

Lateral Support of Longitudinal Reinforcement

Q. *We are designing a box-shaped shear wall core. Although the wall will carry gravity loads from the suspended floors, compressive loads do not control the design of the longitudinal (vertical) reinforcing. In other words, the longitudinal reinforcing is controlled by the tension forces in the wall due to the overturning wind forces. It is our understanding that, even though the wall has some compressive forces in it, the longitudinal reinforcement does not need to be confined by ties because its primary purpose is to carry a tension force. Is this a correct interpretation of the Code provision?*

A. Based on the corresponding provision in the previous edition of the Code (ACI 318-11, Section 14.3.6¹) or the current Code (ACI 318-14, Section 11.7.4.1²), lateral ties are required if the longitudinal bars are designed to provide strength as compression reinforcement. If, however, the capacity of the section in combined compression and bending (for all load cases) is sufficient without the addition of compression reinforcement, then the longitudinal reinforcement does not need to be enclosed by lateral ties. Regardless of whether the reinforcement is required for tensile

capacity, compression capacity, or both, note that lateral ties are required if the area of longitudinal reinforcement (A_{st}) exceeds 0.01 times the gross concrete area (A_g). Also, note that it is good practice to provide confinement reinforcement at lap splices, even if the development length is calculated using $K_{tr} = 0$ as a design simplification. Refer to ACI 318-11, Section 12.2.3, and Commentary Section R12.2 (or ACI 318-14, Section 25.4.2.3, and Commentary Section R25.4.2.3) for more information.

Note: Readers are reminded that ACI provides a transition key that lists section numbers in ACI 318-11 corresponding to section numbers in ACI 318-14 and ACI 318R-14. The key is available at www.concrete.org/tools/318buildingcodeportal.aspx.

References

1. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-11) and Commentary," American Concrete Institute, Farmington Hills, MI, 2011, 503 pp.
2. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)," American Concrete Institute, Farmington Hills, MI, 2014, 519 pp.

Transverse Reinforcement for Torsion

Q. *What are the requirements for transverse reinforcement in beams subject to torsion?*

A. The requirements for transverse reinforcement in beams subject to torsion are given in ACI 318-14, Section 25.7.1.6.¹ The reinforcement should include hoops or closed stirrups with bars anchored at their ends by 135-degree standard hooks (Fig. 1(a)). Where the hook will be restrained by adjacent concrete (Fig. 1(b) and (c)), Section 25.7.1.6(b) allows 90-degree hooks to be used (refer to Commentary Section R25.7.1.6).

Also, note that the extension on the 90-degree hooks must be the greater of $6d_b$ or 3 in. (76 mm) on No. 3 through No. 5 and $12d_b$ on No. 6 through No. 8 bars as shown in Table 25.3.2 of ACI 318-14.

References

1. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)," American Concrete Institute, Farmington Hills, MI, 2014, 519 pp.

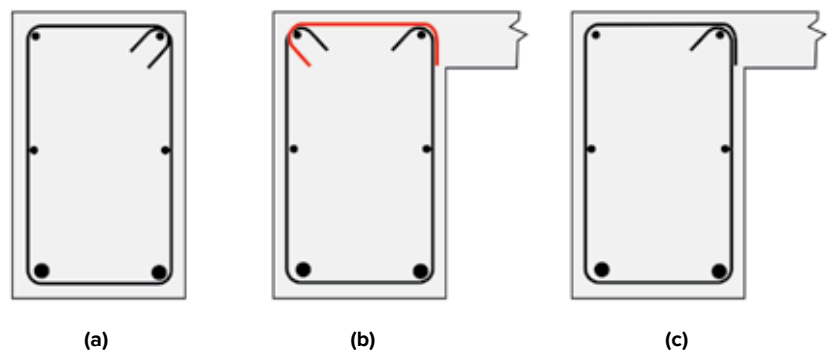


Fig. 1: Torsion reinforcement in a beam: (a) hoop; (b) two-part closed stirrup restrained by slab; and (c) one-part closed stirrup restrained by slab (for clarity, the slab reinforcement is not shown)