(0.5 mm). It should be noted that satisfying the criteria in the NSSS would not in itself ensure compliance with BS 466 [82]. The NSSS tolerances should be used as a basis for positioning the crane girders, but the requirements of BS 466 will need to be considered when positioning the rails. Precambering of the girders to achieve the right rail level is not recommended, since this may result in a 'bow wave' ahead of the crane.

6.6.4 Fixings

The type of fixings used to connect the rails to the girders must be appropriate for the application. The following guidelines should be considered.

For light duty applications, bars may be welded to the girder top flange. Alternatively, to avoid welding or the need for drilling the flange, clips which wrap around the flange may be used to locate and secure the rail.

For light to medium duty applications, with infrequent crane use, the crane rail may be attached using 'hard clips'. These are bolted to the flange, or attached to threaded studs welded to the flange (Figure 6.17). They are unsuitable for cranes which are used frequently because stress cycles occur in the bolt/stud upon each wheel passage, causing fatigue.

'Expansion clips' are particularly recommended for heavy duty applications, but may be used generally. Vertical clearance between the rail and clip (see Figure 6.17) allows limited movement of the rail without inducing fatigue stresses in the clip. This clearance also permits longitudinal expansion of the rail. A resilient pad may be used to reduce noise and vibration, and to reduce load concentrations and stress levels. A pad is essential for outdoor applications to prevent fretting corrosion.

'Spring clips' (Figure 6.17) are also used for heavy duty applications, but are often less economical than expansion clips. They are particularly suitable for long, continuous rails. The springs allow limited vertical movement of the rail, independent of the clip. A resilient pad may be used if required.

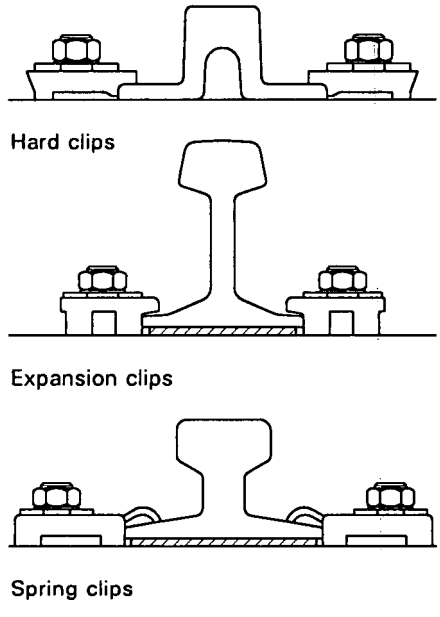

Figure 6.17 *Various types of crane rail fixings*

ACTIONS - Crane girders and rails

The 'simplicity' of the crane girders, rails and fixings depends on the class of crane to be used. The structural designer should consider the following points:

- specify fixings which provide a means of adjustment for the rails relative to the girders
- provide an independent means of adjustment for the girders, to accommodate greater deviation
- use a specialist to provide a complete design and installation service for the rails and fixings.

6.7 Cold formed sections

Cold formed sections can be used, amongst other things, as an alternative to timber for the secondary elements in a building frame. Currently their main structural use is as purlins and side rails for industrial buildings. These uses are similar and described below. A list of several new developments of cold formed section use in housing, light industrial and commercial buildings is given at the end of this Section.

6.7.1 Purlins and side rails

Purlins are often of Z (or similar) shape. The web of a Z section is close to the vertical when the section is used to support a pitched roof. This ensures that vertical loads do not cause serious twisting of the section, for slopes of 10° to 15°. However, roof slopes in modern industrial buildings can be as low as 5°, and this has created a need for modified sections. The so-called 'Zeta' section is one attempt to provide a section shape more suitable for shallow roofs. C shaped sections and their derivatives (for example E) are also widely used for roof and wall applications. The web shape can be modified to reduce twisting of the section by bringing the shear centre closer to the web. Examples of cold formed steel sections are shown in Figure 6.18.

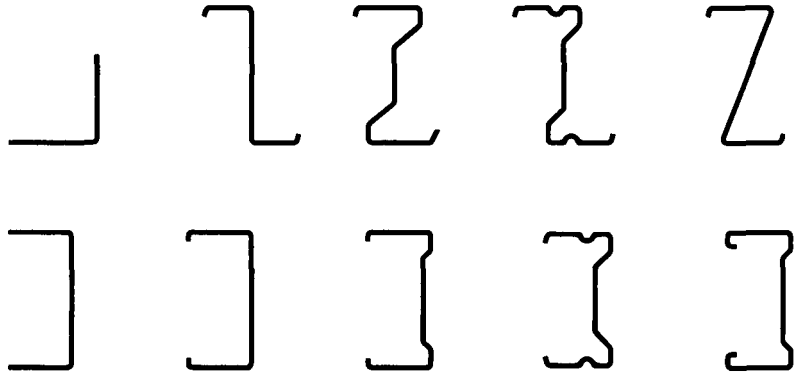

Figure 6.18 *Examples of cold formed steel sections*

Manufacturers often produce sections for specific uses, and base tabulated design information on test data rather than calculations. This enables section use to be