

CHAPTER 24—SERVICEABILITY

CODE

COMMENTARY

24.1—Scope

24.1.1 This chapter shall apply to member design for minimum serviceability, including (a) through (d):

- (a) Deflections due to service-level gravity loads (24.2)
- (b) Distribution of flexural reinforcement in one-way slabs and beams to control cracking (24.3)
- (c) Shrinkage and temperature reinforcement (24.4)
- (d) Permissible stresses in prestressed flexural members (24.5)

24.2—Deflections due to service-level gravity loads

24.2.1 Members subjected to flexure shall be designed with adequate stiffness to limit deflections or deformations that adversely affect strength or serviceability of a structure.

R24.1—Scope

This chapter prescribes serviceability requirements that are referenced by other chapters of the Code, or are otherwise applicable to provide adequate performance of structural members. This chapter does not stand on its own as a complete and cohesive compilation of serviceability requirements for the design of structural members. This chapter has no specific requirements for vibrations.

Cast-in-place floor systems designed in accordance with the minimum thickness and deflection requirements of 7.3, 8.3, 9.3, and 24.2 have generally been found, through experience, to provide vibration performance suitable for human comfort under typical service conditions. However, there may be situations where serviceability conditions are not satisfied, for example:

- (a) Long spans and open floor plans
- (b) Floors with strict vibration performance requirements such as precision manufacturing and laboratory spaces
- (c) Facilities subject to rhythmic loadings or vibrating mechanical equipment

Prestressed floor systems are not subject to the minimum thickness requirements of 7.3, 8.3, and 9.3, and if precast they are frequently simple span systems. Consequently, these floor systems can be more susceptible to vibration.

Guidance on the consideration of vibrations in the design of floor systems and the evaluation of vibration frequency and amplitude for concrete floor systems is contained in the *PCI Design Handbook* (PCI MNL 120), *ATC Design Guide 1* (Applied Technology Council 1999), Mast (2001), Fanella and Mota (2014), and Wilford and Young (2006). An example application is described by West et al. (2008).

R24.2—Deflections due to service-level gravity loads

This section is concerned only with deflections or deformations that may occur at service load levels. When time-dependent deflections are calculated, only the dead load and those portions of other loads that are sustained need be considered.

Two methods are given in the Code for controlling deflections (Sabnis et al. 1974). For nonprestressed one-way slabs and beams, including composite members, the minimum overall thickness required by 7.3.1 and 9.3.1 is considered to satisfy the requirements of the Code for members not supporting or attached to nonstructural elements likely to be damaged by large deflections. For nonprestressed two-way construction, the minimum thickness required by 8.3.1 is considered to satisfy the requirements of the Code.

For nonprestressed members that do not meet these minimum thickness requirements, for nonprestressed one-way members that support or are attached to nonstructural elements likely to be damaged by large deflections, and for prestressed flexural members, deflections are required to be calculated by 24.2.3 through 24.2.5. Calculated deflections are limited to the values in Table 24.2.2.