Preservation Strategies & Implementation at NDDOT

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Bridge Preservation

AASHTO defines **Bridge Preservation [as] "actions** or **strategies** that **prevent, delay** or **reduce deterioration** of **bridges** or **bridge elements, restore the function of existing bridges, keep bridges in good condition and extend their life."**

Source: AASHTO Board of Directors, Policy Resolution PR-3-11, October 17, 2011.

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Bridge Preservation . . .

- Design
- Construction
- Cyclical Preventative Maintenance
- Condition-Based Preventative Maintenance

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Design – Integral Abutments

- Joints (or no joints!)
  - Began using in 1964-1965
- Current Standards – Preferred
  - Bridge Length
    - Less than 400’ with 0° Skew
    - 400’ x cos(angle) of Skew
    - Skew must be less than 30°
  - Minimum Reinforcement Requirements
    - #5 Reinforcement spaced at 1’ each direction or more if required by analysis
  - Tied to Approach Slabs

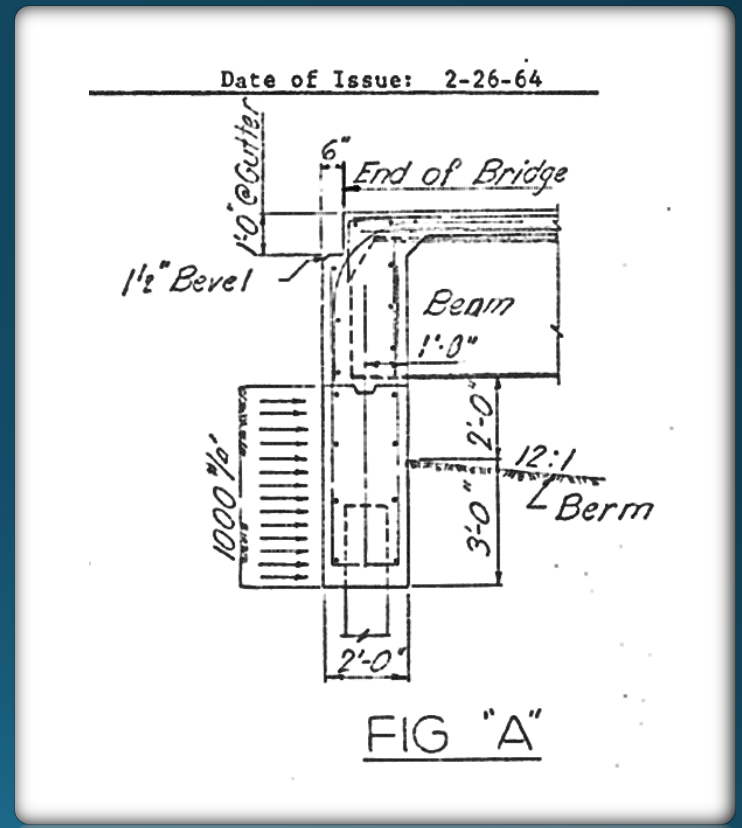

FIG "A"

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Design - Integral Abutment Design Constraints

Maximum height	12'-0"
Minimum thickness	2'-0" (beams < 62" deep)
Minimum thickness	2'-6" (beams > 62" deep)
Minimum embedment in embankment	3'-0" (includes depth of riprap)
Maximum embedment in embankment	5'-0" (includes depth of riprap)
Minimum freeboard	2'-0"
Minimum low beam bottom to abutment bottom	5'-0"
Maximum low beam bottom to abutment bottom	5'-6"

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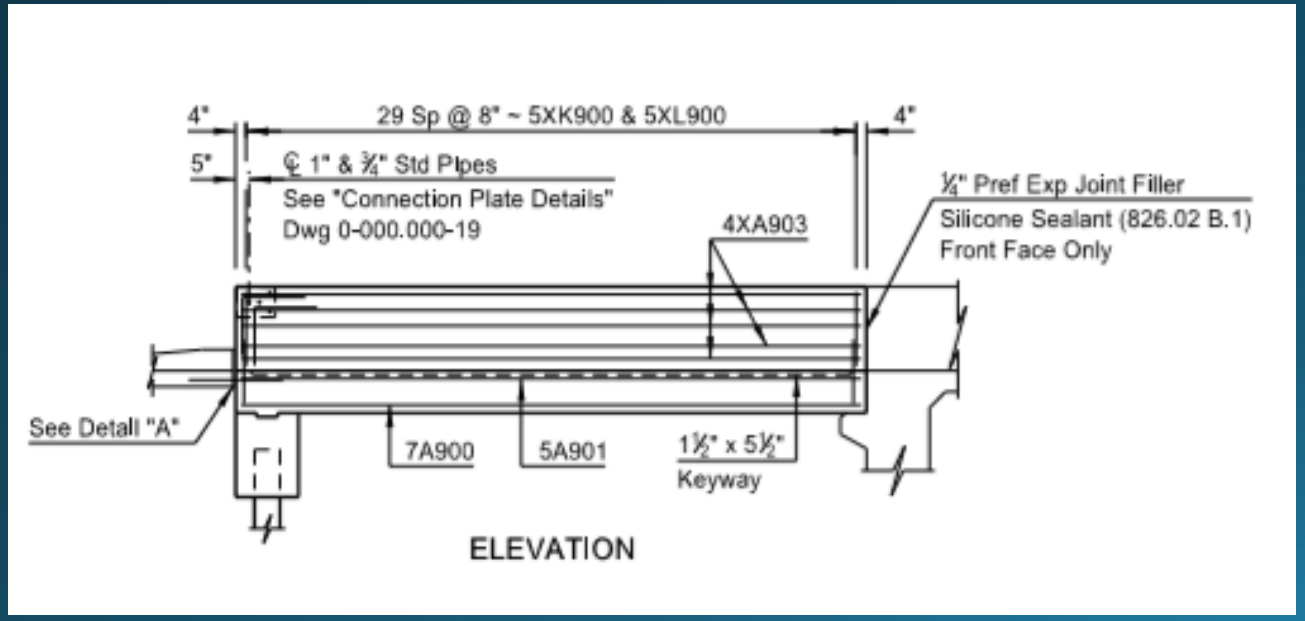
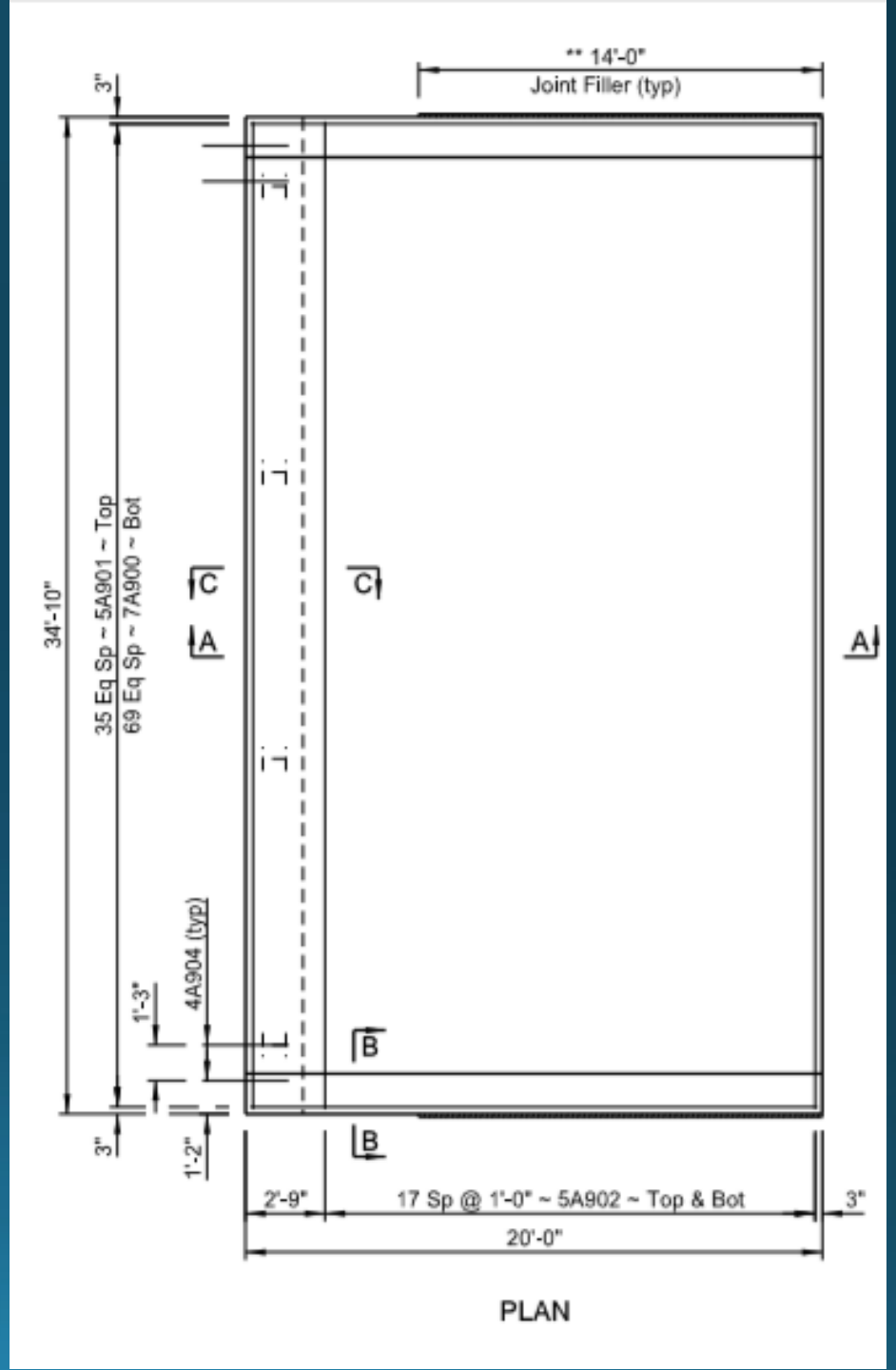
Design – Approach Slabs

- Design on Pile
  - Embankments >5′
- Tie to Bridge
  - 3′ embedment into Deck





Design – Deck Reinforcement

- Epoxy Coated Reinforcement/Rebar

Black Bar

Uncoated rebar both top and bottom mats for bridge decks.

Epoxy-Coated Rebar Top Mat Only

Epoxy coated rebar in top mat and uncoated rebar in bottom mat for bridge decks.

Epoxy-Coated Rebar Both Mats

Epoxy-coated rebars in both top and bottom mats for bridge decks.

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Design – Deck Reinforcement

- Cover
  - Minimum 2 ½" top of deck

Cover to epoxy-coated steel may be as shown for interior exposure in Table 5.10.1-1.

Table 5.10.1-1—Cover for Unprotected Main Reinforcing Steel (in.)

Situation	Cover (in.)
Direct exposure to salt water	4.0
Cast against earth	3.0
Coastal	3.0
Exposure to deicing salts	2.5
Deck surfaces subject to tire stud or chain wear	2.5
Exterior other than above	2.0
Interior other than above	
• Up to No. 11 bar	1.5
• No. 14 and No. 18 bars	2.0

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Design - Other

- Weathering Steel
  - Favorable Environment
    - Relatively low humidity / rainfall
- Seal Joint between Deck and Barrier
  - Keep water and deicing salts on deck

Construction – Concrete Curing

- Wet Cure Requirements
  - Apply within 15 minutes of final paving pass
  - Burlap – 2 Layers
    - Do not allow curing compound
    - Do not allow other types of curing blankets
  - 7 days minimum w/out fly ash
  - 10 days minimum w/fly ash

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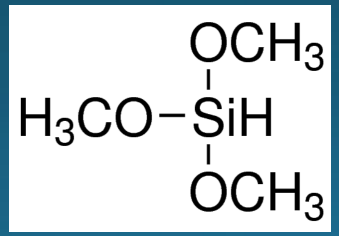
Construction – Apply Water Repellent Treatment

- Apply minimum of 21 days after placement of concrete
- Apply to deck, barriers, medians, approach slabs, top and front of curbs
- Silane Water Repellent –
  - Alkyl-Alkoxysilane
  - 100% solids
  - Solvent based



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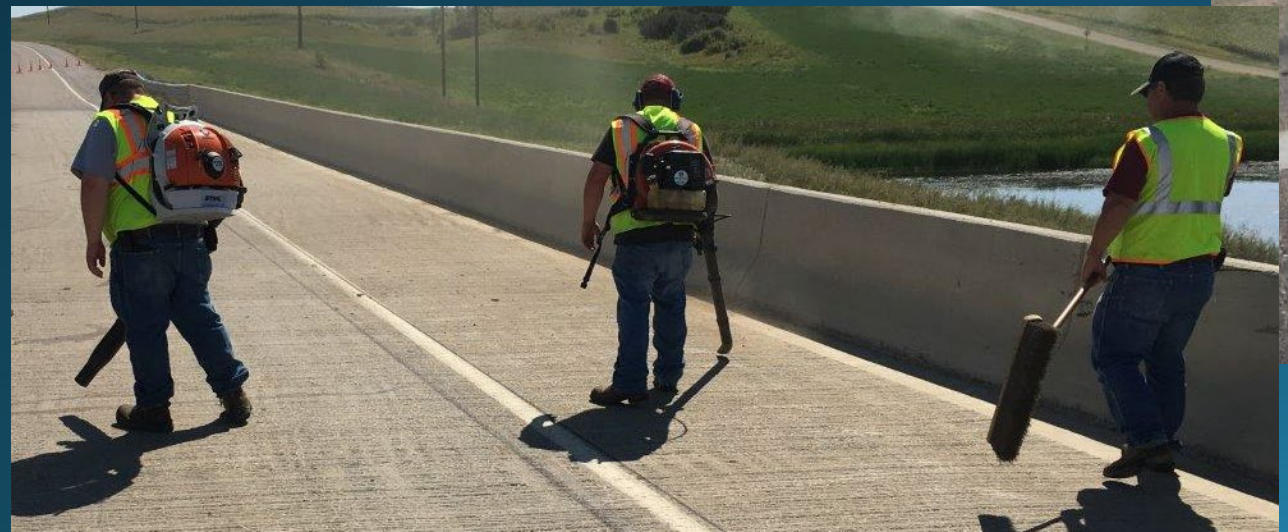
Maintenance

- NDDOT does not have dedicated Bridge Maintenance crews
- District maintenance crews are tasked with all maintenance operations
  - Snow Plowing
  - Road Maintenance
  - Roadside Operations
  - Bridge Maintenance
    - Cyclical
    - Condition Based

Maintenance – Deck Sealing

- Silane Water Repellant
  - Strategy - Reapply every 6 years
  - 2016 – first District reapplication
  - Sized tank based on bridges
  - Sized tank, pump, nozzles
  - Built system



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Maintenance – Deck Sealing

- Silane Water Repellent
  - Strategy - Reapply every 6 years
  - 2017 – More Districts began applying
  - Advances in system
    - Larger bridges
    - More bridges
    - Higher ADT

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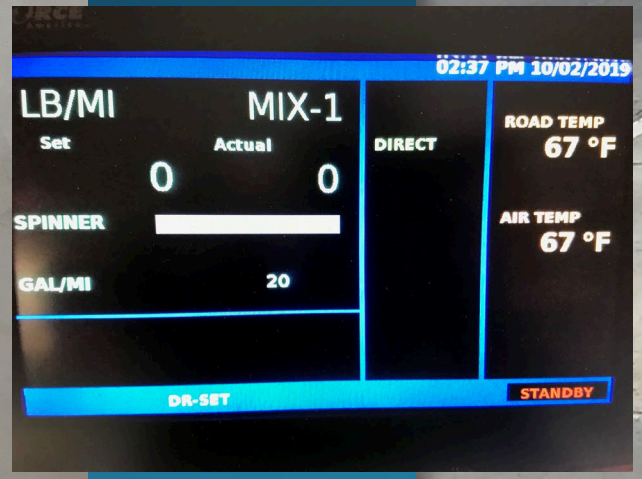
Maintenance – Deck Sealing

- Silane Water Repellent
  - 2019 – Nearly all Districts now apply
  - District received Award for automating and decreasing time required for application

Spraying center lane with **right or left** with spray bar with 4 nozzles on the side bar.

12 nozzles	105 gallons per lane mile
11 nozzles	97.5 gallons per lane mile
10 nozzles	90 gallons per lane mile
9 nozzles	82.5 gallons per lane mile
8 nozzles	75 gallons per lane mile
7 nozzles	67.5 gallons per lane mile
6 nozzles	60 gallons per lane mile
5 nozzles	52.5 gallons per lane mile
4 nozzles	45 gallons per lane mile



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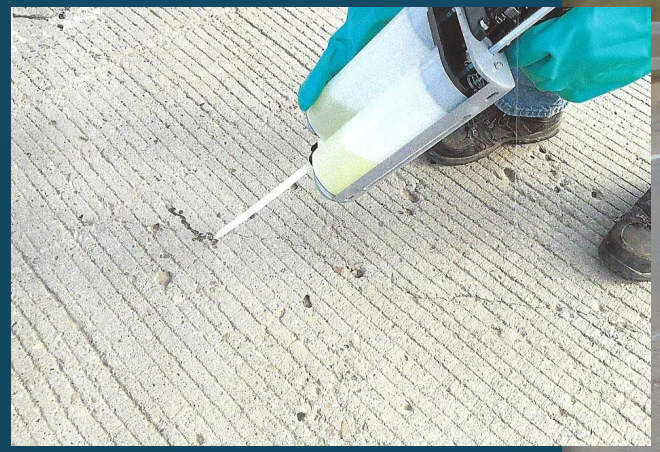
Maintenance – Deck Sealing

- Crack Sealing
  - Strategy – Repeat every 3 years
  - Use 2-part epoxy
  - Considering purchasing larger applicators



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Maintenance – Joints

- Strategy
  - Use Integral Abutments where possible
  - Maintain Joints (Repair/Replace)
- Joint Replacement Project – Tioga, ND

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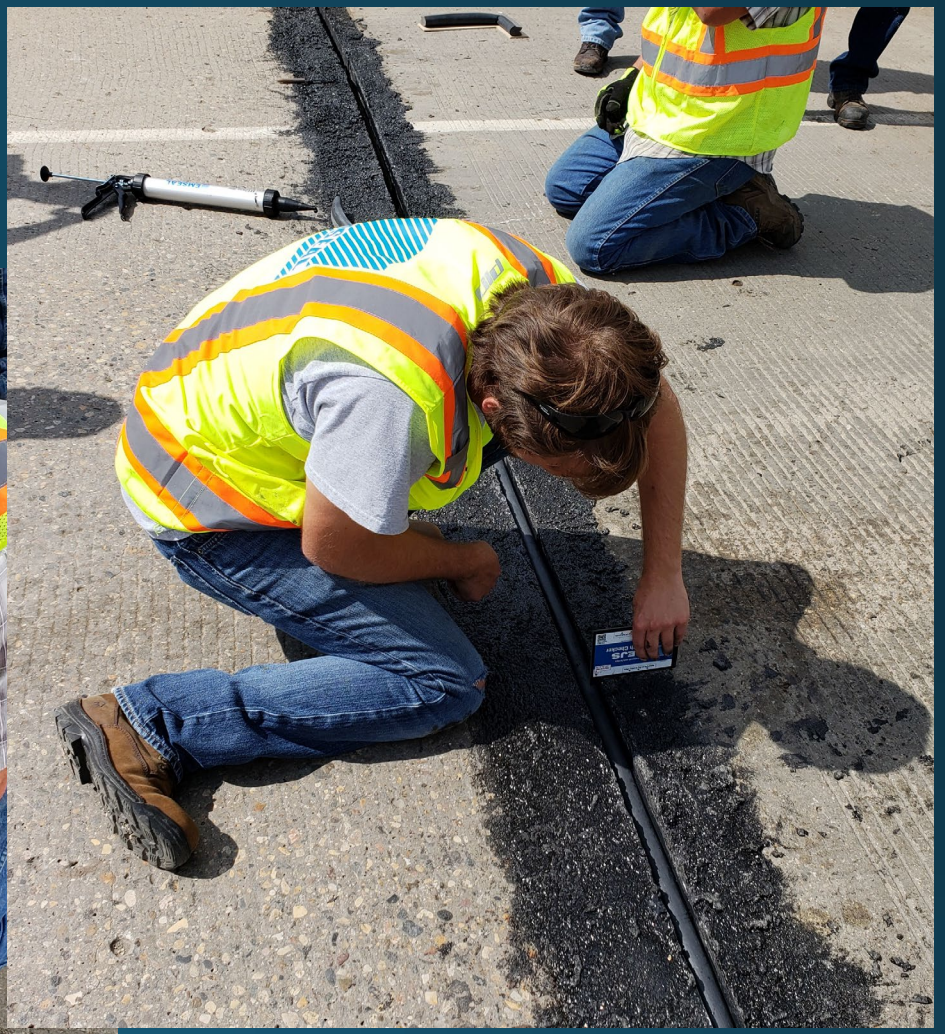
Maintenance – Joints

- Tioga, ND
- Oil country
- Lots of truck traffic
- Tough on joints



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Maintenance – Joints

- Joint Replacements
  - One year later
- Thanks Emseal & SSI

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Thank you!

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