What is Structural Design Integration?

Worksheet

Structural design integration is the coordinated process of embedding a building's structural system - columns, beams, load paths - into its architectural design from the start, verified with core checks like axial stress = F/A.

Questions

1. A column carries 20,000 N over 400 mm. What is the axial stress?

A) 50 MPa
B) 5 MPa
C) 500 MPa
D) 0.02 MPa

2. Structural design integration mainly ensures

A) Only aesthetics matter
B) Structure, architecture and systems are coordinated together
C) Structure is added after finishes
D) Only cost is minimized

3. If cross-sectional area doubles at constant load, stress

A) Doubles
B) Stays the same
C) Halves
D) Quadruples

4. A 'load path' describes

A) The route of electrical wiring
B) How forces travel from roof to foundation
C) The construction schedule
D) The HVAC ductwork route

5. A steel column carries an axial load of 12,000 N through a cross-section of 300 mm. Find the axial stress.

6. A designer wants stress to stay under 25 MPa on a 400 mm column. What is the maximum safe axial load?

7. Two integration options are compared: a 250 mm column carrying 15,000 N versus a 500 mm column carrying 15,000 N. Which has lower stress?

8. Define: What is structural design integration?

9. Define: What is the axial stress formula?

10. Define: Why integrate structure early, not later?

Answer Key

1. A) 50 MPa - = F/A = 20000/400 = 50 MPa.

2. B) Structure, architecture and systems are coordinated together - It coordinates load-bearing systems with architectural and MEP design from the start.

3. C) Halves - = F/A, so doubling A halves .

4. B) How forces travel from roof to foundation - Load path is the structural route gravity/lateral forces take to the ground.

5. = F/A = 12000/300 = 40 MPa

6. = F/A F = A F = 25 400 F = 10,000 N maximum

7. Option A: = 15000/250 = 60 MPa Option B: = 15000/500 = 30 MPa Option B has lower stress - doubling the area halves the stress for the same load

8. Coordinating a building's structural system with its architecture and other systems from the earliest design stage.

9. = F/A - load divided by cross-sectional area, in MPa.

10. Late structure changes force costly redesign of architecture and MEP routing.