Aged Concrete Poles

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Situation

June 2016:

- Incident near Morrinsville where a concrete pole failed while a line mechanic was working on the pole from a ladder.
- The line mechanic was unbinding the LV conductors adjacent to a car v pole work site. The line mechanic sustained injuries as a result of the incident.
- Investigation found that the pole had been damaged just below ground level, possibly as a result of the car damage, that cause structural damage to the pole.
- Believed that pole failed under the combined weight of the mechanic, his tools and the ladder after the LV wires were unbound.

Valley 9 pole

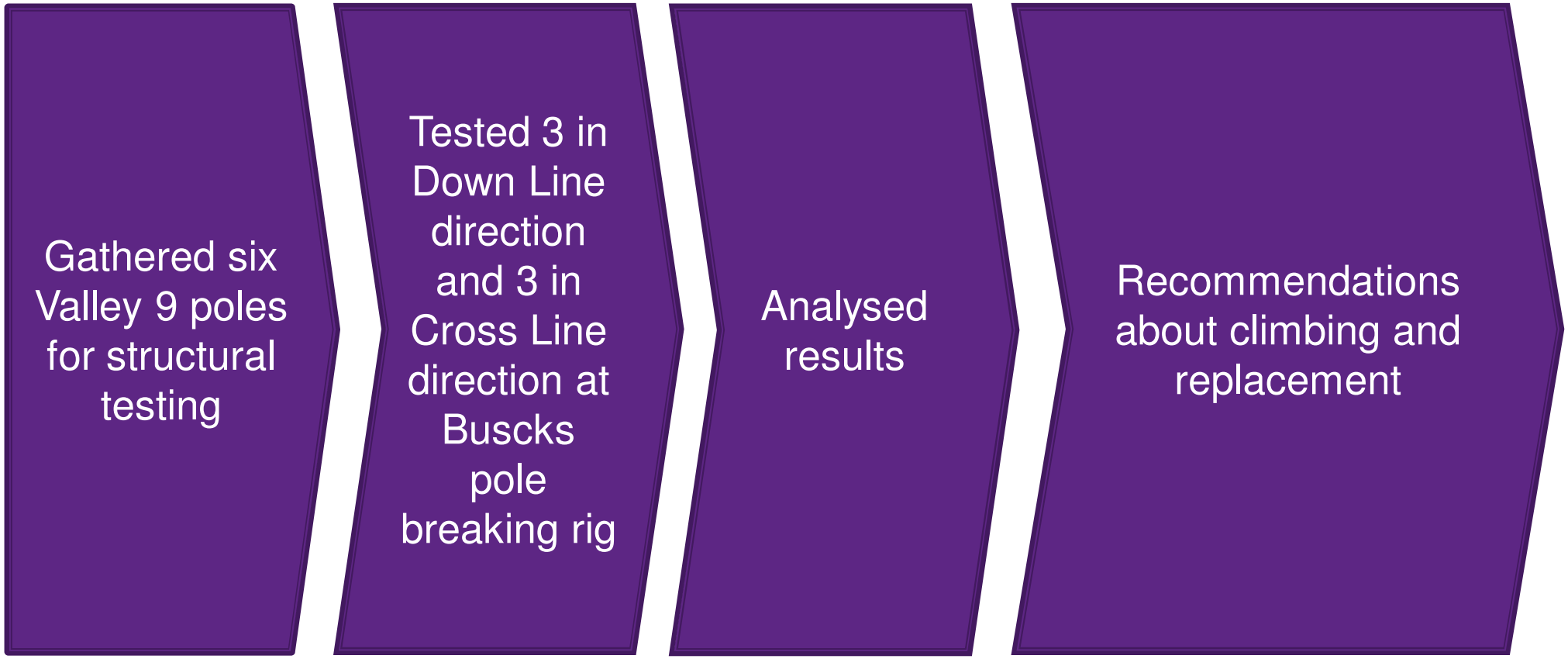
- The pole type is commonly referred to as the Valley 9 – a 9 metre long prestressed concrete pole often found in the Morrinsville area.
- Early versions of the pole have four 7 mm high tensile steel bars with four 5 mm diameter high tensile tendons.
- Later versions have four 9.6 mm diameter pretensioned steel cables.
- Generally made in the late 1950s and 1960, then manufacturer was taken over by Firth.

Pole location

Broken butt (at incident scene, pole removed)

Broken pole and butt (at incident scene)

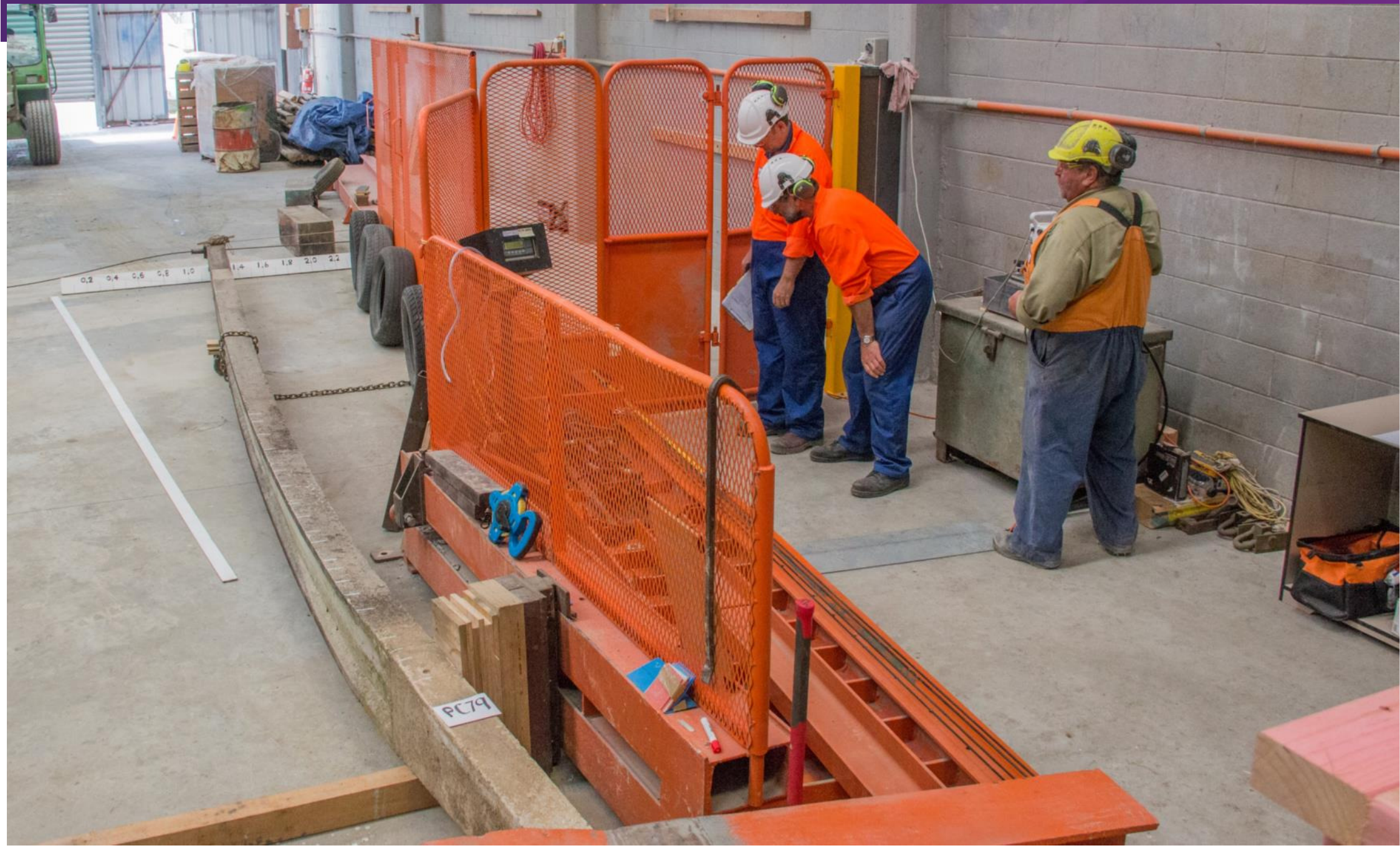
Post Incident Investigation



Cross line pole testing

Down line pole testing

Down line pole testing



Down line pole testing

Below ground line tendon defect on l0888

Below ground line tendon defect close up

Below ground line tendon defect became point of breakage

Damaged tendon at ground line on pole I0885

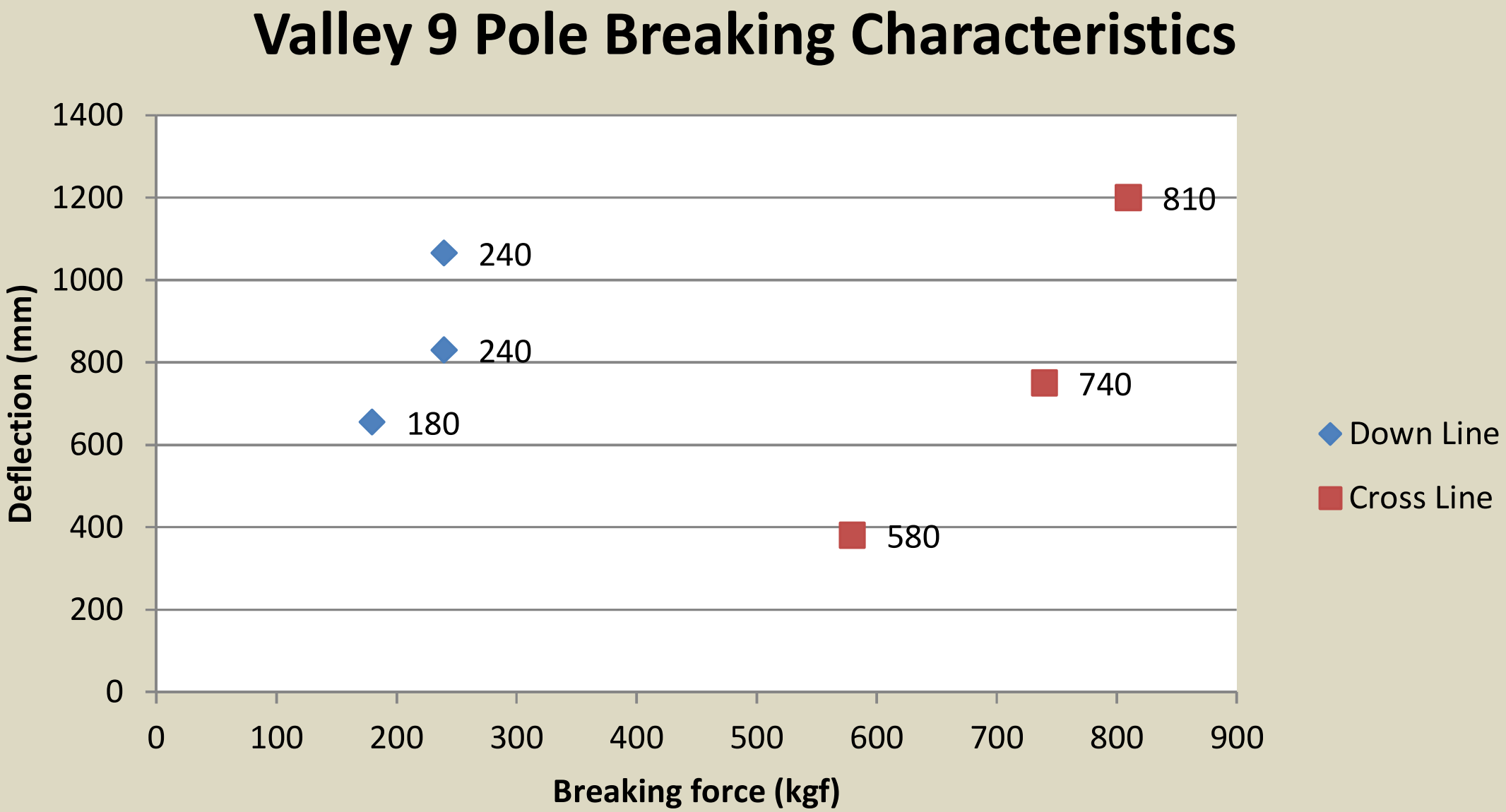
Damaged tendon at ground line on pole I0885

Damaged tendon became point of breakage

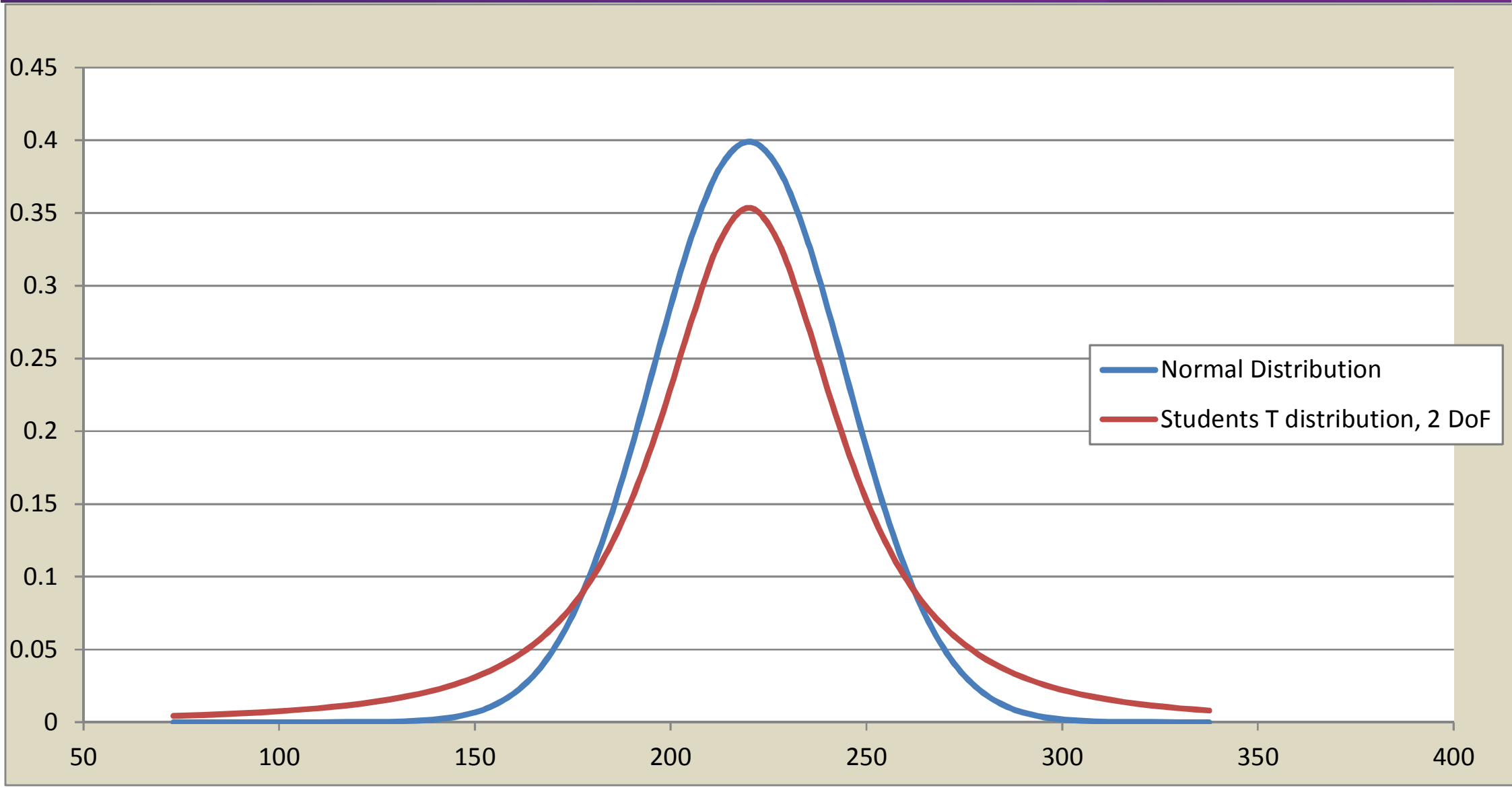
Testing results summary

Test ID	Pole ID	Cast Date	Age	Test Orientation	Breaking Load (kgf)	Deflection (mm)	Comments
Valley 9 Pole							
PC81	I1114	1962	55 years	Down Line	240	1065	
PC79	I0886	1958	59 years	Down Line	240	830	
PC77	I0885	1998 ??? More likely 1958	59 years?	Down Line	180	655	Chip exposing tendon at ground line
PC82	I0888	1968	49 years	Cross Line	580	380	Exposed tendon below ground line
PC78	I0883	1968	49 years	Cross Line	740	750	
PC80	I0884	1960	57 years	Cross Line	810	1200	

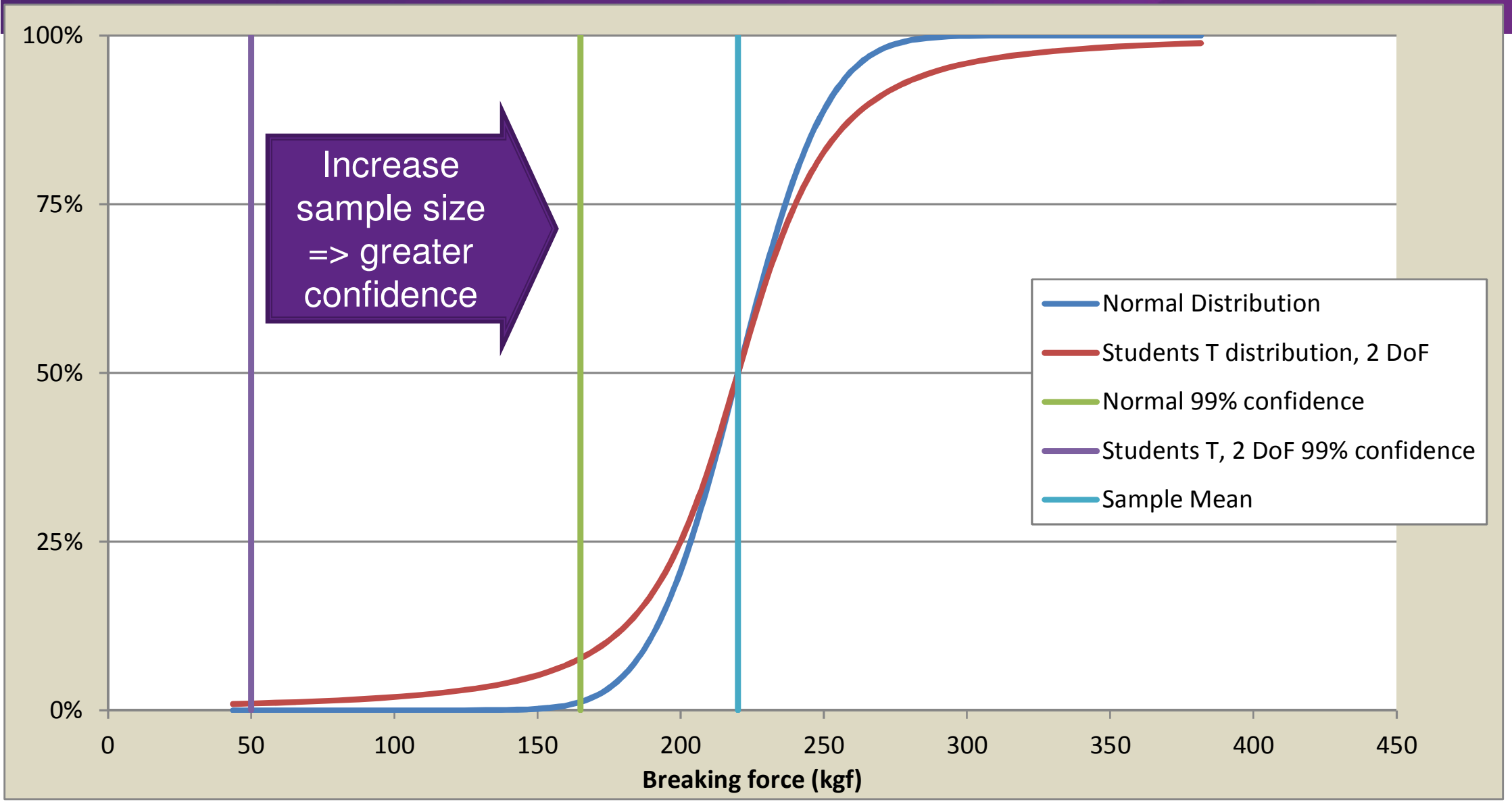
Testing results summary



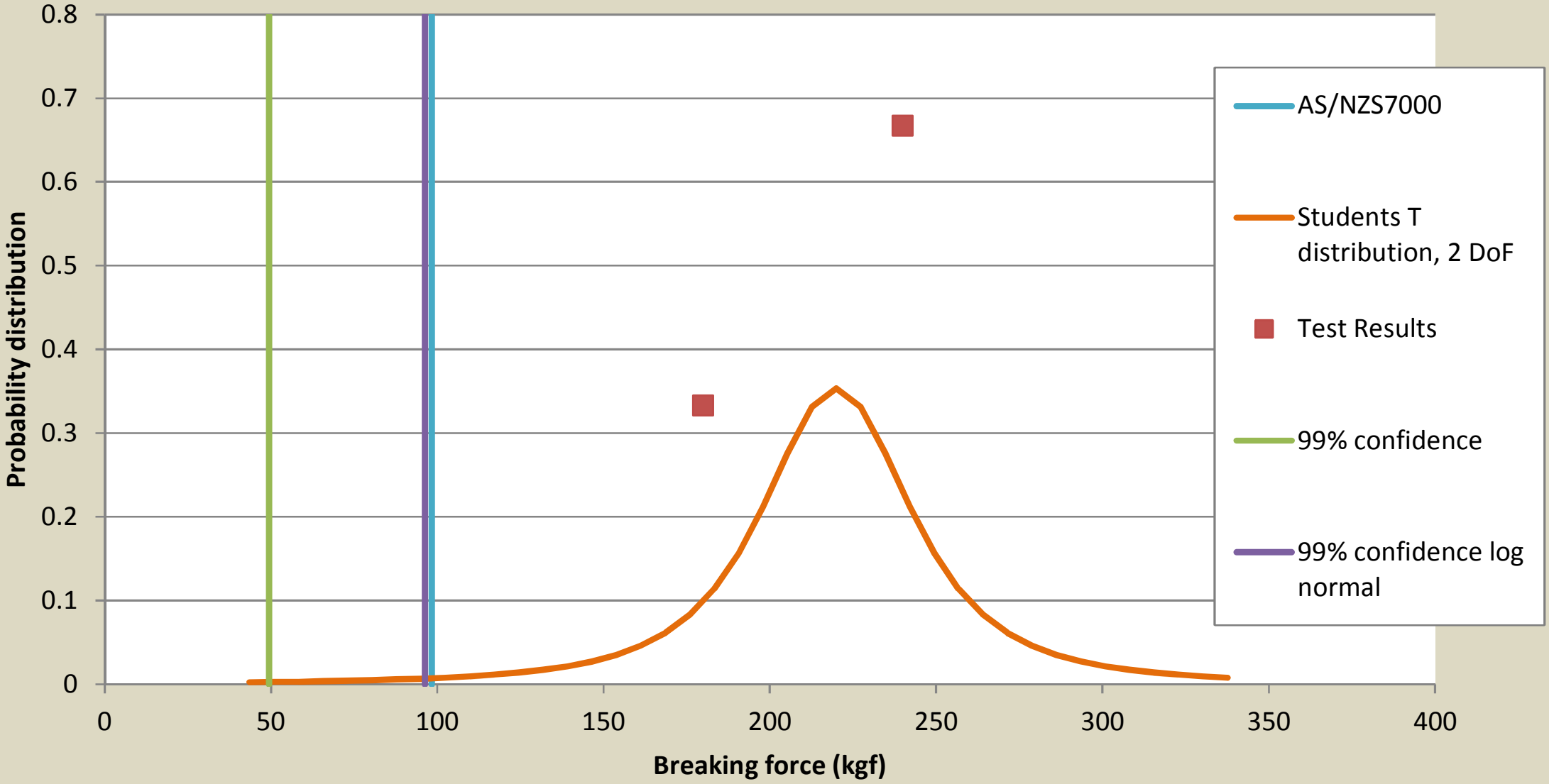
Comparison – Normal & Students T (DoF = 2) Distributions
Benefit of having adequate sample size



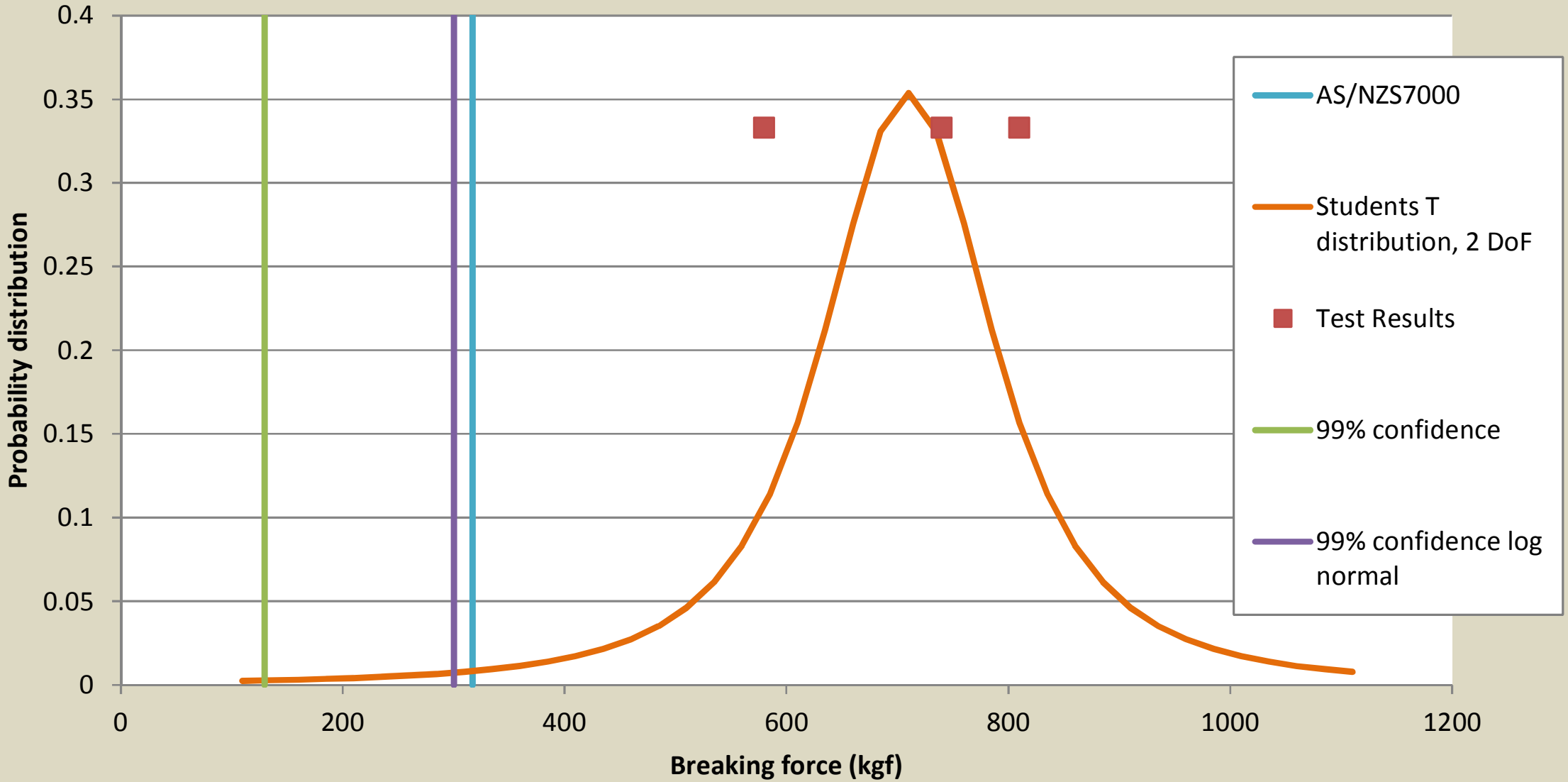
Testing results summary



Downline pole strength



Cross Line Pole Strength



Conclusions

What we've found:

- Some differences exist in approach between AS/NZS7000 (Table 8.1) (minimum strength within a sample) and Students T distribution on pole strength samples (average strength in series of samples).
- We don't have enough pole strength samples for this particular pole type
- Our GIS information does not distinguish between different pole types apart from material and height so identifying these poles needs to be done as part of routine inspection and line crew education.
- The statistical analysis shows that we need to take the concern over aged concrete pole strength seriously.
- Many of the points of weakness in the poles are not able to be easily identified (for instance, it is not normal to have to dig around a concrete pole to assess its strength)
- Given the uncertainties, we are doing proactive replacement of these poles. The proactive replacement will us help to undertake more testing.
- In the mean time, a pragmatic approach is to allow climbing under certain circumstances for the purpose of undertaking limited activities like fuse replacement. Otherwise access to these poles needs to be via elevated work platform or with the pole properly supported.

The End

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