

this extent of misalignment will be just visible. It means that during the Construction Review, any of these connections which show visible misalignment should have the extent of this measured and be straightened to be within the NZS 3404 tolerances if required.

1.3 Design Procedure for an Unstiffened Plate Connected to a Stiffened Plate

After applying the design procedure outlined in section 1 herein, if the connection capacity with both cleats unstiffened has been found to be inadequate, the following checks should be undertaken in conjunction with Figure 1.3:

- The cleat off the supported member is the one that has been stiffened, and
- The supported member and stiffened cleat attached to it are designed to carry the full eccentric moment on the joint as determined from the above design procedure. The bending moment along the supported member is dependent on the connection details at each end. If these are identical then this member is in uniform bending. Note that the stiffened cleat off the supported member is a Tee section and the cleat properties, eccentricity and cleat capacity must be calculated for the Tee section, with these properties used in the determination of first and second order bending moments on the connection. See the design example in section 2.2 for an example.

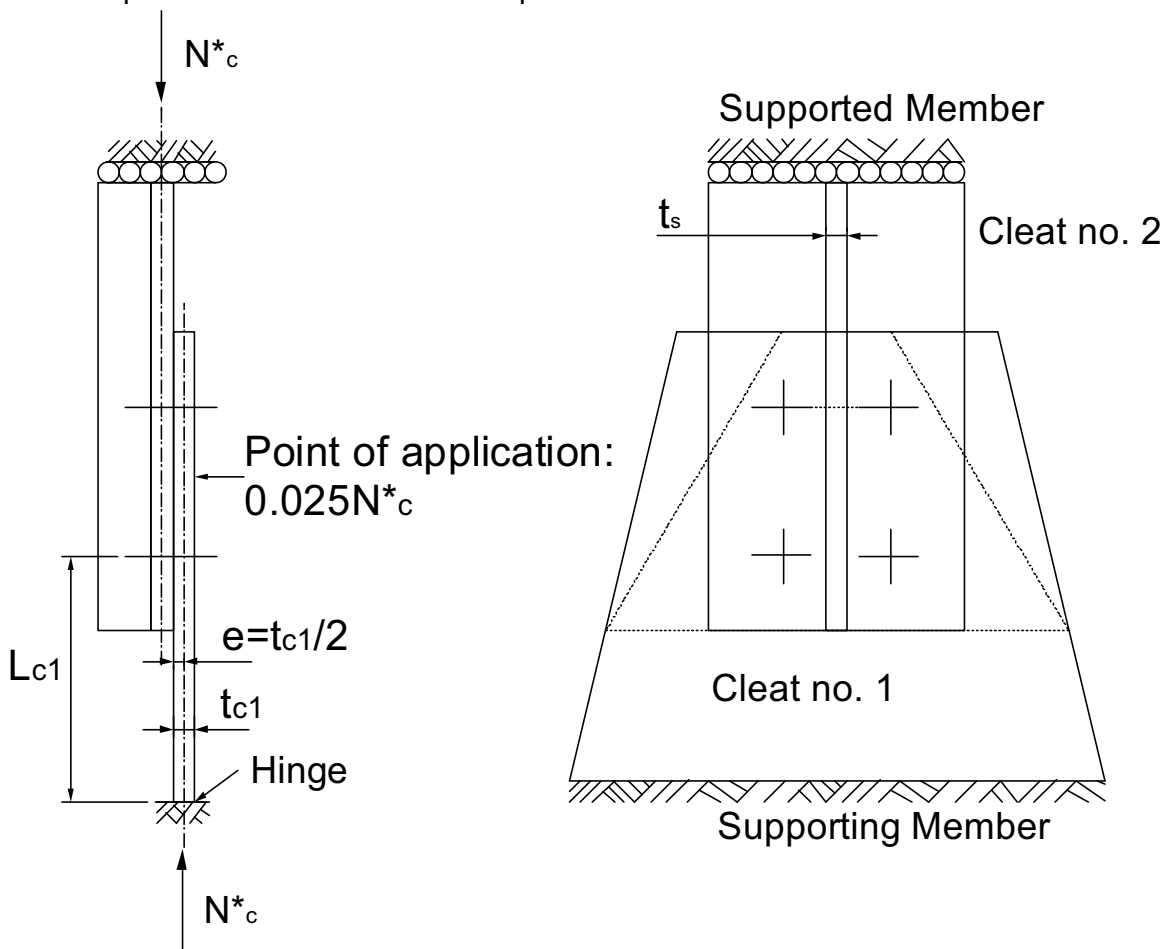


Figure 1.3 Eccentric unstiffened cleat off supporting member connected to stiffened cleat off supported member.

The check on the supporting member cleat, called t_{c1} in this description and in Figure 1.3, to see if it can be left unstiffened, involves the following steps:

- Step 1. Compression section capacity check on the net section under N^* alone (this requires the calculation of loss of area from bolt holes on the effective width of section given by step 2 of section 1.2). It is unlikely that this check will govern.
- Step 2. Calculate the first order design moment on the cleat as being the greater of:
 - a. $M_m^* = N_c^* (t_{cl} / 2)$
 - b. $M_m^* =$ moment due to 2.5% of N_c^* being applied from the face of the supporting member into which the cleat is attached to the centroid of the connection between the two cleats
- Step 3. If the member supporting the unstiffened cleat meets the fixity requirements from section 1.2 herein, then elastic support conditions are as for case no. 4 from NZS 3404 [2] Fig 4.8.3.2, if it doesn't then conservatively use case no. 5 or calculate the stiffness at the support. The length L is from the face of the member into which the cleat is attached to the centreline of the closest row of the bolt group between the cleats. Use this to calculate the second order multiplier, δ_s on M_m^*
- Step 4. Calculate $M^* = M_m^* \delta_s$
- Step 5. Calculate N_c as done for equation 1.5 herein, using $b_{e,N}$ from step 2, section 1.2
- Step 6. Check for combined bending and compression using equation 1.7.

$$M_{ry} = M_{sy} \left(1 - \frac{N_c^*}{\phi N_c} \right) \quad (1.7)$$

where:

- M_{sy} = calculated in accordance with NZS 3404, using the effective (plastic) section modulus, $Z_{ex} = b_{e,M} t^2 / 4$. The reason for this is explained below.
- N_c = the member compression capacity, calculated from NZS 3404 Clause 6.3 using $\alpha_b = 0.5$ and using the clear length of the cleat as the effective length, L_e .

The clear length is $(L_1 - a)$ for cleat t_1 the supporting member cleat, in Figure 1.3. For inclined connections into gusset plates, the design effective length is determined from Figure 10.38 of HERA Report R4-80 [8] with an effective length factor of 1.0.

The use of M_{sy} is appropriate in equation 1.7 because the full plastic moment will have to form at the face of the supporting member before this cleat will fail. In fact it is probably un-conservative to base failure on one plastic hinge forming only, which is what this procedure assumes. However, because the actual nature of the transfer of force between the stiffened cleat and the unstiffened cleat has not been studied, the one hinge criterion is considered appropriate in this instance.