

2015 PLS-CADD Advanced Training and User Group Meeting

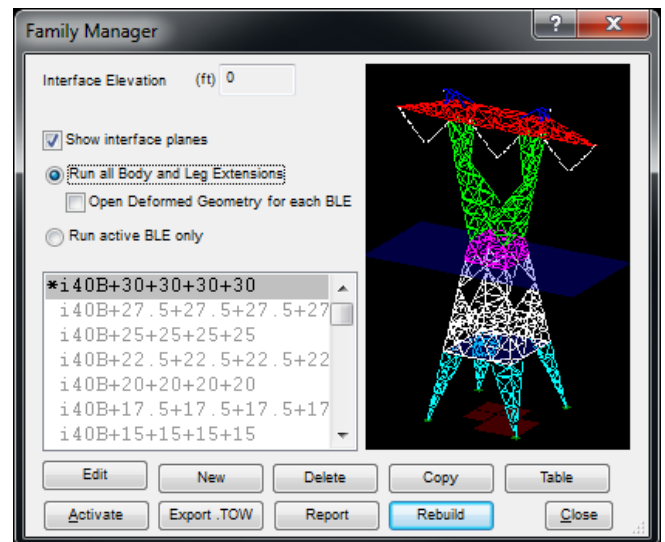
What's New in TOWER™

Summary of changes since July 2013 User Group, covers versions 12.50-13.31

Family Manager (Body and Leg Extensions)

The Body and Leg Extension (BLE) feature previewed at the 2013 ATUG is now in production. You may enable the *Family Manager* via **Model/Family Manager**. The *Family Manager* allows many different body and leg extensions to be modeled in a single TOWER model (.tow file). All of these models share component files, groups definition and all joints and members defined above the interface elevation. When engaged the Family Manager supports the following:

- 1) Ability to build Body and Leg Extensions manually or by importing them from another TOWER model.
- 2) An option to run all defined configurations or just the active one when run an analysis.
- 3) An option to create deformed geometry for each configuration when run an analysis.
- 4) Analysis of all configurations will automatically substitute the *Group Summary Super Set (Compression Portion)* and *Group Summary Super Set (Tension Portion)* outputs for the non-superset version. It also makes the Groups Summary Super Set table available via the deformed geometry.
- 5) Analysis of all configurations will automatically substitute the *Summary of Joint Support Reactions For All Load Cases and Models* and *Summary of Joint Support Reactions For All Load Cases and Models in Direction of Leg* outputs for the non-superset version. It also makes them available via the deformed geometry.
- 6) Optimization can be performed over all configurations that are defined in a model.
- 7) Allowable span/Interaction diagram generation will now iterate over all configurations defined in the model if the *Run all BLEs* Family Manager option is selected.



- 8) For more information view the Family Manager video: <http://youtu.be/2hx8JMw9nRQ>

Engineering

- 1) Overhauled redundant member design:
 - 1.1) No longer require collinear members to be in same group to design them, but added constraint that must not have any other leg members in the plane formed by the redundant and the collinear leg under consideration.
 - 1.2) Now design "secondary redundants" (redundants that do not directly brace a leg), but are attached to another redundant for the load in the other redundant.
 - 1.3) Fixed problem where could not calculate the leg vector when non-support end of leg is a pure redundant joint and redundants are excluded from the analysis which prevented *Summary of Joint Support Reactions For All Load Cases and Models in Direction of Leg* from being printed.
- 2) Now allow modeling of a floating deadend by chaining strain insulators on the end of a suspension insulator.
- 3) Interactive Member Sizing now details how many results were rejected due to capacity limit, L/r and climbing load check when it doesn't find any solutions.

Standards and Codes

- 1) Implemented EN50341-1:2012 Member, Connection, Crossing Diagonal, Climbing Load and Included Angle checks. Also added the conservative variant as *EN50341-1:2012-EN1999*. These checks and interpreting EN50341-1:2012 are non-trivial: study the manual before using.
- 2) Implemented Russian *SNiP (SP 16.13330.2011)* Member and Connection checks and wind/ice loading method.
- 3) The *Member Capacities and Overrides* output now includes a note (not a warning) when rupture capacity is controlled by geometry (RDis) instead of block shear (RBsh).
- 4) The *Member Capacities and Overrides* output now includes a warning when violate ASCE end or edge distances (10-97 equations 4.5-2, 4.5-3, 4.5-6) where previously had just derated rupture capacity.
- 5) Added *ISEC-NCR-83* wind/ice loading method which automates the calculation of the drag coefficient (Ct), wind increase with height (M1') and terrain factor (M2).

- 6) Added *ECCS 1985* method for connection rupture check. This only implements provisions 10.2-10.5 of ECCS 1985. The preexisting "ECCS" check implemented the provisions of EN50341-1:2001.
- 7) Now automate *CSA S37-01's* special case for calculation of compression capacity for solid round members with a diameter > 51mm with $n=0.93$ instead of $n=1.34$. If you have members that meet this criteria, but that are stress relieved then contact us for a switch to do the calculation the old way.
- 8) *BS-8100, EN50341-1 (2001 and 2012)*: revised rupture check of bolt spacing so that it is checked when have 2 or more bolts rather than 3 or more when connected on both legs and the long edge distance is greater than zero (equations EN12-50c, Euro-57, and BS-41).
- 9) Added support for *AS/NZS 7000* Terrain Categories 1.5, 2.5 and 3.5.

Interface

- 1) **TOWER** now has an Entity Info mode similar to the one in **PLS-CADD**. By default it will snap to joints and members while highlighting groups. Left click for context menu items and to access Entity Info Settings. Some of the options available for the selected item when using Entity Info include: edit, info, move, split, intersection, min distance, rename, delete, change group type, change element type, etc.
- 2) Can now undo all operations performed since the last save and redo any undone operations. Previously limited to undo/redo of just the last operation.
- 3) Table pop up menu now has a **Copy & Fill Column** menu item to provide quicker method of filling entire column with a single value.
- 4) Combo boxes now support Ctrl-C, Ctrl-V and Shift-Ins, Ctrl-Ins to copy or paste an item.
- 5) Enhanced preservation of member/joint cut status in the undeformed geometry view so it is maintained even if the number of joints and/or members changes.
- 6) Now close all reports when you close the project. This is consistent with what **PLS-CADD** does and avoids possible problems with independent report windows.
- 7) Pressing 'c' in joint, member or group info now copies the currently selected joint, member or group label to the clipboard.

- 8) Added a "Unit System indicator" to the status bar (Imperial abbreviated as "US" and Metric as "SI").
- 9) Member info now appends origin and end joint coordinates to the status bar text when used in the undeformed geometry.
- 10) Revised **View/Find/Member** and **View/Find/Joint** so hilite in orange using concentric circles. Used orange so that hiliting isn't lost when in Member or Joint info modes. To unhilite, run the Find command a 2nd time and cancel.
- 11) Status bar font size can now be specified in **File/Preferences** *Font size for status bar text* and the status bar automatically grows to multiple lines of text if needed to fit displayed text. Earlier versions tried to make the text fit by decreasing the font size which could result in a font size that was difficult to read or text that got clipped.
- 12) Multiple monitor support improved through right click menu **Detach Window** function that allows reports and graphics windows to be dragged to other monitors.
- 13) Can now drag report/view windows to the edge of the main program window in order to automatically resize them to fill either half the screen, or the whole screen. Drag to the left edge and release to fill the left half of the window, drag to the right to fill the right half of the window, or drag to the top to maximize. Can now also resize report/view windows towards the top or bottom of the main program window to automatically resize to fill the full vertical space of the main program window. During these operations, a preview rectangle is displayed to show the resulting resize operation before it occurs.
- 14) Reuse of dialog box position and sizes from previous session can be defeated through **F1/Debugging Stuff/Reset dialog box positions and sizes....** Resetting dialog box positions and sizes to their default values can be helpful after changing the number of monitors on a computer. While the program attempts to adjust dialog positions to keep them visible on screen there are multiple monitor scenarios where it can't tell additional monitors have been removed (typically involves docking stations).
- 15) Now show ground (translucent green plane) at the elevation input in **General/General Data** if none of the fixed joints in the model lie on ground. Makes it obvious when a grillage or pier is used.
- 16) Pressing 'S' in Joint Info mode now draws concentric circles and hilites from/to joints of the currently selected joint if it is a secondary joint.
- 17) May now drag pictures inset in many dialogs to our reports and to other programs (Word, paint programs, etc.).

18) The *Connection Inspector* is now resizable as well as being accessible from the Entity Info left click menu.

19) Added a Voltage input in **General/General Data**. Input the highest voltage wire the structure is designed to support. Future versions will make use of this for searching and sorting structures. **File/Batch Modify** may be used to populate voltage for many structures at once.

20) The "Point load placed on non-existent joint" error now has an option to remove the LCA/LIC file reference to fix the problem.

21) The **Geometry/Insulators/Optional Attachment Restriction** table now allows suspension tip joints to be selected since can chain strain insulators off of them.

22) Many more minor user interface refinements too numerous to list here.

Drafting

Added a Sheets view and a Drafting menu with functionality similar to **PLS-CADD**'s. You may define a set of sheets (title, note, drawing and appendix pages) upon which you can draw using annotation and send schema output from reports to these pages. An example drawing created with these tools can be seen at http://www.powline.com/files/pls_pole/tower/StructureDrafting_ble.pdf

- 1) Moved the Attachments and Annotation sub-menus from General to the new Drafting menu.
- 2) The Attachment Manager now allows reordering of attachments by right clicking on one to drag and drop it to the desired position.
- 3) The Attachment Manager now has an "Open" button that opens any selected attachments using Windows Explorer.
- 4) Default drafting sheets are created for old structure projects and any new project. These default sheets can be fully replaced or customized.
- 5) **Drafting/Page Size...** specifies the size of all sheet pages.
- 6) **Drafting/Number of Sheet Pages...** specifies the starting page number and how many pages there are for each type of sheet: title, notes, drawing, and appendix.

- 7) **Drafting/Import Drafting Settings...** allows you to import drafting related settings from another project for sheet page configuration, attachments, annotations, structure views, and/or report views. These imported settings can either be added to or replace the current project's drafting settings.
- 8) With **Drafting/Text Size, Line Width, Style, Color and Layer...** you can adjust the default appearance of many drafting elements including annotation text size and line thickness and color, inset report view text size and color (also line thickness and color), sheet border thickness and color, and the border style and label sizes of inset structure views.
- 9) The **Drafting/Annotation (User Input)** commands all apply now to both annotations for the model view and for annotations on drafting sheets.
- 10) When using either **Drafting/Annotation (User Input)/Move Point or Text...** or **Drafting/Annotation (User Input)/Move Line or Polygon...** you can now hold down the CTRL key to restrict movement to the horizontal or vertical plane.
- 11) **Drafting/Annotation (User Input)/Add/Section Bubble...** is a new annotation type which consists of a line with an attached two line label contained by a circle which can be used to document section cuts or regions of the structure in an inset structure view.
- 12) **Drafting/Annotation (User Input)/Add/Arc..** is a new annotation type for a section of a circle defined by three points.
- 13) **Drafting/Annotation (User Input)/Add/Ellipse/Circle...** is a new annotation type for drawing ellipses. Hold down the CTRL key when drawing an ellipse to force it to draw a circle.
- 14) **Drafting/Annotation (User Input)/Add/Dimension Angle...** is a new annotation type which draws an arc and labels that arc with the angle it defines. Hold down the CTRL key when drawing the angle to force horizontal/vertical angles.
- 15) **Drafting/Annotation (User Input)/Add/Dimension Snap...** has been enhanced to replace the offset dialog with graphical controls which allow you to select if you want the dimension to snap to a horizontal or vertical axis, how much of an offset to use, and whether you want lead lines from the joints measured to the dimension arrow points.
- 16) The new annotation types and **Dimension Snap** have been added to the annotation toolbar.

- 17) **Drafting/Inset Views/Add Inset Structure View** creates a view of the structure on one of the drafting sheets. The view can be of either all or part of the structure depending on the selected scale and can be from one of several possible orientations including the plan view, longitudinal view, transverse view, isometric view, or a custom view copied from the current model window.
- 18) Added several new options for customizing Inset Structure Views including a title and border for the view, the style of structure drawing including coloring, and optional labels for joints and members.
- 19) **Add as Annotation to Inset View** command in the context menu for any report will create an Inset Report View on a sheet page with all the contents of that report as appropriately sized annotation elements.
- 20) If you re-run a report that you've created an Inset Report View from, it will automatically update the contents of the view with the latest report results. You can also lock an Inset Report View to prevent the auto update (or any other automatic changes that may result in the loss of manual customizations).
- 21) From any table in the program you can use the **Add as Annotation to Inset View** command in the context menu to create an Inset Report View on a sheet page. This report view can contain the entire table, or just the selected cells.
- 22) **Drafting/Inset Views/Split Inset Report View** will divide any Report Inset View into multiple separate Report Inset Views which can then be moved or resized separately to display long or detailed reports more clearly or across multiple pages. The contents are divided between the newly created inset views. All created views remember the report they came from and can update appropriately if not locked.
- 23) There are **Move**, **Resize**, or **Delete** commands for any inset view. When moving and resizing, you can snap an inset view edge to an adjacent inset view.
- 24) If any inset views overlap, you can use the **Bring to Front** and **Send to Back** commands to determine which views are drawn on top. Any inset view can be set to have a transparent background so it won't completely obscure what is underneath it.
- 25) For Structure Inset Views, the **Drafting/Inset Views/Autoscale Inset View** command will automatically adjust that view's center point, scale, and clip dimensions to fully display the current contents of the model view inside that inset view.
- 26) For Report Inset Views, the **Drafting/Inset Views/Autoscale Inset View** command will automatically adjust the text size, row height, and column width to fit the report contents in the current inset view area. You can

hold down the CTRL key to select multiple report inset views for this command. If you do, then the text size and row height will be the same across all selected views and the rows for the different inset views will line up properly. Note: Autoscaling a Report Inset View will revert any manual customizations made to the annotations within the Report Inset View since it was last generated or auto-updated.

- 27) **Drafting/Add Orientation to Structure View...** will add a VTL diagram annotation labeling the Vertical, Transverse, and Longitudinal axes of the selected Structure Inset View or the model view.
- 28) If this structure has an LCA vector load file associated with it, **Drafting/Add Loading Tree Report...** will create, on the specified sheet, a Loading Tree Report Inset View along with an Isometric Structure Inset View with a VTL diagram and the attachments labeled. The report contains the vertical, transverse, and longitudinal loads for each attachment point for each load case.
- 29) **Drafting/Add Material List Report...** will create a Report Inset View containing the stock number, description, and quantity of each type of material associated with this structure.
- 30) **Drafting/Add Member Group Report...** will create a Report Inset View containing a list of all angle groups with their label, description, type, size, and the material, element, and group types.

Reports

- 1) Added the "Report Navigator" toolbar which allows you to quickly Goto, Table View, XML Export and Add As Annotation the various tables in a report.
- 2) Report windows can now be freed from the main application window by selecting "Detach Window" in the report right click menu (allows report to be displayed on different monitor). An "Attach Window to Application" menu is also provided to undo this. A video demonstrating this feature is available on our Web site. Similar "detach" capability for graphics views is available. This behavior is controlled by a new tristate setting in **File/Preferences: Open reports in separate free-floating windows** which defaults to "Never" (the previous behavior). Select *With Multiple Monitors* or *Always* to benefit from this work. We strongly recommend this for clients with more than one monitor.
- 3) Reports now support keystrokes Ctrl + (Control and plus key) and Ctrl - (Control and minus key) to jump to the next and previous schemas (results) in a report. Also available via **Edit/Next Result** and **Edit/Previous Result**.
- 4) Hovering mouse over tables in reports now displays information about customizing table format and showing hidden columns in the status bar.

5) Right click **Compare report** command now bolds alternate rows in difference schema so obvious which row came from which report.

6) URLs in reports are now highlighted and can be clicked upon to launch a Web browser.

7) The *Group Summary* table is now available for each load case individually in addition to over all load cases. You can find it in the right click Results menu as well as by clicking on a group displayed for a specific load case in the Deformed Geometry.

8) Added *Equilibrium Joint Positions and Rotations for All Load Cases* summary to the *Results* menu available in the deformed geometry.

9) Added *Loads/Loading Tree Report* which produces a simple loading tree report suitable for inclusion on structure drawings.

10) Added the *Material List* report to the input echo when have defined stock numbers for the components in your structure.

Commands

1) **Geometry/Members/Add** now allows undo of each member added rather than an all or nothing undo.

2) **Geometry/Members/Split** command revamped: Unbraced length ratios now have options to reset to 1.0, keep unchanged or auto-adjust. Preference setting to keep eccentricity and restraint codes moved to the *Split Angle Options* dialog.

3) The Merge button in **Loads/Vector Loads** now allows multiple LCA files to be merged in at once (if you multi-select them in the file selection dialog).

4) **General/Output Options** now allows you to suppress some warnings, including slenderness, "Load case does not load insulator", etc. Note that slenderness warnings for tension-only members are suppressed by default ("KL/r" exceeds the maximum...").

6) **Geometry/Members/Fence Remove Symmetry** no longer needs separate passes for removing symmetry from joints and members when have tangled symmetry dependencies. Can now process joints and members with one use of the command (press 'j' and 'm' to toggle between joint and member modes).

7) Added:

7.1) **Geometry/Members/Move** that allows graphical moving of members (including angles) like the corresponding command in PLS-POLE.

7.2) **File/Fit Vertical To Page** mode which fits the vertical extent of the screen to the page (may result in horizontal clipping) which is a better match to the aspect ratio of most structures. If not checked then same as previous behavior: the entire screen is fit to the page.

7.3) **File/Show Print Area** which is only available in "Fit Vertical To Page" mode. Draws dashed lines showing the edge of the page.

7.4) **F1/Debugging Stuff/Toggle Unit System** principally to have the command available for making a custom toolbar button to switch unit systems.

7.5) **F1/Toggle Render Mode (Line/Wireframe/Render)** principally to have the command available for making a custom toolbar button to do this.

7.6) **Geometry/Rename Joint...** command which replaces **F1/Joint Commands/Change All References to a Joint in TOWER**. New command handles symmetry and allows selection of the joint to rename rather than typing it in. **Geometry/Rename Joint** may be invoked by pressing "r" when in Joint Info mode in which case it uses the currently selected joint as the item being renamed.

7.7) **Geometry/Groups/Rename Group...** command that allows you to pick a group to rename and then renames it along with all angle member references to it. **Geometry/Groups/Rename** may be invoked by pressing "r" when in Group Info mode in which case it uses the currently selected group as the item being renamed.

7.8) **Geometry/Prompt For Joint Label on Creation** and **Geometry/Members/Prompt For Member Label on Creation** settings that when toggled will force commands that create new joints/members to prompt you to override the default label.

7.9) **F1/Redefine sections by elements rather than elevations with joints...** command that converts sections from being joint defined to each element selecting a section. This is helpful when using the family manager to move extensions around.

7.10) *Cable Geometry* to the list of items that can be applied via **File/Batch Modify**.

7.11) **F1/Joint Commands/Convert Secondary Joint To Primary** command that does just that.

8) **File/Batch Modify** now has an *Analysis Option (Design Check, Allowable Spans, ...)* option. Coincident with this renamed "Analysis Option" to "Analysis Type" as it selects linear/nonlinear analysis and that is consistent with naming in the General Data dialog.

9) **File/Batch Modify** now has an option for *Post Processor Options*.

10) **File/Model Diff** will now check Steel Material Properties for differences.

Miscellaneous

1) Increased maximum group label length from 8 to 12 characters.

2) Upgraded to newer more reliable versions of libraries used for jpeg, tiff and file compression (libjpeg, libtiff, zlib). This and other related changes should improve performance and reliability.

3) The *Project Repair Wizard* now has an option to "Remove reference to file" which can be useful for missing LCA files.

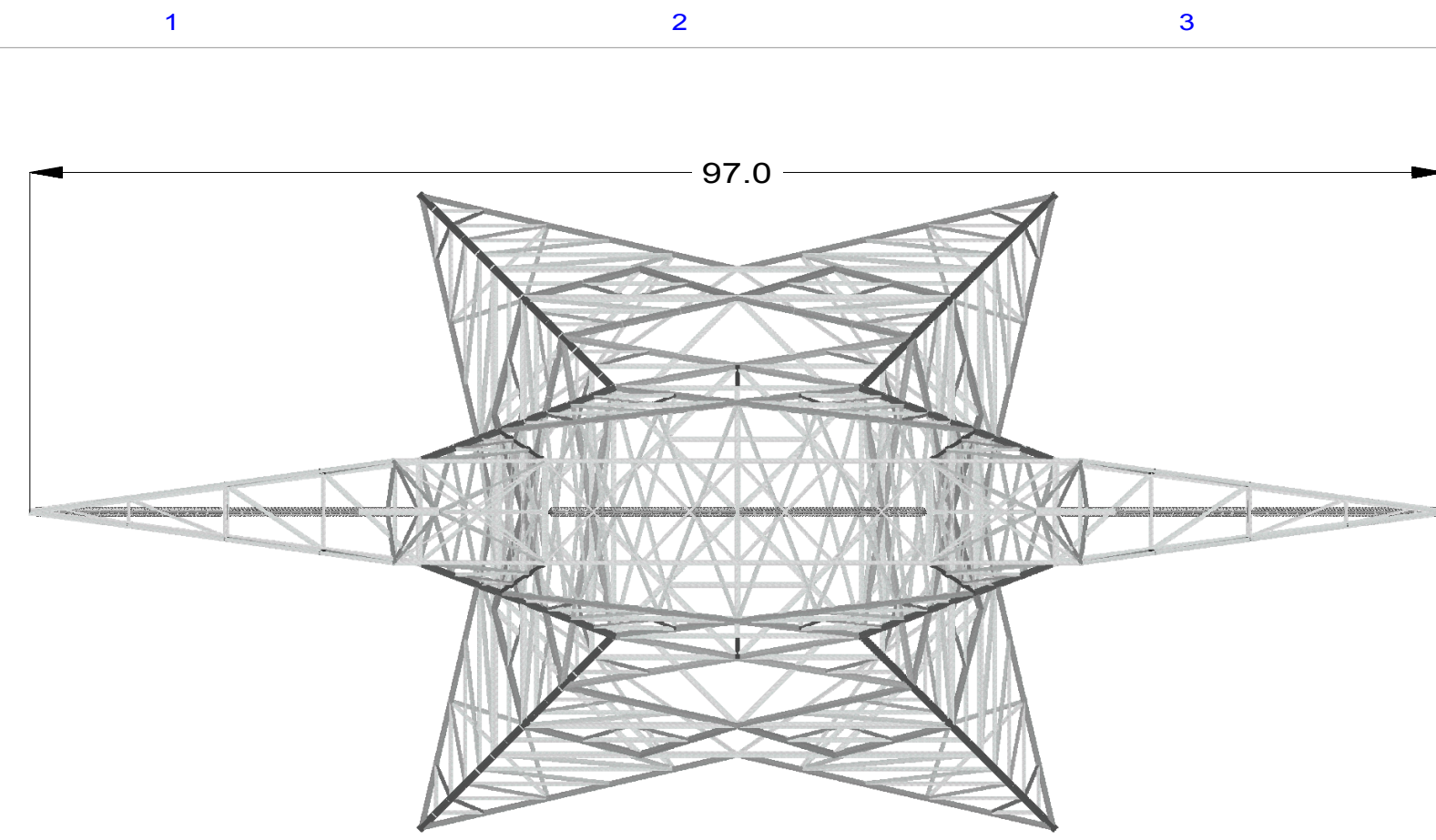
4) New manual available for download via **Help/Check For Updated Manual**.

5) Fixed sources of more than 20 different ways to crash program identified in client submitted crash reports.

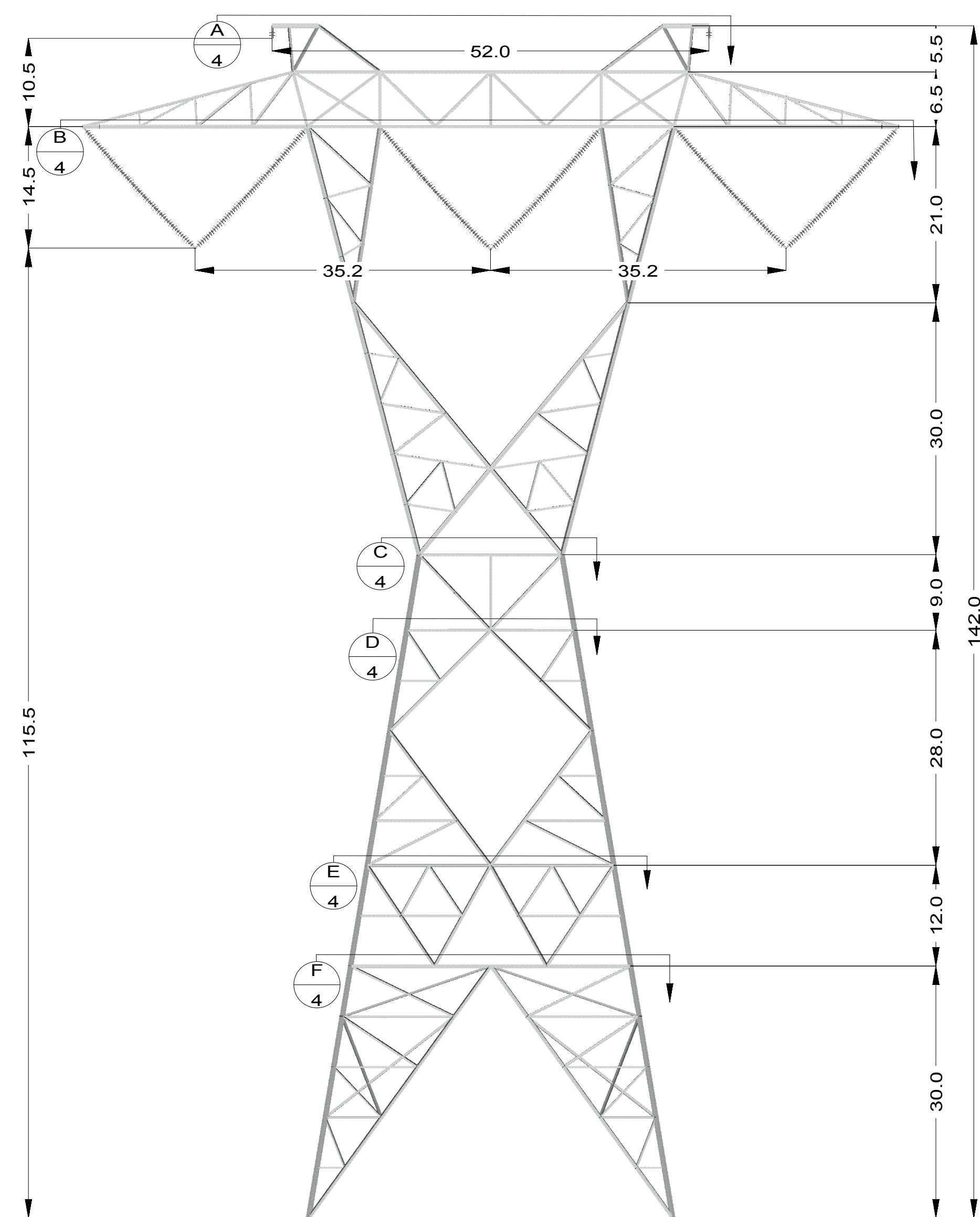
6) Added **F1/Override member section colors with automatically chosen material colors** command so can visualize steel material type usage.

7) Fixed limitation in Intel CPU library that prevented running on computers with more than eight cores per physical processor.

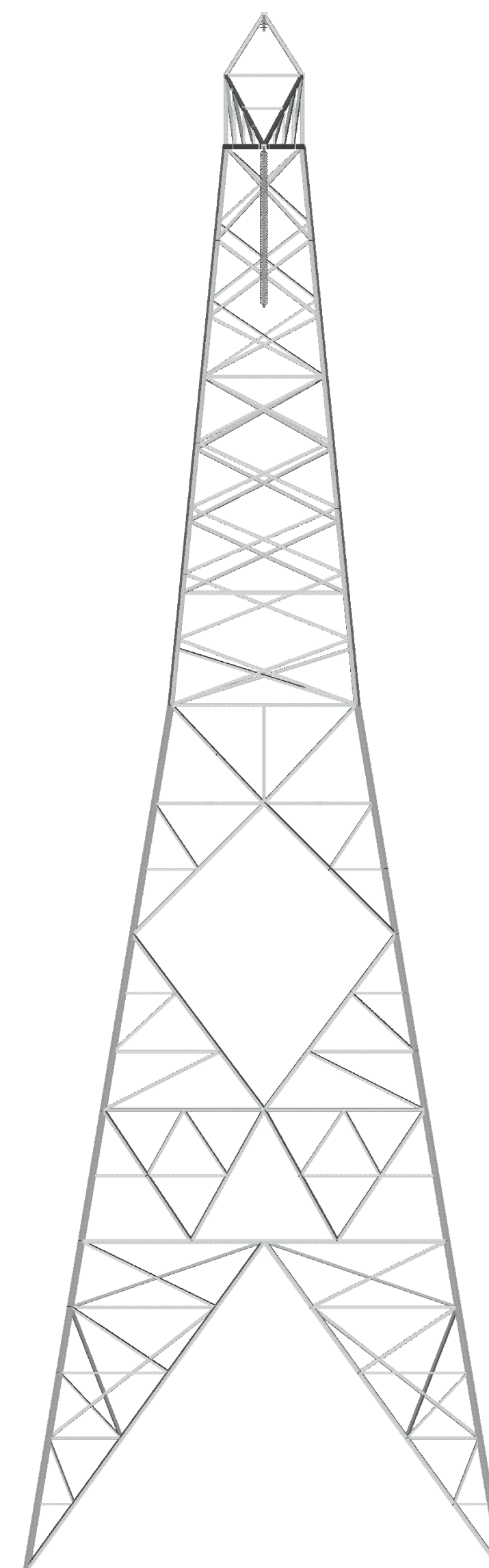
8) Minor changes to reduce memory usage, improve interface or performance too numerous to mention here.



Plan



Longitudinal



Transverse

Group Label	Group Description	Angle Type	Angle Size	Material Type	Element Type	Group Type
2	BB-L2	SAE	5X5X0.3125	50 KSI ST	Beam	Leg
3	BB-L3	SAE	5X5X0.3125	50 KSI ST	Beam	Leg
4	BB-L4	SAE	5X5X0.375	50 KSI ST	Beam	Leg
5	BB-L5	SAE	3.5X3.5X0.25	50 KSI ST	Beam	Leg
6	BB-GW1	SAE	3X3X0.1875	A-36	Truss	Other
7	BB-GW2	SAE	3X3X0.1875	A-36	Truss	Other
8	BB-BRG	SAU	3.5X3X0.25	A-36	Truss	Other
9	BB-WDW	SAE	4X4X0.3125	A-36	Truss	Other
10	BB-WD2	SAE	5X5X0.3125	A-36	Truss	Other
11	BB-WD3	SAE	5X5X0.3125	A-36	Truss	Other
12	BB-BR2	SAE	4X4X0.25	A-36	Beam	Other
13	BB-BR3	SAE	4X4X0.25	A-36	Beam	Other
14	BB-ARM	SAE	5X5X0.3125	50 KSI ST	Beam	Other
15	BB-HGR	SAU	3.5X3X0.25	50 KSI ST	T-Only	Other
16	BB-BR4	SAE	4X4X0.25	A-36	Truss	Other
17	BB-BR5	SAE	3.5X3.5X0.25	A-36	Truss	Other
18	BB-BR6	SAE	2X2X0.1875	A-36	Truss	Other
19	BB-BR7	SAE	3X3X0.1875	A-36	Truss	Other
20	BB-BR8	SAU	2.5X2X0.1875	A-36	Truss	Other
21	BB-BR9	SAU	2.5X2X0.1875	A-36	Truss	Crossing Diagonal
22	BB-B10	SAE	3X3X0.1875	A-36	Truss	Other
23	BB-B11	DAS	3X2X0.375	A-36	Truss	Other
24	BB-B12	SAE	2X2X0.1875	A-36	Truss	Other
25	BB-B13	SAE	2X2X0.1875	A-36	Truss	Crossing Diagonal
26	BB-B14	SAE	3X3X0.1875	A-36	Truss	Other
28	BB-B15	SAE	2X2X0.1875	A-36	Truss	Other
29	BB-B16	SAE	2X2X0.1875	A-36	Truss	Other
30	BB-B17	SAE	3.5X3.5X0.25	50 KSI ST	Truss	Crossing Diagonal
31	BB-G3	SAE	3X3X0.1875	A-36	Truss	Other
32	BB-G4	DAE	6X6X0.625	A-36	Beam	Other
33	BB-B18	SAU	2.5X2X0.1875	A-36	Truss	Other
34	BB-LO1	SAU	3.5X3X0.25	50 KSI ST	Truss	Crossing Diagonal
35	BB-LO2	SAE	3X3X0.25	50 KSI ST	Truss	Crossing Diagonal
36	BB-LO3	SAE	3X3X0.1875	50 KSI ST	Truss	Crossing Diagonal
37	BB-LO4	SAE	3X3X0.1875	A-36	Truss	Crossing Diagonal
38	BB-LO5	SAE	3X3X0.1875	A-36	Truss	Crossing Diagonal
39	BB-LO6	SAE	3X3X0.1875	A-36	Truss	Crossing Diagonal
40	BB-W1(E)	SAE	3X3X0.1875	A-36	Truss	Redundant
41	BB-W2(D)	SAU	3X2.5X0.1875	A-36	Truss	Redundant
42	BB-W3(B)	SAU	2.5X2X0.1875	A-36	Truss	Redundant
43	BB-W4(A)	SAE	2X2X0.1875	A-36	Truss	Redundant
44	BB-W5(B)	SAU	2.5X2X0.1875	A-36	Truss	Redundant
45	BB-W6(E)	SAE	3X3X0.1875	A-36	Truss	Redundant
46	BB-W7(D)	SAU	3X2.5X0.1875	A-36	Truss	Redundant
47	BB-WA1	SAU	5X3X0.25	50 KSI ST	Truss	Other
48	BB-WA2	SAE	3.5X3.5X0.25	50 KSI ST	Truss	Other
49	BB-WA3(C)	SAE	2.5X2.5X0.1875	A-36	Truss	Redundant
50	BB-BOD	SAU	4X3X0.25	A-36	Truss	Other
52	BB-WA4	SAU	4X3X0.25	A-36	Beam	Other
53	BB-WA5(F)	SAU	3.5X3X0.25	A-36	Truss	Redundant
54	BB-BO1	SAU	4X3X0.25	A-36	Beam	Other
56	BB-W8(A)	SAE	2X2X0.1875	A-36	Truss	Redundant
57	BB-W9(E)	SAE	3X3X0.1875	A-36	Truss	Redundant
58	BB-W10(G)	SAE	3.5X3.5X0.25	A-36	Truss	Redundant
59	BB-HG1	SAU	2.5X2X0.1875	A-36	Truss	Other
60	BB-B19	SAU	3.5X3X0.25	A-36	Truss	Other
61	BB-B20	SAU	2.5X2X0.1875	A-36	Truss	Other
62	BB-B21	SAU	2.5X2X0.3125	A-36	Truss	Other
63	BB-B22	SAU	5X3X0.3125	A-36	Truss	Other
64	BB-W11	SAE	4X4X0.25	A-36	Truss	Other
65	BB-(A)	SAE	2X2X0.1875	A-36	Truss	Redundant
66	BB-(D)	SAU	3X2.5X0.1875	A-36	Truss	Redundant
67	BB-(E)	SAE	3X3X0.1875	A-36	Truss	Redundant
68	BB-(I)	SAU	4X3.5X0.25	A-36	Truss	Redundant
69	BB-(D)	SAU	3X2.5X0.1875	A-36	Truss	Redundant
70	BB-(A)	SAE	2X2X0.125	A-36	Truss	Redundant
71	BB-(B)	SAU	2.5X2X0.1875	A-36	Truss	Redundant
72	BB-(A)	SAE	2X2X0.125	A-36	Truss	Redundant
40BE-1	40BE-1	SAE	5X5X0.3125	50 KSI ST	Beam	Leg
40BE-2	40BE-2	SAU	5X3X0.3125	50 KSI ST	Beam	Other
40BE-7	40BE-7	SAU	5X3.5X0.3125	50 KSI ST	Beam	Other
40BE-8	40BE-8	SAU	5X3X0.25	A-36	Beam	Other
40BE-9	40BE-9	SAU	5X3X0.25	A-36	Beam	Other
40BE-10	40BE-10	SAU	5X3X0.25	A-36	Beam	Other
40BE-11	40BE-11	SAE	5X5X0.3125	A-36	Truss	Other
40BE-15	40BE-15	SAU	4X3.5X0.25	A-36	Beam	Other
40BE-A	40BE-A	SAE	2.5X2.5X0.1875	A-36	Truss	Redundant
40BE-B	40BE-B	SAU	2.5X2X0.1875	A-36	Truss	Redundant
40BE-D	40BE-D	SAU	3X2.5X0.1875	A-36	Truss	Redundant
40BE-E	40BE-E	SAE	3X3X0.1875	A-36	Truss	Redundant
40BE-F	40BE-F	SAU	3.5X3X0.25	A-36	Truss	Redundant
40BE-G	40BE-G	SAE	3.5X3.5X0.25	A-36	Truss	Redundant
LE-12	LE-12	SAE	5X5X0.3125	50 KSI ST	Beam	Leg
LE-13	LE-13	SAE	4X4X0.3125	50 KSI ST	Beam	Other
LE-A	40BE-A	SAE	2.5X2.5X0.1875	A-36	Truss	Redundant
LE-B	40BE-B	SAU	2.5X2X0.1875	A-36	Truss	Redundant
LE-D	40BE-D	SAU	3X2.5X0.1875	A-36	Truss	Redundant
LE-E	40BE-E	SAE	3X3X0.1875	A-36	Truss	Redundant
LE-F	40BE-F	SAU	3.5X3X0.25	A-36	Truss	Redundant
LE-G	40BE-G	SAE	3.5X3.5X0.25	A-36	Truss	Redundant

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Page 3 of 7. See <http://www.powline.com> for complete drawing package

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B	05/29/15	Structure Drawings Created Using New Structure Drafting Capabilities
A	04/10/15	BLE.TOW Project Released by Power Line Systems, Inc., Madison, WI 53705
NO	DATE	REVISIONS AND RECORD OF ISSUE

POWER LINE SYSTEMS, INC.
 ENGINEER OJL DRAWN PLS-CADD
 CHECKED NB DATE 5/29/2015

Madison to Nixa
 500 kV Transmission Line
 Designed using TOWER
 Lattice Tower Design and Analysis Software

PROJECT	BLE	DRAWING NUMBER	BLE-3	REV	B
CODE	10-24	Page 3 of 7			
AREA	51				