

Benefits of Water Barriers on Cable Longevity – a few insights from datamining previous A6D presentations

Fall 2025 ICC

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Information taken from
presentation at the last A6D
Discussion Group

Effect of water barrier layers on insulating performance degradation for 66 / 77 kV XLPE cables through experimental investigation for those decommissioned from actual power grids

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and Takashi Kurihara**

**Central Research Institute of Electric Power Industry
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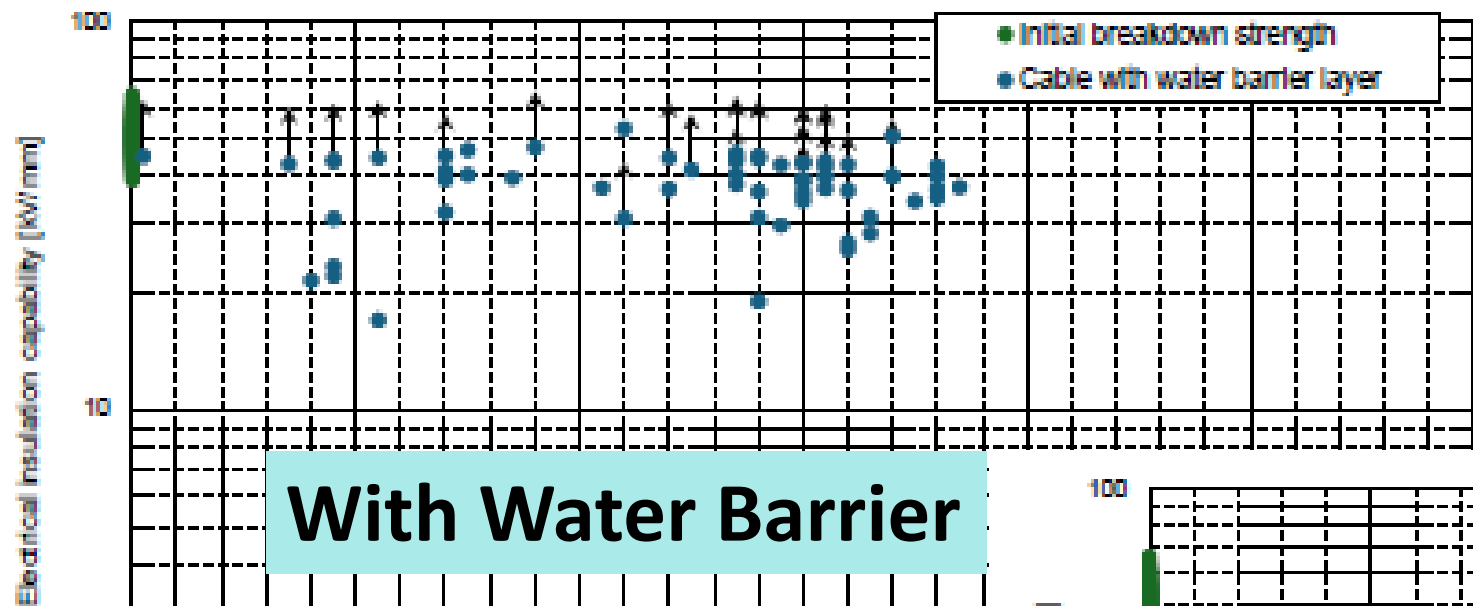
**Presented at: ICC 2025 Spring Meeting, Louisville, KY
A06D, Chair - Rajesh Narayanan, Vice Chair – Vacant
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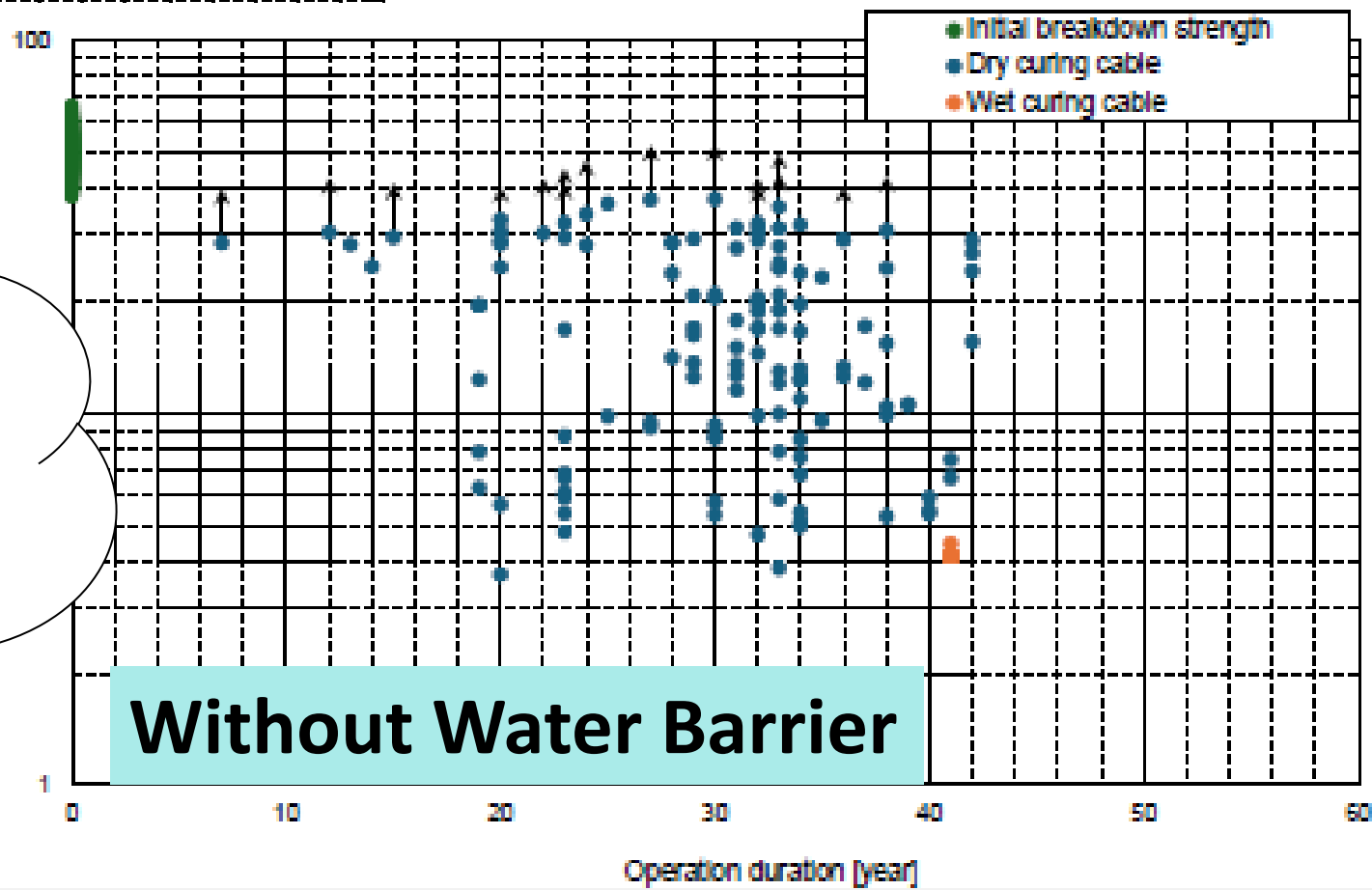
Background

Classification of cable specimen	Laid in underground ducts, in pits, etc., where moisture may affect, without water barrier layer	Laid in underground pipes, in pits, etc., where moisture may affect, with water barrier layer
Rated voltage	66 and 77 kV	
Nominal conductor size	80 to 2500 mm ²	80 to 2000 mm ²
Operating duration (age)	7 to 42 years	0.5 to 37 years
Year of manufacturer	1972 to 2000	1984 to 2014
Number of specimen	131 phases (Dry-curing type : 129 phases, wet-curing type: 2 phases)	61 phases (all are dry-curing type)





With Water Barrier

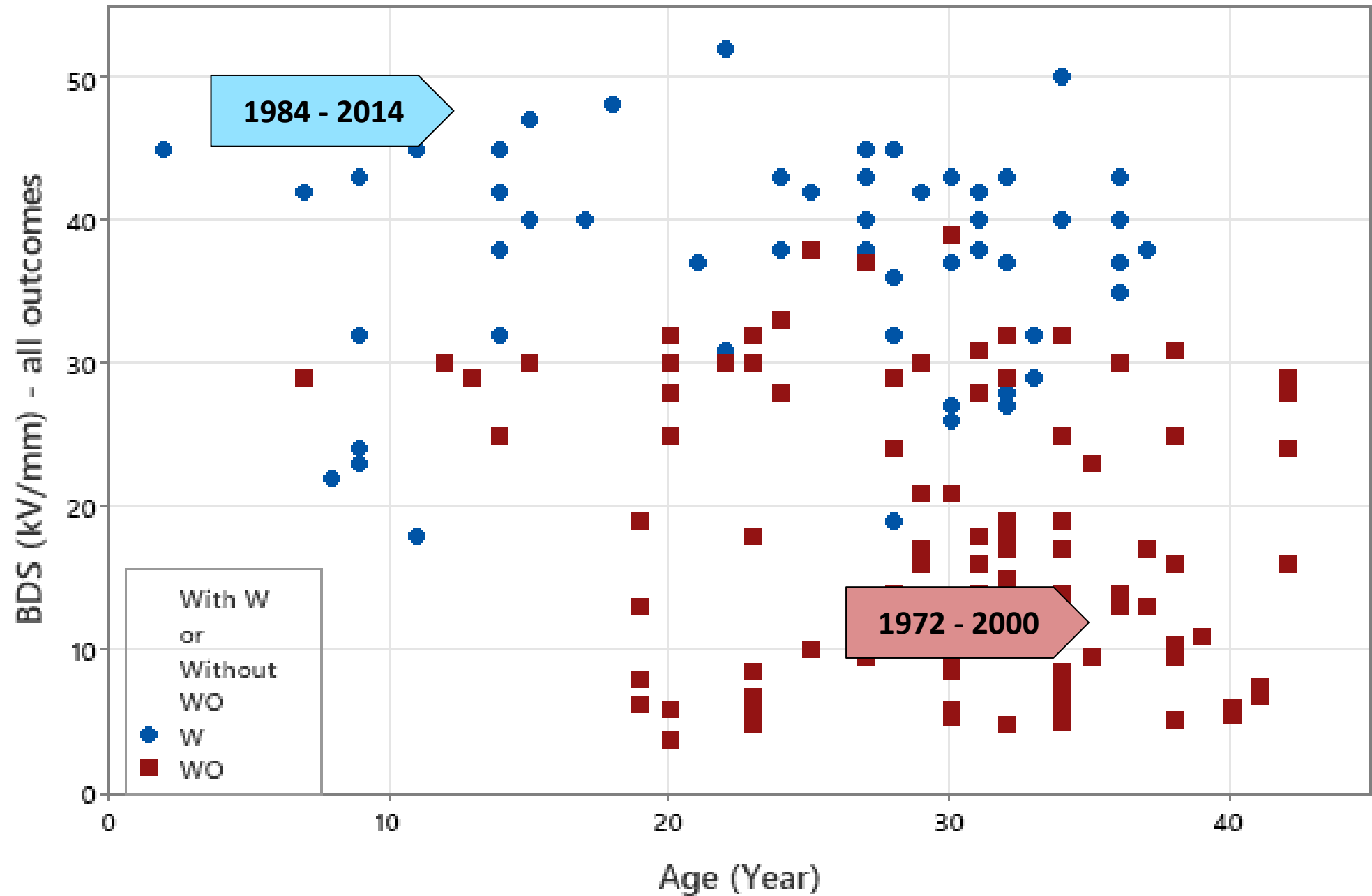


Without Water Barrier

Water tree degradation is a concern at HV if there is no water barrier

Rate of degradation is lower if a water barrier is present

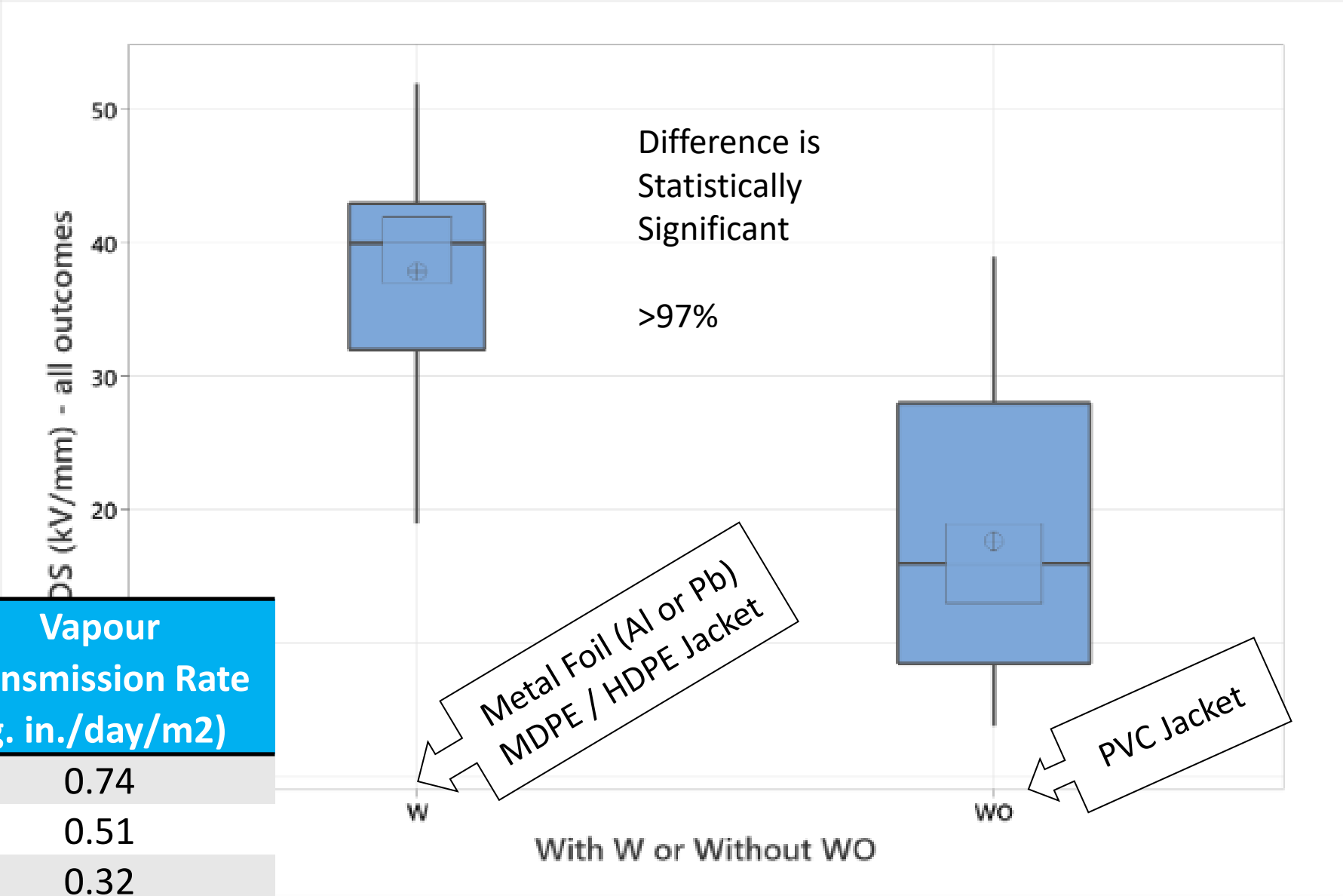
After Extraction



Impact of Water Barriers

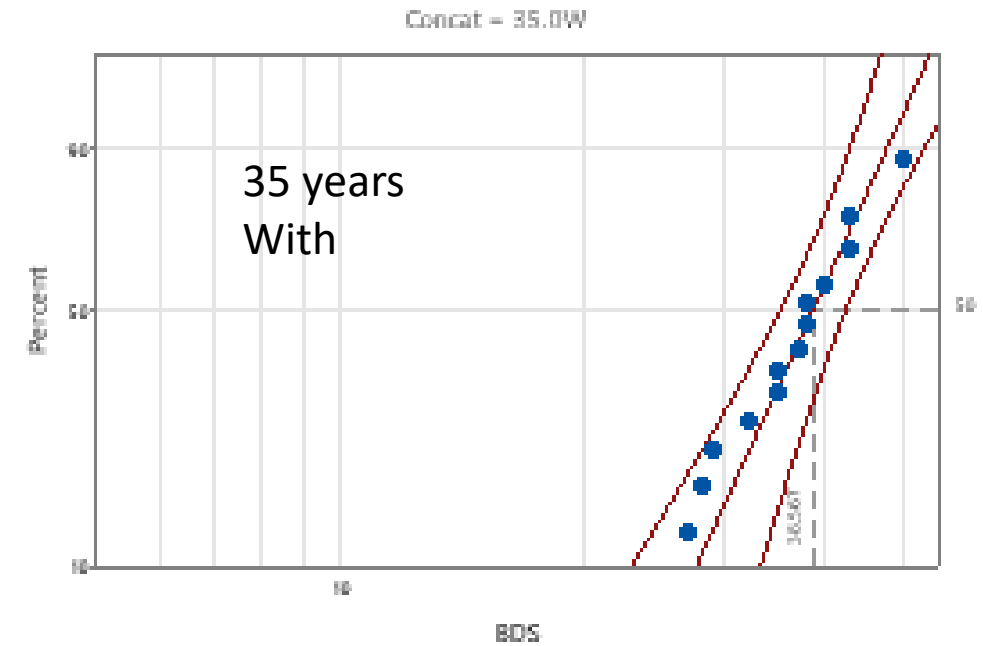
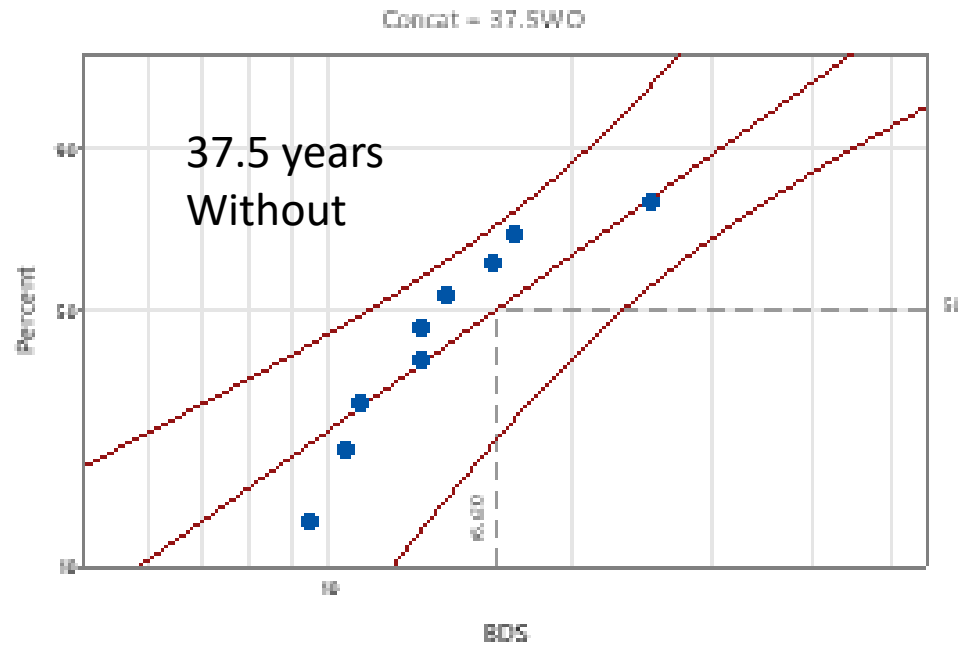
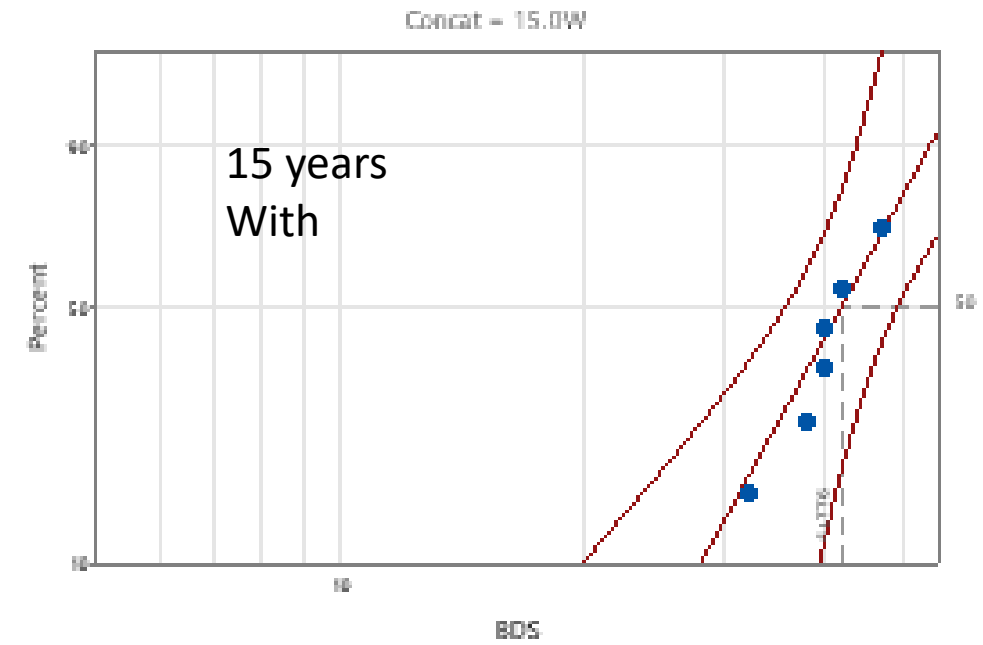
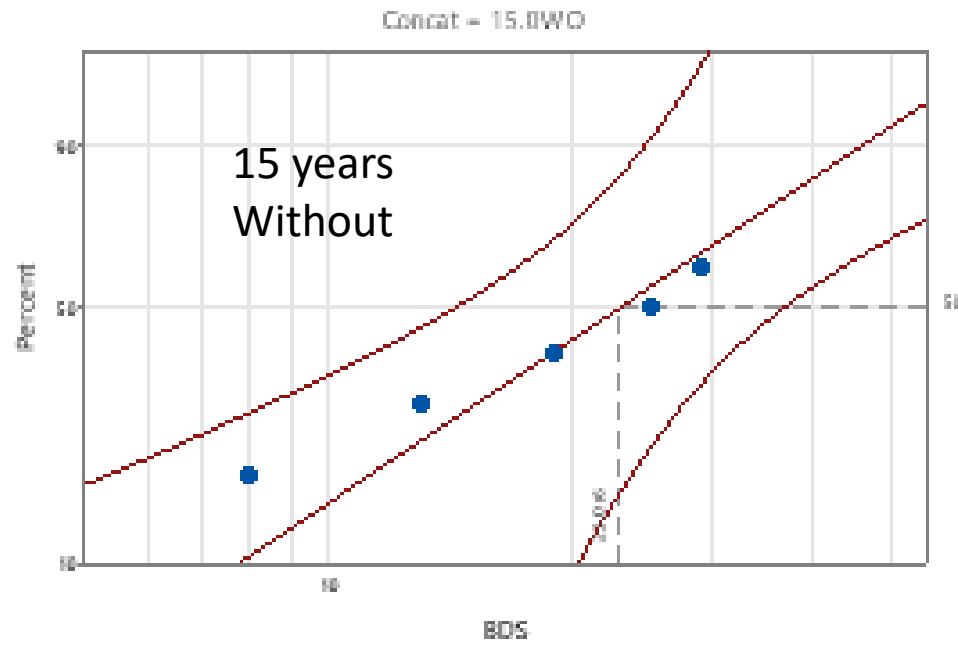
Age 15 - 35

Polymer	Hardness (Shore D)	Vapour Transmission Rate (g. in./day/m2)
LLPDE	45 – 48	0.74
MDPE	53 – 54	0.51
HDPE	57 – 61	0.32
PVC	35 - 43	10

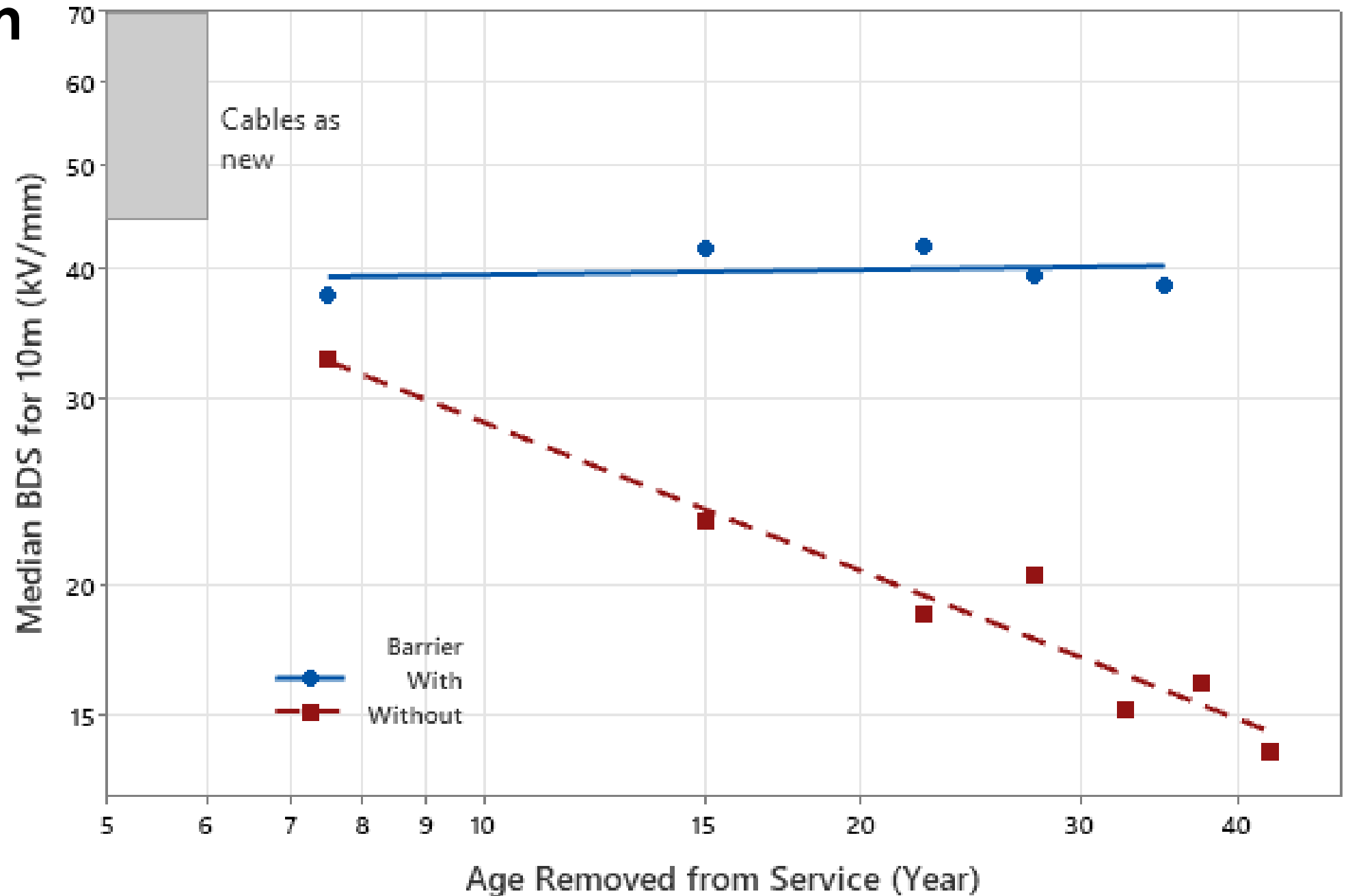


Weibull Analysis

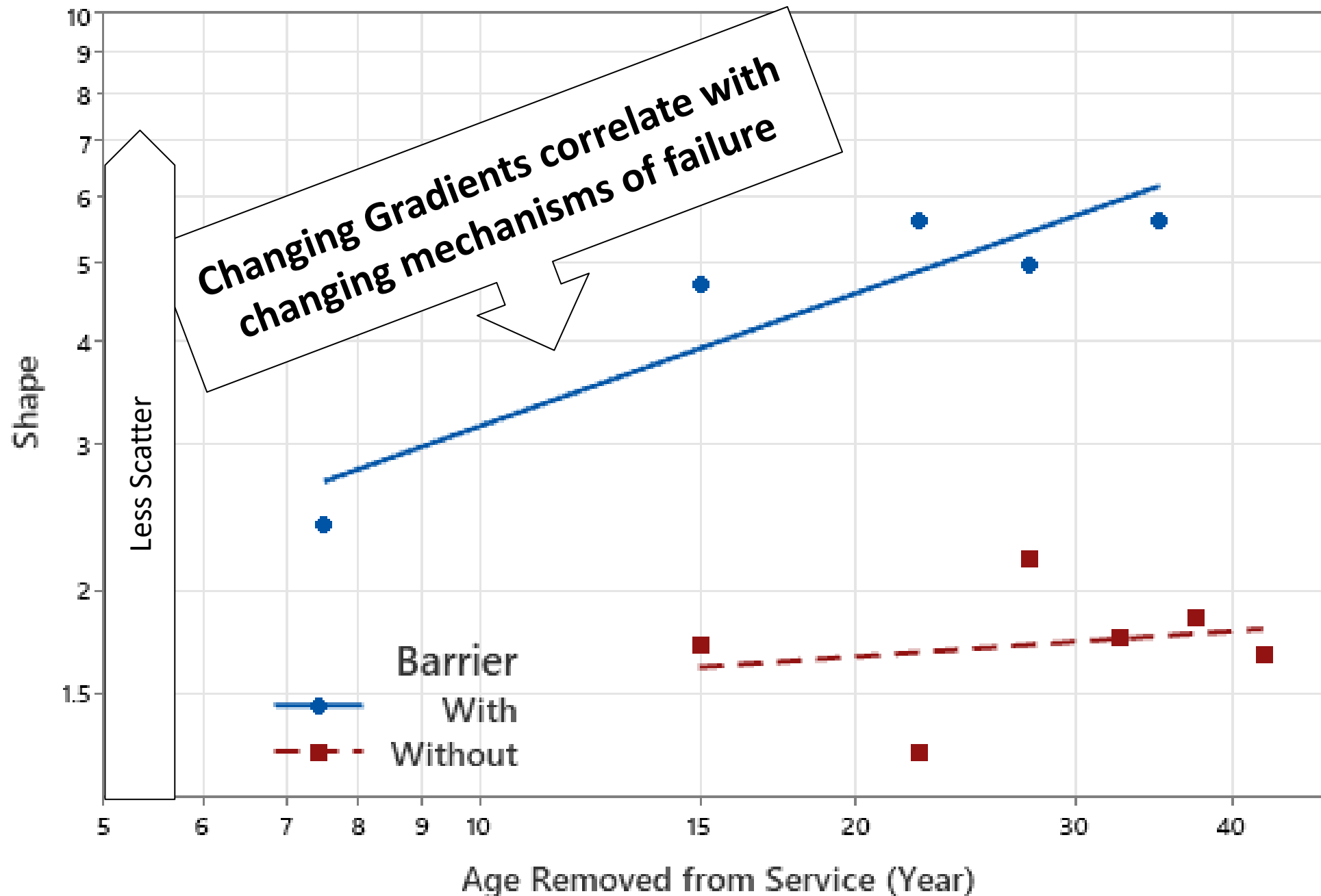
Frequentist analysis
(non Bayesian)



Breakdown Strength Reduces

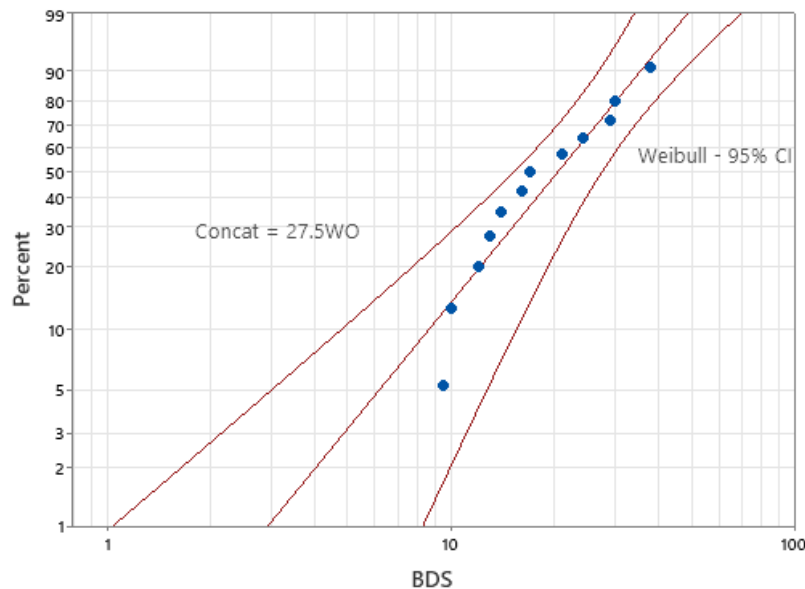
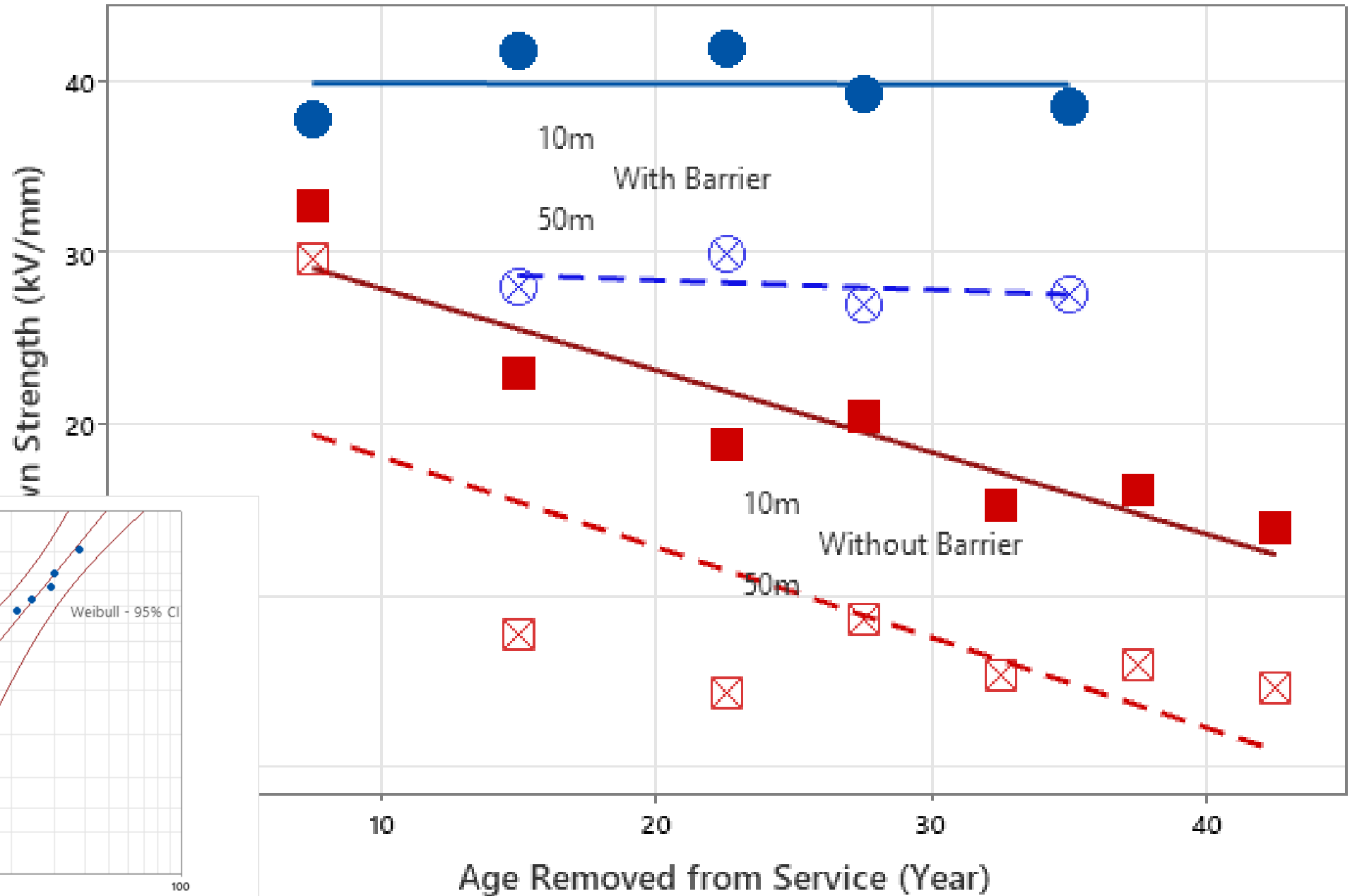


Shape Parameter – Mechanism of Failure



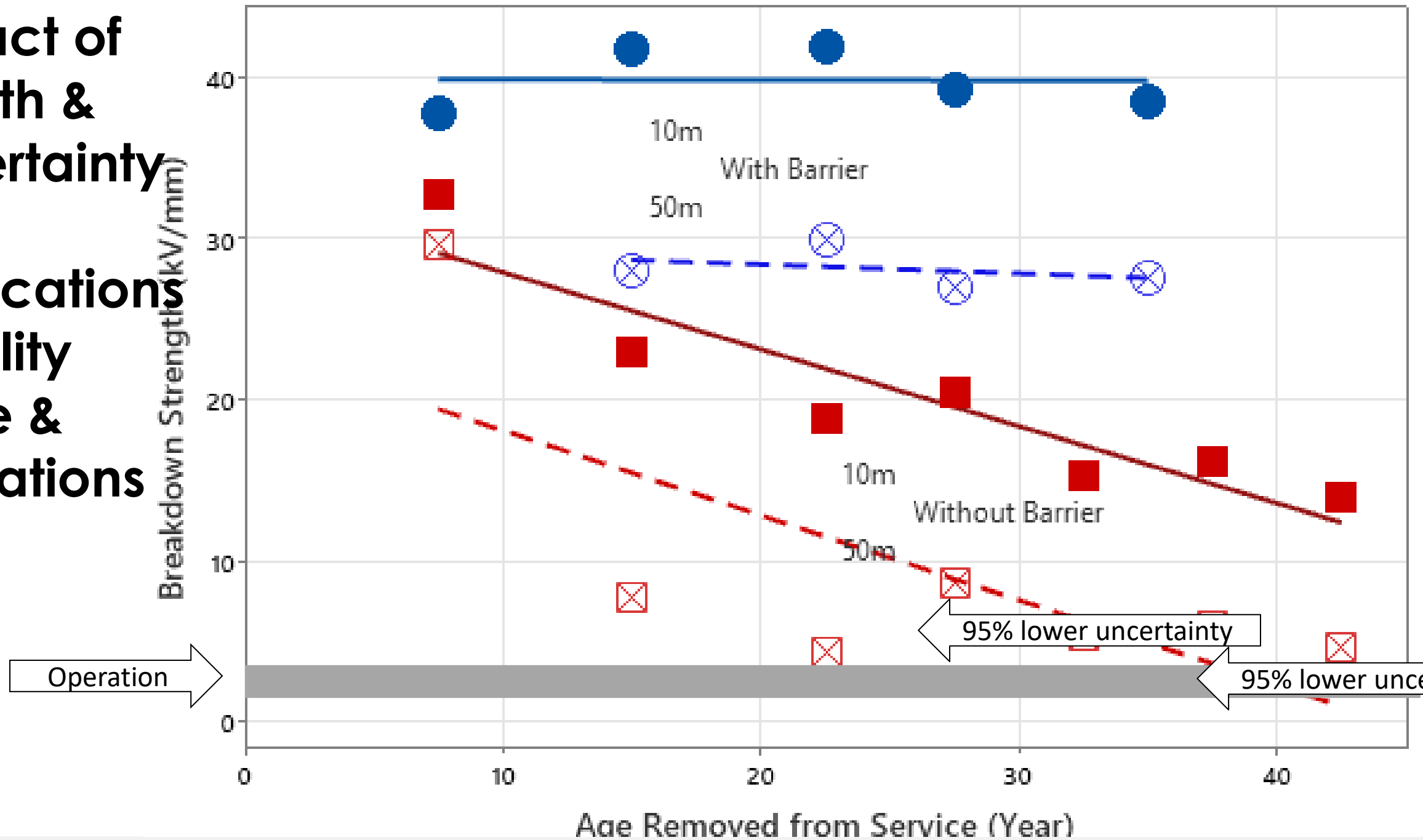
Impact of Length

Implications at utility scale



Impact of Length & Uncertainty

Implications at utility scale & operations



To Wrap Up

1. Very interesting experimental work on a problem that can really only be resolved in the field
2. Analysis required to extract the full value
3. Weibull Analysis is the appropriate approach for failure data
 1. Censors
 2. Shape is an alias for the mechanism
4. Interpret at an appropriate length scale
5. Quantifies the benefit of water barriering in a wet design

To Ponder

Are there undiscovered issues with “wet design” HV Subsea Cables?