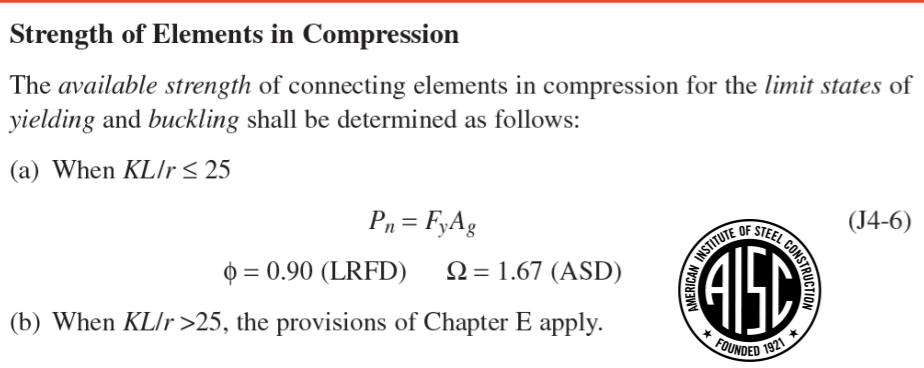


# Evaluation of connection in two-story X-brace configuration of Ordinary Concentrically Braced Frame (OCBF) - CBFEM



**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

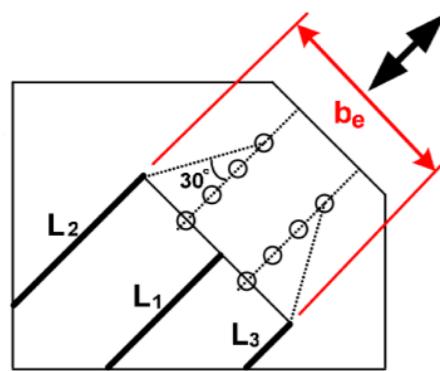
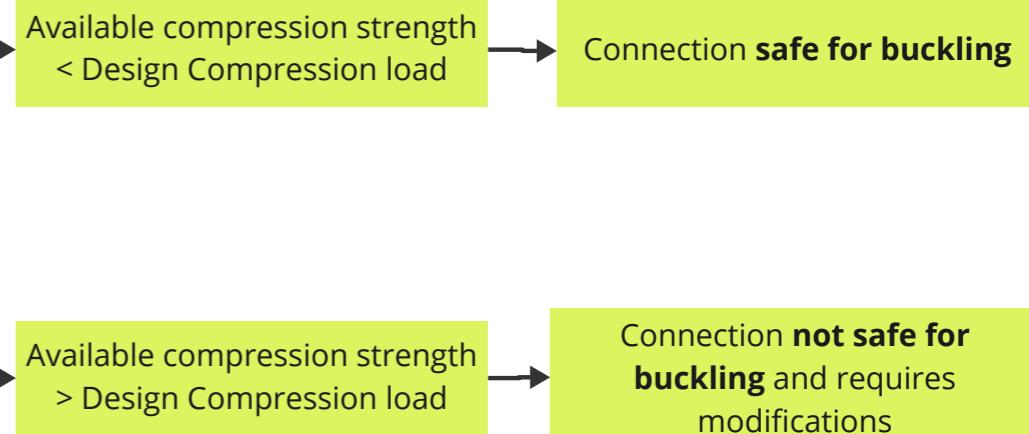


Figure 2.4-2: Gusset plate diagram indicating Thornton lengths (Tsai and Hsiao 2008)

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

## Global

Steel Fy	AISC Method	Critical buckling factor
36 ksi	LRFD	$\alpha_{cr} > 12.7$
50 ksi	LRFD	$\alpha_{cr} > 9.16$
36 ksi	ASD	$\alpha_{cr} > 21$
50 ksi	ASD	$\alpha_{cr} > 15$

## Local

AISC Method	Critical buckling factor
LRFD	$\alpha_{cr} > 3$ – Member plates $\alpha_{cr} > 4$ – Connection plates (i.e. bracket plates)
ASD	$\alpha_{cr} > 4.5$ – Member plates $\alpha_{cr} > 6$ – Connection plates (i.e. bracket plates)

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

IDEA StatiCa®

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

$$\alpha_{cr} = \frac{F_e}{F_y} = \frac{458}{36} = 12.7$$

12

B

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

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



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

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

Connection is **safe for buckling**

**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.

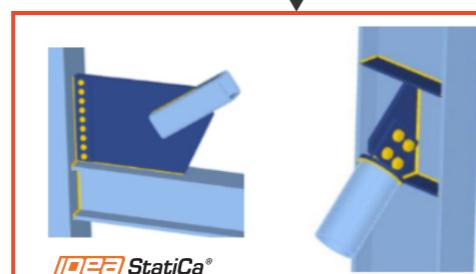
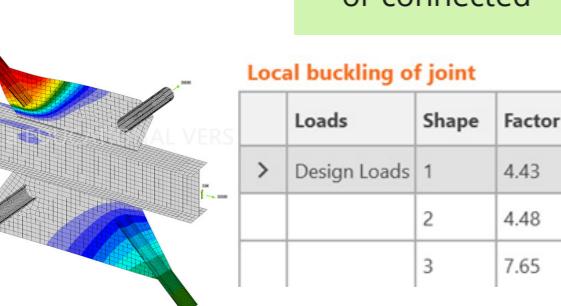
a. Type of buckling in Connection

a. **One Side** Restraint/connected

a. **Global Buckling** (Global Limit factors applies)

Critical Buckling factor in CBFEM **more** than recommended 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]**

