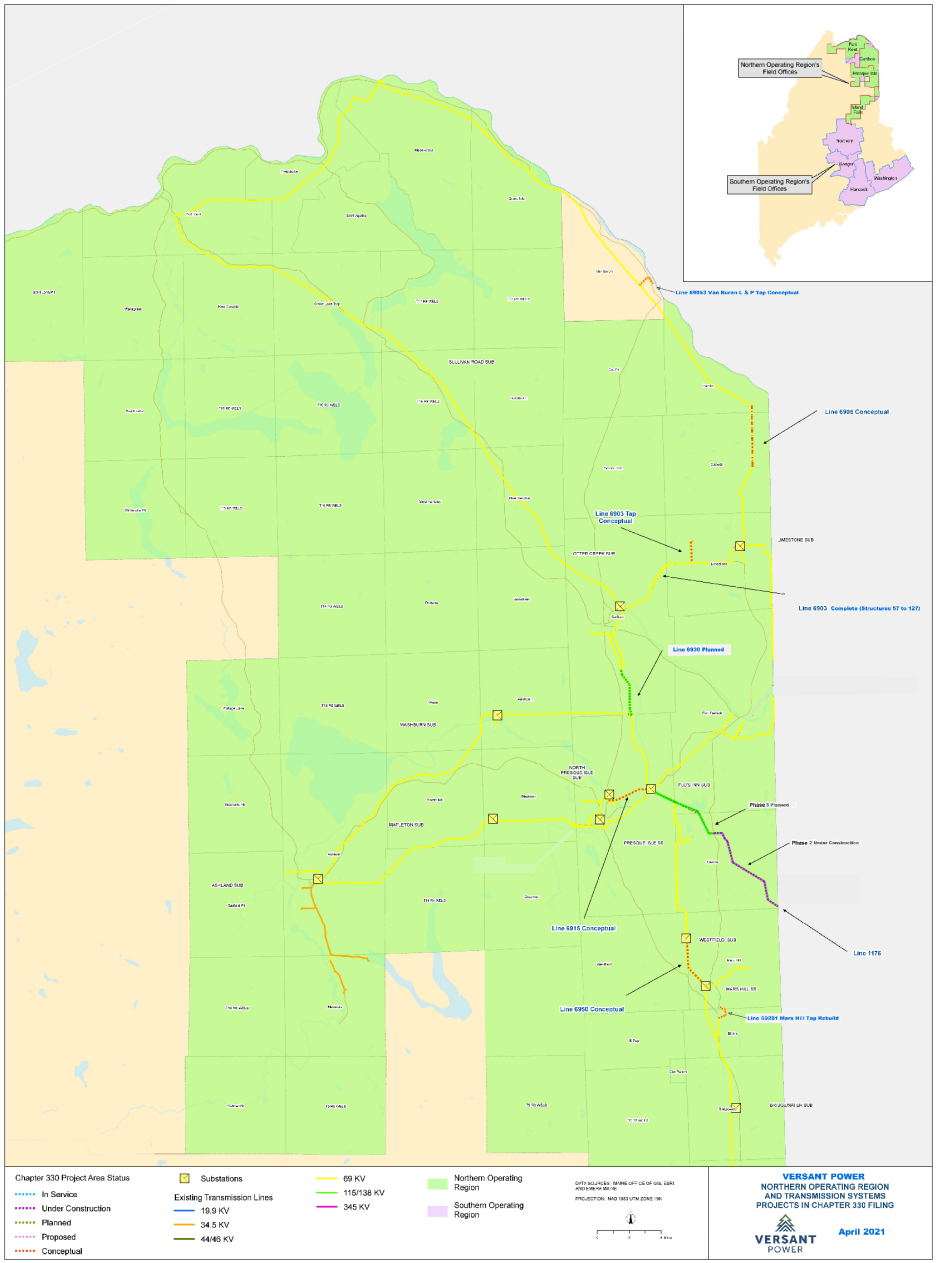
June 17, 2021

2021 Planning Advisory Group Meeting

Northern Maine Transmission System



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Transmission Planning Collaboration

- Adjusted based on customer feedback
- Intent: spread out remaining required MPD rebuild plan over 15-20 years (total rebuild program will span nearly 30 years)
- Final plan subject to enhanced inspection findings (drone, resistograph, climbing)
- Line and targeted line segment rebuilds will be necessary

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Chapter 330 Plans & Adjustments

Summary of Past and Present Chapter 330 Reports												
	2018 Report			2019 Report			2020 Report			2021 Report		
Year	Project	Miles	Cost Range ($M)	Project	Miles	Cost Range ($M)	Project	Miles	Cost Range ($M)	Project	Miles	Cost Range ($M)
2018	6913 Mapleton	0.8	0.6 - 0.9									
	6913 PISS to Pole 160	1.8	1.0 - 1.5									
2019	6901 FF Tap	1.2	0.5 - 0.7	6901 FF Tap	1.2	0.5 - 0.7						
	6903 OC to Limestone	9.8	4.9 - 6.9	6903 Pole 57 - 126	3.8	2.8 - 3.8						
	6930 Maysville to Washburn	8.4	4.5 - 6.0	6913 PISS to Pole 160	1.8	1.0 - 1.5						
				1176 Str 98 to Border	0.8	0.65 - 0.85						
2020	6930 Washburn to Ashland	16.9	12.0 - 14.0	6930 Dow to Maysville	3.0	2.0 - 2.4	6903 Pole 57 - 126	3.8	2.85 - 3.8			
	6930 Dow to Maysville	3.0	1.5 - 2.0	1176 Str 41 to 97	6.4	4.1 - 5.1	1176 Str 42 - Border	7.2	5.5 - 6.0			
	6950 Westfield to MHSS	3.4	3.0 - 3.5									
2021	1176 Flos to Border	11.9	6.0 - 8.5	1176 Str 3 to 41	4.8	3.1 - 3.8	6930 Dow to Maysville	3.0	2.0 - 2.4	6930 Dow to Maysville	3.0	1.4 - 1.6
							1176 Str 3 to 41	4.8	3.1 - 3.8	1176 Str 42 - Border	7.2	6.0 - 6.5
										1176 Str 3 to 41	4.8	3.3 - 3.8
2022	6915 Flos to NPI	3.0	1.5 - 2.0	6915 Flos to NPI	3.0	1.5 - 2.0	69053 Van Buren Tap	1.2	0.8 - 1.2	69053 Van Buren Tap	1.2	0.8 - 1.2
							69201 Mars Hill Tap	1.6	2.0 - 2.6	69201 Mars Hill Tap	1.6	2.2 - 2.6
2023				69032 Loring Tap	1.6	0.88 - 1.1	69032 Loring Tap	1.6	0.88 - 1.1	69032 Loring Tap	1.6	0.88 - 1.1
				6905 Phase 1	4.0	2.2 - 2.6	6905 Phase 1	4.0	2.2 - 2.6	6915 Flos to NPI	3.0	1.5 - 2.0
2024							6915 Flos to NPI	3.0	1.5 - 2.0	6950 Westfield to MHSS	3.4	3.0 - 3.5
							6950 Westfield to MHSS	3.4	3.0 - 3.5			
2025										6905 Phase 1	4.0	2.2 - 2.6
Total		60.2	35.5 - 40.0		30.4	18.7 - 23.0		33.6	23.8 - 29.0		29.8	21.3 - 24.9
Avg/Yr		12.0	7.1 - 8.0		6.1	3.7 - 4.6		6.7	4.8 - 5.8		6.0	4.3 - 5.0

Designates Project Under Construction at time annual Chapter 330 Report filed (April 1)

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2020 Project Work Completed

- Line 6903 - Limestone & Caribou (Rebuild Structure 57 to 127)
- Line 6905 – Grand Isle, Van Buren, Hamlin (Transmission Rebuild per Inspection)
- Line 6909 - Fort Kent, Frenchville, Madawaska (Transmission Rebuild per Inspection)
- Line 1176 - Easton (Rebuild Structure 42 to Border - Engineering & Permitting & Construction Starts)

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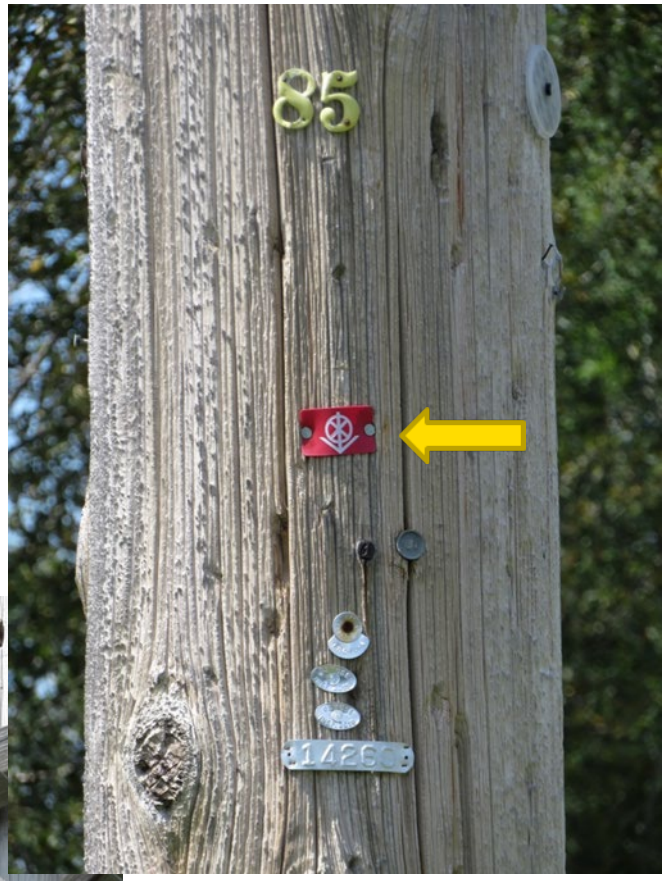
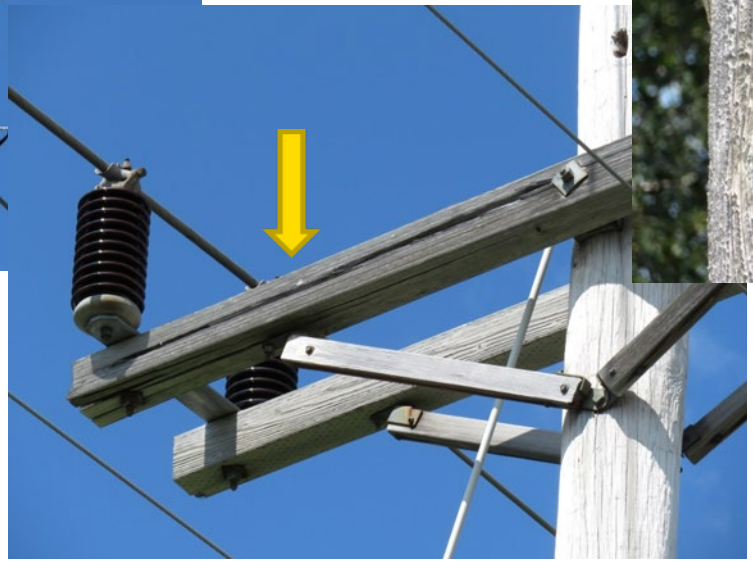
Line 6903 Rebuild (Caribou & Limestone)

Brown glass post type insulators, cracked crossarms and rejected pole due to internal decay





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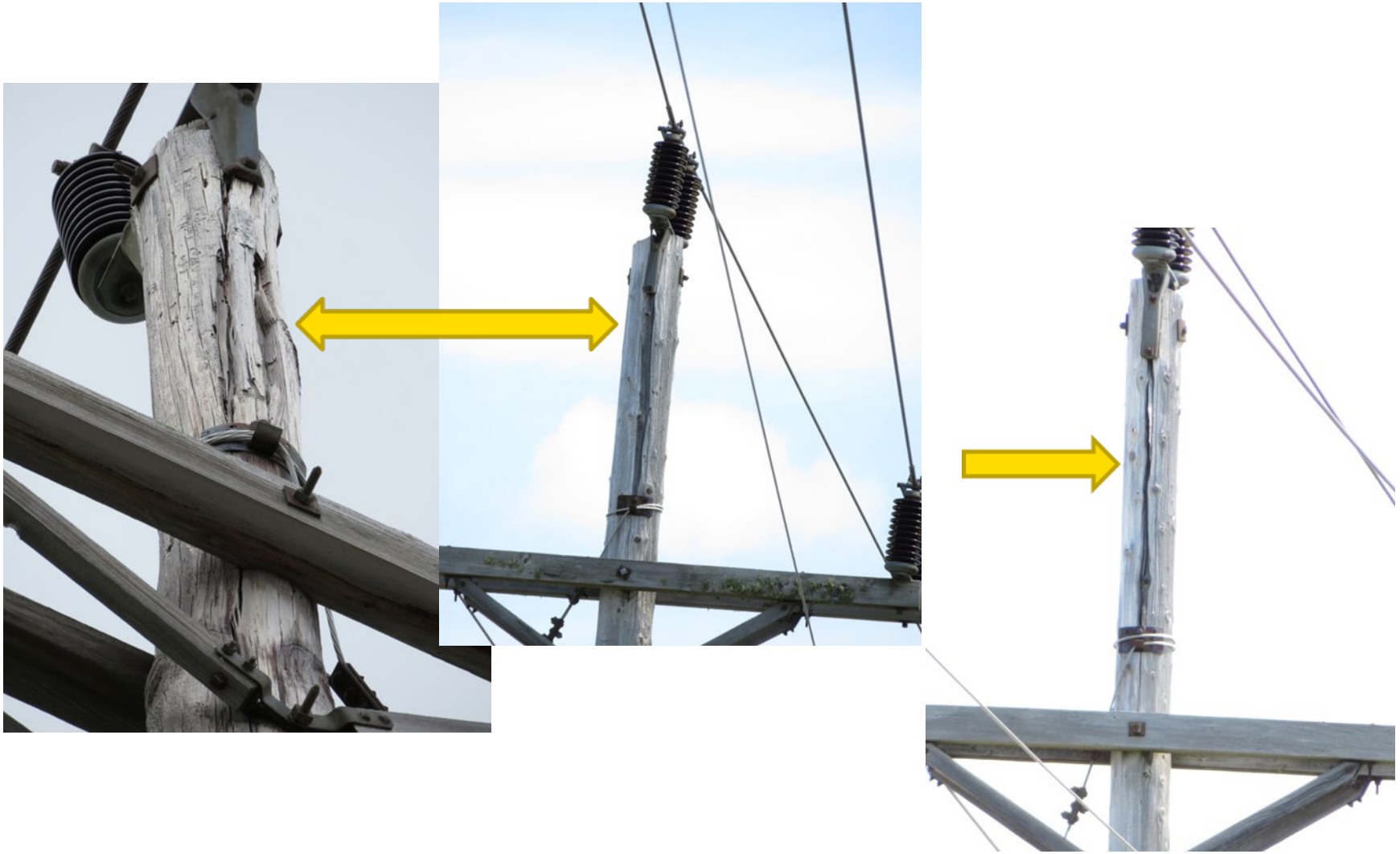
Line 6903 Rebuild continued…



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Line 6903 Post Section Rebuild

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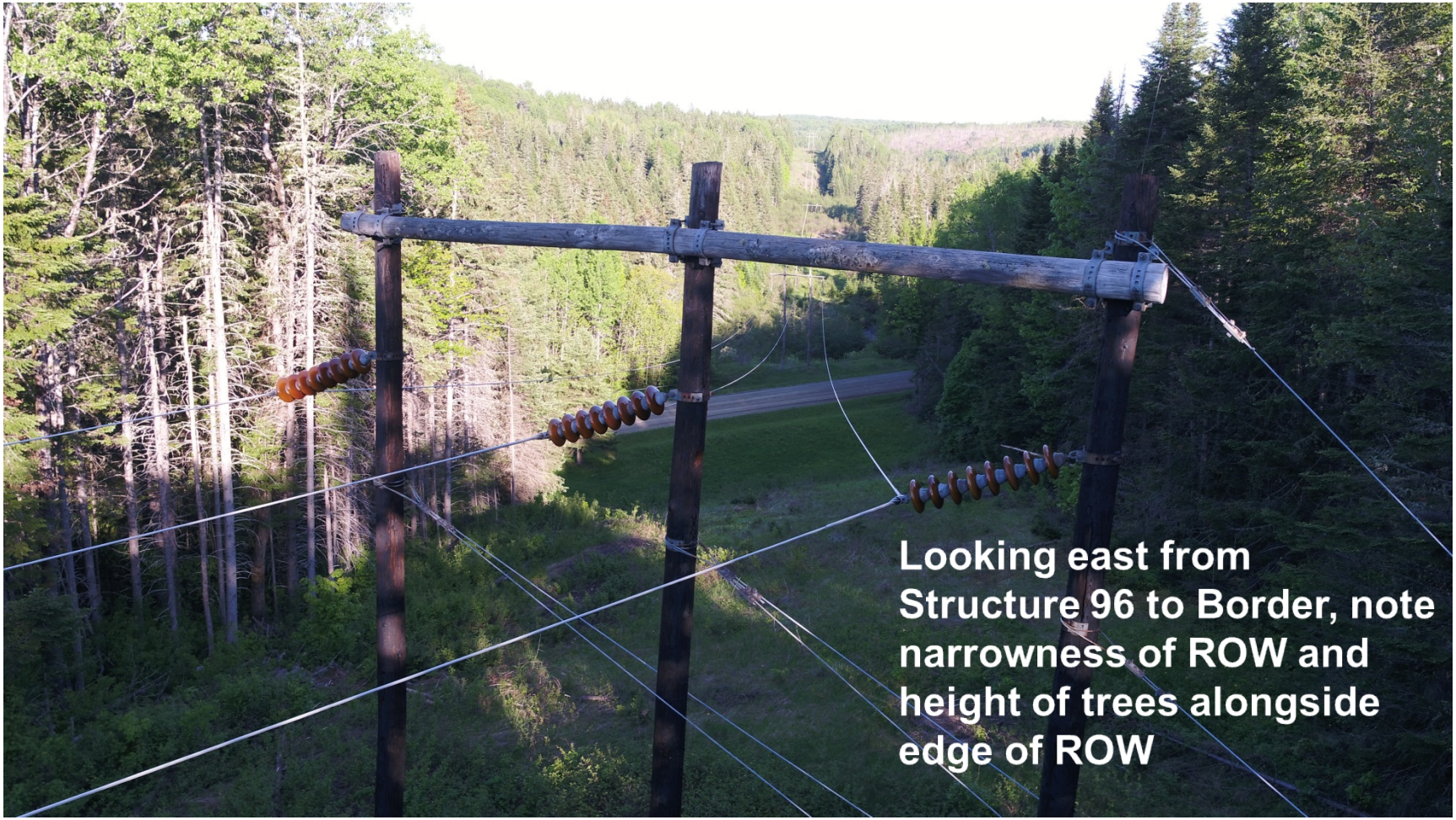
Line 1176 Rebuild Phase 1&2 - Previous



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Line 1176 Rebuild Phase 1&2 – New Line

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Line 1176 Rebuild Phase 1&2 – New Line

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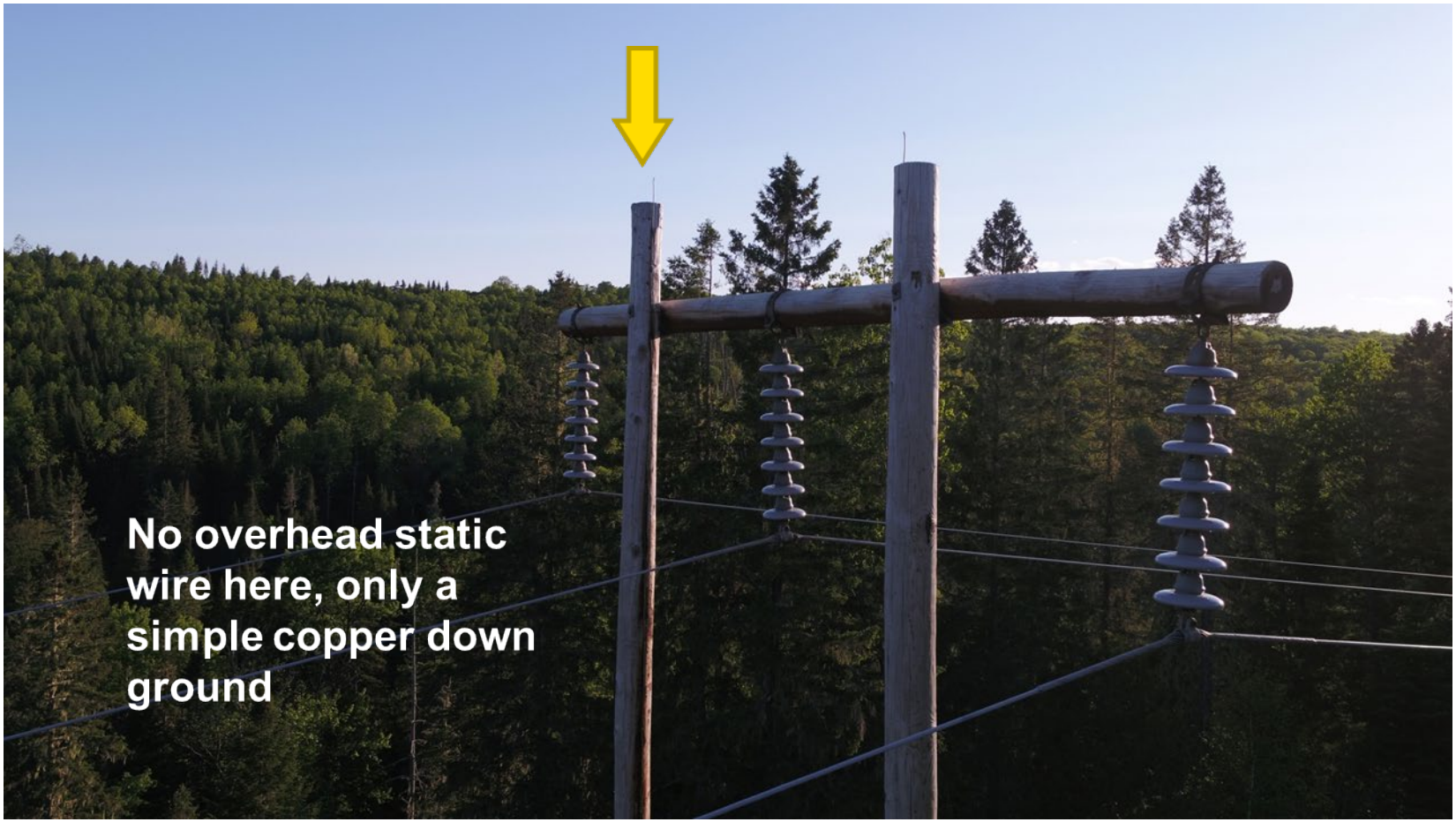
Line 1176 Lightning Protection - Previous



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Line 1176 Rebuild Phase 1&2 - Previous

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Line 1176 Rebuild Phase 1&2 – New Line

k of H-frame
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Line 1176 – Matting

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Emerging Issues

System Condition

- **Line 6905**
- **Line 6909**

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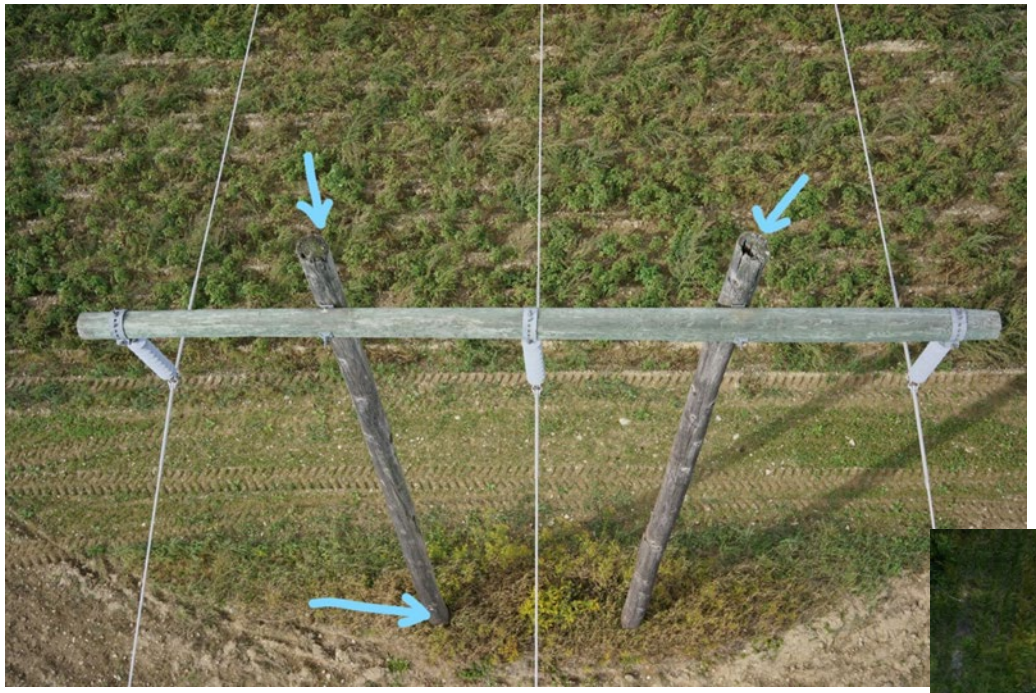
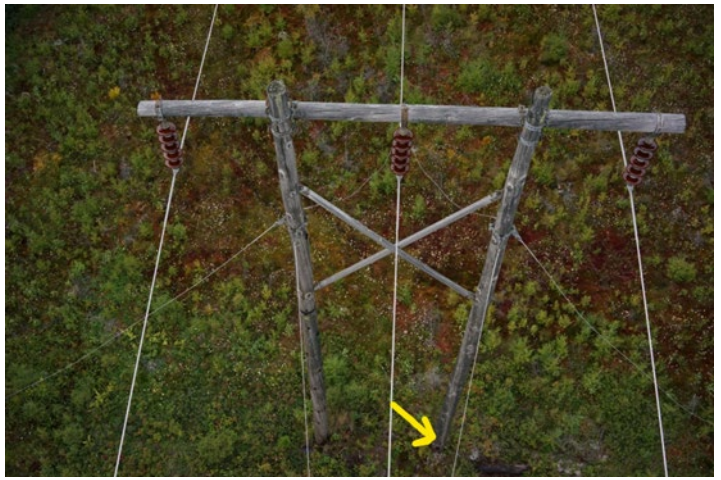
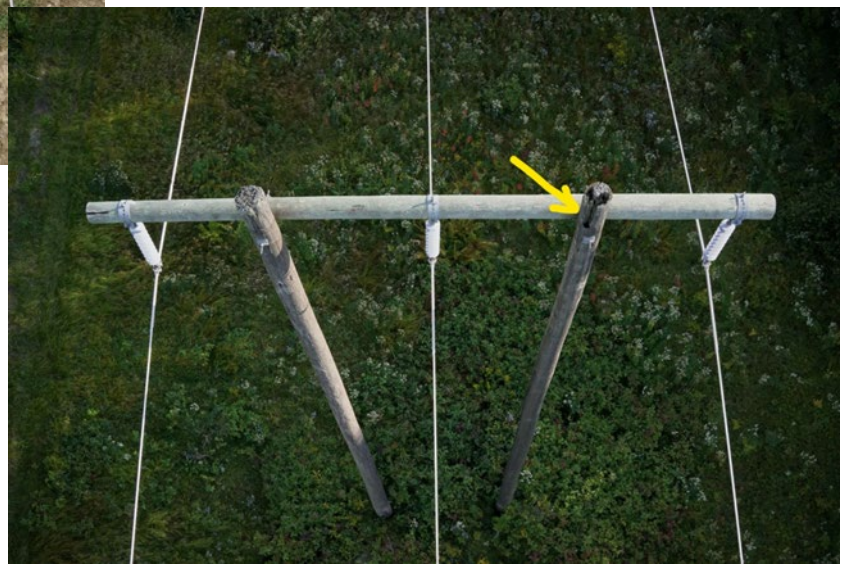
Line 6905 Emergency Pole Replacements







Excessive pole and crossarm rot detected by UAS (a.k.a. drone) inspection resulted in an emergency structure replacement project

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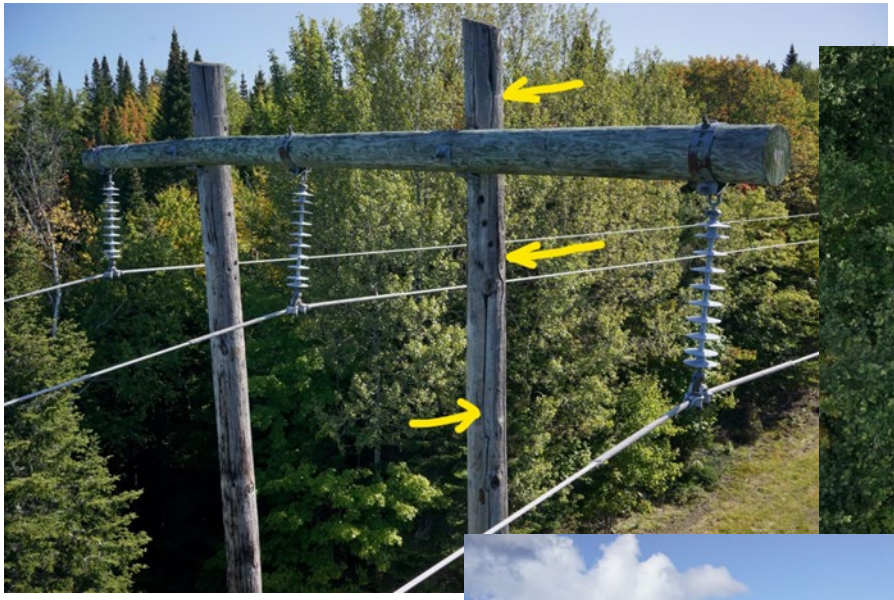
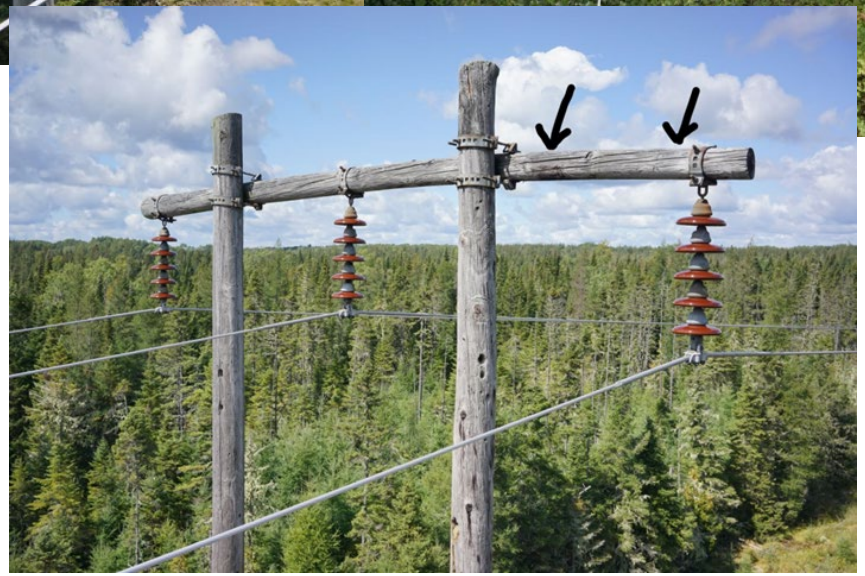
Line 6905 Condition continued…

Line 6905 Condition Continued…





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Line 6909 Condition

GIS Line no.	Str/Pole Number	City	Latitude	Longitude	Inspection Result	Original Circumference	Effective Circumference	Result Strength	Shell Decay Condition	Manufacture Year	Height	Class	Material	Species	Survey Date
6909	23	Fort Kent	47.24750160	-68.52800688	Reject	41.00	33.00	43.79	Decay Above and Below	1961	60	3	Wood	EC	10/6/19 8:59
6909	36	Fort Kent	47.24763900	-68.49986720	Reject	44.00	36.00	48.16	Good	1961	50	3	Wood	WRC	10/12/19 14:11
6909	36	Fort Kent	47.24766640	-68.49986740	Reject	46.00	38.00	50.22	Good	1961	50	3	Wood	WRC	10/12/19 14:13
6909	37	Fort Kent	47.24764150	-68.49724880	Reject	45.00	37.00	49.24	Good	1961	50	3	Wood	WRC	10/12/19 13:24
6909	37	Fort Kent	47.24766890	-68.49724910	Reject	46.00	38.00	50.22	Good	1961	50	3	Wood	WRC	10/12/19 13:25
6909	38	Fort Kent	47.24759943	-68.49454057	Reject	48.00	39.00	46.50	Good	1961	50	3	Wood	WRC	10/12/19 11:54
6909	38	Fort Kent	47.24761262	-68.49452969	Reject	45.00	37.00	49.24	Good	1961	50	3	Wood	WRC	10/12/19 11:57
6909	40	Fort Kent	47.24767014	-68.48922541	Reject	46.00	37.00	43.56	Good	1961	50	3	Wood	WRC	10/12/19 11:33
6909	40	Fort Kent	47.24768528	-68.48923371	Reject	46.00	37.00	43.56	Good	1961	50	3	Wood	WRC	10/12/19 11:35
6909	43	Fort Kent	47.24767720	-68.48101249	Reject	42.00	32.00	35.44	Decay Above and Below	1961	75	3	Wood	SP	10/4/19 8:44
6909	44	Fort Kent	47.24674628	-68.47904180	Priority Reject	44.00	30.00	21.82	Decay Above and Below	1961	70	3	Wood	SP	10/4/19 7:58
6909	44	Fort Kent	47.24674215	-68.47903285	Reject	42.00	36.00	57.08	Decay Below	1961	70	2	Wood	SP	10/4/19 8:05
6909	48	Fort Kent	47.24683845	-68.46992030	Reject	50.00	42.00	53.47	Decay Below	1961	60	2	Wood	WRC	10/8/19 14:58
6909	48	Fort Kent	47.24683339	-68.46988138	Reject	45.00	38.00	54.44	Decay Below	1961	60	2	Wood	WRC	10/8/19 14:59
6909	51	Fort Kent	47.24719084	-68.46094037	Reject	47.00	40.00	55.84	Good	1961	55	2	Wood	WRC	10/4/19 13:50
6909	51	Fort Kent	47.24719691	-68.46092313	Reject	50.00	42.00	53.47	Good	1961	50	2	Wood	WRC	10/4/19 13:52
6909	52	Fort Kent	47.24749978	-68.45798810	Reject	54.00	45.00	51.96	Decay Above and Below	1961	65	2	Wood	WRC	10/8/19 14:10
6909	62	Frenchville	47.24776510	-68.43361367	Reject	44.00	35.00	39.66	Decay Above and Below	1961	50	2	Wood	WRC	10/9/19 9:06
6909	64	Frenchville	47.24887179	-68.42966723	Priority Reject	39.00	28.00	28.71	Decay Above	1975	55	3	Wood	SP	10/9/19 9:47
6909	68	Frenchville	47.25292354	-68.42196795	Reject	42.00	34.00	45.54	Decay Below	1961	55	2	Wood	WRC	10/10/19 13:06
6909	68	Frenchville	47.25290593	-68.42191799	Reject	50.00	42.00	53.47	Decay Below	1961	55	2	Wood	WRC	10/10/19 13:08
6909	115	Frenchville	47.30913964	-68.35633058	Priority Reject	51.00	38.00	33.12	Decay Above	1961	70	2	Wood	WRC	10/14/19 13:59
6909	115	Frenchville	47.30912540	-68.35613160	Reject	50.00	40.00	40.20	Decay Below	1961	70	3	Wood	WRC	11/8/19 12:39
6909	120	Frenchville	47.31809242	-68.35609031	Visual Reject	0.00	0.00	0.00	Decay Above	1961	60	3	Wood	WRC	10/14/19 14:22
6909	120	Frenchville	47.31816896	-68.35625571	Reject	50.00	40.00	40.20	Decay Below	1961	60	3	Wood	WRC	10/14/19 14:24
6909	121	Frenchville	47.32008627	-68.35620533	Reject	50.00	42.00	53.47	Good	1961	55	3	Wood	WRC	10/15/19 8:49
6909	121	Frenchville	47.32007892	-68.35625120	Reject	50.00	42.00	53.47	Good	2002	55	3	Wood	WRC	10/15/19 8:52
6909	123	Frenchville	47.32259281	-68.35626510	Reject	41.00	35.00	56.37	Decay Below	1961	60	3	Wood	WRC	9/30/19 14:55
6909	128	Madawaska	47.32802920	-68.34543470	Reject	48.00	35.00	16.28	Decay Below	1961	65	2	Wood	WRC	9/30/19 12:57
6909	145	Madawaska	47.33637861	-68.31794832	Reject	45.00	36.00	40.20	Good	1961	60	2	Wood	SP	10/18/19 14:02
6909	148	Madawaska	47.34014742	-68.31494033	Reject	50.00	38.00	35.19	Decay Above	1961	60	2	Wood	WRC	10/16/19 9:59

Line 6909 built in 1961, comprised of 160 wood pole structures.

13% rejected in 2019 due to insufficient shell thickness, this quantity will continue to climb as this line ages

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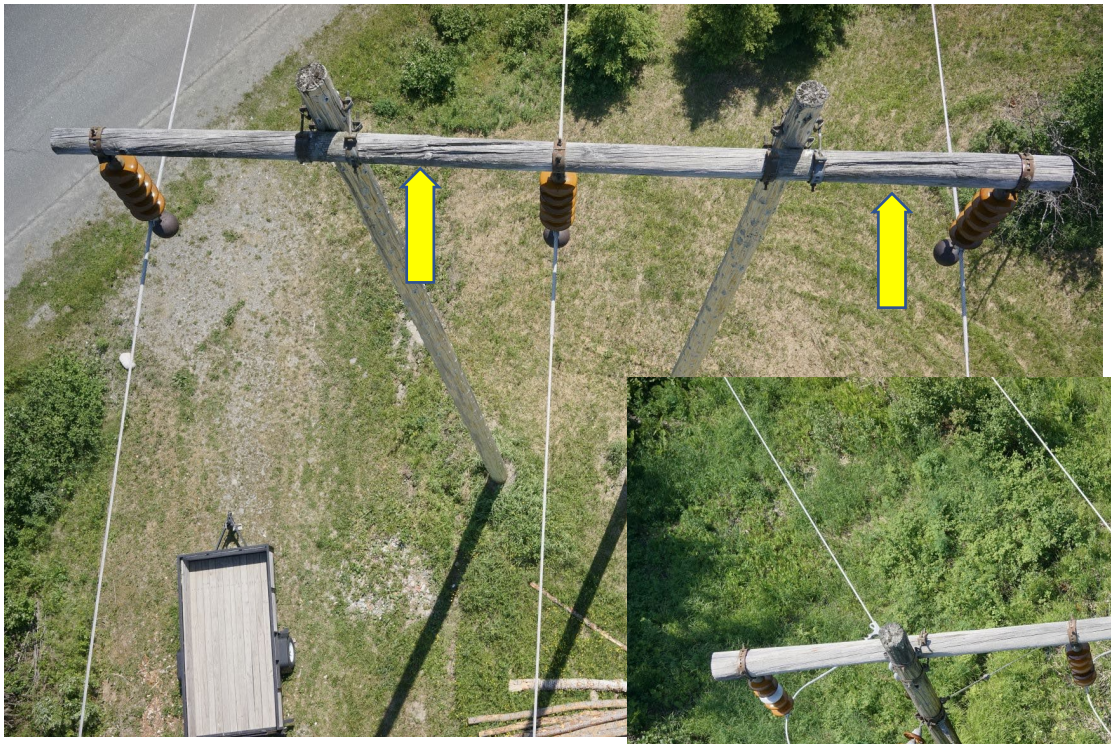
Line 6909 Condition Continued…



Rotting wood pole crossarms and pole tops

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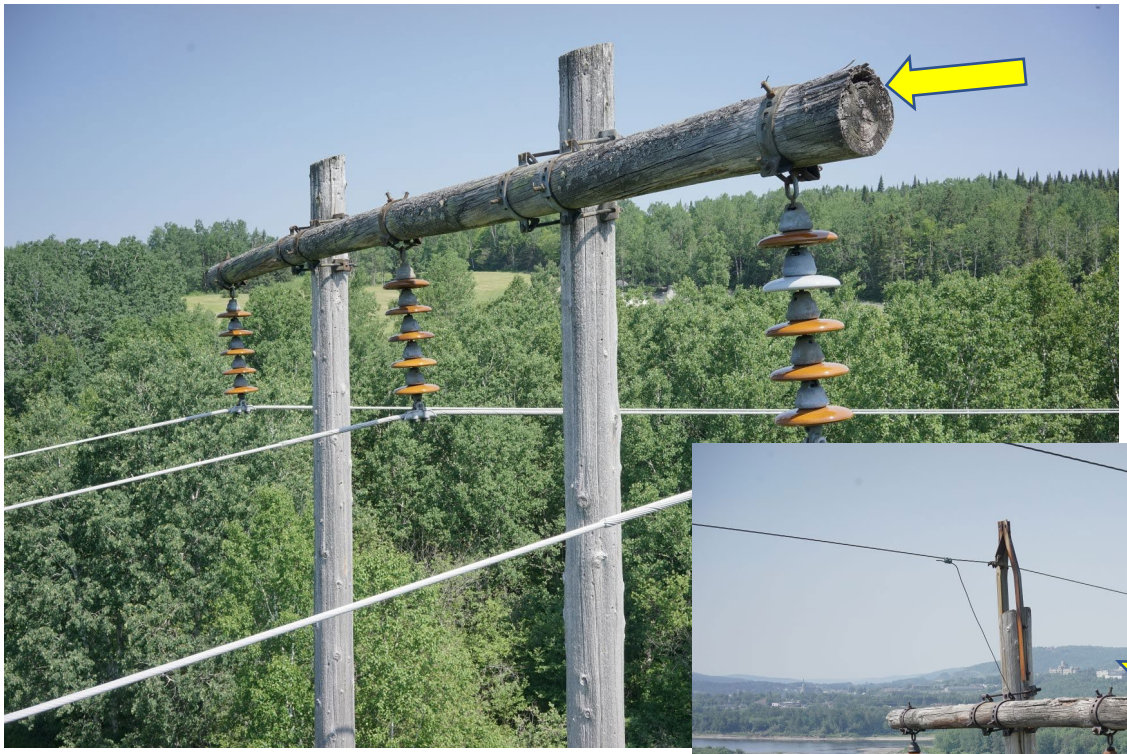
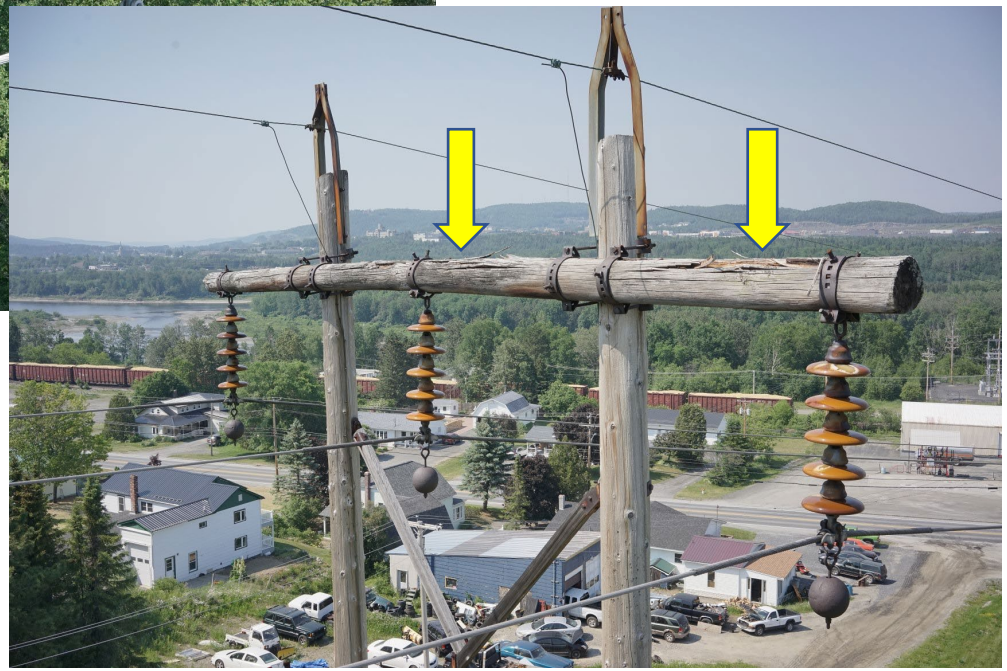
Line 6909 Condition Continued…





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Enhanced Inspection Methods

Visual inspections performed by drone technology are providing engineers with a new and different view of asset condition

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Example of a Closeup Drone Inspection Photo

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Enhanced Inspection Methods continued…Wood Pole Strength Assessment using Resistograph

Using a long thin needle the electric power consumption of the resistograph drilling device is measured and recorded. The resistance data gathered provides a high linear correlation between the measured values and the density of the penetrated wood.

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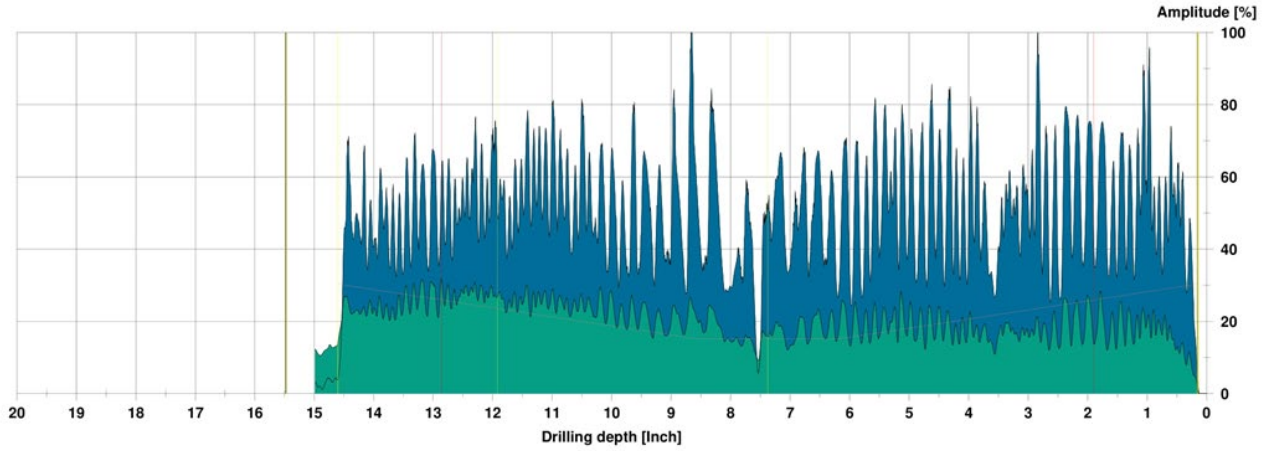
Resistograph Plot - Wood Pole in good condition

Measuring / object data

Measurement no.	: 47	Speed	: 3000 r/min	Diameter	: 13,25 in
ID number	: 20694	Needle state	: ---	Level	:
Drilling depth	: 14,99 in	Tilt	: -30°	Direction	:
Date	: 01/15/2019	Offset	: 56 / 289	Species	:
Time	: 11:33:03	Avg. curve	: off / off	Location	:
Feed	: 10 in/min			Name	:

WoodInspector

Program	: Pole - EMERA 1.00	Sum decay	:	0,0% |	0,0% |	0,0%
Pole type	:	Heart rot	:	0,0% |	0,0% |	0,0%
Measurement	: Below soil level	Shell rot	:	No |	No	
Defect pattern	: No decay	Remaining wall	:	50,0% |	50,0% |	50,0%
Result (auto)	: PASS	Strength	:	100,0% |	100,0% |	100,0%



Assessment

Comment

20694M047 (PASS).rgp

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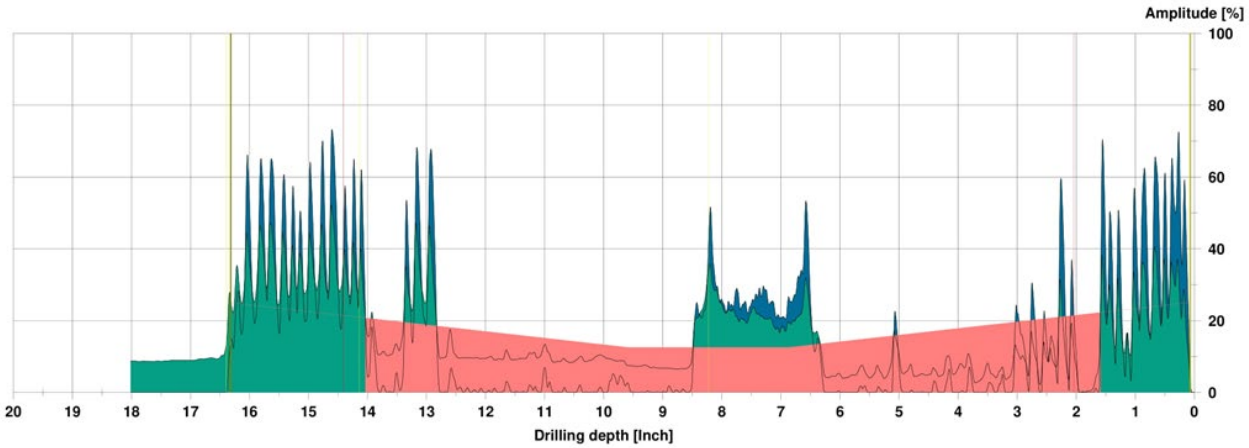
Rejected Wood Pole – Heart Rot

Measuring / object data

Measurement no.	: 13	Speed	: 3000 r/min	Diameter	: 16,25 in
ID number	: 20781	Needle state	: ---	Level	:
Drilling depth	: 18,01 in	Tilt	: -1°	Direction	:
Date	: 10/23/2018	Offset	: 93 / 388	Species	:
Time	: 09:24:24	Avg. curve	: off / off	Location	:
Feed	: 40 in/min			Name	:

WoodInspector

Program	: Pole - EMERA 1.00	Sum decay	: 40,7% | 35,6% | 76,3%
Pole type	:	Heart rot	: 40,7% | 35,6% | 76,3%
Measurement	: Auto diameter	Shell rot	: No | No
Defect pattern	: Heart rot	Remaining wall	: 9,3% | 14,4% | 11,8%
Result (auto)	: REJECT	Strength	: 56,1% | 74,3% | 65,2%



Assessment

Comment

20781M013 (REJECT).rgp

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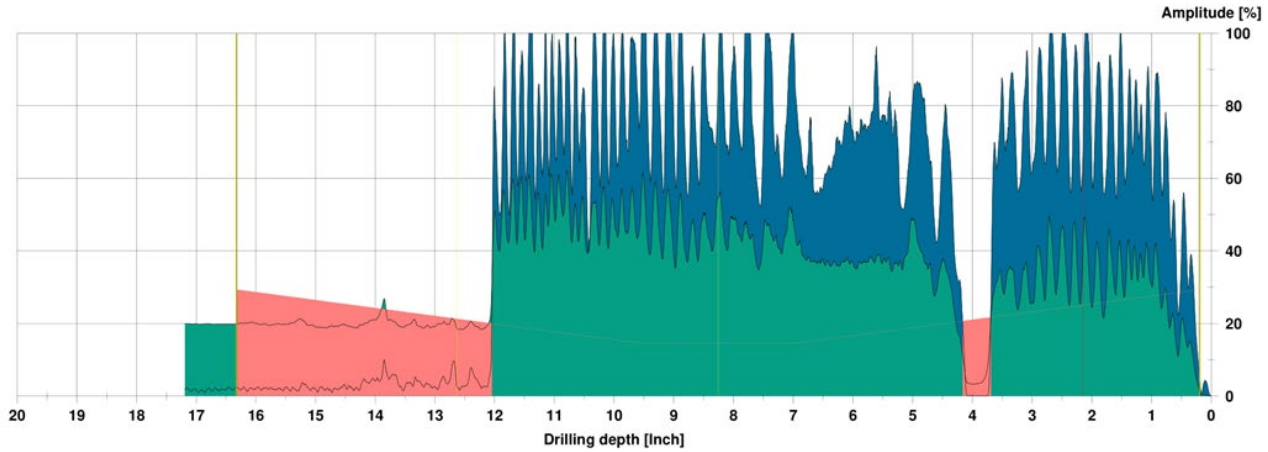
Rejected Wood Pole – Heart Rot & Shell Rot

Measuring / object data

Measurement no.	: 46	Speed	: 3000 r/min	Diameter	: 14,00 in
ID number	: 20705	Needle state	: ---	Level	:
Drilling depth	: 17,19 in	Tilt	: -30°	Direction	:
Date	: 01/17/2019	Offset	: 111 / 415	Species	:
Time	: 10:57:14	Avg. curve	: off / off	Location	:
Feed	: 40 in/min			Name	:

WoodInspector

Program	: Pole - EMERA 1.00	Sum decay	: 2,9% | 0,0% | 2,9%
Pole type	:	Heart rot	: 2,9% | 0,0% | 2,9%
Measurement	: Below soil level	Shell rot	: No | Yes
Defect pattern	: Heart+shell rot	Remaining wall	: 21,7% | ---
Result (auto)	: REJECT	Strength	: 89,7% | ---



Assessment

Comment

20705M046 (REJECT).rgp

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2021 Project Work Summary

- Line 1176 – Easton (Rebuild Structure 42 - Border)
- Line 6930 – Caribou (Dow Rd to Maysville - Rebuild approx. 3 miles)
- Line 1176 - Easton & Presque Isle (Rebuild Structure 41 to Str. 3 - Construction Start)

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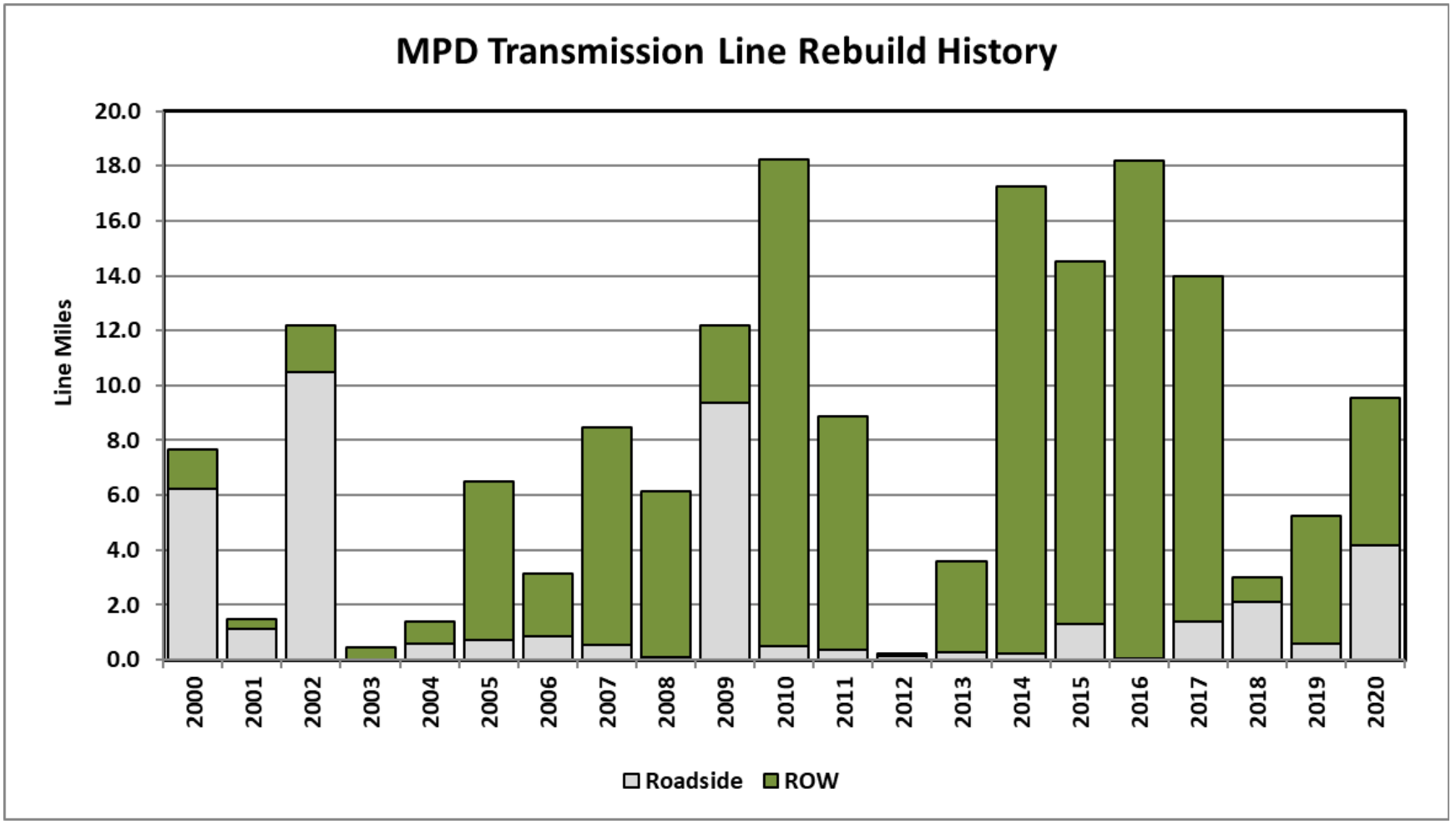
20-Year MPS Transmission Line Rebuild History



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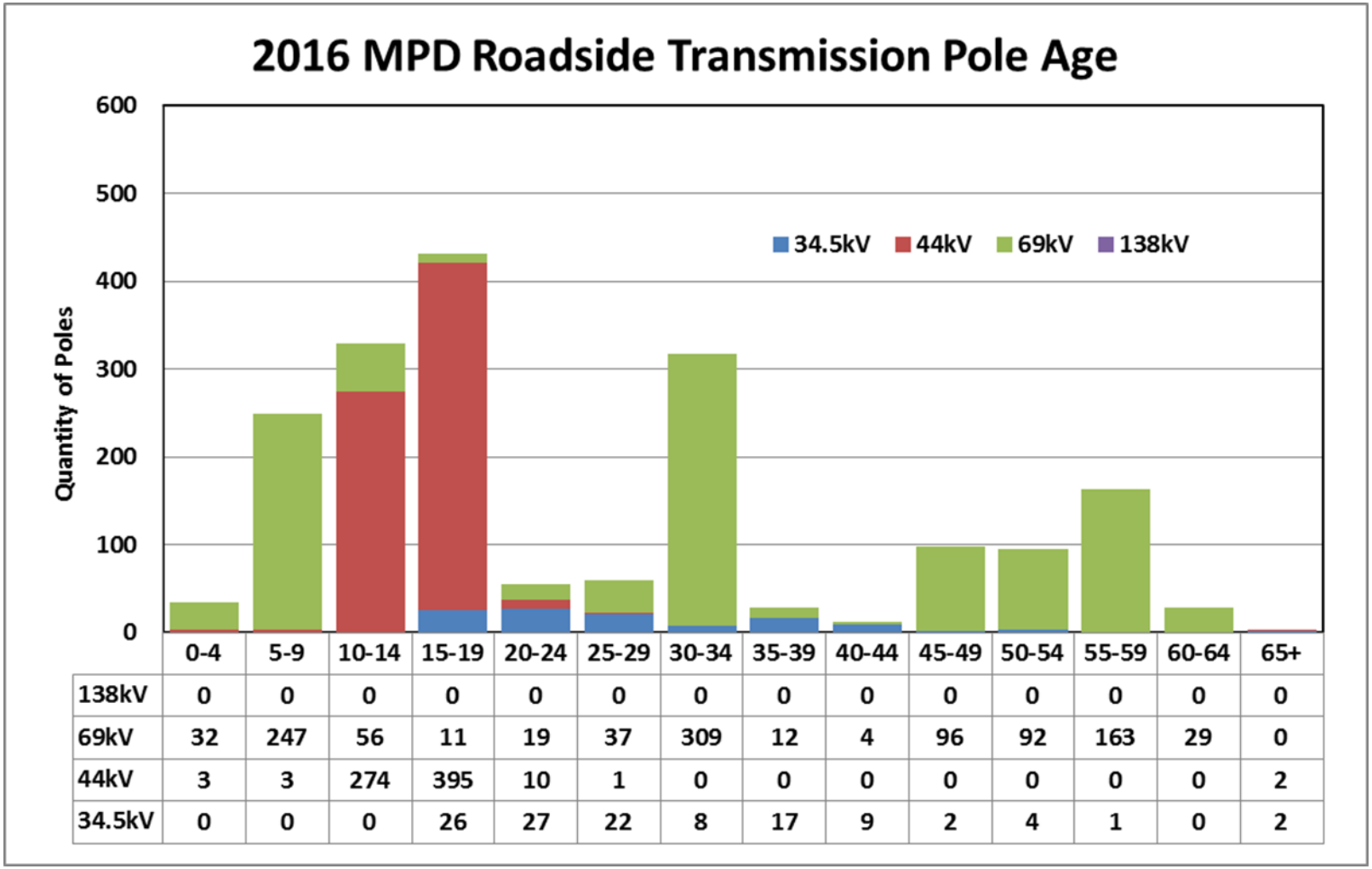
MPD Roadside Transmission Line Pole Age - 2016



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69kV	32	247	56	11	19	37	309	12	4	96	92	163	29	0
44kV	3	3	274	395	10	1	0	0	0	0	0	0	0	2
34.5kV	0	0	0	26	27	22	8	17	9	2	4	1	0	2

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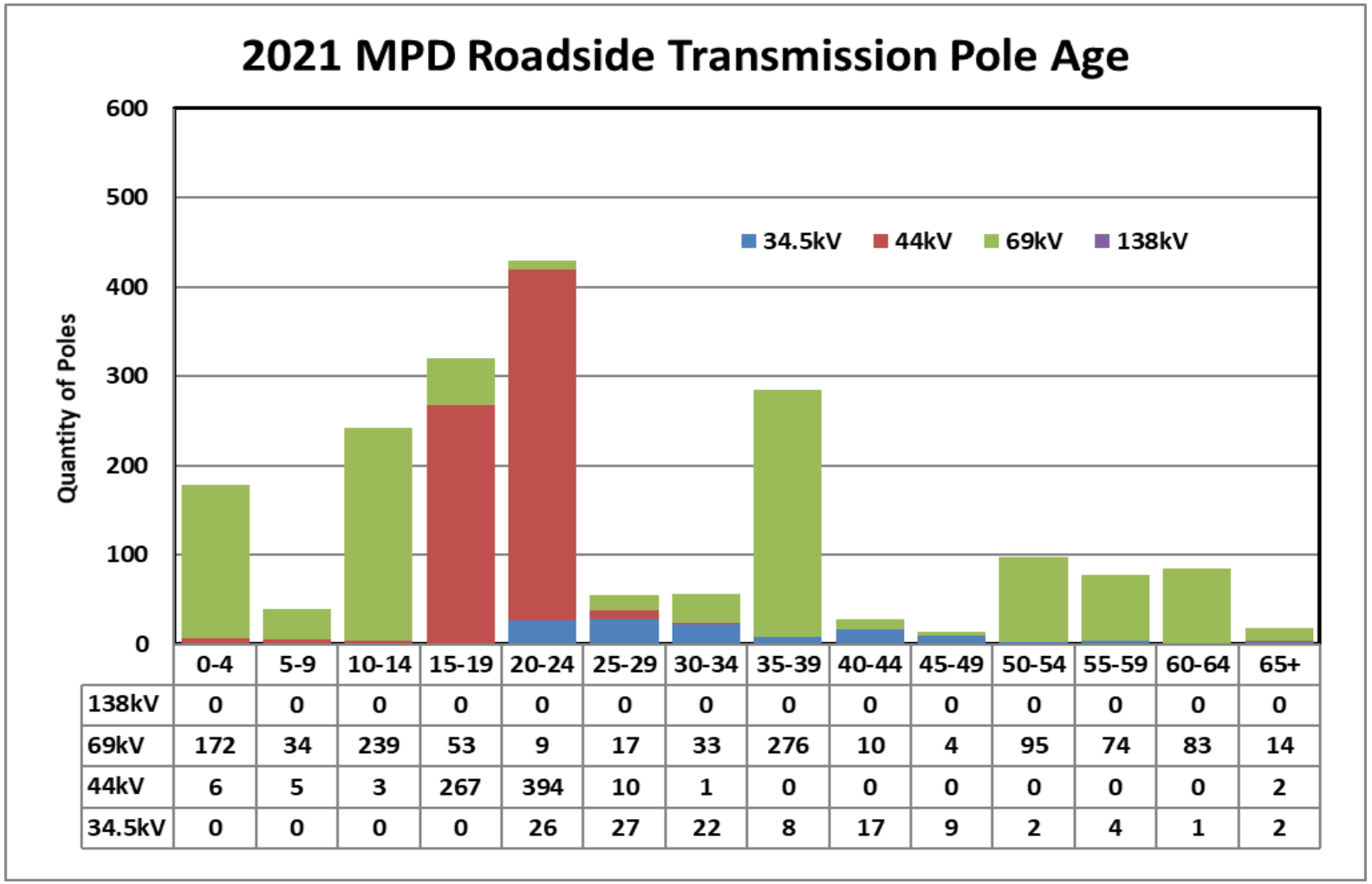
MPD Roadside Transmission Line Pole Age – 2021



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69kV	172	34	239	53	9	17	33	276	10	4	95	74	83	14
44kV	6	5	3	267	394	10	1	0	0	0	0	0	0	2
34.5kV	0	0	0	0	26	27	22	8	17	9	2	4	1	2

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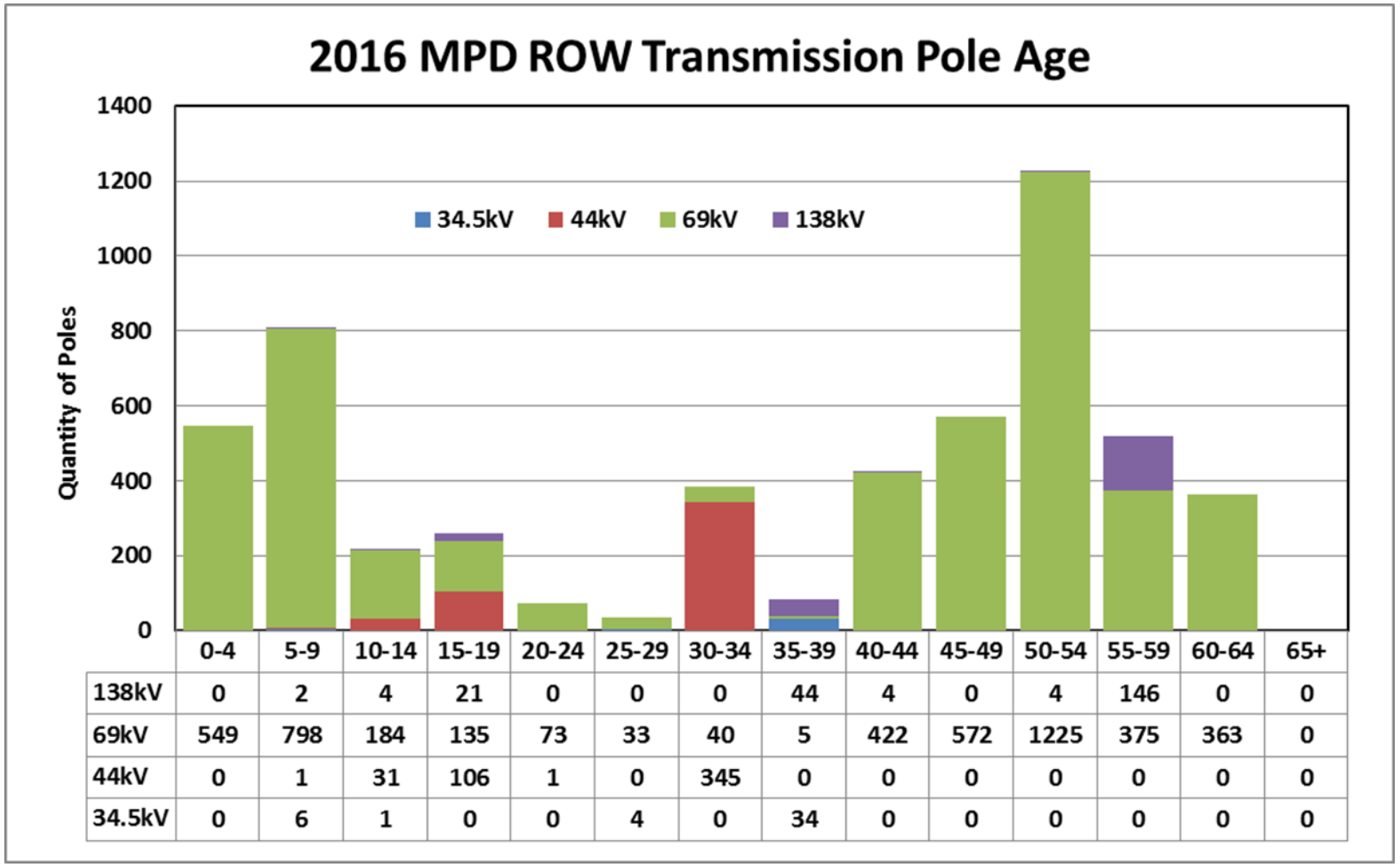
MPD ROW Transmission Line Pole Age - 2016



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	0	2	4	21	0	0	0	44	4	0	4	146	0	0
69kV	549	798	184	135	73	33	40	5	422	572	1225	375	363	0
44kV	0	1	31	106	1	0	345	0	0	0	0	0	0	0
34.5kV	0	6	1	0	0	4	0	34	0	0	0	0	0	0

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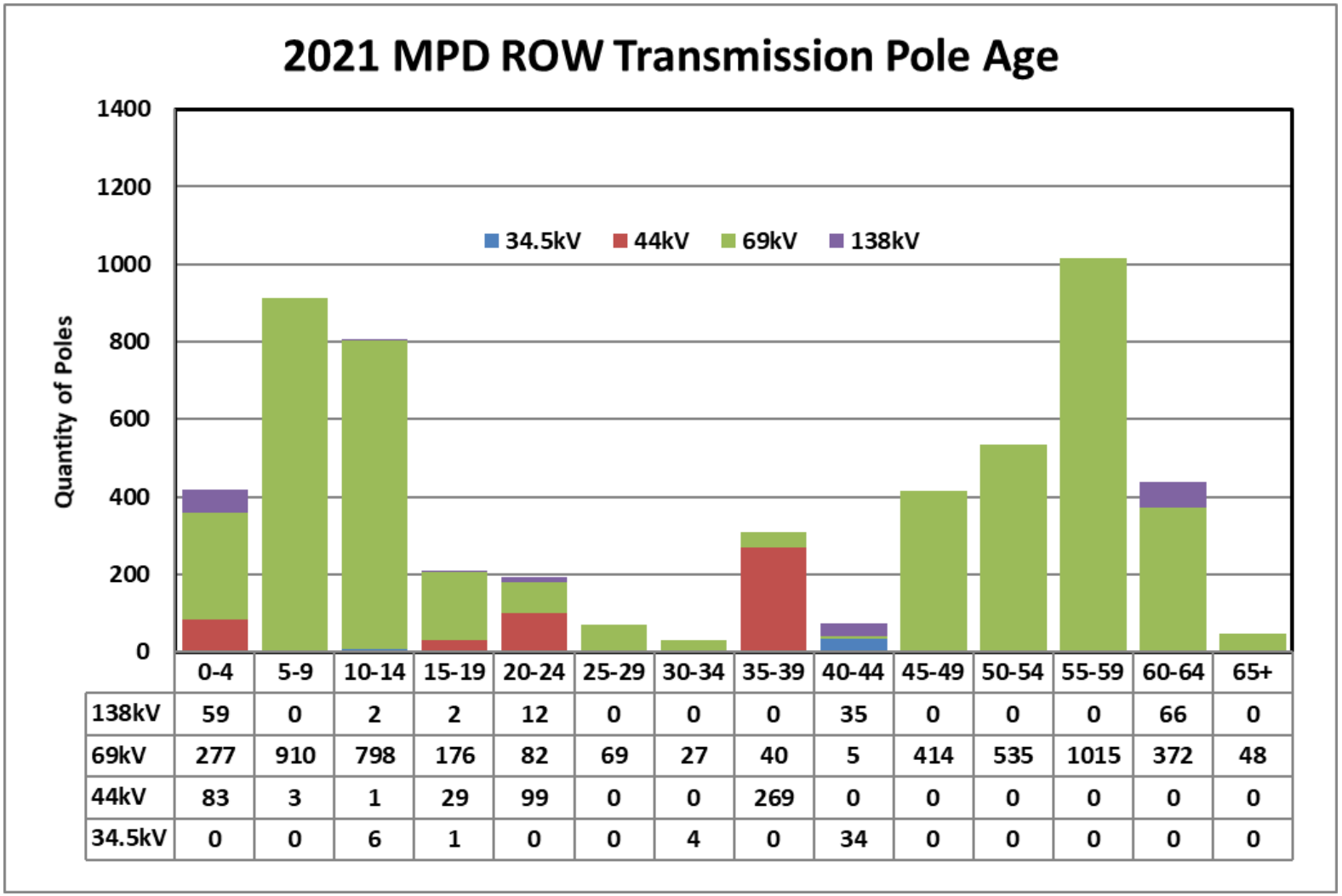
MPD ROW Transmission Line Pole Age - 2021



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
138kV	59	0	2	2	12	0	0	0	35	0	0	0	66	0
69kV	277	910	798	176	82	69	27	40	5	414	535	1015	372	48
44kV	83	3	1	29	99	0	0	269	0	0	0	0	0	0
34.5kV	0	0	6	1	0	0	4	0	34	0	0	0	0	0

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MPD Solar Generation Interconnections

- Dist. (State) projects:
  - 36 Level 4 – 114.5 MW's total
  - 3 Level 2 – 0.5 MW's total
- Transmission (FERC) projects:
  - 2 – 25 MW's total
- Projects/circuits are studied to ensure system protection and reliability for adjacent customers is maintained

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MPD Transmission Studies

- Two Transmission studies initiated
  - Interface study by NBP
    - How will these generators impact interface connections?
  - Versant is conducting a Transmission study of the MPD system at the direction of, and in concert with, NMISA
    - Will these projects and the grid “play well together”?
- Both will be conducted at high generation, low load conditions

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Path to 100% Renewable

- Solar generation (nameplate): 122 MW
- Peak Load: approximately 95 MW
- This represents a solar generation to peak load of 128%: compare to…
  - California: 61%
  - Hawaii: 86%
- Voltage controls and Reactive power support (options are DVARs and Storage) will be necessary at both the circuit and transmission levels

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Complexity Will Increase

- DER's add system complexity – forecasting generation
- Power Quality controls (inverter based generation)
- Outage restoration methods with DER's
- Grid controls on a partly cloudy day

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