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Modeling ADSS Cables in PLS-CADD and PLS-CADD/Lite

Modeling ADSS cables in PLS-CADD and PLS-CADD/LITE is quite simple. This Technical Note discusses how to do so using data sheets commonly supplied by Alcoa Fujicura Ltd. (AFL), or data supplied by other ADSS manufacturers.

The typical ADSS Specification will include the Cable Diameter, Cable Weight, Maximum Cable Rated Load (MRCL), Approximate Cable Breaking Strength, Coefficient of Linear Expansion, and the Initial, Final, and 10 Year Cable Modulus. These quantities are sufficient to model the ADSS in PLS-CADD and PLS-CADD/LITE. The section of the specification will typically be formatted as shown in Figure 1:

Section 3.0 Completed Cable Details

Physical / Mechanical / Electrical Characteristic		Metric		English	
Approximate Cable Diameter		15.5	mm	0.61	in
Approximate Cable Weight		179	kg/km	0.12	lbs/ft
Maximum Rated Cable Load (MRCL)		1,285	kg/km	2,833	lbs
Approximate Cable Breaking Strength		2,378	kg/km	5,243	lbs
Minimum Bending Radius	Static	155	mm	6	in
	Dynamic	312	mm	14	in
Coefficient of Linear Expansion		1.61E-05	1/°C	8.96E-06	1/°F
Cable Modulus	Initial	6.07	kN/mm^2	880.5	kpsi
	Final	6.55	kN/mm^2	949.6	kpsi
	10 Year	5.06	kN/mm^2	733.8	kpsi

Figure 1 - Typical ADSS Specification from Manufacturer

To input this data in PLS-CADD and/or PLS-CADD/Lite, click on ***Sections/Cable Files/Create New Cable File…*** where you can input the following general information as well as the mechanical information on the **Physical** tab of the *Cable Data* dialog:

- Description = User Defined
- Manufacturer = User Defined (AFL, Corning Inc., Prysmian, ZTT, etc.)
- Cable Type = ADSS
- Cable Model = Non-linear
- Unit Weight = Approximate Cable Weight (lbs/ft)
- Cross section area $= \frac{\pi \times Cable\ Diameter^2}{4}$
- Outside diameter = Cable Diameter
- Ultimate tension = Maximum Rated Cable Load (MRCL)[§]

[§] **Note:** Some manufacturers may allow using the higher Cable Breaking Strength, or RBS, for the Ultimate Tension value. When doing so, please note that the MRCL is usually less than the NESC recommended 60% tension limitation in Rule 261H.1.a, and your ***Criteria/Cable Tensions*** and ***Criteria/Automatic Sagging*** information should be modified accordingly. Also note that you may have other design conditions such as a Heavy Ice that may result in a higher tension than the MRCL, so these cases must also be limited in the Criteria tables to ensure that they are not exceeded. It is simpler and safer to just use the MRCL for the Ultimate Tension value to ensure that it is never exceeded.

- Number of independent wires = Usually 1
- Temperature at which strand data below obtained = 70°F (≈20°C) will usually work
- Final modulus of elasticity for the Outer Strands = Final Cable Modulus[**]
- Thermal expansion coefficient = Coefficient of Linear Expansion[††]
- Stress-strain coefficient a1 = Initial Cable Modulus
- Creep coefficient c1 = 10 Year Cable Modulus

No other cable data values are required. Note that you may need to convert the units for the modulus and thermal expansion values. Once input, the data for our example specification would be as shown in Figure 2:

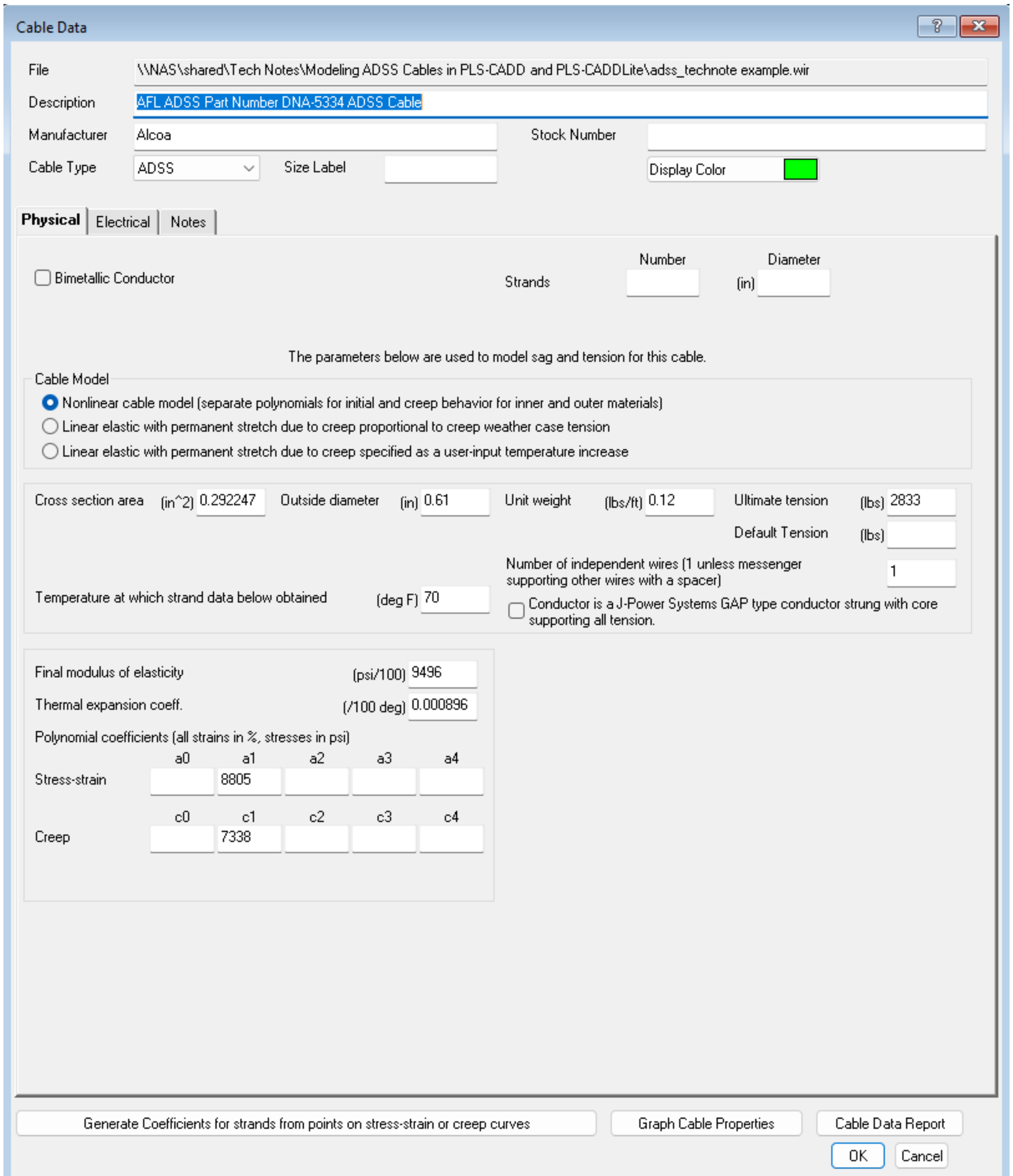

Figure 2 - Cable Data Dialog Box in PLS-CADD

[**] **Note 2:** Pay attention to units. In the example provided 949.6 kpsi = 949,600 psi = 9496 psi/100. Always ensure that you're inputting the correct values based on the units required in the Cable Data Dialog.

[††] **Note 3:** Pay attention to units. In the example provided 8.96x10^-6 /1 deg F = 0.000896 /100 deg F. Always ensure that you're inputting the correct values based on the units required in the Cable Data Dialog.

All information required to use the non-linear cable model is typically provided in a manufacturer's cable specification sheet. You could use a linear elastic model instead, but you'll need to make assumptions about the cable creep behavior. This is discussed in greater detail in our Linear Elastic Cable Model technical note and Section 9.11 and Appendix G.2 and G.3 of the PLS-CADD User's Manual.

Data on the **Electrical** tab for electrical and thermal rating properties are not required, unless you will be using one of the thermal rating functions of PLS-CADD with the ADSS - *this is highly unlikely*.

Once you've created your cable file, you can generate a graph of the stress-strain behavior with the **Graph Cable Properties** button from the dialogue box shown above. The graph for ADSS will look like Figure 3.

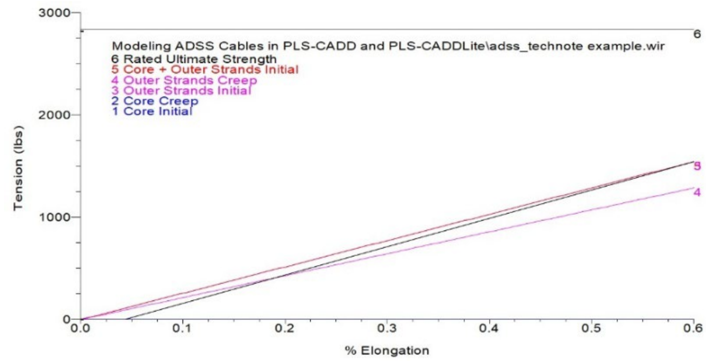

Figure 3 - Cable Stress Strain Graph

That is all that is required to create a PLS-CADD ADSS cable file. This ADSS cable file can now be used on your PLS-CADD projects to not only develop stringing charts, but also to check clearances and loadings of the ADSS under various climatic conditions. In addition, you can ensure that your ADSS will not interfere with the significantly greater sag changes that your transmission and distribution conductors will experience with temperature changes and thereby prevent any clashing, or worse, wrapping, that you might experience in the field. With the communications industry "standard" of sagging in ADSS at 1% of the span length, these types of problems do occur quite frequently and should be carefully checked with a proper analysis.

As you can see from the above, the necessary data is standard properties for any ADSS, so there isn't any reason why your ADSS supplier cannot help you. If your manufacturer has any questions, please have them contact us. We will assist them in getting all of their cable data into a PLS-CADD ready format and, if desirable, we can even add them to our online library for all of their customers to download and use.