

P145 Line Rebuild – Asset Condition and OPGW Project

Planning Advisory Committee Meeting
January 20th, 2022

Agenda

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- Project Drivers
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 - Conductor
 - Shield Wire Asset Condition
 - OPGW
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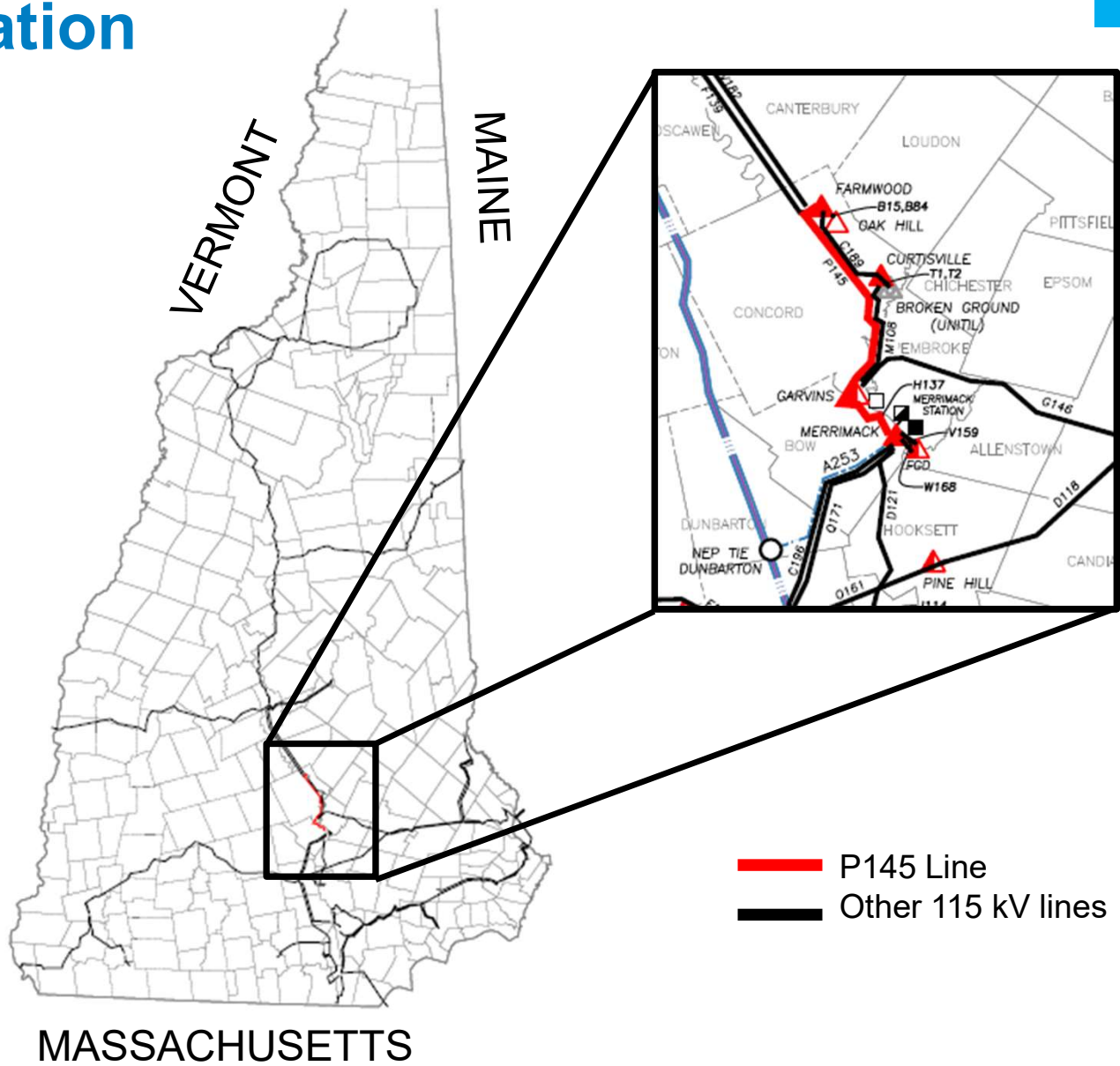
Project Background

- Line P145 is a 115-kV line spanning 12.5 miles between Merrimack Substation and Farmwood Substation in New Hampshire
- Originally constructed in 1966
- Existing conductor is 795 36/1 ACSR
- Existing static wires are two 3#6 Copperweld shield wires
- 165 structures, primarily single circuit wooden H-Frame structures



P145 Structure 104

New Hampshire 115-kV Geographic Location



Project Drivers: Wood Poles

- 25 structures need to be replaced based on recent visual inspections
 - C rated structures on EPRI rating scale
- Engineering analysis in preparation for OPGW installation identified additional structures which are loaded beyond their design capabilities
 - 98 structures found to exceed allowable loading based on the National Electrical Safety Code at the time of construction
 - 8 of these structures also failed recent visual inspections
- 13 additional structures exceed allowable loading with the OPGW added
- Age of structures (55 years) and wood deterioration must also be considered
- In total, 128 (78% of the structures on the line) need to be replaced due to structural overloads, degradation, or both



P145 Structure 73

Project Drivers: Conductor

- The conductor on the P145 is also 55 years old and is near its end of life
- The P145 currently utilizes 795 ACSR 36/1 conductor
- This original conductor is being replaced with Eversource-standard 1272 ACSS 54/19 conductor as an opportunity item for efficiency and to avoid a separate future replacement project

Project Drivers: Shield Wire Asset Condition

- Existing Copperweld shield wire is obsolete and susceptible to failure due to degradation from environmental factors
- Equipment and parts for the repair of these materials are no longer stocked because the technology is obsolete and no longer manufactured
 - System is currently experiencing hardware failures due to aging
 - When they do fail, replacement hardware is difficult to find
- OPGW Installation Drivers:
 - Up-to-date and readily available hardware
 - Similar cost to replacing with non-fiber shield wire replacement
 - OPGW will not only shield the lines, but increase communication and reliability within the Eversource system
- Addressing shield wire issues when replacing structures is more efficient than addressing these issues through separate projects

Project Drivers: Shield Wire Asset Condition (cont'd)

- Eversource periodically tests samples of shield wire obtained from existing lines during repairs and maintenance
- Recent test results show loss of strength in Copperweld shield wire
 - Test Results Indicate:
 - Damaged areas and loose strands
 - Excessive elongation in some strands, potentially due to overheating
 - Shield wire failed to exceed 95% of the rated breaking strength by American Society for Testing and Materials (ASTM) standards for hard drawn copper wire (84.2-91.1% depending on sample)
 - Severe corrosion of shield wire
- Failure of Copperweld shield wire presents a safety hazard and creates risks to the reliable operation of the transmission system
- Other obsolete shield wire materials, such as extra-high strength (EHS) steel, also suffer from similar issues

Project Drivers: OPGW

- OPGW installation expands a private Eversource OPGW / Synchronous Optical Networking (SONET) loop
 - This will provide a controlled alternate fiber communication path supporting the long term build out initiative of the fiber optic network. This greatly reduces the reliance on leased services for protection, SCADA and future Phasor Measurement Units (PMU) and Dynamic Disturbance Recorders (DDR) installations (ISO-NE OP-22)
 - A private network is segregated from third-party Telecom services improving the overall reliability and security of the communications path to BES Cyber Systems
- CIP: Fiber provides the necessary bandwidth for physical security monitoring and triaging of alarms for BES Cyber Systems at Medium and Low impact substations

Project Drivers: OPGW (cont'd)

- SCADA Load Shedding procedures are directed by ISO OP-7 and OP-13. SCADA load shedding is required for a rapid response to prevent cascading contingencies and/or equipment damage
 - OPGW provides a dedicated communication path allowing high-speed operations
- The DOE and EPRI recommend fiber as a means to strengthen the security and resilience of critical communication infrastructure on which the nation depends against the consequences of electromagnetic pulse (EMP) attacks
- Fiber optic cable is a non propagating media for electric and magnetic fields (EMF) and therefore is considered generally immune to the effects of geomagnetic disturbances

Project Scope: Alternatives

- Rebuild the P145 line (preferred solution)
 - Rebuild the P145 line with 154 new weathering steel structures, reusing 6 existing steel structures and permanently removing 5 structures
 - Replace existing 795 ACSR 36/1 with Eversource-standard 1272 ACSS 54/19 conductor
 - Replace obsolete and degrading 3#6 Copperweld with 48 fiber OPGW
- Replace only high priority asset condition structures (Not preferred)
 - Replace only the priority C structures
 - Remaining structures pose a barrier to replacing conductor and shield wire due to increased loading, clearance, and uplift concerns
 - Inability to replace the conductor and shield wire fails to address the asset condition and operational concerns of aging and obsolete copper materials

Project Summary

- Rebuild the P145 line with 154 new weathering steel structures, reusing 6 existing steel structures and permanently removing 5 structures
- Replace existing 795 ACSR 36/1 with 1272 ACSS 54/19 conductor
- Replace existing 3#6 Copperweld with 48 fiber OPGW
- All replacements and upgrades are replacing obsolete components and will meet current design criteria
- Proposed scope for this work is estimated at **\$52 M** (-25% / +50%)
 - Assuming most work will be performed under live-line conditions
 - P145 also has a high number of angle structures and road crossings
- Estimated in-service date **Q1 2024**

Questions

