



November 20, 2002

MEMORANDUM TO TEAM LEADERS AND CONSULTANTS

SUBJECT: Seismic Requirements for Highway Bridges

All bridges shall be detailed and designed to resist seismic loadings as specified in the latest edition of SCDOT Seismic Design Specifications for Highway Bridges including subsequent revisions, memorandum DM0202 and those contained in this memorandum.

This memorandum supersedes and replaces DM0391 dated February 26, 1991, DM0495 dated October 27, 1995, DM 0697 dated June 17, 1997, DM0797 dated August 6, 1997, DM1097 dated October 13, 1997, DM0498 dated July 20, 1998, and LRFD00A dated September 5, 2000.

Grade 60 reinforcing steel conforming to ASTM A706 shall be used according to memorandum DM1302.

1. Classification of Bridges

The Department will classify all bridges as per article 3.2.1 of the SCDOT Seismic Design Specifications.

2. Column Reinforcing Steel

Columns shall conform to the requirements listed below:

- There shall be no splices in the longitudinal reinforcing in the plastic hinge zones. These zones shall be clearly identified as a "No-Splice Zone" by the design engineer, and detailed and shown on the plans. Outside the "No-Splice Zone", ultimate mechanical splices are permitted. A minimum stagger of 2'-0" between adjacent splices shall be required and the location shown on the drawings. Splices in bundle bars shall also be staggered at 2'-0". If coated bars are used, the couplers shall be tested with bars coated as required for the bridge and the couplers shall be coated with a compatible coating. The longitudinal reinforcing steel in columns will be detailed continuous with a maximum spacing of 8 inches center to center. The minimum size bar used for main vertical reinforcing shall be a No. 25 bar.
- Mechanical butt-welded spliced hoops shall be used as confinement steel.
- The hoops in columns shall extend into the bent cap, pile cap and/or footing as shown in figure 1.
- Columns shall have circular cross sections. If a circular column cannot be designed for the required loading, a column with an oblong cross section shall be used and shall meet the following requirements in addition to the above noted column requirements:
 - The center-to-center spacing of interlocking hoop cages in oblong columns shall not be greater than 0.75 times the diameter of the cage. The overlaps shall be interlocked by a minimum of four bars (see figure 2).
- Biased reinforcing in circular columns will not be allowed.



3. Prestressed Concrete Pile Requirements

The prestressed concrete piles shall meet seismic requirements as per seismic design of that particular bridge project. Spiral reinforcing will be permitted in prestressed concrete piles.

4. Cap Stirrups

All cap stirrups shall be one piece-enclosed hoops having 135° seismic hooks at one corner as shown in figure 3.

5. Shear Keys

All concrete beam spans shall have shear keys cast on the bent or pier cap to provide a positive shear transfer between the superstructure and substructure. Shear keys shall be skewed parallel to the girders as shown in figure 4. The substructure shall be checked for the loading transferred from the shear key. If other types of connections are used, the detail shall be approved by the Bridge Design Engineer before using, and the structure shall be analyzed and designed accordingly.

If seismic analysis is not performed, a minimum of 0.2 the superstructure dead load shall be used for designing the shear keys.

6. Beams and Girder Anchorage

All beam or girder spans, including both steel and concrete shall be anchored to the substructure on both ends by means of anchor bolts or other methods. The design of the anchor system shall address both horizontal and vertical loadings and shall be approved by the Bridge Design Engineer. Connections between slabs and caps on slab bridges shall also be designed for seismic loads.

7. Barriers and Retaining Structures

If barriers or retaining structures are placed adjacent to columns, they shall be considered during design of columns. If the barriers or retaining structures are not designed integrally with the columns, a 6" minimum spacing shall be detailed between the barrier or retaining structure and the columns. The 6" spacing shall be increased as required by design.

8. Concrete Flow Ability

The designer shall consider the maximum aggregate size in the concrete and the reinforcing spacing when evaluating the constructibility during placement of the concrete.

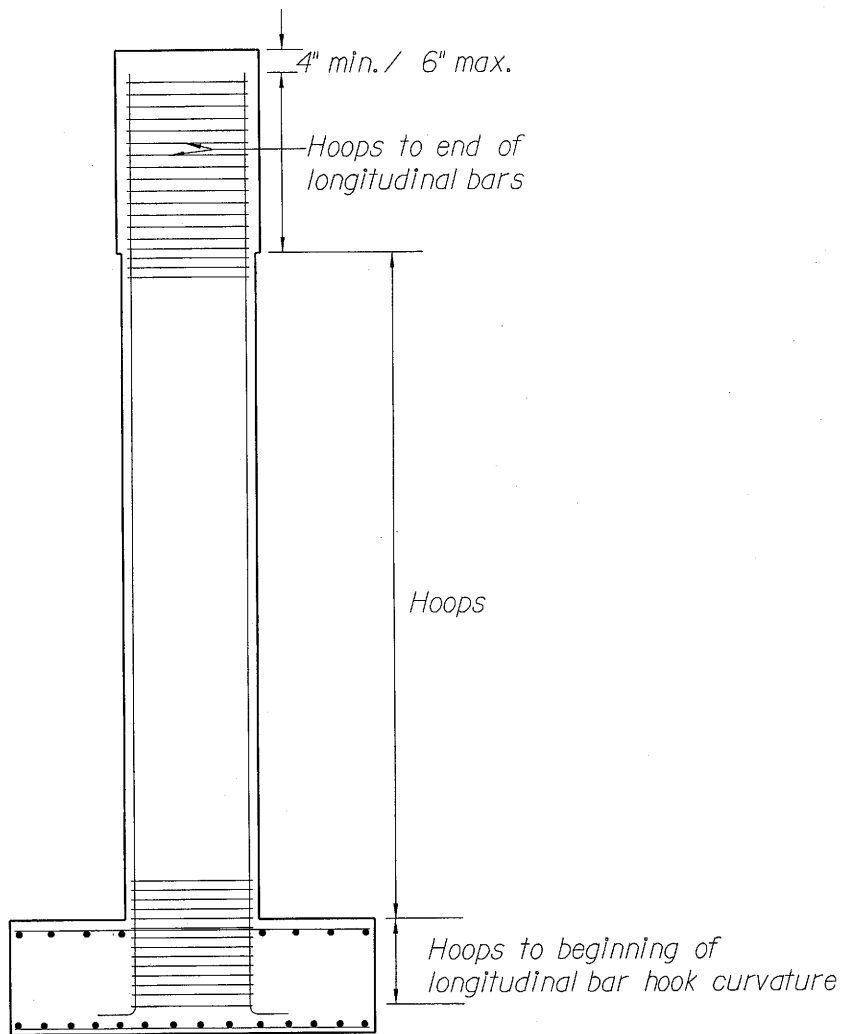

Randy R. Cannon, P.E.
Bridge Design Engineer

RRC/slb

~~Attachments~~

cc: Assistant Bridge Design Engineers
Bridge Construction Engineer
FHWA
CRM East
CRM West

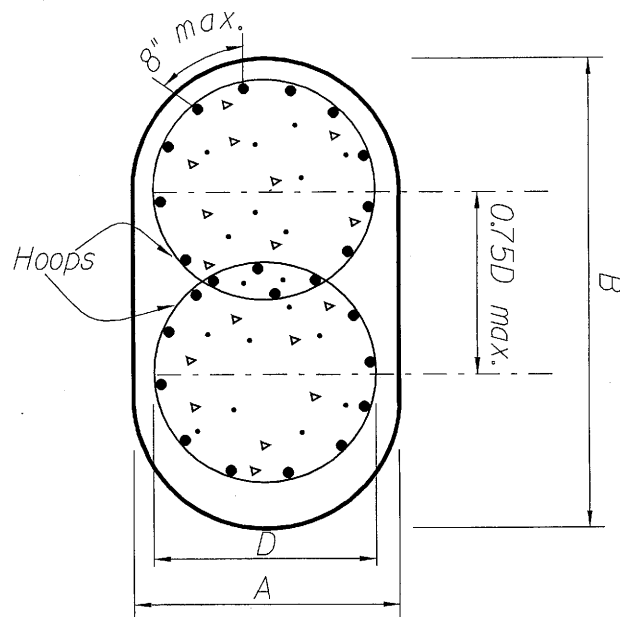
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(All hoops shall be butt welded hoops)

CONFINEMENT REINFORCING DETAIL
AT BENT CAP & FOOTING

Figure 1



COLUMN REINFORCING

Figure 2

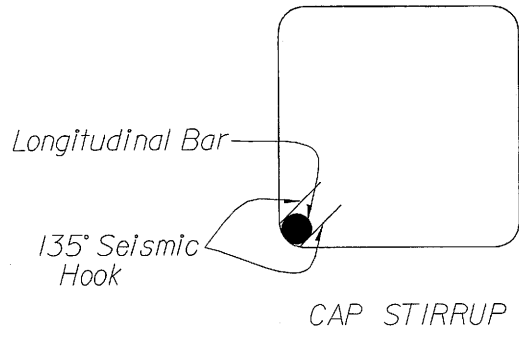


Figure 3

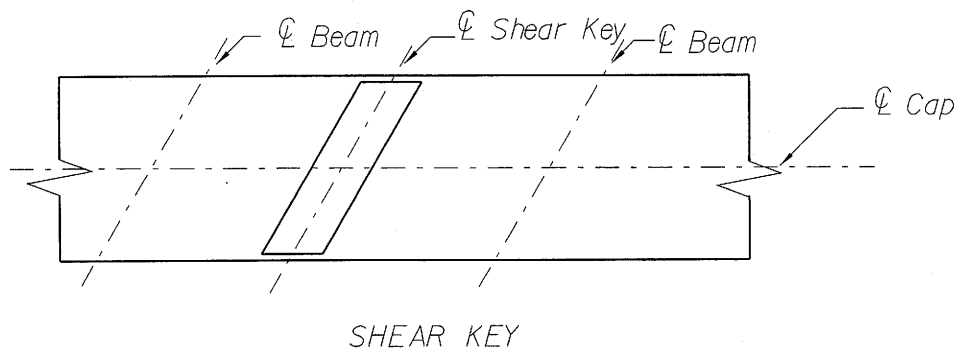


Figure 4