Power System Engineering, Inc.

Northern Neck Electric Cooperative
Your Touchstone Energy® Cooperative

NRECA TechAdvantage

Confronting the Age of an Aging Electric Utility Infrastructure

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www.powersystem.org

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Northern Neck Electric Cooperative
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Aging Infrastructure Overview

Asset Management

Equipment Maintenance

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Aging Infrastructure Overview

Asset Management

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2013 REPORT CARD FOR AMERICA'S INFRASTRUCTURE ASCE

Investments have increased since 2005, however:

- Permitting Issues
- Weather Events
- Investment Gap
- Limited Maintenance
- Increasing Number of Failures
- Increase in Power Interruptions

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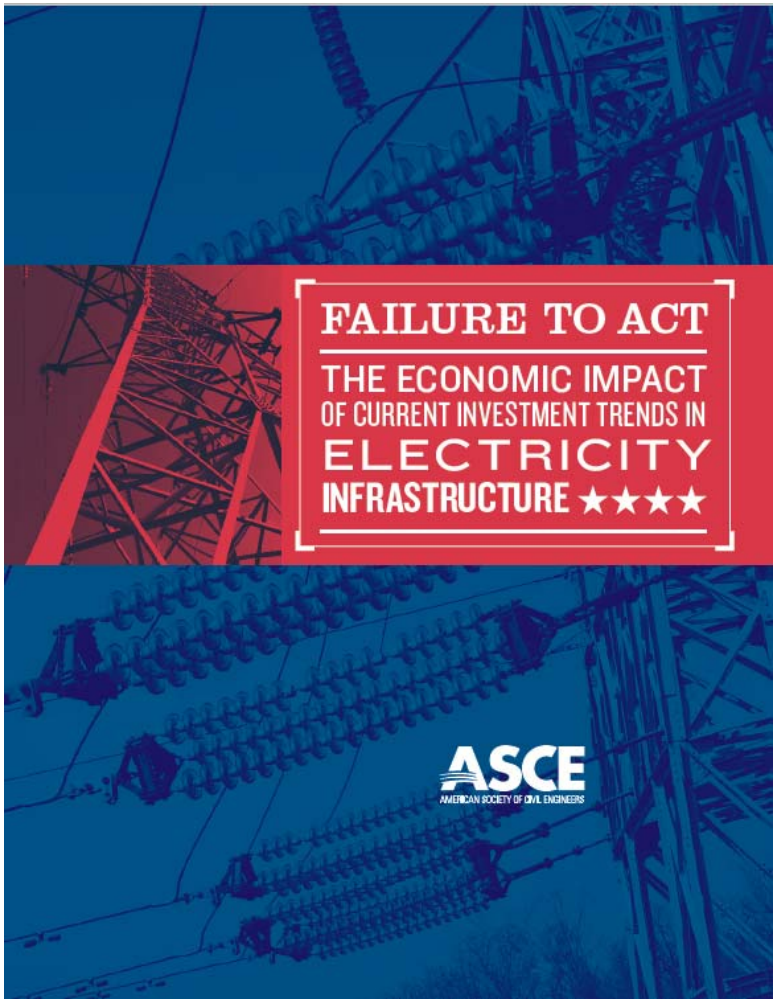

TRANSMISSION & DISTRIBUTION WORLD

Investment Gap by Region in 2020

Region	Transmission Gap Estimate	Distribution Gap Estimate
Florida	$1.8 billion	$2.4 billion
Mid-Atlantic	$6.4 billion	$11.8 billion
Midwest	$1.4 billion	$3 billion
Northeast	$1.6 billion	$6.4 billion
Southeast	$10.9 billion	$18.8 billion
Southwest	0	$2.4 billion
Texas	0	$2.3 billion
West	$15.2 billion	$10.3 billion
Total	$37.3 billion	$57.4 billion

Source: ASCE, "Failure to Act: The Economic Impact of Current Investment Trends in Electricity Infrastructure," 2012.

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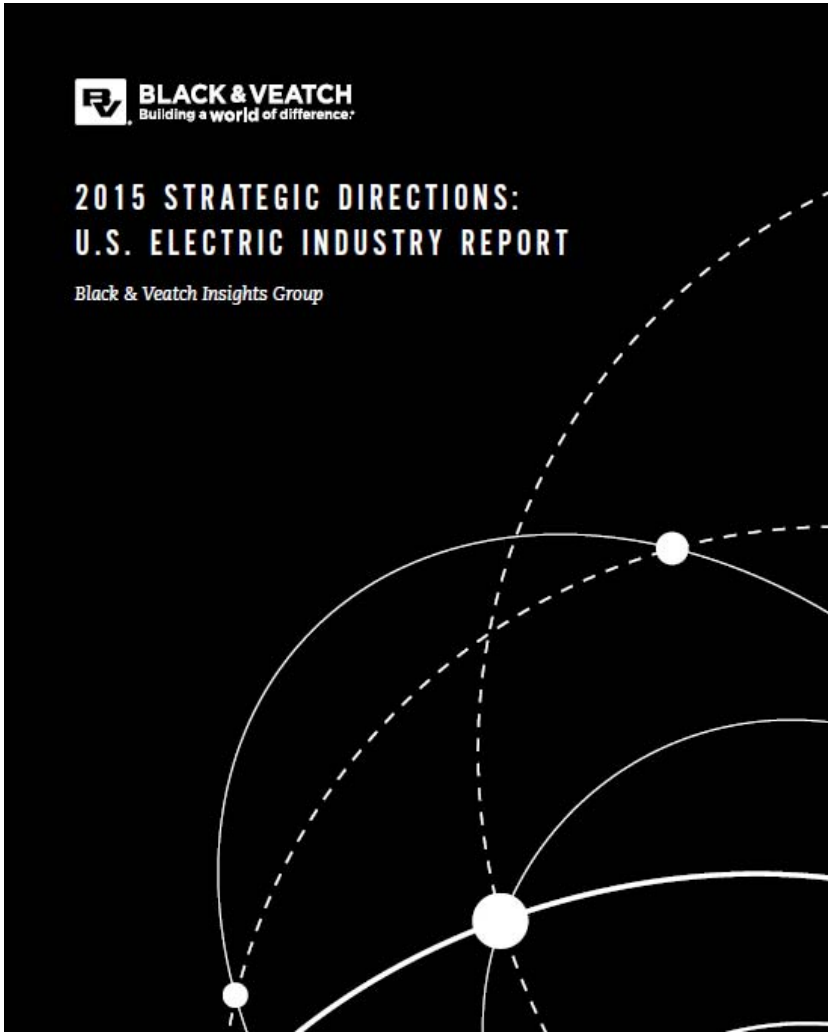

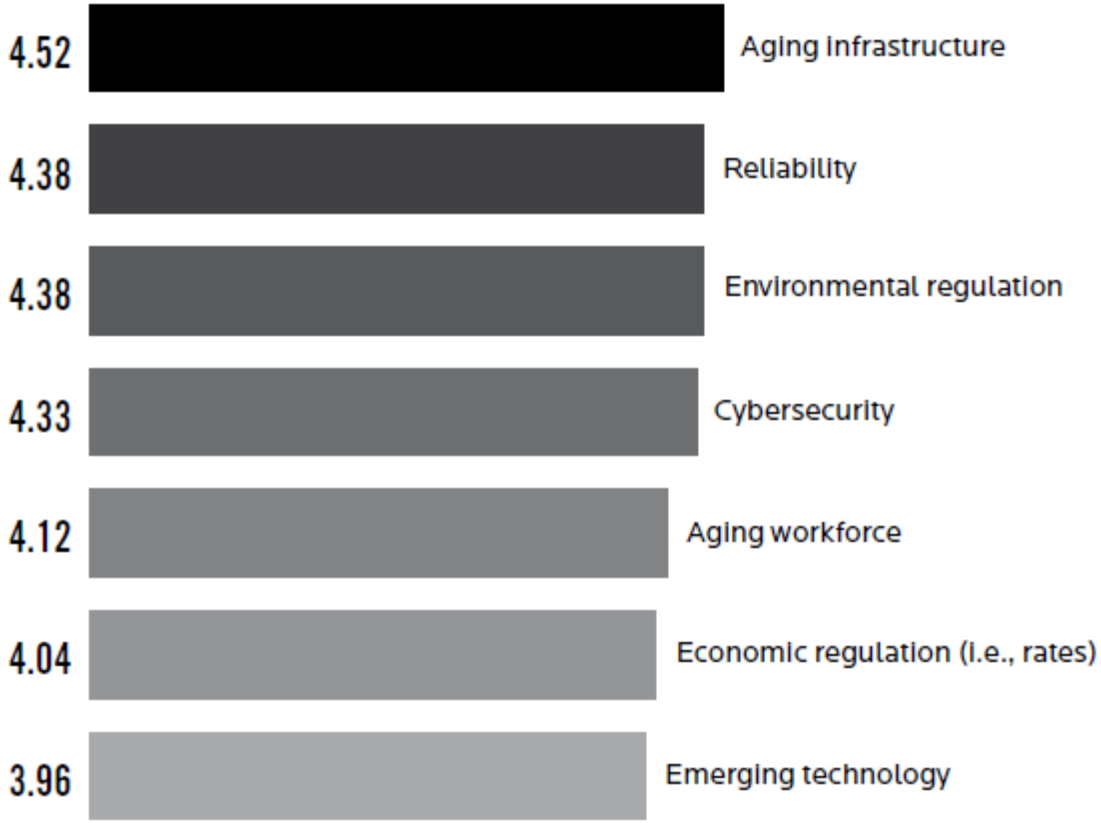

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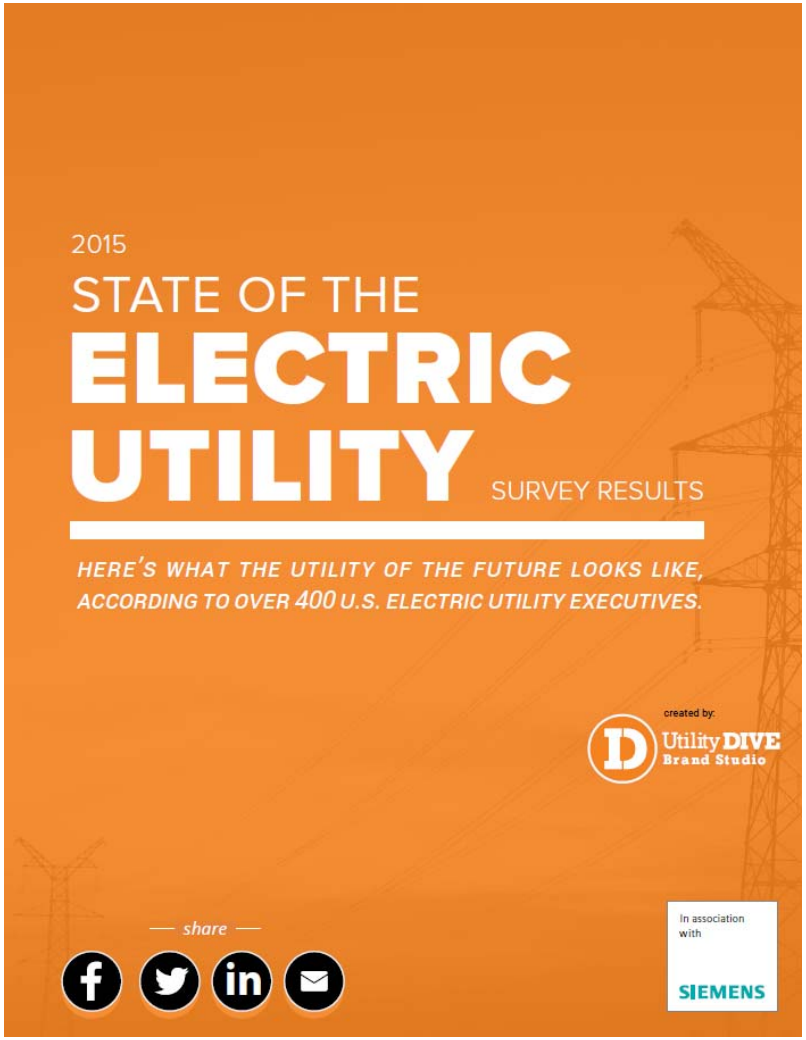

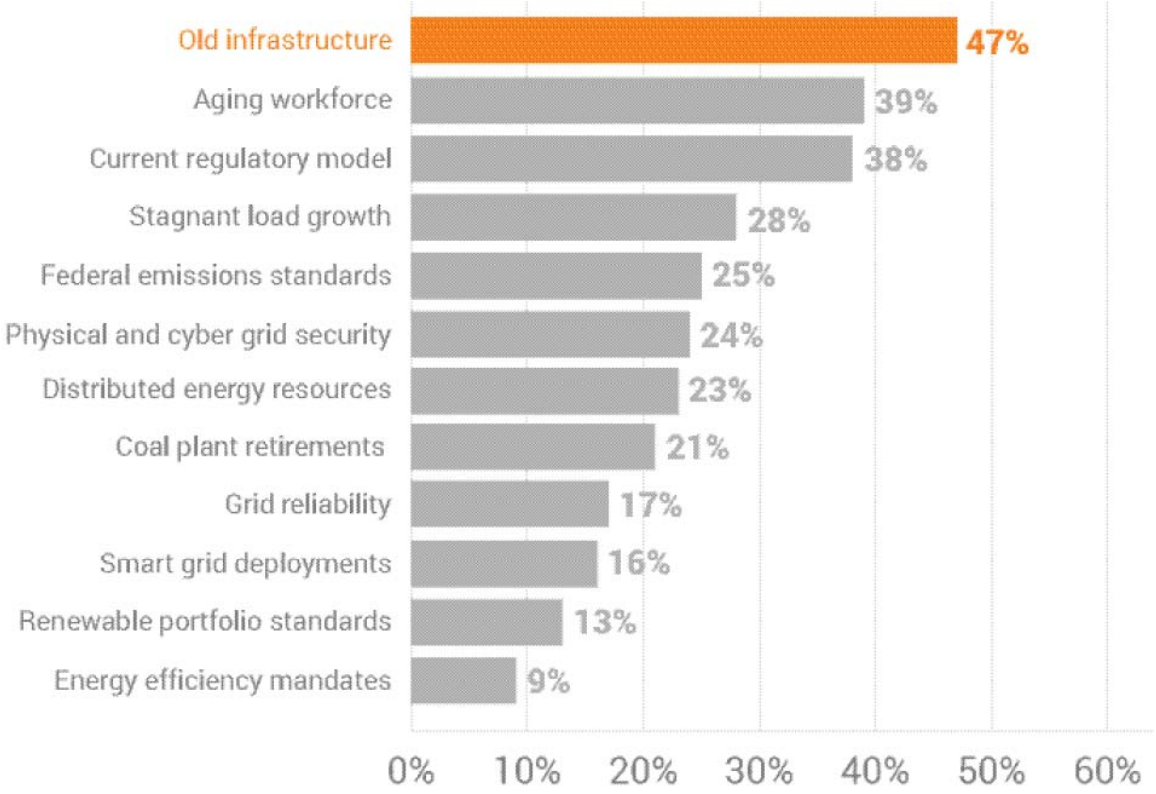

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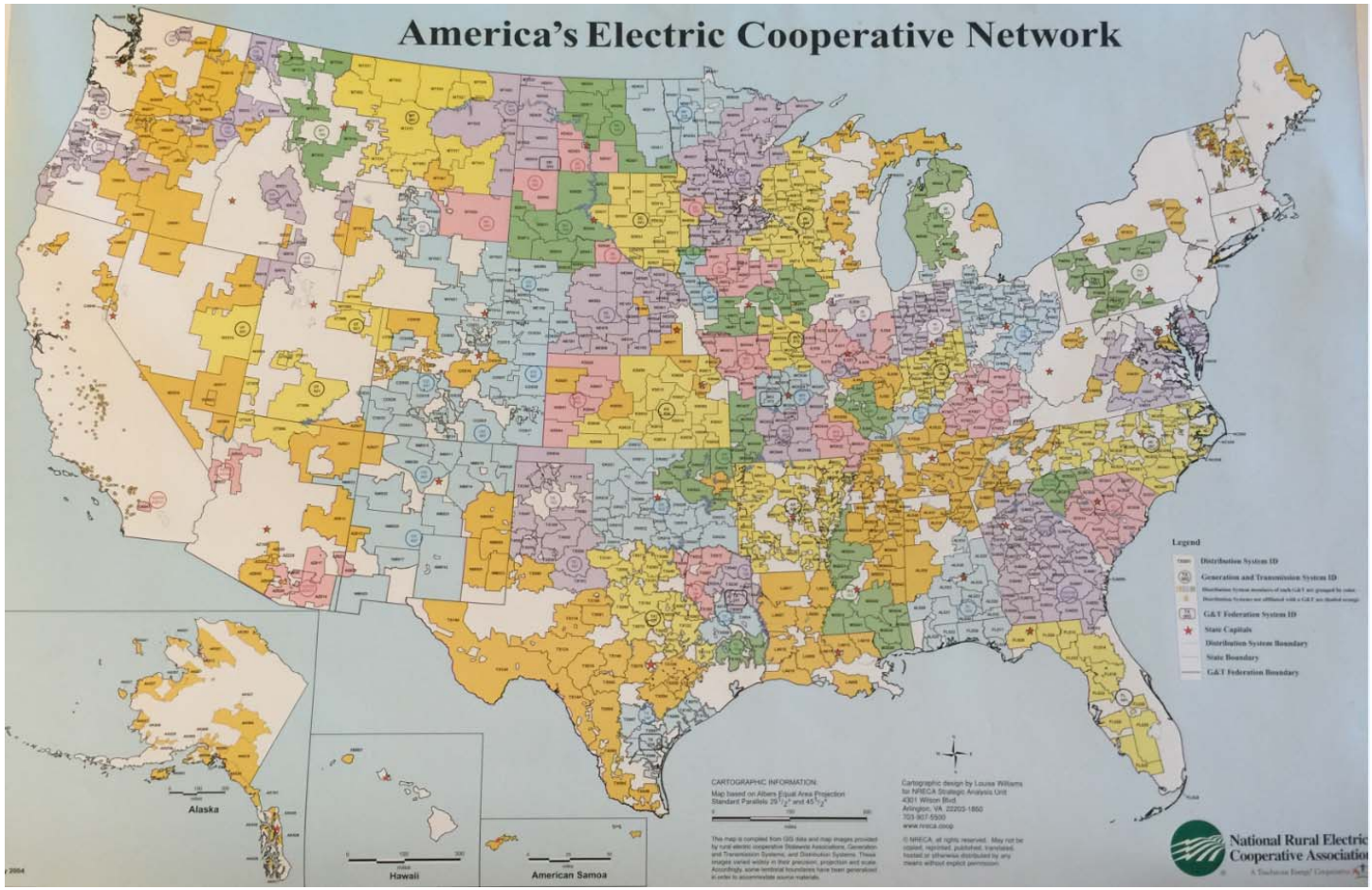

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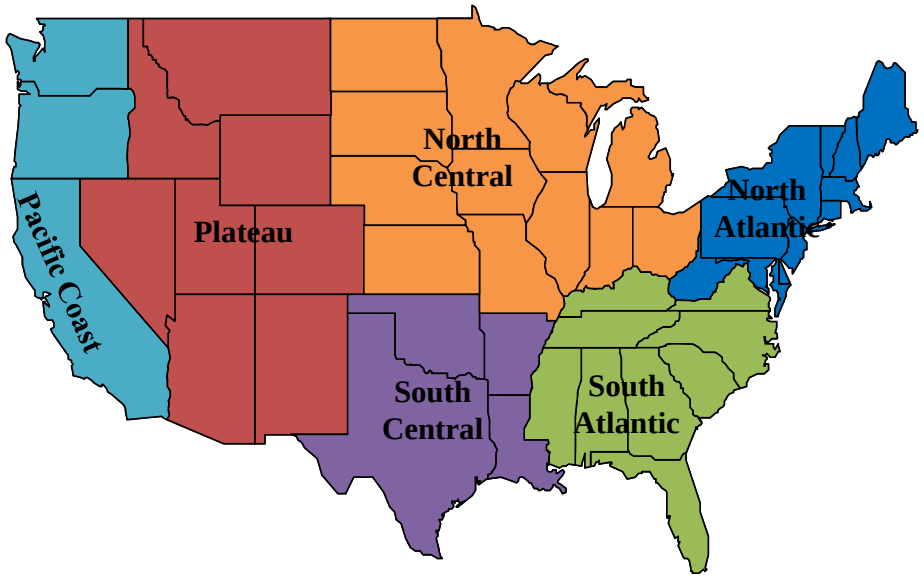
SNLFinancial

- SNL Financial – News and financial information clearing house.
- Collects information through various mechanisms including the Freedom of Information Act.
- Form 7 data available for distribution cooperatives.
- Form 7 data available through 2011.

Handy-Whitman Index

- Cost trends for utility construction.
- Published for the electric, gas and water industries.



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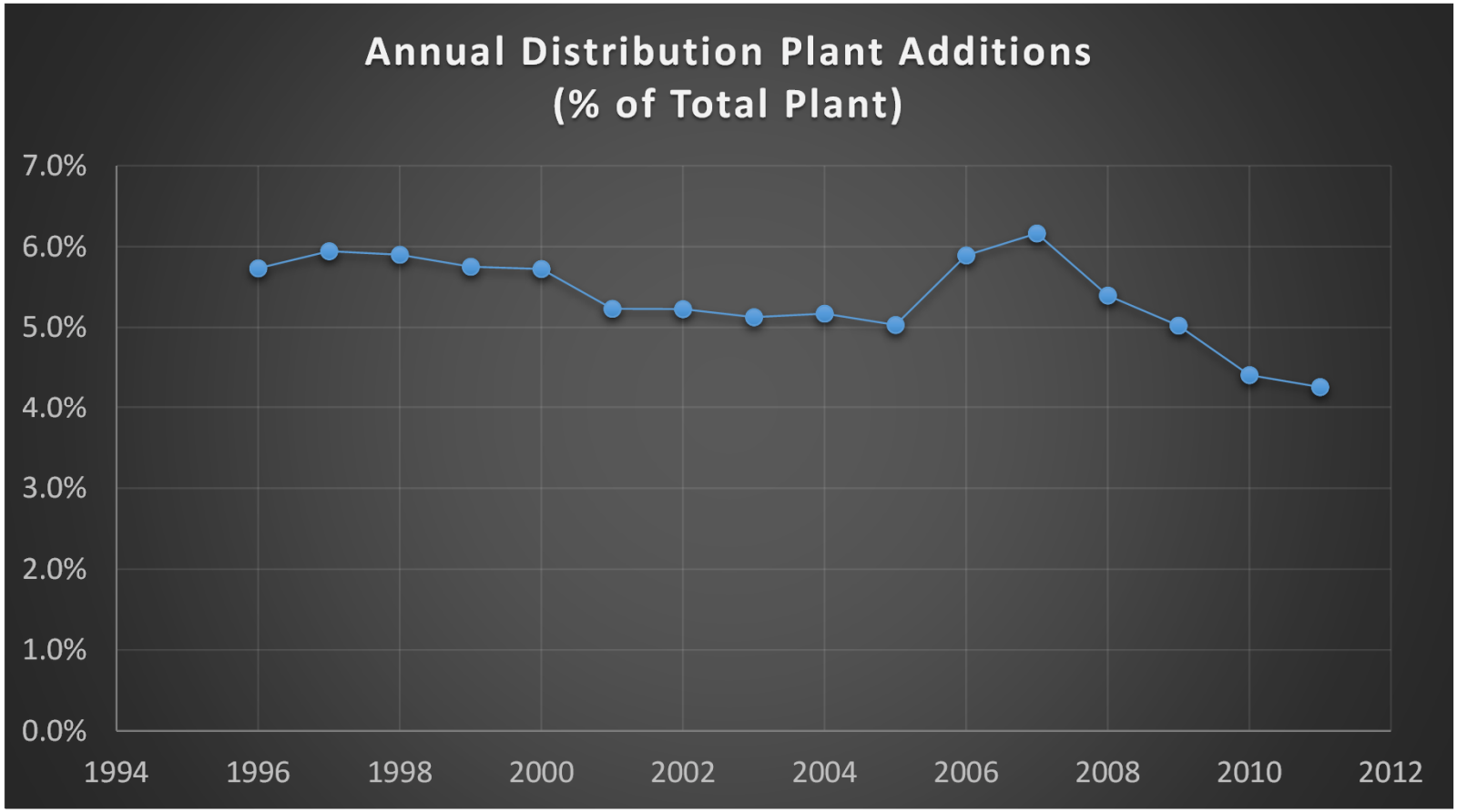

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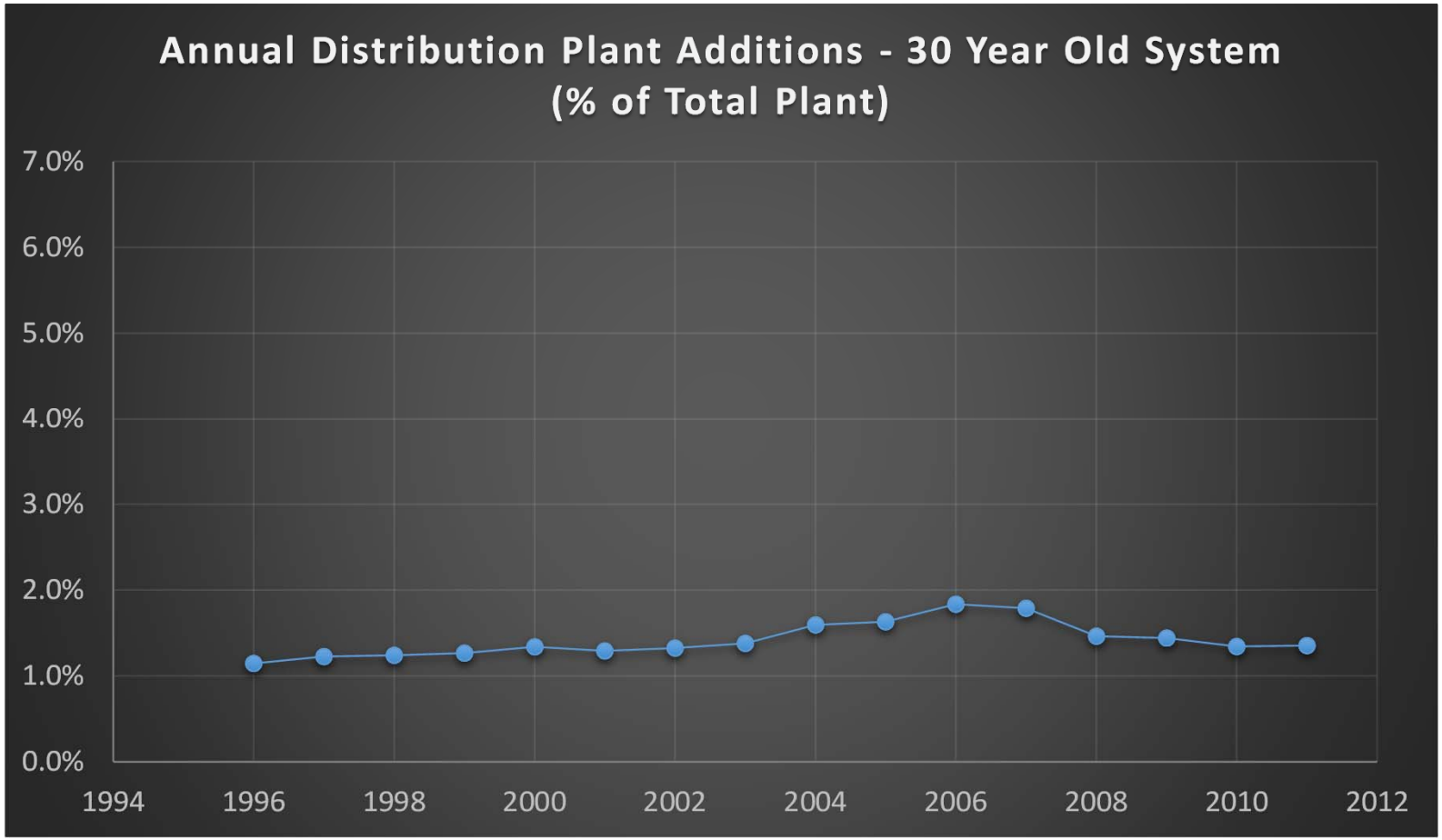

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- What is the average age of your Cooperative's distribution system?
- Where are older lines and equipment located?
- To what degree do these older assets exist?
- What condition are they in?
- What do you operate, maintain, or replace? And When?
- What is your near-term and long-term plan?

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"The numbers underscore the value of, and need for, aggressive asset management programs, in which utilities actively assess the age and condition of their equipment, evaluate the risks of repair or replacement, and plan for replacements and upgrades long before system shocks occur."

- Black & Veatch Insight Group

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Aging Infrastructure Overview

Asset Management

Equipment Maintenance

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Asset Management Presentation Outline

- Objective
- Components
- Distribution System Challenges
- Process
- Considerations
- Data Management
- Monitoring and Reporting
- Summary

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Asset Management Model

Objective: Enhance Performance to Deliver Increased Value

Performance = **Controlling Operations** + **Managing Decisions**

- Optimize Life Cycle Asset Value
  - Transparency and Predictability
  - Defined Program and Basis
  - Defined Process and Procedures
  - Monitoring/Reporting/Control
  - Framework for Decisions
  - Documentation
  - Program Performance Assurance

- Limited Resources
  - Personnel
  - Time
  - Financial
- Reliable System Operation
  - Optimize Performance Measures
  - Minimize Time to Restore
  - Strengthen System

- Management
  - Planning Decisions
  - Equipment Decisions
  - Exposure/Risk Tradeoffs
  - Rate/Service Tradeoffs

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Asset Management Path

1. Define Philosophy
2. Identify Objectives
3. Map Processes
4. Develop Tradeoffs and Benchmarks
5. Build/Integrate Guides and Procedures
6. Implement Programs
7. Collect and Monitor Key Data
8. Report and Act on Outliers

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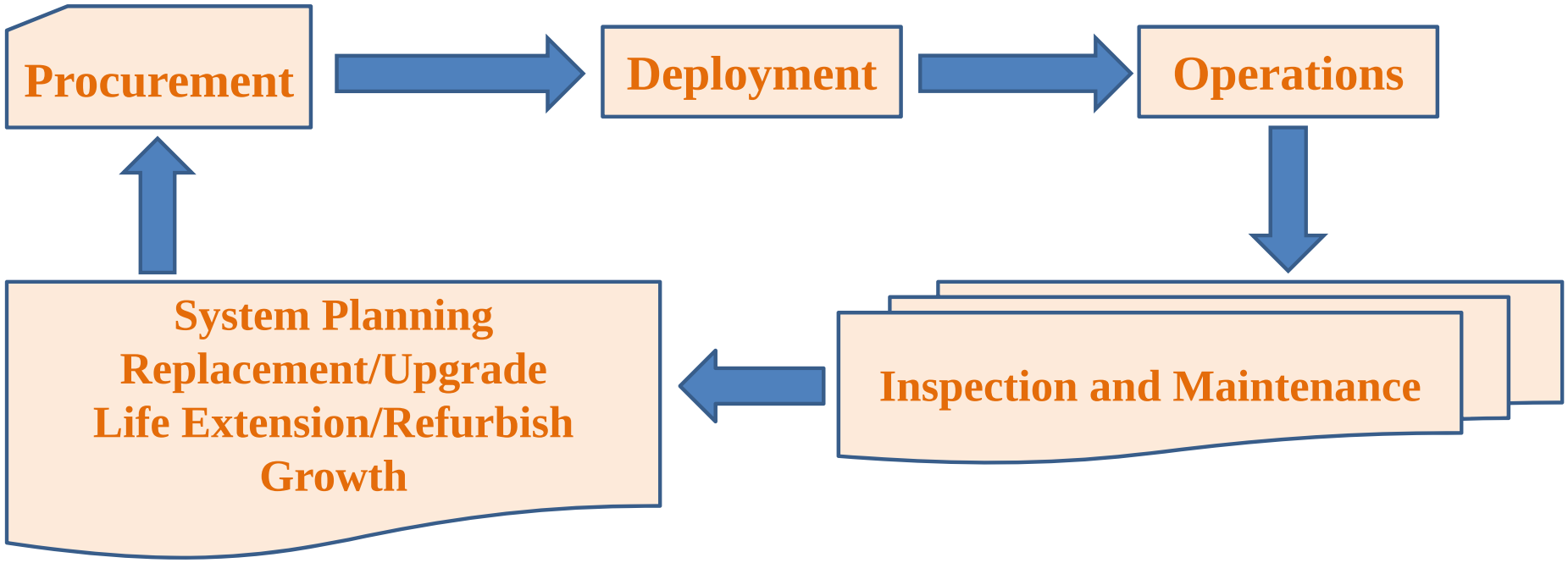
Asset Management Components



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Asset Management Outcomes

- Optimize Processes
  - Foundation for Inspection and Maintenance Program
    - Resources, Schedules, Funding Requirements
  - Framework for Equipment Decisions
    - Life Extension, Refurbish, Replace Decisions
  - Methodology for Exposure/Risk Tradeoffs
    - Outliers, Known Issues, Unforeseen
  - Basis for System Planning
    - Expansion and Equipment Upgrade, Renewal Programs
  - Program Decisions
    - Changes in Funding
    - New Methods
    - Risk Adjustment

Visualize The End State!

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Distribution System Challenges

- Large Number of Various Assets
  - Transformers, Regulators, Conductor, Poles
- Variety of Asset Life Cycles
  - Long, Short, Interdependency, Past Installation Cycles
- Variables Affecting Asset Life Cycle
  - Age, Loading, Maintenance, Extension
- Variable Exposure/Risk and Sensitivities on Systems
  - Current Performance Metrics, Outage Sensitivity, Transfer Capability

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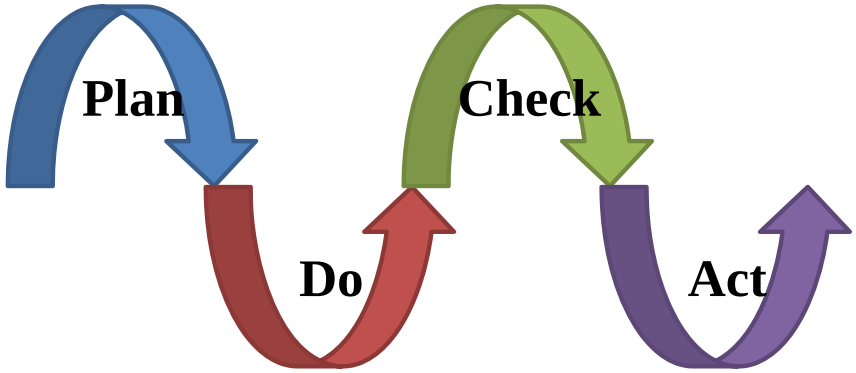
Asset Management Process

- Establish Philosophy
  - Desired Service Benchmarks
  - Balancing Resources and Funding Levels
  - Technology Platforms
  - Local Customization
- Layout System Framework
  - Inputs, Process, Decisions, Metrics, Monitor, Reports
  - Assign Responsibilities
- Build Out Program and Guides
  - Assumptions, Definitions, Tradeoffs, Control Limits, Triggers



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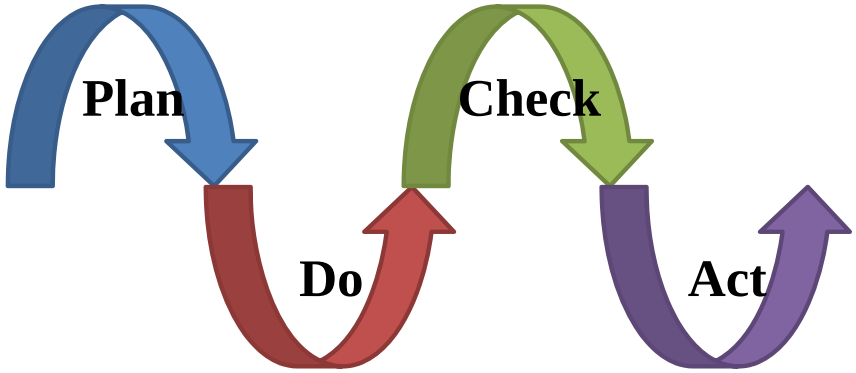
Asset Management Process

- Detail Key Metrics
  - Definitions
  - Monitor and Highlight Conditions Exceeding Limits
  - Control Actions
- Monitoring and Reporting
  - Trending, Charts, Frequency, Performance
  - Drives Responsibility and Accountability
- Controlled Process Document
  - Process Improvement



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Asset Management Considerations

- Upgrade, Replace, Refurbish Capital Planning
  - Variable by System/Assembly/Component
    - Categorize (Visibility)
    - Identification
    - Prioritize (Criticality)
    - Interdependence on Other Systems/Assembly/Components
    - Forecasted Variables
    - Past Installation Patterns
- Strategies
  - Run to Failure
  - Time Based
  - Condition Based
  - Reliability Centered

Ask why, why, why, why, why……

Collaborate and Document, Document, Document!

Controlled Documents

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Asset Management Considerations

- Approach
  - Statistical (Limited Input Data)
  - Element (High Visibility/High Consequence)
  - Available Input Data (Record Keeping)
  - Assumptions (Failure Rates, Impact, Recovery, Consequence)
  - Local Experience and Conditions
  - Alignment Across Equipment Types and Assemblies
  - Resource Management

Ask why, why, why, why, why……

Collaborate and Document, Document, Document!

Controlled Documents

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Data Management

- Identify Key Equipment Attributes
  - Inventory? Statistics?
  - Nameplate Data?
  - Tracking?
- Process Runs By the Numbers
  - Decisions/Actions driven by logic and experience
- Identify Norms and Control Limits
- Refine the Procedures
  - Collect and Process Key Numbers
- Data Base Change Management
  - Inspections/Replacements
  - Failures: Special Case/Common Cause

New Perspective!

Compelling Vision

Relentless Execution

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Monitoring and Reporting

- Collect Data
  - Optimize Activity and Decisions
  - Optimize Key Component and Assembly Life Cycle Costs
- Monitor
  - Identify Trending, Outliers, And Control Limits/Triggers
- Decisions
  - Guide Actions Triggered By Outliers
  - Analog Gray Area
- Results
  - Report and Act on Key Metrics
  - Consistency and Frequency
  - Responsibility and Accountability

Technology is Key!

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Summary

Process

- Define Philosophy
- Identify Objectives
- Map Processes
- Develop Trade Offs and Benchmarks
- Build/Integrate Guides and Procedures
- Implement Programs
- Collect and Monitor Key Data
- Report and Act on Outliers

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Aging Infrastructure Overview

Asset Management

Equipment Maintenance

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Equipment Maintenance (BC)

- Equipment records on index cards
- Change outs as necessary
- In-house maintenance
- “Run to Fail” maintenance strategy

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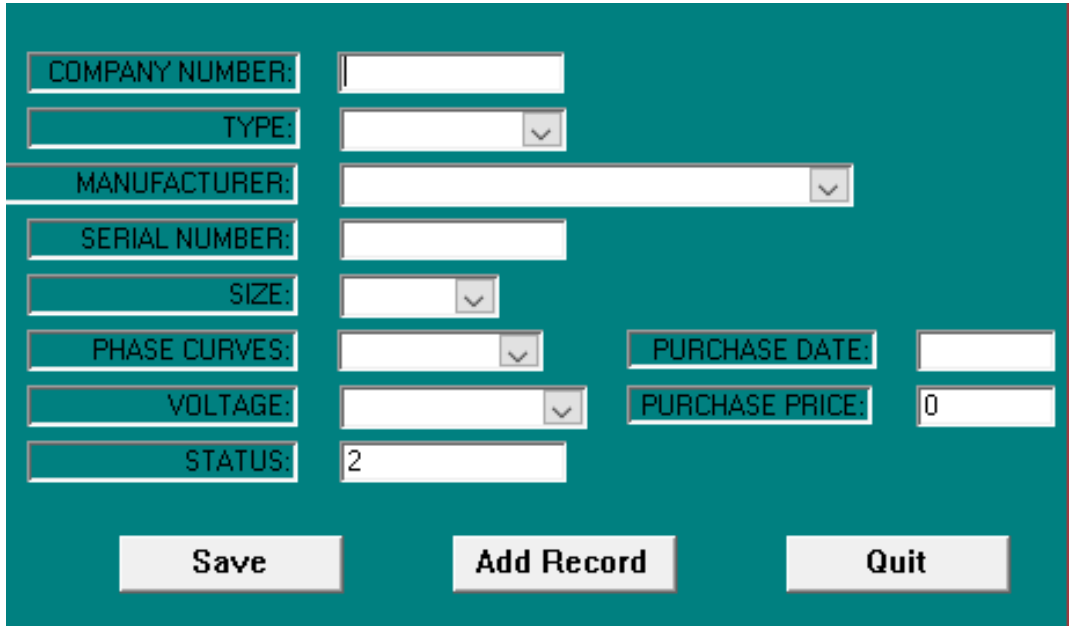
Equipment Maintenance Today

- In-house equipment database linked to GIS data



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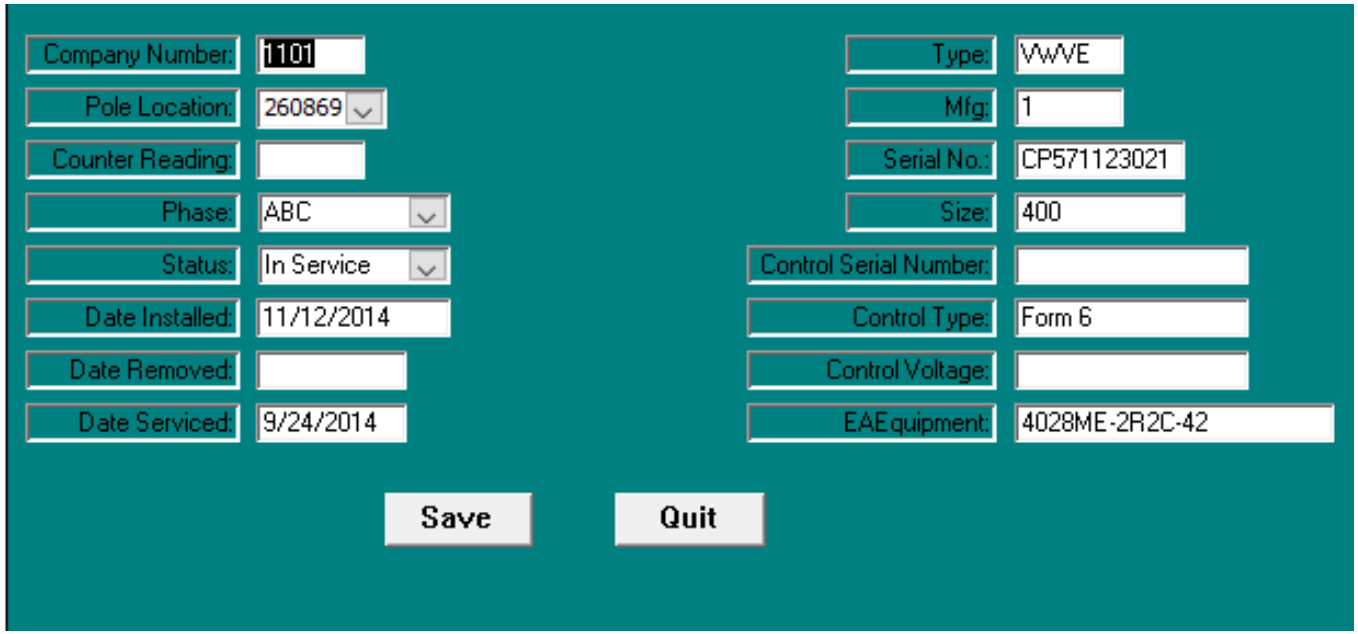
Equipment Maintenance Today

- Track installs and removals



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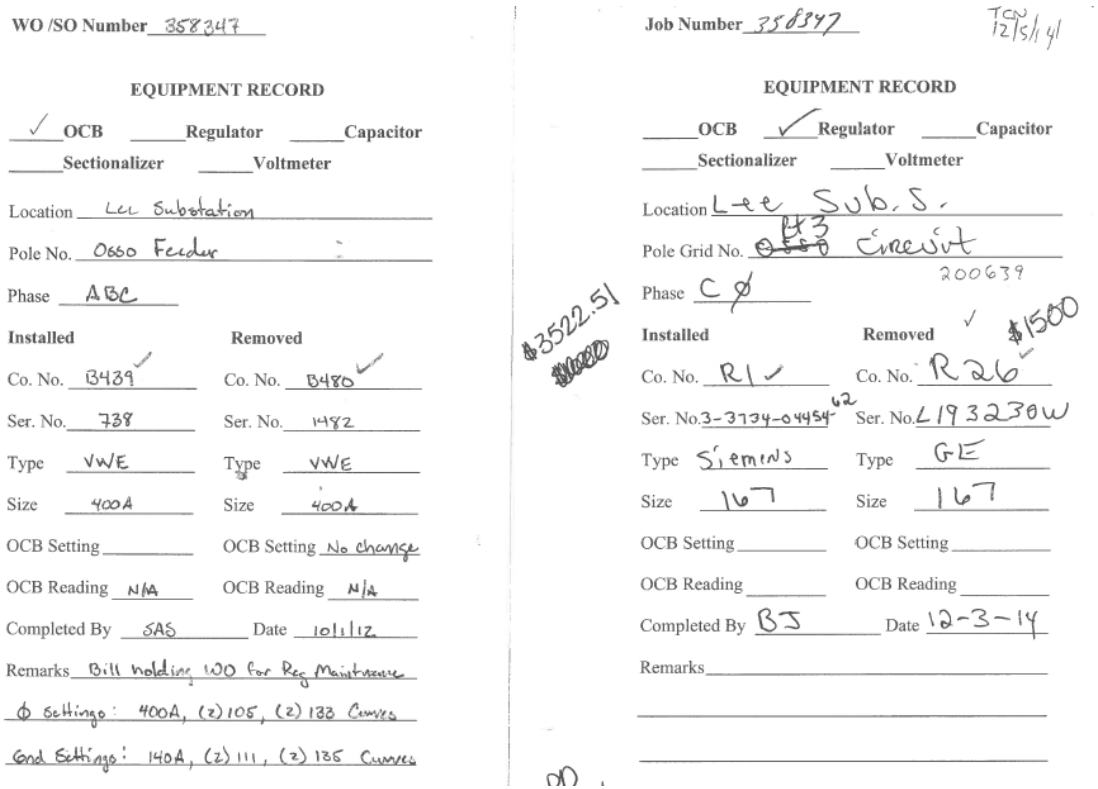
Equipment Maintenance Today

- Equipment activity data on paper slips filled out by linemen



WO /SO Number 358347

EQUIPMENT RECORD

✓ OCB ____ Regulator ____ Capacitor
____ Sectionalizer ____ Voltmeter

Location Lee Substation

Pole No. 0660 Feeder

Phase ABC

Installed	Removed
Co. No. B439	Co. No. B480
Ser. No. 738	Ser. No. 1482
Type VWE	Type VWE
Size 400A	Size 400A
OCB Setting	OCB Setting No change
OCB Reading N/A	OCB Reading N/A

Completed By SAS Date 10/1/12

Remarks Bill holding WO for Reg Maintenance
Ø Settings: 400A, (2) 105, (2) 133 Curves
Gnd Settings: 140A, (2) 111, (2) 135 Curves

Job Number 358347 TCN 12/5/14

EQUIPMENT RECORD

____ OCB ✓ Regulator ____ Capacitor
____ Sectionalizer ____ Voltmeter

Location Lee Sub. S.

Pole Grid No. ~~0660~~ R43 Circuit 200639

Phase CØ

$3522.51

Installed	Removed
Co. No. R1	Co. No. R26
Ser. No. 3-3734-04454 62	Ser. No. L193230W
Type Siemens	Type GE
Size 167	Size 167
OCB Setting	OCB Setting
OCB Reading	OCB Reading

$1500

Completed By BJ Date 12-3-14

Remarks

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Equipment Maintenance Today

- Report of in service equipment

1/18/2016 **In Service Reclosers** Page: 1

Sub	Feed	Pole Number	Installed Date	Company Number	Size	Type	Phase	PhaseTripCurve:
1	1	O417-1R	8/30/2012	1160	35	V4L	2	2A2B
1	1	O415_1/2-4R	8/30/2012	602	50	V4H	1	2A2C
1	1	O415_1/2-4R	8/30/2012	548	50	V4H	2	2A2C
1	1	O415_1/2-4R	8/30/2012	446	50	V4H	3	2A2C
1	1	O403-1/2R	7/18/2012	719	70	V4H	1	2A2C
1	1	O403-1/2R	7/18/2012	700	70	V4H	2	2A2C
1	1	O403-1/2R	7/18/2012	698	70	V4H	3	2A2C
1	1	O403-11R-2L	5/16/2012	482	50	V4H	1	2A2B
1	1	O403-13R	5/16/2012	509	35	V4H	2	2A2B
1	1	O401_1/2	5/17/2012	363	35	V4H	2	2A2B
1	2	O444-1_1/4L	12/10/2012	1150	70	V4L	1	2A2C
1	2	O444-1_1/4L	12/10/2012	1022	70	V4L	2	2A2C
1	2	O444-1_1/4L	12/10/2012	1021	70	V4L	3	2A2C
1	2	O444-8_1/4L	5/17/2012	816	50	V4H	2	2A2B
1	2	O444-26_1/2L	8/30/2012	624	50	V4H	3	2A2B
1	2	O459-1L	5/17/2012	575	70	V4H	2	2A2C
1	2	O465	9/4/2012	916	50	V4H	3	2A2C
1	2	O468-7R-2R	9/10/2012	931	70	V4H	2	2A2C

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Equipment Maintenance Today

- Report of in stock equipment

1/18/2016 **In Stock Reclosers By Company Number** Page: 1

Company Number	Size	Type	PhaseTripCurve:
1003	35	V4L	2A2B
1015	70	V4L	2A2C
1018	70	V4L	2A2C
1019	70	V4L	2A2C
1025	50	V4H	2A2B
1026	50	V4H	2A2B
1028	50	V4H	2A2B
1029	50	V4H	2A2B
1030	50	V4H	2A2B
1031	50	V4H	2A2B
1032	50	V4H	2A2B
1034	50	V4H	2A2B
1036	50	V4H	2A2B
1037	50	V4H	2A2B
1039	50	V4H	2A2B
1046	50	V4H	2A2B
1048	50	V4H	2A2B

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Equipment Maintenance Today

- Preventive maintenance strategy (5 year cycle)
- Rotate equipment based on substation feeder areas

Recloser Maintenance																		
Location	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Lee - Osso						10							10					
Lee - Rt 3						24							24					
Comorn-Passapatanzy						8							8					
Comorn - Presidential Lakes						1							1					
Comorn - Indiantown						8							8					
Office Hall - Rt 301						17							17					
O208_1/4 (VW)									1					1				
Oak Grove - Leedstown							10							10				
Oak Grove - Leedstown							11							11				
Oak Grove - Ebb Tide							7							7				
Oak Grove - Westmoreland Shores							12							12				
O28-38_5/8R (VW)									1					1				
Oak Grove Placid							13							13				
Foneswood - Foneswood							9							9				
Foneswood - Chiltons							1							1				
Foneswood - Newland							7							7				
Chisford - Currioman							3											

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Equipment Maintenance Today

- Third party maintenance company

Three Phase Recloser Maintenance Record Entry

Co#: B641 PO#: TM#: 16046-A Serial #: 4051

Customer Name: NORTHERN NECK EC

Amps: 140 Make: Kyle Type: VWE

Oil Condition Arrived:	Oil Condition Returned:	Closing Coil Type:	Date
Used	New	12.0-13.2 KV	10/15/2015

Repaired By: Adam Vann Visual Inspection: Jerry Vann

Min Trip Amps:	280	Operations to Lockout:	4	Delay Curves:	2A2B
Phase A #1 Amps:	560	Tripping Time:	0.046	Reclosing Time:	2.568
Phase A #2 Amps:	560	Tripping Time:	0.041	Reclosing Time:	3.293
Phase A #3 Amps:	560	Tripping Time:	2.523	Reclosing Time:	2.660
Phase A #4 Amps:	560	Tripping Time:	2.505	Reclosing Time:	13.63
Phase B #1 Amps:	560	Tripping Time:	0.042	Reclosing Time:	2.935
Phase B #2 Amps:	560	Tripping Time:	0.041	Reclosing Time:	3.286
Phase B #3 Amps:	560	Tripping Time:	2.456	Reclosing Time:	2.704
Phase B #4 Amps:	560	Tripping Time:	2.416	Reclosing Time:	13.88
Phase C #1 Amps:	560	Tripping Time:	0.041	Reclosing Time:	3.003
Phase C #2 Amps:	560	Tripping Time:	0.047	Reclosing Time:	3.312
Phase C #3 Amps:	560	Tripping Time:	2.076	Reclosing Time:	2.835
Phase C #4 Amps:	560	Tripping Time:	2.040	Reclosing Time:	13.35

Comments: Counter reading: before - n/a, after - 8

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Equipment Maintenance Today: Pros and Cons

- Good program for record keeping of data
- Tied to GIS equipment locations
- Database program custom
- Maintenance data on paper outside of program
- Equipment tracking relies on paper slips
- Maintenance limited by number of spares
- Maintenance costs adds to budget
- Need better communications between departments

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Equipment Maintenance Today: Possible Enhancements

- Utilize third party record keeping program
- Utilize mobile device for equipment tracking
- Request digital files from maintenance vendor
- Upload maintenance records, develop history
- Have periodic meetings to discuss progress on maintenance cycle
- Purchase additional spare equipment

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Inspections

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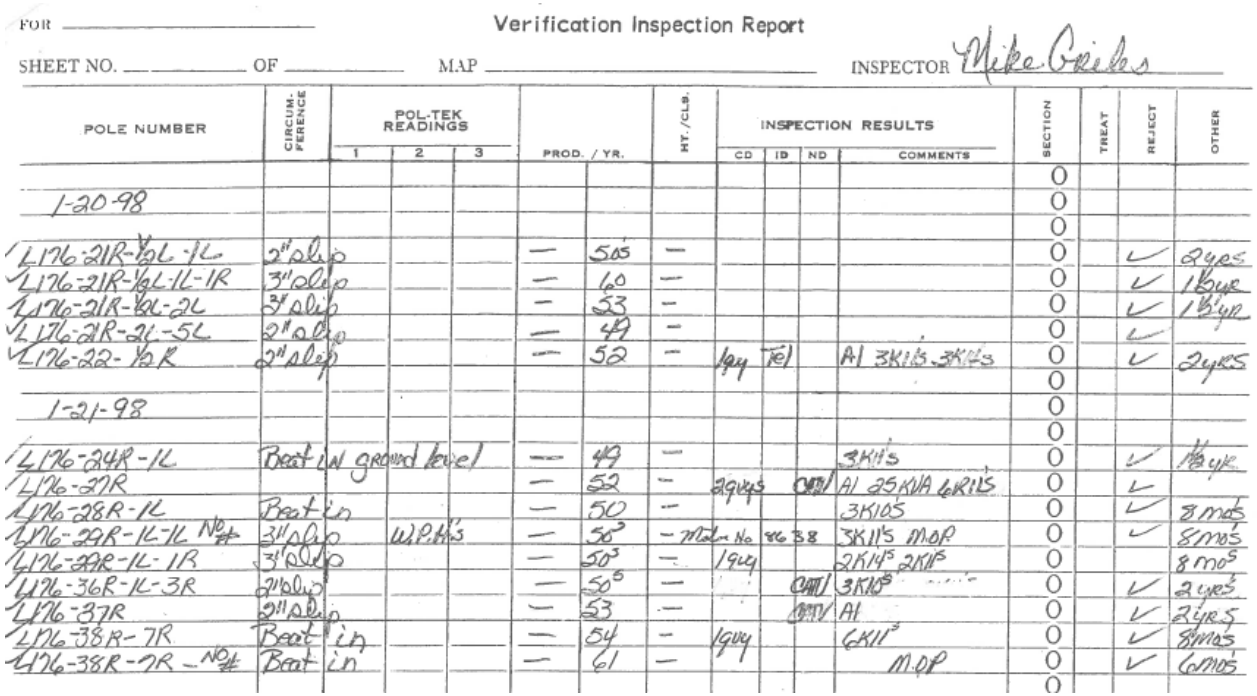
Pole Inspections (BC)

- Pole inspections on 6 year cycle
- Hand written reports from pole inspection company



FOR _____ Verification Inspection Report

SHEET NO. _____ OF _____ MAP _____ INSPECTOR Mike Grieb

POLE NUMBER	CIRCUM-FERENCE	POL-TEK READINGS 1	2	3	PROD.	/ YR.	HT./CLS.	INSPECTION RESULTS CD	ID	ND	COMMENTS	SECTION	TREAT	REJECT	OTHER
												0			
1-20-98												0			
												0			
L176-21R-½L-1L	2" slip				—	50's	—					0		✓	2 yrs
L176-21R-½L-1L-1R	3" slip				—	60	—					0		✓	1½ yr
L176-21R-½L-2L	3" slip				—	53	—					0		✓	1½ yr
L176-21R-2L-5L	2" slip				—	49	—					0		✓	
L176-22-½R	2" slip				—	52	—	1994	Tel		A1 3K11's 3K14's	0		✓	2 yrs
												0			
1-21-98												0			
												0			
L176-24R-1L	Beat in ground level				—	49	—				3K11's	0		✓	½ yr
L176-27R					—	52	—	2994's		CATV	A1 25KVA 6K11's	0		✓	
L176-28R-1L	Beat in				—	50	—				3K10's	0		✓	8 mos
L176-29R-1L-1L No #	3" slip	W.P.H.'s			—	50	—	1994 No		8638	3K11's M.O.P	0		✓	8 mos
L176-29R-1L-1R	3" slip				—	50	—	1994			2K14's 2K11's	0			8 mos
L176-36R-1L-3R	2" slip				—	50	—			CATV	3K10's	0		✓	2 yrs
L176-37R	2" slip				—	53	—			CATV	A1	0		✓	2 yrs
L176-38R-7R	Beat in				—	54	—	1994			6K11's	0		✓	8 mos
L176-38R-7R - No #	Beat in				—	61	—				M.O.P	0		✓	6 mos
												0			

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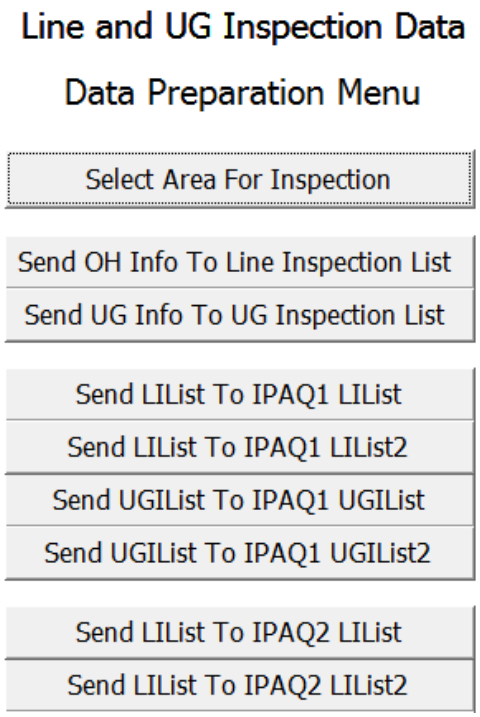
Pole Inspections

- Developed in-house pole inspection database program



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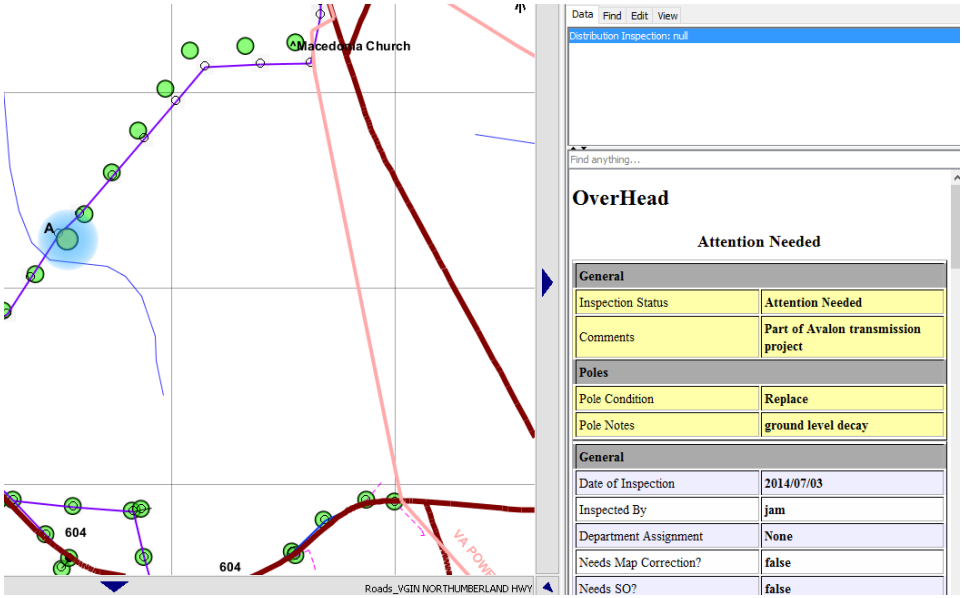
Pole Inspections

- Switched to third party handheld data collection program
- Added third party inspection record display program



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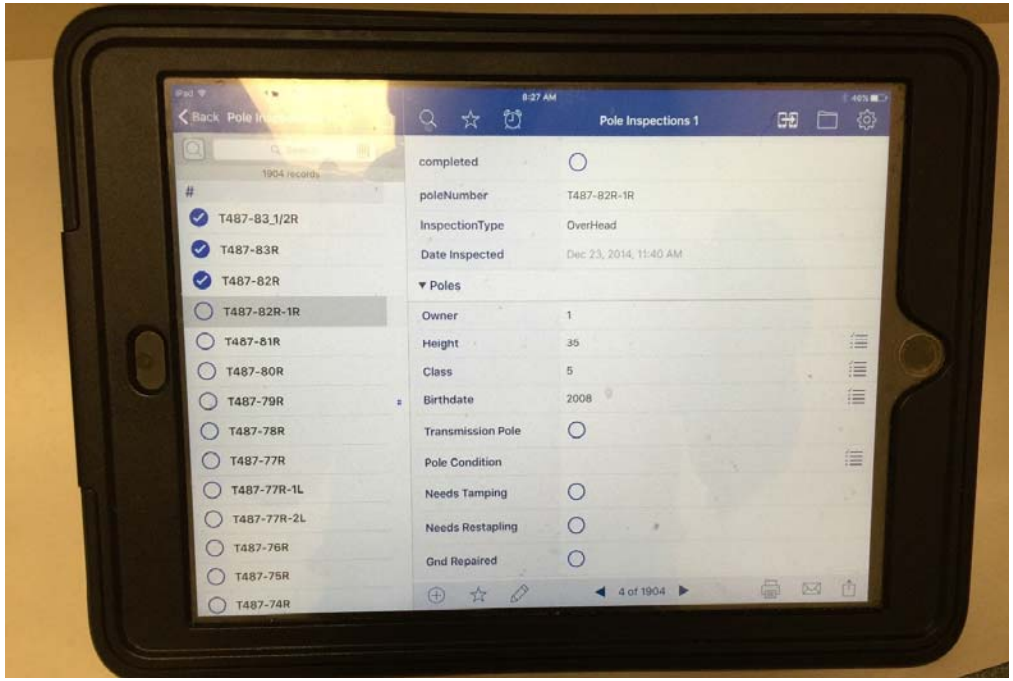
Pole Inspections Today

- Still using same pole inspection company with no digital capabilities
- Switched to iPad handheld data collection program



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Pole Inspections Today

- Still using third party inspection record display program
- Still generating invoice and paper records in-house with database

Date	
Tuesday, January 19, 2016	
Inspection Period	
Week Ending 4/1/15	
Inspector	
SUM	

Northern Neck Electric Cooperative
A Touchstone Energy Cooperative

Pole and Line Inspection Report

	Pole										Guys				Conductors										Assemblies				ROW			Devices																
					Treat Type																																											
Pole Number	No Pole Tag	Pole Condition	Tamp Pole	No Fuse Tag	Treat Reject and-Bore s-B Reject Report Rep-Reject	Transmission	Pole Year	Ground Required	Need Grnd Staples	Tighten Grnd	Action Needed	Bond Guy	Remove Anchor	Guards Added	Type 1	Status 1	Action Needed 1	Type 2	Status 2	Action Needed 2	Type 3	Status 3	Action Needed 3	Crossarm	Crossarm Brace	Insulator	UG Riser Status	ROW Status	Danger Tree	Other Status	Type 1	Status 1	Type 2	Status 2	Type 3	Status 3	Type 4	Status 4	Type 5	Status 5	Type 6	Status 6	Comments
T487-228R	☐	O	☐	☐	Sound-Bore	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-227R	☐	O	☐	☐	Sound-Bore	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-226R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-225R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-224R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-223R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-222R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-221R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-221R-1L	☐	O	☐	☐	Treat	☐	1965	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-221R-2L	☐	O	☐	☐	Sound-Bore	☐	1974	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-221R-2L-1R	☐	O	☐	☐	Sound-Bore	☐	1974	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-221R-2_1/2L	☐	O	☐	☐	Treat	☐	1966	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-221R-2_1/2L-1MP	☐	O	☐	☐	Sound-Bore	☐	No Y	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-220R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R	☐	O	☐	☐	Treat	☑	1961	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-1/2R	☐	O	☐	☐	Sound-Bore	☐	1982	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-1R	☐	O	☐	☐	Sound-Bore	☐	1971	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-2R	☐	O	☐	☐	Sound-Bore	☐	1972	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-3R	☐	O	☐	☐	Sound-Bore	☐	1971	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-4R	☐	O	☐	☐	Sound-Bore	☐	1972	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-5R	☐	O	☐	☐	Sound-Bore	☐	1971	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-6R	☐	O	☐	☐	Sound-Bore	☐	1971	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		
T487-219R-7R	☐	O	☐	☐	Sound-Bore	☐	1971	☐	☐	☐	N	☐	☐	0	N	O	N	N	O	N	N	O	N	O	O	O	O	O	☐	O	N	O	N	O	N	O	N	O	N	O	N	O		

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Pole Inspections Today: Pros and Cons

- Inspection cycle extended to 8 years
- iPad data collection program for inspectors - low cost and easy to use
- Inspections displayed graphically with problem identification
- Able to use less expensive inspectors
- Quickly generate paperwork for inspection billing using in-house database
- Requires my time to process data records
- Three sets of inspection records maintained
- Historical data not readily accessible

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Pole Inspections Today: Possible Enhancements

- Make data processing more user friendly
- Provide training on in house programs
- Consider other third party inspection programs
- Make historical data more accessible

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Line Inspection (BC)

- Relying on ride by of facilities as visual inspection
- Line inspections not documented
- Relying on data collected during pole inspections
- RUS requires yearly inspections

a. Inspection and Maintenance - Program and Records: Above and below ground pole inspection performed on cycle based upon decay zone using experienced inspectors. Records of all poles inspected, treated, rejected and changed out readily available in summary form. All overhead lines (including those on private right-of-way) patrolled annually (walking, riding, or aerial); more frequently if experience dictates. Records maintained for pole inspection and line patrol with deficiencies corrected in a timely manner. Pole and equipment changeout program in place to keep rejected poles and failed equipment to a minimum.

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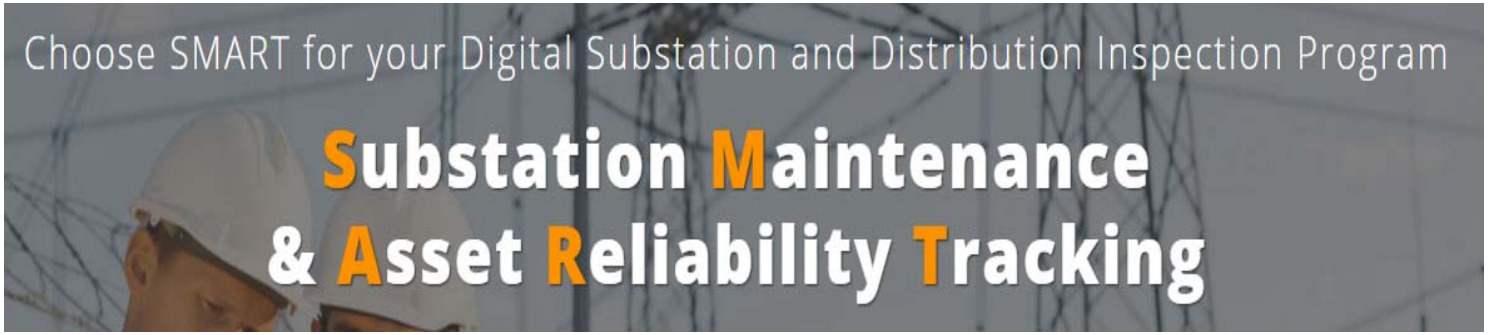
Line Inspection (BC)

- Looked for program to work on iPads
- Found substation inspection program
- Performed pilot program for line inspection

minmax TECHNOLOGIES



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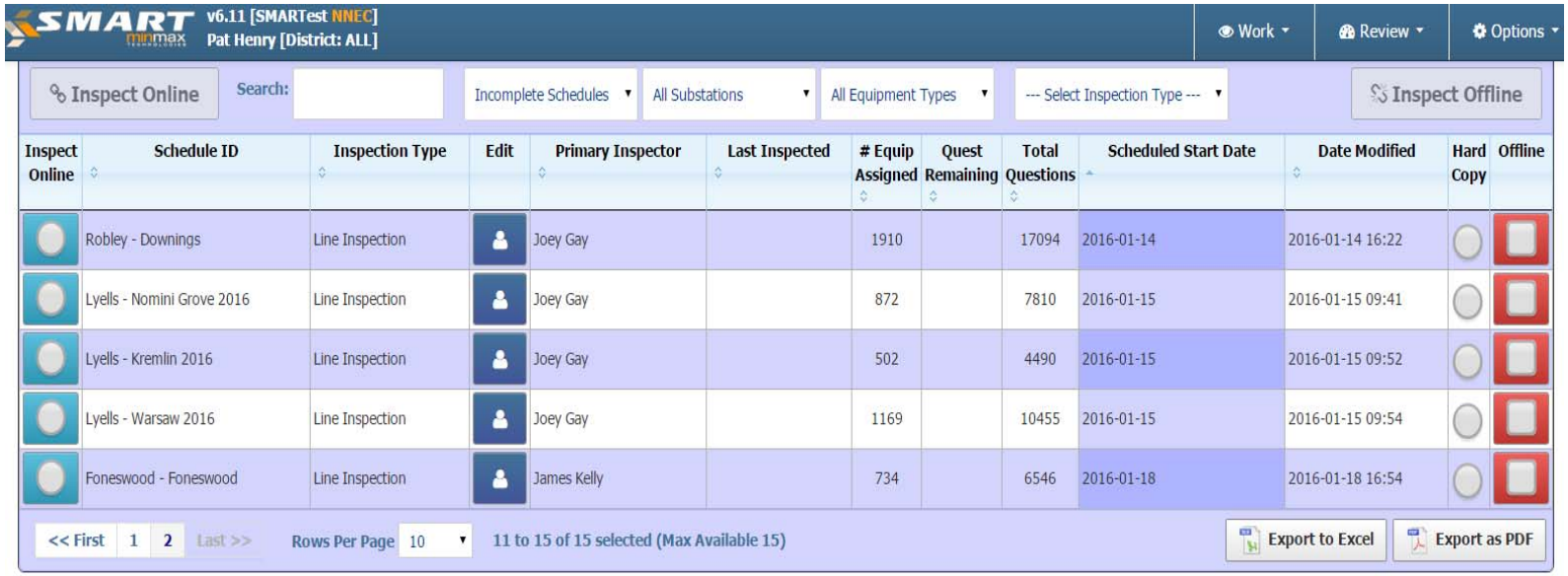
Line Inspection Today

- Web based program for inspections



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Line Inspection Today

- Input pole and pad data from GIS

	A	B	C	D	E	F	G
1	Substation *	Section *	Equip Type *	Equip ID *	Equip Name *	Location	Sequence
2	Foneswood - Poles	Foneswood 121	POLE	211551	T108-32_1/4L		490250
3	Foneswood - Poles	Foneswood 121	POLE	211552	T108-32L		490300
4	Foneswood - Poles	Foneswood 121	POLE	211773	T108-31L		490350
5	Foneswood - Poles	Foneswood 121	POLE	211772	T108-31L-1L		490400
6	Foneswood - Poles	Foneswood 121	POLE	211651	T108-30L		490450
7	Foneswood - Poles	Foneswood 121	POLE	211652	T108-29L		490500
8	Foneswood - Poles	Foneswood 121	POLE	211774	T108-28L		490550
9	Foneswood - Poles	Foneswood 121	PAD	237091	T108-28L-1R		490600
10	Foneswood - Poles	Foneswood 121	PAD	104570	T108-28L-2R		490650
11	Foneswood - Poles	Foneswood 121	POLE	211771	T108-27L		490700
12	Foneswood - Poles	Foneswood 121	POLE	211770	T108-26_1/2L		490750
13	Foneswood - Poles	Foneswood 121	POLE	211769	T108-26L		490800
14	Foneswood - Poles	Foneswood 121	POLE	211542	T108-26L-STUB		490850
15	Foneswood - Poles	Foneswood 121	POLE	260133	T108-26L-1/2R		490900
16	Foneswood - Poles	Foneswood 121	POLE	211630	T108-26R-1R		490950
17	Foneswood - Poles	Foneswood 121	POLE	211541	T108-26L-1R-1R		491000
18	Foneswood - Poles	Foneswood 121	POLE	211540	T108-26L-1R-2R		491050
19	Foneswood - Poles	Foneswood 121	POLE	211620	T108-26L-1R-1AR		491100
20	Foneswood - Poles	Foneswood 121	POLE	211619	T108-26L-1R-2AR		491150
21	Foneswood - Poles	Foneswood 121	POLE	211788	T108-26L-1R-2AR-1MP		491200
22	Foneswood - Poles	Foneswood 121	POLE	211626	T108-26L-2R		491250
23	Foneswood - Poles	Foneswood 121	POLE	211625	T108-26L-3R		491300
24	Foneswood - Poles	Foneswood 121	POLE	211614	T108-26L-3R-1R		491350

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Line Inspection Today

- Inspect lines by feeder based on poles

Inspect by Map

Search: All Equipment --- Select Equip Type --- --- Select Substation --- --- Select Section ---

<< First 1 2 3 4 5 Last >> Rows Per Page 25 1 to 25 of 734 selected (Max Available 734)

Step 3	Questions Remaining	Equip ID	Equip Name	Equip Type	Substation	Section	Sequence	Lat	Long
	9	211551	T108-32_1/4L	POLE [Pole]	Foneswood - Poles	Foneswood 121	1	38.100184607	-76.886838345
	9	211552	T108-32L	POLE [Pole]	Foneswood - Poles	Foneswood 121	2	38.10021681	-76.886883298
	9	211773	T108-31L	POLE [Pole]	Foneswood - Poles	Foneswood 121	3	38.100830412	-76.887762954
	9	211772	T108-31L-1L	POLE [Pole]	Foneswood - Poles	Foneswood 121	4	38.101042396	-76.886939482
	9	211651	T108-30L	POLE [Pole]	Foneswood - Poles	Foneswood 121	5	38.100993703	-76.889047239
	9	211652	T108-29L	POLE [Pole]	Foneswood - Poles	Foneswood 121	6	38.10122387	-76.890470196
	9	211774	T108-28L	POLE [Pole]	Foneswood - Poles	Foneswood 121	7	38.101448275	-76.891928147
	7	237091	T108-28L-1R	PAD [Pad mounted equipment]	Foneswood - Poles	Foneswood 121	8	38.099968405	-76.892372017

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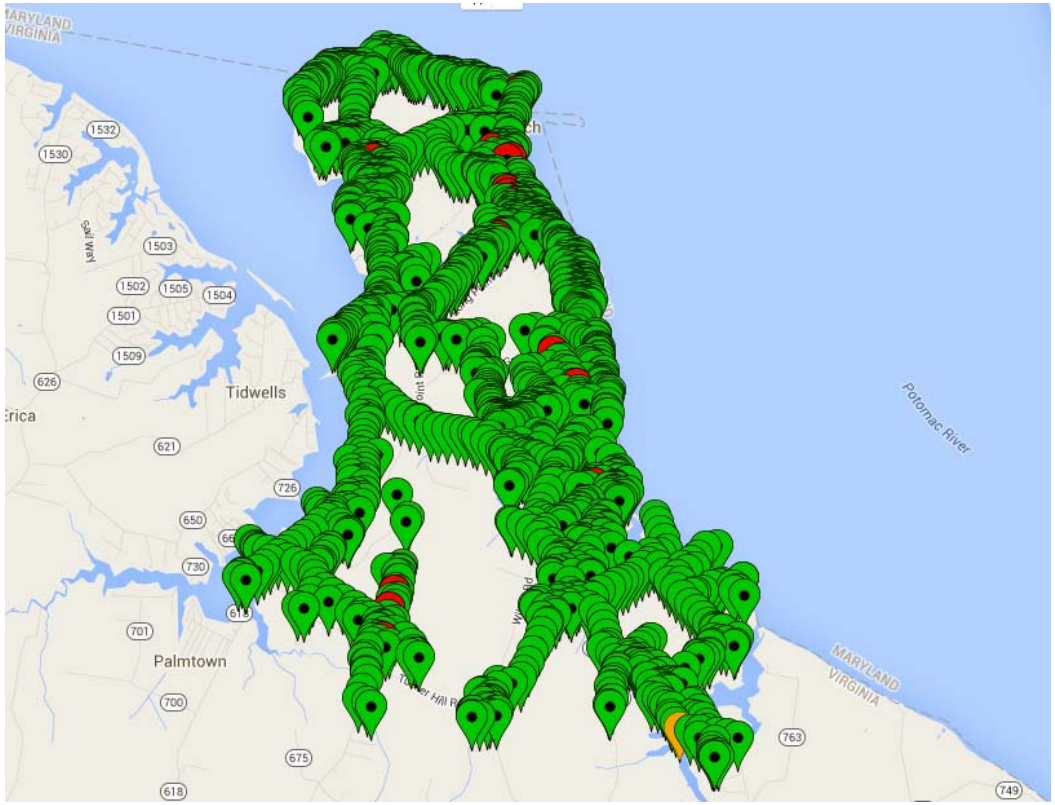
Line Inspection Today

- Ability to inspect lines graphically



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Line Inspection Today

- Identify work needed by pole or pad

ID: 206246

No.		Status	Inspection Question	Action	Results	
1			Enclosure Condition	Inspected	OK	
2			Foundation	Inspected	OK	
3			Area Around Pad	Needs Work	Vegetation	
4			Doors Secured	Inspected	OK	
5			Markers or Signs	Inspected	OK	
6			Pest Infestation	Inspected	OK	
7			Terminations & Arrestor	Inspected	OK	

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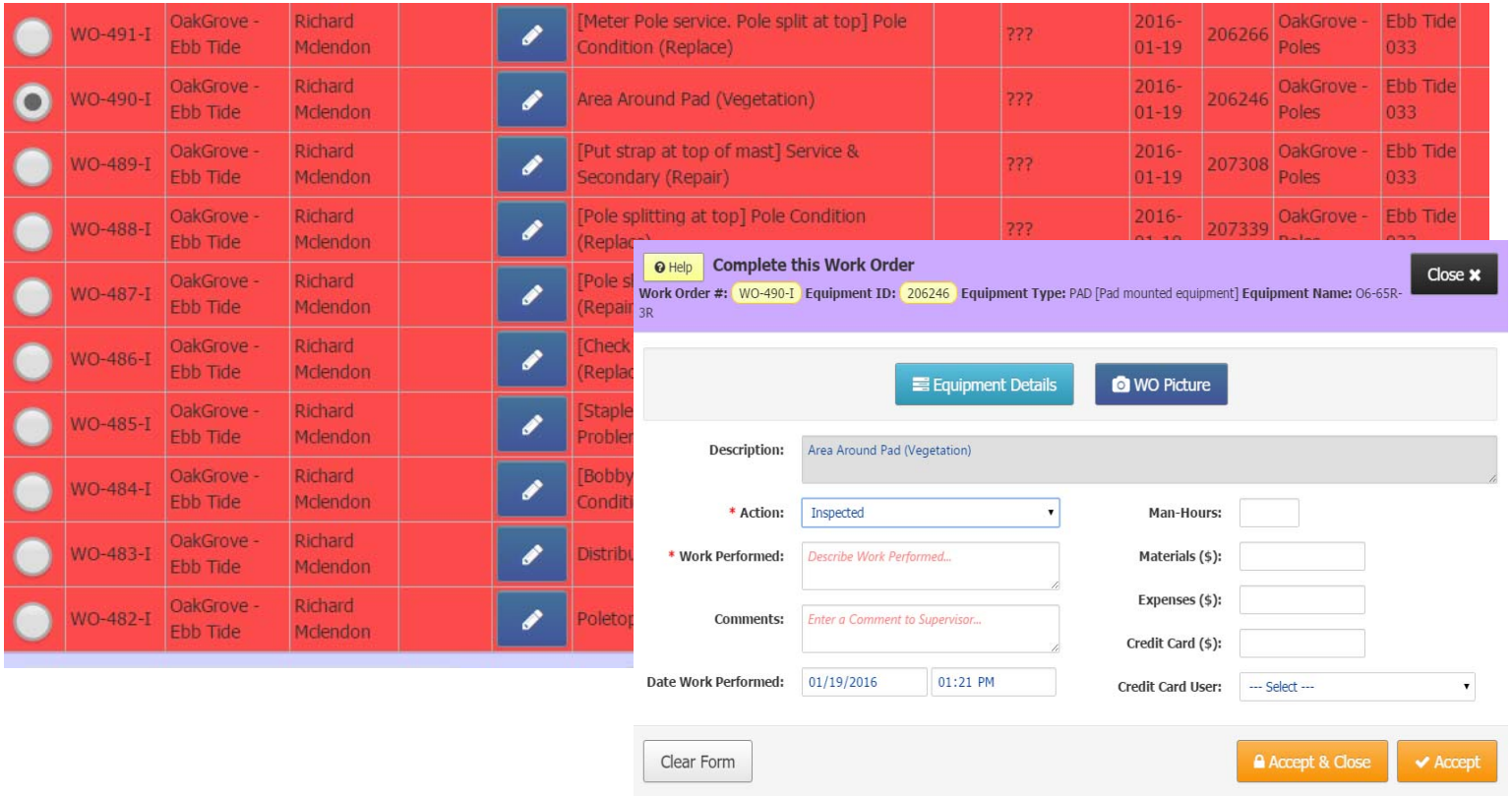
Line Inspection Today

- Work orders generated for work needed



	WO-491-I	OakGrove - Ebb Tide	Richard Mclendon			[Meter Pole service. Pole split at top] Pole Condition (Replace)		???	2016-01-19	206266	OakGrove - Poles	Ebb Tide 033
	WO-490-I	OakGrove - Ebb Tide	Richard Mclendon			Area Around Pad (Vegetation)		???	2016-01-19	206246	OakGrove - Poles	Ebb Tide 033
	WO-489-I	OakGrove - Ebb Tide	Richard Mclendon			[Put strap at top of mast] Service & Secondary (Repair)		???	2016-01-19	207308	OakGrove - Poles	Ebb Tide 033
	WO-488-I	OakGrove - Ebb Tide	Richard Mclendon			[Pole splitting at top] Pole Condition (Replac		???	2016-	207339	OakGrove -	Ebb Tide
	WO-487-I	OakGrove - Ebb Tide	Richard Mclendon			[Pole s (Repair						
	WO-486-I	OakGrove - Ebb Tide	Richard Mclendon			[Check (Replac						
	WO-485-I	OakGrove - Ebb Tide	Richard Mclendon			[Staple Probler						
	WO-484-I	OakGrove - Ebb Tide	Richard Mclendon			[Bobby Conditi						
	WO-483-I	OakGrove - Ebb Tide	Richard Mclendon			Distribu						
	WO-482-I	OakGrove - Ebb Tide	Richard Mclendon			Poletop						

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Line Inspection Today

- Problems found during inspections

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Line Inspection Today

- Problems found during inspections

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Line Inspection Today

- Problems found during inspections

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Line Inspection Today: Pros and Cons

- Works with any device
- Able to do offline inspections and sync to cloud database
- Work orders developed for work needed
- Accountability trail to inspectors
- On track to inspect entire system in a year
- Requires two way syncing with GIS data
- Operations overwhelmed with problems found
- Extra maintenance causing budget concerns

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Line Inspection Today: Possible Enhancements

- Evaluate historical data functionality
- Utilize photo attachment capabilities
- Develop other applications for the program
- Connect third party test results

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Questions?

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