Evaluation of corner connection with wide flange brace in Ordinary Concentrically Braced Frame (OCBF) - CBFEM

Strength of Elements in Compression

The *available strength* of connecting elements in compression for the *limit states* of *yielding* and *buckling* shall be determined as follows:

(a) When $KL/r \le 25$

$$P_n = F_y A_g \qquad \text{(J4-6)}$$

$\phi = 0.90$ (LRFD) $\quad \Omega = 1.67$ (ASD)

(b) When $KL/r > 25$, the provisions of Chapter E apply.

Available compressive strength of the gusset plate based on the limit state of flexural buckling is determined from **AISC Specification Section J4.4.** and then compared with **design compression load** to determine if buckling is a limit state

Available compression strength < Design Compression load → Connection **safe for buckling**

Available compression strength > Design Compression load → Connection **not safe for buckling** and requires modifications

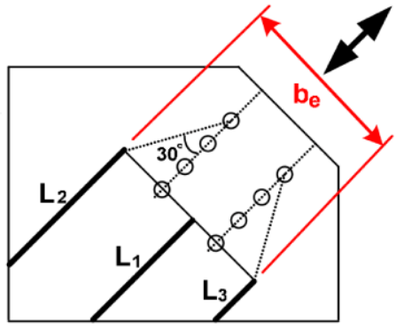


Figure 2.4-2: Gusset plate diagram indicating Thornton lengths (Tsai and Hsiao 2008)

1. Evaluation of buckling according to **AISC (AISC 360-16)**

Global

Steel Fy	AISC Method	Critical buckling factor
36 ksi	LRFD	αcr>12.7
50 ksi	LRFD	αcr>9.16
36 ksi	ASD	αcr>21
50 ksi	ASD	αcr>15

Local

AISC Method	Critical buckling factor
LRFD	αcr>3 – Member plates αcr>4 – Connection plates (i.e. bracket plates)
ASD	αcr>4.5 – Member plates αcr>6 – Connection plates (i.e. bracket plates)

Slenderness limit ratio for non slender connecting plates $\frac{Lc}{r} = 25$

$$Fe = \frac{\pi^2 E}{(Lc/r)^2} = \frac{\pi^2 (29{,}000\ ksi)}{(25)^2} = 458\text{ksi}$$

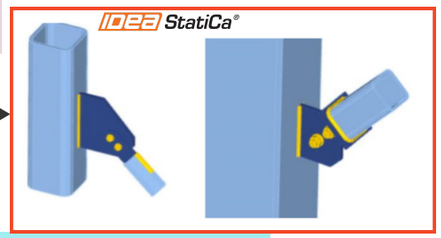
$$\alpha cr = \frac{Fe}{Fy} = \frac{458}{36} = 12.7$$

IDEA StatiCa 12

B

Check of gusset plate for buckling at the **Whitmore section**

2. Evaluation of Buckling in **IDEA StatiCa Connection (Linear Buckling Analysis)**



a. Type of buckling in Connection

a. **One Side** Restraint/ connected → a. **Global Buckling** (Global Limit factors applies)

Critical Buckling factor in CBFEM **more** than recommended global limit factor by AISC → Connection is **safe for buckling**

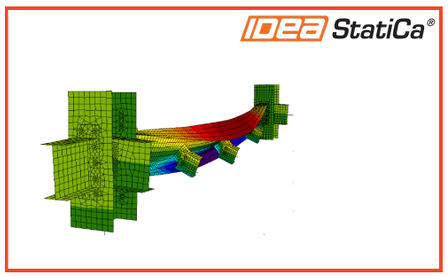
Critical Buckling factor in CBFEM **less** than recommended global limit factor by AISC

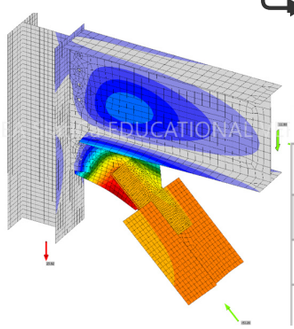
Ways to increase the buckling factor in CBFEM or AISC
1. Increase gusset plate thickness or
2. Stiffen the members in connection with stiffeners or / and doubler plates.

b. **Two / Three** sides restrained or connected → b. **Local Buckling** (Local Limit factors applies)

Critical Buckling factor in CBFEM **more** than recommended local limit factor by AISC → Connection is **safe for buckling**

Critical Buckling factor in CBFEM **less** than recommended local limit factor by AISC → **Issue with buckling** of local member plate or in thin walled / hollow section members → Use **IDEA StatiCa Member [Non-Linear Buckling Analysis]**





Local buckling of joint

	Loads	Shape	Factor
>	-53.2K	1	7.94
		2	20.53
		3	22.09