1.3 Units

The units in the Tables are consistent with those in the SI (metric) system. The base units utilised in the Tables are *kilonewton* (kN) for force, *metre* (m) for length, and *kilogram* (kg) for mass. Where noted, stress is expressed in *megapascals* (MPa).

With some minor exceptions, all values in the Tables are rounded to three (3) significant figures.

1.4 Limit States Design Using these Tables

AS 4100 sets out the minimum requirements for the design, fabrication and erection of steelwork in accordance with the limit states design method and follows a semi-probabilistic limit state basis presented in a deterministic format.

Definition of limit states - When a structure or part of a structure is rendered unfit for use it reaches a `limit state'. In this state it ceases to perform the functions or to satisfy the conditions for which it was designed. Relevant limit states for structural steel include strength, serviceability, stability, fatigue, brittle fracture, fire, and earthquake. Only two limit states are considered in the Tables - the strength limit state and, where applicable, the serviceability limit state.

Limit states design for the strength limit state requires structural members and connections to be proportioned such that the **design action effect** (S^*) resulting from the **design action (**W^***),** is less than or equal to the **design capacity** (ϕR_u) i.e.

$$S^* \le \phi R_U$$

Design action or **design load** (W^*) is the combination of the nominal actions or loads imposed upon the structure (e.g. transverse loads on a beam) multiplied by the appropriate load combination factors as specified in AS 1170 Part 0. These **design actions/loads** are identified by an asterisk (*) after the appropriate action/load (e.g. W_L^* is the maximum design transverse load on a beam).

Design action effects (S^*) are the actions (e.g. design bending moments, shear forces, axial loads) calculated from the **design actions** or **design loads** using an acceptable method of analysis (Section 4 of AS 4100). These effects are identified by an asterisk (*) after the appropriate action effect (e.g. M^* describes the design bending moment).

Design capacity (ϕR_u*)* is the product of the nominal capacity (R_u) and the appropriate value of the capacity factor (ϕ) found in Table 3.4 of AS 4100. R_u is determined from the characteristic values and specified parameters found in Sections 5 to 9 of AS 4100.

For example, consider the strength limit state design of a simply supported beam which has full lateral restraint subject to a total transverse **design load** (W^*) distributed uniformly along the beam.

For flexure, the appropriate **design action effect** (S^*) is the design bending moment (M^*) which is determined by:

$$M^* = \frac{W^* L}{8}$$

where *L* = span of the beam.

In this case the design capacity (ϕR_u) is equal to the design section moment capacity (ϕM_s), given by:

$$\phi M_S = \phi f_y Z_e$$

where ϕ = the capacity factor

Z_e = effective section modulus

f_y = yield stress used in design

To satisfy the strength limit state, the following relationship (equivalent to $S^* \le \phi R_u$) is used:

$$M^* \le \phi M_S$$

The maximum design bending moment (M^*) is therefore equal to or less than the design section moment capacity (ϕM_s), and the **maximum design load** is that design load (W^*) which corresponds to the maximum M^*. (It should be noted that other checks on the beam may be necessary - e.g. shear capacity, bearing capacity, etc).

When considering external loads, in the context of this publication, the **maximum design load** (W_L^*) given in the relevant table must be greater than or equal to the actual imposed **design load** (W^*).

Where applicable, the Tables give values of **design capacity** (ϕR_u) and/or **maximum design load** (W_L^*) determined in accordance with AS 4100. When using the Tables, the designer must determine the relevant *strength limit state* **design action** (W^*) and/or corresponding **design action effect** (S^*) to ensure that the strength limit state requirements of AS 4100 are satisfied. Where relevant, other limit states (e.g. serviceability, fatigue, etc) must also be considered by the designer. Some information useful for checking the serviceability limit state is included in the Tables.

1.5 Table Contents

For the range of structural steel grades and sections considered, tables are provided for:

(i) section dimensions and section properties:

- Dimensions and Properties (PART 3)
- Properties for Assessing Section Capacity (PART 3)
- Surface Areas (PART 3)
- Fire Engineering Design (PART 3)
- Detailing Parameters (PART 10)
- Rails, Crane Runway Beams (PARTS 12 & 13)

(ii) design capacity (ϕR_u) for:

- Members Subject to Bending (PART 5)
- Members Subject to Axial Compression (PART 6)
- Members Subject to Axial Tension (PART 7)
- Members Subject to Combined Actions (PART 8)
- Connectors – Bolts/Welds (PART 9)

(iii) maximum design load (W^*) for:

- Strength Limit State (W_L^*) for Beams (PART 5)
- Serviceability Limit State (W_S^*) for Beams (PART 5)
- Strength Limit State (q_{st}^*, P_{st}^*) for Floor Plates (PART 11)
- Serviceability Limit State Deflection Factor (D_{SV}) for Floor Plates (PART 11)

Acceptable methods of analysis for determining the **design action effects** are defined in Section 4 of AS 4100 and material relevant to some of these methods of analysis is presented briefly in Part 4 of this publication.

1.6 References

See Section 1.1.2 for details of reference Standards.