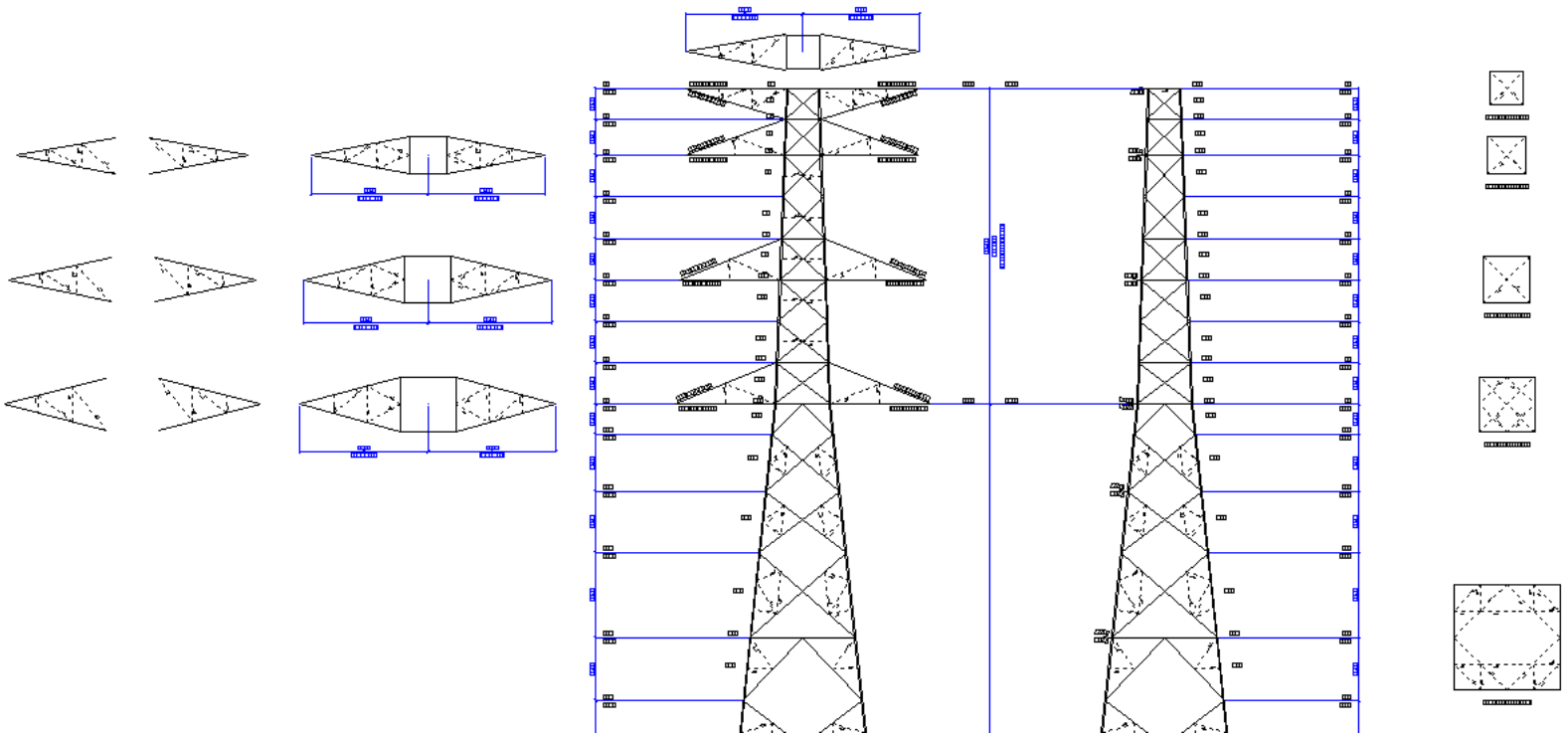
TowerSmart

Tower Detailing Tips



Series 1

gad TECHNOLOGIES
Software Developers

Tower Detailing Tips

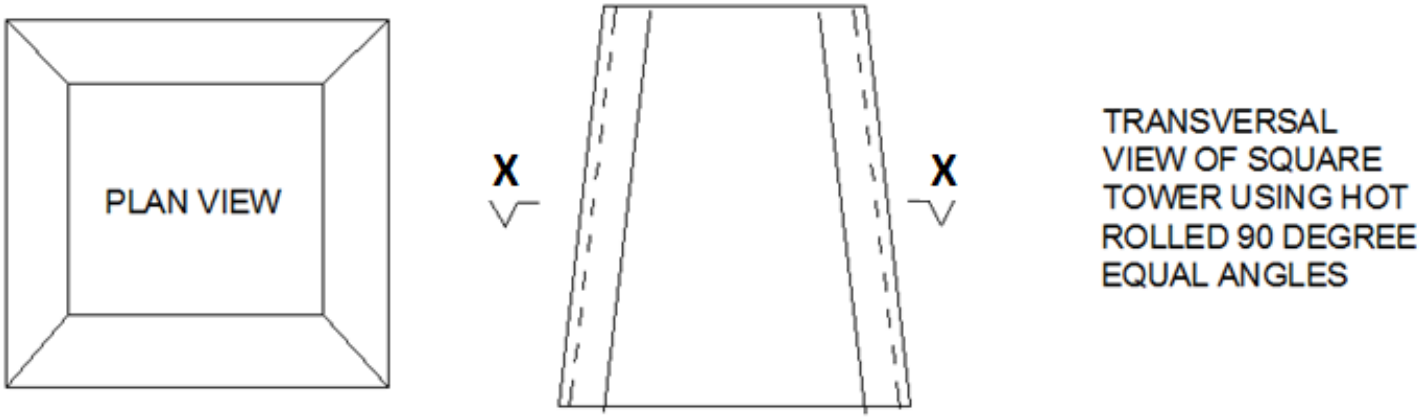
My name is Stan Gad, I develop software for the design and detailing of lattice like structures such as Radio, TV and Transmission Line towers. I started my career as a tower detail draftsman back in 1977 with a company called Electric Power Transmission Pty Ltd. EPT was at the time the co-leader of transmission line design and construction in Australia, basically the majority of transmission lines in Australia were built by EPT and Transfield. After my apprenticeship I moved to the software development section under the guidance of Lino Pozzobon. Lino was a pioneer in software development within the CAD/CAM field, he was the first to develop tower macros in early 1970's that would calculate internal bracings (hips) using a 512 step IME computer. The macros eventually grew to a full turnkey system that over many decades has developed to not only a sophisticated productivity tool but more importantly as an electronic library of tower detailing knowhow.

The intent of these presentations (Tower Detailing Tips) is to demystify tower 'myths' and 'taboos' and to give a better understanding of why tower detailing is quite simple yet can be very complex at the same time. Please enjoy the first series, I intend making many more.

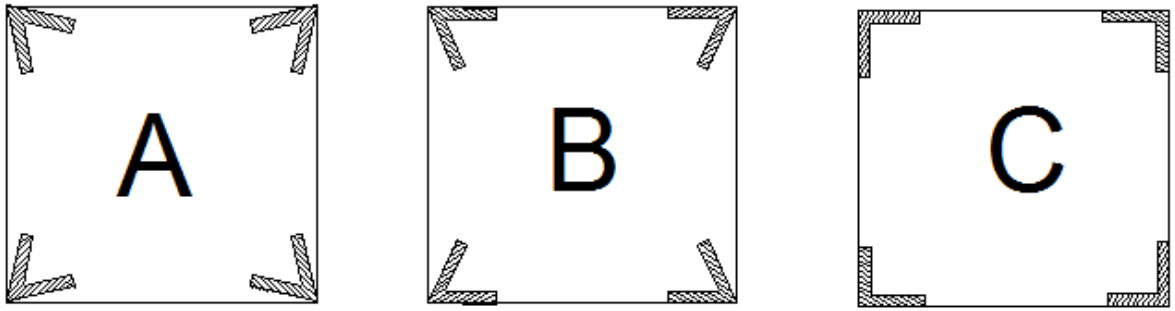
IME computer, circa 1970's …

Tower Detailing Tips

Below is a typical cross section of a Tower Body …



What is the correct view for the cross section of X-X above, is it A, B or C from below ?



The correct answer is A. This is known as the ‘open’ affect of corners on tower bodies.

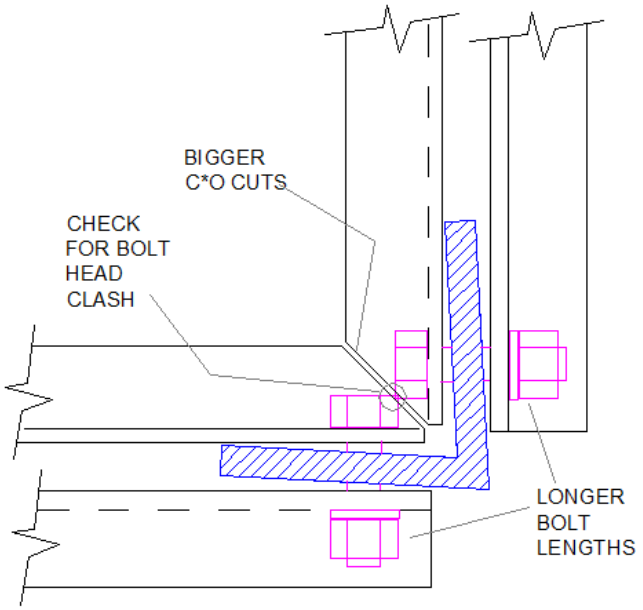
Tower Detailing Tips

Most times the open affect of corners can be disregarded but in wide towers this can cause havoc, some issues to consider are …

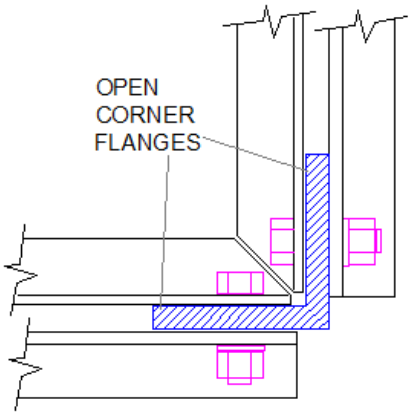
1. Increased bolt lengths
2. Bigger clearance cuts
3. Increased corner gauges

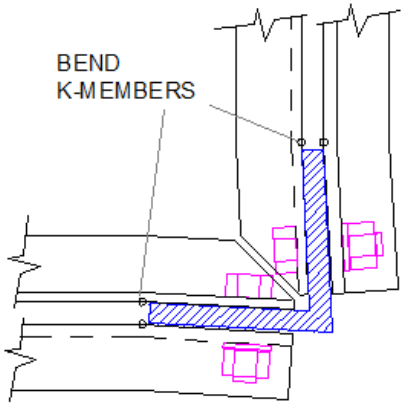
How to accommodate for the corner open ?

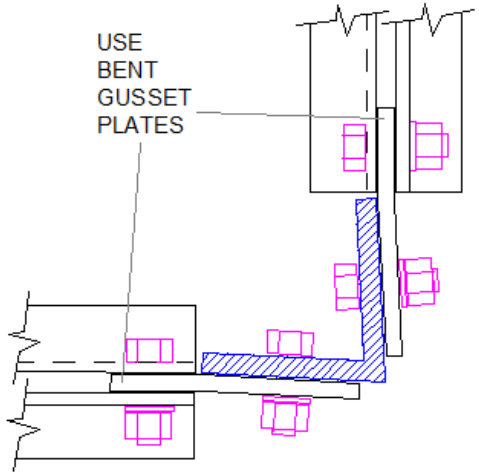
The simplest and best solution is to 'open' the corner flange at main nodes.



The alternative is to bend all incoming members (K's) or use bent gusset plates which is costlier and not necessarily the better detailing solution.







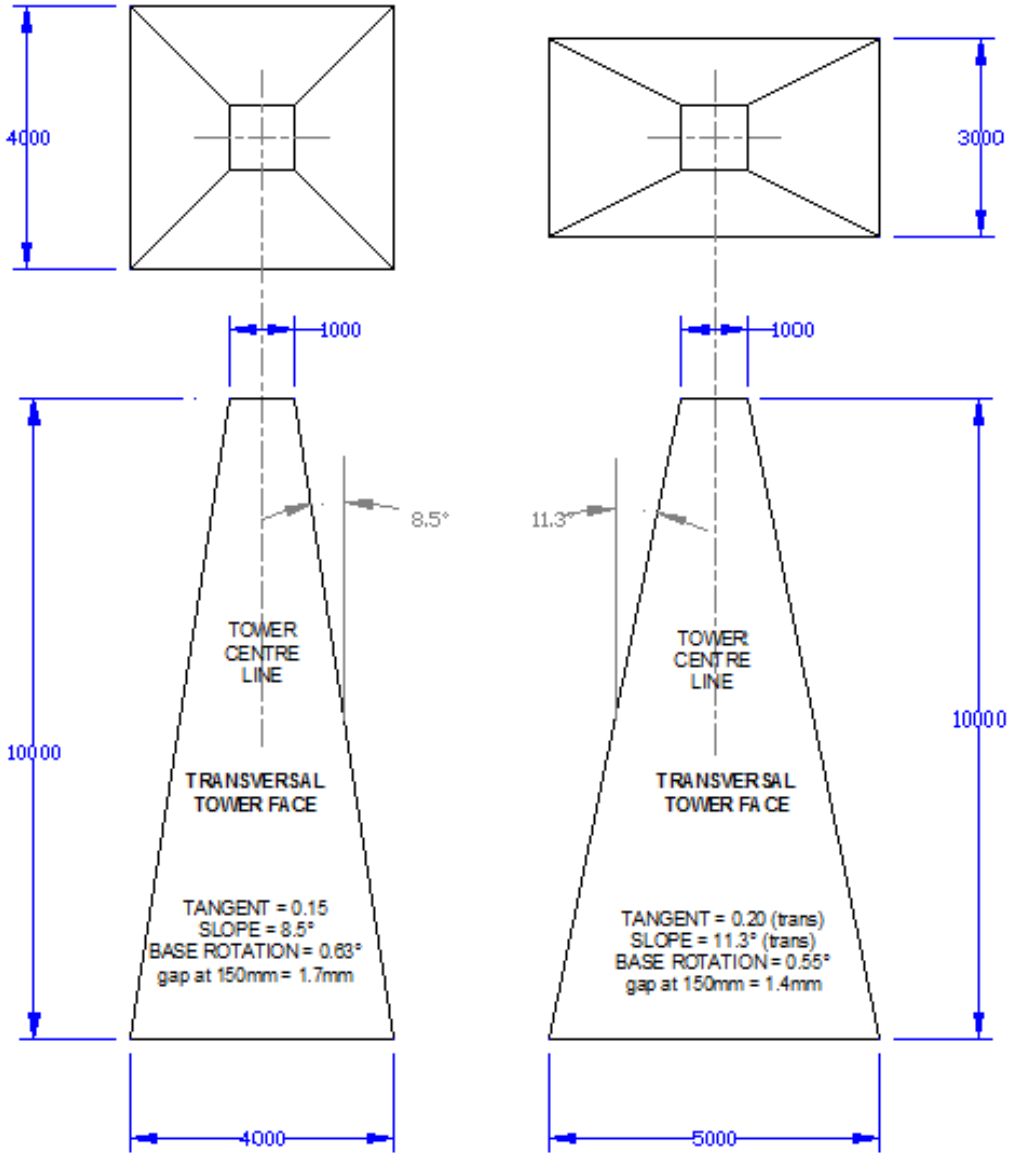
Tower Detailing Tips

Just because a tower is wide does not necessarily mean that the openning of corners are necessary.

One misconception is that wide rectangular towers require corner opens.

This is incorrect, the calculation of the open is dependant on the tangent of both the transversal and longitudinal faces.

In the next slide, we go through an example of how to calculate the corner open value.



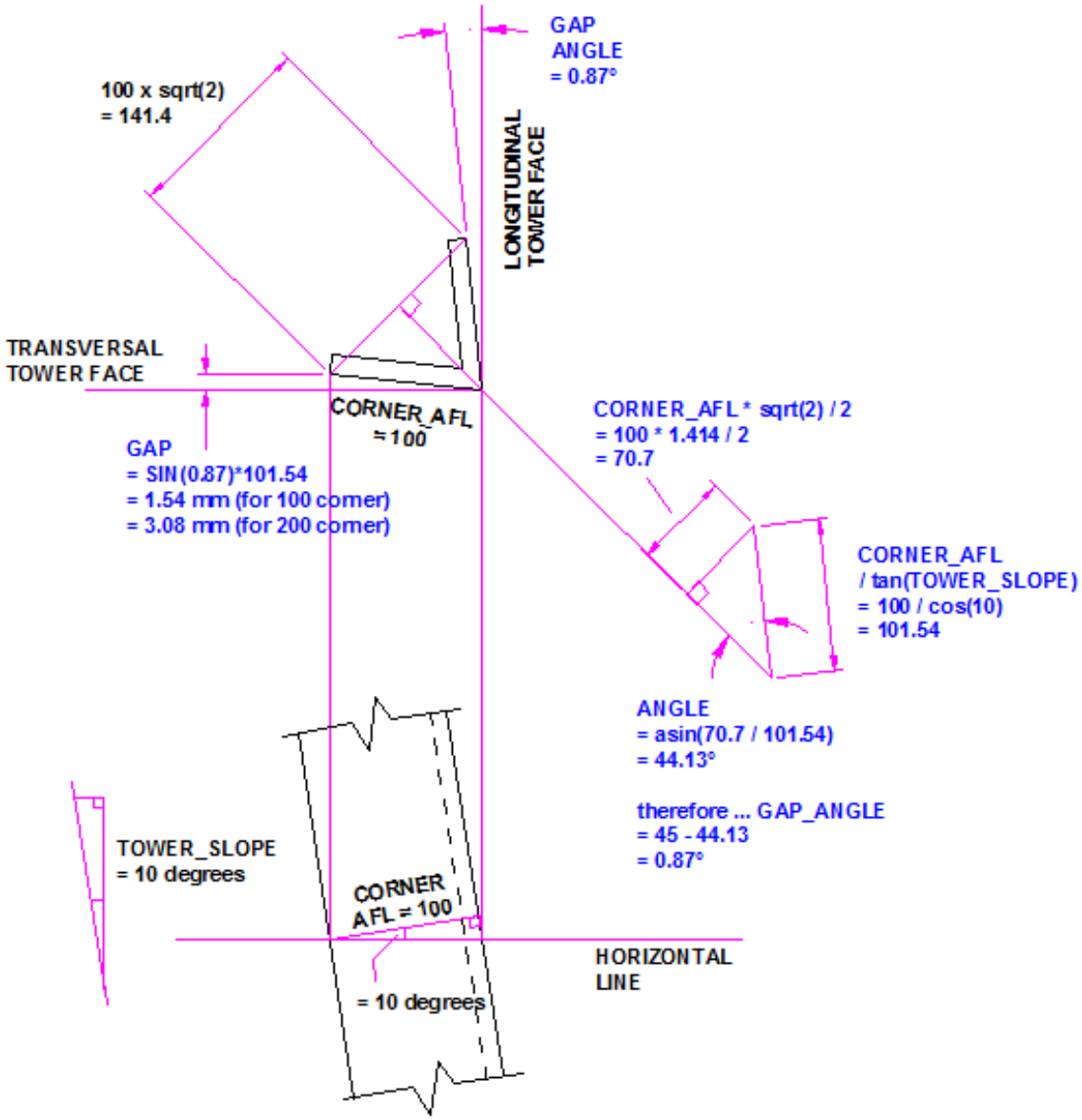
Tower Detailing Tips

The total open of a corner is basically the angle between two planes, that is the angle between the transversal and longitudinal faces as viewed thru the corner.

On the right is an example of how to calculate the corner open for a square tower using the tower slope.

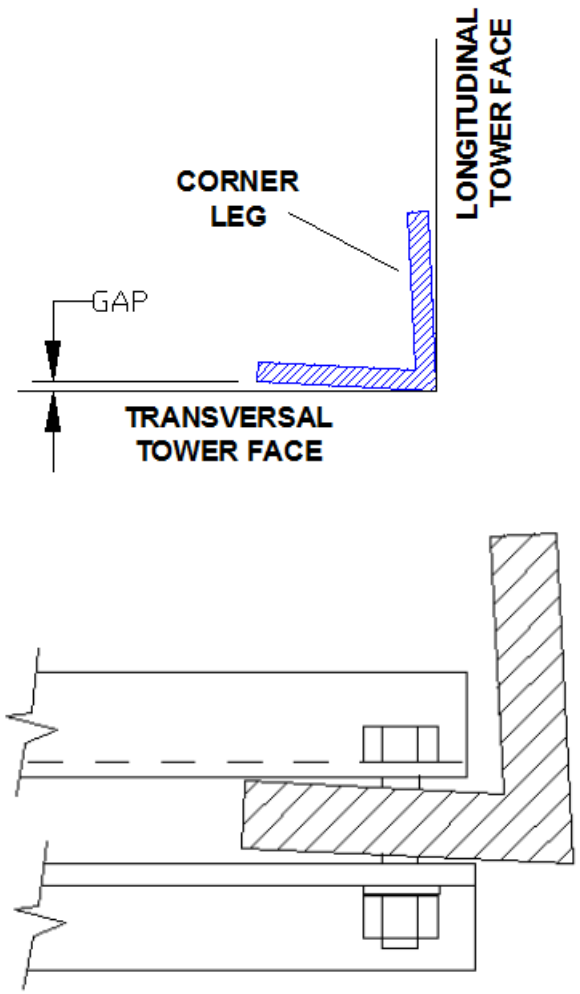
Below are formulas for calculating opens for any tower type (square or rectangular) …

T1 = Tan(Transversal_Tower_Slope)
L1 = Tan(Longitudinal_Tower_Slope)
A1 = Arctan(T1 / L1)
A2 = Arctan(Sqrt(L1*L1 + T1*T1))
A3 = Arctan(Sin(A1) / (Cos(A1) / Cos(A2)))
A4 = Arctan(Cos(A1) / (Sin(A1) / Cos(A2)))
TRANS_GAP_ANGLE = A1 - A3
LONG_GAP_ANGLE = 90 - A1 - A4



Tower Detailing Tips

When to consider local opening of the corner ?



In TowerSmart we locally open corners at main nodes when the gap value at the toe is greater than 3mm.

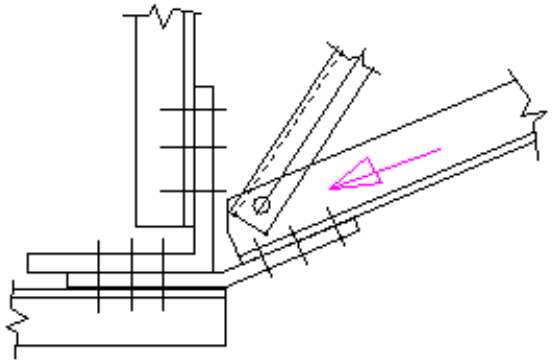
This value is a parameter that can be easily adjusted or switched off in the job options file.

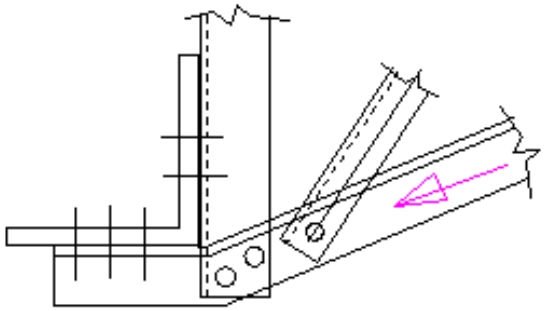
TowerSmart will automatically apply local open bends to the main nodes of corners while dismissing corner nodes with redundants (webs) since they are usually near the toe of corners and not as critical.

If open bends is not considered, it is important to understand the affect on bolt lengths. This could cause bolt threads to be exposed at the shear plane which could cause tower failure.

Tower Detailing Tips

In the next presentation (Tower Detailing Tips - Series 2) we go through the pro's and con's of bending main tower elements (corners, k-members cross-arm chords etc)





For further information on tower detailing, visit us at …

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or send us an email …

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TowerSmart

3D Detailing Systems for Lattice Structures