# 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

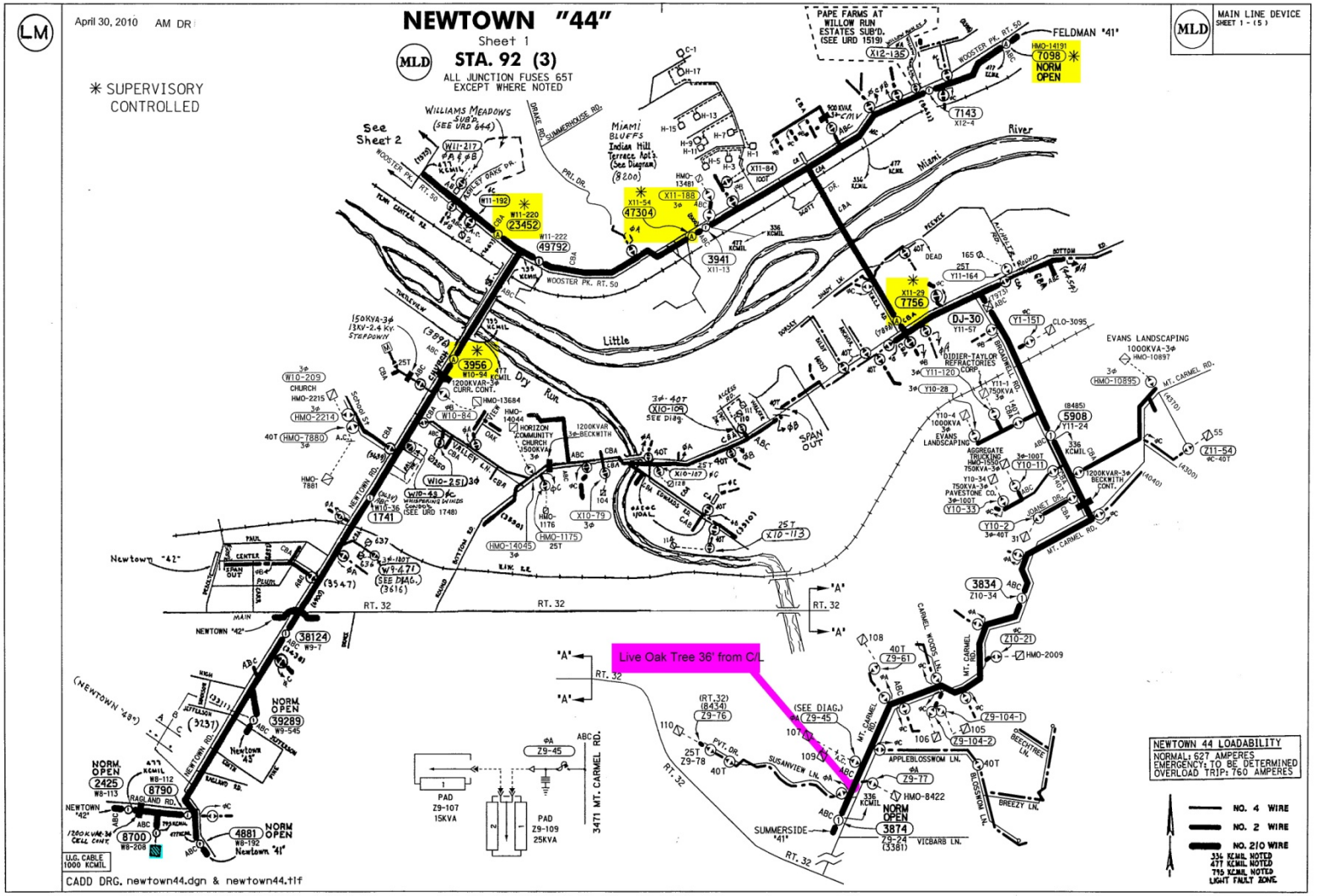
**Region A**

- 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

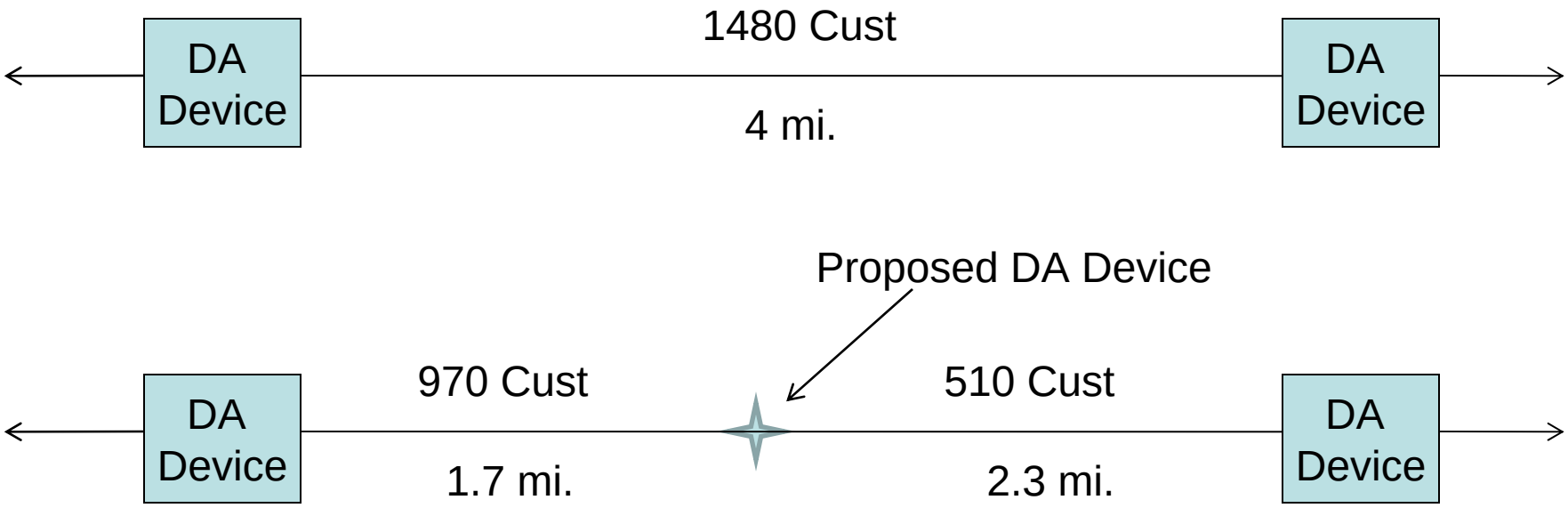
**Region B**

- 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

# Radial vs. Loop Sectionalization



# DA SECTIONALIZATION

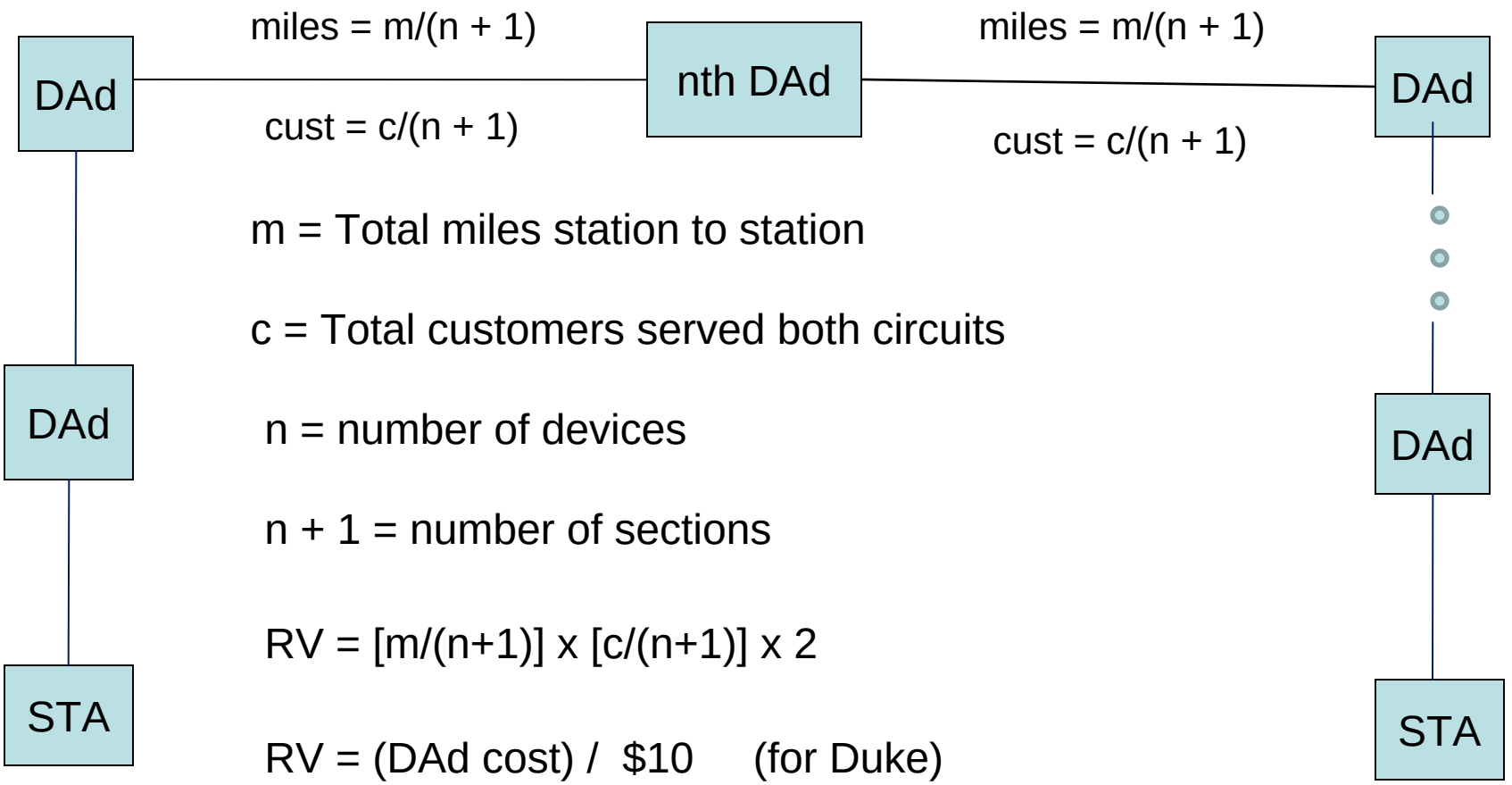



RV = cust upstream X miles downstream + cust downstream X miles upstream

RV = 970 x 2.3 + 510 X 1.7 = 2,231 + 867 = 3,098 cm

Reliability Budget = 3,098 x $10 = $30,980

# How many DA devices to place?




m = Total miles station to station

c = Total customers served both circuits

n = number of devices

n + 1 = number of sections

RV = [m/(n+1)] x [c/(n+1)] x 2

RV = (DAd cost) / $10 (for Duke)

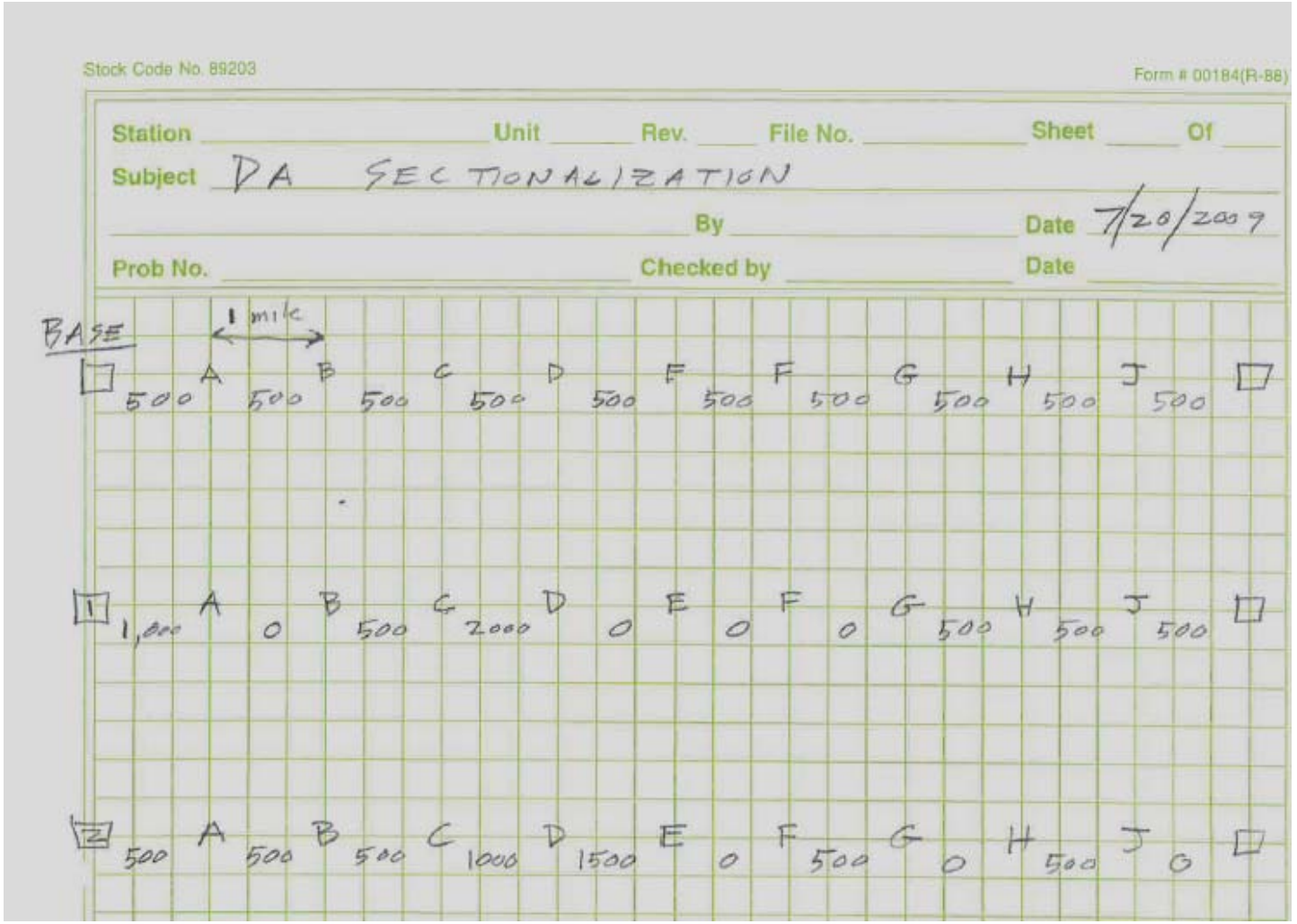
… where $10 (for Duke) = 0.2 faults per mile per yr X $50 cost to prevent CI per year

# 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 |

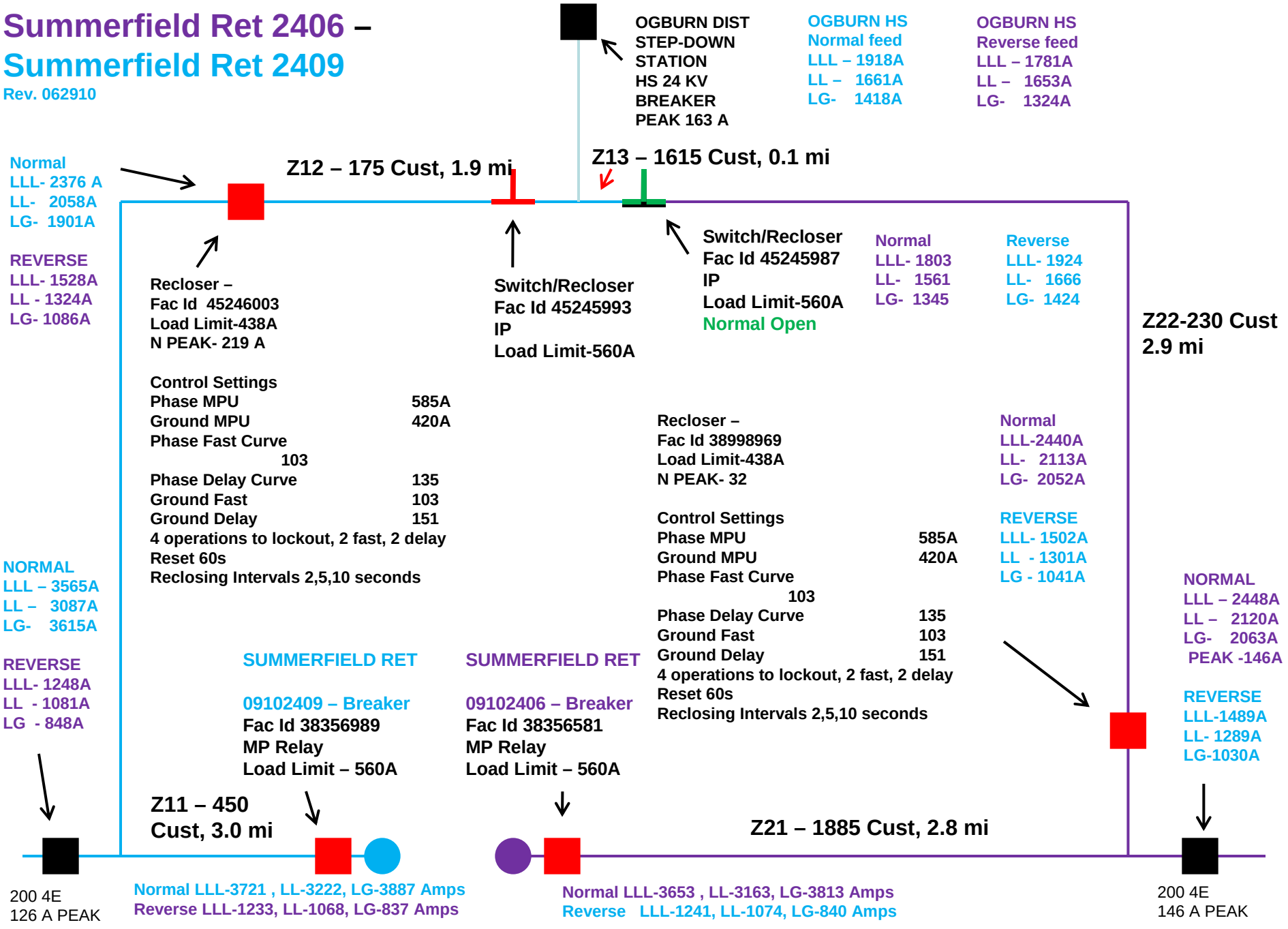
| Total Customer Miles | Number of DA Devices Needed in 2 Circuit Loop |
|---|---|
| 13,500 | 2 |
| 24,000 | 3 |
| 37,500 | 4 |
| 54,000 | 5 |
| 73,500 | 6 |
| 96,000 | 7 |

# Where are the best locations for four devices?



# Summerfield Ret 2406 – Summerfield Ret 2409

Rev. 062910



# 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