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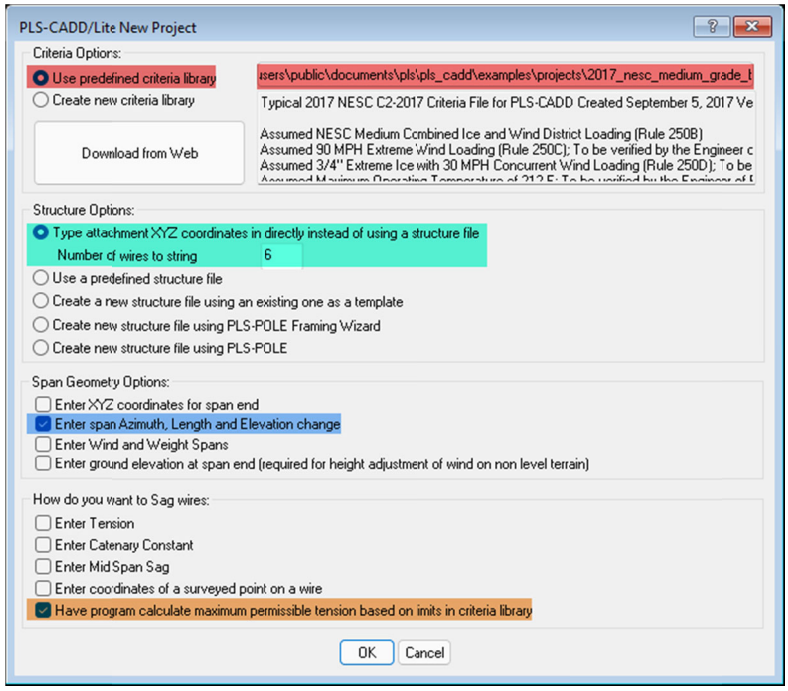
Generating Ruling Span Sag-Tension Runs in PLS-CADD/Lite

Introduction

This TechNote describes how to use PLS-CADD/Lite to make stand-alone sag-tension runs. Please keep in mind that this practice is redundant as the same sag-tension routines can be used interactively in PLS-CADD to calculate sag-tension data, make required checks (such as galloping, tension limits, etc.) and produce stringing charts. However, many transmission engineers still need to create sag-tension charts, so here is how to do it.

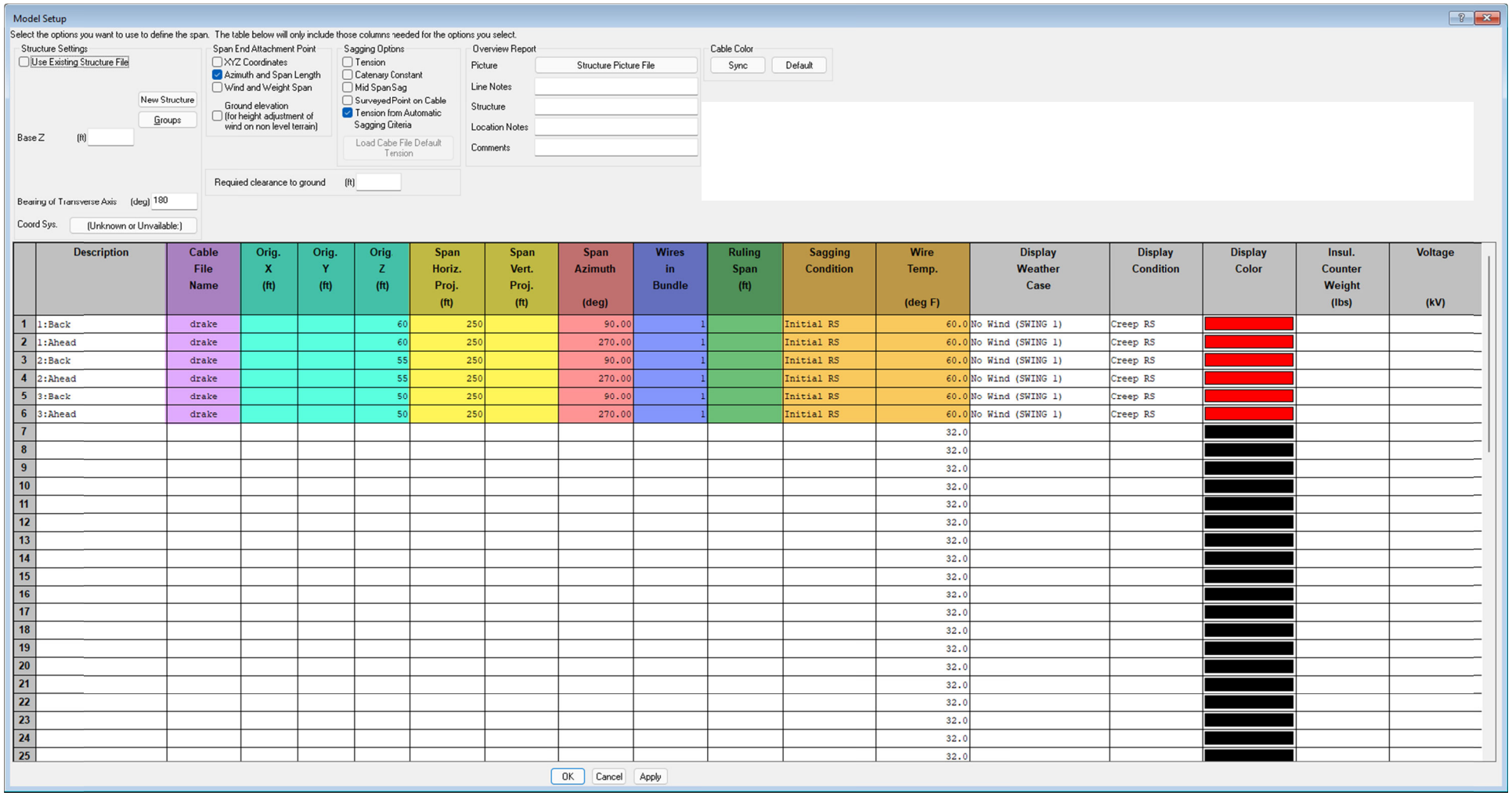
Process

1. Start by opening PLS-CADD.
2. Select ***File/ New/ PLS-CADD/Lite*** menu item.
3. An "*Untitled.loa*" file will be opened, and you will be presented with the PLS-CADD/Lite New Project Wizard/dialog box as shown.



   - Criteria Options: Select the option to use your own predefined criteria library, download and use one from our website here, or select the option to create a new criteria library. We recommend that you start with one of our NESC criteria libraries as opposed to creating a new one completely from scratch.
   - Structure Options: Select "*Type attachment XYZ coordinates in directly instead of using a structure file*" (unless you have a structure file set up in PLS-POLE or TOWER that you would like to link to). Also specify the number of wires to string in (noting that each Ahead or Back span wire counts as 1 wire, so for example 3 phases both ahead and back spans you would need 6 wires).
   - Span Geometry Options: Select the "*Enter span Azimuth, Length, and Elevation change*".
   - How do you want to sag wires option: Select the "*Have program calculate maximum permissible tension based on limits in criteria library*", assuming that you have properly filled out the Automatic Sagging table in your criteria library file (it is set up this way in our downloadable NESC criteria files).
   - Click the ***OK*** button.

4. You will now be taken to the Model Setup dialog, where PLS-CADD/Lite has started you off with basic information for setting three 250' spans ahead and three 250' spans back of Drake conductor (if you chose to string in 6 wires in the previous Wizard), based on a 250' ruling span. You can modify all six rows, delete entire rows, or even add rows depending on how many sag-tension runs you want and if you need any sag coordination, phase-to-phase clearances, or galloping checks. Simply change this default information by:



	Description	Cable File Name	Orig. X (ft)	Orig. Y (ft)	Orig Z (ft)	Span Horiz. Proj. (ft)	Span Vert. Proj. (ft)	Span Azimuth (deg)	Wires in Bundle	Ruling Span (ft)	Sagging Condition	Wire Temp. (deg F)	Display Weather Case	Display Condition	Display Color	Insul. Counter Weight (lbs)	Voltage (kV)
1	1:Back	drake			60	250		90.00	1		Initial RS	60.0	No Wind (SWING 1)	Creep RS			
2	1:Ahead	drake			60	250		270.00	1		Initial RS	60.0	No Wind (SWING 1)	Creep RS			
3	2:Back	drake			55	250		90.00	1		Initial RS	60.0	No Wind (SWING 1)	Creep RS			
4	2:Ahead	drake			55	250		270.00	1		Initial RS	60.0	No Wind (SWING 1)	Creep RS			
5	3:Back	drake			50	250		90.00	1		Initial RS	60.0	No Wind (SWING 1)	Creep RS			
6	3:Ahead	drake			50	250		270.00	1		Initial RS	60.0	No Wind (SWING 1)	Creep RS			
7												32.0					
8												32.0					
9												32.0					
10												32.0					
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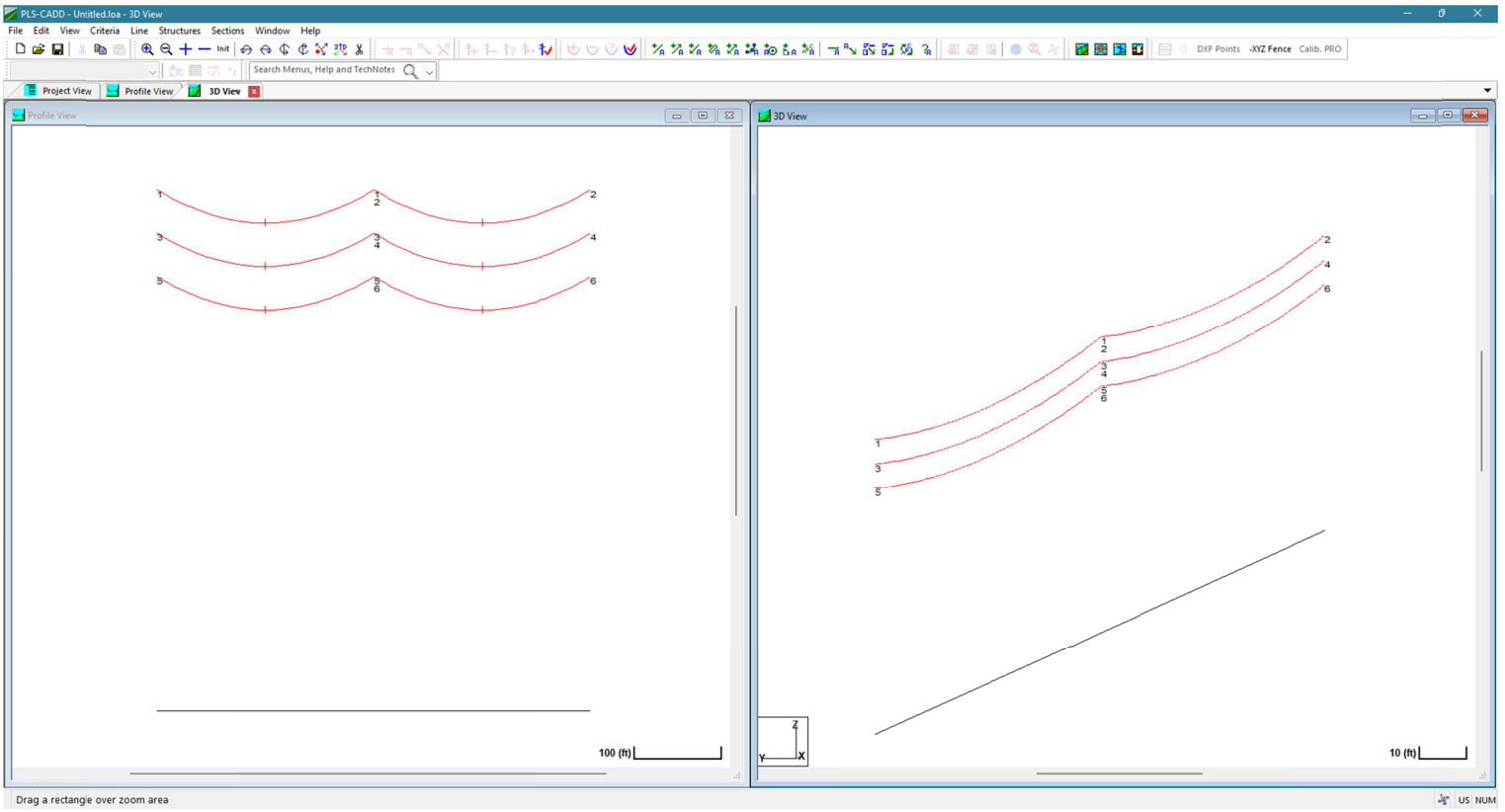
- Selecting the applicable cable file name(s). You can download over 8000 cable models from our website here or develop your own cables with data provided by your manufacturer.
- Modifying the origin X, Y, and Z values of each span - accept the defaults if you are just interested in obtaining a basic sag-tension run. Remember that if you are using NESC or any of the other ASCE variable wind functions in your criteria file, the elevation (Z) will impact the effective wind pressure in accordance with those codes. You can enter "0" for Z if you want to negate those effects.
- Changing your Span Projections, where horizontal is the horizontal span distance and the vertical accounts for inclined spans (positive values indicate a rise from the origin spans - you can double check your span geometry after you press "OK" and you will have plenty of opportunities to come back into this screen and change your entries later).
- The azimuths are set for 90 (back) and 270 (ahead). This provides for a coordinate system consistent with structure files and the full PLS-CADD should you be using them. Change these values if you want to model a line angle, but this is not necessary to develop a simple sag-tension report. This will only be a factor if you want to further develop a loading tree for a structure or link in a PLS-POLE or TOWER model.
- Wires in Bundle can be left at one unless again, you want to develop a loading tree for a structure or perform a direct structure analysis by linking in a PLS-POLE or TOWER model. This has no effect on a simple sag-tension report.
- Ruling Span should be the same as your Horizontal Span Projection value as described above, unless you do have a situation where you want to calculate sags and tensions of a section of conductor that in reality is a small part of a different ruling span.
- The Display Weather Case, Condition, and Color will have no bearing on any sag or tension calculations but will be the settings used to show your wires in the graphics views. If you want to see how multiple wires at different conditions interact with each other, you can select different conditions for each wire. If you are just interested in running a sag-tension report, there is no reason to modify these from the defaults.
- Insulator/Counter Weight is self-explanatory, but this is also not required to just develop a sag-tension report. This would only be relevant if you want to calculate phase-to-structure clearances, insulator swing angles, or use any other function that considers counterweights (such as galloping).
- Voltage of wire. Defaults to 0. Used by some codes to identify ground wires (0 kV) and adjust their properties. For example: CAN/CSA-C22.3 No. 60826-10 adjusts groundwire ice to match conductor ice weight. IS 802 1995 adjusts groundwire drag coefficients.
- Click the **OK** button.

5. You will now see the screen refresh with your wires shown on the left-hand side in the profile view and on the right-hand side in a 3D view. All the PLS-CADD functions such as zooming, and rotating are available should you want to see these views in different perspectives.



6. Save your file through ***File/ Save*** or ***File/ Save As...*** You will be presented with the option to specify a folder and name of your PLS-CADD/Lite project (which should have a ".loa" extension - LOA stands for "loads" and indicates this is a PLS-CADD/Lite project).

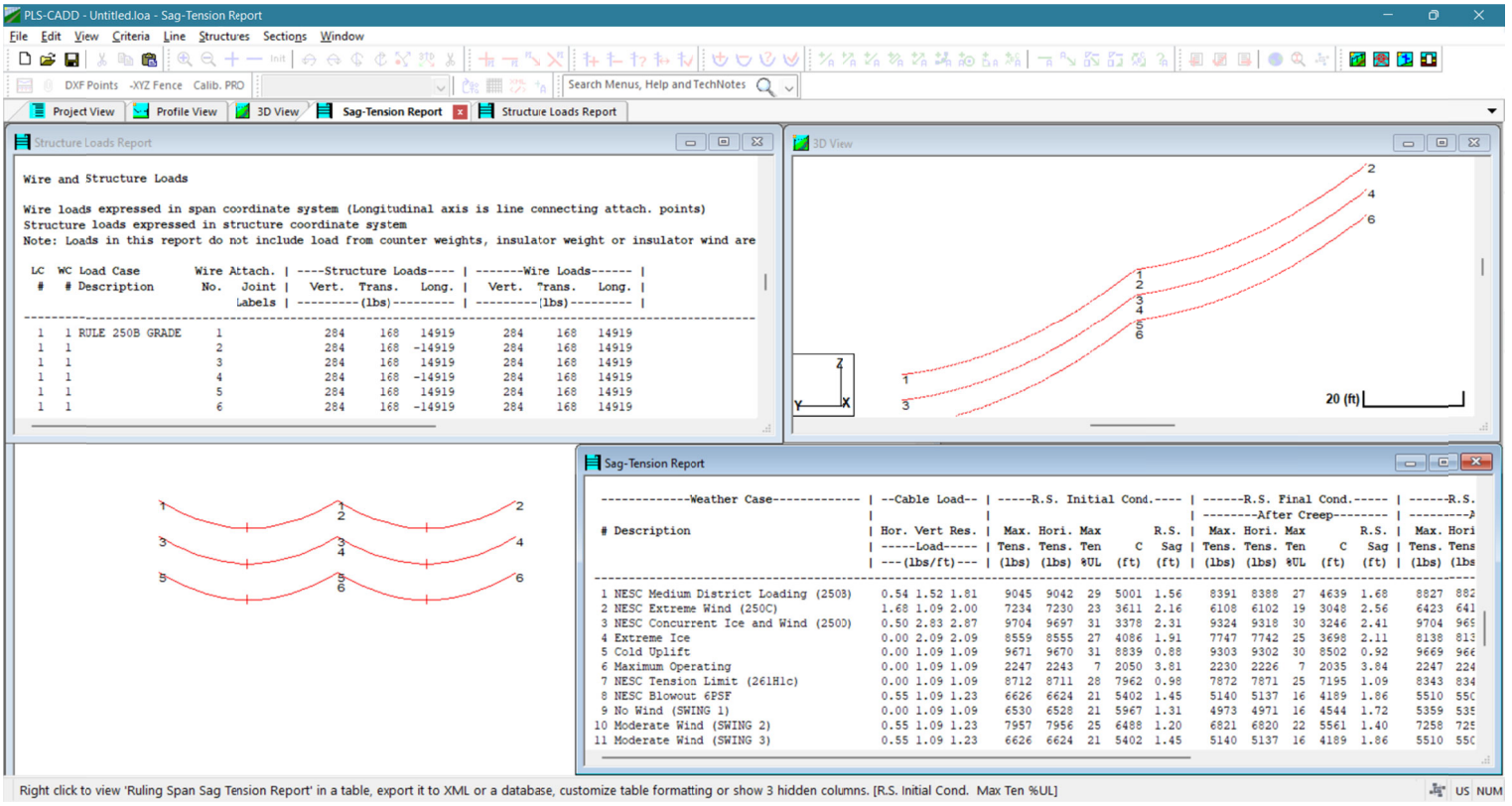
7. To generate a sag-tension report, simply select ***Sections/Sag-Tension***... then click on one of the wires. To make sure you have clicked on the appropriate wires you can click on the Next button until the desired section is selected. Then click on the report button and you will be presented with a full sag-tension report ready for printing or copying into another program such as Word or Excel.

Additional Capabilities

That is all it takes to create a sag-tension report. Of course, there are quite a few other options in PLS-CADD/Lite that you might want to take advantage of such as:

- Stringing Charts, Galloping, Wire and Structure Clearances (all under the Sections submenu).
- ***Structures/ Loads/ Report*** will generate a loading tree report, ready to print or e-mail to your structure manufacturer for use in designing your structures. These loads are generated for the conductors, tensions, line angles, and overload factors you entered (open ***Criteria/ Structure Loads (methods 3,4)...*** to see the table and edit the weather conditions, overload factors and other information needed to develop proper loading trees).
- ***Lines/ Report*** will give you much of the above information in a single report.

To make any changes to your model, simply go back into ***Line/ Setup...*** and make whatever modifications you need to.



Don't forget that if you first model your structure in PLS-POLE or TOWER, you can check the "*Use Existing Structure File*" option and then you will not need to input the Origin XYZ values (since they will come from the structure file). Once you click OK and exit this table, the geometry view is updated, and you can use the ***Structures/ Check*** menu item to check your PLS-POLE or TOWER structure. You will receive results in both reports and graphics views that will show you if you had any failures, where those failures occurred and how much stress was applied to each part of the structure (and insulator) for each load case. You can even click on the ***Structures/ Generate Allowable Spans...*** menu item and PLS-CADD/Lite will report the maximum wind and weight spans that your structure is capable of supporting given the current set of loading conditions and parameters.

Additionally, PLS-CADD/Lite allows you to string up to 60 cables with any relationship to each other and then to perform cable to cable clearance checks under varying conditions. So, if you've got that ADSS cable that your cable supplier is just telling you to string up at "1% sag" and you are concerned about the clearances when your conductors are operating at high temperatures you can model both and check it! Better to do it now than to end up with wrapping problems in the field later.