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## EE/CprE/Se 491 WEEKLY REPORT 08

November 4, 2018- November 11, 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, we broke off into groups of two to work on a separate deliverable. The three deliverables that we focused on were the grounding design, the substation layout, and the lightning study. Before completing the grounding design, we first had to review the IEEE 80 standards to determine that the conductor sizes could withstand the maximum current given to us by Burns and McDonnell. After determining this size, we did some research on the different types of conductors and the cost to add to the bill of materials. We then modified the grounding design based on comments given to us by Burns and McDonnell as well as updates to the plan view. The second deliverable that was worked on this week was the plan view of the substation layout. Last week, Burns and McDonnell sent us a pdf of comments on the plan view, so we worked on incorporating those comments. We also modified the plan view to incorporate the industry standard clearances found in IEEE and ANSI that we reviewed last week. The final deliverable we worked on was the lightning study. We reviewed the IEEE standard for lightning protection and began determining the heights of various equipment. We also looked at the plan view drawings to help determine the location and heights of the lightning masts. Since none of us had ever performed a lightning study or worked with lightning protection, we compiled a full list of questions to ask our client about the topic.

### Past Week Accomplishments:

- Determine size of conductors used in substation- Riley and Rebecca

- Reviewed IEEE standards to ensure that the size of the conductors could withstand the amount of current
- Researched different types, sizes, and different manufacturers
- Determined the conductor size that would meet standards but also was most cost efficient
- Modify grounding design- Rebecca and Riley
  - Reviewed IEEE 80 and the equations that are used for grounding
  - Modified conductor size to ensure it can withstand the maximum current value given to us by Burns and McDonnell
  - Update design to incorporate changes to the plan view
    - Take out grounding under control building
    - Add more ground rods around transformer
- Finalize plan view of substation layout- Wilson and Jake
  - Incorporated all comments given to us by Burns and McDonnell using the AutoCAD software
  - Modified to incorporate clearance values found in the IEEE standards and ANSI standards that were reviewed last week
  - Added surge arrestors on the 69kV position
- Continue work on the lightning study- Tom and Connor
  - Reviewed IEEE standard for lightning protection to ensure client and industry expectations were going to be met
  - Determined heights of equipment in the Cyclone Substation
  - Reviewed the plan drawing to determine location and heights of lightning masts
  - Reviewed equations and steps to complete a lightning protection study
  - Compiled list of questions about lightning protection for client meeting

**Pending Issues:**

- Determine how to size rigid and strain bus based on ampacity tables

**Individual Contributions:**

| Name / Role     | Individual Contribution       | Hours this week | Cumulative Hours |
|-----------------|-------------------------------|-----------------|------------------|
| Rebecca Franzen | Grounding Design Modification | 7               | 73               |
| Jacob Heiller   | Plan view AutoCAD             | 9               | 73               |
| Tom Kelly       | Lightning Study               | 8.5             | 72               |
| Connor Mislivec | Lightning Study               | 8.5             | 71.5             |
| Riley O'Donnell | Grounding Design Modification | 7               | 73               |

|                      |                   |   |      |
|----------------------|-------------------|---|------|
| Wilson Pietruszewski | Plan view AutoCAD | 9 | 73.5 |
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Comments and extended discussion:

Plan for coming week:

- Update grounding report to incorporate changes- Riley and Rebecca
  - Run grounding study in CDEGS after incorporating all changes
  - Updated the pictures, graphs, and tables with new grid
  - Updated equations and numbers based on review of IEEE 80 calculations
- Meet to plan how to incorporate lightning protection on plan view- Wilson, Jake, Tom, and Connor
  - Determine size and location of the lightning masts to protect each breaker and the transformer itself
  - Determine the type of lightning mast needed
  - Determine future positions for the masts should equipment be added to the substation
- Create Bill of Materials- Wilson and Jake
  - Determine equipment information within the substation
  - Research various manufacturers of equipment and materials
  - Estimate lengths of cables and copper conductors
- Begin elevation view of layout- Wilson and Jake
  - Determine necessary elevation views to satisfy client demands
  - Begin drafting the equipment in the exact position they are in based off of the plan view
  - Coordinate between elevation drawings to match bus heights
- Continue lightning study- Connor and Tom
  - Confirm location and heights of lightning masts
  - Reference IEEE 998 and ensure that industry standards are being followed
  - Determine the area that is protected based off lightning mast height

Weekly Advisor Meeting Summary:

- Discussed progression on lightning study
- Discussed AutoCAD and background knowledge of it
- Outlined schedule for the remaining semester