

Bundled Reinforcement in Concrete Columns and Bridge Piers

Overview

Bundled reinforcement is a group of parallel reinforcing bars bundled in contact to act as a unit. The bars in the bundle shall be limited to four (4). [Figure 1](#) shows the bundled reinforcement shapes that are commonly utilized in concrete columns and bridge piers.

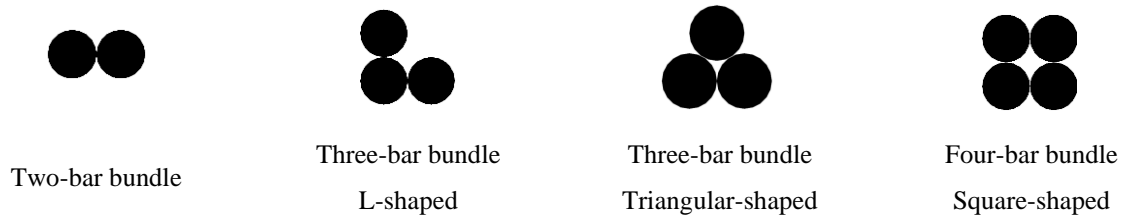


Figure 1 – Typical Bundled Reinforcement Shapes in Concrete Columns and Bridge Piers

Cross-Sectional Capacity Determination in [spColumn](#)

For the determination of cross-sectional capacity of a reinforced concrete column or bridge pier, each bar within the bundled reinforcement shall be treated individually where each bar's contribution to the capacity is determined based on its area and centroid.

Concrete Cover and Minimum Clear Spacing in [spColumn](#)

For specified concrete cover and minimum clear spacing between longitudinal reinforcement determination in columns or bridge piers containing bundled reinforcement, ACI 318, CSA A23.3, and AASHTO utilize a diameter, d_b , of a single bar with an area equivalent to that of the bundled reinforcement.

The specified concrete cover needs to satisfy [ACI 318-19, 20.5.1.3.5](#), [CSA A23.3-19, Annex A, 6.6.6](#), and [AASHTO 9th Edition, 5.10.1](#) and is defined as the distance between the outer-most surface of embedded reinforcement and the closest outer surface of the concrete. The specified concrete cover is a user-defined input in [spColumn](#).

The diameter, d_b , of a single bar with an area equivalent to that of the bundle shall be considered in determining the minimum clear spacing between longitudinal reinforcement per [ACI 318-19, 25.2.3](#), [CSA A23.3-19, Annex A, 6.6.5](#), and [AASHTO 9th Edition, 5.10.3.1](#). The minimum clear spacing between bundled reinforcement shall be measured as the closest distance between individual bars of the adjacent bundled reinforcement in a given [spColumn](#) model.

References

- [1] Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary (ACI 318R-19), American Concrete Institute, 2019
- [2] Design of Concrete Structures (CSA A23.3-19) and Explanatory Notes on CSA Standard A23.3-19
- [3] AASHTO LRFD Bridge Design Specifications, 9th Edition, American Association of State Highway and Transportation Officials, 2020