

 Office of Structures Guidelines and Procedures Memorandum	DESIGN
	Number: D-18-51(4)
	Date: 03-16-2018
Reinforced Concrete	Approval: 

The following guidelines and procedures relate to the design of bridges containing reinforced concrete and shall be used in conjunction with the AASHTO LRFD Bridge Design Specifications.

Concrete Design Strength

The design compressive strength for the following MDOT SHA Concrete Mixes shall be used in the design calculations.

Mix No. 6: $f'_c = 4,000$ psi

Mix No. 3: $f'_c = 3,000$ psi

The design strength of any proposed concrete mix shall be 500 psi less than the specified mix design strength to allow for the potential acceptance of individual strength tests below the specified strength per MDOT SHA Standard Specifications.

Grade 60 Reinforcing Steel

All designs shall be performed utilizing ASTM A-615 Grade 60 steel with an allowable $f_y = 60,000$ psi ($f_s = 24,000$ p.s.i.)

Number 14 and Number 18 Reinforcing Bars in Substructure Units

Whenever possible, substructure units shall be so designed that the largest reinforcing bar utilized will be a #11 bar. If during design it is determined that #14 or #18 bars are required, then approval in writing for their use will be required from the Director-Office of Structures before these bars are to be used in the design of the substructure.

Minimum Reinforcing Bars in Retaining Walls and Abutment Stems

AASHTO specifications require a minimum of 1/8 square inch of horizontal reinforcement per foot of height of retaining walls and abutments to resist the formation of temperature and shrinkage cracks. While this is adequate for relatively small walls, it is not usually sufficient for thicker walls to resist temperature stresses, etc. Therefore, the following minimum reinforcing shall be used:

Walls 1'-0" thick or less, use #4 @ 18" in both faces in both directions;

Walls over 1'-0" up to 3'-0", use #4 @ 12" in both faces in both directions;

Walls 3'-0" thick and over, use #5 @ 12" in both faces in both directions; and

All abutment faces, use #5 @ 12" in both faces in both directions.

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Doweling into Existing Concrete

The designer may wish to use dowel bars to tie new concrete into an existing structure. If dowels are shown on the Plans, then they shall be at least 6" from the face of any concrete surface. The minimum size of dowel bars shall be #6 and the diameter of the dowel holes shall be at least the dowel bar diameter plus 1/2". When dowel bars are called for the following note shall appear on the appropriate Plan sheet:

“Grout for dowels shall be a non-shrink epoxy grout consisting of sand and epoxy mixed by volume according to manufacturer's recommendations and capable of developing a minimum compressive strength of 6500 psi in 72 hours when tested in accordance with M.S.M.T. 501. Sand for epoxy grout shall conform to Section 901.01 of the Specifications.”

If more than one substructure unit on the same bridge is affected, these notes shall appear on only one sheet and referenced on all others.

Spiral Reinforcing for Circular Bridge Pier Columns

All circular pier columns whose diameter is 7'-0" or less shall be designed using spiral reinforcing. When spirals are used, include the General Notes for column spirals on the Contract plans. Circular columns greater than 7'-0" in diameter shall not use spirals, but shall utilize another form of tie detailing.

This requirement is based on shipping limitations. The Concrete Reinforcing Steel Institute recommends a maximum width of 7'-4" for shipping in an effort to limit the bar bundle size to the 8'-0" maximum load width. Generally, shipping widths greater than 8'-0" require the permission of authorities or must be shipped under special freight rates.

Hammerhead Type Piers – Cap Reinforcing Steel

All main reinforcing steel in the top of caps required for the "cantilever/corbel" portion of cap shall be properly anchored at ends of caps and extend continuously across the entire length of the cap. These bars shall not be spliced, unless the lengths of the bars are such that splicing cannot be avoided. If splicing is required, it shall be accomplished by alternating the location of the splices of adjacent bars near the center of the cap.