The following three classes of corrosion resistant reinforcing (CRR) steel deformed bars shall be used in the structural elements identified in this document for all VDOT projects:

**Corrosion Resistant Reinforcing Steel, Class I:** Steel shall conform to AASHTO M 334M/M 334-17 – Standard Specification for Uncoated, Corrosion-Resistant, Deformed and Plain Chromium Alloyed, Billet-Steel Bars for Concrete Reinforcement and Dowels. UNS* Designations: K81550 (Alloy Type 1035 CS steel with a minimum chromium content of 9.2%) or S24100.

**Corrosion Resistant Reinforcing Steel, Class II:** Steel shall conform to AASHTO M 334M/M 334-17 – Standard Specification for Uncoated, Corrosion-Resistant, Deformed and Plain Chromium Alloyed, Billet-Steel Bars for Concrete Reinforcement and Dowels. UNS* Designation: S32101.

**Corrosion Resistant Reinforcing Steel, Class III:** Steel shall conform to AASHTO M 334M/M 334-17 – Standard Specification for Uncoated, Corrosion-Resistant, Deformed and Plain Chromium Alloyed, Billet-Steel Bars for Concrete Reinforcement and Dowels. UNS* Designations: S24000, S30400, S31603, S31653, S31803 and S32304.

* Unified Numbering System for Metals and Alloys

The Class(es) of CRR steel(s) required on a project is/are to be denoted in the plans. CRR Class II or Class III may be substituted for Class I. CRR Class III may be substituted for Class II. CRR with a lower class designation than specified shall not be used.
**REINFORCING STEELS DESIGNATED AS CRR:**

CRR steels shall be used as indicated herein on all projects including new construction, widening, deck replacement, superstructure replacement, repair and rehabilitation projects.

For the following structural elements, the Class of CRR used shall be based on functional classification:

Concrete deck slabs (including bolster): All reinforcement.

Raised medians and sidewalks: All reinforcement.

Parapets, rails, median barriers and terminal walls: All reinforcement including that extending into the concrete deck slab, approach slab, retaining wall or moment slab.

Moment slabs: All reinforcement.

Integral backwalls for full integral, semi-integral and VA abutments: All reinforcement.

Concrete diaphragms (end, intermediate and continuity) for prestressed concrete beams: All reinforcement.

Prestressed concrete slabs (including Inverted-Tee beams, Box beams and Voided slabs): All reinforcement including reinforcement in Virginia Adjacent Member Connections.

Precast concrete slab beam: All reinforcement.

Reinforced concrete slab spans: All reinforcement.

<table>
<thead>
<tr>
<th>Functional Classification</th>
<th>CRR Steel Class I</th>
<th>CRR Steel Class II</th>
<th>CRR Steel Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rural Principal Arterial</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rural Minor Arterial</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rural Collector Road</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural Local Road</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Urban Principal Arterial</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Urban Minor Arterial</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Urban Collector Street</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Local Street</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>All Pedestrian Bridges</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: x = all districts, all counties
For the following structural elements, CRR Steel shall be Class I:

Substructure units in tidal waters: All reinforcement.

Substructure units located within 22 feet from the edge of the traveled way (in the splash zone): All reinforcement above the footings including footing bars extending above the top of the footings in the substructure units (abutments, protection barriers, piers, architecture treatment panels, etc.) to the limits identified in APPENDIX A - Splash Zones.

Portions of retaining walls located within 22 feet from the edge of the traveled way identified in APPENDIX A - Splash Zones: All reinforcement in MSE wall panels or any other retaining walls including the facing of anchored type walls and architecture treatment panels.

Piers or bents located under joints: All reinforcement in cap section, columns, walls and bent piles.

Conventional abutments without deck slab extensions or VA Abutments: All neat reinforcement.

MSE Wall Coping: All reinforcement.

Footings of full integral abutments: All reinforcement.

Stub abutments for prestressed concrete voided slab, box beam or inverted T-beam superstructures: All reinforcement.

Box culverts (CIP and precast) with 0 to 2 foot fill: All reinforcement.

Rigid frames with less than 2 foot fill: All reinforcement in and extending into the top slab.

Prestressed concrete (Bulb-T and AASHTO) beams: Stirrups and other reinforcement extending into the concrete deck slab, full and semi-integral backwalls and continuity diaphragms.

Where the existing element does not contain CRR and where supplemental reinforcing steel is required, the supplemental reinforcing steel shall be CRR Class I for the following repair applications:

Concrete superstructure surface repair (excluding concrete deck patching) and concrete substructure surface repair located within 22 feet from the edge of traveled way (splash zone) on restorative maintenance work.

Examples of applications where CRR is not required include box culverts (CIP and precast) with fill greater than 2 feet, precast wingwalls of culverts and approach slabs (except as noted above).
DESIGN ISSUES:

Design shall be based on yield strength of 60 ksi for all three Classes of CRR except as identified below.

Hooks, lap lengths and development lengths are in accordance with the design specifications using yield strength of 60 ksi. See also the office practice (Manual of the Structure and Bridge Division, Part 2), Chapter 7.

When expanding or replacing any portion of an existing structure using CRR in accordance with this IIM, CRR can be spliced with the existing carbon (black) or epoxy coated reinforcing steel.

Yield strength of 75 ksi may be used for box culverts and rigid frames. In these cases, development length, lap length of CRR and crack control shall be designed and detailed based on yield strength of 75 ksi.

DETAILING ISSUES:

Availability of bars sizes (#3 through #11) and bar lengths:

<table>
<thead>
<tr>
<th></th>
<th>CRR Low Carbon/ Chromium</th>
<th>CRR Solid Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bar sizes</strong></td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td><strong>Bar lengths</strong></td>
<td>40 feet – all sizes</td>
<td>40 feet – all sizes</td>
</tr>
<tr>
<td></td>
<td>60 feet all except #3*</td>
<td>60 feet – all sizes</td>
</tr>
</tbody>
</table>

* Standard fabrication bar length for #3 is 40 feet. Longer length is available by special order.

CRR STEEL: INSERTS, TIES, SPICERS, CHAIRS/BAR SUPPORTS AND SPACERS:

Supplemental Section 406 – Reinforcing Steel to the VDOT Road and Bridge Specifications includes the following items addressing corrosion resistant reinforcing steels:

INSERTS:

All inserts, rods, clips, angles and other steel hardware that will remain in the concrete superstructure or deck shall be galvanized or stainless unless otherwise specified by the Engineer.

TIES:

Unless otherwise specified by the Engineer, tie wires used with corrosion resistant reinforcing steel shall be: plastic; solid stainless; epoxy-coated carbon (black) steel wire or plastic-coated carbon (black) steel wire.
MECHANICAL BUTT SPLICERS (CONNECTORS):

For corrosion resistant reinforcing bars, mechanical butt splicers shall be of the same material as the bars being spliced.

CHAIRS/BAR SUPPORTS:

Plastic (composite) chairs may be used to support Corrosion Resistant Reinforcement (CRR) in precast concrete elements; otherwise, CRR in structures shall be supported by steel bar supports as follows, unless otherwise specified by the Engineer:

1. For Class I CRR, steel bar supports shall be: plastic-protected wire bar supports (per CRSI Class 1 – Maximum Protection) when stay-in-place forms are not used and the steel bar support will be exposed; and epoxy-coated bright basic wire bar supports (per CRSI Class 1A – Maximum Protection) when either stay-in-place forms are used or the steel bar support will not be exposed.

2. For Class II and Class III CRR, steel bar supports shall be: either stainless steel wire bar supports or plastic-protected wire bar supports (per CRSI Class 1 – Maximum Protection) when stay-in-place forms are not used and the steel bar support will be exposed; and epoxy-coated bright basic wire bar supports (per CRSI Class 1A – Maximum Protection) when either stay-in-place forms are used or the steel bar support will not be exposed.

Steel bar supports for CRR shall be fabricated from cold-drawn carbon steel wire conforming to the CRSI corrosion protection class listed above for their specific use, except for plastic-protected wire bar supports, which shall be epoxy-coated with plastic protection applied by dipping legs (i.e., capping legs with pre-molded plastic tips is prohibited).

SIDE-FORM SPACERS:

Side-form spacers shall meet the same corrosion protection level as the bar supports.

SUPPLEMENTAL SPECIFICATIONS

See: Supplemental Section 223 and Supplemental Section 406

SPASH ZONES

See: Appendix A – Splash Zones
CC:  Chief Engineer
     Deputy Chief Engineer
     Division Administrators
     District Administrators
     District Construction Engineers
     District Maintenance Engineers
     Assistant State Structure and Bridge Engineers
     District Structure and Bridge Engineers
     Residency Administrators/Engineers
     Structure and Bridge Program Managers
     FHWA: Bridge Section
APPENDIX A – SPLASH ZONES:

Example 1: MSE wall or reinforced concrete abutment retaining wall parallel to roadway
APPENDIX A – SPLASH ZONES: (Cont’d)

Example 2: U-back MSE wall or reinforced concrete abutment and wing wall
APPENDIX A – SPLASH ZONES: (Cont’d)

Example 3: Pier