3. Framing Concepts and Connection Types

3.1 Introduction

The framing system and framing layout chosen for a particular application will be influenced by:

- Nature and level of the loads to be resisted.
- Requirements and restrictions on useable space within the framework.
- Constraints imposed by architectural requirements.

One advantage of steel framing is the diversity of solutions that are possible for any given application.

There are available to the designer two basic connection types, namely:

- Rigid connections.
- Flexible connections.

The above connections may be used in the three basic framing systems available:

- Two-way rigid frameworks.
- One-way rigid/one-way braced frameworks.
- Two-way braced frameworks.

Judicious selection of the appropriate framing system and connection types is a prerequisite to an economical structural design. Once a framing system is selected, the connection types to be used follow directly, thus setting bounds to the final cost of the structure. Economy in detailing, fabrication and erection can only serve to move the final design towards the lower bound of cost established by the framing system.

In the discussions of connection types and framing systems which follow, no distinction will be made between single or multi-storey buildings since the basic principles apply to most buildings.

3.2 Connection Types

3.2.1 DESIGN METHODS IN AS 4100

AS 4100 allows the use of three different design methods, wherein the behaviour of the connections is fundamental to the design method. These methods are:

(a) Rigid Construction, in which it is assumed that the connections have sufficient rigidity to hold the original angles between the members unchanged.

(b) Semi-Rigid Construction, in which the connections may not have sufficient rigidity to hold the original angles between the members unchanged, but are assumed to have a capacity to furnish a dependable and known degree of flexural restraint.

(c) Simple Construction, in which the connections are assumed not to develop bending moments. The stability of the structure is therefore provided by triangulation (i.e. bracing) or by separate shear walls – see Section 3.3 et seq.

Clearly from these brief descriptions it is seen that connection behaviour has a significant influence on design.

Allied to design methods (a) and (c) above are the basic connection types noted in Clause 3.1, namely:

- Rigid connections.
- Flexible connections.

Design method (b), Semi-Rigid Construction, will not be considered further in this publication.

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3.2.2 FLEXIBLE CONNECTIONS

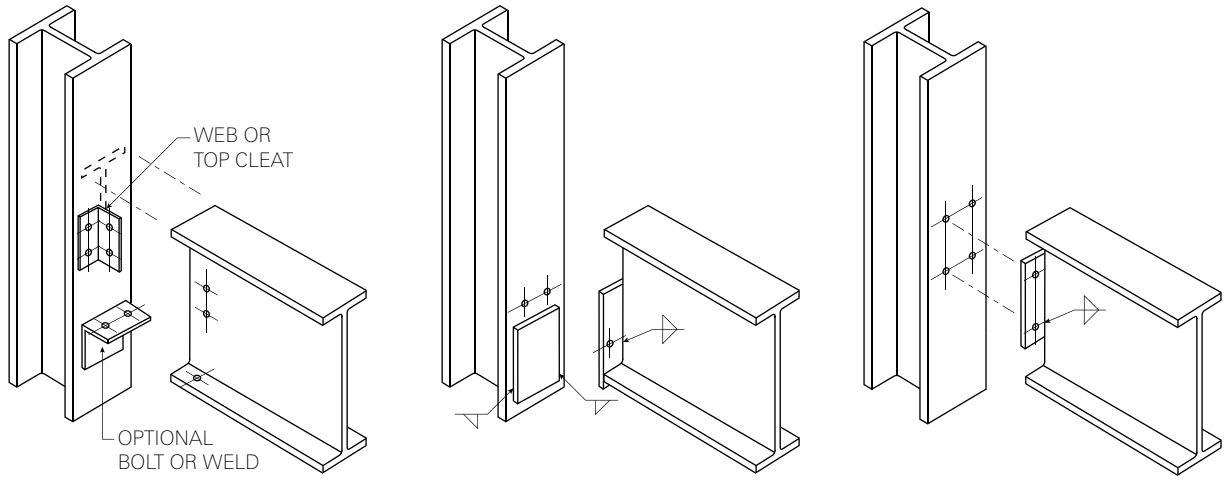
Flexible connections are used in steel structures designed using the simple design method of AS 4100. These connections offer low restraint to beam rotation, being close in behaviour to that of an ideal pin.

Typical flexible connections are shown in Figure 3.1. The most common flexible connections in use in Australia are the flexible end plate (Figure 3.1(c)), the angle cleat (Figure 3.1(d)), and the web side plate (Figure 3.1(e)).

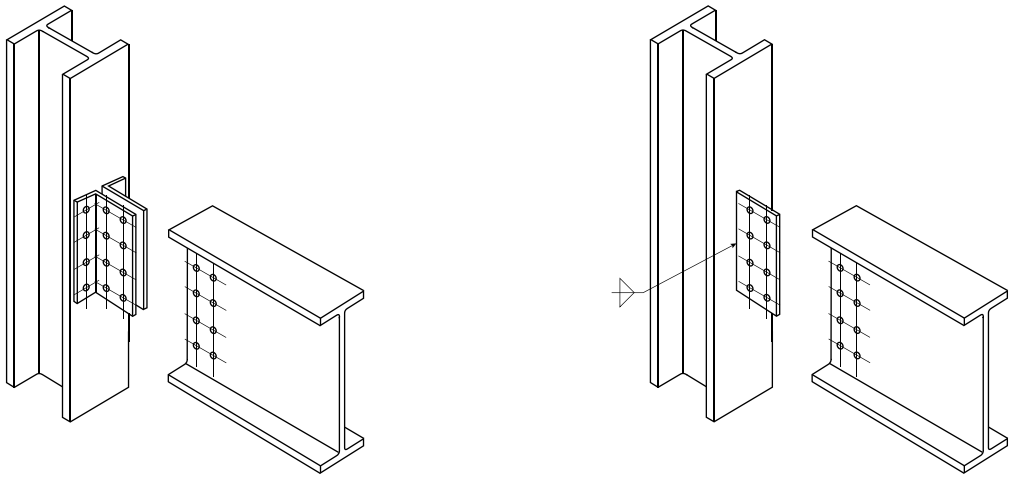
Such connections are:

- Assumed to behave as a simple support.
- Simple to fabricate.
- Simple to erect.
- Less costly of the two connection types.

Flexible connections shown in Figure 3.1 are standardised in the ASI: Structural Steel Connections series.



(a) Angle seat. (b) Bearing pad. (c) Flexible end plate.



(d) Angle cleat (single or double). (e) Web side plate.

FIGURE 3.1: Flexible connections

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Contents