Load Combinations as Per ASCE7-16

An Online Continuing Education Course for Engineers

Course Number: S-2020

Credit: 2 Hours / 2 PDH / 2 CPD

Load Combinations as Per ASCE7-16

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1. Introduction:

Structural design is a set of processes that assures that the building is capable of resisting applied loads, fulfilling its functions, and sustaining its stability.

The processes of structural design can be summarized in the following steps (**Figure 01**):

1. Determination of applied loads.
2. Selection of economic and proper structural system.
3. Structural analysis of the structural system to get internal actions.
4. Design of structural members to resist internal actions.

The determination of loads is a critical step because any deviation in calculations of applied loads will lead to an underestimate of loads, which may cause structural failures, or it will lead to an overestimation of loads, which may cause uneconomic design.

After the determination of all structural loads, these loads shall be combined using the load combinations set by the building code or by the code of loads. The loads are combined statistically to reflect the realistic behavior of the loads acting on the building.

Structural members are designed to resist load combinations, not to resist loads separately.
This course is the tenth course of a series related to the determination of loads; all of these courses are independent and do not require any perquisites. The following is the list of related courses:

1. Determination of Dead, Soil Pressure, & Hydrostatic Pressure Loads as Per ASCE7-16.
2. Determination of Live & Roof Live Loads as Per ASCE7-16.
3. Determination of Rain Loads as Per ASCE7-16.
4. Determination of Snow Loads as Per ASCE7-16.
5. Determination of Flood Loads as Per ASCE7-16.
6. Determination of Ice Loads as Per ASCE7-16.
7. Determination of Crane Loads as Per ASCE7-16, MBMA$_2$016, and AISE13.
8. Determination of Wind Loads as Per ASCE7-16.
9. Determination of Seismic Loads as Per ASCE7-16.
10. |Load Combinations as Per ASCE7-16.

This course involves a deep study on the determination of Load Combinations, according to ASCE7-16-Chapter 2 and 2018 IBC-Chapter 16.

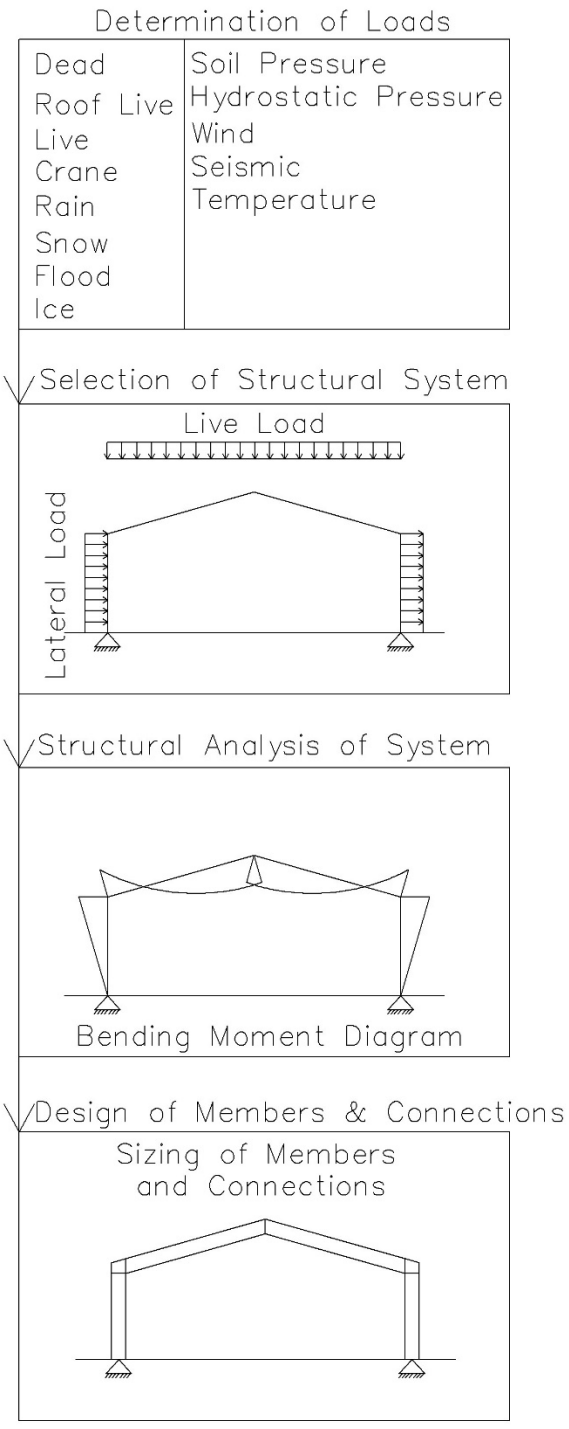

Figure (01). Steps of Structural Design

This course covers the following topics:

1. Types of Loads.
2. Usage of load combinations (Strength, Serviceability, and Stability)
3. Basic load combinations.
4. Load combinations, including flood loads.
5. Load combinations, including ice loads.
6. Seismic load combinations.
7. Load combinations, including self-straining actions.
8. Load combinations, including notional loads.
9. Load combinations, including extraordinary events.
10. Load combinations, including crane loads.
11. Load combinations for steel cables.
12. Load combinations of IBC-2018.

1) Types of Load Loads:

i. Vertical Loads & Incidental Lateral Loads:

This type of load includes the vertical loads (or gravity loads) and some incidental lateral loads, resulting from those loads such as lateral live loads acting on handrails or side thrust of crane loads.

a) Dead Load (D): (Figure **02**)

- Weight of all materials of construction incorporated into the building: such as self-weight of structural elements (beams, slabs, walls columns, concrete on metal deck, stairways, roofs...) and self-weight of architectural elements (cladding, ceilings, built-in partitions, finishes…).
- Fixed service equipment: such as plumbing stacks and risers, electrical feeders, heating, ventilating, air conditioning systems, cable trays, lighting supports, sprinkler systems, utility services, the weight of cranes (crane bridge weight), and material handling systems.

- Vegetative & Landscaped Roofs: such as weights of all landscaping & hardscaping materials, the weights shall represent the most severe cases, such as fully saturated soil weights, fully fry soil weights, and also drainage layer materials.
- Solar Panels, their support system, and ballast.

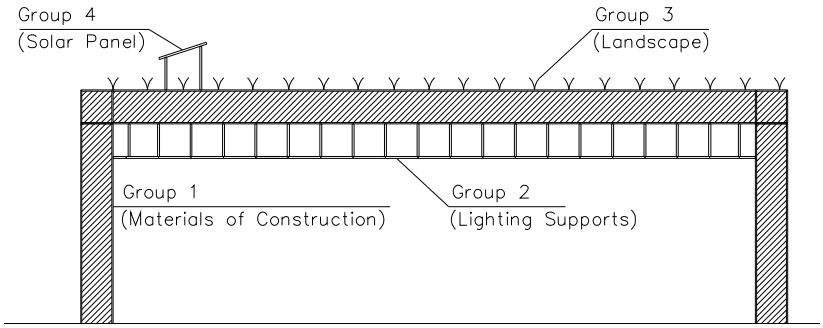

Figure (02). Groups of Dead Load

b) Weight of Ice Load (D_i): (Figure **03**)

It is the weight of ice loads acting on the structural members of the building, such as I-beams, channels, or HSS.

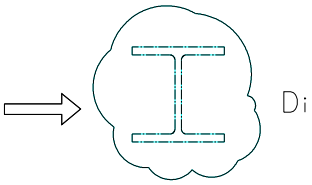

Figure (03). Weight of Ice Load

c) Roof Live Load (L_r):

It is the load produced due to the following:

- Maintenance by workers, equipment, and materials.
- Movable objects during the life of the structure, such as planters or other similar small decorative appurtenances, are not occupancy-related.

d) Rain Load (R):

It is a load of rainwater that will accumulate on the roof when the primary drainage system is blocked, plus the load of water that rises above the inlet of the secondary drainage system.

e) Snow Load (S):

It is a load of snow load acting on the roof of the building.

f) Live Load (L):

uilding or other

ntal loads, such as

n the function of

age, and any

d ladders,

hicle barrier

g)

crane (cranes), otherwise the own weight of the crane bridge, hoist, and trolley.

It includes rated capacity load (lifted load), impact load, side thrust, buffer force, crane stop force, collision force, and forces due to skewing.