

## Loading Methods in PLS-CADD

### Introduction

Version 7 of PLS-CADD restructures criteria related to wire and structure loading and introduces several new methods for calculating structure loads. Projects created in any previous version of PLS-CADD can still be opened, their criteria will automatically be migrated and by default PLS-CADD will calculate the same loads it did in version 6.

The changes to weather criteria include new options under “Wire Wind Height Adjust Model” and “Wire Gust Response Factor” for adjusting wind and ice according to the following codes: ASCE 74-1991, ASCE 74-2009, NESC 2002, 2007, 2012, 2017, IEC 60826:2003, IS802 : 1995 (India), EN 50341-1:2001, EN 50341-1:2012, EN 50341-3-9:2001 (UK), EN50341-2-9:2015 (UK), EN 50341-3-17 (Portugal), EN50341-2-22:2016 (Poland), REE (Spain), Russia 7<sup>th</sup>/SNIIP, ISEC-NCR-83 (Israel), TPNZ (New Zealand), ESAA C(b)1-2003, AS/NZS 7000:2010, AS/NZS 7000:2016, and others.

The structure loads changes include new columns for “Structure Area Factor”, “Structure Ice Thickness” and “Structure Wind Load Model”. The Wind and Ice Load Model column replaces the “Structure Gust Response Factor” found in earlier versions and also provides new methods for applying wind to structures according to the following codes: ASCE 74-1991, ASCE 74-2009, NESC 2002, 2007, 2012, 2017, IEC 60826:2003, IS802 : 1995 (India), EN 50341-1:2001, EN 50341-1:2012, EN 50341-3-9:2001 (UK), EN50341-2-9:2015 (UK), EN 50341-3-17 (Portugal), EN50341-2-22:2016 (Poland), REE (Spain), Russia 7<sup>th</sup>/SNIIP, ISEC-NCR-83 (Israel), TPNZ (New Zealand), ESAA C(b)1-2003, AS/NZS 7000:2010, AS/NZS 7000:2016 and others. It also provides improved options for ASCE 74-1991 and NESC 2002 as well as new options for SAPS Wind, Wind on Face, Wind on All, RTE Hyp1 and RTE Hyp2.

With these changes, we have greatly expanded our support for international codes, provided better control over the application of wind on structures and simplified the criteria through a more logical grouping of items affecting wire loads and wind/ice on structure.

## Revisions

Version 7.34	<b>ASCE 74-2006</b> (draft) made available (replaces <b>ASCE 2002</b> draft) <b>IEC 60826:2001</b> now adjusts ice for wire diameter and height above ground <b>Russia 1</b> revised and renamed to <b>Russia 7<sup>th</sup> Edition</b> <b>Statnett</b> (Norway) <i>Wire Gust Response Factor</i> option added
Version 8.10	<b>NESC 2007</b> made available (effectively identical to <b>NESC 2002</b> )
Version 10.36	<b>ASCE 74-2009</b> made available (replaces <b>ASCE 74-2006 draft</b> which is identical)
Version 11.11	<b>AS/NZS 7000:2010</b> introduced
Version 12.04	<b>NESC 2012</b> introduced (effectively identical to <b>NESC 2007</b> )
Version 12.35	<b>IS 802 : 1995</b> introduced
Version 12.36	<b>EN50341-1:2012</b> introduced
Version 13.03	<b>Russia 7<sup>th</sup>/SNiP</b> introduced
Version 13.09	<b>ISEC-NCR-83</b> introduced
Version 14.31	<b>NESC 2017</b> introduced (effectively identical to <b>NESC 2012</b> )
Version 14.31	<b>EN50341-2-9:2015 (UK)</b> introduced
Version 14.44	<b>EN50341-2-22:2016 (Poland)</b> introduced
Version 14.44	<b>AS/NZS 7000: 2016</b> introduced

## Notes for Users of Previous Versions

The criteria changes occurred in three places in PLS-CADD: *Criteria/ASCE Terrain Type*, *Criteria/Weather Cases* and *Criteria/Structure Loads*. The *ASCE Terrain Type* menu has been made a submenu of *Code Specific Wind and Terrain Parameters* which now has options for the codes mentioned above as well as others. You only need to enter data for those codes that you plan on using. The *Weather Cases* table has been simplified so that the adjustments in it apply only to wires; all structure related items including the structure component of the *Wind Height Adjust* column (now called *Structure Wind Load Model*) and the *GRF Structure* column have been moved to *Criteria/Structure Loads*. A *Wire Wind Height Adjust Model* column has been added that includes the wire component of the adjustment previously specified by the *Wind Height Adjust* column and that adds options for the codes mentioned above and others. The *Wire Gust Response Factor* also adds these options (and Statnett, but not REE) and unless you have a very good reason not to, you should make sure that you select the same code in both columns. Finally, *Criteria/Structure Loads* has several additional columns. *Structure Wind Area Factor* can be used to factor the structure wind area whether to approximate the increase in wind area of the structure caused by icing or for any other reason (UK NNA users should input  $K_{COM}$  in this column or leave it zero to have  $K_{COM}$

calculated automatically). The *Structure Wind Load Model* combines the structure component of the old *Weather Cases Wind Height Adjust* and *GRF Structure* columns and has many options which are described below. The *Structure Ice Thickness* and *Structure Ice Density* columns allow you to apply ice on a structure. While this is required by CENELEC, IEC 60826 and others, neither ASCE 74 nor the NESC requires it so most US users will leave these columns blank. Non-zero values will result in ice being applied on the surface of your structures. If you use method 4 structures and elect to take advantage of any of the new criteria options introduced in version 7 of PLS-CADD then must also run the same version of the structure program to ensure compatibility.

Additional information is available in the *Loading Methods Introduced in Version 7 of TOWER and PLS-POLE* document available at [http://www.powline.com/products/version7\\_loads.pdf](http://www.powline.com/products/version7_loads.pdf). You should carefully review this document and verify that your structure models have been appropriately modified prior to using any method other than a "Pre V7" one. In particular, for lattice towers it is imperative that you have input the appropriate factors in the *Geometry/Sections/Define* table in TOWER prior to using a new loading method.

## Structure Wind Load Models

The various structure wind load models can be divided into three categories: those that existed in previous versions of PLS-CADD (referred to as Legacy), those that existed in previous versions of the structure programs, but which could not be selected from PLS-CADD (referred to as V7-Selectable) and those that are new to version 7 (referred to as V7-New). As you develop new criteria in the future we encourage you to only use the non-legacy methods (V7-Selectable and V7-New) for generating loads. However, it is not necessary and in many cases, will not be desirable, to modify existing criteria and structures for projects that have already been completed or that are in progress.

The calculations automated by our software are described in detail in the various *Criteria/Code Specific Wind and Terrain Parameters* dialogs. Note that the wind pressures printed in the PLS-CADD Structure Loads report include the factors applied by PLS-CADD, but not those applied in PLS-POLE or TOWER. These wind pressures become the basic wind pressure for PLS-POLE and TOWER which can be found in the *Loads/Vector Loads* table. They are then further modified before being applied to the structure (as described in the notes printed for each code in the *Loading Method Parameters* dialog reached via *Loads/Vector Loads*). The final pressures used are printed in the *Detailed Pole Loading Data for Load Case* tables in PLS-POLE and the *Section Load Case Information* tables in TOWER. You should verify your understanding of the application of all the factors involved in calculating loads by calculating one of these pressures by hand and verifying that it matches what the program calculates.

Modern codes are regrettably complicated, so this may be a long and tedious process, but it is the only way to assure yourself that your interpretation of the code matches the programs. To assist you with this process we have provided a “Show Graphs” button at the bottom of the code specific parameters dialog for many of the codes which will show you the quantities built into PLS-CADD. In addition, you can use the *Structures/Loads/Report Options* dialog to set the *Include extended diagnostic information on adjustments to input wind and ice* option which will provide intermediate results to assist you with your validation.