

WEBS UNDER CONCENTRATED LOADS

Criteria for Buildings

The AISC specification for ASD for buildings places a limit on compressive stress in webs to prevent local web yielding. For a rolled beam, bearing stiffeners are required at a concentrated load if the stress f_a , ksi (MPa), at the toe of the web fillet exceeds $F_a = 0.66F_{yw}$, where F_{yw} is the minimum specified yield stress of the web steel, ksi (MPa). In the calculation of the stressed area, the load may be assumed distributed over the distance. For a concentrated load applied at a distance larger than the depth of the beam from the end of the beam:

$$F_a = R / f_w (N + 5K)$$

where

R = concentrated load of reaction, kip (kN)

t_w = web thickness, in (mm)

N = length of bearing, in (mm), (for end reaction, not less than k)

K = distance, in (mm), from outer face of flange to web toe of fillet

For a concentrated load applied close to the beam end:

$$f_a = R / t_w (N + 2.5 k)$$

To prevent web crippling, the AISC specification requires that bearing stiffeners be provided on webs where concentrated loads occur when the compressive force exceeds R, kip (kN), computed from the following:

For a concentrated load applied at a distance from the beam end of at least $d/2$, where d is the depth of beam:

$$R = 67.5 t_w^2 [1 + 3(N/d)(t_w/t_f)^{1.5}] (F_{yw} t_f / t_w)^{1/2}$$

where

t_f = flange thickness, in (mm)

For a concentrated load applied closer than $d/2$ from the beam end:

$$R = 34 t_w^2 [1 + 3(N/d)(t_w/t_f)^{1.5}] (F_{yw} t_f / t_w)^{1/2}$$

If stiffeners are provided and extend at least one-half of the web, R need not be computed.

Another consideration is prevention of sidesway web buckling. The AISC specification requires bearing stiffeners when the compressive force from a concentrated load exceeds

limits that depend on the relative slenderness of web and flange r_{wf} and whether or not the loaded flange is restrained against rotation:

$$r_{wf} = (d_c/t_w) / (l/b_f)$$

where

l = largest unbraced length, in (mm), along either top or bottom flange at point of application of load

b_f = flange width, in (mm)

d_c = web depth clear of fillets = $d - 2k$

Stiffeners are required if the concentrated load exceeds R , kip (kN), computed from

$$R = 6800t_w^3/h(1 + 0.4r_{wf}^3)$$

where

h = clear distance, in (mm), between flanges, and r_{wf}

is less than 2.3 when the loaded flange is restrained against rotation. If the loaded flange is not restrained and r_{wf} is less than 1.7,

$$R = 0.4r_{wf}^3(6800t_w^3/h)$$

R need not be computed for larger values of r_{wf}

Source: <http://www.engineeringcivil.com/webs-under-concentrated-loads.html>