PJM Facilities Study Report

For

Network Upgrade N9200

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 N9200. The scope of this Network Upgrade includes the following:

- Upgrade 11.79 Miles of 230kV transmission line 238 from Sapony to Carson

B. Transmission Owner Facilities Study Results

1. Detailed Scope of work for Network Upgrade N9200:

The following is a detailed description of Transmission Owner Upgrades for Network Upgrade N9200. 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 45 months to construct, from the time of full execution of the Generation Interconnection Agreement and completion of a construction kickoff call. This schedule 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	45

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 Sapony

Attachment #3: Preliminary Scoping Summary – Transmission

Attachment #1

Project Number: N9200 – Carson Substation

SUBSTATION SCOPE OF WORK

Project Description: Replace Line Lead for Line 238

Date: 06/20/2025

Revision Number: 0

Project Summary

Network upgrade N9200 provides for the uprate of line 238 at Carson Substation in Petersburg City, 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.*

Purchase and install substation material – Network Upgrade:

1. Conductors, connectors, and grounding materials as per engineering standards

Purchase and install relay material – Network Upgrade:

1. One (1), 1340 – 24” dual SEL-411L DCB/PLC line panel

Remove relay material – Network Upgrade:

1. Remove Panel No. 29

Attachment #2

Project Number: N9200 – Sapony Substation

SUBSTATION SCOPE OF WORK

Project Description: Replace Line Lead for Line 238

Date: 06/20/2025

Revision Number: 0

Project Summary

Network upgrade N9200 provides for the uprate of line 238 at Sapony Substation in Sussex County, Virginia.

Assumptions & Clarifications:

2. *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.*

Attachment #3

230kV LINE 238
SAPONY - CARSON
PROJECT N9200

PRELIMINARY SCOPING SUMMARY

This project serves to wreck and rebuild and partial reconductor of 230kV Line 238 between Sapony Substation and Carson Substation for approximately 11.79 miles, which is located between Dinwiddie and Sussex County, VA. See Figure 1 for the project location. The proposed work will require approximately 48.27 acres of additional land along the existing right of way between structure 238/1 to structure 238/110. The project will install a total of ninety-five (95) new structures. A Certificate of Public Convenience and Necessity (CPCN) filing is expected due to the quantity of structures that will need to be replaced as part of this project.

The existing line primarily consists of single circuit steel and wooden h-frame structures built in 1982, 2016, and 2022, along with single circuit steel 3-pole and double circuit tower structures constructed in 2023. The proposed structures to be installed are engineered single circuit 230kV steel double deadend and suspension h-frame structures. The existing twin bundled (2) 636 ACSR (24/7) conductor and twin bundled (2) 721 ACAR (18/19) conductor will be replaced with twin bundled (2) 768.2 ACSS/TW/HS (20/7) "Maumee" conductor. The existing single (1) 26/39 MM2 Optical ground wire (OPGW) and single (1) 3#6 Alumoweld shield wire will be replaced with dual (2) DNO-11410 OPGW.

It is assumed that an outage for Line 238 will be acquired for the work specified in this scope, and no temporary line configurations will be necessary for this project.

Design Considerations:

EXISTING FACILITIES TO BE REMOVED:

1. Remove ninety-three (93) existing 230kV single circuit suspension wood h-frame structures as follows:
    a. Structures 238/10 to 238/17, 238/19 to 238/32, 238/34 to 238/44, 238/46 to 238/83, 238/86 to 238/93, and 238/95 to 238/108

2. Remove one (1) existing 230kV single circuit double deadend wood 3-pole structure as follows:
    a. Structure 238/33

3. Remove one (1) existing 230kV single circuit double suspension steel h-frame structure as follows:
    a. Structure 238/109

4. Remove approximately 1.17 miles of 3-phase twin bundled (2) 636 ACSR (24/7) conductor from the Line 238 side of backbone structure 238/1A (2002/1A) inside Carson Substation to the back side of structure 238/9.

5. Remove approximately 10.62 miles of 3-phase twin bundled (2) 721 ACAR

(18/19) conductor from the ahead side of structure 238/9 to the back side of backbone structure 238/1 l0A inside Sapony Substation.

6. Remove approximately 10.62 miles of single (1) 3#6 Alumoweld shield wire from the ahead side of the east pole of structure 238/9 to the back side of the west pole of backbone structure 238/110A inside Sapony Substation.

7. Remove approximately 10.62 miles of single (1) 26/39 MM2 OPGW from the ahead side of the east pole of structure 238/9 to the back side of the east pole of backbone structure 238/1 l0A inside Sapony Substation.

EXISTING FACILITIES TO BE MODIFIED:

1. Replace three (3) 230kV bundled conductor crossing strain assemblies with three (3) 230kV bundled conductor crossing strain assemblies [32.338] as follows on the following three (3) structures:
    a. Three (3) strain assemblies on the Line 238 side of backbone structure 238/1A (2002/1A)
    b. Three (3) strain assemblies on the back side of structure 238/2
    c. Three (3) strain assemblies on the back side of backbone structure 238/110A

2. Replace six (6) 230kV bundled conductor strain assemblies with six (6) 230kV bundled conductor strain assemblies [32.630] on the Line 238 side of the following three (3) structures:
    a. Structures 238/3, 238/6 (249/90), and 238/9

3. Replace three (3) 230kV bundled conductor strain assemblies with three (3) 230kV bundled conductor strain assemblies [32.630] as follows on the following structure:
    a. Three (3) strain assemblies on the ahead side of structure 238/2

4. Replace three (3) 230kV bundled conductor jumper loops with three (3) 230kV bundled conductor jumper loops [39.227] on the Line 238 side of the following four (4) structures:
    a. Structures 238/2, 238/3, 238/6 (249/90), and 238/9

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5. Replace two (2) 230kV bundled conductor I-String suspension assemblies with two (2) 230kV bundled conductor I-String suspension assemblies [32.120] on the following five (5) structures:
    a. Structures 238/18, 238/45, 238/84, 238/85, and 238/94

6. Replace two (2) 230kV bundled conductor crossing I-String suspension assemblies with two (2) 230kV bundled conductor crossing I-String suspension assemblies [32.302] on the following structure:
    a. Structure 238/110

7. Replace one (1) 230kV bundled conductor V-String suspension assemblies with one (1) 230kV bundled conductor V-String suspension assemblies [32.850] on the following five (5) structures:
    a. Structures 238/18, 238/45, 238/84, 238/85, and 238/94

8. Replace one (1) 230kV bundled conductor crossing V-String suspension assembly with one (1) 230kV bundled conductor crossing V-String suspension assembly [32.851] on the following structure:
    a. Structure 238/110

9. Replace three (3) 230kV bundled conductor V-String suspension assemblies with three
(3) 230kV bundled conductor V-String suspension assemblies [32.850] on Line 238 side of the following four (4) structures:
    a. Structures 238/4 (249/92), 238/5 (249/91), 238/7 (249/89), and 238/8 (249/88)

10. Replace one (1) insulated OPGW strain assembly and one (1) insulated shield wire strain assembly with two (2) insulated OPGW strain assemblies [96.060] on the ahead side of the east pole of the following structure:
    a. Structure 238/109

11. Replace one (1) insulated OPGW suspension assembly and one (1) insulated shield wire suspension assembly with two (2) insulated OPGW suspension assemblies [96.020] on the following six (6) structures:
    a. Structures 238/18, 238/45, 238/84, 238/85, 238/94, and 238/110

12. Replace one (1) insulated OPGW suspension assembly with two (2) non-insulated OPGW strain assemblies [96.061] on the east pole of the

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following structure:
   a. Structure 238/110A

13. Replace one (1) insulated shield wire suspension assembly with one (1) non-insulated OPGW strain assembly [96.061] and one (1) non-insulated shield wire strain assembly [42.010] as follows on the following structure:
    a. One (1) OPGW strain assembly on the back side of the east pole of structure 238/110A
    b. One (1) shield wire strain assembly on the ahead side of the west pole of structure 238/110A

14. Replace one (1) OPGW safety catch assembly and one (1) shield wire safety catch assembly with two (2) OPGW safety catch assemblies [96.100] as follows on the following two (2) structures:
    a. Two (2) on the ahead side of structure 238/110
    b. Two (2) on the back side of backbone structure 238/110A

15. Cut and transfer existing single (1) 3#6 Alumoweld shield wire from the back side of the west pole of existing structure 238/111 to the ahead side of the west pole of existing backbone structure 238/110A inside Sapony Substation.

16. Cut and transfer existing single (1) 26/39 MM2 OPGW from the back side of the east pole of existing structure 238/111 to the ahead side of the east pole of existing backbone structure 238/1 l0A inside Sapony Substation.

17. Install two (2) OPGW grounding assemblies [61.310] as follows:
    a. Structure 238/110A

18. Install one (1) OPGW safety catch assembly [96 100] on the back side of the east pole as follows:
    a. Structure 238/110A

19. Install one (1) shield wire safety catch assembly [44.222] on the back side of the west pole as follows:
    a. Structure 238/110A

PERMANENT FACILITIES TO BE INSTALLED:

1. Install eighty-nine (89) 230kV direct embed steel single circuit suspension

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h-frame structures [12.555] as follows:

a. Structures 238/10 to 238/15, 238/17, 238/19 to 238/32, 238/34 to 238/44, 238/46 to 238/51, 238/53 to 238/69, 238/71 to 238/83, 238/86, 238/87, 238/89 to 238/93, 238/95 to 238/105, and 238/107 to 238/109

2. Install six (6) 230kV custom engineered steel single circuit double deadend h-frame structures [12.165] on foundations as follows:
   a. Structures 238/16, 238/33, 238/52, 238/70, 238/88, and 238/106

3. Install approximately 11.79 miles of 3-phase twin bundled (2) 768.2 ACSS/TW/HS (20/7) "Maumee" conductor from the Line 238 side of backbone structure 238/1A (2002/1A) inside Carson Substation to the back side of backbone structure 238/110A inside Sapony Substation.

4. Install approximately 10.62 miles of dual (2) DNO-11410 OPGW from the ahead side of structure 238/9 to the back side of backbone structure 238/110A inside Sapony Substation.
   a. This includes the installation of fifteen (15) fiber splices as follows:
      i. One (1) fiber splice on the east pole of structure 238/9
      ii. Two (2) fiber splices on structures 238/16, 238/33, 238/52, 238/70, 238/88, 238/106, and 238/110A

CONCEPTUAL SCOPE NOTES:

1. The existing line consists primarily of wood suspension h-frame structures installed in 1982. These structures are considered insufficient for the proposed conductor, necessitating the rebuilding of the line in the segment between structure 238/9 and structure 238/1 l0A, where this structure type is predominant. No PLS-CADD modeling was done for this project. Structures were replaced like for like and estimated using typical transmission right of way characteristics.

   In the segment of line from Carson to structure 238/9, the structures are primarily steel towers installed in 2023. Since no PLS-CADD modeling was done for this project, a design span was used to determine the difference in sags between the existing and proposed conductors at max sag conditions. The resulting change in max sags is approximately -0.33 ft. This change in sags means it is feasible to reconductor this segment of the line.

   a. Design span length = 1050 ft
   b. Existing design tension = 9820 lbs NESC Heavy
   c. Proposed design tension = 9500 lbs NESC Heavy

PRELIMINARY SCOPING SUMMARY

2. Structures are designed based off the following NESC code parameters: NESC Heavy, 90 mph wind, 3/4" 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 450 feet between structure 238/3 and structure 238/9, and 150 feet between structure 238/9 and structure 238/110, is assumed based on existing plan and profiles and map viewer information. An additional 37.5 feet of ROW will be required between structure 238/10 and structure 238/110 for approximately 10.62 miles. The necessary ROW extents will be verified during detailed design.
    a. If additional ROW is unable to be acquired, alternative solutions could be to rebuild the line as monopoles or acquire project specific approval to not meet typical minimum right of way requirements.
    b. The additional ROW may shift the proposed centerline from the existing centerline. This project was scoped assuming that the shift would not be substation enough to require replacing existing structures, 238/18, 238/45, 238/84, 238/85, 238/94, and 238/110 which were replaced within the last ten years.
    c. Typical ROW width for two (2) 230kV lines on h-frame structures adjacent to each other is 200 ft. this scope is only increasing the width to 187.5 ft to account for the existing centerline of the adjacent line being offset 47.5 ft from the ROW edge, rather that the typical 60 ft.

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

7. Deadend structures have been incorporated into the line design to accommodate 12,000- foot wire reels, thereby eliminating the need for tension splices. The exact pull pad locations will be determined during the detailed design phase.

8. Line 238 crosses under Line 511 twice: between structures 238/2 and 238/3, and between structures 238/10 and 238/11. Additionally, Line 238 crosses under Line 563 twice: between structures 238/3 and 238/4, and between structures 238/9 and 238/10. Line 238 also crosses under Line 585 between structures 238/33 and 238/34.

PRELIMINARY SCOPING SUMMARY

9. This project scope assumes that project N9200 occurs prior to other network upgrades included in Transition Cycle 1, Phase 3. The following projects may impact the project scope if this assumption is incorrect:
    a. N9138 - Uprating line 511 from Carson - Rawlings
    b. N9139 - Uprating line 563 from Midlothian - Carson
    c. N9201 - Replace wave trap at Carson
    d. N9202 - Replace line switch at Sapony
    e. N9249 - Construct new 500kV line from Midlothian - Carson
    f. N9250 - Construct new 500kV line from Carson - Rawlings
    g. N8487 - Uprate line 69 from Frog Lick - Sapony
    h. N9204 - Uprate line 238 from AE2-033 – Sapony
    i. N9205 - Replace line switch at Sapony

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. 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.

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

4. According to the existing plan and profiles, there is a Columbia Gas line running parallel along the east side of Line 238. This gas line is approximately 35 feet from the center of the Line 238 structures. The project estimate includes a $50,000 const for an AC mitigation study for cathodic protection to cross this and any other existing utility

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

6. Access estimate cost inputs include the following assumptions:
    a. Work pad totals based on provided SOW and assumptions from kmz file. Assume 15 mats for tangents and 30 mats for angles at each work

pad for reconductor work and 50 mats per pull pad.

b. DDE structures assumed based off of wire reel lengths - based off of pull pad locations.
c. Pull pad locations based on location of major road/water crossings and line mileage.
d. Assuming that existing stone in Substations will be used for access per SOW and that access is existing or will be built by others before the start of construction. Assumes that the substations will be constructed with access roads built to and from Substations and work from inside the substations for Backbone installation.
e. Assumes no delays due to permitting or real estate issues after work begins. Assume no schedule compressions from SOC/PJM.
f. Assumes all clearing and forestry costs have been captured by others. No access costs for forestry activities included in this pricing.
g. Stream crossing based on estimates from aerial imagery.
h. Assumes that all existing roads may be dressed with stone that can remain at the end of the project. Assumes existing two track roads in many locations will be impermeable. No costs for stone road removal are included.

PRELIMINARY SCOPING SUMMARY

Figure 1 – Project Location

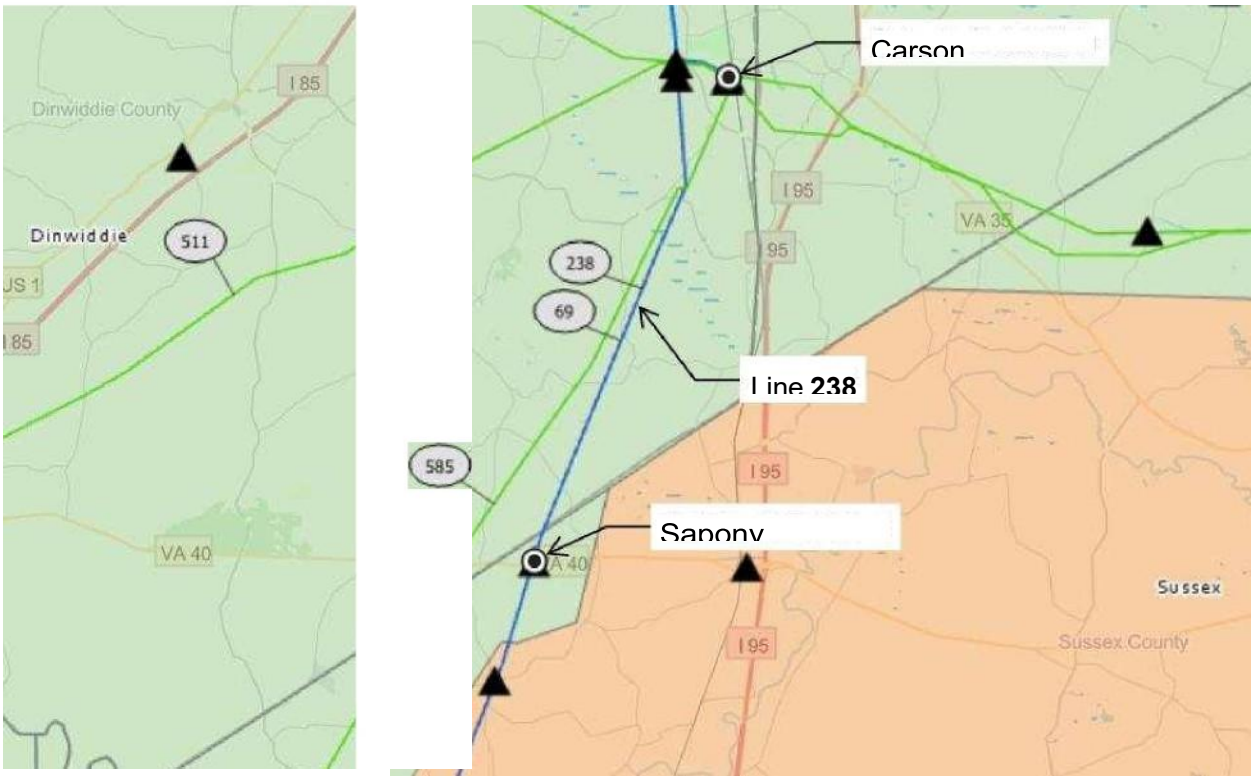

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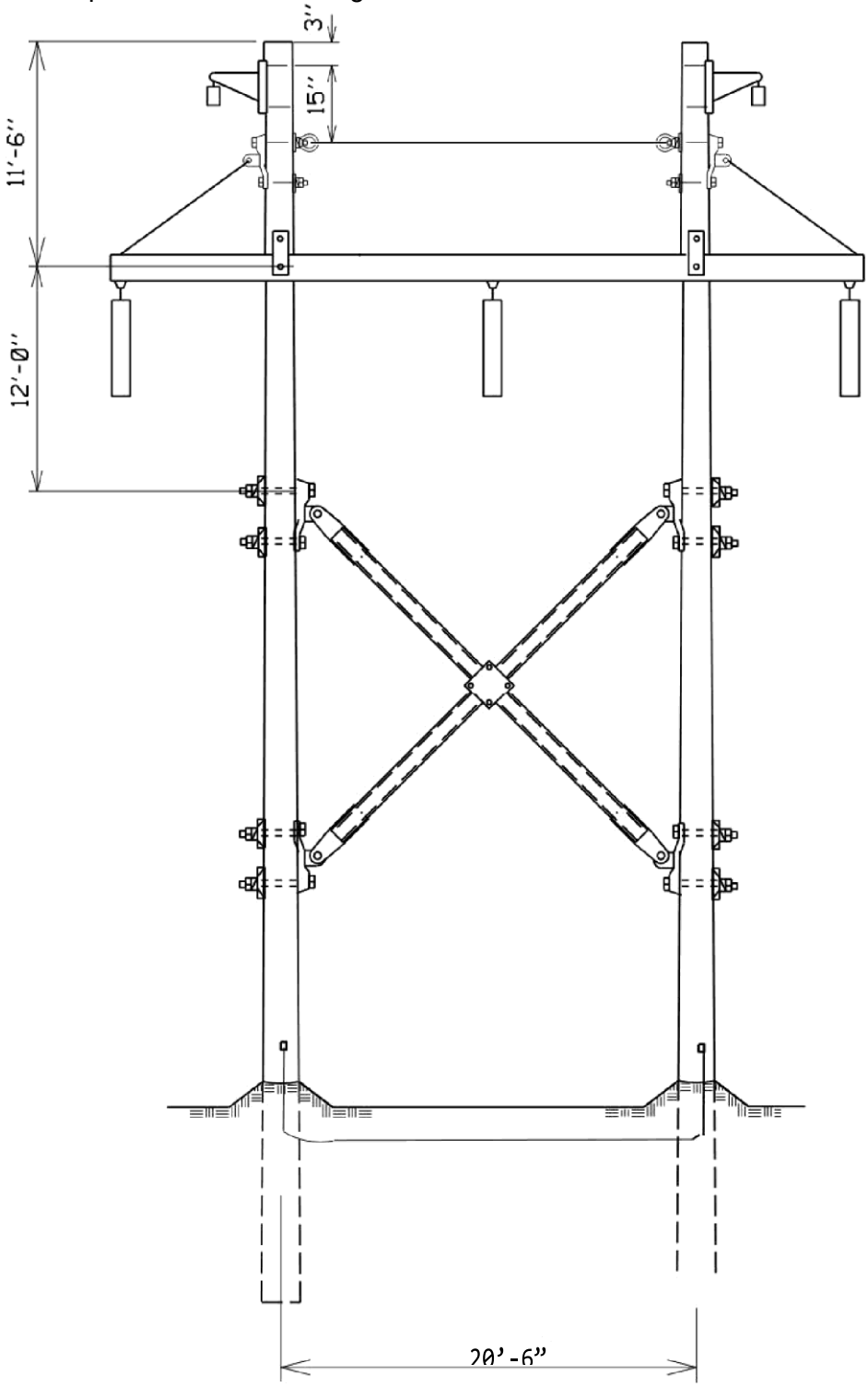
Figure 2 — Proposed Structure Configuration



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Required Material Summary

Item	Qty
230kV SC Suspension Steel H-Frames [12.555]	89
230kV SC DDE Steel H-Frames [12.165]	6
12,000-Ft DNO-11410 OPGW Reels	12
12,000-Ft 768.2 ACSS/TW/HS “Maumee” Conductor Reels	42