

CODE

4.4—Structural system and load paths

4.4.1 The structural system shall include (a) through (g), as applicable:

- (a) Floor construction and roof construction, including one-way and two-way slabs
- (b) Beams and joists
- (c) Columns
- (d) Walls
- (e) Diaphragms
- (f) Foundations
- (g) Joints, connections, and anchors as required to transmit forces from one component to another

4.4.2 Design of structural members including joints and connections given in 4.4.1 shall be in accordance with **Chapters 7 through 18**.

4.4.3 It shall be permitted to design a structural system comprising structural members not in accordance with 4.4.1 and 4.4.2, provided the structural system is approved in accordance with **1.10.1**.

4.4.4 The structural system shall be designed to resist the factored loads in load combinations given in 4.3 without exceeding the appropriate member design strengths, considering one or more continuous load paths from the point of load application or origination to the final point of resistance.

4.4.5 Structural systems shall be designed to accommodate anticipated volume change and differential settlement.

COMMENTARY

R4.4—Structural system and load paths

R4.4.1 Structural concrete design has evolved from emphasizing the design of individual members to designing the structure as an entire system. A structural system consists of structural members, joints, and connections, each performing a specific role or function. A structural member may belong to one or more structural systems, serving different roles in each system and having to meet all the detailing requirements of the structural systems of which they are a part. Joints and connections are locations common to intersecting members or are items used to connect one member to another, but the distinction between members, joints, and connections can depend on how the structure is idealized. Throughout this chapter, the term “members” often refers to “structural members, joints, and connections.”

Although the Code is written considering that a structural system comprises these members, many alternative arrangements are possible because not all structural member types are used in all building structural systems. The selection types of the members to use in a specific project and the role or roles these member types play is made by the licensed design professional complying with requirements of the Code.

R4.4.2 In the chapter for each type of structural member, requirements follow the same general sequence and scope, including general requirements, design limits, required strength, design strength, reinforcement limits, reinforcement detailing, and other requirements unique to the type of member.

R4.4.3 Some materials, structural members, or systems that may not be recognized in the prescriptive provisions of the Code may still be acceptable if they meet the intent of the Code. **Section 1.10.1** outlines the procedures for obtaining approval of alternative materials and systems.

R4.4.4 The design should be based on members and connections that provide design strengths not less than the strengths required to transfer the loads along the load path. The licensed design professional may need to study one or more alternative paths to identify weak links along the sequence of elements that constitute each load path.

R4.4.5 The effects of column and wall creep and shrinkage, restraint of creep and shrinkage in long roof and floor systems, creep caused by prestress forces, volume changes caused by temperature variation, as well as potential damage to supporting members caused by these volume changes should be considered in design. Reinforcement, closure strips, or expansion joints are common ways of accommodating these effects. Minimum shrinkage and temperature reinforcement controls cracking to an acceptable level in many concrete structures of ordinary proportions and exposures.