UNDERSTANDING ASCE-10 COMPRESSION AND TENSION DESIGN IN PLS-TOWER

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ABSTRACT

This paper has the objective of showing through two simple flow charts, how PLS-Tower develops the compression and tension design according to the ASCE-10 requirements. It is intended to present information about the design results that the program performs internally, and do so in a simpler, more understandable form.

The information contained in this article only applies when dealing with ASCE-10 requirements; however, it could be easily extrapolated to other design codes that the PLS-Tower supports, like AS-3995, Canada S37, PN-90/B-03200, etc.

NOTATION

Variable	Short definition
a	Width of single angle short leg [in]
A_{eff}	Member effective area [in²]
A_g	Gross cross-sectional area [in²]
A_{net}	Net cross-sectional area [in²]
A_t	Minimum net area in tension from the hole to the toe of the angle perpendicular to the line of force [in²]
A_v	Minimum net area in shear [in²]
b	Width of single angle long leg [in]
B_{cap}	Connection bearing capacity [kips]
$C1$	Eccentricity code
$C2$	Restrain code
C_c	Column slenderness ratio
C_{cap}	Compression capacity based on member slenderness L/r column slenderness ratio [kips]
CL	Angle legs connection code (Both, Long only or Short only)
d_b	Nominal diameter of bolt [in]
d_h	Diameter of attachment hole [in]
e	End distance of bolt hole [in]
E	Modulus of elasticity of steel [ksi]
f	Short edge distance of bolt hole [in]
F_a	Design axial compressive stress [ksi]
F_{cr}	Critical stress for local buckling [ksi]
F_t	Design axial tensile stress [ksi]
F_u	Specified minimum tensile strength [ksi]

Variable	Short definition
F_y	Specified minimum yield stress [ksi]
K	Effective length factor
L	Unbraced length of member [in]
L_x	Unbraced member length about its local x-axis [in]
L_y	Unbraced member length about it local y-axis [in]
L_z	Unbraced member length about it local z-axis [in]
n_a	Number of angles in cross section
n_b	Number of bolts in end connection
n_{bear}	Number of bearing areas per bolt
n_h	Number of holes to be deducted
n_s	Number of shear planes per bolt
N_{cap}	Tension capacity based on net section [kips]
r	Member radii of gyration [in]
R_{bsh}	Connection block shear capacity [kips]
R_{cap}	Connection rupture capacity [kips]
R_{dis}	Connection end, edge or spacing distance capacity [kips]
$RLOUT$	Alternate unbraced length ratio for crossing diagonals
RLX	Member unbraced length ratio for its local x-axis
RLY	Member unbraced length ratio for its local y-axis
RLZ	Member unbraced length ratio for its local z-axis
r_x	Member radii of gyration for its local x-axis [in]
r_y	Member radii of gyration for its local y-axis [in]
r_z	Member radii of gyration for its local z-axis [in]
s	Bolt spacing [in]
S_{cap}	Connection shear capacity [kips]
t	Thickness of element [in]
V_b	Design shear capacity of one bolt [ksi]
w	Flat-width of element [in]
w/t	Width to thickness ratio
Ψ	Unit factor (1.0 for F_y in ksi and 2.62 for F_y in MPa)
$\%\mathrm{ratio}$	Absolute value of the tension force in the supporting member divided by the force in the compressed member

DISCLAIMER

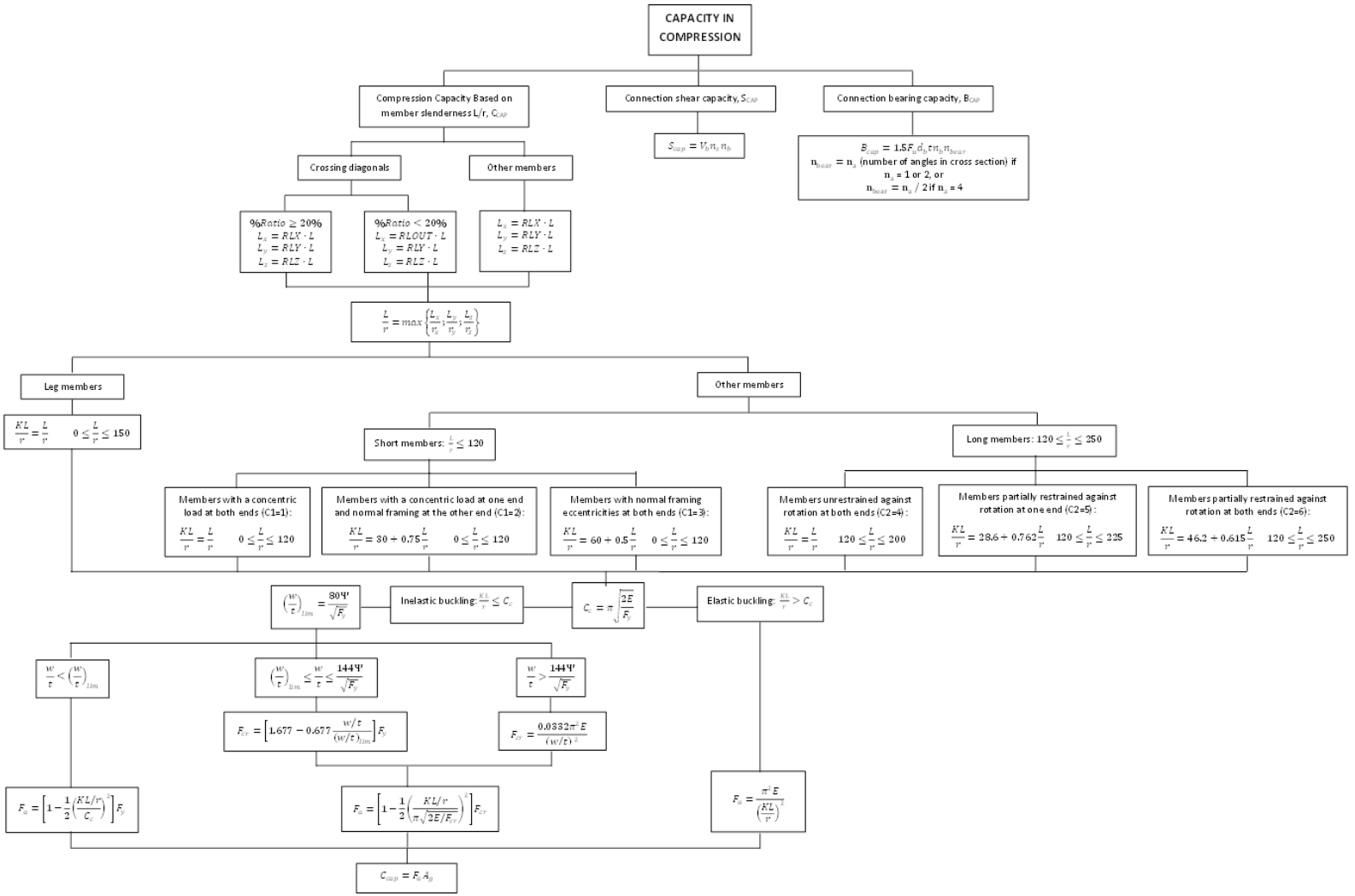

Figure 1. Compression design flow chart

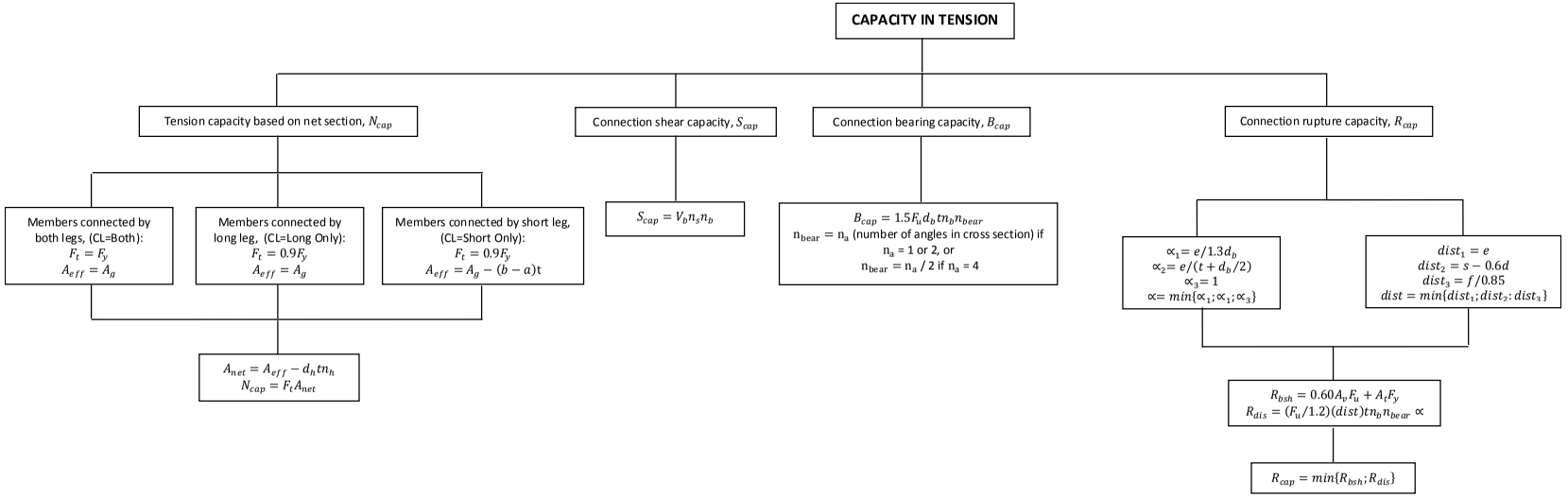

Figure 2. Tension design flow chart

REFERENCES

(1) TOWER – Version 12.3 Manual. Power Line System, Inc ©. 2012.
(2) ASCE 10 (1997). Design of Latticed Steel Transmission Structures. American Society of Civil Engineers. Reston, Va.