Loads –

Various loads expected to act on a structure may be classified as given below.

a) Dead loads (DL)
b) Imposed loads (IL)
c) Wind loads (WL)
d) Earthquake loads (EL)
e) Erection loads (ER)
f) Accidental loads (AL)
g) Secondary Effects.

a) **Dead loads** – Dead loads include the weight of all permanent construction. for ex - in a building weight of roofs, floors, floor finishes, wall, beams, columns, footing, architectural finishing materials etc.. constitute dead load. These loads may be assessed by estimating the Quantity of each material & then multiplying it with unit weight. The unit weight of various materials in a structure are given in IS code 875 (Part 1) → Table 1.2.

b) **Imposed loads** – IS 800-2007 groups the following loads as imposed loads.

i) Live load.
ii) Crane load
iii) Snow load
iv) Dust load
v) Hydrostatic & earth pressure
vi) Impact load
vii) Horizontal loads on parapets & balustrades.

1) Live loads (LL) - The loads which keep on changing from time to time are called live loads. Common examples of such loads in a building are the weight of the persons, weight of movable partition dust loads & weight of furniture.

These loads are to be suitably assumed by the designer. It is one of the major loads in the design. The minimum values to be assumed are given in Is 875 (part 2) - 1987. It depends upon the intended use of the building. These values are presented for square metre of floor area.

2) Crane loads (CL) - These loads include loads from cranes & other machines acting on the structure. The loads may be taken as per manufacturers / suppliers data. In the absence of specific indications they may be taken as given below (Is 800 - 2007, clause 3.5.4).

3) Snow load - Is 875 (part 4) deals with snow loads on roof of the buildings. This load is to be considered for the buildings to be located in the regions where snow is likely to fall. The snow load acts vertically down ward. It may be expressed in kN/m².

$$S = \mu S_0$$

where,

S = Snow load on plan area of roof

μ = Shape Coefficient

S_0 = Ground Snow load.

4) Dust load - In areas prone to settlement of dust on roof (e.g - steel plants, cement plants) provision for dust load equivalent to probable thickness of accumulation of dust may be made.

5) Hydrostatic & earth pressure -

IS 875 (part 5)

In the design of structures partly or fully below ground level, the pressure exerted by soil or water or both shall be duly accounted on the basis of established theories.

All foundation slabs & other footings subjected to water pressure shall be designed to resist a uniformly distributed uplift equal to the fully uplift hydrostatic pressure.

Impact load -

for structures supporting moving loads suitable additional allowance of load should be made by increasing imposed load.

Horizontal loads -

parapets, balustrades & their supporting structures shall be designed for the horizontal forces acting at the hand rail or coping level. These loads may be considered to act vertically also but not simultaneously with the horizontal forces. The values are given in Table 1.6

c) Wind loads - The force exerted by the horizontal compo of wind is to be considered in the design of buildings, tow etc.. The wind force depends upon the velocity of wind, shape, size & location of building.

Complete details in IS 875 (part - 3)

$$V_z = K_1 K_2 K_3 V_b$$

where, K_1 = Risk co-efficient

K_2 = Co-efficient based on terrain, ht & structure size

K_3 = Topography factor.

V_b → wind pressure

d) Earthquake loads -

Earthquake shocks cause movement of foundation of structures. Due to inertia additional forces develop on super-structure. The total vibration caused by earthquake may be resolved into three mutually perpendicular directions, usually taken as vertical & two horizontal directions.

The following 2 methods.

i) Seismic co-efficient method

ii) Response spectrum method.

e) Erection loads - prefabricated or precast members are subjected to different types of supports & different types of loads during erection compared to the types of supports & types of loads after erection.

f) Accidental loads - IS 875 (part 5) gives certain guidelines to take care of the following accidental loads on the structures.

i) Impact & Collision.
ii) Explosions &
iii) fire.

The probability of occurrence of such loads may be quite less but if it occurs the consequences are severe.

j) Secondary effects -

The following types of secondary effects should be looked into the design.

→ Differential settlement of foundations.
→ Differential shortening of columns.
→ Eccentric connections.
→ Rigidity of joints differing from design assumptions.

Load combinations -

A judicious combination of the loads is necessary to ensure the required safety & economy in the design keeping in view the probability of.

a) their acting together
b) their disposition in relation to other loads & severity of stresses or deformation caused by the combination of various loads.

The recommended load combinations by IS 875 - 2000 are as given below.

1) DL

2) DL + IL

3) DL + WL

4) DL + EL

5) DL + TL

6) DL + IL + WL

7) DL + IL + EL

8) DL + IL + TL

9) DL + WL + TL

10) DL + EL + TL

11) DL + IL + WL + TL

12) DL + IL + EL + TL

Where,

DL = Dead load.

IL = Imposed load

WL = Wind load.

EL = Earthquake load.

TL = Temperature load

Note - When snow load is present on roofs, Replace imposed load by snow load for the purpose of above load combinati

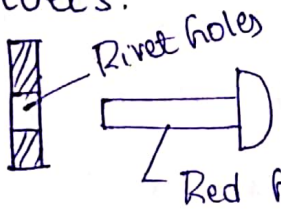
Connections –

The design of connections is very important because the failure of joint is sudden & catastrophic.

The following three types of connections may be made in steel structures.

a) Riveted.
b) Bolted
c) Welded.

Riveted Connection – Riveting is a method of joining together pieces of metal by inserting ductile metal pins called rivets.



Advantages.

→ Rivet holes are made in the structural members to be connected by punching or by drilling.

→ The size of rivet hole is kept slightly more [1.5–2mm] than the size of rivet.

Disadvantages –

→ It is associated with high level of noise pollution

→ It needs heating the rivet to red hot

→ Inspection of connection is a skilled work.

→ Removing poorly installed rivets is costly

→ Labour cost is high.