



# Distribution Automation at Duke Energy

Presentation to Smart Distribution Working Group

July 26, 2010

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Reliability Planning and Asset Management

# Project Justifications

- “It’s made of gold.”
- Regulator says to do it.
- “I want one of those!”
- Classical business case
- Classical business case that includes “reliability valuation” in \$/CI or \$/CMI
- Government (or someone) gives you a bunch of money

# “Let’s do some Distribution Automation”

So who is going to do it?

- Power Delivery
- Relay Department
- Substation Operations
- Standards
- Reliability Department
- Planners

# Regions A and B

## Region A

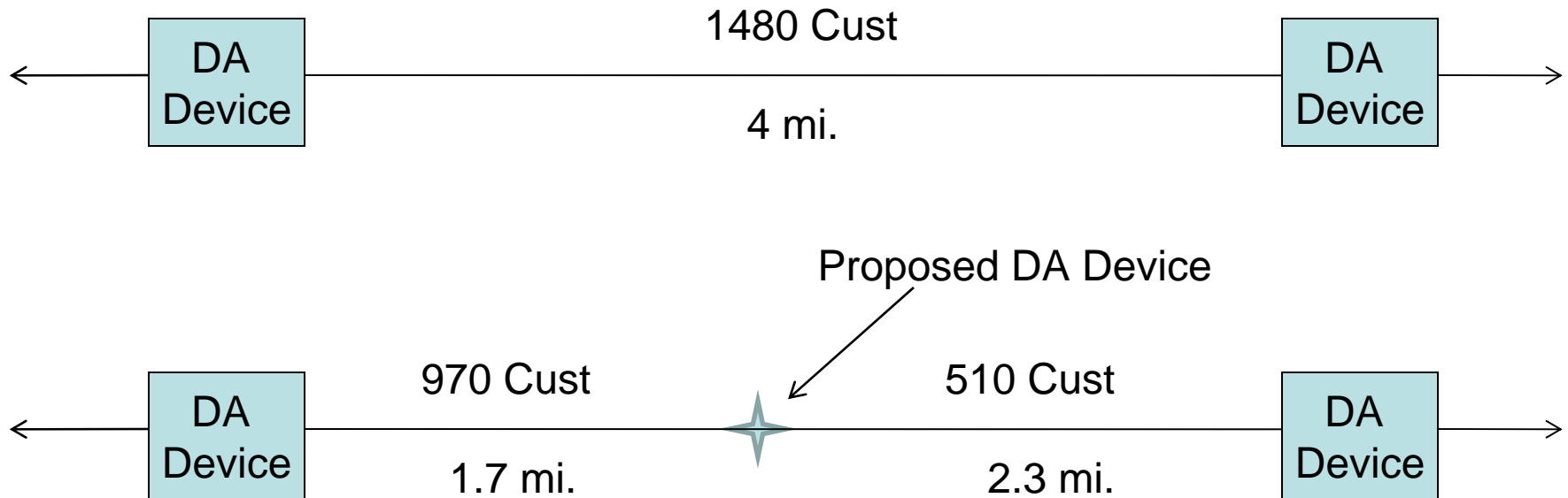
- Smart Grid approval
- Planners all P.E.'s or 4 yr degree engineers
- Recently learned radial sectionalization
- Received some guidance in DA Device Placement
- Have a “bunch of money” to do the DA...and regulatory expectations

## Region B

- No Smart Grid
- Planners are techs with P.E. leads
- Very experienced in radial sectionalization
- Received a tutorial in DA Device Placement and Device justification
- Must justify DA among other reliability projects



# DA SECTIONALIZATION

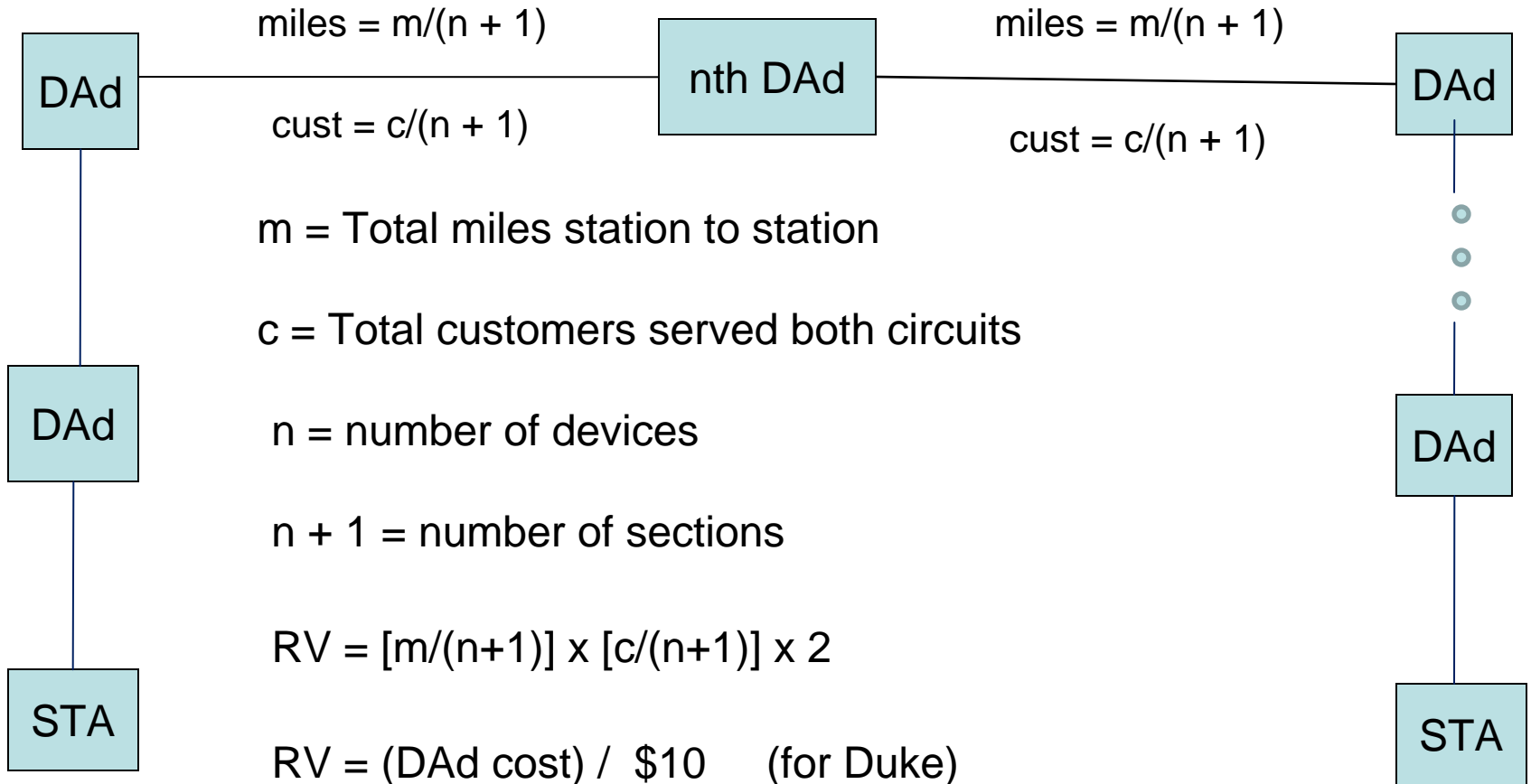


$RV = \text{cust upstream} \times \text{miles downstream} + \text{cust downstream} \times \text{miles upstream}$

$$RV = 970 \times 2.3 + 510 \times 1.7 = 2,231 + 867 = 3,098 \text{ cm}$$

$$\text{Reliability Budget} = 3,098 \times \$10 = \$30,980$$

# How many DA devices to place?

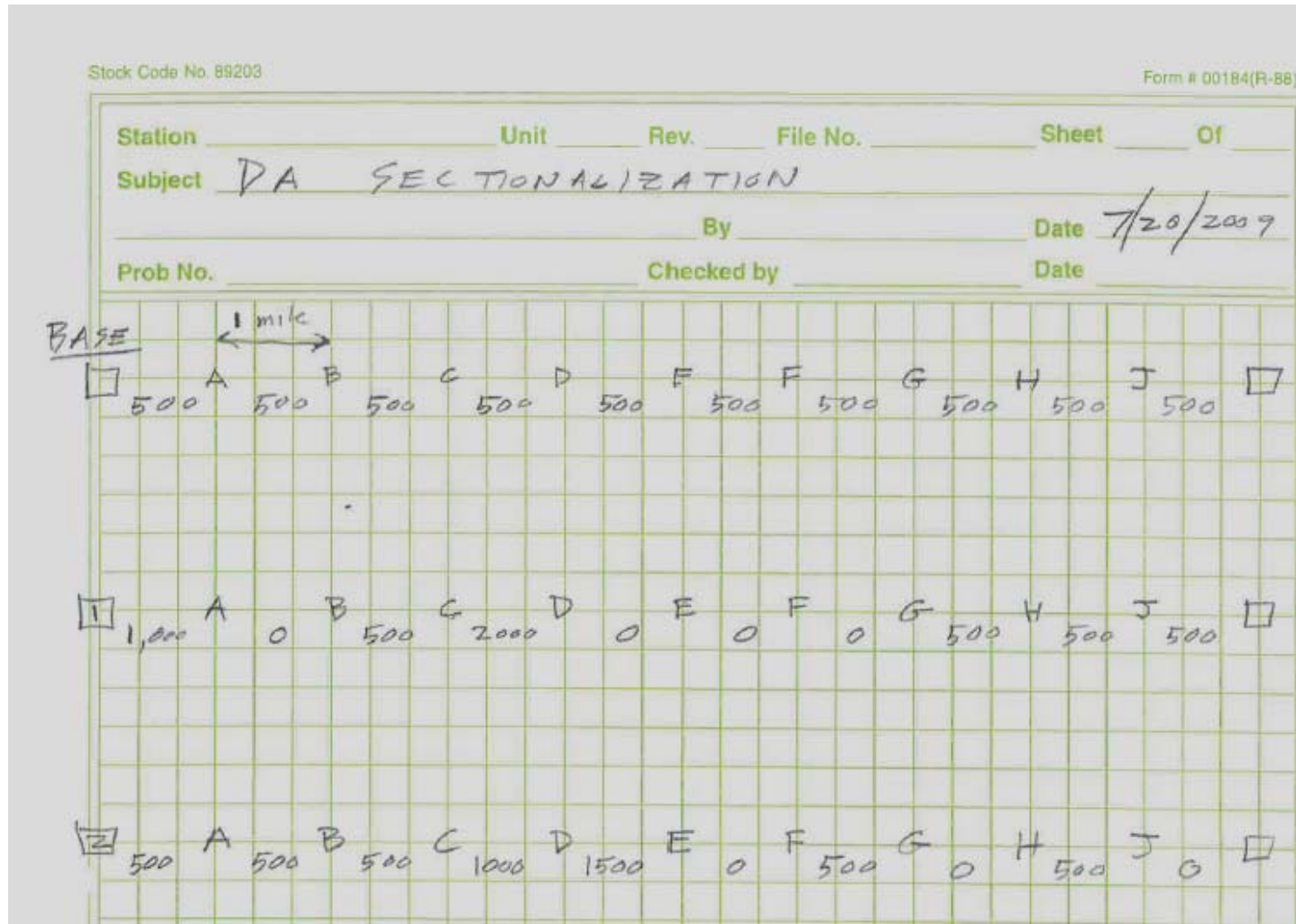


... where \$10 (for Duke) = 0.2 faults per mile per yr X \$50 cost to prevent CI per year

# Spreadsheet Solution for DA Devices

\$30,000	(entry)	- Sample cost of DA device
0.20	(entry)	- Fault rate per mile per year
\$50	(entry)	- Will pay to prevent CI/yr
3,000		- Minimum Reliability value in Customer Miles for nth device
Total Customer Miles		Number of DA Devices Needed in 2 Circuit Loop
13,500		2
24,000		3
37,500		4
54,000		5
73,500		6
96,000		7

# Where are the best locations for four devices?



# Summerfield Ret 2406 – Summerfield Ret 2409

Rev. 062910

OGBURN DIST  
STEP-DOWN  
STATION  
HS 24 KV  
BREAKER  
PEAK 163 A

OGBURN HS  
Normal feed  
LLL – 1918A  
LL – 1661A  
LG- 1418A

OGBURN HS  
Reverse feed  
LLL – 1781A  
LL – 1653A  
LG- 1324A

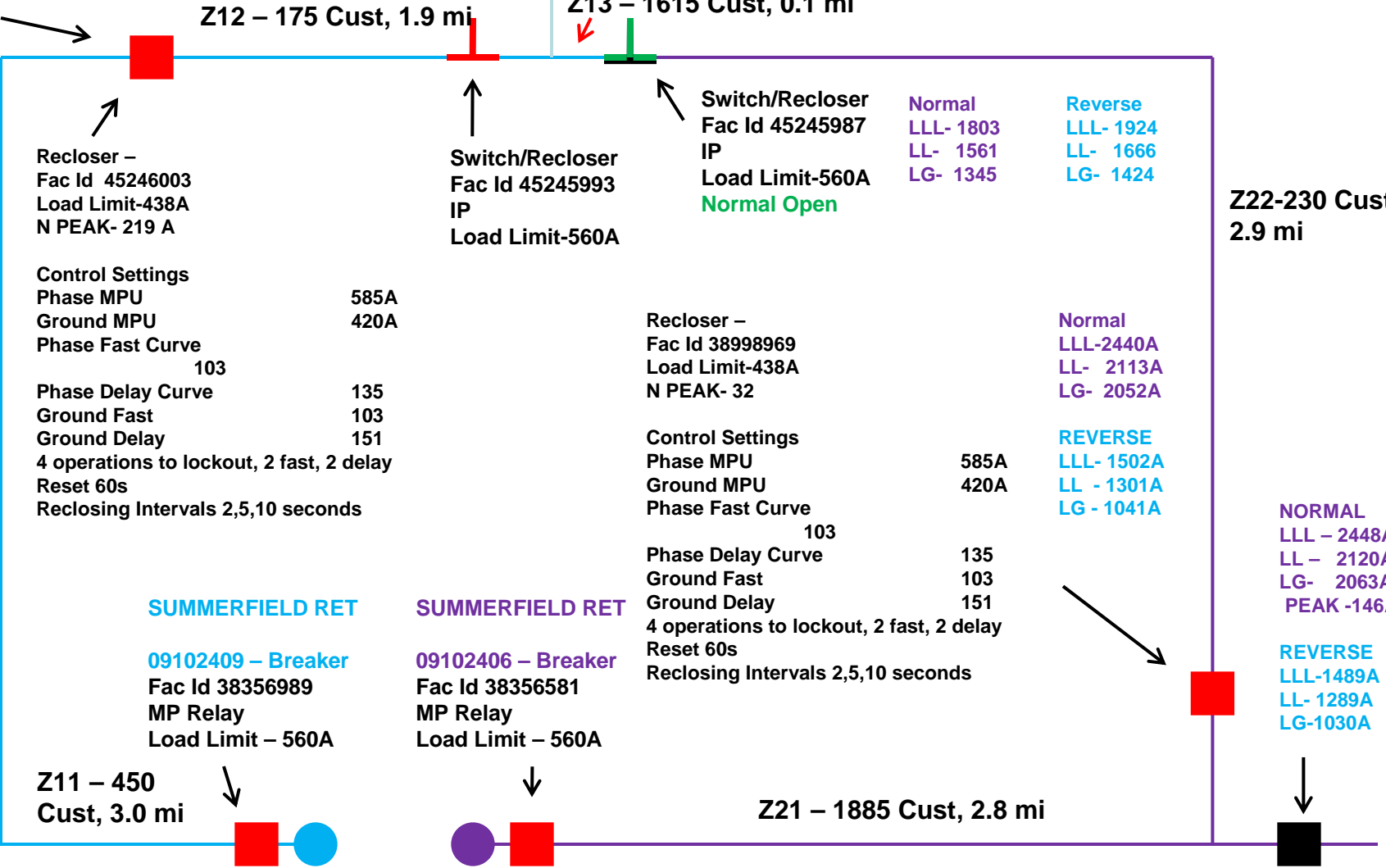
Normal  
LLL- 2376 A  
LL- 2058A  
LG- 1901A

REVERSE  
LLL- 1528A  
LL - 1324A  
LG- 1086A

NORMAL  
LLL – 3565A  
LL – 3087A  
LG- 3615A

REVERSE  
LLL- 1248A  
LL - 1081A  
LG - 848A

200 4E  
126 A PEAK



Z12 – 175 Cust, 1.9 mi

Z13 – 1615 Cust, 0.1 mi

Recloser –  
Fac Id 45246003  
Load Limit-438A  
N PEAK- 219 A

Control Settings  
Phase MPU 585A  
Ground MPU 420A  
Phase Fast Curve 103  
Phase Delay Curve 135  
Ground Fast 103  
Ground Delay 151  
4 operations to lockout, 2 fast, 2 delay  
Reset 60s  
Reclosing Intervals 2,5,10 seconds

Switch/Recloser  
Fac Id 45245993  
IP  
Load Limit-560A

Switch/Recloser  
Fac Id 45245987  
IP  
Load Limit-560A  
Normal Open

Recloser –  
Fac Id 38998969  
Load Limit-438A  
N PEAK- 32

Control Settings  
Phase MPU 585A  
Ground MPU 420A  
Phase Fast Curve 103  
Phase Delay Curve 135  
Ground Fast 103  
Ground Delay 151  
4 operations to lockout, 2 fast, 2 delay  
Reset 60s  
Reclosing Intervals 2,5,10 seconds

Normal  
LLL- 1803  
LL- 1561  
LG- 1345

Reverse  
LLL- 1924  
LL- 1666  
LG- 1424

Normal  
LLL-2440A  
LL- 2113A  
LG- 2052A

REVERSE  
LLL- 1502A  
LL - 1301A  
LG - 1041A

SUMMERFIELD RET

SUMMERFIELD RET

Z11 – 450  
Cust, 3.0 mi

Z21 – 1885 Cust, 2.8 mi

Z22-230 Cust  
2.9 mi

Normal LLL-3721 , LL-3222, LG-3887 Amps  
Reverse LLL-1233, LL-1068, LG-837 Amps

Normal LLL-3653 , LL-3163, LG-3813 Amps  
Reverse LLL-1241, LL-1074, LG-840 Amps

200 4E  
146 A PEAK

NORMAL  
LLL – 2448A  
LL – 2120A  
LG- 2063A  
PEAK -146A

REVERSE  
LLL-1489A  
LL- 1289A  
LG-1030A

# Comparison of Alternative Placements

## Original Design

Section	Miles	Cust	Cust-Mi
Z11	3.0	450	1,350
Z12	1.9	175	333
Z13	0.1	1,615	162
Z21	2.8	1,885	5,278
Z22	2.9	230	667
			7,789
LE MAX	10.7	4,355	46,599

## Split Z21 instead

Section	Miles	Cust	Cust-Mi
Z11-Z12	4.9	625	3,063
Z13	0.1	1,615	162
Z22	2.9	230	667
Z21a	1.4	943	1,320
Z21b	1.4	943	1,320
			6,530
LE MAX	10.7	4,355	46,599

# Answers to Placement of Devices for exercises #1 and #2

...will be given out tomorrow during  
the meeting of the Working Group on  
Switching and Overcurrent Protection.

# Working Group on Switching and Overcurrent Protection

Meeting Agenda – Rm 205C

Tuesday July 27, 2010 8-10 am

Minneapolis MN

Lee Taylor, Chair

Charlie Williams, Vice Chair

Frank Lambert, Secretary