I N T E R O F F I C E M E M O

TECHNICAL SERVICES
Bridge Engineering Section
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DATE: April 8, 2014

TO: Craig Shike
ODOT Bridge Operations and Standards
Managing Engineer

FROM: Tanarat Potisuk Phone#: 503-986-3342
ODOT Prestressed Concrete Standards Engineer

SUBJECT: Proposed Revision to Bridge Design & Drafting Manual

RE: BDDM Section 1.5.5.1.17 – ASTM A706 Grade 80 Reinforcement

Problem Statement:

Grade 80 bars are needed to reinforce Str.22008's drilled shafts for Newberg-Dundee project. Use of the high strength bars reduces congestion in the shafts. Cascade Steel Rolling Mills was contacted to confirm minimum required quantities for rebar production. As a result, information in this BDDM section needs an update.

Proposal:

Modify Section 1.5.5.1.17 as follows

1.5.5.1.17 ASTM A706 Grade 80 Reinforcement

ASTM A706 Grade 80 reinforcement is available on the market and is acceptable for use on ODOT bridges. When using A706 Grade 80 reinforcement, the design yield ~~will be~~strength is 80 ksi.

The cost premium for A706 Grade 80 reinforcement is approximately 5 cents per pound over Grade 60.

Do not use A706 Grade 80 reinforcement in members designed for plastic seismic performance (such as bridge columns). Although A706 Grade 80 reinforcement has similar ductile properties compared to A706 Grade 60, testing of full-scale seismic models sufficient to satisfy AASHTO concerns has not yet been completed.

Local steel mills (Cascade Steel) requires a minimum order of ~~30~~ 90 tons to make A706 Grade 80 reinforcement ~~. This~~and a minimum order ~~is~~ of 24 tons for each bar size ~~and assuming~~with standard cut lengths.

Normally, ~~I~~it ~~will usually~~ requires a multi-span structure to have sufficient quantity in selected sizes to meet the minimum order quantity required by steel mills. The following are areas where use of A706 Grade 80 reinforcement might be warranted:

- Bridge decks – When Grade 80 reinforcement is used in a bridge deck, use it for both longitudinal and transverse bars. Do not mix Grade 80 and Grade 60 within the same bridge deck. Ensure all deck design requirements for project specific designs given in *Section 1.9.1* are satisfied. Assuming a typical deck with approximately 5 pounds of deck steel per square foot of deck, the minimum deck area required to meet the minimum order of ~~30~~ 24 tons ~~will be~~is about ~~12,000~~~~7~~9,600 square feet. If different bar sizes are used in transverse and longitudinal directions, the minimum deck area will be much larger.

- Drilled shafts – Use of Grade 80 reinforcement ~~will~~ reduces cost and ~~reduce~~ congestion in drilled shafts thereby making them more constructible. Drilled shafts are designed for elastic seismic performance and so there would typically be no concern with the seismic performance. If there is sufficient quantity to meet the minimum order, Grade 80 reinforcement can also be used for lateral confinement in drilled shafts.

- Crossbeams & End beams – Use of Grade 80 reinforcement can reduce cost and congestion in negative and positive moment areas of crossbeams and end beams. Even if the same bar size is used for both negative and positive moment areas, the minimum order quantity will normally be met only on a large multi-span bridge. Use of Grade 60 reinforcement for temperature steel and stirrups is acceptable for these applications.

Splice lengths and development lengths for Grade 80 rebar ~~will be~~are longer compared to Grade 60.

Couplers are available on the market for Grade 80 reinforcement. These couplers are capable of meeting 125% of yield strength. This is less than required by current specifications (*02510.20* in the Standard Specifications) which require couplers to meet 135% of yield strength. However, for the proposed applications above, 125% of yield strength ~~will~~ provides satisfactory performance. A project specific change to *02510.20* ~~will be~~is required when ASTM A706 Grade 80 bars are used. Note also that the ODOT Materials Lab has the capability to test Grade 80 couplers.

ASTM A706 reinforcement ~~should be~~is weldable. Welding would be needed when A706 Grade 80 reinforcement is used for confinement hoops. The ~~C~~contractor~~s will~~ needs to submit a PQR and WPS for approval as is typical for any rebar welding.

Analysis / Research / Other Supporting Data:

☐ None
☐ Attached:
- [name of attachment]
- [name of attachment]

Bridge Engineering Section Response:

☐ Accepted for consideration as submitted ☐ Accepted for consideration as noted ☐ Proposal tabled, see Remarks ☐ Proposal not accepted, see Remarks		
Remarks:		
[name of reviewer] Bridge Design Standards Reviewer		Date
~~Scott Liesinger~~Craig Shike Bridge ~~Design~~Operations and Standards Managing Engineer		Date

Cc: file