, construction guidelines, and specifications - Riley and Rebecca
  - Made a list of ways we needed to change plan view to incorporate standard
  - Discussed with Connor and Tom differences between ANSI standard and IEEE Standard
  - Determined clearances needed to follow for design of Cyclone Substation
- Reviewed IEEE 1427 Standard, Guide for Recommended Electrical Clearances and Insulation Levels in Air Insulated Electrical Power Substations- Tom and Connor
  - Skimmed through standard in an attempt to determine the purpose
  - Determined minimum clearances needed for Cyclone Substation
  - Ensured insulation of certain equipment was considered in the design

## Pending Issues:

- Make changes to preliminary plan view to incorporate Burns and McDonnell comments

**Individual Contributions:**

Name / Role	Individual Contribution	Hours this week	Cumulative Hours
Rebecca Franzen	Plan view plan, client discussion & standards review	8.5	66
Jacob Heiller	Plan view plan, client discussion & AutoCAD	10	64
Tom Kelly	Plan view plan, client discussion & standards review	8	63.5
Connor Mislivec	Plan view plan, client discussion & standards review	8	63
Riley O'Donnell	Plan view plan, client discussion & standards review	8.5	66
Wilson Pietruszewski	Plan view plan, client discussion & AutoCAD	10	64.5

Comments and extended discussion:

Plan for coming week:

- Modify grounding design to ensure IEEE 80 Standards are met- Rebecca and Riley
  - Increase size of conductors to ensure it can withstand the maximum current
  - Update design to incorporate changes to the plan view
- Determine size of conductors used in substation- Riley and Rebecca
  - Follow IEEE standards to ensure that the correct size of conductors and bus is being used
  - Research different sizes and different manufacturers
  - Consider cost when choosing a certain size of cable or bus
- Finalize plan view of substation layout- Wilson and Jake
  - Incorporate all comments from Burns and McDonnell
  - Incorporate clearances values found from IEEE standards and ANSI standards
- Continue work on the lightning study- Tom and Connor
  - Determine heights of various equipment from plan view drawing
  - Review equations from IEEE Standard for lightning protection

- Review steps for completing a lightning study
- Compile list of questions for client meeting about lightning studies

Weekly Advisor Meeting Summary:

- Discussed technical issue that will be discussed in lightning talk for class
- Discussed comments on the first draft of the grounding report
- Updated progress on the physical design
- Discussed the progress of project plan and design document for the final drafts