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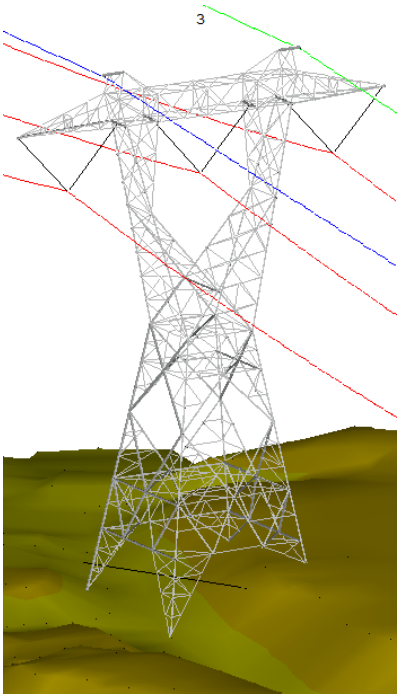
Optimum Body and Leg Extension Selection in PLS-CADD

Introduction

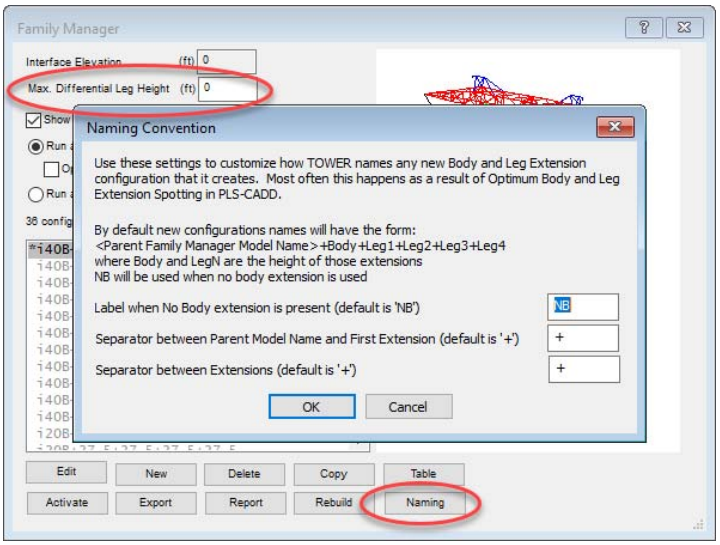
Starting in version 15.30, PLS-CADD can automate the selection of body and leg extensions (BLE) for lattice towers which have been built using the Family Manager feature in **TOWER**. No more trial and error or using cumbersome spreadsheets to find the correct combination of leg extensions to fit to the ground terrain!



TOWER Model Requirements

In order to use the BLE selection feature, the lattice towers must be saved in version 15.30 or newer of **TOWER** and must have all possible body and leg extensions created in the Family Manager feature of **TOWER** for each unique tower type. It is not necessary to have every potential combination of body and leg extensions created in the Family Manager. You just need to model each potential body extension and each potential leg extension.

Within the Family Manager settings in **TOWER**, there is a **Naming** button which provides options to customize how **TOWER** assigns names to any new body and leg extension configurations created by the BLE Selection feature in **PLS-CADD**.

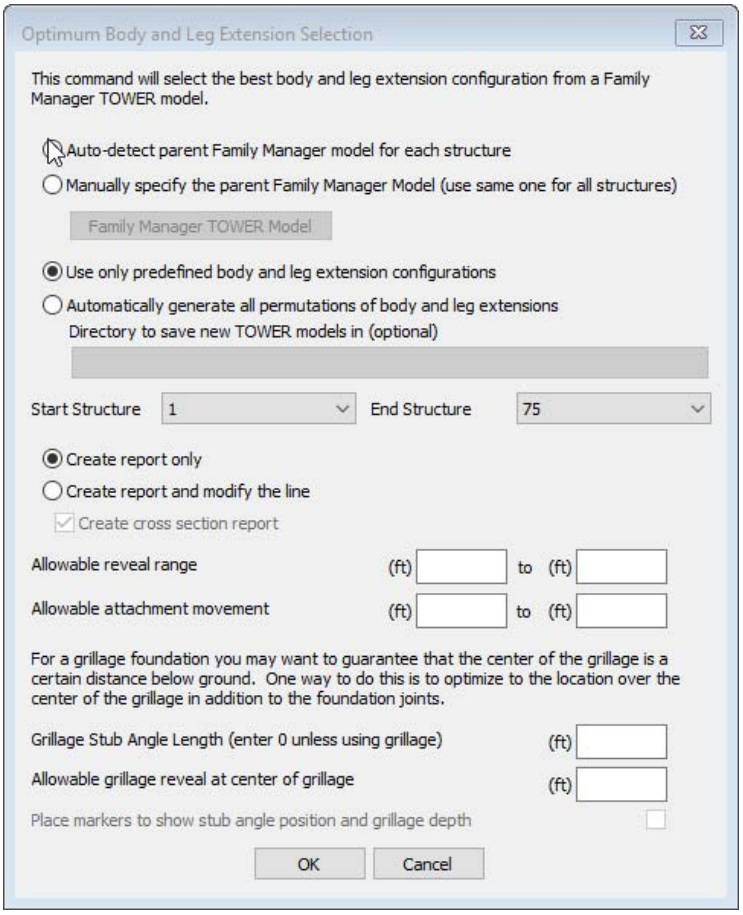


Also, in Family Manager, you can define the **Maximum Differential Leg Heights**. This setting will be used by **PLS-CADD** if it needs to generate additional towers with different body and leg combinations which are not built in Family Manager.

Optimum Body and Leg Extension Feature and Settings

The Optimum BLE Selection feature can be found at **Structures/Automatic Spotting/Optimum Body and Leg Extension Selection** in **PLS-CADD**. As the name implies, the feature works by reading the Family Manager compliant .tow files and finds the optimum combination of body and leg extensions to fit the TIN ground surface at each location. The optimum combination is defined as the minimum tower weight configuration that satisfies the input parameters.

To use the BLE selection feature, you must first have a **PLS-CADD** model with structures spotted and a ground TIN model created. The structures may be either M1 or M2 (stick structures) or M4 (**PLS-POLE** or **TOWER**) structures.



In the Optimum BLE Selection dialog box, you first need to select the parent Family Manager **TOWER** model that you have in the **PLS-CADD** model. Use the **Auto-detect parent Family Manager model for each structure** option to run the optimum selection on all existing **TOWER** models spotted on the line. Use the **Manually specify the parent Family Manager Model** option to run the optimum selection on all stick structures and **PLS-POLE** models on the line.

When evaluating each structure site for the optimum BLE combination, you have the option to force **PLS-CADD** to only evaluate BLE combinations that have been built in the **TOWER** Family Manager or to allow **PLS-CADD** to create all possible BLE combinations based on the tower geometry. If you select the second option, you have the option to specify a folder where any new BLE combination tower models will be saved. If you do not specify a folder, any new BLE combination towers models will be saved to the same directory as the parent Family Manager model. Note that **PLS-CADD** will add any new BLE combinations used in the optimization back into the Family Manager table of the parent **TOWER** model.

When running the optimum BLE selection, you can choose to create a report only or have **PLS-CADD** make the necessary changes to your model. When you elect to modify the line, **PLS-CADD** will create a copy of the current line model and all of the structure changes will be made in the new line and

this will become the active line. The original line will be unaffected by the changes. The original line and the new line can be viewed under **Lines/Edit** in **PLS-CADD**.

You also have the ability to specify specific ranges for foundation reveal and wire attachment movement. The **Allowable foundation reveal** is the vertical distance between the ground TIN and the bottom leg joint. The **Allowable attachment movement** is the vertical distance the wire attachment points are allowed to move when evaluating BLE combinations. However, be aware that if no vertical movement of wire attachment locations is allowed, an optimum solution may not exist at a structure location.

Additional settings are provided for lattice towers with grillage foundations to ensure that the center of the grillage is always set a minimum distance below TIN ground surface. The **Grillage Stub Angle Length** is the length along the slope of the main leg (true 3D length) from the bottom of the leg extension to the top of the grillage base. This creates an X, Y, Z reference point at the top of the grillage base, which is called the grillage center top in **PLS-CADD**. **PLS-CADD** then calculates the vertical projection of the stub angle length from the X, Y, Z reference point and this vertical projection becomes the default grillage setting depth.

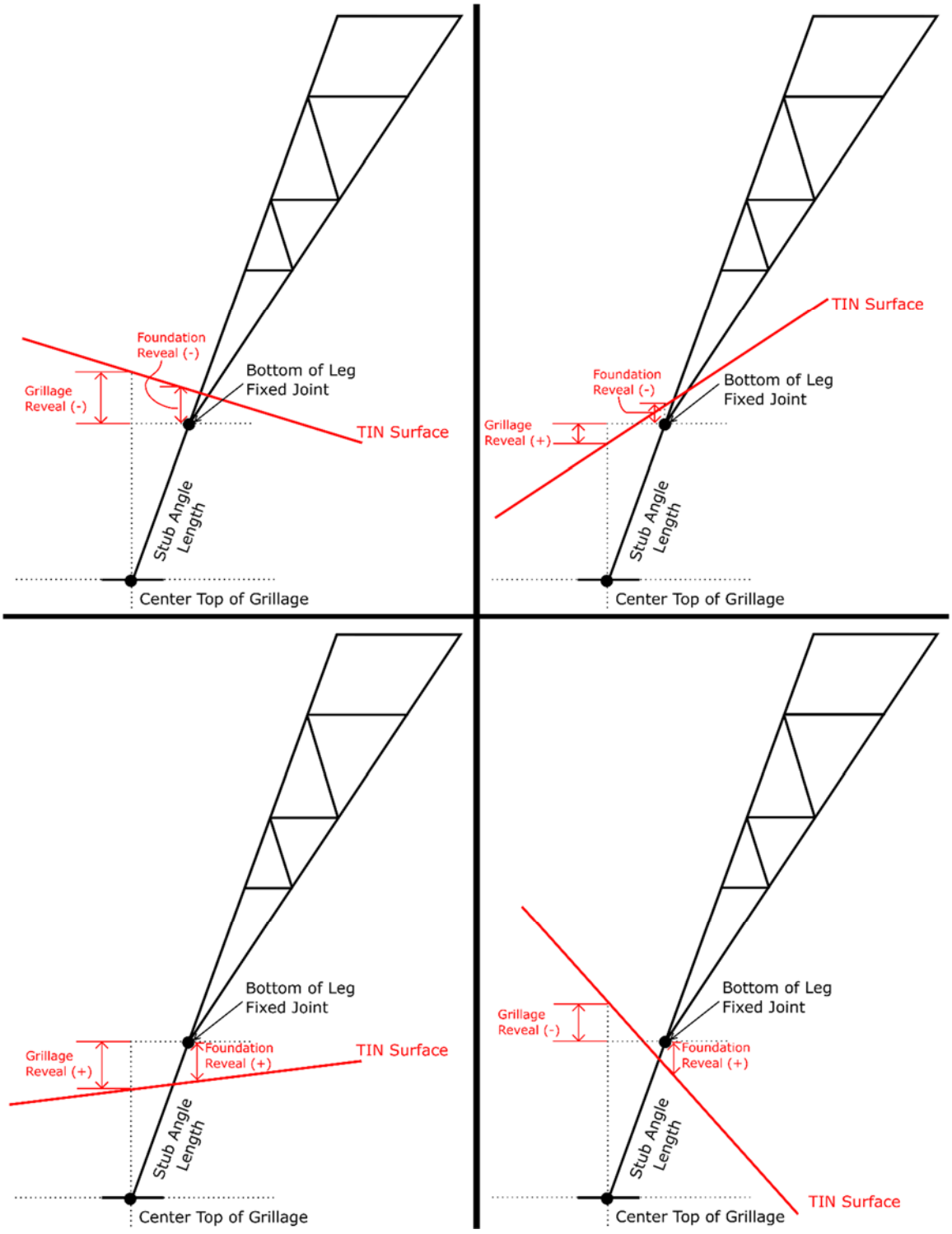
You can enter a value for the **Allowable grillage reveal at center top grillage**. This value defines the maximum reveal, either positive or negative, of the grillage setting depth top relative to the TIN model. In effect, this value can be used to control the minimum grillage embedment depth relative to the TIN surface for the optimum BLE selection calculations. The distance from the top of the default grillage setting depth to the TIN surface will be reported by **PLS-CADD** as the grillage reveal.

In the image to the right, the pink markers below the tower legs can be drawn by **PLS-CADD** to graphically indicate the stub angle length (sloped lines) and the grillage setting depth (vertical lines).

The brighter portion of the pink lines are the above the TIN model while the darker portions are below the TIN model.

These markers can useful to help understand and visualize the grillage reveals and interpret the results in the BLE optimization report.

The figures below illustrate the foundation reveal and grillage reveal for a leg extension with four different TIN surface location scenarios.



Optimum Body and Leg Extension Feature Limitations

It's important to understand that during the Optimum BLE Selection routine, **PLS-CADD** does not perform a complete optimization of the transmission line, it only optimizes the body and leg extensions at each structure site. Therefore, if you choose to have **PLS-CADD** modify the line by inserting new tower models, you must rerun all of your structure, wire, and line design checks. Any changes made to the wire attachment heights during the BLE selection will influence the wire tensions and therefore will affect other design aspects of the line, such as structure loadings, clearances, swing angles, uplift, etc.