UNIT I INTRODUCTION AND ALLOWABLE STRESS DESIGN

5.5 Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications

LOADS AND FORCES :(Clause 3.2 of IS 800:2007)

For the purpose of designing any element, member or a structure, the following loads (actions) and their effects shall be taken into account, where applicable, with partial safety factors and combinations

- Dead loads
- Imposed loads (live load, crane load, snow load, dust load, wave load, earth pressures, etc.)
- Wind loads; (d) Earthquake loads
- Erection loads
- Accidental loads such as those due to blast, impact of vehicles, etc.
- Secondary effects due to contraction or expansion resulting from temperature changes, differential settlements of the structure as a whole or of its components, eccentric connections, rigidity of joints differing from design assumptions.

LOADS ON STRUCTURES:

- Dead Load: [I.S. 875 Part-I]-Code of practice for Design loads (dead load) Dead loads are the permanent loads acting on the structure including the self-weight of the section.
- Live Load: [I.S. 875 Part-II] -Code of practice for Design loads (imposed load) It is an imposed load in structure due to people, furniture, movable objects etc. Based on utility of the structure the values are given in [I.S 875 Part-II]

Example:

For Residential Buildings – 2 KN/m^2

For Commercial Buildings – 3 KN/m^2

- Wind Load [I.S 875 Part-III] -Code of practice for Design loads (wind load)
- Snow Load [I.S 875 Part-IV] -Code of practice for Design loads (snow load)
- Seismic Load (or) Earth quake Load [I.S 1893-2002]
- Accidental Loads
- Errection Loads
- Temperature effects

LOAD COMBINATIONS:

[I.S 875 Part-V] -Code of practice for Design loads (Special Loads and Combinations)

Load combinations for design purposes shall be those that produce maximum forces and effects and consequently maximum stresses and deformations. The following combination of loads with appropriate partial safety factors as given in Table 4 of IS 800:2007 may be considered.

a) Dead load + imposed load

b) Dead load + imposed load + wind or earthquake load

c) Dead load + wind or earthquake load

d) Dead load+ erection load.

The effect of wind load and earthquake loads shall not be considered to act simultaneously. The load combinations are outlined in detail in Clause. 3.5 of IS 800:2007.

CHARACTERISTICS OF LOAD:

It is designed as the action of the load which are not expected more than five percentage probability during the life of the structure.

1. Partial safety factor for loads for limit state 'γf' is given in table 4 [I.S 800-2007]
2. Partial safety factor for material is given in table 5 [I.S 800-2007]

Table 4 Partial Safety Factors for Loads, γ_f, for Limit States

(*Clauses* 3.5.1 *and* 5.3.3)

Combination	Limit State of Strength					Limit State of Serviceability			
	DL	LL[1]		WL/EL	AL	DL	LL[1]		WL/EL
		Leading	Accompanying				Leading	Accompanying	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DL+LL+CL	1.5	1.5	1.05	—	—	1.0	1.0	1.0	—
DL+LL+CL+ WL/EL	1.2	1.2	1.05	0.6	—	1.0	0.8	0.8	0.8
	1.2	1.2	0.53	1.2					
DL+WL/EL	1.5 (0.9)[2]	—	—	1.5	—	1.0	—	—	1.0
DL+ER	1.2 (0.9)[2]	1.2	—	—	—	—	—	—	—
DL+LL+AL	1.0	0.35	0.35	—	1.0	—	—	—	—

Table 5 Partial Safety Factor for Materials, γ_m

(*Clause* 5.4.1)

Sl No.	Definition	Partial Safety Factor	
i)	Resistance, governed by yielding, γ_{m0}	1.10	
ii)	Resistance of member to buckling, γ_{m0}	1.10	
iii)	Resistance, governed by ultimate stress, γ_{m1}	1.25	
iv)	Resistance of connection:	*Shop Fabrications*	*Field Fabrications*
	a) Bolts-Friction Type, γ_{mf}	1.25	1.25
	b) Bolts-Bearing Type, γ_{mb}	1.25	1.25
	c) Rivets, γ_{mr}	1.25	1.25
	d) Welds, γ_{mw}	1.25	1.50