5.3.5.2 *Resin adhesives*

Resin adhesives may be used to form joints subjected to compression but not to resist tension or shear. They should only be used where they are adequately protected against the effects of fire.

5.3.5.3 *Other types*

Any other type of connection that can be shown to be capable of carrying the ultimate loads acting on it may be used. Amongst those suitable for resisting shear and flexure are those made by prestressing across the joint.

5.3.6 Joints transmitting mainly compression

This type of joint is most commonly used for horizontal joints between load-bearing walls or columns. The joint should be designed to resist all the forces and moments implicit in the assumptions made in analysing the structure as a whole and in designing the individual member to be joined. In the absence of more accurate information derived from a comprehensive programme of suitable tests, the area of concrete to be considered in calculating the strength of the joint in a wall or column should be the greater of:

a) the area of the in situ concrete ignoring the area of any intruding floor or beam units (this area should not be taken as greater than 90 % of the wall or column area); or

b) 75 % of the area of contact between wall or column and joint.

NOTE. Only those parts of the floor beam units that are solid over the bearing should be considered and the units should be properly bedded on concrete or mortar of adequate quality.

Particular attention should be paid to detailing the joint and joint reinforcement to prevent premature splitting or spalling of the concrete in the ends of the precast members.

5.3.7 Joints transmitting shear

Joints transmitting shear may occur when a wall acts as a wind-bracing wall or a floor acts as a wind girder. They may be assumed effective if the joint is grouted with a suitable concrete or mortar mix and the appropriate condition is satisfied.

a) *Units transmitting shear in plane.* These should be restrained to prevent their moving apart. No reinforcement need be provided in or across the joint, and the sides of the units forming the joint may have a normal finish, when the design ultimate shear stress in the joint does not exceed 0.23 N/mm^2. Very smooth moulded finishes should be roughened.

b) *Joints under compression in all design conditions.* No reinforcement need be provided when the sides or ends of the panels or units forming the joint have a rough as-cast finish and when the design ultimate shear stress does not exceed 0.45 N/mm^2.

c) *Shear stress due to ultimate loads less than 1.3 N/mm^2, calculated on the minimum root area of a castellated joint.* Separation of the units normal to the joints should be prevented by either steel ties across the ends of the joint or by the compressive force normal to the joint under all loading conditions. A taper is usually provided to the projecting keys of a castellated joint to ease the removal of formwork. To limit movements in the joint, this taper should not be excessive.

d) *Reinforcement provided to resist the entire shear force due to design ultimate loads.* In this case the shear force V should not exceed the value given by:

$$V = 0.6F_b \tan \alpha_f \qquad \text{equation 61}$$

where

F_b is $0.95f_yA_s$; or the anchorage value of the reinforcement, whichever is the lesser;

A_s is the minimum area of reinforcement;

α_f is the angle of internal friction between the faces of the joint.

NOTE. Tan α_f can vary between 0.7 and 1.7 and is best determined by tests. However, for concrete-to-concrete connections, the values used may be taken from table 5.3.

Table 5.3 Values of tan α_f for concrete connections

Type of surface	tan α_f
Smooth interface, as in untreated concrete	0.7
Roughened or castellated joint without continuous in situ strips across the ends of joints	1.4
Roughened or castellated joint with continuous in situ strips across the ends of joints	1.7

e) *Resistance to sliding provided by other means.* Other means of providing resistance to sliding would normally involve testing in accordance with **2.6.1** and **2.6.2**.

5.4 Composite concrete construction

5.4.1 General

This sub-clause is applicable where precast reinforced or precast prestressed concrete units combine with added in situ concrete to resist flexure, provision for horizontal shear transfer having been made at the contact surface.

5.4.2 Analysis and design of composite concrete structures and members

The analysis and design of composite concrete structures and members should be in accordance with section **3** or **4** (modified where appropriate by **5.4.6** and **5.4.7**).

5.4.3 Effects of construction methods

The design of component parts as well as composite sections should take account of construction methods and whether props are used; stresses and deflections will both be affected.