5.2 Advantages of cold formed sections

Cold forming has the effect of increasing the yield strength of steel, the increase being the consequence of cold working well into the strain-hardening range. These increases are predominant in zones where the metal is bent by folding. The effect of cold working is thus to enhance the mean yield stress by 15% - 30%. For purposes of design, the yield stress may be regarded as having been enhanced by a minimum of 15%.

Some of the main advantages of cold rolled sections, as compared with their hot-rolled counterparts are as follows:

- Cross sectional shapes are formed to close tolerances and these can be consistently repeated for as long as required.

- Cold rolling can be employed to produce almost any desired shape to any desired length.

- Pre-galvanised or pre-coated metals can be formed, so that high resistance to corrosion, besides an attractive surface finish, can be achieved.

- All conventional jointing methods, (i.e. riveting, bolting, welding and adhesives) can be employed.

- High strength to weight ratio is achieved in cold-rolled products.

- They are usually light making it easy to transport and erect.

It is possible to displace the material far away from the neutral axis in order to enhance the load carrying capacity (particularly in beams).

There is almost no limit to the type of cross section that can be formed. Some typical cold formed section profiles are sketched in Fig.5.1.

In Table 1 hot rolled and cold formed channel section properties having the same area of cross section are shown. From Table 5.1, it is obvious that thinner the section walls, the larger will be the corresponding moment of inertia values (I_{xx} and I_{yy}) and hence capable of resisting greater bending moments. The consequent reduction in the weight of steel in general applications produces economies both in steel costs as well as in the costs of handling transportation and erection. This, indeed, is one of the main reasons for the popularity and the consequent growth in the use of cold rolled steel. Also cold form steel is protected against corrosion by proper galvanising or powder coating in the factory itself. Usually a thickness limitation is also imposed, for components like lipped channels.

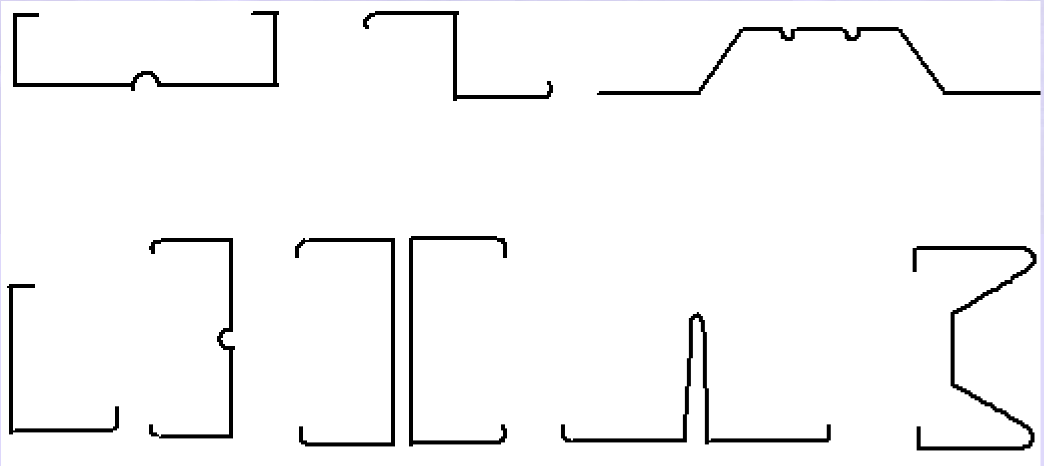
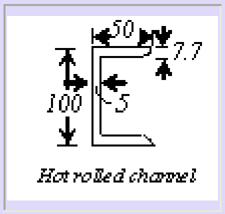
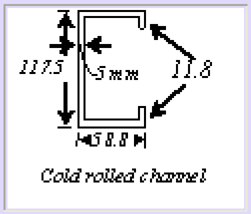
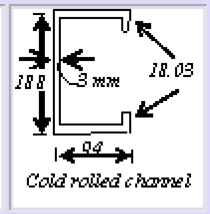
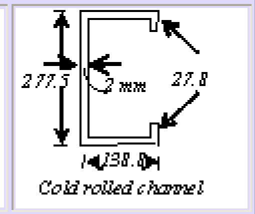


Fig. 5.1 Typical cold formed steel profiles

Table -5.1 Comparison of hot rolled and cold rolled sections

				
A	1193 mm^2	1193 mm^2	1193 mm^2	1193 mm^2
I_{xx}	1.9×10^6 mm^4	2.55×10^6 mm^4	6.99×10^6 mm^4	15.53×10^6 mm^4
Z_{xx}	38×10^3 mm^3	43.4×10^3 mm^3	74.3×10^3 mm^3	112×10^3 mm^3
I_{yy}	0.299×10^6 mm^4	0.47×10^6 mm^4	1.39×10^6 mm^4	3.16×10^6 mm^4
Z_{yy}	9.1×10^3 mm^3	11.9×10^3 mm^3	22×10^3 mm^3	33.4×10^3 mm^3

While the strength to weight ratios obtained by using thinner material are significantly higher, particular care must be taken to make appropriate design provisions to account for the inevitable buckling problems.

5.2.1 Types of stiffened and unstiffened elements

As pointed out before, cold formed steel elements are either ***stiffened*** or ***unstiffened***. An element which is supported by webs along both its longitudinal edges is called a ***stiffened*** element. An ***unstiffened*** element is one, which is supported along one longitudinal edge only with the other parallel edge being free to displace. Stiffened and unstiffened elements are shown in Fig. 5.2.

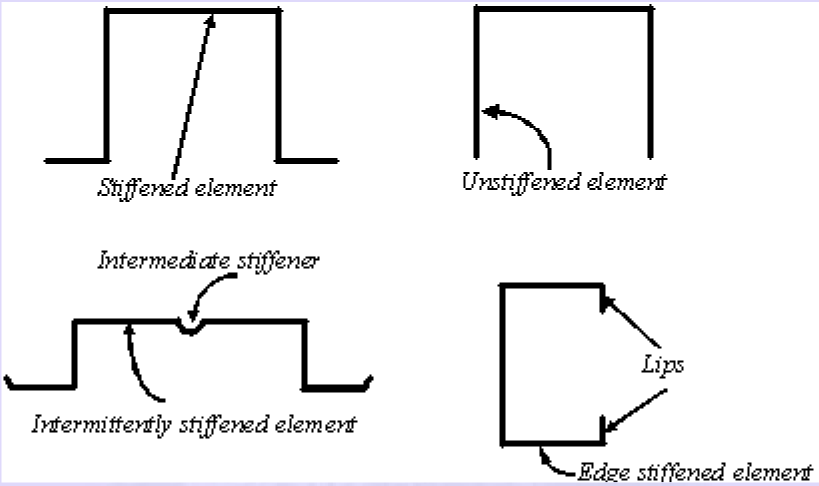


Fig.5.2 Stiffened and unstiffened elements

An ***intermittently stiffened element*** is made of a very wide thin element which has been divided into two or more narrow sub elements by the introduction of intermediate stiffeners, formed during rolling.

In order that a flat compression element be considered as a ***stiffened element***, it should be supported along one longitudinal edge by the web and along the other by a web or lip or other edge stiffener, (eg. a bend) which has sufficient flexural rigidity to maintain straightness of the edge, when the element buckles on loading. A rule of thumb is that the depth of simple “lips” or right angled bends should be at least one-fifth of the adjacent plate width. More exact formulae to assess the adequacy of the stiffeners are provided in Codes of Practice. If the stiffener is adequate, then the edge stiffened element may be treated as having a local buckling coefficient (K) value of 4.0. If the edge stiffener is inadequate (or only partially adequate) its effectiveness is disregarded and the element will be regarded as ***unstiffened***, for purposes of design calculations.