

UNIT I INTRODUCTION AND ALLOWABLE STRESS DESIGN

Design of Laterally supported Solid Hot Rolled section beams

A beam is a structural member, the primary function of which is to support loads to its axis. The loads produce bending and shear force in the beam. Rolled I- sections with or without cover plates are used for floor beams. Channel, Tee and angle – sections are usually used for beams in roof trusses as purlins and common rafters.

The laterally supported beams are also called laterally restrained beams. When lateral deflection of the compression flange of a beam is prevented by providing effective lateral support (restraint), the beam is said to be laterally supported. The effective lateral restraint is the restraint which produces sufficient resistance in a plane perpendicular to the plane of bending to restrain the compression flange of a beam from lateral buckling to either side at the point of application of the restraint.

Depending upon conditions at the supports, beams may be

- (i) simply supported
- (ii) Fixed
- (iii) Cantilever
- (iv) Propped cantilever
- (v) Continuous

Failure of a beam can occur in several ways such as

- (i) bending failure
- (ii) shear failure
- (iii) deflection failure

The size of the structural steel beam is designed based on Bending, shear and deflection.

LATERALLY SUPPORTED BEAMS

For most of the rolled shapes, the permissible stress in bending (σ_{bc}) is equal to $0.66f_y$. The important conditions associated with the use of this value is

- (i) The member must have an axis of symmetry in the plane of the web,
- (ii) The member must be loaded in the plane of the web
- (iii) The compression flange must have lateral support, and
- (iv) The section is compact.

Loads on a beam cause bending, due to which tension is induced in one flange and compression is induced in the other flange. The compression flange behaves somewhat like a column and will tend to buckle to the side, or laterally, as the stress increases, if it is not restrained in some way.

Most beams have some lateral support – especially those which support the floor slab. However, the degree of lateral support is often a matter of engineering judgement. Fig shows lateral support conditions of beams. In some cases, the degree of lateral support may not be clear. In doubtful cases, it is conservative and safe to assume no lateral support.

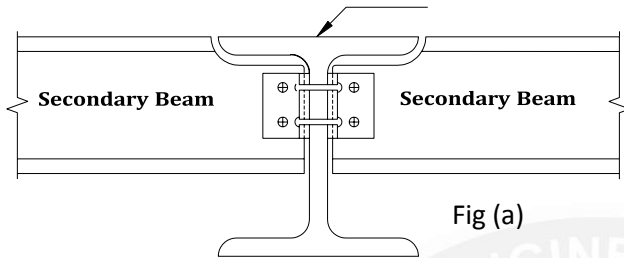
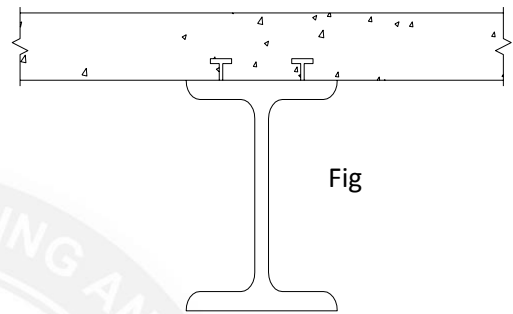


Fig (a)



Fig

Fig. (a) and Fig. (b) shows two cases of full lateral support for the top flange, assumed to be in compression. In Fig.(c), no lateral support exists for top flange.

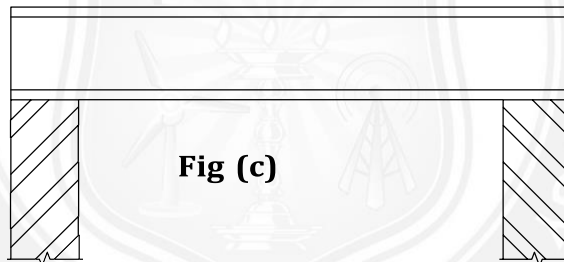


Fig (c)