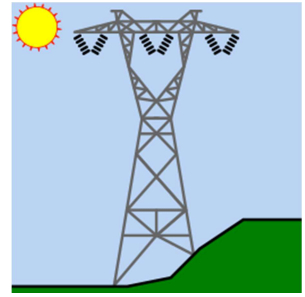# 2022 PLS-CADD Advanced Training and User Group Meeting
## What's New in TOWER™

Summary of changes since June 2019 User Group, covers versions 16.01-17.31. This includes the general releases v16.20, v16.51, v16.81, v17.22 and subsequent insider releases.

## PLS-GRID

1) PLS-GRID Project Manager can now manage TOWER projects.

   See "What's New in PLS-CADD", technical notes and videos for everything new on PLS-GRID.

## New Commands

1) **General/Reference Manager** is a new command which keeps track of any non-project file you want to associate with a project. These files can be tagged with keywords, searched for, viewed and included in .bak files.

2) "F3" hot key to reports for repeating the last Find. Use "Shift-F3" to repeat previous search but backwards and "Ctrl-F3" to use current selected text for the search, "Shift-Ctrl-F3" same as Ctrl-F3 but search backwards.

3) **Help/Register for Training** Classes command which enables you to see and sign up for classes (including our popular free Webinars) directly from within the software. Download of videos of previous Webinars from this command is available when running the current version of the software.

4) Added **File/Model Diff Since Last Save** command to allow a difference report of the model since the last time it was saved.

5) **File/Batch Modify** now includes "Family Manager Options" option.

## Engineering

1) Can now check crossing diagonals when redundants are modeled.

2) Added Group Type of "Corner Diagonal" that when used with a Crossing Diagonal Check will check them as if they were Crossing Diagonals (when instead they are in adjacent faces and connected by a shared joint and corner member). See cross bracing with diagonal corner member in EN1993-3-1:2006 H.3.3 and figure H.2b. Selection of "Corner Diagonal" will result in a new file format being used when your model is saved.

3) Added Group Type of Redundant-AI (Redundant "Always Included") which are redundants that are always modeled even when the option to not include redundants in the Finite Element analysis is selected.

4) Added Leg Connect Code of Continuous which is effectively the same as Both except members with it can't have bolts.

5) Added default "Short Edge Distance" input to Bolt properties file (".blt").  Save .blt file in a new version if this is input.  It is only used when the member short edge distance is zero and the angle properties short edge distance is zero.

6) **Sections/Table** "Force Solid Face" converted to an "Adjustment Type" column with a new option of "Crossarm" so can identify sections that need special crossarm wind loading.

7) **Geometry/Sections/Table** Edit Adjustment Type of "Crossarm" now decides if arm is mounted transversely or longitudinally based on "L*CdL > T*CdT" instead of "L > T".

8) Converted the "RBSH Only" setting in **General/General Data** "Design Check Options" tab to a pick box with "RBSH and RDIS" (the default), "RBSH Only" or "RDIS Only" options.  You may now choose to ignore block shear.

9) Now only check RDIS component of rupture capacity for spacing when have more than two bolts for angles connected on both legs (previously checked when had 2 bolts).

10) Increased limits for finite element engine to more than double the number of joints and members that can be included in an analysis to enable modeling absurdly large lattice substation structures.

11) Introduced concept of nbeff (number effective bolts = number bolts/2 for double angles where the back-to-back leg is not the connected leg and for cruciform angles) which impacts Net Section Tension and Rupture capacity calculations for many codes.

12) Added optional Connection Modifier column to Angle Members table with options: None, No Stagger, 3 Rows and Symmetrical 3 Rows.  This is an extensible mechanism to handle various special case connections.  Currently only implemented for European codes.

13) Steel Material Properties has a new optional "Hyper Static Exponent" column.  When non-zero TOWER will set the MOE for FE analysis = MOE * 1/(2^HyperStatic) and will write the ".smp" file in a new format.  This can be used to skew load distribution.

14) Now warn when have collinear crossing diagonals where some, but not all of the members are found to be unsupported.  If redundants are acting as expected this would not happen, but have seen it when diagonals are modeled with a beam element and have a large torsion load.

15) The Loading Method Parameters dialog reached from **Loads/Vector Loads and Loads/Wire Loads** now has a third section load distribution method: proportional which allocates loads as a percentage of the tributary area/weight that each joint has vs the total tributary area/weight of all joints in the section.  Using this forces write of v16 .lca/.lic file format.

16) **Geometry/Change Leg Slope** now allows new foundation joint position to be specified by X and Y offsets for towers with a rectangular base.  Also fixed a problem scaling joint positions in rectangular towers with only primary joints.

17) Added a "Cruci2x2na" connection modifier that can only be used with double cruciform members to double their number of bearing areas.

a. Intended for a connection that consists of an angle bolted inside each quadrant (four single angles used to connect the two double-cruciform angles that abut).

b. Use of this Connection Modifier will force save in a new .TOW file format.

c. Cruci2x2na connection modifier sets the EN93 "long joint" factor CLn to 4 and a connection modifier of "3 Rows" NL to 3.

d. Cruci2x2na connection modifier sets EDF A4, F4, and J4 effective number of bolts to 1/2 (just like a cruciform member does).

e. Connection modifier of "3 Rows" now sets the EN93 "long joint" factor NL to 3.

## Performance

1) 32-bit version or Windows Vista is no long supported support.

2) During **File/Open** now read each DXF/SHP file on a separate processor core to speed up open.

3) Increased limits for finite element engine to more than double the number of joints and members that can be included in an analysis to enable modeling absurdly large lattice substation structures.

4) Dramatically sped up creating configurations for PLS-CADD's **Structures/Automatic Spotting/Optimum Body and Leg Extension Selection...** feature when not all leg extensions are compatible with all body extensions.

5) Implemented Family Manager model memory compression to reduce memory used by up to 8x.

## Standards and Codes

1) Implemented NESC 2023 which is identical to pre-2023 NESC except for GRF which is calculated as per ASCE 74-2020.

2) Initial implementation of EN50341-2-4:2016 (German NNA) requirements for wind and ice loading on towers provided for testing. Sections of type "Crossarm" are loaded as per 4.4.3.2 DE1.2.

3) Added EN50341-2-2:2019 (Belgian NNA) wind/ice loading model that is similar to EN50341-1:2012. Sections of type "Crossarm" are loaded as per 4.4.3.2 BE.3.

4) Implemented EN50341-2-2:2019 and EN50341-2-2:2019en93 strength checks and EN50341-2-2:2019 (Belgian NNA) connection check. Unique thing is that RDIS is checked via Bearing Capacity and Rupture Capacity solely consists of RBSH.

5) Added EN50341-3-2:2001 (Belgium NNA) strength check option and no longer print Bcc (Bearing Capacity Coefficient) for EN50341-2-2:2019 ECCS/EN93 checks because not used.

6) Implemented ASCE 74-2020 (Face and Member) wind/ice loading methods in **Loads/Vector Loads** and **Loads/Wire Loads**.

7) Added AS/NZS 7000 terrain category selection: "1_2021" which includes the new $M_{z,cat}$ values for TC1 in AS 1170.2-2021.

8) Added "IS802:2015 NFW" Structure Wind/Ice Loading Method (NFW = Narrow Front Wind) same as

IS802:2015, but with Kz = 1 (note IS802 refers to Kz as GRF, but it is Kz). Use of this method forces saving in a new file version.

9) Implemented EN50341-2-8:2017 (French NNA) connection rupture check that is derived from 2012 EN93 check. Use of this option will force saving in a new file format.

10) Updated EN50341-2-8:2017 (French NNA) equations FR17EN93-74, FR17EN93-76 and FR17EN93-78 as per RTE. Ask RTE or technical support for updated documentation before using.

11) Merged ECCS and EN50341-1:2012 crossing diagonal check implementations so that either code-family can be used with the other's check.

12) Fixed special case in ECCS and EN50341-1:2012 Crossing Diagonal Check with unequal double angles connected by the short leg where could use the wrong axis for normalized slenderness when deciding if member long (eccentricity) or short (restraint).

13) Removed warnings about "PN-90/B-03200" and "EN50341-2-22:2016" implementations being preliminary after client feedback.

14) **Model/Check** now validates that terrain category values for ASCE, IEC, CENELEC, UKNNA (2001), UKNNA (2015/2017) and TPNZ are valid. We strongly discourage hand editing PLS input files.

15) Fixed Equation 3-12a (the "long joints" shear reduction factor) which applies to EN93 variants of EN50341-1:2012 and derived NNA's that effectively overestimated the length of the joint by one bolt which was conservative.

16) For ECCS and ECCS derived EN50341-1:2012 codes now set the effective non-dimensional slenderness of leg members with restraint code of 4 equal to the non-dimensional slenderness which is more conservative. Note: leg members should not be used in the slenderness range where this matters.

17) Fixed special case in ECCS (and derived codes) of Crossing Diagonal Check with unequal double angles connected by the short leg where could use the wrong axis for normalized slenderness when deciding if member long (eccentricity) or short (restraint).

18) Changed EN50341-2012 (and all derived codes) RBSH calculation to explicitly only include members "that contains two or more bolts (nb > 1)." even though do not expect rupture check with one bolt to control.

19) Fixed EN50341-2-9:2017 (UK17ECCS) tension capacity calculation when nh = 0 and nb = 1 so that Ft = Fy instead of Ft = Fu.

20) Bolt Properties now has an Ultimate Stress (Fub) input which when non-zero TOWER will use the minimum of it and angle Fu for bearing capacity calculation in ASCE-10, EN50341-1:2001, EIA 222-F, EIA 222-G, IS-802, CSA S37, EN50341-1:2012 (and EN93 variant) and SP 16 13330.2011 and used instead of calculated Fub for rupture capacity calculation for EN50341-1:2012EN1993 (ENC12), EN50341-2-9:2015 EN1993, EN50341-2-9:2017 EN1993, EN50341-2-22:2016 and EN50341-2-15:2017.

21) Added a Stub Angle Check as per EN50341-2-2:2019. Read the manual carefully before using this.

22) **Geometry/Sections/Table Edit** Adjustment Type of "Crossarm" now triggers special EN50341 crossarm loading for all EN50341 derived load cases.

23) Added **Geometry/Sections/Table Edit** Adjustment Type of "IECSquare" that triggers use of IEC60826:2017

equation 16 for yawed wind on lattice tower body for all IEC60826 and EN50341 derived load cases.

## Drafting and Graphics

1)  Added **Drafting/Add Loading Tree Views** command that creates inset views for all load cases that show vector loads graphically. You enter the number of load cases per page.
2)  Added option to Structure Inset Views to "Hide symmetrical labels", "Only label angle members" and "Avoid text collisions".
3)  **Drafting/Attachments (Raster and Vector)/Stretch and Drafting/Attachments (Raster and Vector)/Move** are now undoable and move now has a preview rectangle.
4)  Structure Inset Views now allow the view angle to be different than the clip box angle so you can view a structure from a different angle than straight on.  Use of this option will force saving in a new file format.
5)  You may now apply bold, italic, and/or underline styles to text annotation. When used annotation will be saved in a new file format.
6)  Annotation table edit now applies the same background color to all rows in multi-part entities (e.g. polygons).
7)  Text annotation now has an option to auto-size to fit in a box.  When used annotation will be saved in a new file format.
8)  Added "Draw center of gravity symbols" check box to the 3D Controls dialog that when checked draws one CoG symbol per section.  Also draws in inset orientation view.
9)  The Connection View now draws extra half bolt spacing on the short leg when both legs connected and an odd number of bolts.  Previously drew on the long leg which looks unnatural for the odd bolt case.
10) Added **Drafting/Annotation (Program Generated)/Auto Add Dimension Lines** command that dimensions insulator attachment heights as well as Family Manager body and leg extension boundaries (or Section boundaries in non-Family Manager models).

## Interface

1)  Now store undeformed geometry extents, scale and rotation in <project_name>.wnd whenever you save.  On open the undeformed geometry will be returned to this state. Added **Window/Save Window State** so you can commit Window State without having to save the model.
2)  Added "Append" command to table right click menu which will append text in the clipboard to all selected cells.
3)  Restructured "3d Controls" dialog reached via **View/Display Options/Set Rotation, Color and Label Options** to make room for new options.
    a.   "Along Member" now draws Member Labels along the axis of the member.
    b.   "Angles only" only draws Member Labels on angle members.
    c.   "Custom" Member Labeling option that draws label based on settings in **General/Output Options**. This label can include anything you like and recognizes the following keywords:

%member_label, %length, %stock_no, %bolt_type, %num_bolts, %num_holes, %group_label, %group_desc, %group_angle_type, %group_angle_size, %group_material, %section_label, %beta_angle, %RLX, %RLY, %RLZ, %Eccentricity, and %Restraint.

    d.  Added new Render Mode of "de-emphasize" that makes it much easier to see labels on top of a still rendered structure.

4) Automatic window resizing when you drag to the border of the application can now create half height windows if dragging to the bottom or top.

5) 3D Controls dialog now has a "Guys only" option to limit labeling to guy elements. This feature was also added to Inset Views.

6) Added a scale indicator to the lower right of most graphics views.  Control default visibility with new **File/Preferences** setting "Default show scale indicator" and explicitly turn it On/Off with **View/Pan, Zoom & Rotate/Show Scale Indicator**.

7) Added **Help/Download Examples...** command that enables access to the latest examples at any time (you can now restore examples inadvertently overwritten without a reinstall) as well as examples that are too large to ship with regular updates.

8) Reference Manager now includes the program name and version in the default informational string for newly referenced files.

9) Otto-Pilot improvements: re-enabled access to Otto-Pilot, adjusted defaults so small projects fly by smoothly, now try to draw at a consistent rate irrespective of how much of the model is on the screen (will move smoothly for sparse scenes and take larger steps for more complex scenes).

10) Streamlined **Help/Download Upgrade** so it launches directly into the upgrade selection dialog.  Options that only apply to legacy upgrade methods are no longer displayed.

11) Added "Load case <name> has a dead load factor of 0.0" to the list of suppressible warnings in **General/Output Options**.

12) Now color code Connection Inspector text (also shown in **Geometry/Members/Table Edit**): group type now shown in group type color, capacities called out, controlling capacity shown in purple, warnings in blue and errors in red.

13) **Results/Group Summary/...** menu now puts Angle Forces For All Load Cases, Climbing Load Check and Stub Angle Check at top level.

14) Inset Angle Orientation view in **Geometry/Members/Table** and "Connection Inspector" now rotated by the angle beta angle.  Also, double angles now drawn to match the coordinate system definition given in the TOWER manual

## Miscellaneous

1) **File/Backup** now indicates that it includes files from the Reference Manager by default.

2) Added menu item **View/Dance Structure** so you can bind a hotkey to it (previously only available in right click menu).

3) Joints with **Geometry/Miscellaneous/Foundation Strength** capacities input are now drawn in dark green and those with a spring constant are drawn in reddish-orange when rendering the view.

4) Now print distance in the status bar when using **Drafting/Annotation (User Input)/Add/Dimension**.

5) The Generate Graphs button in the Loading Method Parameters dialog now generates GRF and Wind Height Adjust graphs for non-solidity ratio based loading codes.

6) Model Diff now considers Reference Manager, User Entered Material, Attachment Manager, and User Annotations.

## Reports

1) The **F1/Print All Load Cases** command now offers to Save As PDF instead of printing: PDFs will automatically be named after each load case.

2) Now auto-detect PDF print driver built into Windows 10.  You may manually choose a PDF print driver in the **File/Preferences** setting "Print driver used to create PDF files".

3) The new "Save As PDF" command now includes an option to save that PDF to Google Drive automatically.

4) Added right click menu command "Save As PDF to Reference Manager" for geometry views that saves the view to a PDF file which is added to the Reference Manager.

5) Added option to export tables to Google Sheets (both those in windows and those in reports): we preserve formatting, color coding, etc. during export.

6) Added ability to specify page size to use when saving reports to PDF to the **Drafting/Page Size** dialog. Otherwise this will default to sheet page dimensions.

7) Added experimental **File/Preferences** setting "Include XSD export along with XML export" that defaults to No. When set to Yes, the software will write the XSD file that corresponds to the XML exported.

8) Added **File/Preferences** setting "Program version to report during XML export" which defaults to blank.  You may set this to whatever version you would like to have shown in the XML file header.

9) Changed Material Decompose Assemblies option available in **Model/Generate Input Echo Report** and **Drafting/Add Material List Report**, to include subassembly names in addition to component parts to be consistent with PLS-CADD.

10) Added "Stub Angle Check", "Joint Support Reactions", "Joint Support Reactions in Direction of Leg", to XML postprocessor file.

11) Added **General/Output Option** "Print Group instead of Angle Forces" that replaces the "Angle Forces For All Load Cases" output with "Group Forces For All Load Cases".

12) Load case specific Groups Summary now includes Stub Angle Check and load case specific Climbing Load Check in it (previously only in overall Groups Summary).

13) Added Center of Gravity (CoG) X, Y, Z coordinates to the Sections Information table in Analysis Results report.

14) Added Resultant Force to the "Foundation Design Forces For All Load Cases" output.

## Licensing

1) Added ability to "Unclaim" a license from the license dialog reached via the key button in Help/About. Licenses may only be "Unclaimed" from within the software if they had been claimed for at least 30 days. Please continue to contact technical support to unclaim licenses that are younger than 30 days.

## Family Manager (Body and Leg Extensions)

1) Added "Fix foundation rotational restraints when used as a leg" option to Extension Edit dialog. When set save .TOW as a version 21.6 file.
2) The Family Manager "Configurations" table now uses protected background color for "Include In Analysis" column when set to "No" so can easily find those configuration that will actually be run.
3) Interactive Member Sizing now works for Family Manager models with "Run Only Active Model" set, that have been opened and analyzed without any other Family Manager operations.
4) Family Manager now automatically removes characters in Body and Leg Extension name that are illegal in file names when exporting family members.
5) The Family Manager Export command now offers option to export DXF files in addition to XML and TOWER models.

## Climbing Check

1) Added EN50341-3-2:2001, EN50341-2-2:2019 ECCS and EN93 Climbing Load Checks which are combined bending and axial checks that rely on the orientation of the angle about it's longitudinal axis (the beta angle).
2) Removed extra factor of RLClimb from BE19-96a.
3) Now apply RLClimb squared to be conservative with Climbing Load Check in CLC-1b when calculating weight of member.
4) Added Climbing Strength Factor to Vector Loads (.LCA) and Wire Loads (.LIC) files. Entering a non-zero value will trigger saving these files in a new format.
5) Now print "Vertical Leg Up" and "Vertical Leg Down" for single angle members in the: Connection Inspector, Angle Members table and status bar for Member Info. This is relevant for the new Climbing Load Checks.
6) Added Climbing Status and Climbing Load to overrides in **Geometry/Members/Capacities and Overrides...**. Entering a non-default value will trigger saving the the ".tow" file in a new format.

## Web, Components, & Examples

1) New Videos
   a. TOWER Optimization Methods - https://www.youtube.com/watch?v=xcU7TCfRY7o
   b. Redundant Member Design Checks in TOWER - https://www.youtube.com/watch?v=TvajkHJoiok
   c. Crossing and Corner Diagonal Checks in TOWER - https://www.youtube.com/watch?v=nq1Uylek_Pk

    d. Reference Manager see the video at [https://youtu.be/K04mKvUcVzA](https://youtu.be/K04mKvUcVzA)

    e. PLS-GRID Project Manager - [https://www.youtube.com/watch?v=UUZDwMKQi_s](https://www.youtube.com/watch?v=UUZDwMKQi_s)

    f. Auto-detect PDF print driver built into Windows 10 - [https://youtu.be/o5F_UzeFVrs](https://youtu.be/o5F_UzeFVrs)

    g. Export tables to Google Sheets - [https://youtu.be/o5F_UzeFVrs](https://youtu.be/o5F_UzeFVrs)

2) Technical Notes

    a. PLS-GRID Workflow - [https://www.powline.com/technotes/PLS-GRID_Workflow.pdf](https://www.powline.com/technotes/PLS-GRID_Workflow.pdf)

    b. Crossing Diagonal Check -

    [https://www.powline.com/technotes/TOWER_Crossing_Diagonal_Check.pdf](https://www.powline.com/technotes/TOWER_Crossing_Diagonal_Check.pdf) (Updated)