



# Corrosion Resistant Reinforcing Steel (CRR)

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AMERICAN ASSOCIATION  
OF STATE HIGHWAY AND  
TRANSPORTATION OFFICIALS

**AASHIO**

# Presentation Outline



- IIM S&B – 81 CRR
- IIM S&B – 81.7 CRR

- **First Released on June 18, 2008**
  - After extended research by Research Council.
  - Three types – ASTM1035, Stainless Solid & Clad
- **Revised 7 times as of December 13, 2016**
  - Clad is taken out – No Producers
  - New ASSHTO tests
  - New players - Clad producers in US

- **Two Types of CRR steels**
  - Low-carbon, Chromium ASTM A1035/A1035 M
    - Minimum Chromium Content of 9.2%
  - Solid Stainless Steel AASHTO MP18M/MP18-15
- **Three Classes**
  - Class I - ASTM A1035/A1035 M, UNS S24100
  - Class II - AASHTO MP18M/MP18-15, UNS S32101
  - Class III - AASHTO MP18M/MP18-15, UNS S24000, S30400, S31603, S31653, S31803 & S32304

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- **Substitution**

- 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



Class I



Class II

Clad – Not Allowed



Class III

# IIM S&B – 81.7 CRR

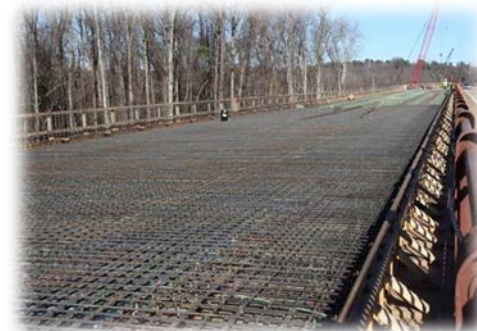
- Usage based on Functional Classification

Functional Classification	Class I	Class II	Class III
Freeway			X
Rural Principal Arterial			X
Rural Minor Arterial		X	
Rural Collector Road	X		
Rural Local Road	X		
Urban Principal Arterial			X
Urban Minor Arterial		X	
Urban Collector Street	X		
Urban Local Street	X		
All Pedestrian Bridges	X		

- Usage based on Functional Classification

- All Reinforcement

- Concrete Decks
- Medians and Parapets
- Approach Slabs
- Moment Slabs
- Integral Backwall
- Concrete Diaphragms
- Prestressed Concrete Slabs
- Reinforced Concrete Slabs



- **CRR Steel Class I**

- All reinforcement
  - Substructure units in tidal waters
  - Footings in integral abutments
  - Box culverts (CIP and precast) with 0 to 2 foot fill
- All neat reinforcement including footing bars extending into neat concrete in the substructure units
  - Substructure units located within 22 feet from the edge of the traveled way
  - Portions of retaining walls located within 22 feet from the edge of the traveled way (splash zone):



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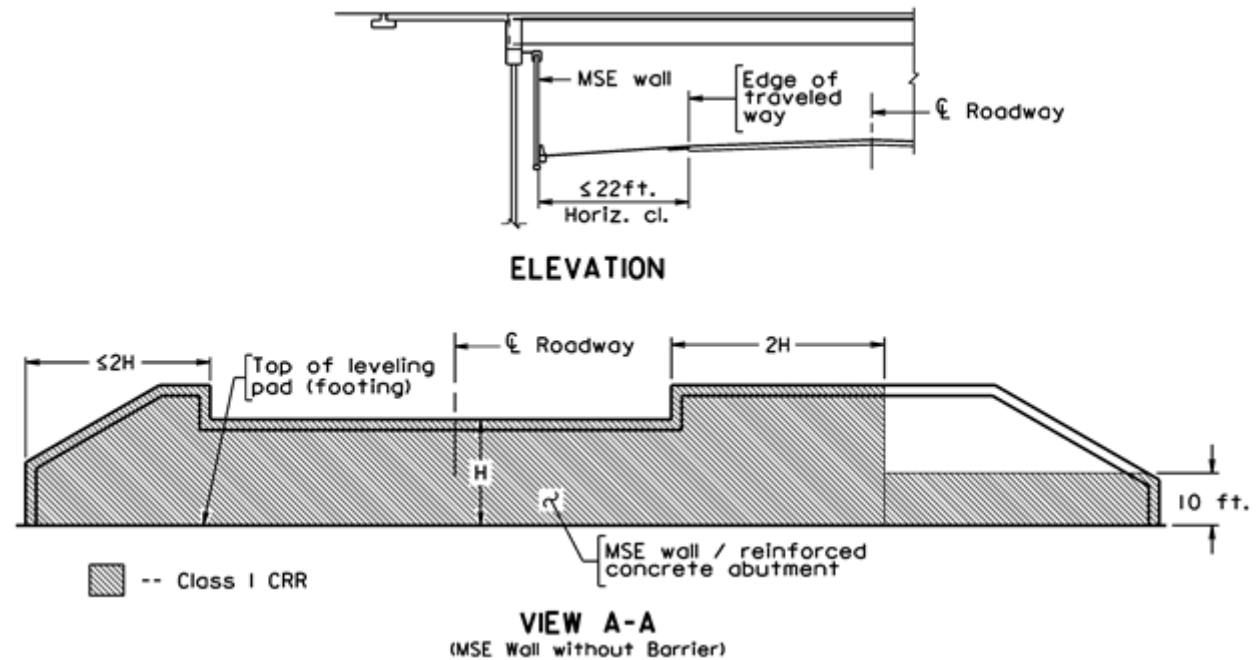
- Design

- Based on 60 Ksi for all 3 Classes of CRR
  - Easy Substitution
- Sizes
  - Availability of bars sizes (#3 through #11) and bar lengths

	CRR Low Carbon/ Chromium	CRR Solid Stainless
Bar Sizes	All	ALL
Bar Lengths	40 feet – all sizes 60 feet all except #3	40 feet – all sizes 60 feet – all sizes

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- Splash Zones
  - MSE walls
  - Depressed highways



# CRR bars

- **Storage**

- Keep free from oil, dirt and mud
- Should not be stored directly on the ground
- Deleterious materials should be removed from the bars before placing concrete
- Surface rust of mill scale for Class I (MMFX-2) bars should not be cause for rejection

- **Cutting Bars**

- Cut by shearing
- Cut with a fluid cooled saw
- Torch cutting is never permitted



# CRR bars

- **Bending Bars**

- Cold bend
- Prescribed min. diameter pin
- No bending or straightening that will damage material
- Heating material to bend is never allowed



- **Welding**

- Welding of CRR bars is not permitted



# Prestress Strands - Piles

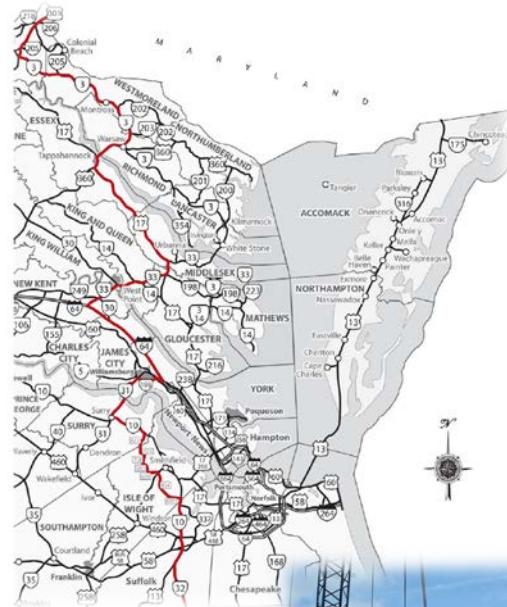
- Comparison of Properties

Strand Properties	ASTM A416	CFRP	Stainless Steel
Tensile Strength (ksi)	270	338	250
Elastic Modulus (ksi)	28,600	22,500	24,500
Elongation at break (%)	3.5	1.7	1.47

CFRP: Carbon Fiber Reinforced Polymer

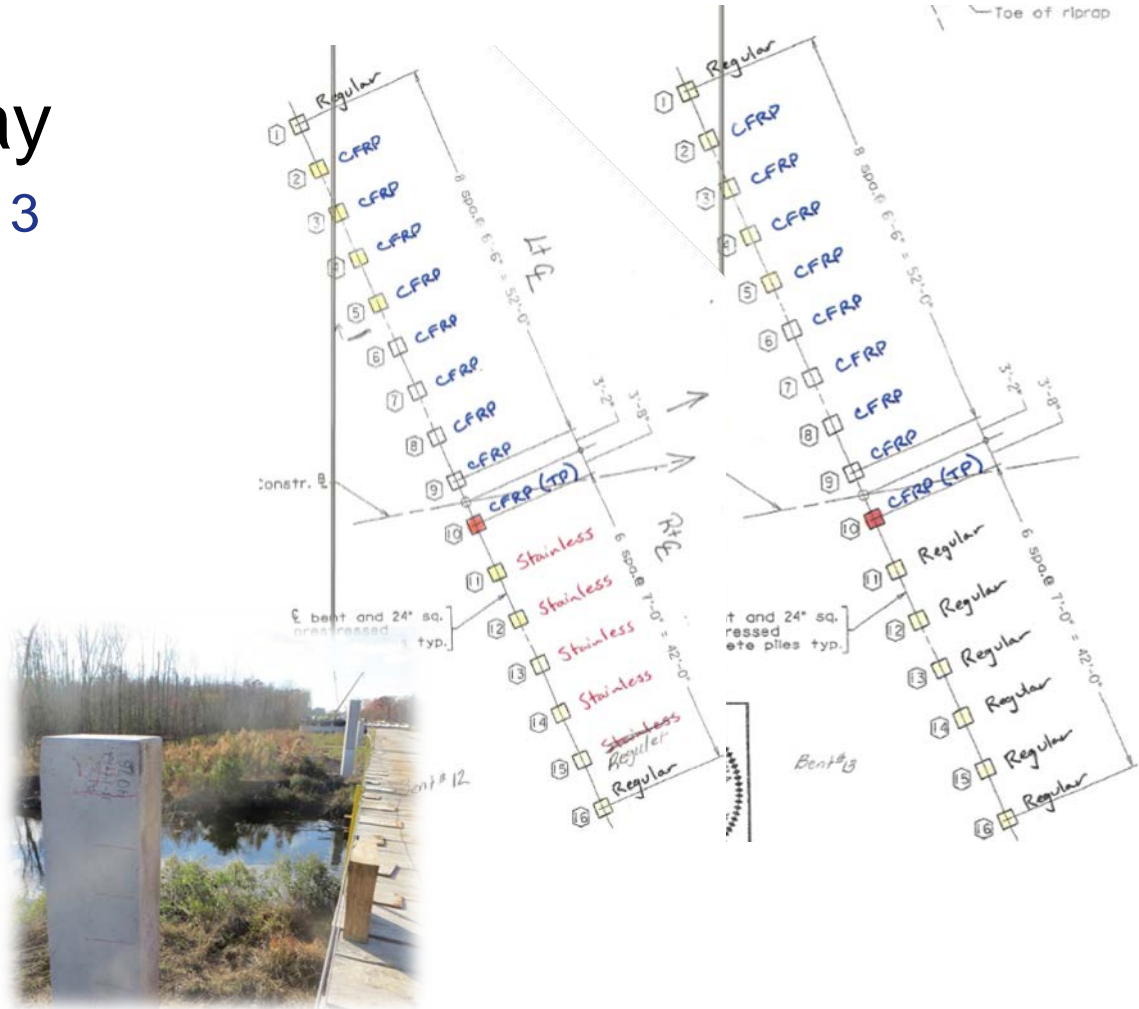
# Prestress Strands - Piles

- Strands in Piles
  - As of Dec, 2016
    - CFRP Standard BPP-3
    - Stainless Steel BPP-2
    - East of the Red line



# Prestress Strands - Piles

- Nimmo Parkway
  - Bent 12 and Bent 13



# CFRP - Strands

- Finding in the public interest
  - FHWA approved
    - Use of Carbon Fiber Composite Cable (CFCC) in piles
  - Based on 100-year service life
  - Use in high salt, high corrosion, costal areas, high salinity and areas where traffic volumes are so high that access for repairs is a constraint.
  - 5 Year trail period for projects in PE phase ,Dec 31, 2021



# Prestress Strands - Beams

- Strands in Beams
  - Route 49 over Aaron's Creek
    - 4 beams per span
    - 45" modified bulb tee girders
    - 82-ft length beam



# Questions?

## Implementation Leads:

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## Resource: AASHTO's R19A Product Page

- <http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx>