

Chapter C14

MATERIAL-SPECIFIC SEISMIC DESIGN AND DETAILING REQUIREMENTS

C14.2 CONCRETE

The section adopts by reference ACI 318-08 for structural concrete design and construction. In addition, modifications to ACI 318-08 are made that are needed to coordinate the provisions of that material design standard with the provisions of ASCE 7. Work is ongoing to better coordinate the provisions of the two documents (ACI 318 and ASCE 7) such that the provisions in Section 14.2 will be significantly reduced in future editions of ASCE 7.

C14.2.2.1 ACI 318, Section 7.10

Section 7.10.5.6 of ACI 318 prescribes reinforcement details for ties in compression members. This modification prescribes additional details for ties around anchor bolts in structures assigned to SDC C through F.

C14.2.2.2 Definitions

The first two definitions describe wall types for which definitions currently do not exist in ACI 318. These definitions are essential to the proper interpretation of the R and C_d factors for each wall type specified in Table 12.2-1 of ASCE 7-05.

A wall pier is recognized as a separate category of structural element in this document but not in ACI 318.

C14.2.2.3 Scope

This provision describes how the ACI 318 provisions should be interpreted for consistency with the ASCE 7 provisions.

C14.2.2.4 Wall Piers and Wall Segments

Wall piers are typically segments between openings in walls that are thin in the direction normal to the horizontal length of the wall. In current practice these elements are often not regarded as columns or as part of the structural walls. If not properly reinforced, these elements are vulnerable to shear failure and that failure prevents the wall from developing the assumed flexural hinging. Section 21.9.10 is written to reduce the likelihood of a shear failure. Wall segments with a horizontal length-to-thickness ratio less

than 2.5 are required to be designed as columns in compliance with Section 21.9 if they are utilized as part of the lateral force-resisting system, even though the shortest cross-sectional dimension may be less than 12 in. in violation of Section 21.6.1.1. However, because such segments are part of walls that do not need to satisfy 21.6.1.1's limitation on the shortest cross-sectional dimension of 12 in., such segments may be designed to comply with Section 21.13 if they are not utilized as part of the lateral force-resisting system. Wall segments with a horizontal length-to-thickness ratio larger than or equal to 2.5, which do not meet the definition of wall piers (Section 14.2.2.1), must be designed as special structural walls or as portions of special structural walls in full compliance with Section 21.9 or 21.10.

C14.2.2.6 Foundations

The intention is that there should be no conflicts between the provisions of Section 21.12 of ACI 318 and Sections 12.1.5, 12.13, or 14.2 of ASCE 7. However, the additional detailing requirements for concrete piles of Section 14.2.3 can result in conflicts with ACI 318 provisions if the pile is not fully embedded in the soil.

C14.2.2.7 Intermediate Precast Structural Walls

Section 21.4 of ACI 318 imposes requirements on precast walls for moderate seismic risk applications. Ductile behavior is to be ensured by yielding of the steel elements or reinforcement between panels or between panels and foundations. This provision requires the designer to determine the deformation in the connection corresponding to the earthquake design displacement, and then to check from experimental data that the connection type used can accommodate that deformation without significant strength degradation. By contrast, the 2006 edition of the International Building Code (IBC) restricts yielding to steel reinforcement only because of concern that steel elements in the body of a connection could fracture due to inelastic strain demands.

The wall pier requirements of Section 21.4.5 are patterned after the same requirements of Section 14.2.2.5 for wall piers that are part of structures in high seismic design categories.