ISO-NE PAC MEETING

08/26/26

E-205E and E-205W 230 kV Line Asset Condition Replacement

This document has been reviewed and does not contain Critical Energy/Electric Infrastructure Information (CEII).

nationalgrid

Project Summary

Project Drivers

The drivers were determined using information from aerial inspection, 5-year cyclical foot patrol, and wood pole groundline strength inspections performed on the line

Primary Driver:

- Woodpecker damage, wood pole deterioration, and wood pole top deterioration were observed on majority of the wood structures
- Corrosion was observed on the shieldwire posing failure risks, increasing the chance of failure
- Insulation is flashed and damaged

Secondary Driver:

- Frequent splices on conductors and shieldwire posing failure risks, increasing the chance of failure
- Telecommunication needs
- Limited/challenging access along the right-of-way (ROW)

Project Summary

Alternatives Considered

Alternative	*Description*	*Cost Estimate*
Base Alternative (230 kV Targeted Refurbishment)	Replace all 913 Grade C E-205E & E-205W structures (620 E-205E & 293 E-205W) with steel **230 kV standard structures**, Replace 92.5 circuit miles of shieldwire with two (2) 3/8" EHS steel shieldwires on the E-205E and E-205W lines, replace all insulators and hardware, update grounding at all structure locations, improve access ways	**E-205E:** $379.1M (ACR) + $162.2M (Access) **E-205W:**$143.7M (ACR) + $68.8M (Access) **Total:** $522.8M (ACR) + $231.0M (Access) **$753.8M** (+50%, -25%) PTF
Alternative 2 (230 kV Full Rebuild)	Replace all 1,205 E-205E & E-205W structures (886 E-205E & 319 E-205W) with steel **230 kV standard structures**, reconductor all 101.1 circuit miles of E-205E & E-205W with **1113 ACSS Finch** conductor, replace 101.1 circuit miles of shieldwire with two (2) ½" OPGW on the E-205E and E-205W lines, replace all insulators and hardware, improve access ways	**E-205E:** $522.9M (ACR) + $162.2M (Access) **E-205W:**$160.4M (ACR) + $68.8M (Access) **Total:** $683.3 (ACR) + $231.0M (Access) **$914.3M** (+50%, -25%) PTF
Alternative 3 (345 kV Full Rebuild with H-frame)	Replace all 1,205 E-205E & E-205W structures (886 E-205E & 319 E-205W) with steel **345 kV design H-frame structures** (operated at 230kV), reconductor all 101.1 circuit miles of E-205E & E-205W with bundled (2) **1590 ACSS Falcon** conductor, replace 101.1 circuit miles of shieldwire with two (2) ½" OPGW on the E-205E and E-205W lines, replace all insulators and hardware, improve access ways	**E-205E:** $747.2M (ACR) + $162.2M (Access) **E-205W:**$230.6M (ACR) + $68.8M (Access) **Total:** $977.8M (ACR) + $231.0M (Access) **$1.209B** (+50%, -25%) PTF
Alternative 4 (345 kV Full Rebuild with Delta monopoles)	Replace all 1,205 E-205E & E-205W structures (886 E-205E & 319 E-205W) with steel **345 kV design delta monopole structures** (operated at 230kV), reconductor all 101.1 circuit miles of E-205E & E-205W with bundled (2) **1590 ACSS Falcon** conductor, replace 101.1 circuit miles of shieldwire with two (2) ½" OPGW on the E-205E and E-205W lines, replace all insulators and hardware, improve access ways	**E-205E:** $832.3M (ACR) + $162.2M (Access) **E-205W:**$309.6M (ACR) + $68.8M (Access) **Total:** $1.142B (ACR) + $231.0M (Access) **$1.373B** (+50%, -25%) PTF

Project Summary

Preferred Alternative: Rebuild at 345kV Design with H-frame Construction

Alternative	*Reason for Recommendation*	*Cost Estimate*
Alternative 3	• Alternatives 2, 3, and 4 address the deteriorated 913 wood structures rated Grade C and the remaining 141 wood structures rated Grade B by replacing them with new steel structures. • The woodpecker damage is widespread throughout the line and not replacing the Grade B rated wood structures on the line as part of the base alternative will simply encourage the birds to move onto these remaining wood structures which would require eventual replacement in the near term. • Alternatives 2, 3, and 4 also replace the corroded shieldwire by replacing it OPGW which will improve communications along the corridor. • Replacement of conductor in Alternatives 2, 3, and 4 meets the condition concerns identified via inspection that are not remediated by the Base Alternative • All alternatives address the damaged and flashed insulators across the full extent of both circuits • All alternatives address the challenging and poor access by refreshing existing access ways and identifying targeted areas where new access is beneficial • Rebuilding at 345 kV standards is a once-in-a-generation upgrade opportunity, as the lines are unlikely to be rebuilt again for 70+ years. In contrast, the Base Alternative and Alternative 2 would require a near complete replacement of facilities to support future 345 kV operation, resulting in significant duplication of project costs. • The TCS final report results indicate that increasing the rating of the E-205E and E-205W would benefit interconnecting facilities currently in the queue. There are further benefits to future 345kV operation beyond currently planned interconnections as generation, storage, load centers, and electrification are further developed in the region. • Future 345kV operation could increase transfer capacity by approximately 1,000MW between ISO-NE & NYISO. This improved connectivity between the regions would result in reduced generation curtailment and more efficient dispatch between regions. These benefits would create a significant long-term cost savings • Alternative 4 monopole design was considered to provide largest possible clearance to edge of Right of Way. Alternative 3's H-frame design has larger vegetation management costs where monopole design has significantly more construction costs. • Ultimately, Alternative 3 is chosen as preferred alternative because it addresses all the primary and secondary needs and builds for the future by increasing the structure design to support a future increase to 345kV. This is accomplished at a lower cost and shorter timeline as compared to Alternative 4 by reducing the number of poured concrete foundations required in Alternative 4's monopole design.	**E-205E:** $747.2M (ACR) + $162.2M (Access) **E-205W:**$230.6M (ACR) + $68.8M (Access) **Total:** $977.8M (ACR) + $231.0M (Access) **$1.209B** (+50%, -25%) PTF

Outline

- Background Information
- Project Needs and Drivers
- Review of Relevant Transmission Studies
- Solution Alternatives
- Selection of Preferred Solution
- Schedule and Contact Information

Background Information – E-205E

Key Details	
Location	From: Bear Swamp Substation To: Pratts Junction Substation
Line length	74 miles
Operating Voltage	230 kV
Age and upgrade history	• E-205 was constructed in 1962 and split into E-205E and E-205W in 1972 with the construction of Bear Swamp substation • In 2002 wood pole crossarms replaced with steel crossarms • A project completed in 2010 replaced half of structures with new wood structures. Many of these structures and others are now showing significant woodpecker damage • The line is 100% PTF
Prior PAC presentations	• April 2024

Existing structures

Material	*Configuration*	*Number*	*Avg. age*
E-205E Line			
Wood	H-Frame (Installed before 2010 project)	413	51 years
Wood	H-Frame (Installed for 2010 project or after)	467	16 years
Steel	Lattice tower	4	64 years
Steel	Terminal DE	2	14 years
Total		886	

Existing conductor and shieldwire

Type	*Length*	*Avg. age*
795 kcmil ACSR Condor	6 miles	64 years
795 kcmil AAC Arbutus	68 miles	64 years
2-7#9 Alumoweld	5.5 miles	41 years
2-1/2” steel	0.7 miles	64 years
2-3/8” EHS steel	67.8 miles	64 years

Background Information – E-205W

Key Details	
Location	From: Bear Swamp Substation To: NY/VT Border
Line length	27.1 miles
Operating Voltage	230 kV
Age and upgrade history	• E-205 was constructed in 1962 and split into E-205E and E-205W in 1972 with the construction of Bear Swamp substation • E-205W line runs from Bear Swamp Substation in MA through VT to the NY/VT border where it becomes NiMo circuit T6530. The E-205W ends at the NY/VT border. • The T6530 continues to the National Grid, NY/Niagara Mohawk Eastover Substation (20.4 mi.). The T6530 consists of 170 structures (168 wood). • In 2000 all wood pole crossarms were replaced with steel crossarms • The line is 100% PTF
Prior PAC presentations	• April 2024

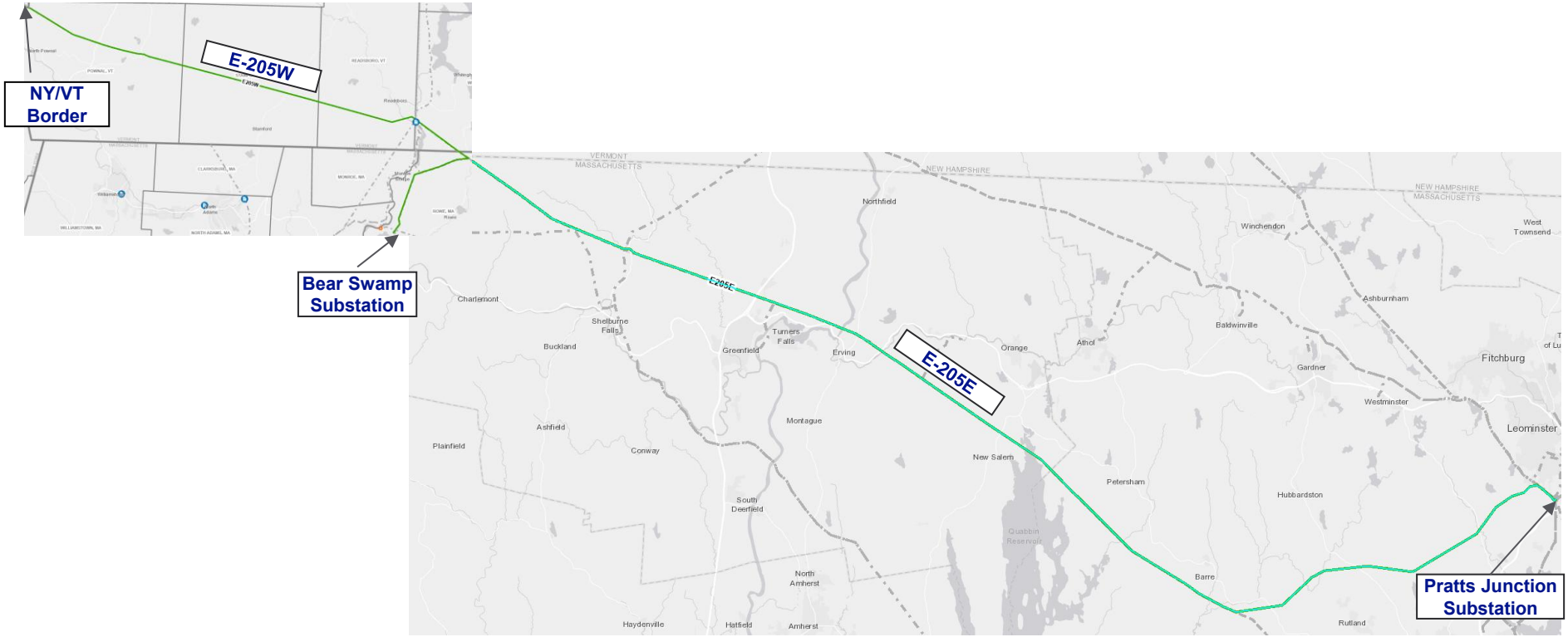
Existing structures

Material	*Configuration*	*Number*	*Avg. age*
E-205W Line			
Wood	H-Frame/Davit-Arm/3-pole pull off	319	56 years
Total		319	

Existing conductor and shieldwire

Type	*Length*	*Avg. age*
2-795 kcmil ACSR Condor	24 miles	64 years
2-795 kcmil ACSS Condor	3.1 miles	17 years
2-3/8" steel	18.5 miles	64 years
2-3/8" EHS steel	8.6 miles	17 years

Background Information – Maps and Diagrams



Project Needs and Drivers

Concerns	
Primary Concerns (must be addressed)	
Woodpecker Damage	• Significant woodpecker activity present in structures across the entire length of both circuits • Simple replacement of a structure with woodpecker burrows will simply encourage the birds to transfer the nests to adjacent structures • Patching/filling of woodpecker nesting holes is ineffective as the birds frequently burrow back into the same area through the patch or directly adjacent • Age of wood pole has no correlation to woodpecker activity. Nesting is present on poles of all vintages • Size/quantity of holes in the shell of a pole does not indicate the severity of the damage. Poles can be largely hollow with minimal outside warning signs • Woodpecker populations and activity have significantly increased in the last decade
Pole Deterioration	• Pole and pole top deterioration was observed on the wood structures • Deterioration of the pole weakens the structural integrity increasing the risk of failure • Damage at the pole top and near attachment points poses additional risk to the structure
Shieldwire Corrosion	• Corrosion was observed on the full length of shieldwire on both circuits • Consistent corrosion along the length of the wire indicates it is approaching end of serviceable life

Project Needs and Drivers (cont.)

Concerns	
Primary Concerns (must be addressed)	
Insulation Deterioration	• Insulators experiencing flashover and damage • Flashover and damage to insulators indicate **compromised insulation**, which can lead to electrical faults, outages, or equipment damage.

Project Needs and Drivers (cont.)

Concerns	
Secondary concerns (may be addressed)	
Limited/Challenging Access	• Access along the ROW is extremely challenging. The terrain is rugged with lots of rock outcrops, sloped terrain and access is further made difficult by limited road crossings to access the ROW. • Due to challenging terrain, work pads are required at each structure to provide access for construction including foundation installation, setting new structures, removal of existing structures, and overhead linework.
Spliced Conductor and Shieldwire	• 438 splices on the E-205E phase conductors and shield wires, 83 splices on E-205W phase conductors and shield wires • Splices pose mechanical and corrosion risks, increasing the chances of failure
Telecommunication Needs	• Fiber needed to support relaying and internal communication networks

Project Needs and Drivers – Structure Grades E-205E

Summary of Current Structure Grades		
Category	**Recommended Action**	**Number of structures**
A	No replacement required due to deterioration	130
B	Consider replacement in conjunction with other structure replacements	130
C	Initiate planned structure replacement project or Replace as part of upcoming structure replacement project	620
D	Replace immediately (emergency replacement)	6
Total		886

- Six hundred twenty (620) wood structures on the line are grade C due to poor condition.
- One hundred thirty (130) wood structures on the line are grade B. These are considered opportunity structures due to limited access and due to location in a woodpecker infested habitat
- One hundred thirty (130) structures are grade A.
- Six (6) structures are rated grade D due to degraded condition and will be replaced in advance of this project with wood structures. The wood replacement structures will get replaced with steel 345kV structures as part of the preferred alternative proposed in this project.

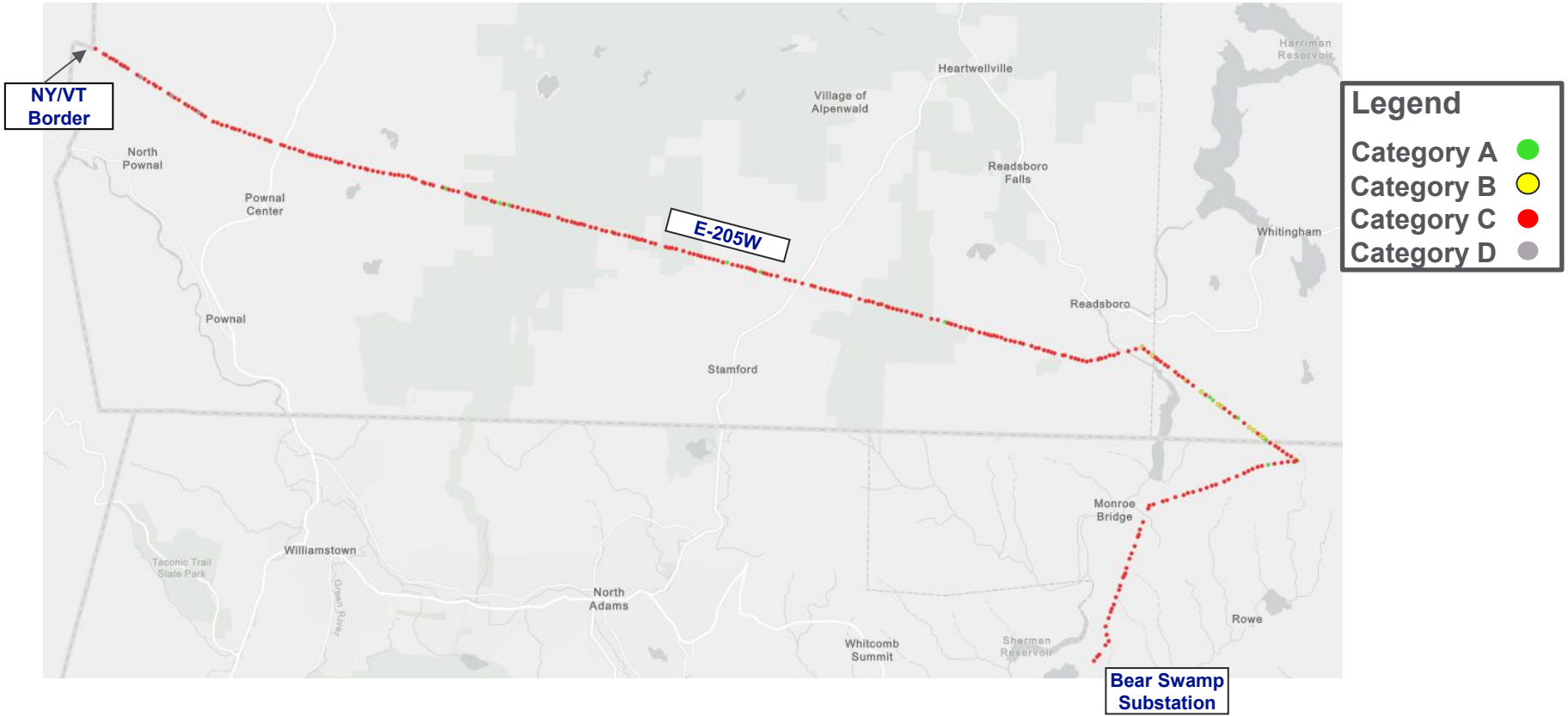
Project Needs and Drivers – Structure Grades – E-205W

Summary of Current Structure Grades		
Category	**Recommended Action**	**Number of structures**
A	No replacement required due to deterioration	12
B	Consider replacement in conjunction with other structure replacements	11
C	Initiate planned structure replacement project or Replace as part of upcoming structure replacement project	293
D	Replace immediately (emergency replacement)	3
Total		319

- Two hundred ninety-three (293) wood structures on the line are grade C due to poor condition.
- Eleven (11) wood structures on the line are grade B. These are considered opportunity structures due to access and due to location in a woodpecker infested habitat
- Twelve (12) steel structures are grade A.
- Three (3) structures are rated grade D due to poor condition and will be replaced in advance of this project with new wood structures. These replacement wood structures will get rebuilt with steel 345kV structures as part of the preferred alternative.

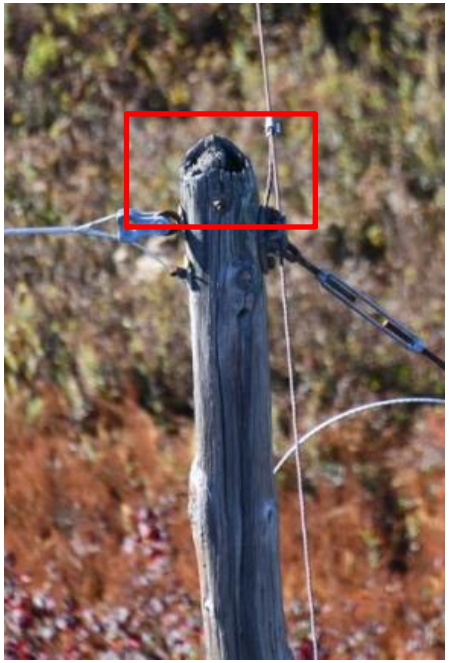
Project Needs and Drivers - Structure Grades Map (E-205E)

Project Needs and Drivers - Structure Grades Map (E-205W)



Project Needs and Drivers – Deteriorated Wood Poles (E-205E)

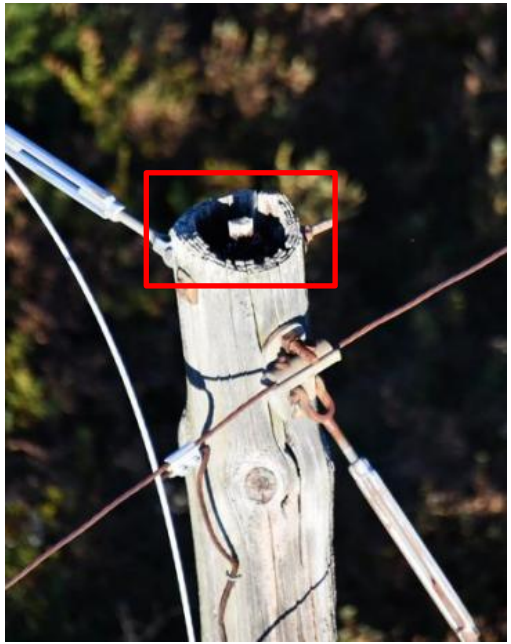
E-205E Str. 53
Installed 1972
Grade C – Pole top decay



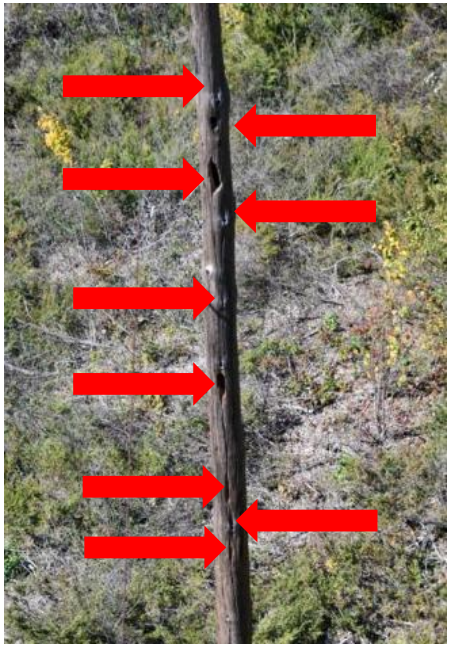
E-205E Str. 280
Installed 1962
Grade C – Pole top decay

E-205E Str. 283
Installed 1962
Grade C – Pole top decay

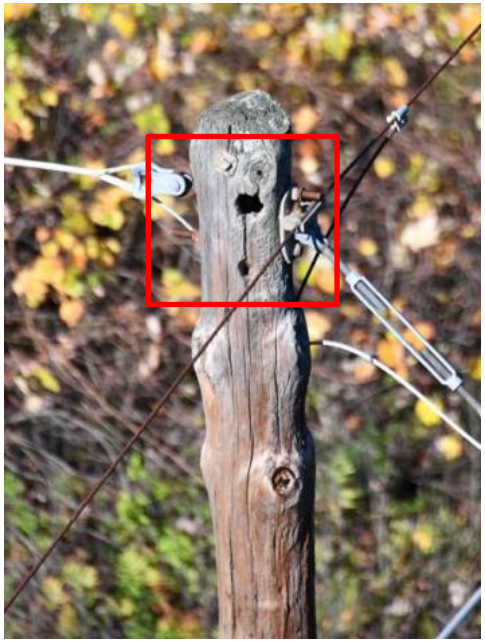
Project Needs and Drivers – Deteriorated Wood Poles (E-205E)



E-205E Str. 288
Installed 1962
Grade C – Pole top decay



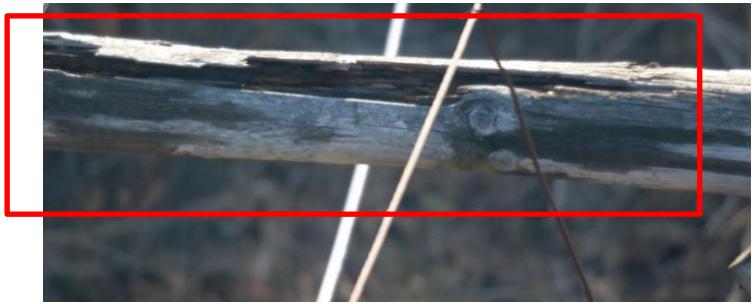
E-205E Str. 355
Installed 1962
Grade C – Woodpecker damage



E-205E Str. 378
Installed 1962
Grade C – Woodpecker damage

Project Needs and Drivers – Deteriorated Wood Poles (E-205E)

E-205E Str. 423
Installed 1962
Grade C – Deteriorated pole

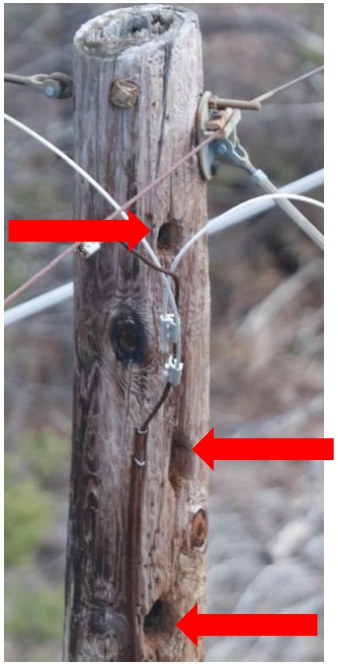


E-205E Str. 440
Installed 1962
Grade C – Deteriorated pole

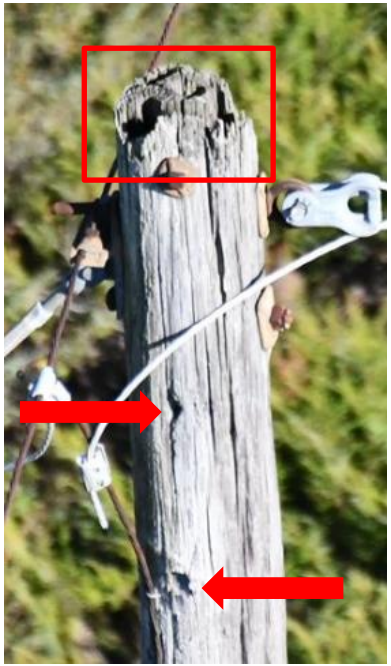
E-205E Str. 471
Installed 1962
Grade C – Deteriorated pole

Project Needs and Drivers – Deteriorated Wood Poles (E-205E)

E-205E Str. 479
Installed 1962
Grade C – Deteriorated pole



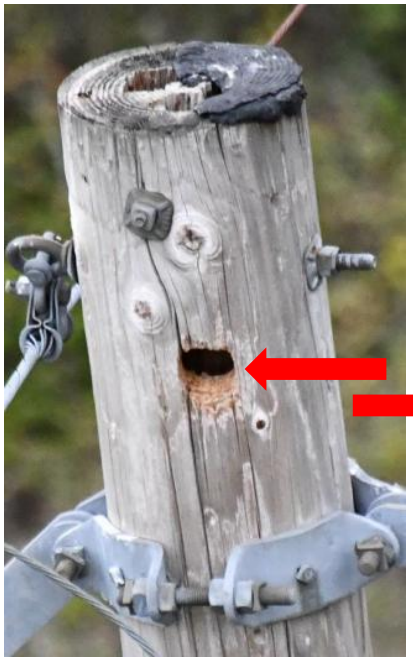
E-205E Str. 511
Installed 1962
Grade C – Woodpecker damage



E-205E Str. 514
Installed 1962
Grade C – Pole top decay

E-205E Str. 547
Installed 2009
Grade C – Deteriorated pole

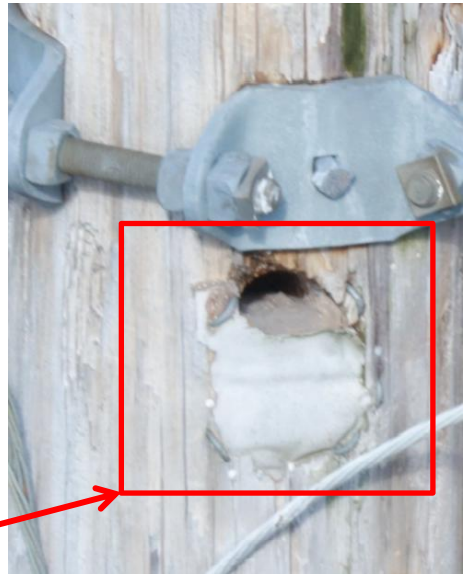
Project Needs and Drivers – Deteriorated Wood Poles (E-205E)



E-205E Str. 569
Installed 2009
Grade C – Woodpecker damage

E-205E Str. 676
Installed 2009
Grade C – Woodpecker damage

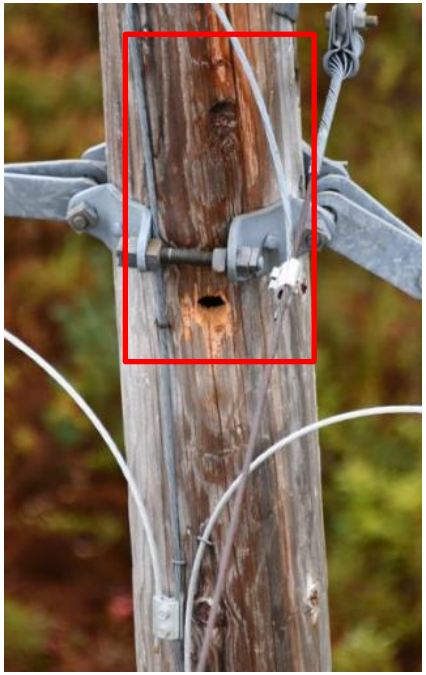
E-205E Str. 677
Installed 2009
Grade C – Woodpecker damage



E-205E Str. 684
Installed 1995
Grade C – Woodpecker damage

Project Needs and Drivers – Deteriorated Wood Poles (E-205E)

E-205E Str. 701
Installed 1995
Grade C – Woodpecker damage

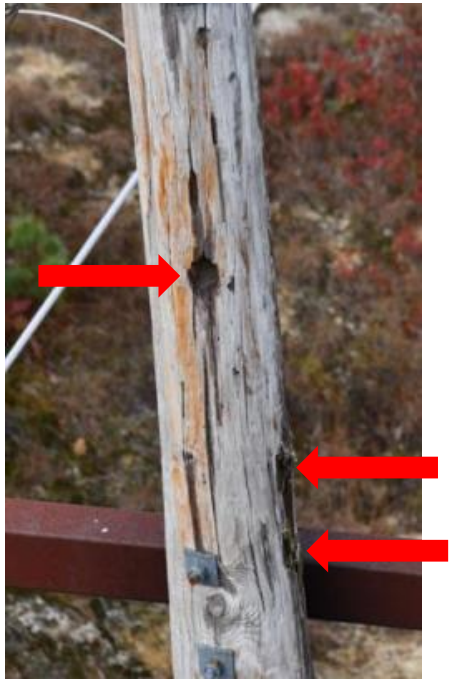


E-205E Str. 711
Installed 1995
Grade C – Woodpecker damage

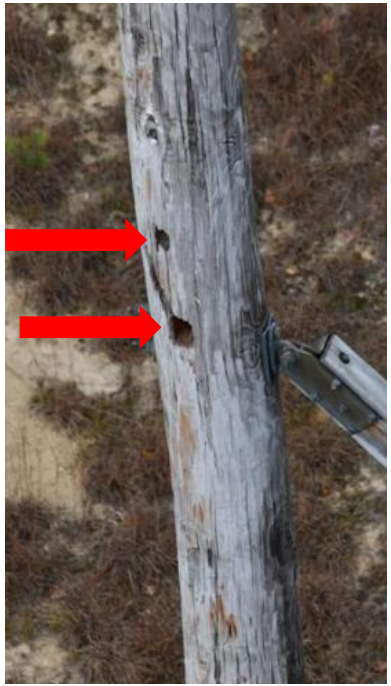
E-205E Str. 739
Installed 2009
Grade C – Deteriorated pole

E-205E Str. 785
Installed 2009
Grade C – Deteriorated pole

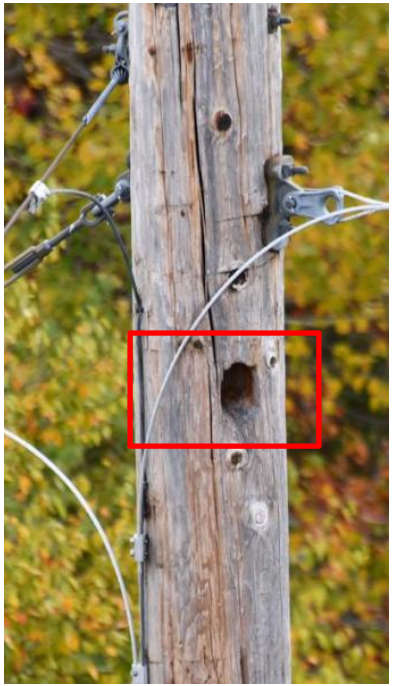
Project Needs and Drivers – Deteriorated Wood Poles (E-205E)



E-205E Str. 773
Installed 2009
Grade C – Woodpecker damage

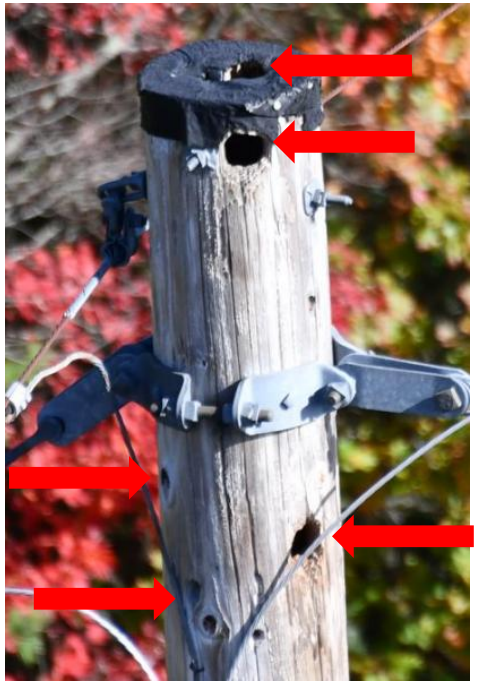


E-205E Str. 773
Installed 2009
Grade C – Woodpecker damage



E-205E Str. 776
Installed 2009
Grade C – Woodpecker damage

Project Needs and Drivers – Deteriorated Wood Poles (E-205E)

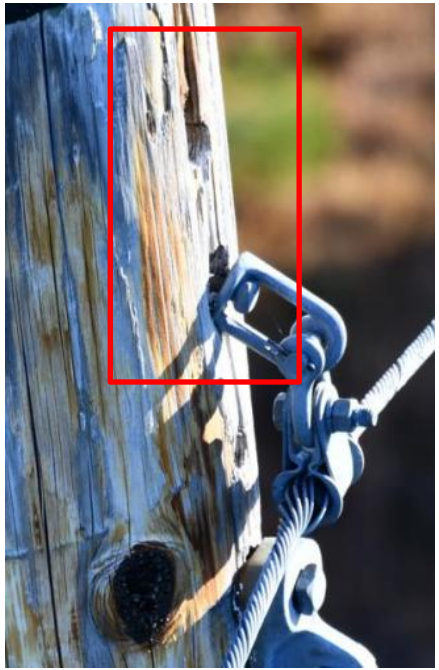


E-205E Str. 830
Installed 2006
Grade C – Woodpecker damage

E-205E Str. 851
Installed 2009
Grade C – Woodpecker damage

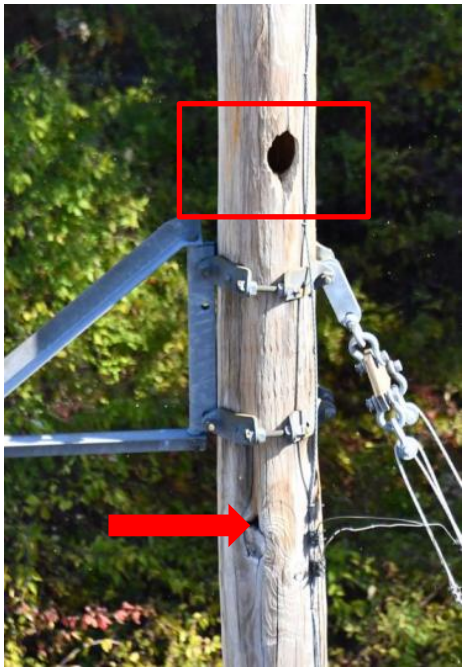
E-205E Str. 868
Installed 2009
Grade C – Deteriorated pole top

Project Needs and Drivers – Deteriorated Wood Poles (E-205E)



E-205E Str. 868
Installed 2009
Grade C – Deteriorated pole top

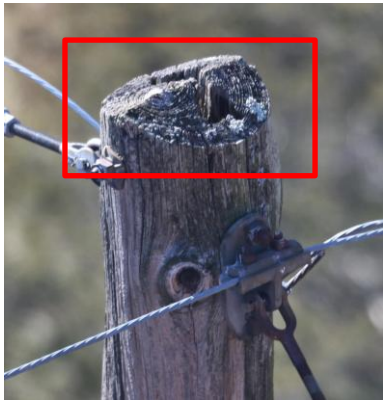
E-205E Str. 917
Installed 2010
Grade C – Woodpecker damage



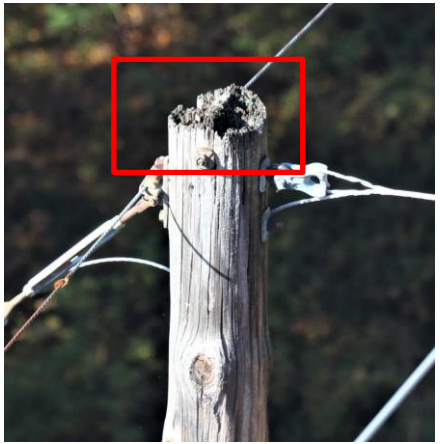
E-205E Str. 1068
Installed 2009
Grade C – Woodpecker damage

Project Needs and Drivers – Deteriorated Wood Poles (E-205W)

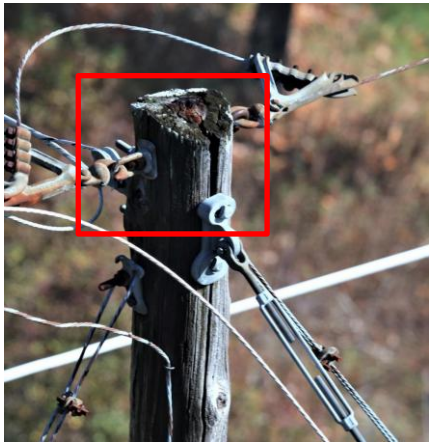
E-205W Str. 12
Installed 1962
Grade C – Pole top deterioration



E-205W Str. 21
Installed 1962
Grade C – Woodpecker damage

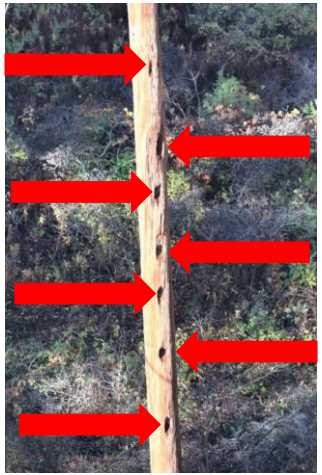


E-205W Str. 38
Installed 1972
Grade C – Pole top deterioration

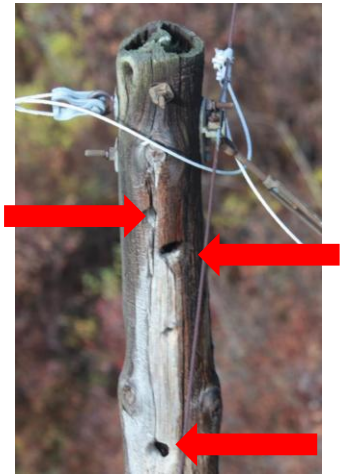


E-205W Str. 43
Installed 1981
Grade C – Pole top deterioration

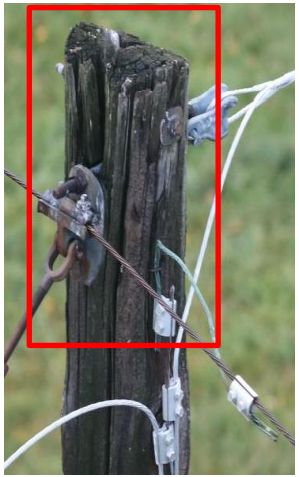
Project Needs and Drivers – Deteriorated Wood Poles (E-205W)



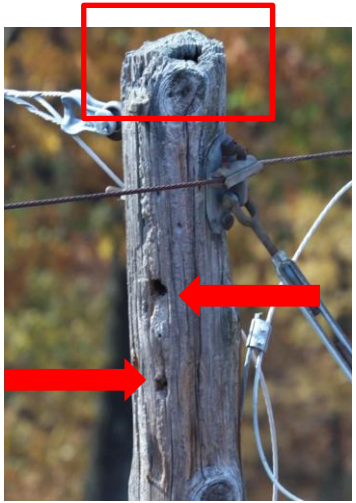
E-205W Str. 50
Installed 1972
Grade C – Woodpecker damage



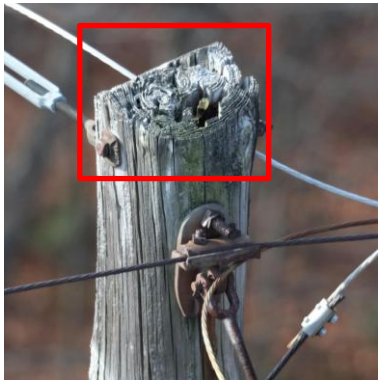
E-205W Str. 63
Installed 1962
Grade C – Woodpecker damage



E-205W Str. 68
Installed 1962
Grade C – Pole top deterioration

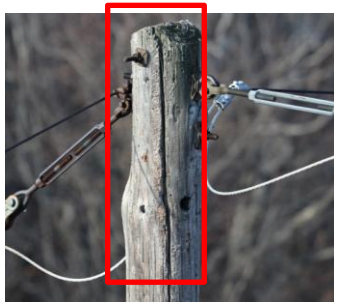


E-205W Str. 74
Installed 1962
Grade C – Woodpecker damage

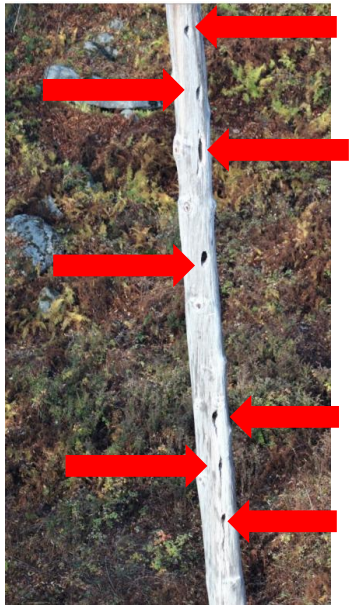


E-205W Str. 99
Installed 1962
Grade C – Pole top deterioration

Project Needs and Drivers – Deteriorated Wood Poles (E-205W)

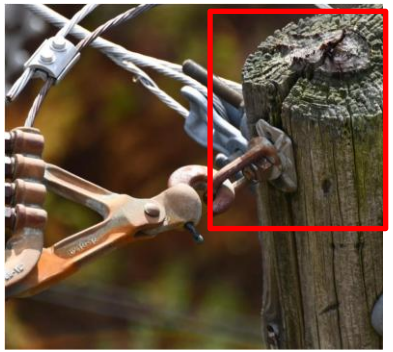


E-205W Str. 134
Installed 1962
Grade C – Pole top deterioration

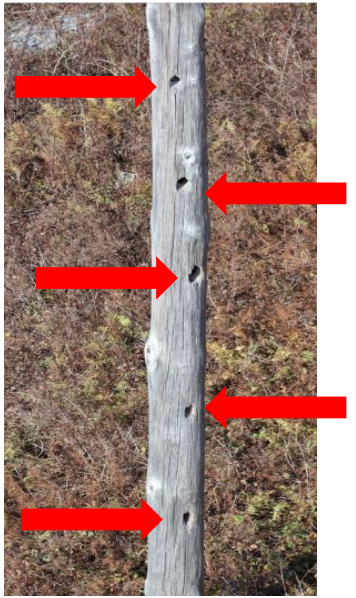


E-205W Str. 135
Installed 1962
Grade C – Woodpecker damage

E-205W Str. 160
Installed 1962
Grade C – Woodpecker damage



E-205W Str. 167
Installed 1962
Grade C – Pole top deterioration

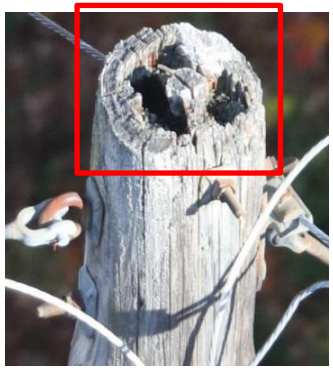


E-205W Str. 197
Installed 1962
Grade C – Woodpecker damage

Project Needs and Drivers – Deteriorated Wood Poles (E-205W)

E-205W Str. 203
Installed 1981
Grade C – Woodpecker damage

E-205W Str. 215
Installed 1962
Grade C – Pole top deterioration

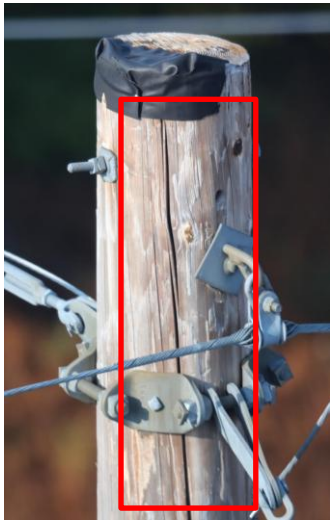


E-205W Str. 223
Installed 1962
Grade C – Pole top deterioration

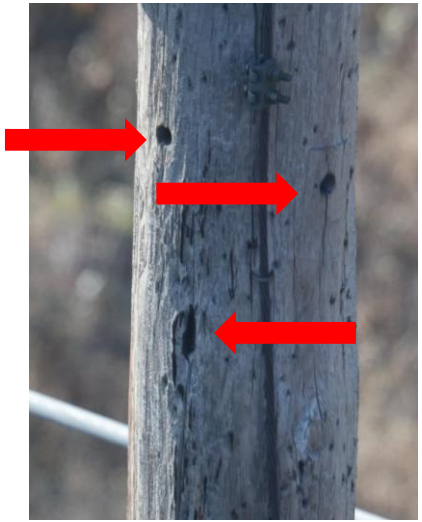
E-205W Str. 225
Installed 1962
Grade C – Pole top deterioration

Project Needs and Drivers – Deteriorated Wood Poles (E-205W)

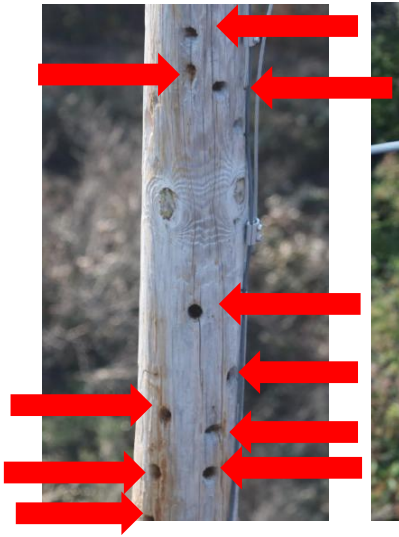
E-205W Str. 238
Installed 1981
Grade C – Woodpecker damage



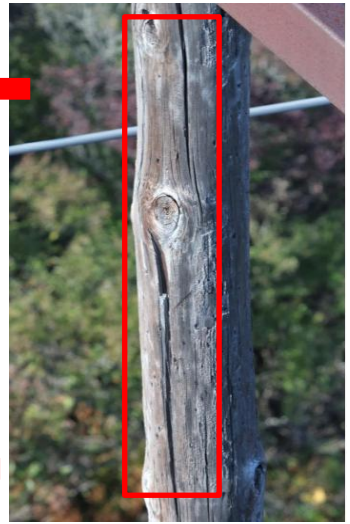
E-205W Str. 256
Installed 2006
Grade C – Pole top deterioration



E-205W Str. 261
Installed 1962
Grade C – Woodpecker damage



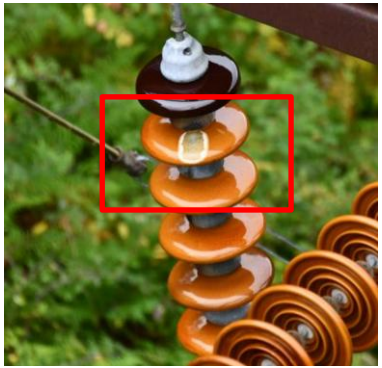
E-205W Str. 262
Installed 2000
Grade C – Woodpecker damage



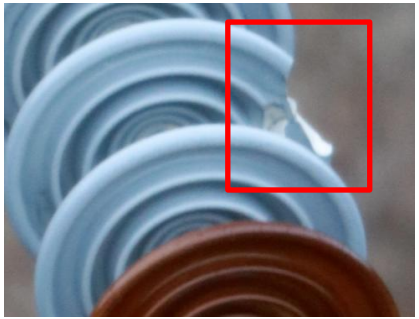
E-205W Str. 263
Installed 1962
Grade C – Pole top deterioration

Project Needs and Drivers – Deteriorated insulation

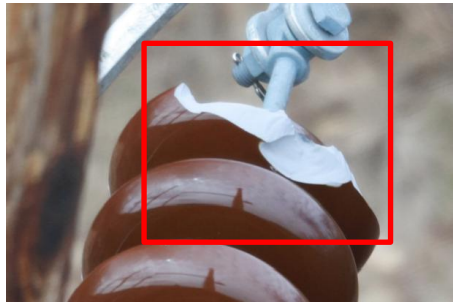
E-205W Str. 30



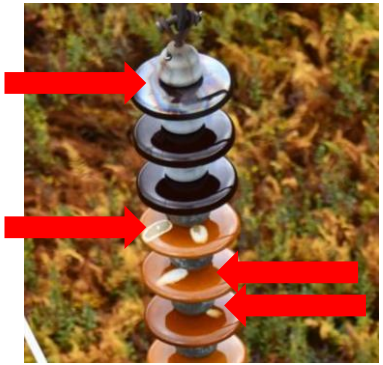
E-205W Str. 73



E-205E Str 450

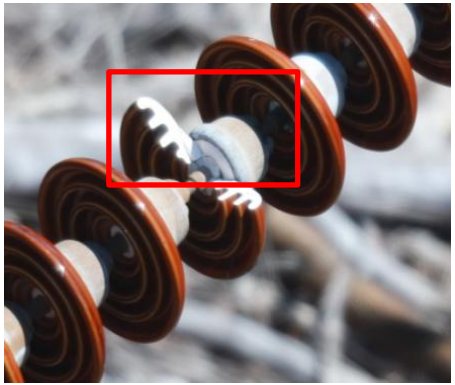


E-205E Str 528

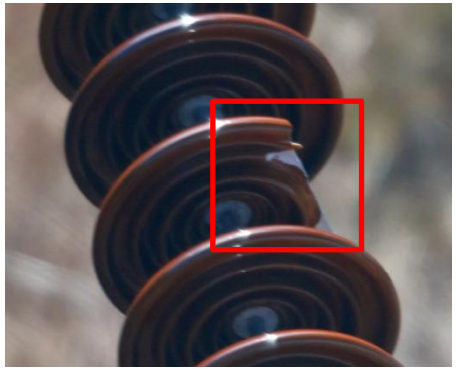


E-205W Str. 100

E-205W Str. 127

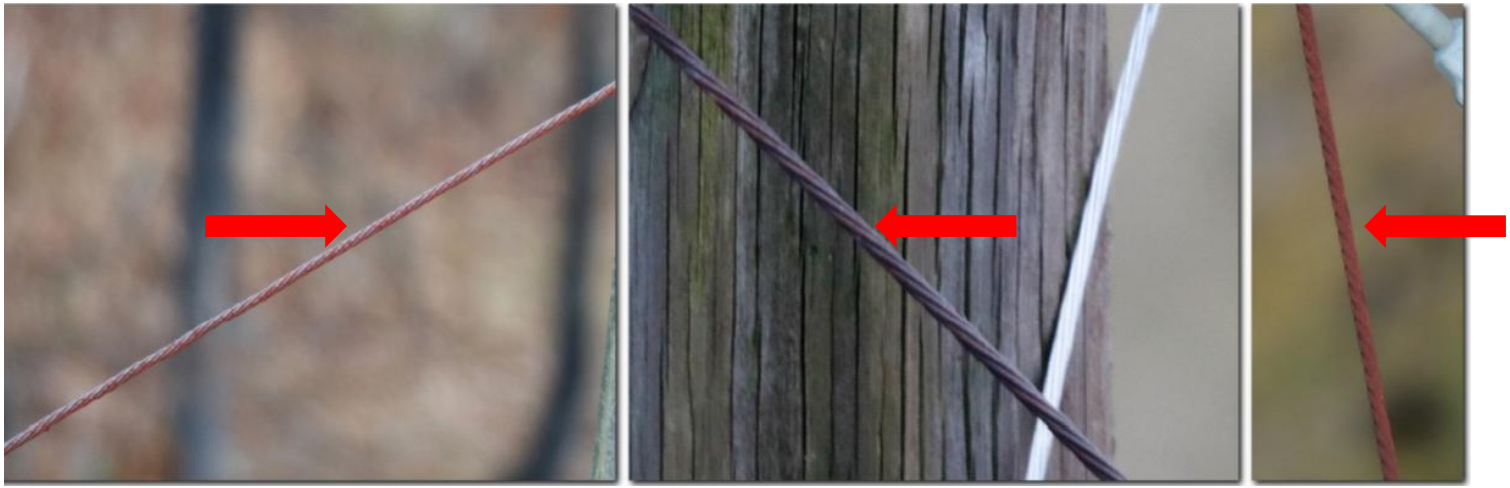


E-205E Str 604



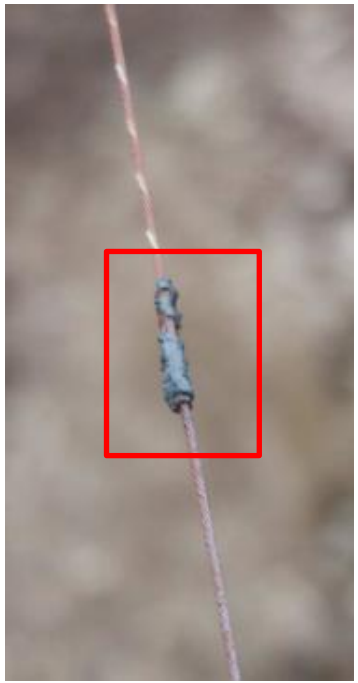
E-205E Str 440

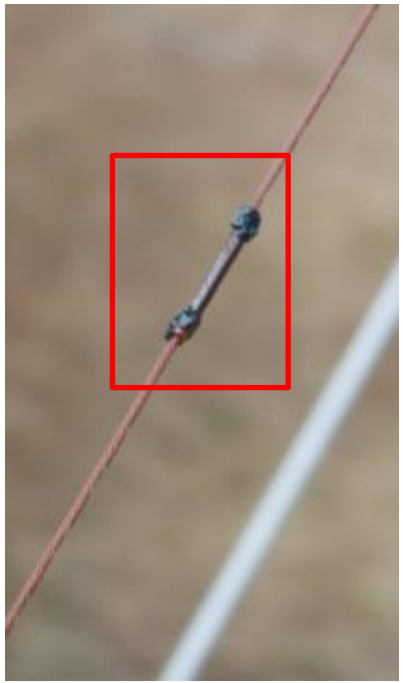
Project Needs and Drivers – Corroded Shieldwire

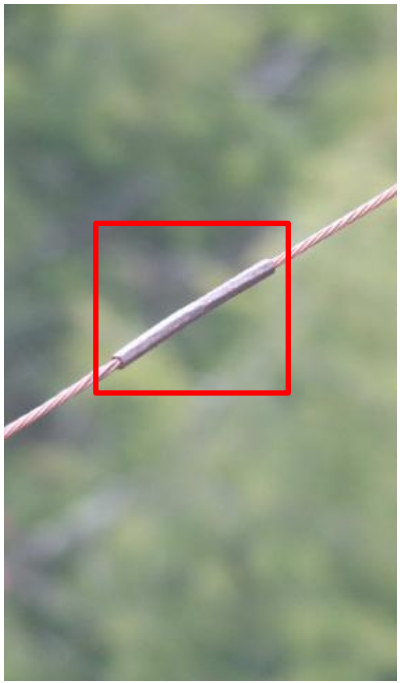


Entire circuit exhibiting deteriorated shieldwire condition due to corrosion

Project Needs and Drivers – Spliced Shieldwire

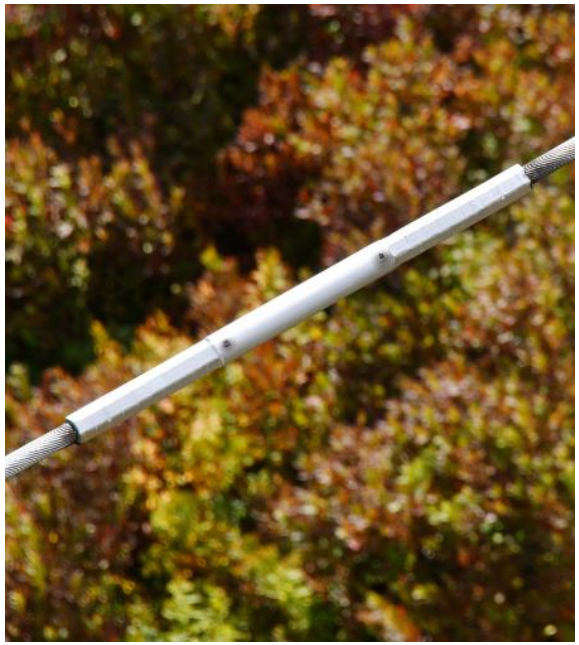






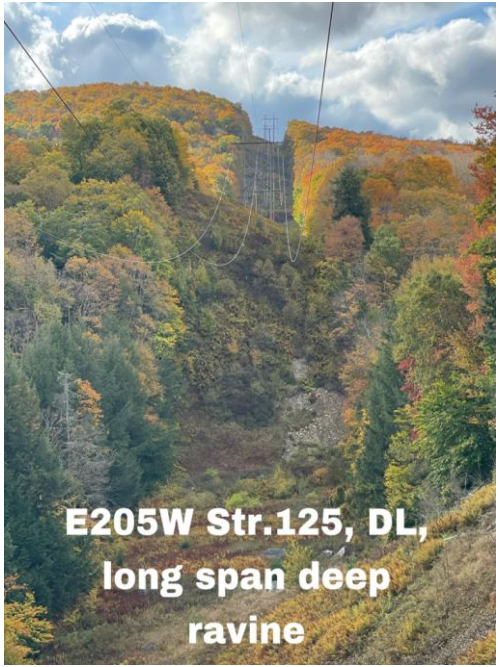
Frequent splices in shieldwire across entire circuit

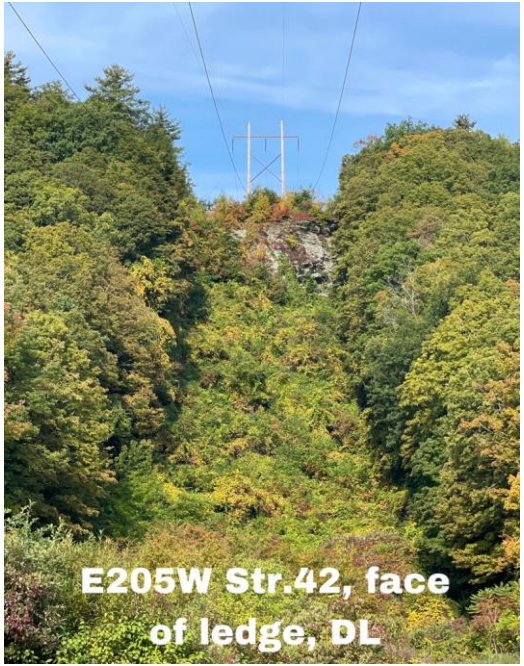
Project Needs and Drivers – Spliced Conductor



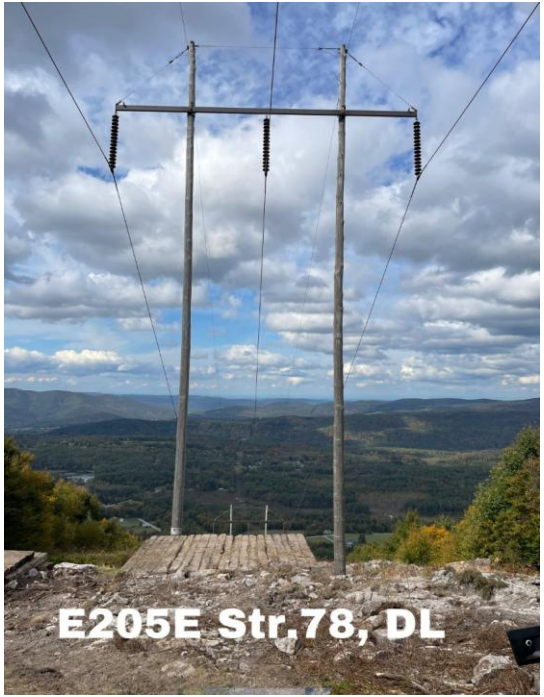
Frequent splices in all phases of the conductor across entire circuit

Project Needs and Drivers - Limited/Challenging Access





Project Needs and Drivers - Limited/Challenging Access



Project Needs and Drivers - Access Improvements

- As part of this project, approximately 560,524 linear feet (106.1 miles) of access will be addressed. The new access consists of new type S, type 1 and type 5 engineered roads.
- In order to safely access the E-205E and E-205W circuits, approximately 3,660,000 square feet of temporary matting will be installed in the ROW and off the ROW. Work pads will also be constructed at each structure to support construction including foundation installation, setting new structures, removal of existing structures, and overhead linework. Work pads will be constructed by placement and compaction of gravel (where feasible) or using temporary timber mats where required in wetland areas, within floodplain areas, or where placement of gravel is not feasible to provide a level workspace.

Road Type Classification	Description of work	Amount
Type S	Refresh with stone and potentially widen existing stable sub-base road. Widen as necessary to 16 feet standard width.	498,636 linear feet (94.4 miles)
Type 1	Non-engineered roads	4,193 linear feet (0.8 miles)
Type 5	Engineered road per National Grid standards – 16 feet wide.	57,695 linear feet (10.9 miles)
Gravel Workpads	Work pads will be used to access the ROW and at structure locations to provide access for construction including foundation installation, setting new structures, removal of existing structures, and overhead linework	1,245 workpads
Construction Matting	Temporary construction matting will be utilized for access and workpads in wetland, agricultural, and lawn areas	3,660,000 square feet

Review of Relevant Transmission Studies

Transmission Study Status
Was this line overloaded in recent Attachment K studies (Reliability Needs Assessments, Longer-Term Transmission Studies, etc.) or other recent studies?
Both E-205E and E-205W lines were not found to be overloaded in any of the Attachment K studies. However, the ISO-NE Transitional Cluster Study (TCS) Final Report published on August 6th, 2026 identified the below overloads on these circuits. E-205E line is shown to be overloaded up to 110% of Summer Normal rating under all-lines in condition; up to 144% of Summer LTE rating under N-1 conditions • E-205W line is shown to be overloaded up to 103% of Summer LTE rating under N-1 conditions
Have modifications or upgrades to this line been identified as potential solutions in any of those studies?
The following upgrades were considered in the TCS study to provide adequate capacity to mitigate the identified overloads • Rebuild E-205E line with 795 ACSS conductor with 458 structure replacements • Replace 44 structures on E-205W line section from Bear Swamp to NE/NY border to increase conductor clearance

Evaluated Solution Alternatives

Base Alternative

Targeted Refurbishment at 230 kV Design	
Description	• Replace all 913 E-205E & E-205W Grade C structures (620 E-205E & 293 E-205W) with steel 230 kV standard structures • Replace 92.5 circuit miles of shieldwire with two (2) 3/8” EHS steel shieldwires on the E-205E and E-205W lines • Replace damaged insulators and hardware • Refresh existing access ways and construct permanent access in targeted areas where new access is beneficial
Primary Needs Addressed	Structures, Shieldwire, Insulators
Secondary Needs Addressed	Access Improvements
Advanced transmission technologies to be considered	N/A
Cost Estimate and Accuracy	**E-205E:** $379.1M (ACR) + $162.2M (Access) = $541.3M Total **E-205W:**$143.7M (ACR) + $68.8M (Access) = $212.5M Total **Total:** $522.8M (ACR) + $231.0M (Access) **$753.8M** (+50%, -25%) PTF
Longer-term transmission needs addressed	N/A
Key standards or criteria affecting design if different than current design	NESC-Heavy

Evaluated Solution Alternatives

Alternative 2

Rebuild at 230 kV Design	
Description	• Replace all 1,205 E-205E & E-205W structures (886 E-205E & 319 E-205W) with steel 230 kV design structures • Reconductor all 101.1 circuit miles of E-205E & E-205W with 1113 ACSS Finch conductor • Replace 101.1 circuit miles of shieldwire with two (2) ½" OPGW on the E-205E and E-205W lines • Replace all insulators and hardware • Refresh existing access ways and construct permanent access in targeted areas where new access is beneficial
Primary Needs Addressed	Structures, Conductor, Shieldwire, Insulators
Secondary Needs Addressed	Fiber, Access Improvements
Advanced transmission technologies to be considered	Use of ACSS conductor
Cost Estimate and Accuracy	**E-205E:** $522.9M (ACR) + $162.2M (Access) = $685.0 Total **E-205W:**$160.4M (ACR) + $68.8M (Access) = $229.2M Total **Total:** $683.3 (ACR) + $231.0M (Access) **$914.3M** (+50%, -25%) PTF
Longer-term transmission needs addressed	N/A
Key standards or criteria affecting design if different than current design	NESC-Heavy

Evaluated Solution Alternatives

Alternative 3

Rebuild at 345 kV Design (H-frame structures)	
Description	• Replace all 1,205 E-205E & E-205W structures (886 E-205E & 319 E-205W) with steel 345 kV design H-frame structures (continued operation at 230kV) • Reconductor all 101.1 circuit miles of E-205E & E-205W with bundled (2) 1590 ACSS Falcon conductor • Replace 101.1 circuit miles of shieldwire with two (2) ½" OPGW on the E-205E and E-205W lines • Replace all insulators and hardware (345kV standard) • Refresh existing access ways and construct permanent access in targeted areas where new access is beneficial
Primary Needs Addressed	Structures, Conductor, Shieldwire, Insulators
Secondary Needs Addressed	Fiber, Access Improvements
Advanced transmission technologies to be considered	Use of ACSS conductor
Cost Estimate and Accuracy	**E-205E:** $747.2M (ACR) + $162.2M (Access) = $909.4M Total **E-205W:**$230.6M (ACR) + $68.8M (Access) = $299.4M Total **Total:** $977.8M (ACR) + $231.0M (Access) **$1.209B** (+50%, -25%) PTF
Longer-term transmission needs addressed	N/A
Key standards or criteria affecting design if different than current design	NESC-Heavy

Evaluated Solution Alternatives

Alternative 4

Rebuild at 345 kV Design (Monopole structures)	
Description	• Replace all 1,205 E-205E & E-205W structures (886 E-205E & 319 E-205W) with steel 345 kV design delta monopole structures (continued operationat 230kV) • Reconductor all 101.1 circuit miles of E-205E & E-205W with bundled (2) 1590 ACSS Falcon conductor • Replace 101.1 circuit miles of shieldwire with two (2) ½" OPGW on the E-205E and E-205W lines • Replace all insulators and hardware (345kV standard) • Refresh existing access ways and construct permanent access in targeted areas where new access is beneficial
Primary Needs Addressed	Structures, Conductor, Shieldwire, Insulators
Secondary Needs Addressed	Fiber, Access Improvements
Advanced transmission technologies to be considered	Use of ACSS conductor
Cost Estimate and Accuracy	**E-205E:** $832.3M (ACR) + $162.2M (Access) = $994.5M Total **E-205W:** $309.6M (ACR) + $68.8M (Access) = $378.4M Total **Total:** $1.142B (ACR) + $231.0M (Access) **$1.373B** (+50%, -25%) PTF
Longer-term transmission needs addressed	N/A
Key standards or criteria affecting design if different than current design	NESC-Heavy

Comparative Analysis of Alternatives

Comparison				
Key Criteria	**Base Alternative** (230 kV Targeted Refurbishment)	**Alternative 2** (230 kV Full Rebuild)	**Alternative 3** (345kV Full Rebuild with H-frames)	**Alternative 4** (345kV Full Rebuild with Delta Monopoles)
Addresses Primary Need(s)	• Yes	• Yes	• Yes	• Yes
Secondary Needs Addressed	• Yes (Access)	• Yes (Access, Fiber)	• Yes (Access, Fiber)	• Yes (Access, Fiber)
Cost	**E-205E:** $379.1M (ACR) + $162.2M (Access) = $541.3M Total **E-205W:**$143.7M (ACR) + $68.8M (Access) = $212.5M Total **Total:** $522.8M (ACR) + $231.0M (Access) **$753.8M** (+50%, -25%) PTF	**E-205E:** $522.9M (ACR) + $162.2M (Access) = $685.0 Total **E-205W:**$160.4M (ACR) + $68.8M (Access) = $229.2M Total **Total:** $683.3 (ACR) + $231.0M (Access) **$914.3M** (+50%, -25%) PTF	**E-205E:** $747.2M (ACR) + $162.2M (Access) = $909.4M Total **E-205W:**$230.6M (ACR) + $68.8M (Access) = $299.4M Total **Total:** $977.8M (ACR) + $231.0M (Access) **$1.209B** (+50%, -25%) PTF	**E-205E:** $832.3M (ACR) + $162.2M (Access) = $994.5M Total **E-205W:** $309.6M (ACR) + $68.8M (Access) = $378.4M Total **Total:** $1.142B (ACR) + $231.0M (Access) **$1.373B** (+50%, -25%) PTF
Constructability concerns or advantages	• Shortest construction duration	• Similar for alternatives 2 and 3	• Similar for alternatives 2 and 3 • Requires increased vegetation maintenance compared to Alternative 4	• Requires larger construction vehicles for foundations. Improved clearance to edge of ROW compared to Alternative 3. Longest construction duration.

Comparative Analysis of Alternatives

Comparison				
Key Criteria	**Base Alternative (230 kV Targeted Refurbishment)**	**Alternative 2 (230 kV Full Rebuild)**	**Alternative 3 (345kV Full Rebuild with H-frames)**	**Alternative 4 (345kV Full Rebuild with Delta Monopoles)**
Siting, Environmental and regulatory issues	• Access costs comparable to Alternative 2	• Access costs comparable to Base Alternative	• Similar access costs compared to Alternative 4, slightly higher than Alternatives 1 and 2 • Siting permits will be required due to upgrading to 345kV	• Similar access costs compared to Alternative 3, slightly higher than Alternatives 1 and 2 • Siting permits will be required due to upgrading to 345kV
Governmental or Community Goals addressed	• Similar for all alternatives	• Similar for all alternatives	• Similar for all alternatives	• Similar for all alternatives
Future-Proofing	• Requires replacement of all assets if 345kV facilities are needed in the future resulting in significant duplication of costs at nearly the same cost as the currently proposed project • Remaining wood structures left in a woodpecker habitat • Does not add fiber to the lines • Does not address transitional cluster study needs for increased capacity	• Requires replacement of all assets if 345kV facilities are needed in the future resulting in significant duplication of costs at nearly the same cost as the currently proposed project • Addresses the need for fiber • Addresses TCS but does not provide as much additional capacity as Alternative 3 and Alternative 4	• Addresses the need for fiber • Addresses TCS needs for increased capacity and allows for future 345kV operation	• Addresses the need for fiber • Addresses TCS needs for increased capacity and allows for future 345kV operation
Schedule and Outage Coordination	• Shortest outage duration	• Alternative 2 and alternative 3 require similar outage windows	• Alternative 2 and alternative 3 require similar outage windows	• Requires the longest outage durations

Conclusion

Conclusion

- Alternatives 2, 3, and 4 address the deteriorated 913 wood structures rated Grade C and the remaining 141 wood structures rated Grade B by replacing them with new steel structures
- The woodpecker damage is widespread throughout the line and not replacing the Grade B rated wood structures on the line as part of the base alternative will simply encourage the birds to move onto these remaining wood structures which would require eventual replacement in the near term
- Shieldwire is corroded throughout the circuits and replacement addresses condition concerns. Replacement with OPGW meets the secondary driver of improving communications along the corridor
- Replacement of conductor in Alternatives 2, 3, and 4 meets the condition concerns identified via inspection that are not remediated by the Base Alternative
- Addresses the damaged and flashed insulators across the full extent of both circuits
- Addresses the challenging and poor access by refreshing existing access ways and identifying targeted areas where new access is beneficial
- Inclusion of permanent access improvements reduces the dependency on temporary matting which require multiple relocations during the project and reduces overall construction timeline and construction costs
- Alternative 4 monopole design was considered to provide largest possible clearance to edge of Right of Way. Alternative 3's H-frame design has larger vegetation management costs where monopole design has significantly more construction costs

Conclusion (Cont.)

Conclusion

- A full rebuild of the lines as part of this project will represent a generational upgrade opportunity. If the lines are not right-sized to 345kV design standards now, they likely will not be rebuilt/reconductored for another 70+ years, missing a rare upgrade opportunity
- Future 345kV operation could increase transfer capacity by approximately 1,000MW between ISO-NE & NYISO. This improved connectivity between the regions would result in reduced generation curtailment and more efficient dispatch between regions. These benefits would create a significant long-term cost savings
- There are further benefits to future 345kV operation beyond currently planned interconnections as generation, storage, load centers, and electrification are further developed in the region
- The Base Alternative and Alternative 2 would require full replacement of all the facilities if 345kV operation is needed in the future resulting in significant duplication of most of the costs incurred as part of this project
- The TCS final report results indicate that increasing the rating of the E-205E and E-205W would benefit interconnecting facilities currently in the queue
- Ultimately, Alternative 3 is chosen as preferred alternative because it addresses all the primary and secondary needs and builds for the future by increasing the structure design to support a future increase to 345kV. This is accomplished at a lower cost and shorter timeline as compared to Alternative 4 by reducing the number of poured concrete foundations required in Alternative 4's monopole design

Schedule

Planned Schedule	
Comment Deadline	9/10/2026
Follow-up PAC Presentation	TBD
Start of Major Construction	E-205E: Q4 2032 E-205W: Q3 2031
Project in Service	E-205E: Q1 2036 E-205W: Q4 2033

Please submit any comments to pacmatters@iso-ne.com and:

Transmission Owner Contact	
Contact Name	Rafael Panos
Contact Email Address	pac.questions@nationalgrid.com

Questions

E-205E & E-205W 230 kV Line Asset Condition Replacement

This document has been reviewed and does not contain Critical Energy/Electric Infrastructure Information (CEII).

nationalgrid

Scope Summary for Base Alternative

Structure Characteristics		
		Per Unit
Primary Structure Configuration	H-Frame	N/A
Material	Steel	N/A
Number of Structure Replacements (est)	913	9.00 per mile

Structure Characteristics	
	Total
Miles of ROW Affected	96 miles
Miles of shieldwire replacement	92.5 miles
Miles of conductor replacement	0 miles
ADSS substation connections	None

Structure Characteristics		
	Cost ($M)	Per Unit Cost ($M)
Structure Replacements	$303.8M	$0.333M/str
Reconductoring / Shieldwire	$19.3M	$0.209M/mile
Access Costs	$292.0M	$3.042M/mile
Other Costs (risk and contingency)	$138.7M	
Total Cost	$753.8M	

Scope Summary for Alternative 2

Structure Characteristics		
		Per Unit
Primary Structure Configuration	H-Frame	N/A
Material	Steel	N/A
Number of Structure Replacements (est)	1,205	11.88 per mile

Structure Characteristics	
	Total
Miles of ROW Affected	96 miles
Miles of shieldwire replacement	101.1 miles
Miles of conductor replacement	101.1 miles
ADSS substation connections	3

Structure Characteristics		
	Cost ($M)	Per Unit Cost ($M)
Structure Replacements	$365.1M	$0.303M/str
Reconductoring / Shieldwire	$79.2M	$0.390M/mile
Access Costs	$291.8M	$3.039M/mile
Other Costs (risk and contingency)	$178.2M	
Total Cost	$914.3M	

Scope Summary for Alternative 3

Structure Characteristics		
		Per Unit
Primary Structure Configuration	H-Frame	N/A
Material	Steel	N/A
Number of Structure Replacements (est)	1,205	11.88 per mile

Structure Characteristics	
	Total
Miles of ROW Affected	96 miles
Miles of shieldwire replacement	101.1 miles
Miles of conductor replacement	101.1 miles
ADSS substation connections	3

Structure Characteristics		
	Cost ($M)	Per Unit Cost ($M)
Structure Replacements	$515.3M	$0.428M/str
Reconductoring / Shieldwire	$145.4M	$0.717M/mile
Access Costs	$293.7M	$3.059M/mile
Other Costs (risk and contingency)	$254.4M	
Total Cost	$1.209B	

Scope Summary for Alternative 4

Structure Characteristics		
		Per Unit
Primary Structure Configuration	Delta Monopole	N/A
Material	Steel	N/A
Number of Structure Replacements (est)	1,205	11.88 per mile

Structure Characteristics	
	Total
Miles of ROW Affected	96 miles
Miles of shieldwire replacement	101.1 miles
Miles of conductor replacement	101.1 miles
ADSS substation connections	3

Structure Characteristics		
	Cost ($M)	Per Unit Cost ($M)
Structure Replacements	$639.1M	$0.530M/str
Reconductoring / Shieldwire	$144.0M	$0.710M/mile
Access Costs	$293.1M	$3.091M/mile
Other Costs (risk and contingency)	$296.7M	
Total Cost	$1.373B	

Access Details

Before construction

After construction

The example photos on the left show a transmission line before and after construction. As part of the asset condition project, structures were replaced and access improvements including new road building was done.

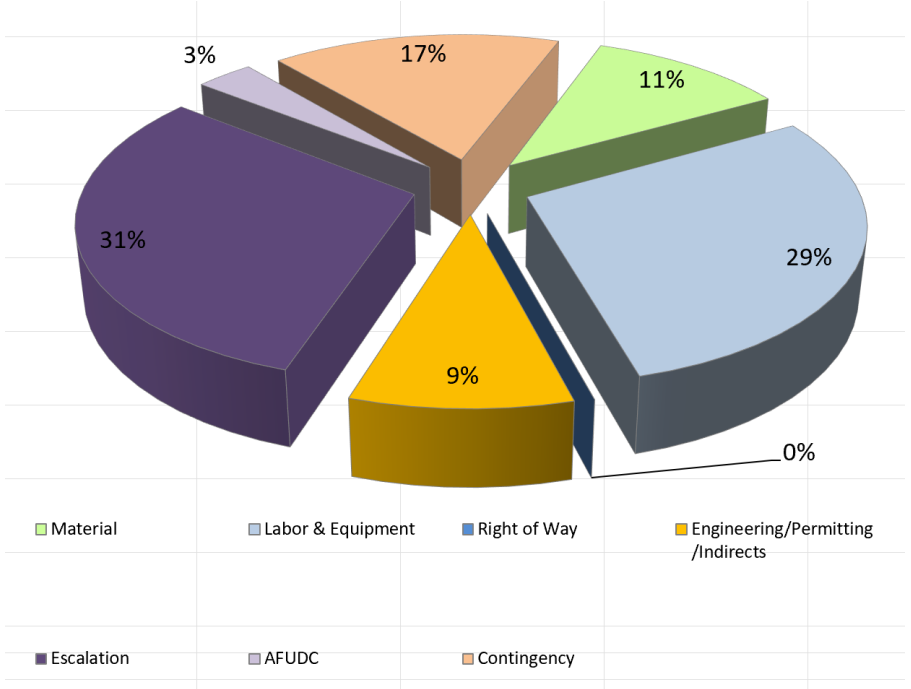
Access Details

Wood temporary mats (removed after project completion)

The example photos on this slide depict the typical wood mats used to safely access the structures and work around the structures

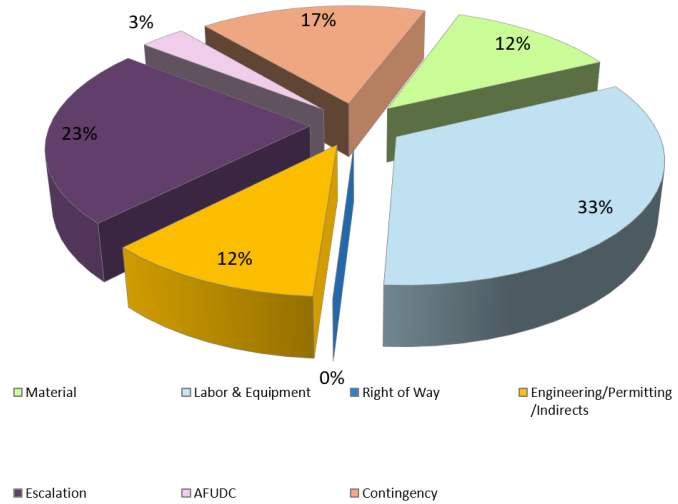
Additional Cost Detail – Preferred Option – E-205E

2.1. Project Cost Summary			
	PTF	Non-PTF	**Total**
Material	$ 102,577,267	$ -	$ 102,577,267
Labor & Equipment	$ 263,816,660	$ -	$ 263,816,660
Right of Way	$ -	$ -	$ -
Engineering/Permitting /Indirects	$ 81,989,842	$ -	$ 81,989,842
Escalation	$ 279,575,457	$ -	$ 279,575,457
AFUDC	$ 29,838,203	$ -	$ 29,838,203
Contingency	$ 151,559,486	$ -	$ 151,559,486
Total Project Cost	$ 909,356,915	$ -	$ 909,356,915



Additional Cost Detail – Preferred Option – E-205W

Project Cost Summary			
	PTF	Non-PTF	**Total**
Material	$ 36,886,722	$ -	$ 36,886,722
Labor & Equipment	$ 99,189,857	$ -	$ 99,189,857
Right of Way	$ -	$ -	$ -
Engineering/Permitting /Indirects	$ 33,911,721	$ -	$ 33,911,721
Escalation	$ 69,601,800	$ -	$ 69,601,800
AFUDC	$ 9,883,934	$ -	$ 9,883,934
Contingency	$ 49,894,807	$ -	$ 49,894,807
Total Project Cost	$ 299,368,841	$ -	**$ 299,368,841**



Preliminary Conductor Ratings*- E-205E

- **Current and preliminary post-project conductor ratings are listed below – final post-project ratings may differ**

Line Section	Rating Set (MVA)				
	Pre/Post Project	Normal (Sum/Win)	LTE (Sum/Win)	STE (Sum/Win)	DAL (Sum/Win)
E-205E	Pre (795 ACSR Condor) 230kV	468/576	519/614	555/664	698/838
	Pre (795 AAC Arbutus) 230kV	417/531	502/595	532/634	666/793
	Post (1113 ACSS Finch) 230kV	902/976	902/976	970/1062	1209/1346
	Post (2-1590 ACSS Falcon) 230kV	2262/2448	2262/2448	2510/2760	3233/3615
	Post (2-1590 ACSS Falcon) 345kV	3394/3671	3394/3671	3765/4139	4849/5423

***Final circuit ratings may be limited due to associated substation equipment. Practical transfer limits TBD by detailed studies.**

Preliminary Conductor Ratings* - E-205W

- **Current and preliminary post-project conductor ratings are listed below – final post-project ratings may differ**

Line Section	Rating Set (MVA)				
	Pre/Post Project	Normal (Sum/Win)	LTE (Sum/Win)	STE (Sum/Win)	DAL (Sum/Win)
E-205W	Pre (795 ACSR Condor) 230kV	468/576	519/614	555/664	698/838
	Pre (795 ACSS Condor) 230kV	727/786	727/786	764/834	922/1023
	Post (1113 ACSS Finch) 230kV	902/976	902/976	970/1062	1209/1346
	Post (2-1590 ACSS Falcon) 230kV	2262/2448	2262/2448	2510/2760	3233/3615
	Post (2-1590 ACSS Falcon) 345kV	3394/3671	3394/3671	3765/4139	4849/5423

***Final circuit ratings may be limited due to associated substation equipment. Practical transfer limits TBD by detailed studies.**

Woodpecker Damage Example

- This structure was removed from service from a different circuit within National Grid's New England territory in 2023
- Some woodpecker damage was visible on exterior of pole, just a hole
- Pole collapsed while being lifted out of place, exposing largely hollow interior with extensive damage
- At time of removal, extent of structural damage was not known before the pole collapsed
- The most common two species of woodpeckers found in National Grid territory have a nesting range of between 3 and 45 acres meaning that removal of a wood pole nesting site places all nearby remaining wood structures at risk of continued damage by the woodpecker population

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