Evaluation of Corrosion Resistant Steel Reinforcing in the Deck Slab of a Three-span Prestressed Concrete Girder Bridge

Objective and Scope

- Investigate and evaluate the field performance of new reinforcing steel and compare with conventional reinforcing steel

- Corrosion sensors embedded in deck slab to be monitored
- Data collected occasionally to assess performance in terms of corrosion resistance

MMFX vs. Epoxy coated steel

- Micro-composite Multi-structural Formable Steel (MMFX)
  - Relatively new form of corrosion resistant material
- Epoxy coated steel (ECS)
  - Conventional black steel coated with epoxy

Bridge Description

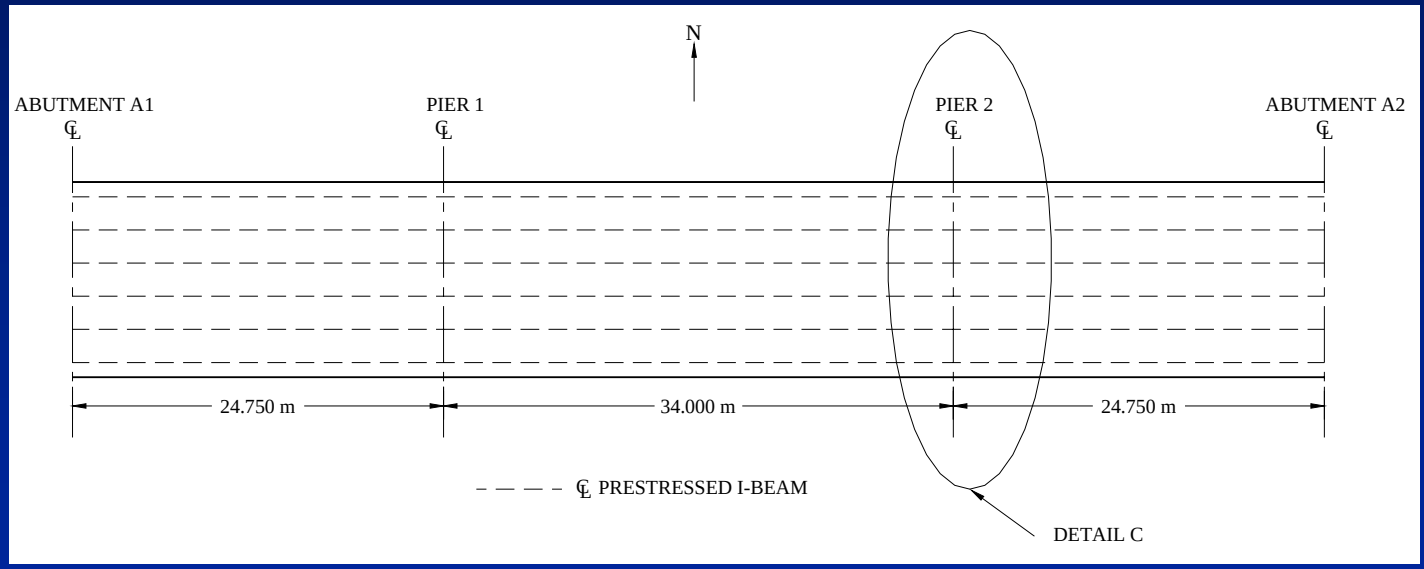
MMFX bridge

Epoxy bridge

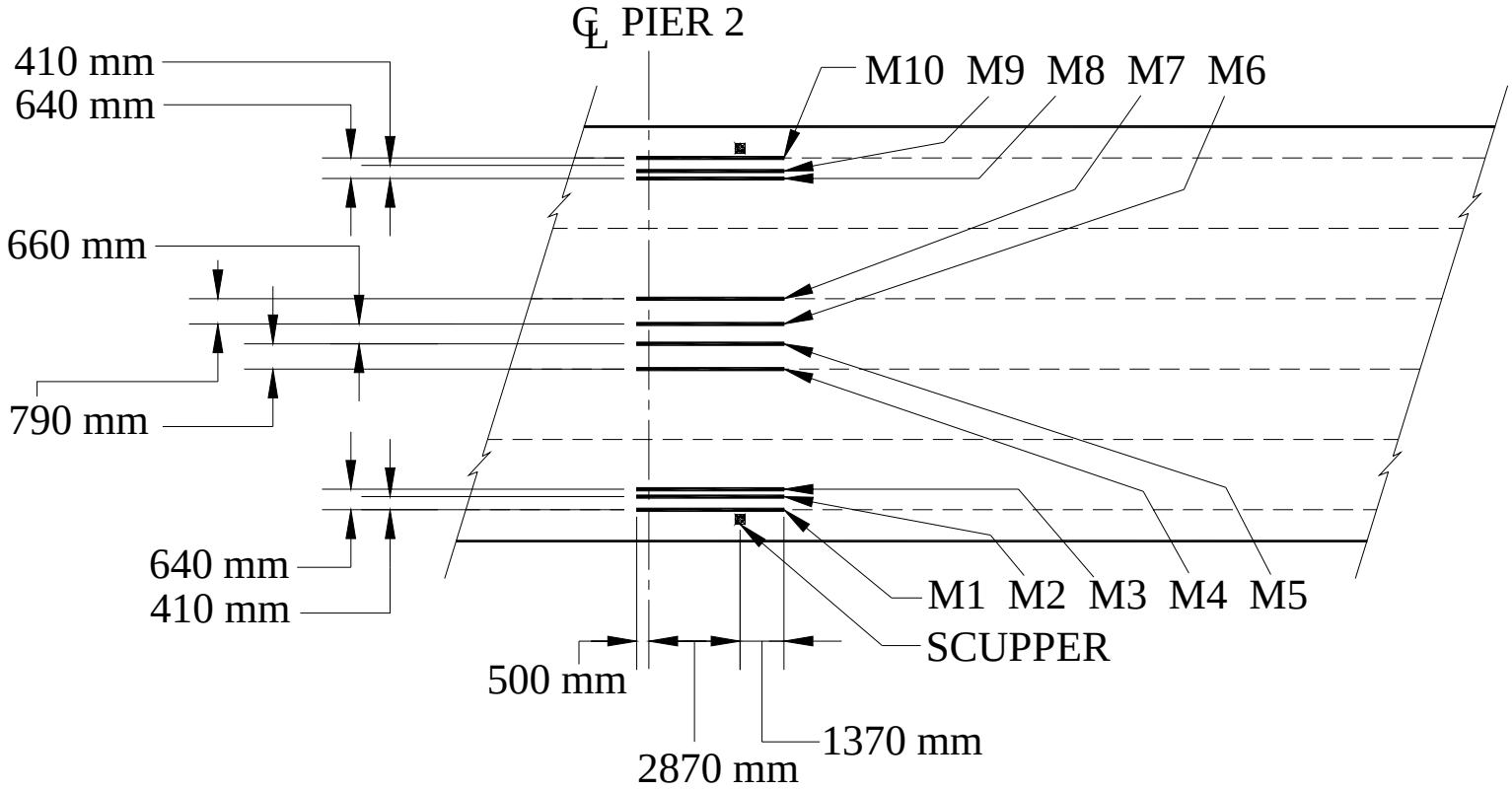
- Twin 83.5m x 12m three-span prestressed concrete girder bridges constructed in May 2002, and open to traffic in Aug 2003
- Located in Grundy County, IA carrying relocated Highway U.S. 20
- Each bridge deck constructed with different types of reinforcing steel
  - East bound : MMFX steel (MMFX bridge)
  - West bound: Epoxy coated steel (Epoxy Bridge)

Instrumentation

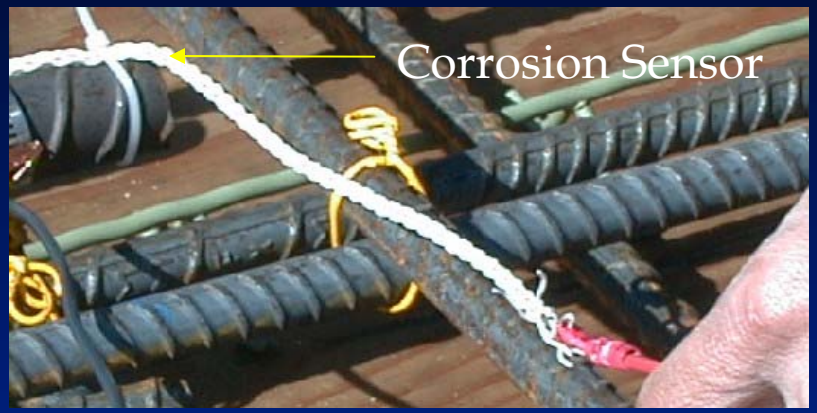
- Sensors on Ten bars in each bridge deck
- Negative bending moment region near the eastern drainage points



Instrumentation (Detail C – MMFX Bridge)



Instrumentation



- Lead wires run out of deck to measure voltage and electric current

Completed installation

Monitoring Concept

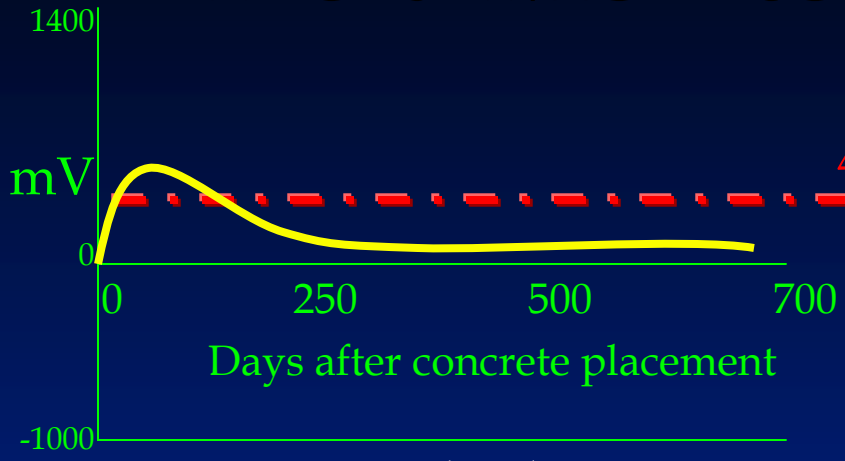
- Increase in electric potential and internal voltage with presence of active corrosion
- DC voltage and DC current measured with a Voltmeter

Voltmeter

Monitoring Concept

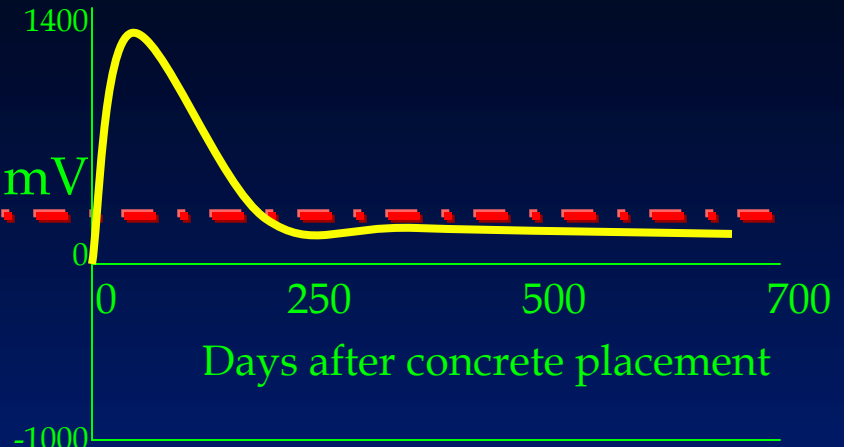
- Output dependent on conditions of concrete after placement
- Normal to expect high voltage levels with fresh and uncured concrete (could be over 1000 mV)
- Initial “spike” subsides back to within the “normal” range of less than 400 mV
- Corrosion indication
  - Electric Current above 0.100 mA (1000 μA)

Field Monitoring

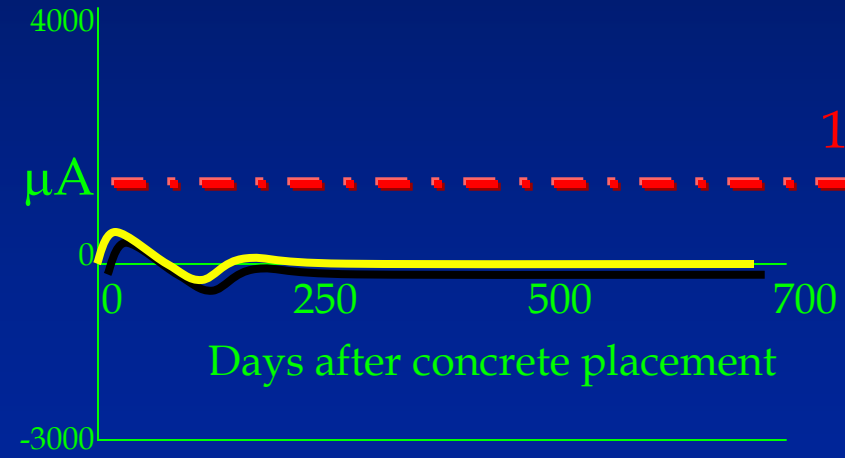


MMFX bridge

400 mV

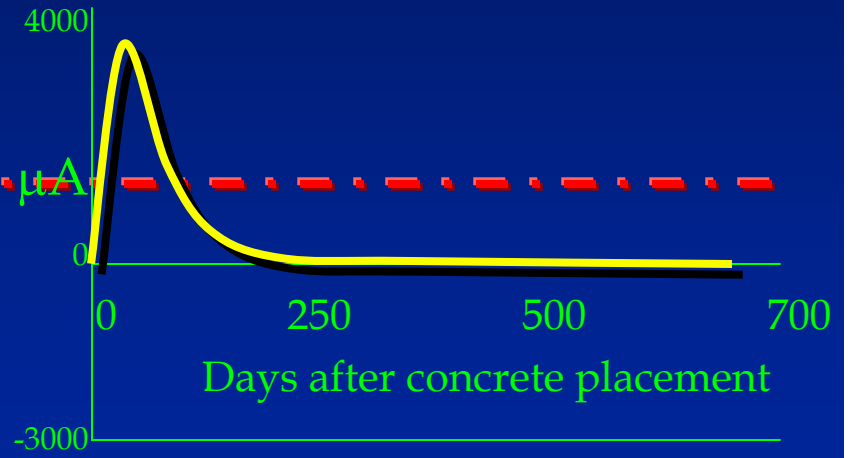


Epoxy bridge



MMFX bridge

1000 μA



Epoxy bridge

Overall to date

- In general, Readings on MMFX bridge lower than Epoxy bridge
- No significant active corrosion
  - Electric Current reading close to zero
- On-going investigation
  - More Data to be collected

Acknowledgement

- Projects initiated by
  - Iowa Department of Transportation (Iowa DOT)
- Sponsored by
  - Federal Highway Administration (FHWA) through the Innovative Bridge Research and Construction (IBRC) program

Questions?