PJM Facilities Study Report

For

Network Upgrade N9250

Transition Cycle #1

June 2025

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff and PJM Manuals. The Transmission Owner (TO) is Virginia Electric and Power Company (VEPCO or Dominion).

A. Project Description

The System Impact Study for PJM Interconnection Transition Cycle #1 has identified the need for PJM Network Upgrade N9250. The scope of this Network Upgrade includes the following:

- Construct 22.59 Miles of new 500kV transmission line from Carson Substation to Rawlings Substation.

B. Transmission Owner Facilities Study Results

1. Detailed Scope of work for Network Upgrade N9250:

The following is a detailed description of Transmission Owner Upgrades for Network Upgrade N9250. These facilities shall be designed according to the Transmission Owner's Applicable Technical Requirements and Standards. Once built the Transmission Owner will own, operate, and maintain these facilities.

See Preliminary Scoping Summaries located in the Appendices, Attachment #1, #2 and #3.

2. MILESTONE SCHEDULE FOR COMPLETION OF DOMINION WORK

Facilities outlined in this report are estimated to take 60 months to construct, from the time of full execution of the Generation Interconnection Agreement and completion of a construction kickoff call. This schedule is may be impacted by the timeline for procurement and installation of long lead items and the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Engineering	1	30
Permitting/Procurement	3	38
Construction	36	60

Due to outage congestion, Network Upgrades and/or internal Dominion projects have been identified as having possible outage conflicts with this network upgrade that may affect the

estimated milestones listed above. Additional outage sequencing may be required that includes, but not limited to the following projects:

- Project AF1-125
- Coordinate with line 563 work
- Coordinate with other projects associated with Carson and Rawlings Substations

3. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- The preliminary construction schedule is dependent on outage availability.
- See Attachment 1 and 2 – Preliminary Scoping Summary – Substation for additional assumptions
- See Attachment 3 – Preliminary Scoping Summary – Transmission line for additional assumptions

4. LAND REQUIREMENTS

Dominion will be responsible for the following expectations in the area of Real Estate:

- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation.
- Any other Land/Permitting requirements required by the Network Upgrade

5. ENVIRONMENTAL AND PERMITING

The Dominion will be responsible for the following expectations in the area of Environmental and Permitting:

- Assessment of environmental impacts related to the Network Upgrade including:
    - Environmental Impact Study requirements
    - Environmental Permitting
- A stormwater easement and/or specific stormwater design BMP's to allow access to and use of the facilities, including a maintenance agreement for said stormwater facilities.
- Conditional Use Permit for Substation
- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation
- Any other Permitting requirements required by the Network Upgrade

C. APPENDICES

Attachment #1: Preliminary Scoping Summary – Substation Carson

Attachment #2: Preliminary Scoping Summary – Substation Rawlings

Attachment #3: Preliminary Scoping Summary – Transmission

Attachment #1

Project Number: N9250 – Carson Substation

SUBSTATION SCOPE OF WORK

Project Description: New 500kV Line to Rawlings

Date: 7/1/2025

Revision Number: 0

Project Summary

Network upgrade N9250 provides for the construction of a new 500kV line to Rawlings Substation in Brunswick County, Virginia.

Assumptions & Clarifications:

1. *The scope of work depicted on the drawings assumes that there is no overlap with other designs and construction activities, except if mentioned in this Project Summary.*
2. *Relay Settings and P&C design will be revised as part of the SPE Scope of Work.*
3. *4-hole pad connections must be replaced with 6-hole and 8-hole pad connections to maintain 5000A ratings.*

Purchase & install substation material – Network Upgrade:

1. One (1), 500kV, 5000A, 63kA, circuit breaker
2. Three (3), 500kV, relay accuracy CCVT
3. Three (3), 396kV, 318kV MCOV, surge arrester
4. Approximately 100 feet of cable trough
5. Conductor, connectors, conduit, control cable, cable trough, foundations, structures, and grounding material as per engineering standards

Relocate substation material – Network Upgrade:

1. One (1), 500kV, 3000A, double-end break switch (W78)
2. Conductor, connectors, conduit, control cable, cable trough, foundations, structures, and grounding material as per engineering standards

Remove substation material – Network Upgrade:

1. Conductor, connectors, conduit, control cable, foundations, structures, and grounding material as per engineering standards

Purchase & install relay material – Network Upgrade:

1. One (1), 4510 – SEL-2411 breaker annunciator
2. One (1), 1510 – 24” dual SEL-351-7 transmission breaker with reclosing panel
3. One (1), 1340 – 24” dual SEL-411L CD/Fiber, DCB/Fiber line panel
4. One (1), 4506 – 3-phase CCVT potential make-up box
5. One (1), 4526_A – circuit breaker fiber optic make-up box

Attachment #2

Project Number: N9250 – Rawlings Substation

Project Description: Add 500kV Line Position to Carson Substation

SUBSTATION SCOPE OF WORK

Date: 7/1/2025

Revision Number: 0

Project Summary

Network upgrade N9250 provides for the addition of new 500kV line position at Rawlings Substation in Brunswick County, Virginia.

Transmission line engineering is to provide a new number for the new line between Rawlings Substation and Carson Substation.

Assumptions & Clarifications:

1. *The scope of work depicted on the drawings assumes that there is no overlap with other designs and construction activities, except if mentioned in this Project Summary.*
2. *Relay Settings and P&C design will be revised as part of the SPE Scope of Work.*
3. *4-hole pad connections must be replaced with 6-hole and 8-hole pad connections to maintain 5000A ratings.*
4. *Currently, the scope and estimate assume Dominion standard spread footer foundations. Once the soil information is available and it is prudent to change the design to "helical pile foundations" the Dominion team should be informed to adjust the project estimate at the earliest possible opportunity.*

Purchase & install substation material – Network Upgrade:

1. One (1), 500kV, 5000A, 63kA, circuit breaker
2. One (1), 500kV, 5000A, double end break switch
3. Three (3), 500kV, relay accuracy CCVT
4. Three (3), 396kV, 318kV MCOV, surge arrester
5. Approximately 80 ft of cable trough
6. Conductor, connectors, conduit, control cable, foundations, structures, and grounding material as per engineering standards

Remove substation material – Network Upgrade:

1. Approximately 70 ft of 6” tubular bus
2. Conductor, connectors, conduit, control cable, foundations, structures, and grounding material as per engineering standards

Purchase & install relay material – Network Upgrade:

1. One (1), 4510 – SEL-2411 breaker annunciator
2. One (1), 1510 – 24” dual SEL-351-7 transmission breaker with reclosing panel
3. One (1), 1340 – 24” dual SEL-411L CD/Fiber, DCB/Fiber line panel
4. One (1), 4506 – 3-phase CCVT make-up box
5. One (1), 4526_A – circuit breaker fiber optic make-up box

Attachment #3

500kV LINE 5XX

Carson Substation – Rawlings Substation

PROJECT N9250

PRELIMINARY SCOPING SUMMARY

This project serves to build a new 500kV line 5XX from Carson Substation to Rawlings Substation for approximately 22.59 miles, which is located in Brunswick and Dinwiddie County, VA. See **Figure 1** for the project location. The proposed work requires 50-ft of additional right of way between structures 5XX/82 and 5XX/84, and 75-ft between structures 5XX/84 and Carson substation. The project will install a total of eighty-five (85) new structures. This proposed line will be routed into existing vacant backbones in both Carson and Rawlings Substations.

The proposed structures to be installed are single circuit engineered steel monopoles. The new conductor will be triple-bundled (3) 1351 ACSS/TW/HS and the new OPGW will be DNO-10100.

Project N9138 plans to wreck and rebuild approximately 22.59 miles of existing line 511, which will be in the same corridor as project N9250. It is assumed that N9138 would occur first prior to the construction of N9250.

EXISTING FACILITIES TO BE MODIFIED:

1. Install three (3) conductor strain assemblies [Reference Drawing 35.250] and two (2) OPGW deadend assemblies [Reference Drawing 96.051] on the following two (2) structures:
    a. Structures 5XX/1 (591/71) and 5XX/87 (585/1A).

PERMANENT FACILITIES TO BE INSTALLED:

1. Install sixty-five (65) 500kV engineered steel vertical monopoles [Reference Drawing 15.200] on foundations as follows:
    a. Structures 5XX/2 – 5XX/7, 5XX/9 – 5XX/15, 5XX/17 – 5XX/22, 5XX/24 – 5XX/28, 5XX/30 – 5XX/32, 5XX/34 – 5XX/42, 5XX/44, 5XX/46 – 5XX/51, 5XX/53 – 5XX/58, 5XX/60 – 5XX/63, 5XX/65 – 5XX/68 and 5XX/70 – 5XX/77.
    b. See **Figure 2** for a visual of the proposed structure design.

2. Install four (4) 500kV engineered steel single circuit suspension monopole structures [Reference Drawing 15.200] with shield wire deadend assemblies on foundations as follows:
    a. Structures 5XX/16, 5XX/23, 5XX/43 and 5XX/69.
    b. See **Figure 2** for a visual of the proposed structure design.

3. Install eleven (11) 500kV engineered steel small angle (0°-25°) DDE monopole structures [Reference Drawing 15.210] on foundations as follows:

a. Structures 5XX/8, 5XX/29, 5XX/33, 5XX/45, 5XX/52, 5XX/59, 5XX/64, 5XX/81 – 5XX/83 and 5XX/86.
b. See **Figure 3** for a visual of the proposed structure design.

4. Install three (3) 500kV engineered steel tension imbalance DDE monopole structures [Reference Drawing 15.210] on foundations as follows:
    a. Structures 5XX/78, 5XX/80 and 5XX/84.
    b. See **Figure 3** for a visual of the proposed structure design.

5. Install two (2) 500kV engineered steel large angle (0°-60°) deadend structure [Reference Drawing 15.212] on a foundation as follows:
    a. Structures 5XX/79 and 5XX/85
    b. See **Figure 4** for a visual of the proposed structure design.

6. Install approximately 22.59 miles of 3-phase triple-bundled (3) 1351 ACSS/TW/HS from existing backbone 5XX/1 (591/71) at Rawlings Substation to existing backbone 5XX/87 (585/1A) at Carson Substation.

7. Install approximately 22.59 miles of two (2) DNO-10100 OPGW from existing backbone 5XX/1 (591/71) at Rawlings Substation to existing backbone 5XX/87 (585/1A) at Carson Substation.
    a. This includes the installation of twenty-two (22) splices as follows:
        i. Two (2) on structures 5XX/1, 5XX/8, 5XX/16, 5XX/23, 5XX/33, 5XX/43, 5XX/52, 5XX/59, 5XX/69, 5XX/79 and 5XX/87.

CONCEPTUAL SCOPE NOTES:

1. No PLS-CADD modeling was done for this project. Structures are placed like for like adjacent to Line 511, Project N9138, and estimated using the existing transmission right of way.

2. Structures are designed based off the following NESC 2017 code parameters: NESC Heavy, 90 mph wind, ¾" Ice & 30 mph wind regardless of project location.

3. It is assumed for detailed engineering that a LiDAR survey will be required.

4. Any potential height restrictions were not accounted for in this design.

5. An existing right of way width of 150' between Rawlings substation and structure 5XX/82, and 100' between structure 5XX/82 and Carson substation is assumed based on existing plan and profiles for Line 511, N9138. It is assumed that the new line will utilize the same right of way and will be on the south/east side of Line 511. Additional right of way of 50' will be needed between structures 5XX/82 and 5XX/84 due to the ROW being shared with line 563. An additional 75' between structures 5XX/84 and Carson substation will be needed due

to the 2-pole phase roll structure.

6. A wetland delineation has not been completed as part of this conceptual package.

7. In general, wire reel lengths of 15,000-ft were assumed for this line design.
    a. Conductor is assumed to be able to have full tension splices installed as necessary to reduce the amount of in-line strain structures required.
    b. OPGW is assumed to be able to be strained with the use of deadend assemblies installed on suspension structures as necessary.
    c. In detailed engineering, actual reel lengths should be further investigated.

8. Critical Crossing were found here:
    a. Between structures 5XX/9 and 5XX/10 – State Highway 1
    b. Between structures 5XX/12 and 5XX/13 – Interstate Highway I-85
    c. Between structures 5XX/21 and 5XX/22 – Beaver Canal
    d. Between structures 5XX/28 and 5XX/29 – Unknown voltage transmission lines
    e. Between structures 5XX/58 and 5XX/59 – Stony Creek
    f. Between structures 5XX/61 and 5XX/62 – pond
    g. Between structures 5XX/80 and 5XX/81 – Transmission Lines 69 and 238
    h. Between structures 5XX/85 and 5XX/86 – Transmission Lines 238 and 249

CONCEPTUAL ESTIMATE NOTES:

1. Engineered steel pole costs were determined based off typical wind and weight spans, line angles, and average structure heights in the typical right of way associated with the structure type.

2. The standard suspension structure is assumed to be similar in cost to the suspension structure with OPGW deadends installed on it.

3. Steel pole foundation costs were based off the projects' location and structure type in the regional soil profile map. The regional soil profile map used for this project is Piedmont.

4. The conceptual estimate assumes that a laydown yard is required for this project.

5. This estimate assumes that existing backbones 585/1A and 591/71 will remain in place. This will need to be analyzed in detailed design.

6. Prior to detailed engineering, a full land rights review would be required. A desktop review was completed to estimate the project cost.

7. Access estimate cost inputs include the following assumptions:

a. This estimate is assuming that the same access will be used as was estimated for Project N9138. The road will be installed one time and both circuits worked simultaneously, or each separate estimate would be to install the access twice – once per project. No additional access costs are estimated. Assumption would be to work the project similar fashion to the TL 588/5005.
b. Access matting costs do not account for forestry work in between large spans that were not matted through for access.
c. Tangent Structures are allotted 40 mats. Angle structures are allotted to 80 mats. Pull Pads are allotted 100 mats for the 500kV Wreck and Rebuild and New Lines.
d. Assumes between a 10-20% Markup for contingency on Emtek specialty matting dependent on size and scope of material to be used in each project that requires the specialty matting in swamp/wetlands. Markup applied in Success Enterprise.

Figure 1 – Project Location

Figure 2 – Proposed Structure Configuration – Suspension

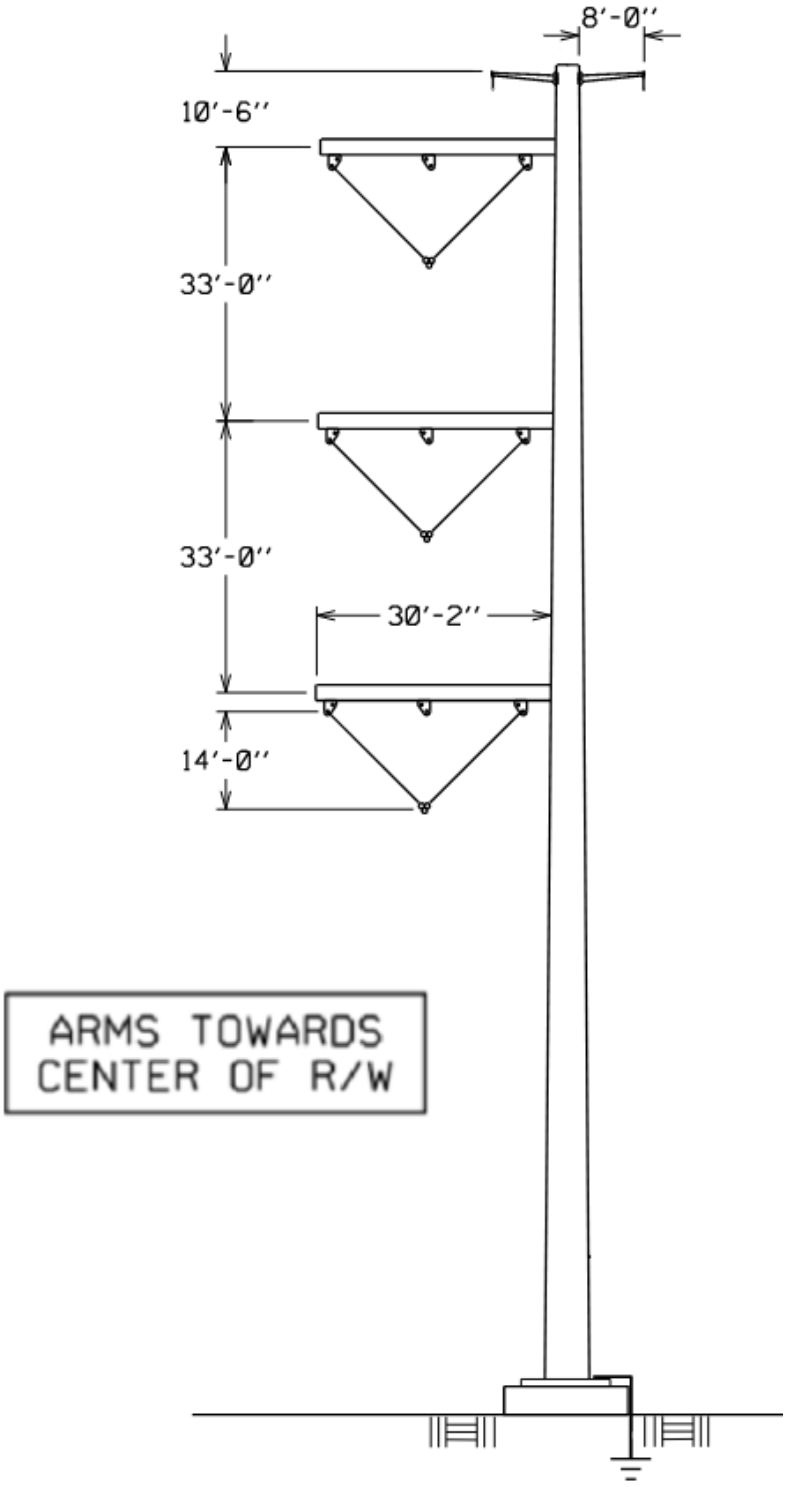


Figure 3 – Proposed Structure Configuration – Small Angle/Tension Imbalance

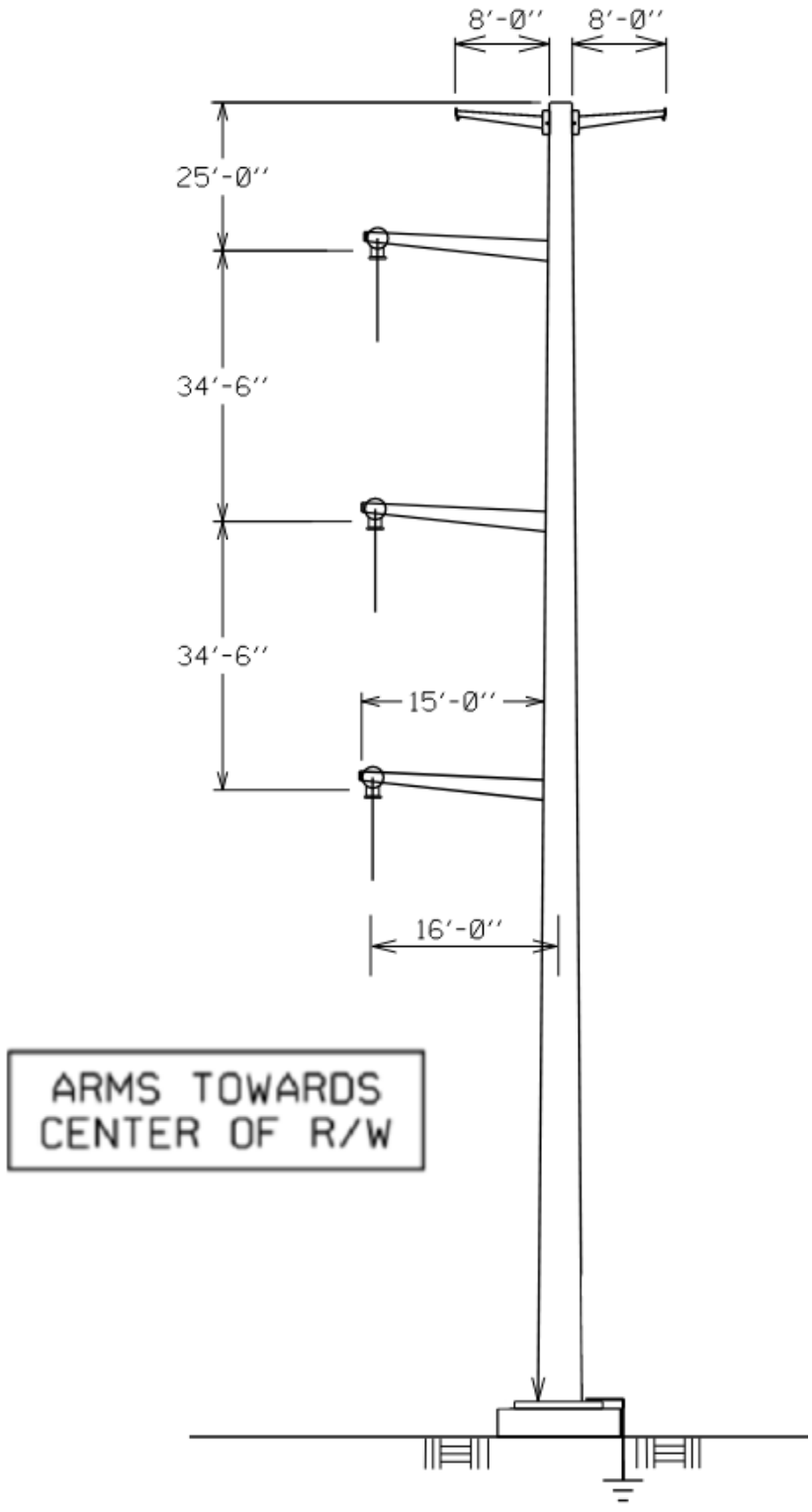
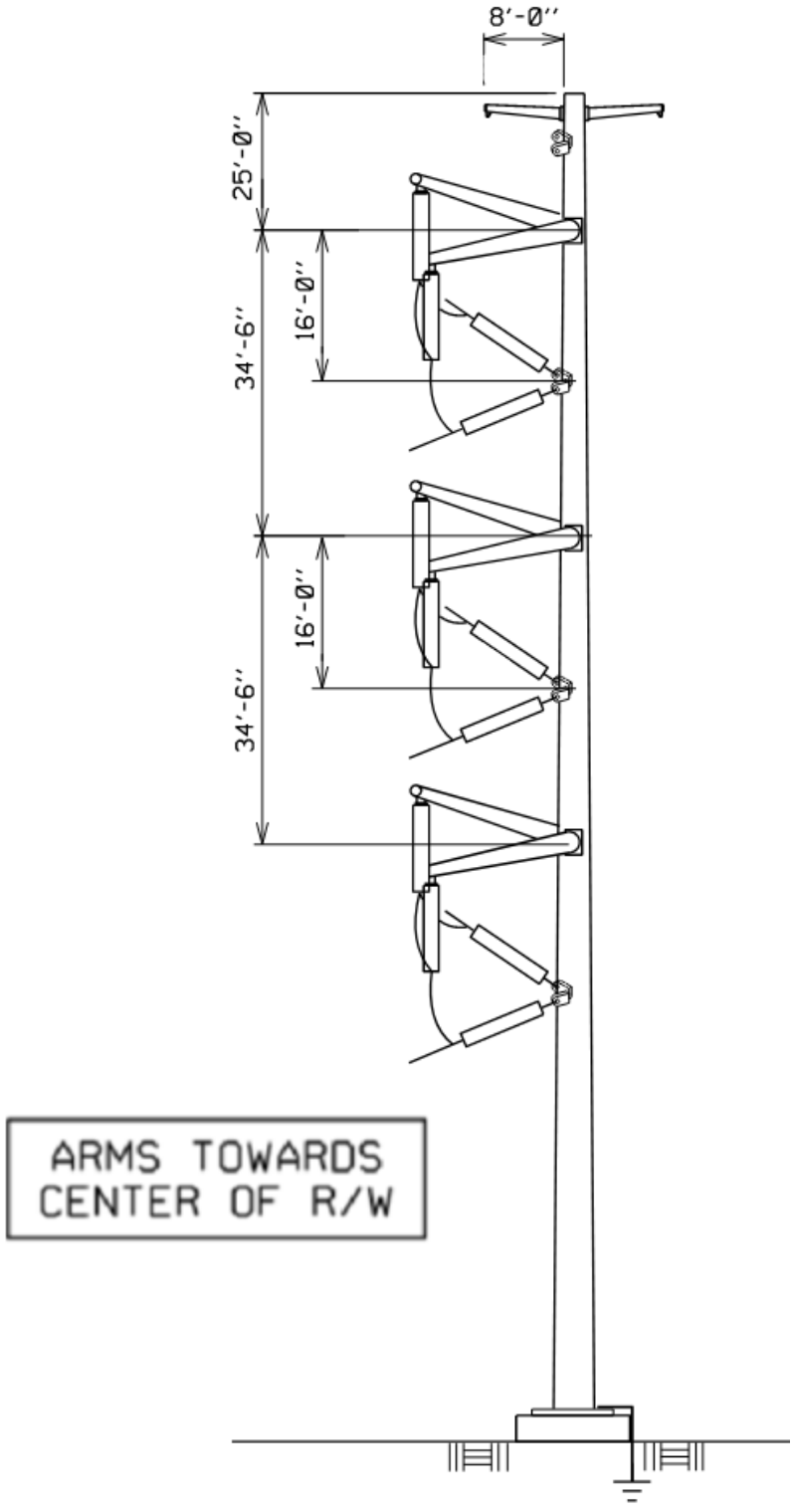


Figure 4 – Proposed Structure Configuration – Large Angle (0°-60°) Deadend



Required Material Summary

Item	Qty
Engineered Structures	85
12,000-Ft OPGW Reels	20
12,000-Ft Conductor Reels	81