AS 2327.1—2003

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Australian Standard™

# Composite structures

## Part 1: Simply supported beams

Standards Australia

This Australian Standard was prepared by Committee BD-032, Composite Construction. It was approved on behalf of the Council of Standards Australia on 3 June 2003 and published on 18 August 2003.

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Steel Reinforcement Institute of Australia

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AS 2327.1—2003

# Australian Standard™

## Composite structures

## Part 1: Simply supported beams

Originated as AS 1480 Supplement 1—1974.
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# PREFACE

This Standard was prepared by the Standards Australia Committee BD-032, Composite Construction, to supersede AS 2327.1—1996 *Composite structures in structural steel and concrete*, Part 1—*Simply supported beams*.

This revision incorporates a number of technical and editorial changes. The principal differences are briefly outlined in the following:

1 *Shear connectors:*

(a) The value of the density reduction factor ($k_r$), used in the calculation of the design shear capacity ($f_{ds}$) of shear connectors with lightweight concrete, has been changed to equal 1.0 for welded-studs (since the effect of lower concrete density is already taken into account in the calculation of nominal shear capacity ($f_{vs}$) using Equation 8.3.2.1(2)), and a constant value of 0.8 for channels and high-strength structural bolts.

(b) A procedure for calculating the nominal shear capacity ($f_{vs}$) of channel or high-strength structural bolt shear connectors during the initial part of Construction Stage 5 when $15 \leq f'_{cj} < 20$ MPa, previously omitted from AS 2327.1, has been included, viz. at $f'_{cj} = 15$ MPa, $f_{vs}$ equals 80% of the values given in Table 8.2 and Table 8.3 $f'_c = 20$ MPa, and linear interpolation is used for values of $f'_{cj}$ between 15 and 20 MPa.

(c) The Grade 300, 100 PFC (parallel flange channel) may now be used as a fully equivalent shear connector to the Grade 250, 100 TFC (channel).

2 *Open-rib and closed-rib profiles* Distinction is made between open-rib and closed-rib profile steel sheeting when designing the shear connection of the composite beam.

3 *Welded stud locations* Clause 8.4.2 clarifies that when automatically welded studs are placed in the pans of sheeting ribs deemed to be perpendicular to the steel beam, no more than two studs are permitted between adjacent sheeting ribs. New rules have been written to allow shear connectors to be placed closer to steel ribs of closed-rib profiles.

4 *New reference material* New reference material has been provided for designers regarding the design of beams with large web penetrations and design for occupant-induced vibrations.

5 *Reinforcement* $f_{yr} = 500$. The maximum design yield strength has been increased to 500 MPa for the longitudinal shear reinforcement in the composite slab.

The terms 'normative' and 'informative' are used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

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APPENDICES

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Part 1: Simply supported beams

# SECTION 1 SCOPE AND GENERAL

## 1.1 SCOPE

This Standard sets out minimum requirements for the design, detailing and construction of simply supported composite beams composed of a steel beam and a concrete slab interconnected with shear connectors, including applications where the slab incorporates profiled steel sheeting, as defined in Clause 1.2.

This Standard does not cover the design of composite beams—

(a) where the elements of the steel beam are less than 3 mm thick or the value of the yield stress ($f_{yb}$) assumed in design exceeds 450 MPa (see Note 1);

(b) where the strength grade of the slab concrete exceeds 40 MPa;

(c) where the slab is precast or prestressed;

(d) with negative design moments (see Note 2);

(e) subjected to dynamic loads;

(f) for road or railway bridges (see Note 3); or

(g) for fatigue.

NOTE:

1 This does not preclude the use of steels with a minimum yield strength greater than 450 MPa.

2 For the design of composite beams with negative design moments reference may be made to BS 5950:3:1990, Code of Practice for Design of Simple and Continuous Composite Beams.

3 For the design of composite bridge beams, reference should be made to HB 77 the AUSTROADS Bridge Design Code.

## 1.2 GENERAL

### 1.2.1 Components

This Standard applies only to composite beams for which the components satisfy the requirements specified in Clauses 1.2.2 to 1.2.5.

### 1.2.2 Steel beam

The steel beam shall be entirely below, but in contact with, the soffit of the concrete slab, and shall be of structural steel, symmetrical about its vertical axis (i.e., doubly symmetric or monosymmetric), suitably proportioned (see Note) and have one of the following forms (see Figure 1.2.2)—

(a) a hot-rolled I-section, or channel section;

(b) a welded I-section;

(c) a rectangular cold-formed hollow section;

(d) a fabricated I-section, Tee section, channel section or rectangular hollow section; or

(e) any of the above sections as appropriate with an additional plate welded to the bottom flange.

NOTE: Steel beams with a slender section (i.e., $\lambda_e > \lambda_{ey}$ for any top flange or web plate element either partially or fully in compression (see Clause 5.2.3.3)) are not permitted.

When a fire resistance level (FRL) must be achieved, a fire protection material may be used to protect the exposed surfaces of the steel beam.

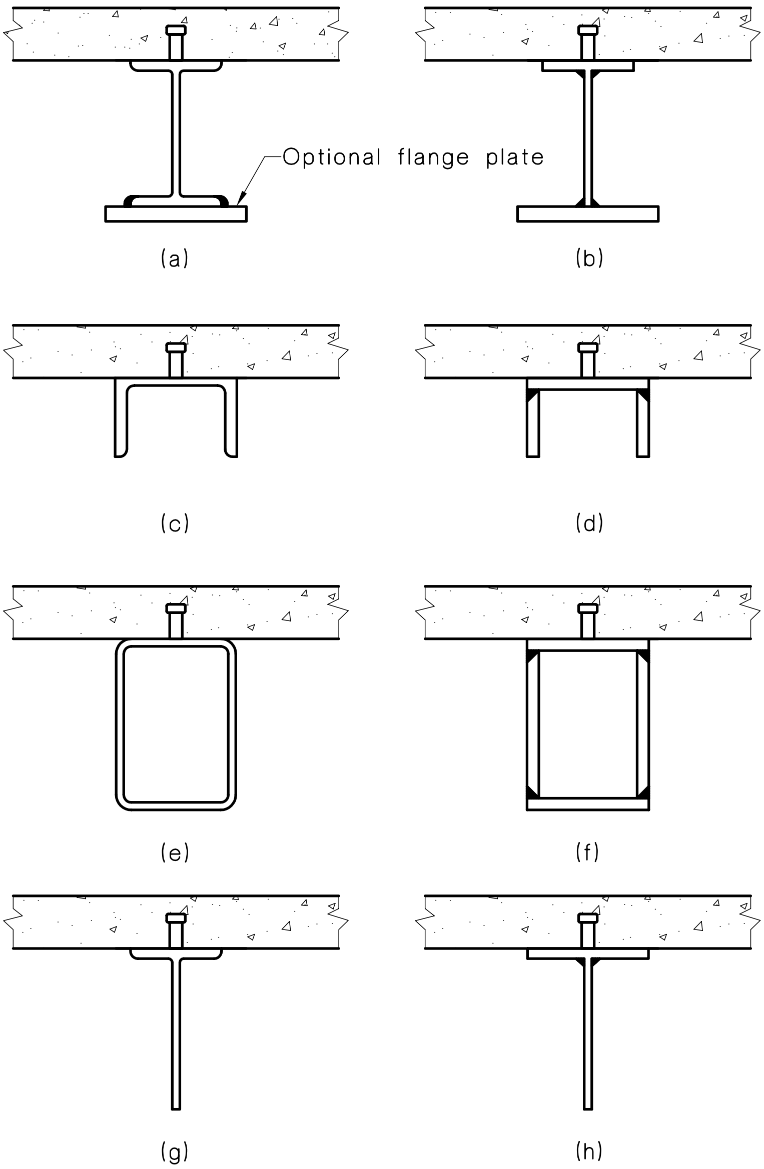
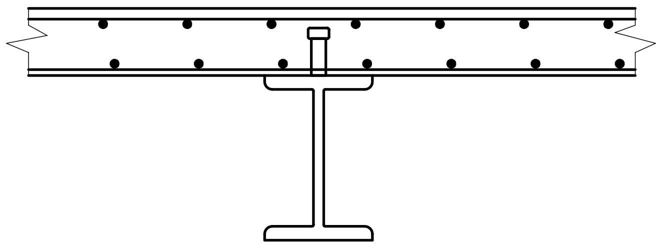



FIGURE 1.2.2 ALTERNATIVE STEEL BEAM TYPES

### 1.2.3 Concrete slab

The concrete slab shall be of reinforcement in accordance with AS/NZS 4671, non-prestressed concrete complying with AS 3600, and be either a solid slab (without a haunch) or a composite slab (see Figure 1.2.3).



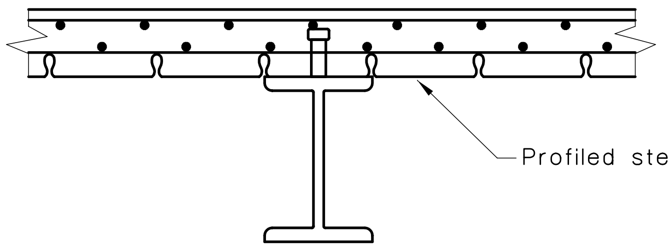




FIGURE 1.2.3 ALTERNATIVE CONCRETE SLAB TYPES

### 1.2.4 Profiled steel sheeting

The geometry of the profiled steel sheeting incorporated in a composite slab shall satisfy all of the following requirements (see Figure 1.2.4(a)):

(a) The overall height of a steel rib ($h_r$) shall be not greater than 80 mm, excluding any embossments.

(b) The width of the opening at the base of a steel rib ($b_b$) shall be not greater than 20 mm.

(c) The area of the voids formed by the steel ribs in the concrete shall be not greater than 20% of the area of the concrete within the depth of the steel ribs.

(d) The width of the concrete between the mid-height of adjacent steel ribs ($b_{cr}$) shall be not less than 150 mm.

(e) The cover slab thickness (that is, the thickness of the concrete above the steel ribs, which equals $D_c - h_r$) shall be not less than 65 mm.

Longitudinal stiffeners in the pans of the sheeting with an overall height ($h_s$) greater than 10 mm, measured from the same face of the sheet (see Figure 1.2.4(b)), shall be deemed to be steel ribs for the purpose of this Standard.

Open-rib and closed-rib profiles shall be defined as follows:

(i) *Closed-rib profiles* All of the steel ribs of a closed-rib profile shall satisfy the geometric requirements shown in Figure 1.2.4 (c).

(ii) *Open-rib profiles* A profile that is not a closed-rib profile shall be treated as an open-rib profile.