

8.4 LONGITUDINAL SHEAR IN COMPOSITE AND MONOLITHIC BEAMS

8.4.1 General

This Clause applies to the transfer of longitudinal shear forces, across interface shear planes through webs and flanges of—

- (a) composite beams constructed of precast concrete sections and cast in situ toppings or flanges; and
- (b) beams constructed monolithically.

8.4.2 Design shear stress

The design shear stress (τ^*) acting on the interface shall be taken as follows:

$$\tau^* = \beta V^* / (z b_f) \quad \dots 8.4.2$$

where

z = internal moment lever arm of the section

For a shear plane that passes through a region in compression—

β = ratio of the compressive force in the member (calculated between the extreme compressive fibre and the shear plane) and the total compression force in the section

For a shear plane that passes through a region in tension—

β = ratio of the tensile force in the longitudinal reinforcement (calculated between the extreme tensile fibre and the shear plane) and the total tension force in the section

8.4.3 Shear stress capacity

The design shear stress at the shear interface shall not exceed $\phi \tau_u$ where—

$$\tau_u = \mu \left(\frac{A_{sf} f_{sy}}{s b_f} + \frac{g_p}{b_f} \right) + k_{co} b_f f_{ct}' \quad \dots 8.4.3$$
$$\leq \text{lesser of } (0.2 f_c', 10 \text{ MPa})$$

where

τ_u = unit shear strength

g_p = permanent distributed load normal to the shear interface per unit length, newtons per millimetre (N/mm)

μ = coefficient of friction given in Table 8.4.3

k_{co} = cohesion coefficient given in Table 8.4.3

b_f = width of the shear plane, in millimetres (mm)

A_{sf} = area of fully anchored shear reinforcement crossing the interface (mm²)

f_{sy} = yield strength of shear reinforcement not exceeding 500 MPa

s = spacing of anchored shear reinforcement crossing interface

TABLE 8.4.3
SHEAR PLANE SURFACE COEFFICIENTS

Surface condition of the shear plane	Coefficients	
	μ	k_{co}
A smooth surface, as obtained by casting against a form, or finished to a similar standard	0.6	0.1
A surface trowelled or tamped, so that the fines have been brought to the top, but where some small ridges, indentations or undulations have been left; slip-formed and vibro-beam screeded; or produced by some form of extrusion technique	0.6	0.2
A surface deliberately roughened— (a) by texturing the concrete to give a pronounced profile; (b) by compacting but leaving a rough surface with coarse aggregate protruding but firmly fixed in the matrix; (c) by spraying when wet, to expose the coarse aggregate without disturbing it; or (d) by providing mechanical shear keys.	0.9	0.4
Monolithic construction	0.9	0.5

NOTE: Where a beam is subjected to high levels of differential shrinkage, temperature effects, tensile stress or fatigue effects across the shear plane, the values of μ and k_{co} in the above Table do not apply.

8.4.4 Shear plane reinforcement

Where reinforcement is required to increase the longitudinal shear strength, the reinforcement shall consist of shear reinforcement anchored to develop its full strength at the shear plane. Shear and torsional reinforcement already provided, and which crosses the shear plane, may be taken into account for this purpose.

The centre-to-centre spacing (s) of the shear reinforcement shall not exceed the maximum spacing—

$$s_{\max} = 3.5t_f \quad \dots 8.4.4$$

where

t_f = thickness of topping or flange anchored by the shear reinforcement

8.4.5 Minimum thickness of structural components

The average thickness of structural components subject to interface shear shall be not less than 50 mm with a minimum local thickness not less than 30 mm.