

# Various Rebar Types: Pros and Cons

*Structural Performance and Corrosion Resistance of Corrosion-Resistant Rebars for Concrete Bridge Decks*

Chungwook Sim

Bridge Workers, Supervisors & Engineers Conference, Mt. Sterling, OH

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# Bridge Deck Deterioration

- Service life of a bridge deck in cold or coastal area
  - 20-30 years with conventional or epoxy coated rebar
- Deck replacement or entire bridge reconstruction



# Solutions

- High performance concrete
  - lower permeability
  - less shrinkage
- Crack control
  - spacing of reinforcement
- Prevent corrosion of reinforcing steel
  - increase cover
  - use epoxy coated rebar

# Problems with epoxy coated rebar

- Coating damage
  - during fabrication, transportation, construction
- Debonding of coating





# Research Scope

## Corrosion Resistance



## Bond Strength



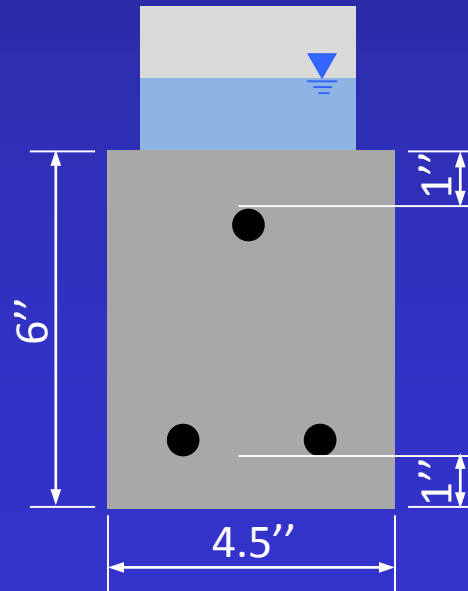
## Cracking Performance



# Corrosion Resistance

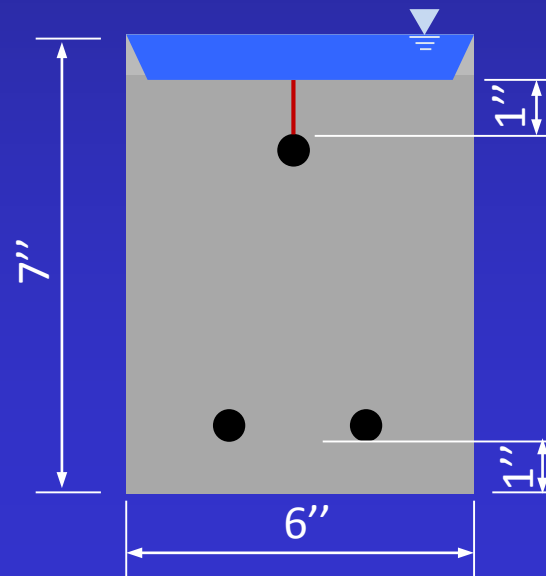
# Macrocell Corrosion Test

- ASTM G109
  - evaluate concrete admixtures
  - uncracked specimen
  - 3% sodium chloride solution



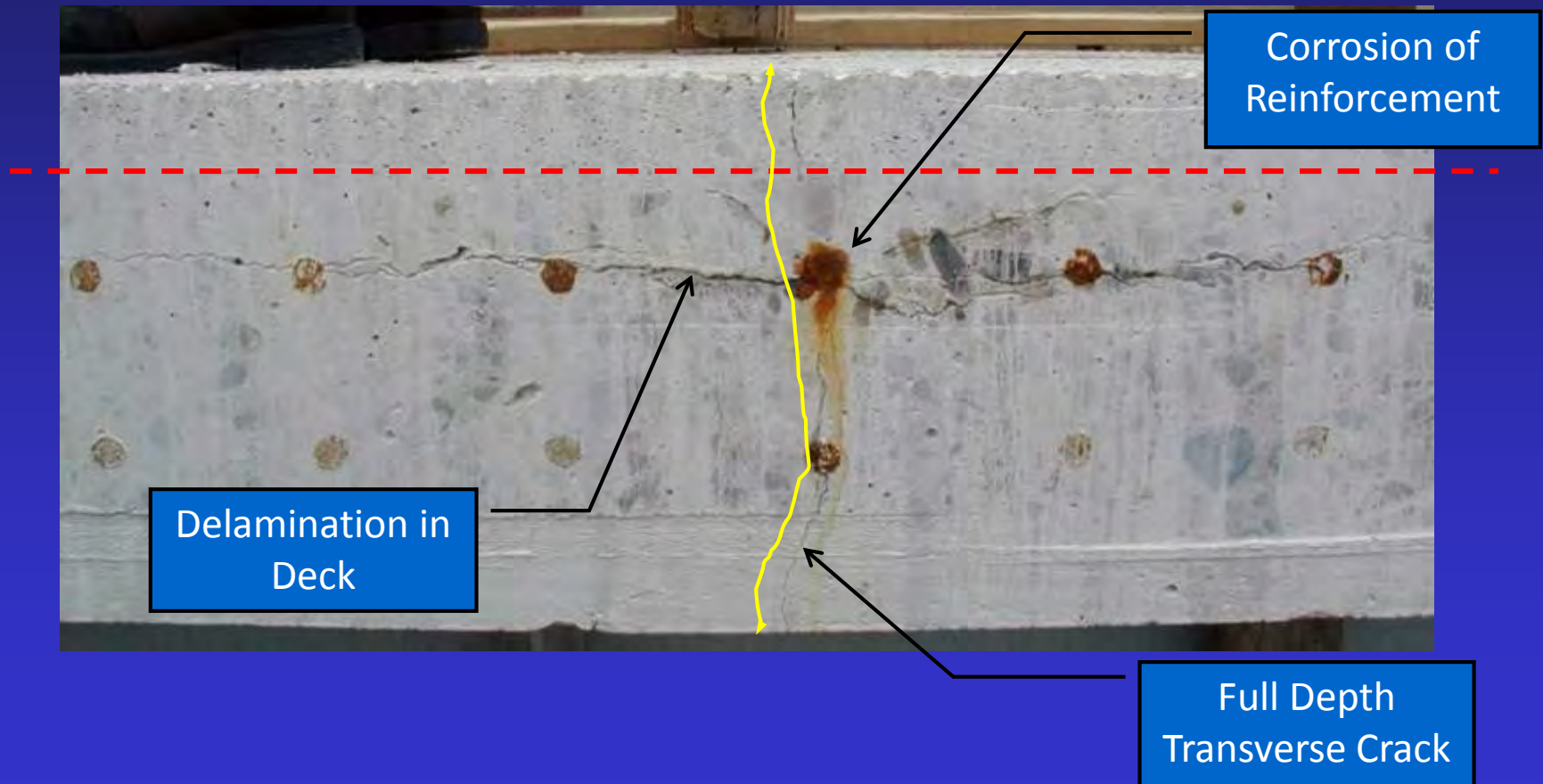
# Macrocell Corrosion Test

- ASTM A955
  - to evaluate stainless steel reinforcement
  - cracked specimen with artificial cracks
  - 15% sodium chloride solution

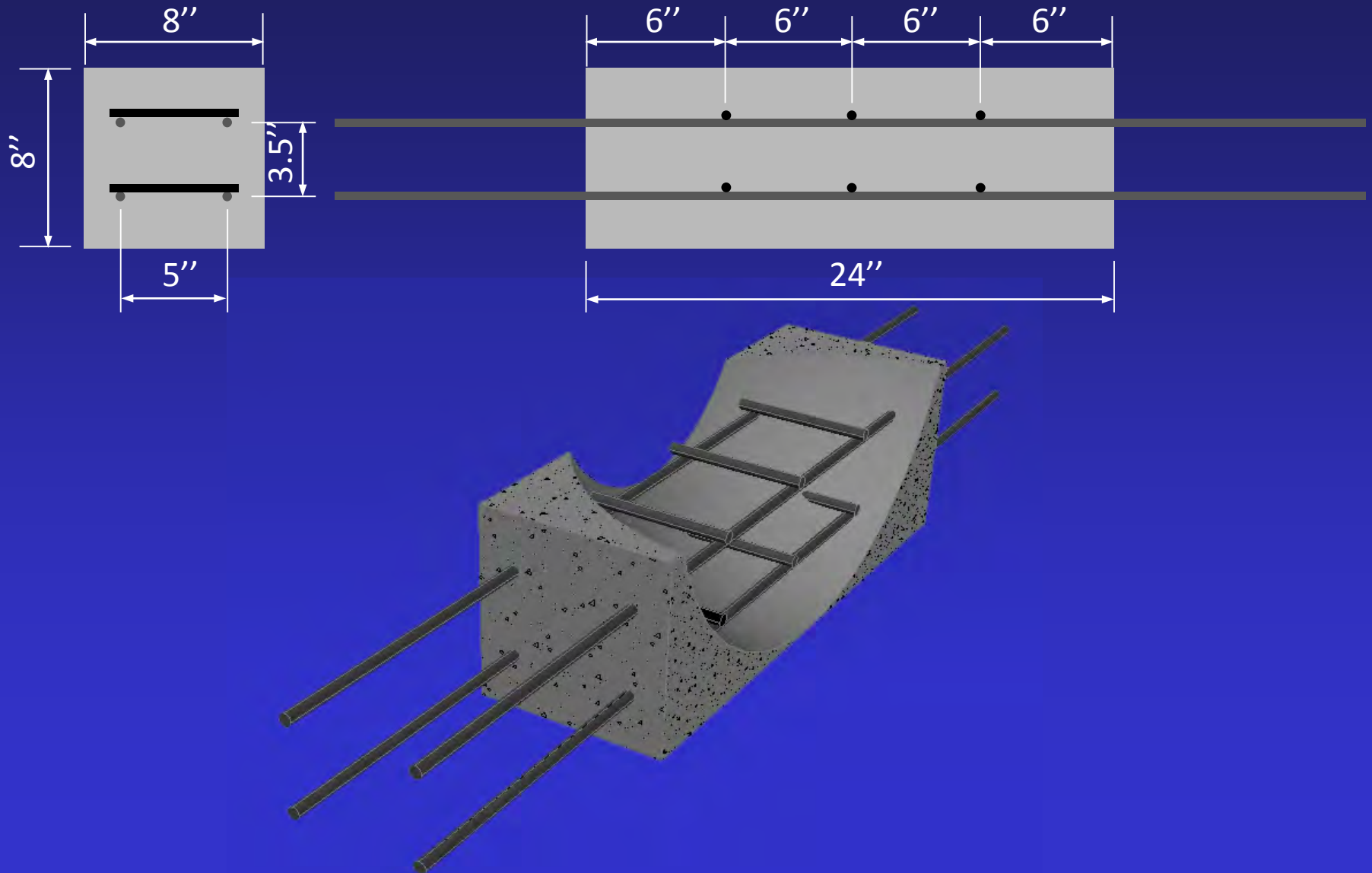




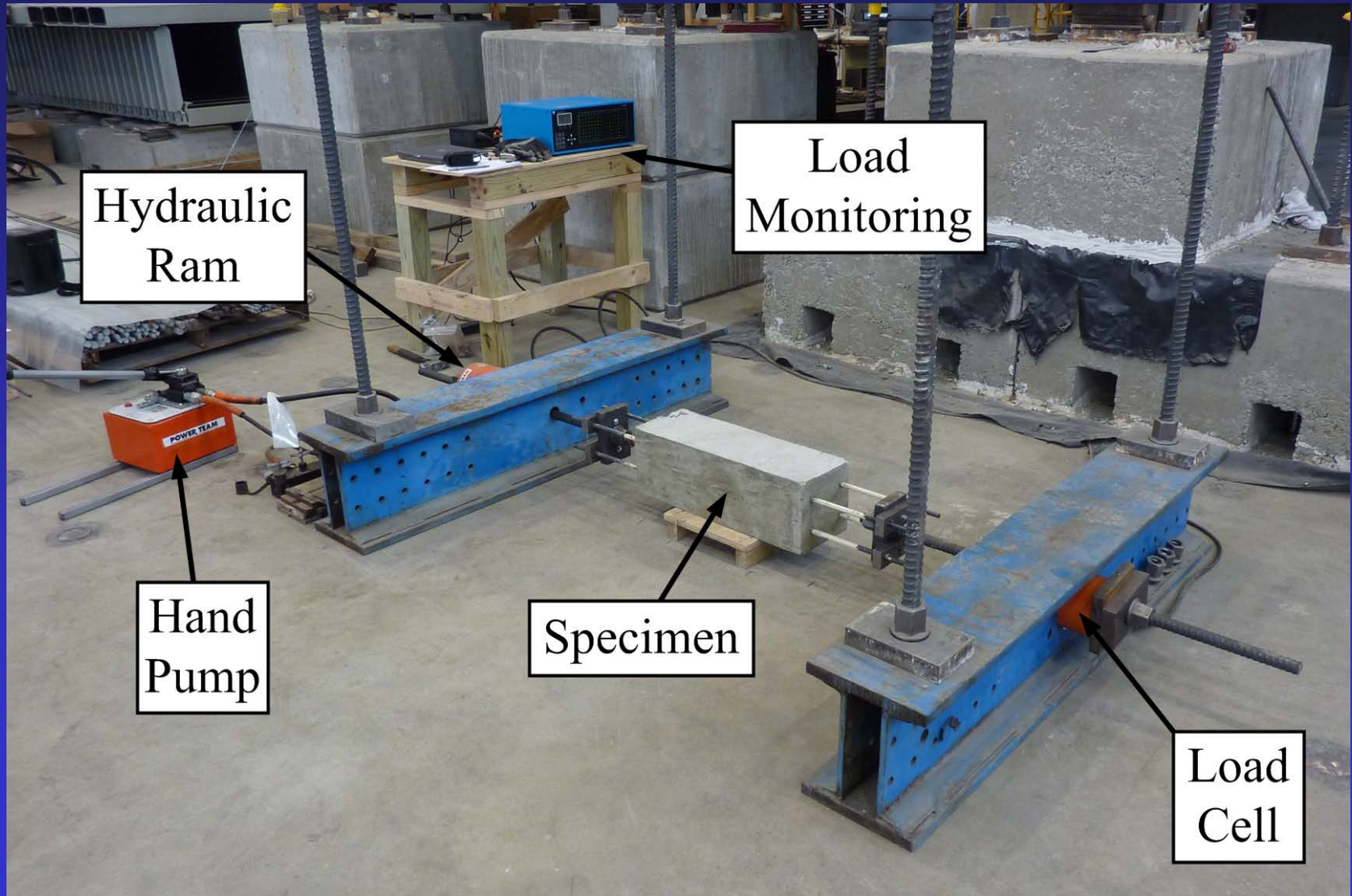
# Bridge Deck Shrinkage Cracks



# Modified Macrocell Specimens

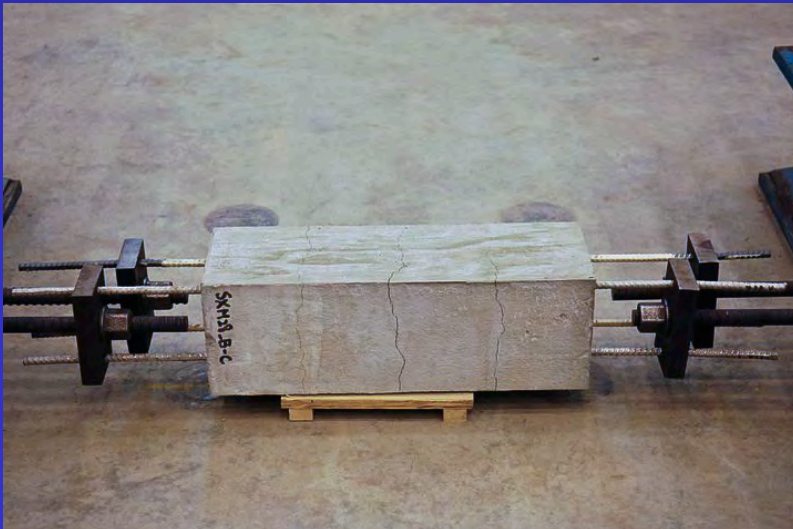
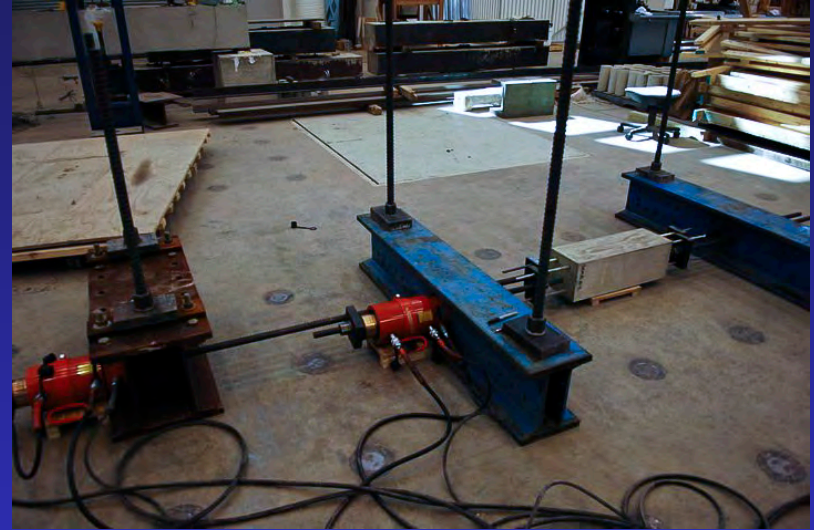


# Cracking Macrocells

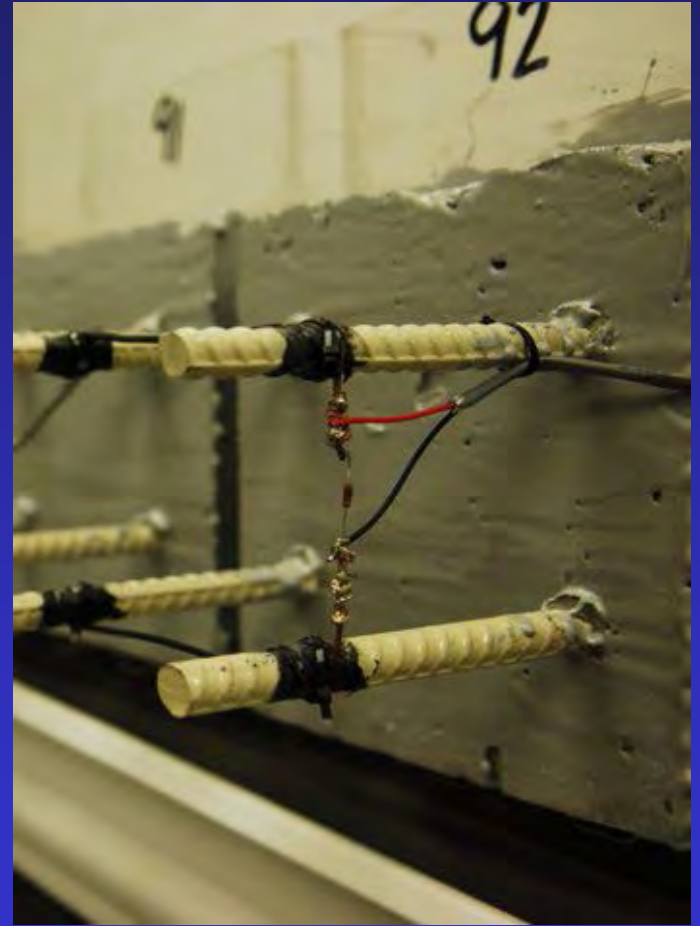




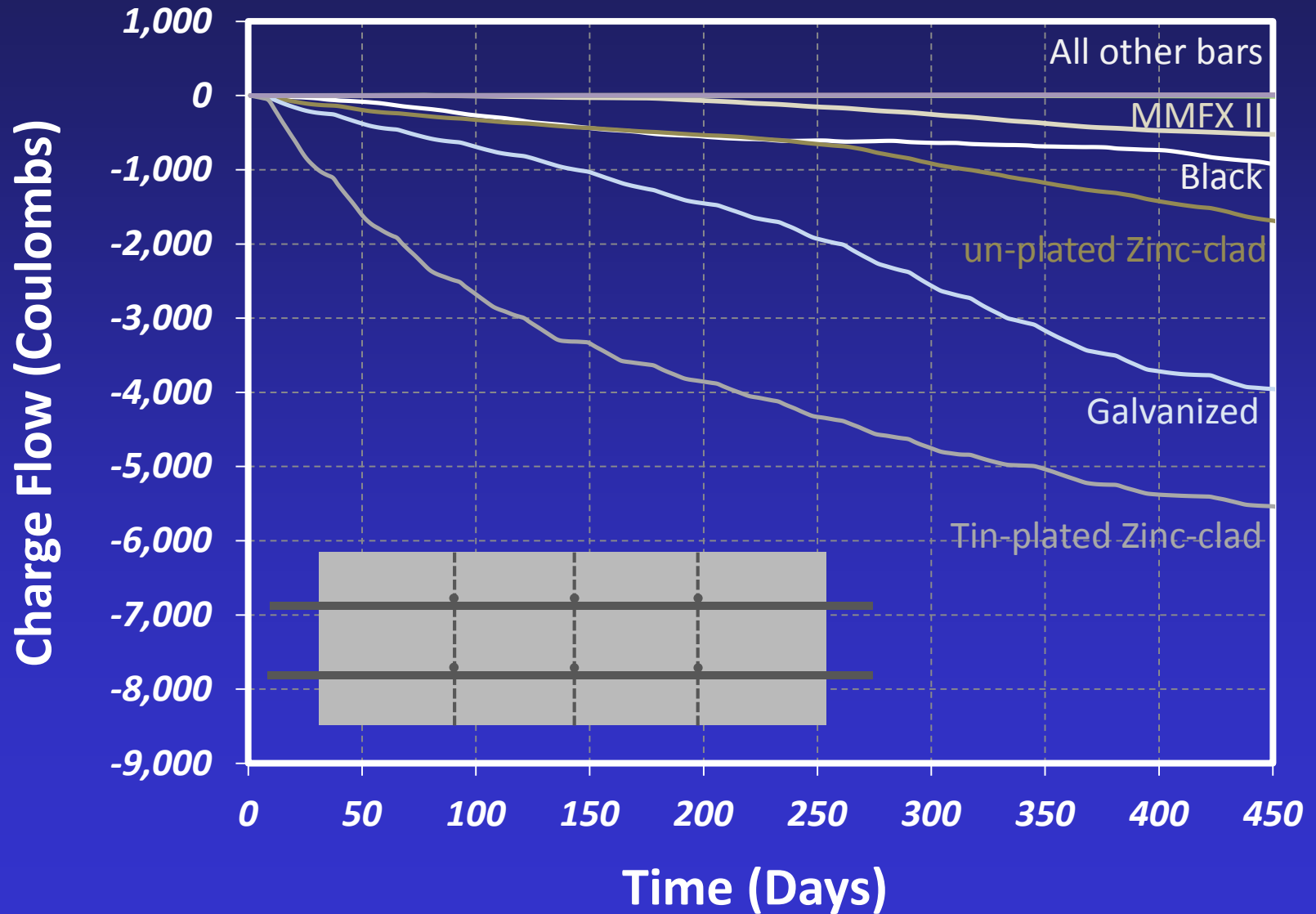
# Cracking macrocells



# Macrocells under corrosion testing



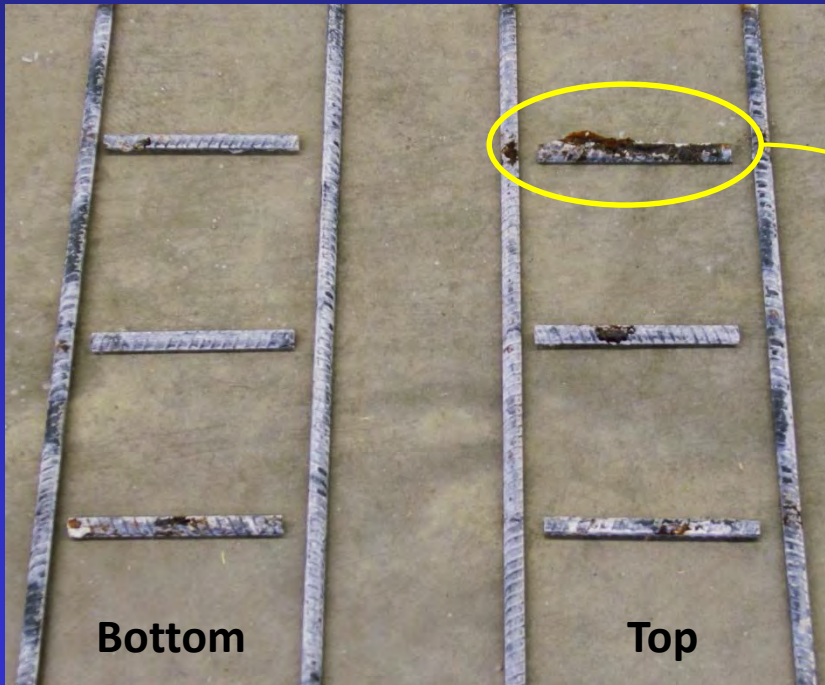
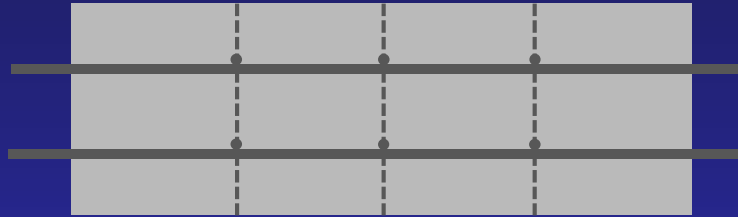
# Identical Bars





# Autopsy Results

Cracked specimens with identical bars



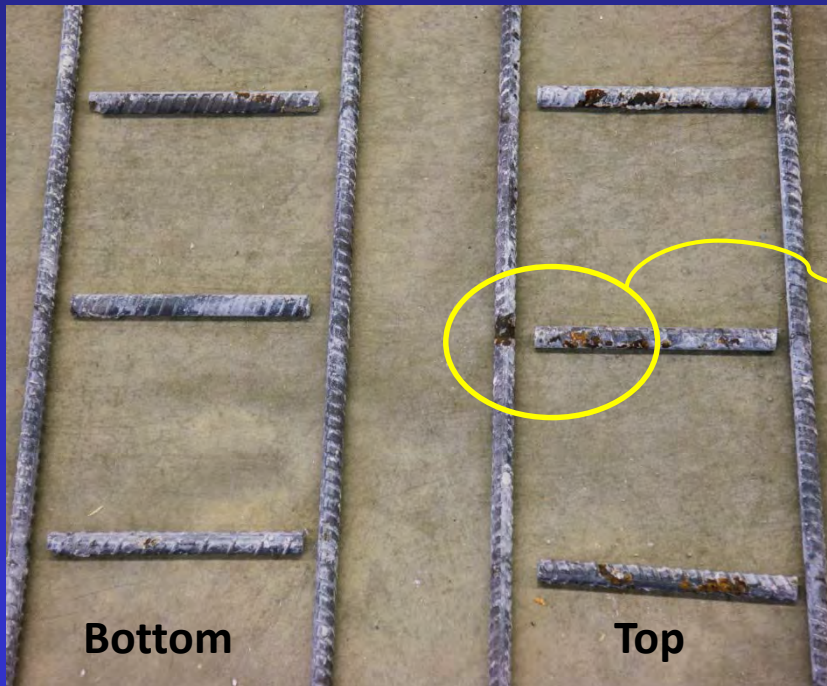
Black



Top Layer

# Autopsy Results

Cracked specimens with identical bars



Bottom

Top

MMFX II

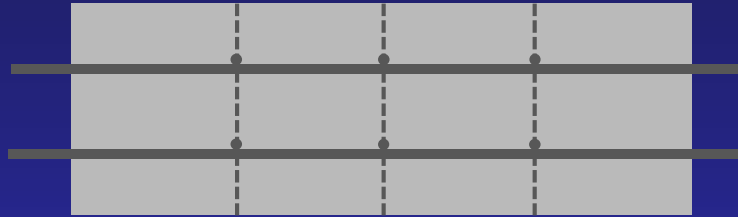


Top Layer



# Autopsy Results

Cracked specimens with identical bars



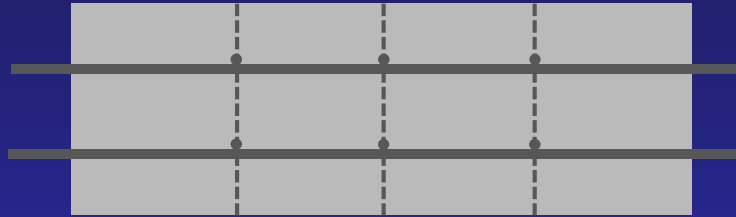
Epoxy coated



Zbar (Dual-coated)

# Autopsy Results

Cracked specimens with identical bars



Zinc-clad



Galvanized

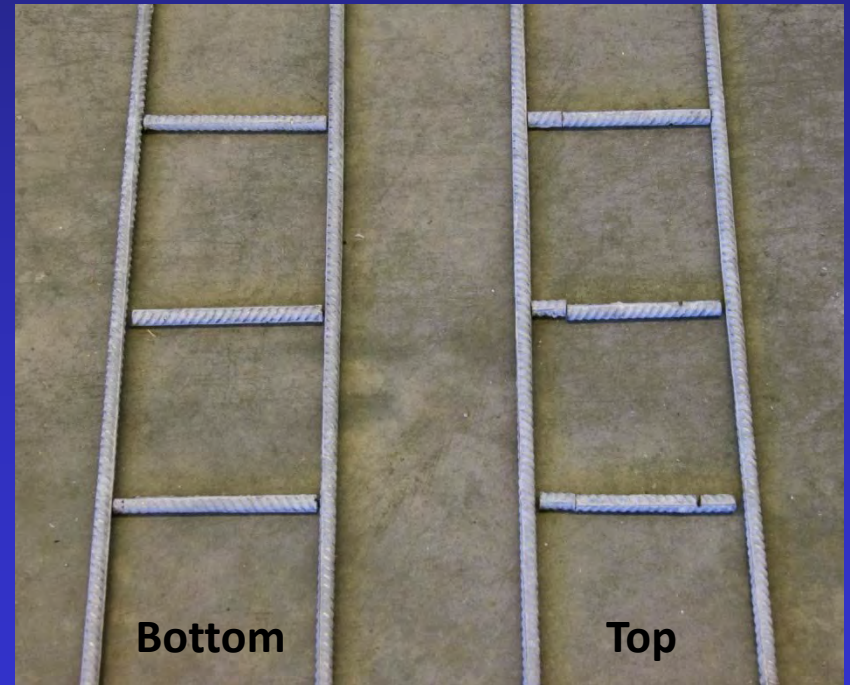


# Autopsy Results

Cracked specimens with identical bars



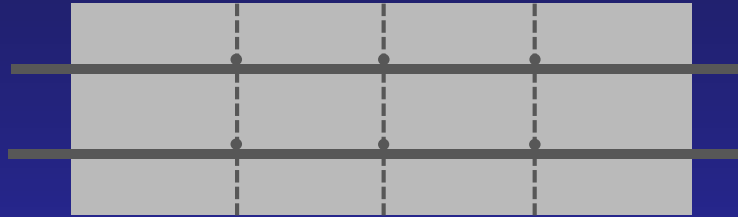
Discoloration and reddish-brown corrosion products



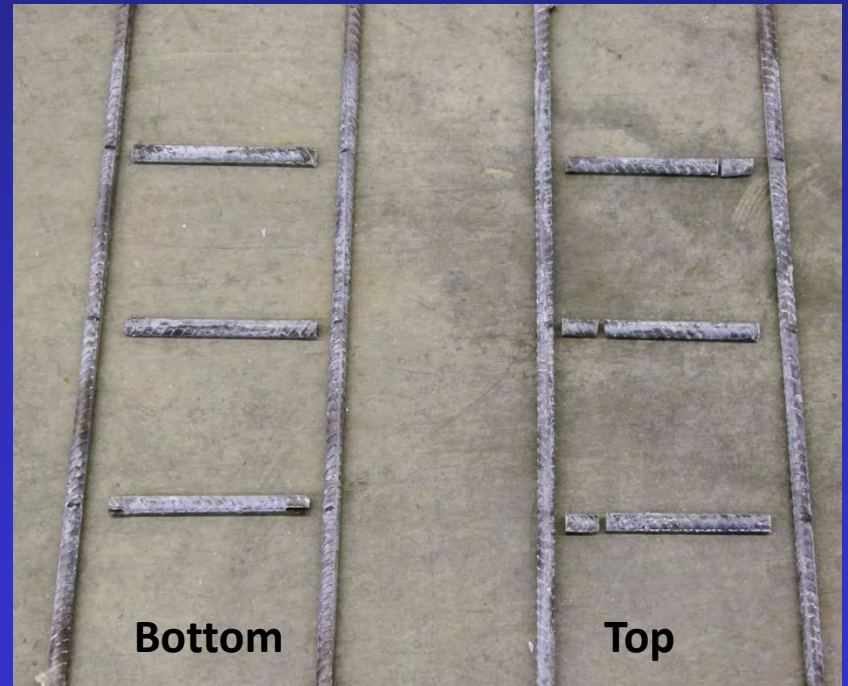
Duplex 2304

# Autopsy Results

Cracked specimens with identical bars



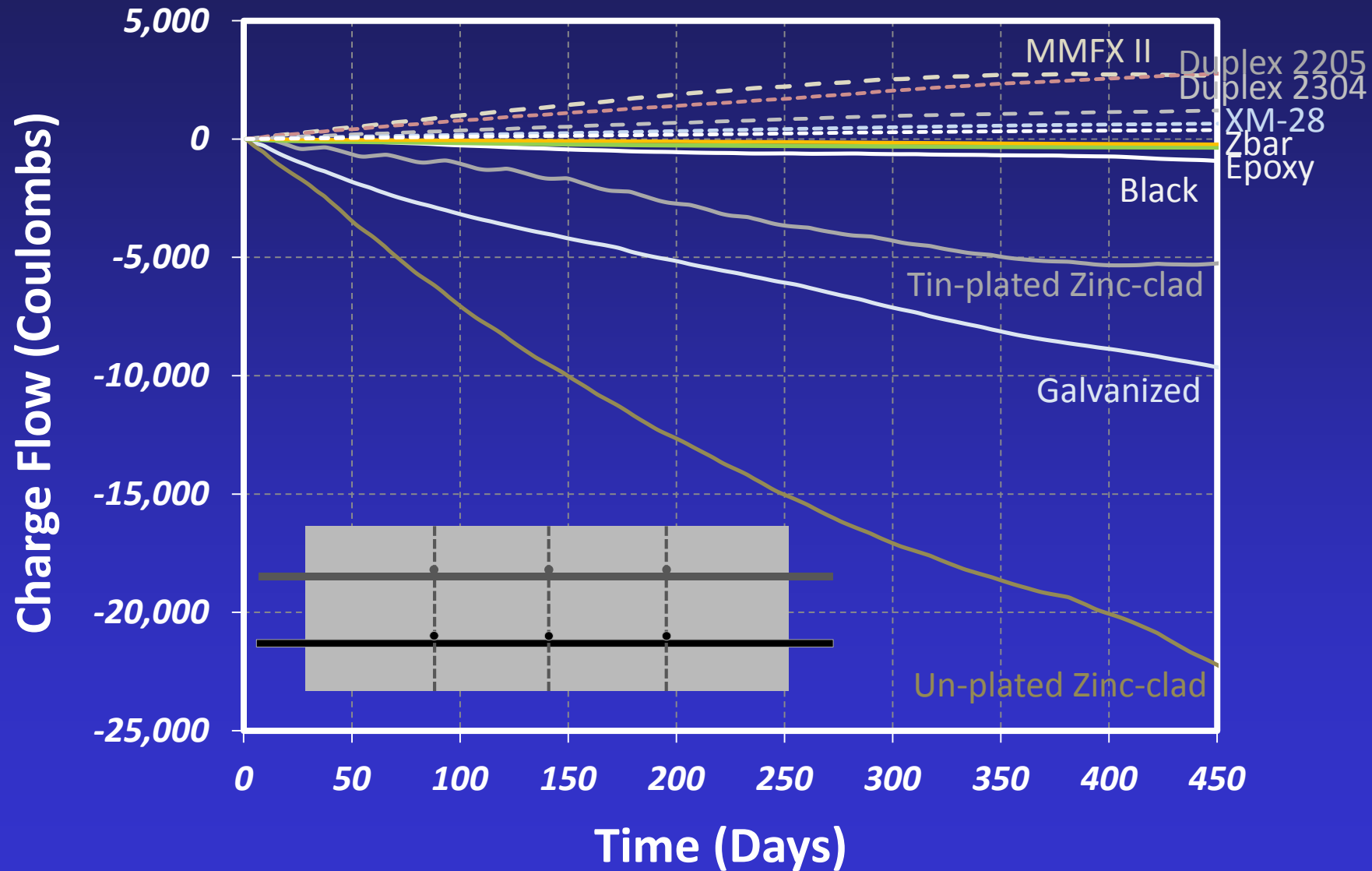
316LN



Duplex 2205

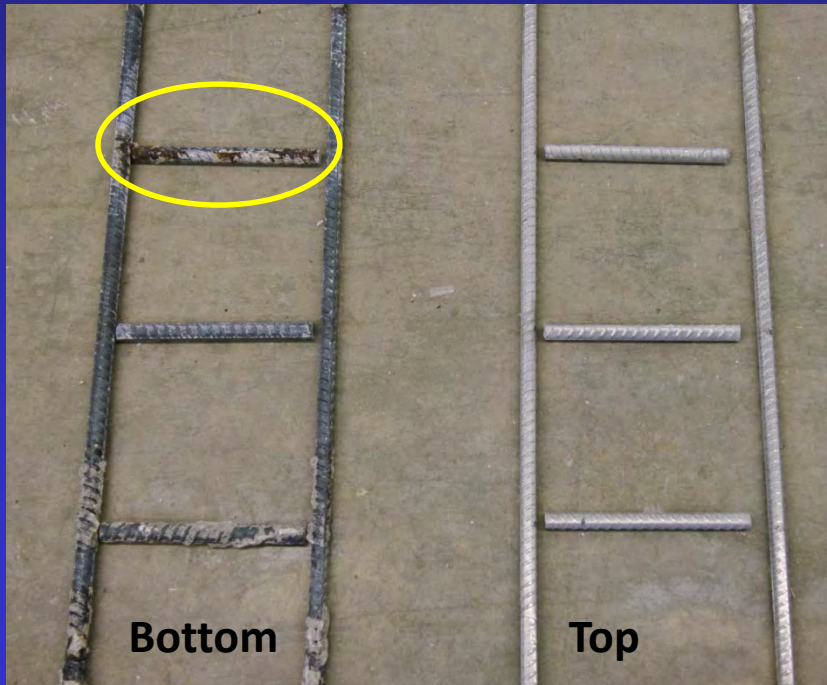
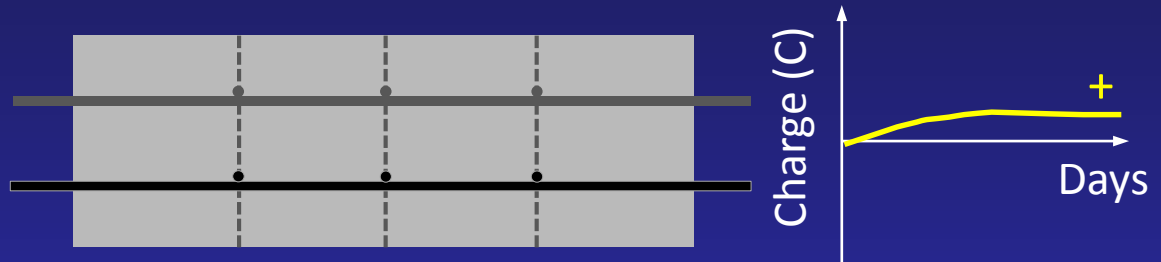


# Dissimilar Bars



# Autopsy Results

Cracked specimens with dissimilar bars



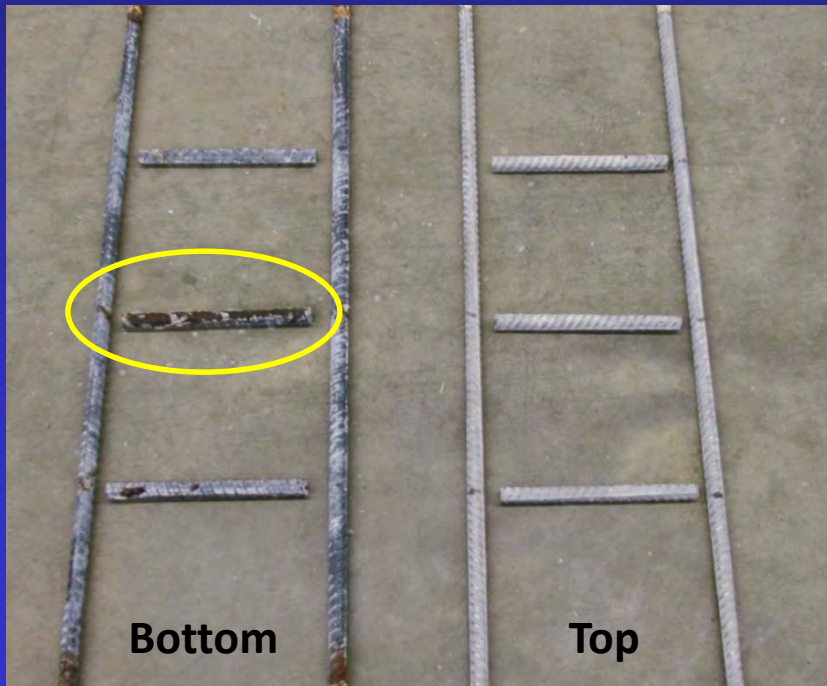
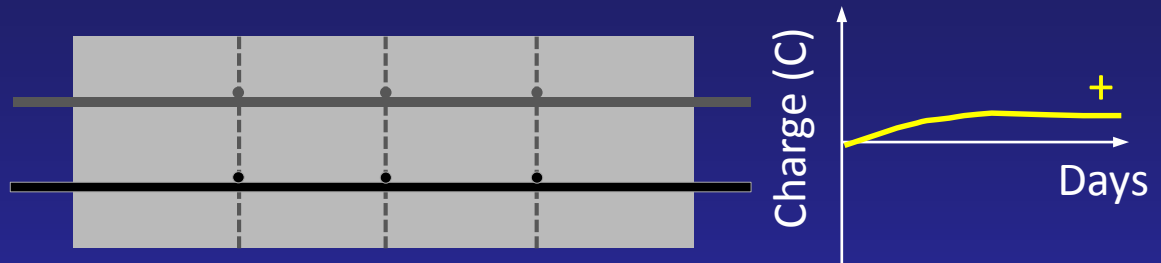
316LN



Bottom Layer

# Autopsy Results

Cracked specimens with dissimilar bars



Duplex 2304

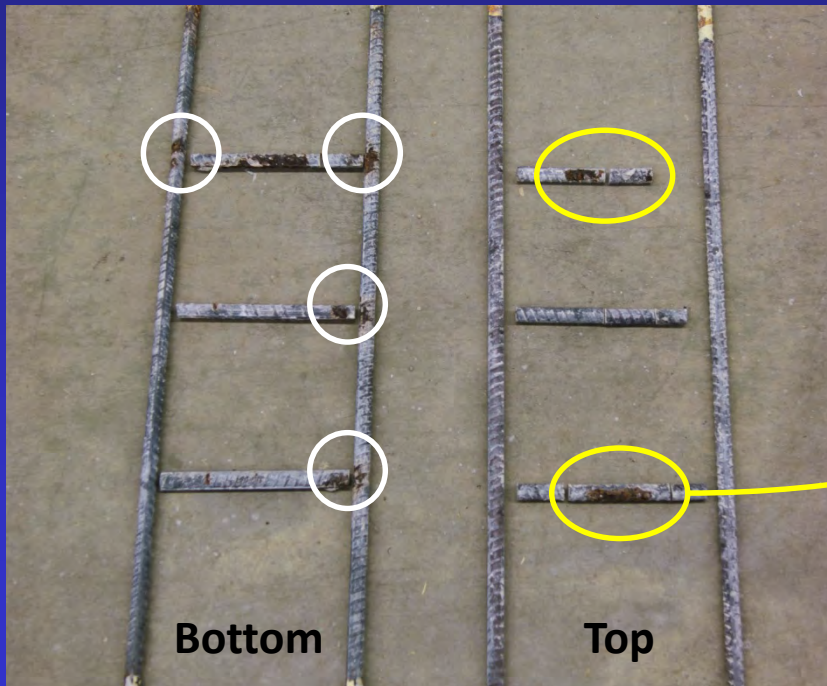
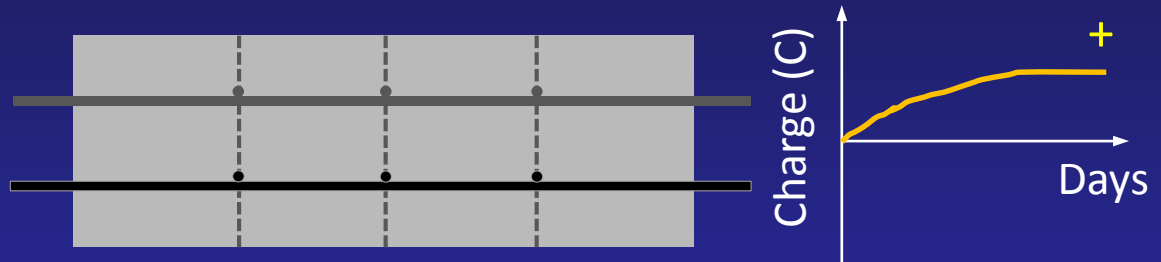


Bottom Layer

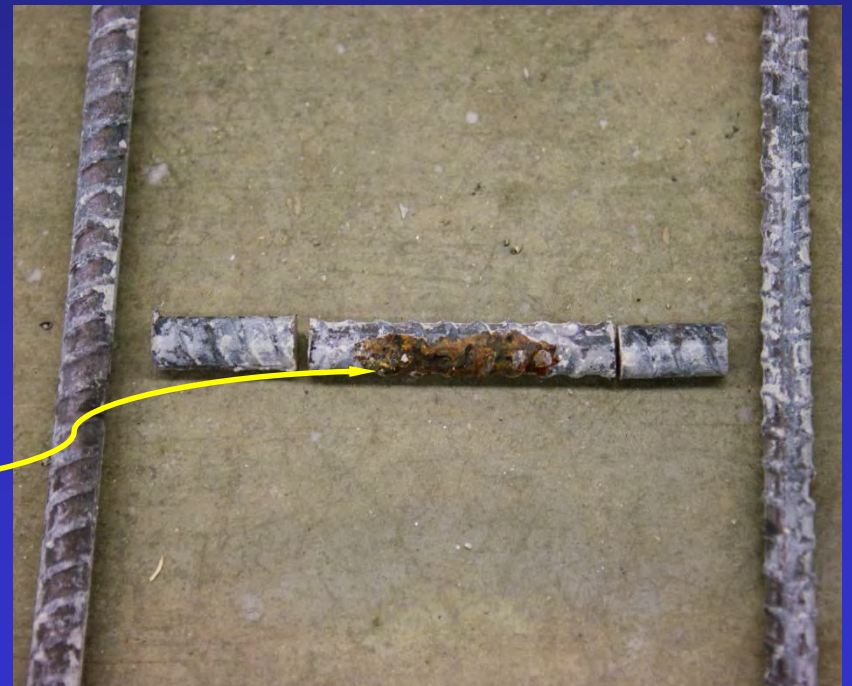


# Autopsy Results

Cracked specimens with dissimilar bars



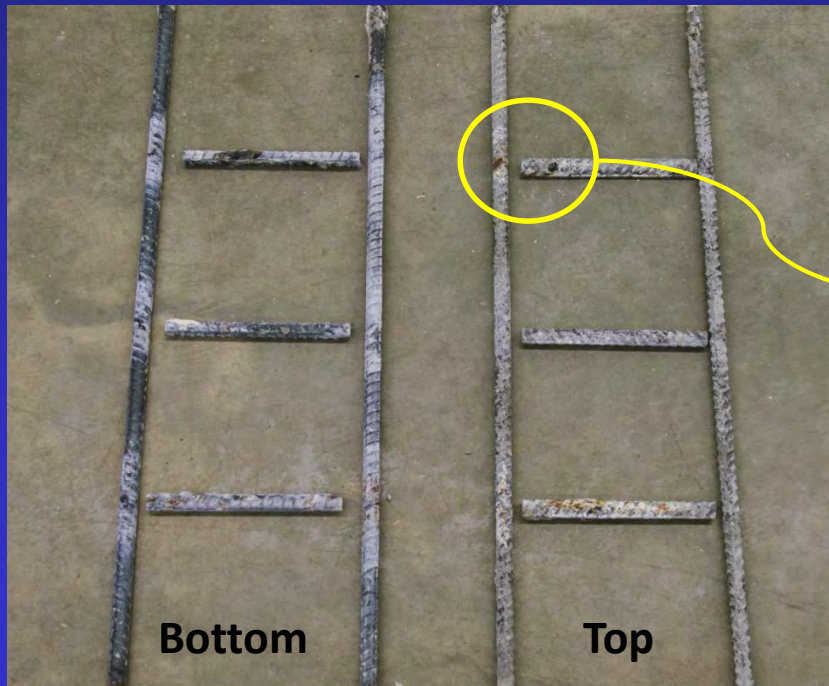
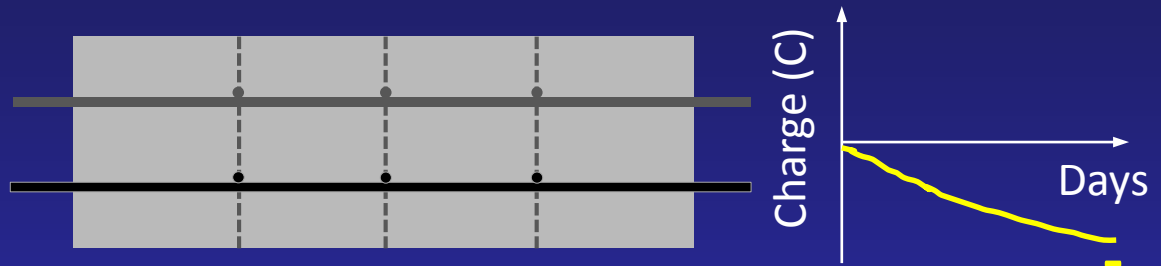
MMFX II



Microcell Corrosion on Top Layer

# Autopsy Results

Cracked specimens with dissimilar bars



Galvanized



White rust corrosion and iron oxide corrosion