Spring 2012 ICC Educational Session

Accelerated Aging Tests for Transmission Cables – Part 2

II. Field Aged Cable Performance Data and Correlation to Accelerated Aging Data

HV AC Extruded Cables

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Southwire Company

Seattle, WA March 28, 2012

Overview

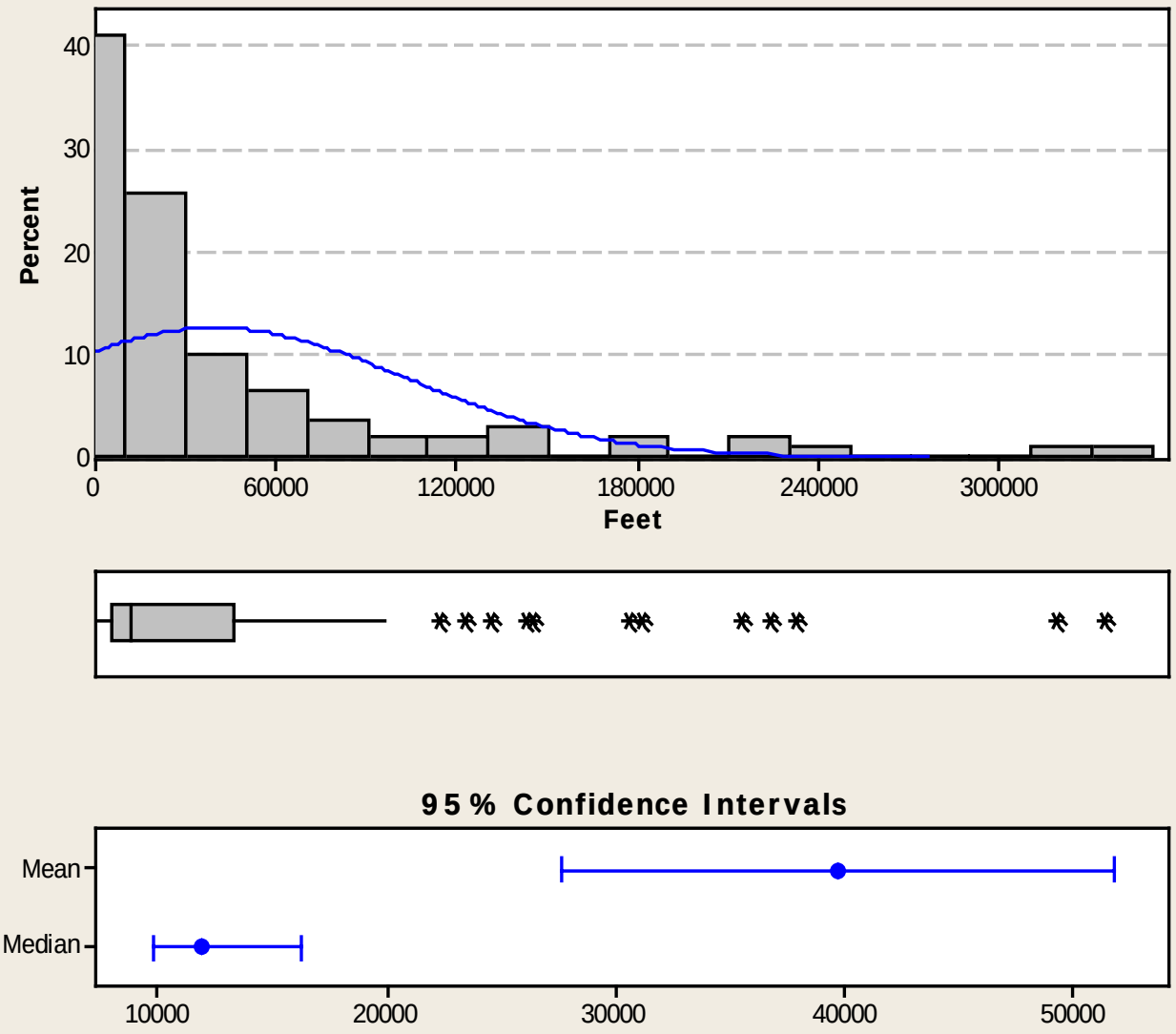
- Caution – Not all cables are created equal
- Cable Population by Voltage Class and Frequency
- Insulation Wall Thickness – Traditional Wall vs. Stress Based Design
- Cable Population with Stress Based Design
- Accelerated Aging Stress vs. Cable Population
- Concept of the Life Curve
- Cable Life Curves
- Discussion: Cable Life Curves vs. Cable population

Caution – Not all cables are created equal

- Length – test short length, infer performance of long length
- Big vs. small
- Insulation and shield materials may vary
- We have both wet and dry designs
- Small and big cable orders
- Consistency in materials and processing
- Voltage classes dictate variations in stress

Summary for Feet

Voltage (kV) = 69

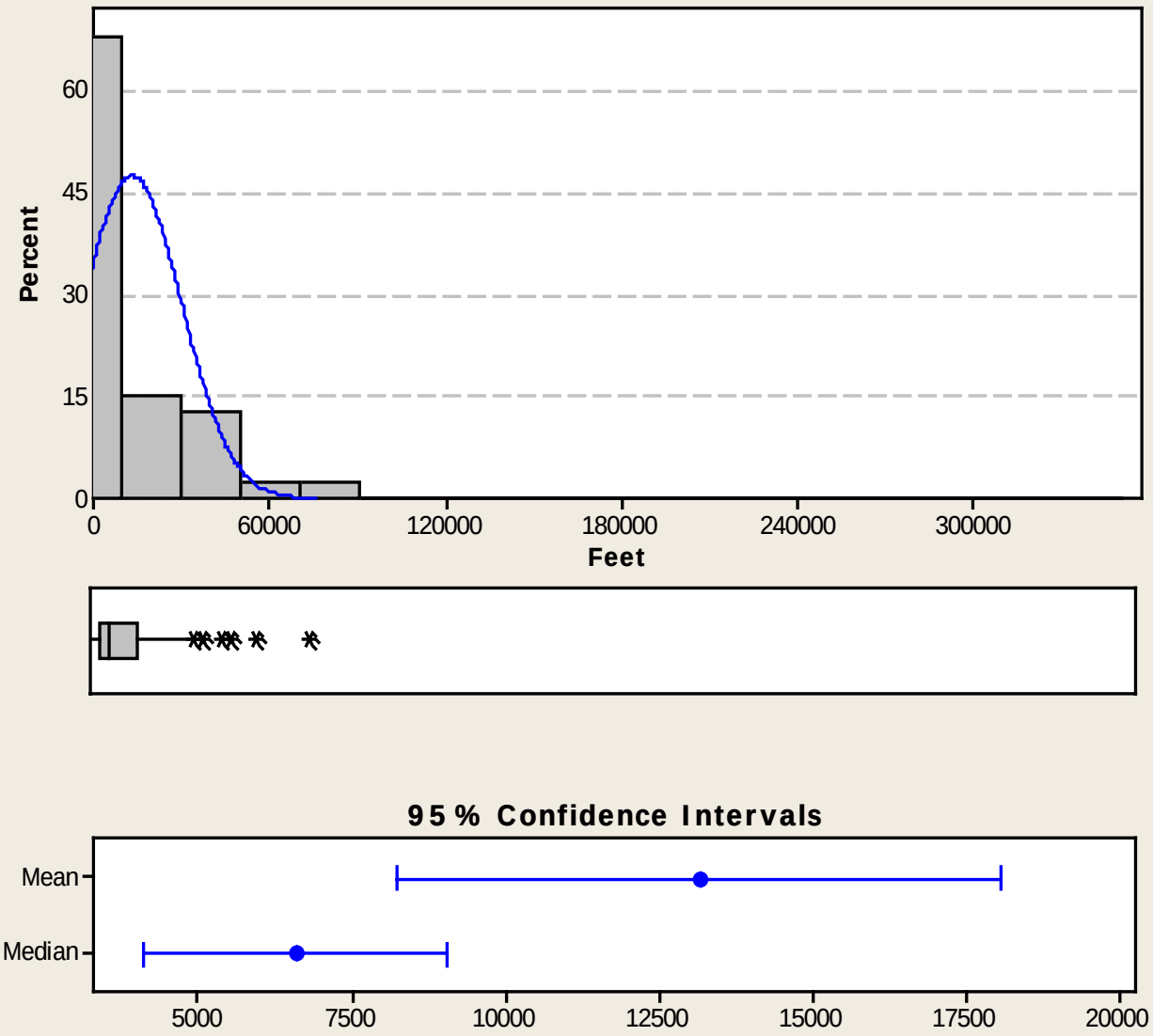


Important aspects:

- How much cable are we looking at?
- How often do we make the same cable?
- How long are the cable runs?
- How similar or different are these cables?

Summary for Feet

Voltage (kV) = 115

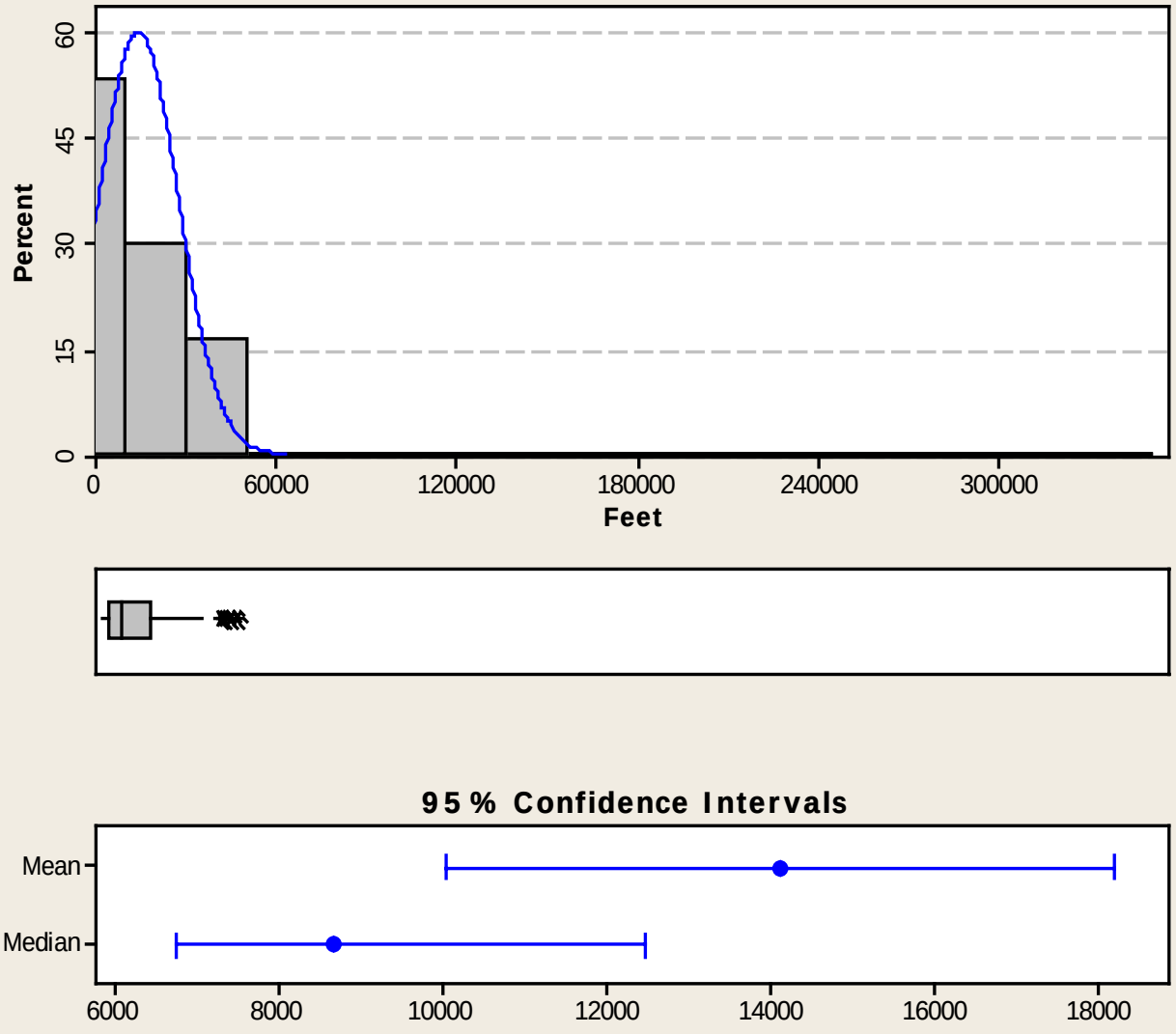


Important aspects:

- How much cable are we looking at?
- How often do we make the same cable?
- How long are the cable runs?
- How similar or different are these cables?

Summary for Feet

Voltage (kV) = 138

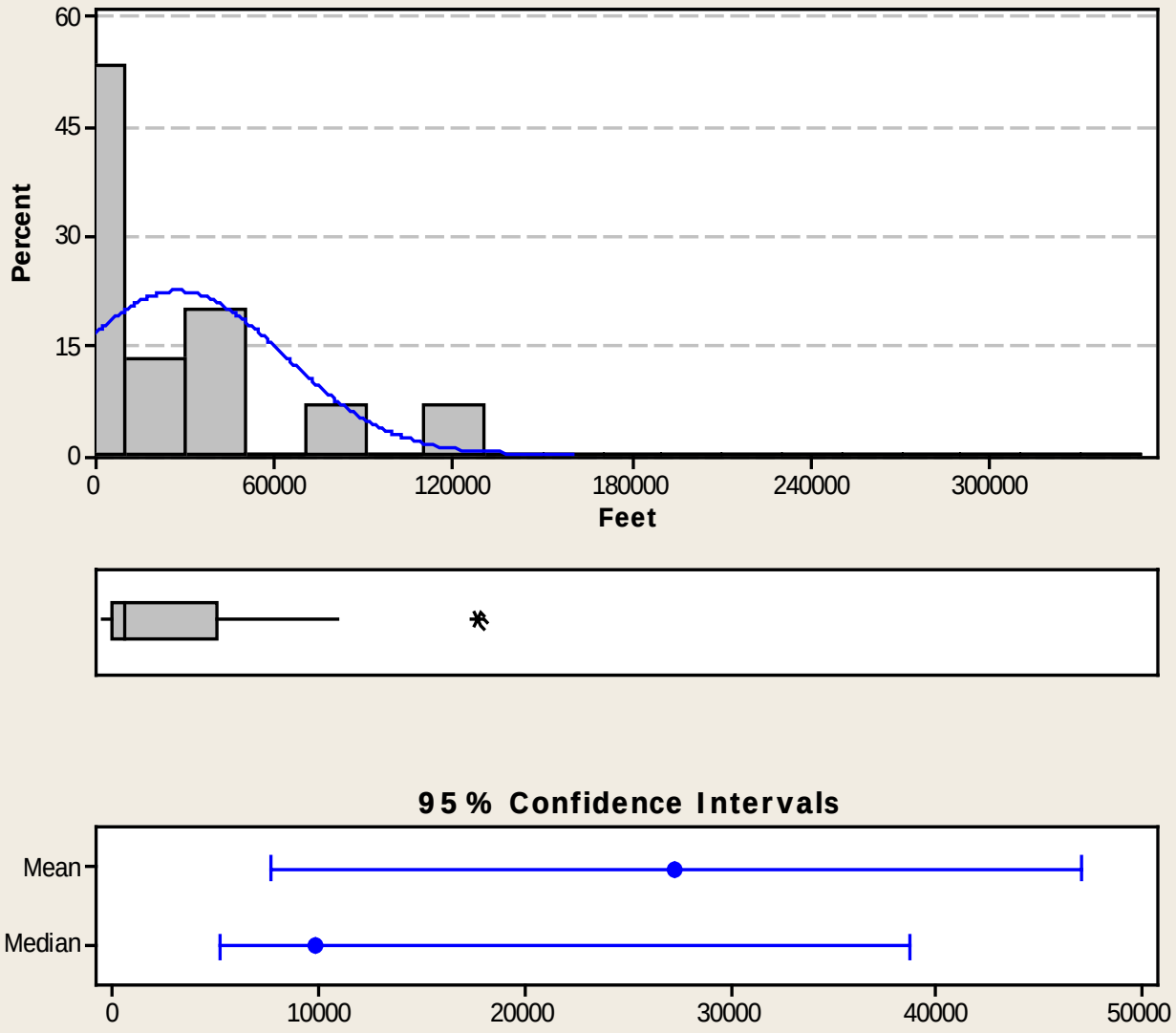


Important aspects:

- How much cable are we looking at?
- How often do we make the same cable?
- How long are the cable runs?
- How similar or different are these cables?

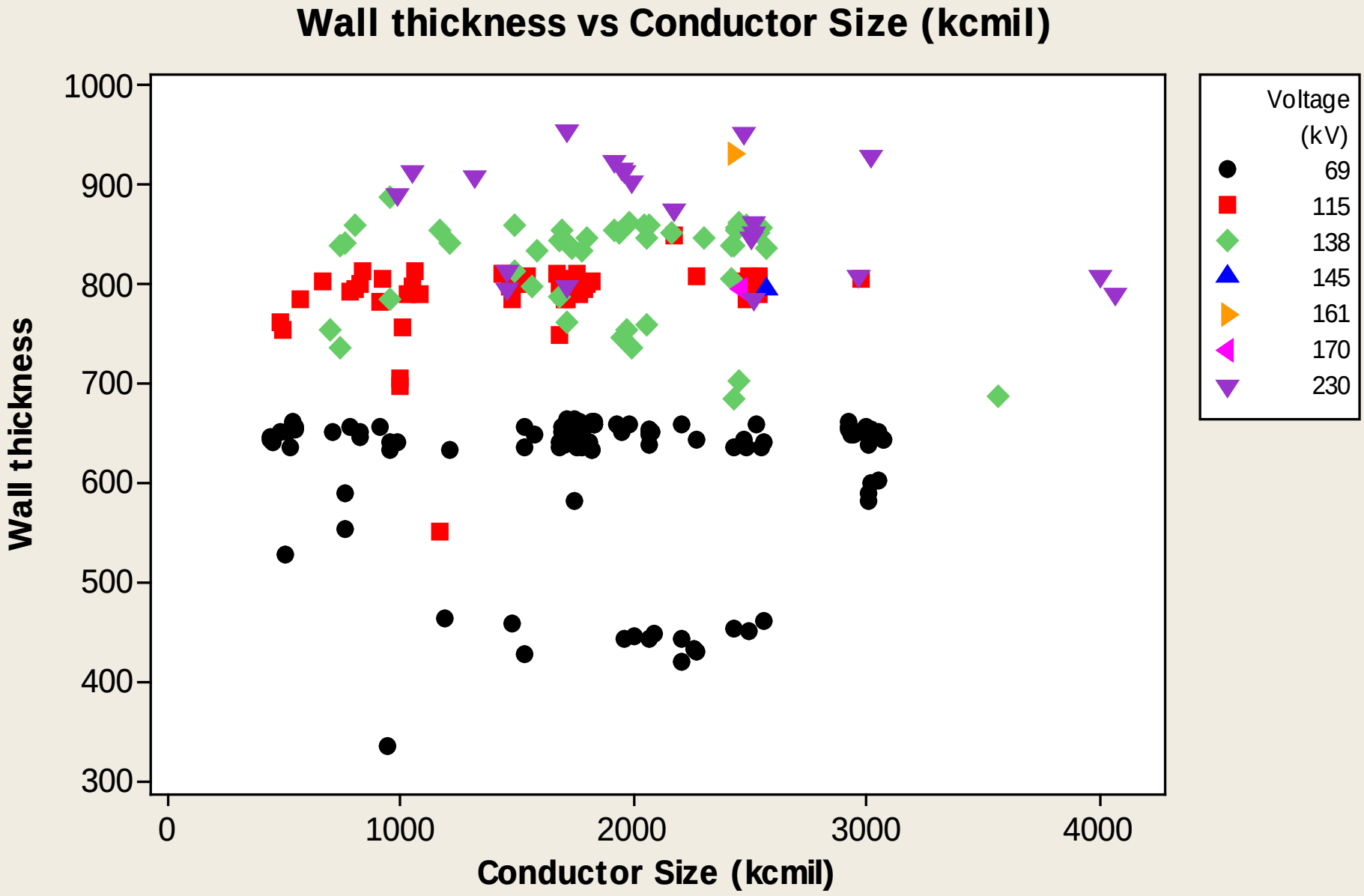
Summary for Feet

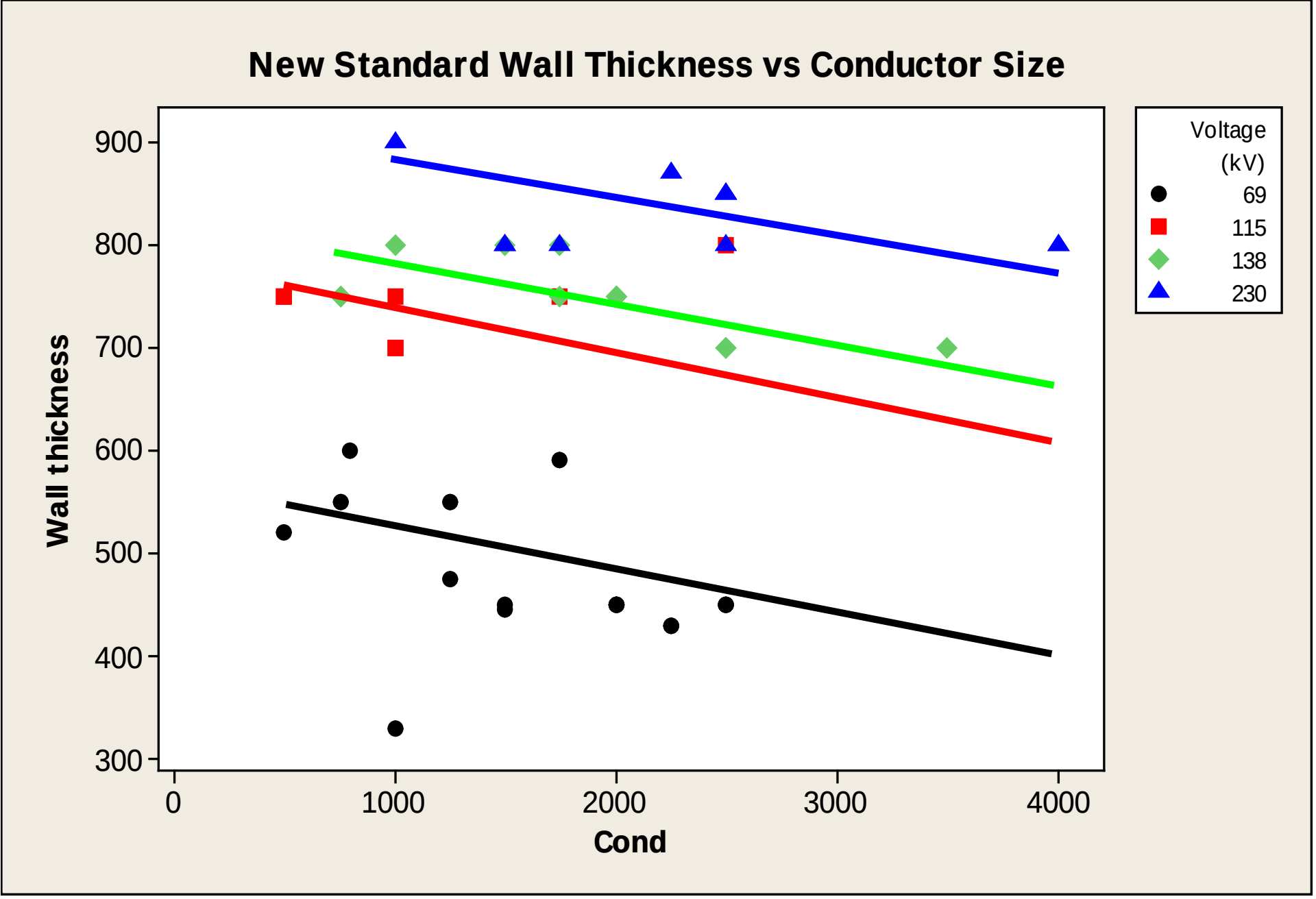
Voltage (kV) = 230

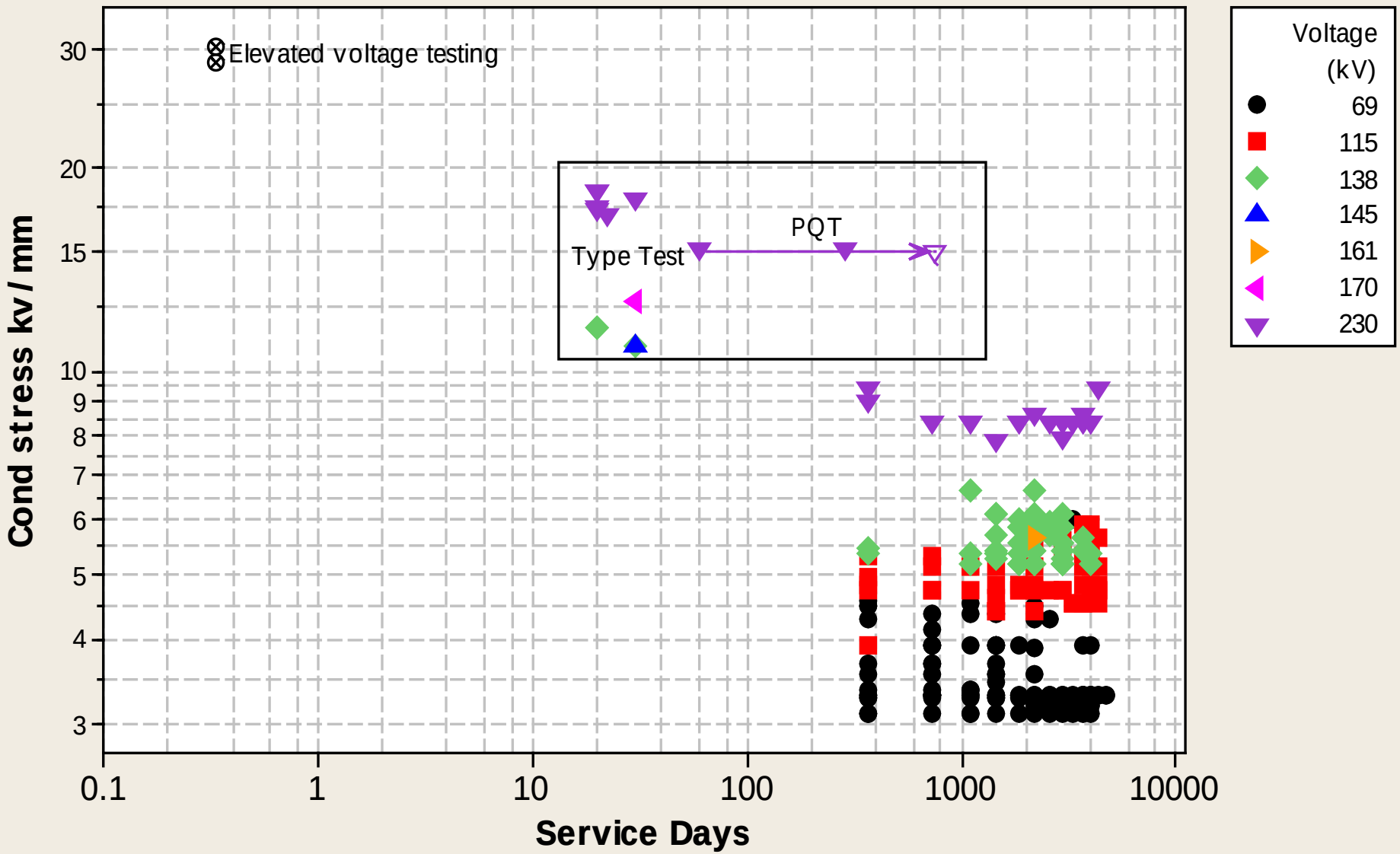


Important aspects:

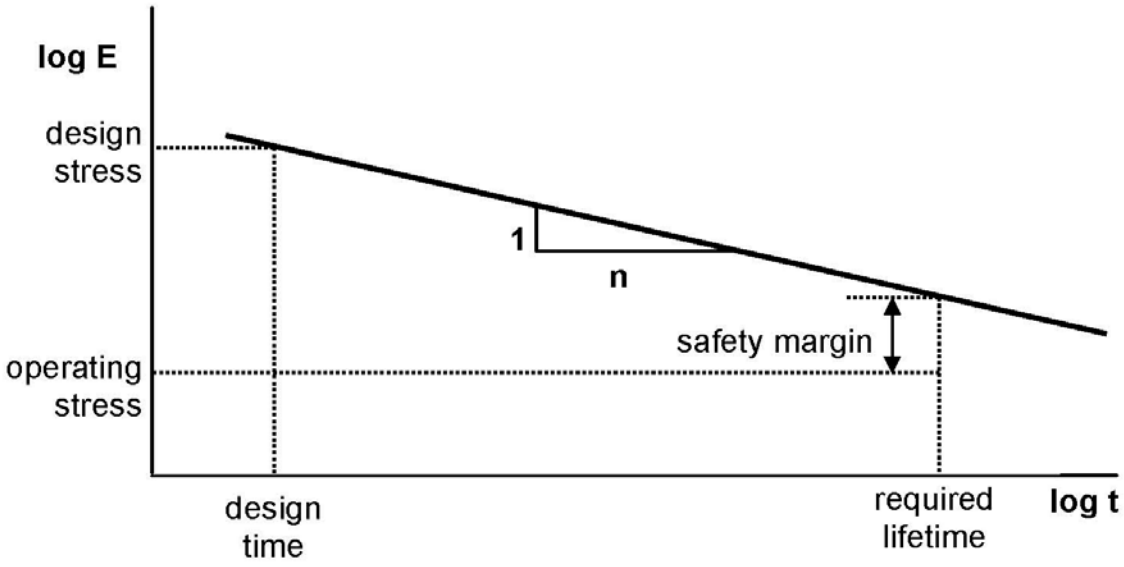
- How much cable are we looking at?
- How often do we make the same cable?
- How long are the cable runs?
- How similar or different are these cables?


Wall thickness vs Conductor Size (kcmil)
Wall thickness
1000
900
800
700
600
500
400
300
0
1000
2000
3000
4000
Conductor Size (kcmil)
Voltage (kV)
69
115
138
145
161
170
230

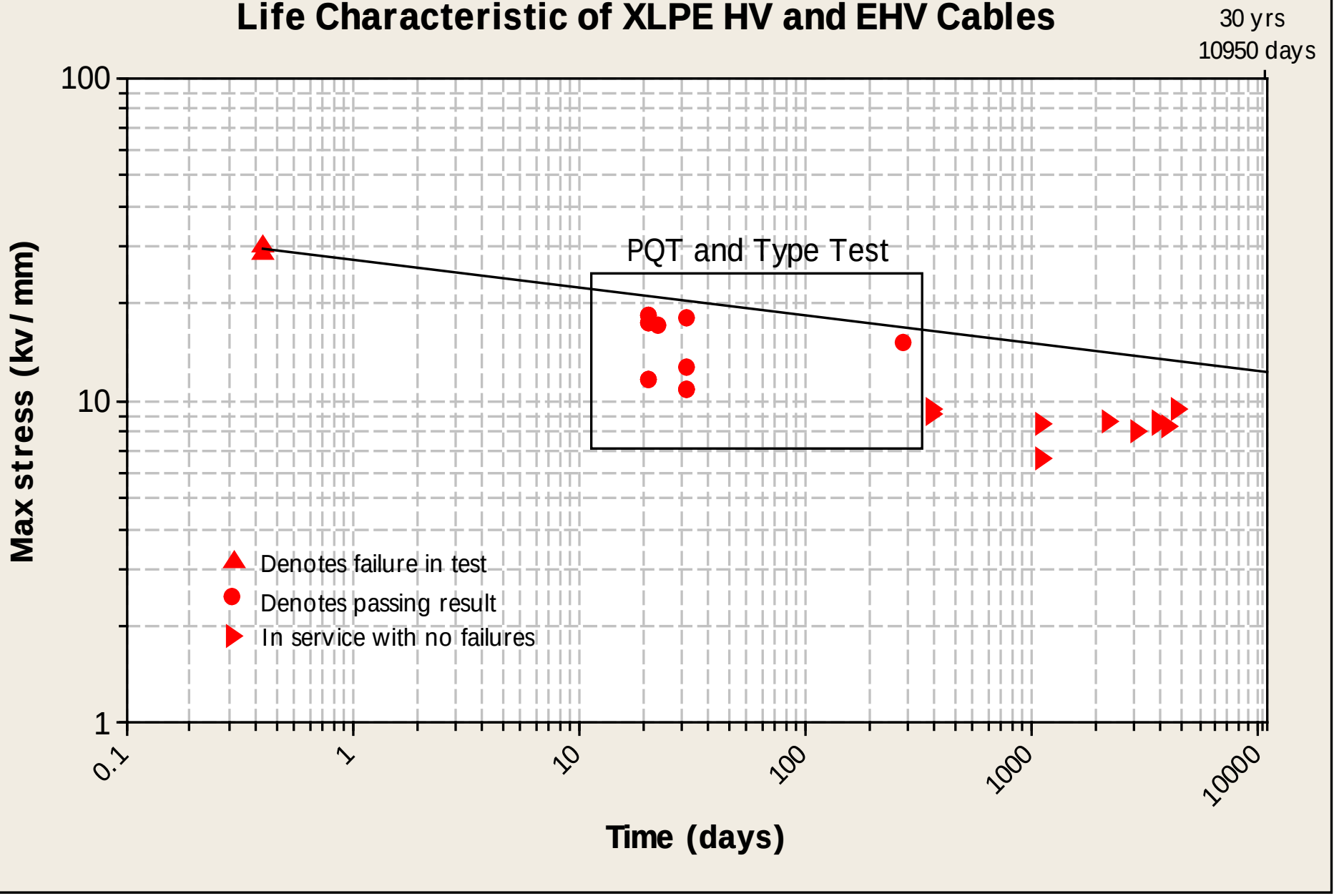

New Standard Wall Thickness vs Conductor Size
Wall thickness
900
800
700
600
500
400
300
0
1000
2000
3000
4000
Cond
Voltage (kV)
69
115
138
230

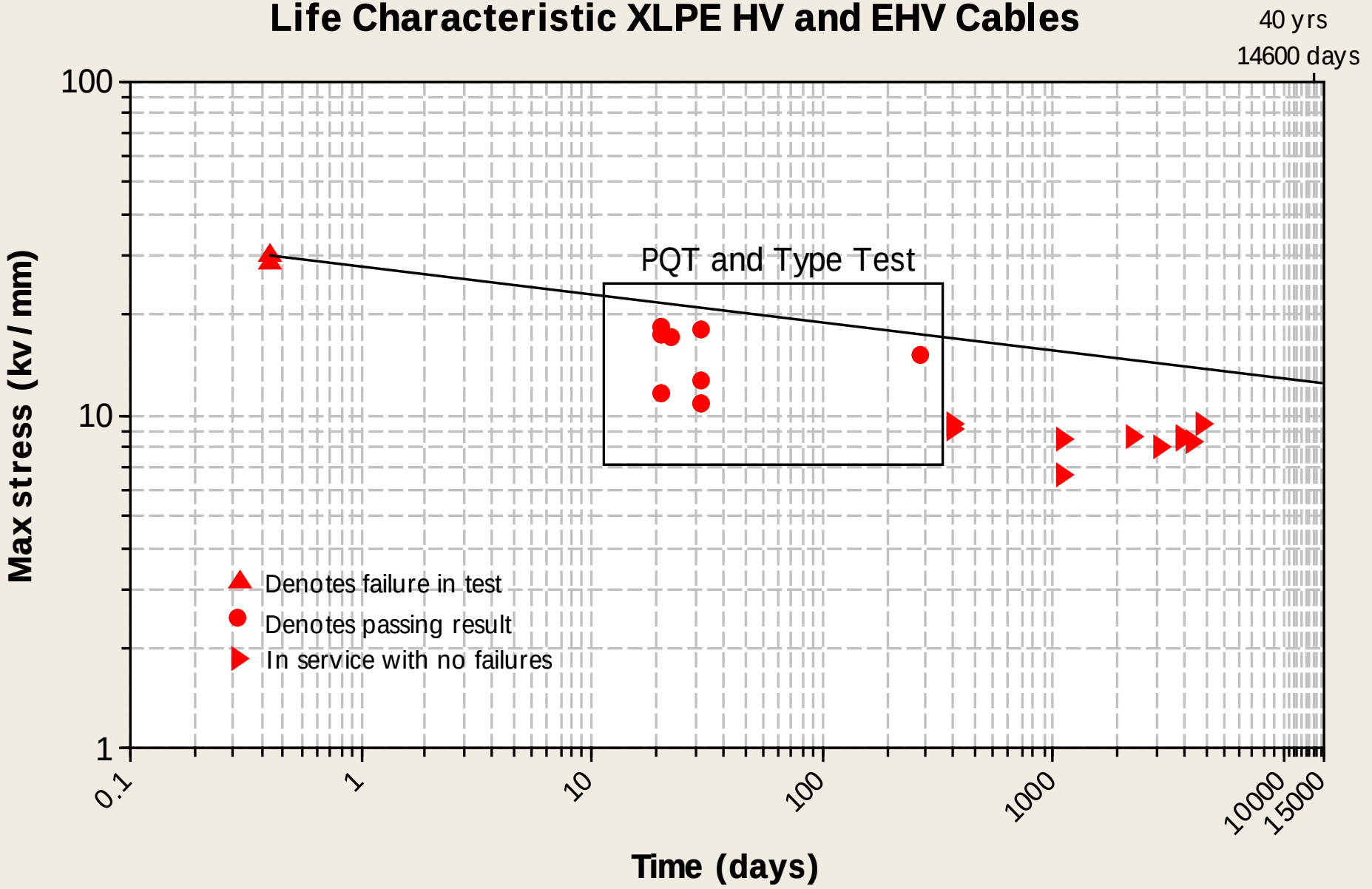

Cond stress kv / mm vs Service Days
Elevated voltage testing
Type Test
PQT
Voltage (kV)
69
115
138
145
161
170
230
Cond stress kv / mm
30
20
15
10
9
8
7
6
5
4
3
0.1
1
10
100
1000
10000
Service Days

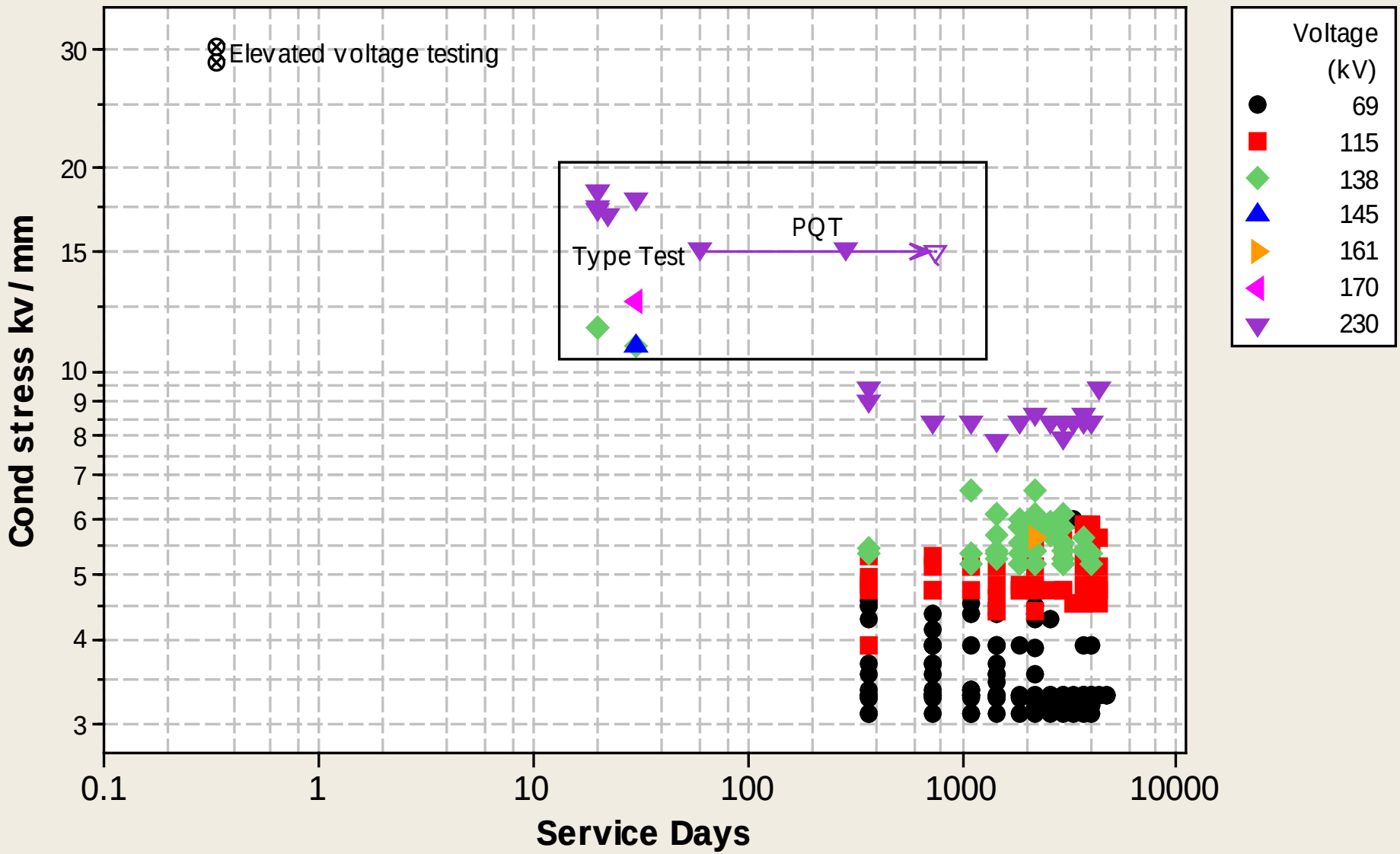
LIFETIME CURVE



Fall ICC, 2011, Denver, Colorado


Life Characteristic of XLPE HV and EHV Cables
30 yrs
10950 days
100
10
1
Max stress (kv / mm)
PQT and Type Test
Denotes failure in test
Denotes passing result
In service with no failures
0.1
1
10
100
1000
10000
Time (days)


Life Characteristic XLPE HV and EHV Cables
40 yrs
14600 days
100
10
1
Max stress (kv / mm)
PQT and Type Test
Denotes failure in test
Denotes passing result
In service with no failures
0.1
1
10
100
1000
10000
15000
Time (days)


Cond stress kv / mm vs Service Days
Elevated voltage testing
Type Test
PQT
Voltage (kV)
69
115
138
145
161
170
230
Cond stress kv / mm
30
20
15
10
9
8
7
6
5
4
3
0.1
1
10
100
1000
10000
Service Days