Conductor Length and Sag

There is a relationship between the span length (horizontal distance between poles), length of conductor (also called catenary length) and sag. A small change in catenary length makes a big difference to the sag.

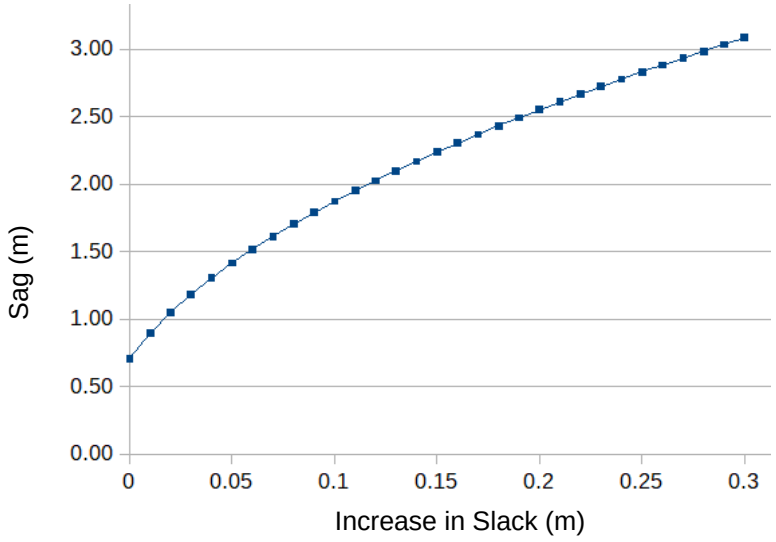
AS/NZS7000:2016 section R has equations describing the catenary curve as well as parabolic approximations suitable for when the sag is less than about 9% of the span length (section R4).

As an example, the properties of a level 80m span of Moon conductor tensioned at 20% CBL (so sag is about 9% of the span length and we can use the parabolic equations) are:

Property	Reference	Value
Tension @ 20% CBL (H)	CBL 18.8kN	3760N
Load per unit length (W)	Mass 0.34 kg/m	3.335N/m
Catenary constant (C)	$C=\frac{H}{W}$ (AS7000 R8)	1127.3m
Slack (Δ)	$\Delta=\frac{L^3}{24C^2}$ (AS7000 R13)	0.0168m
Sag (D)	$D=\frac{L^2}{8C}$ (AS7000 R12)	0.71m

Slack is the difference between span length and catenary length.

Starting with this span and tension, increasing the length of conductor in 1cm increments gives this chart:



The chart shows that increasing the conductor length by 30cm increases the sag by over 2m.

Concluding Remarks

The relationship between conductor length and sag means that a small change in length gives a large change in sag. This is applicable for all conductor types and span lengths because it is a property of the catenary, which defines the behaviour of a freely suspended cable subject to a uniformly distributed load.

This also means that conductor length changes due to tension or temperature changes make a big difference to sag.

When inserting a joint into a span, measurements should be undertaken accurately to avoid under or over sagging.

References

Standards Australia 2016, *AS7000:2016*, Standards Australia, Sydney.
Wareing, B 2005, *Wood Pole Overhead Lines*, IET London.

Revision history

Rev No.	Date	Details
A	2/4/2019	Initial issue