Bridge Deck Repair & Preservation using Hydrodemolition & Latex Modified Concrete Overlays

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Oklahoma Transportation
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Bridge Deck Preservation

- It is very cost effective to attain a minimum of 75 years of service life from a bridge deck.
- By placing Latex Modified Concrete Overlays on Hydrodemolition prepared bridge deck surfaces before decks becomes structurally deficient, 75 years of service life or more can be achieved.
- The use of **Fast Track Hydrodemolition and Latex Modified Concrete Overlays** will provide an owner with an economical, long lasting and very fast bridge deck preservation method. Used for 50 years.

Bridge Deck Preservation Strategies

- ***75 Year Bridge Decks***
  - Year 1 – Construct New Bridge Deck
  - Year 25 – Place LMC O/L #1 – Hydrodemolition
  - Year 50 – Place LMC O/L #2 – Hydrodemolition
  - Year 75 – Replace Bridge Deck (Third O/L ? = 100 years)

Systematic Approach – utilize bridge deck inspections.

Hydrodemolition Definition

- Hydrodemolition is a mechanical process by which deteriorated concrete is selectively removed utilizing a high-pressure water jet.
- Replaces jackhammers – cost effective, efficient and precise.
- Rapid erosion occurs with the high-pressure water jet. The cement matrix and fine aggregates between the coarse aggregate is essentially washed away.
- By properly calibrating the hydrodemolition robot movements, concrete of uniform strength can be removed to a specified depth + unsound deteriorated concrete with one pass of the robot = Selective Removal.

Hydrodemolition Equipment

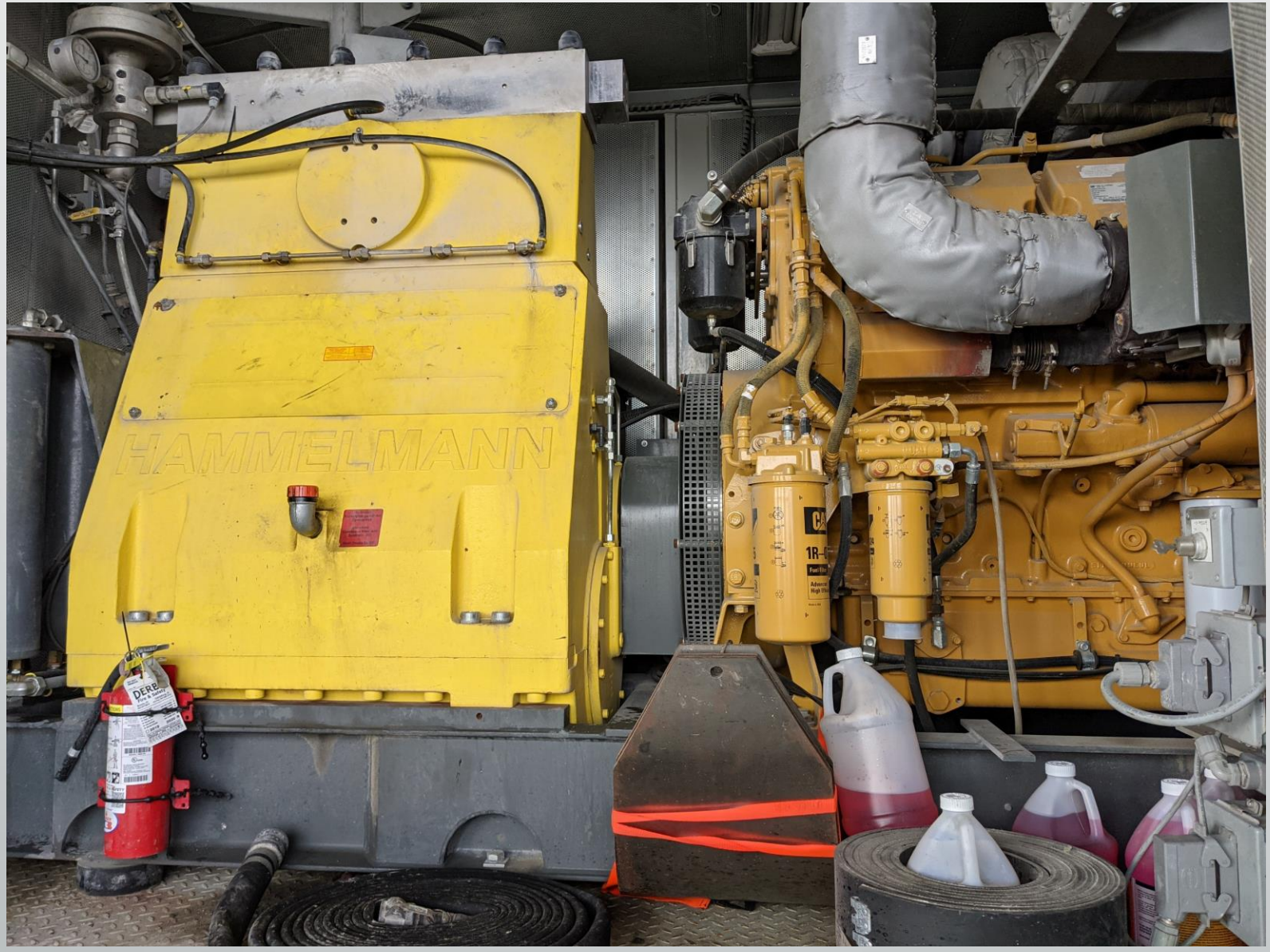
- Consists of a Pump & Power Unit, a Hydrodemolition Robot and a Vacuum Truck
- Can be readily mobilized to any project
- Set up time is quick and relatively easy

Hydrodemolition Pump Unit

- Receives water intake from either water tankers, a fire hydrant or directly from a stream or a lake
- Filters and pressurizes the water
- Supplies water at 12K to 20K psi minimum and 55 gal/min minimum to the Hydrodemolition Robot
- Selective settings

Hydrodemolition Pump Unit

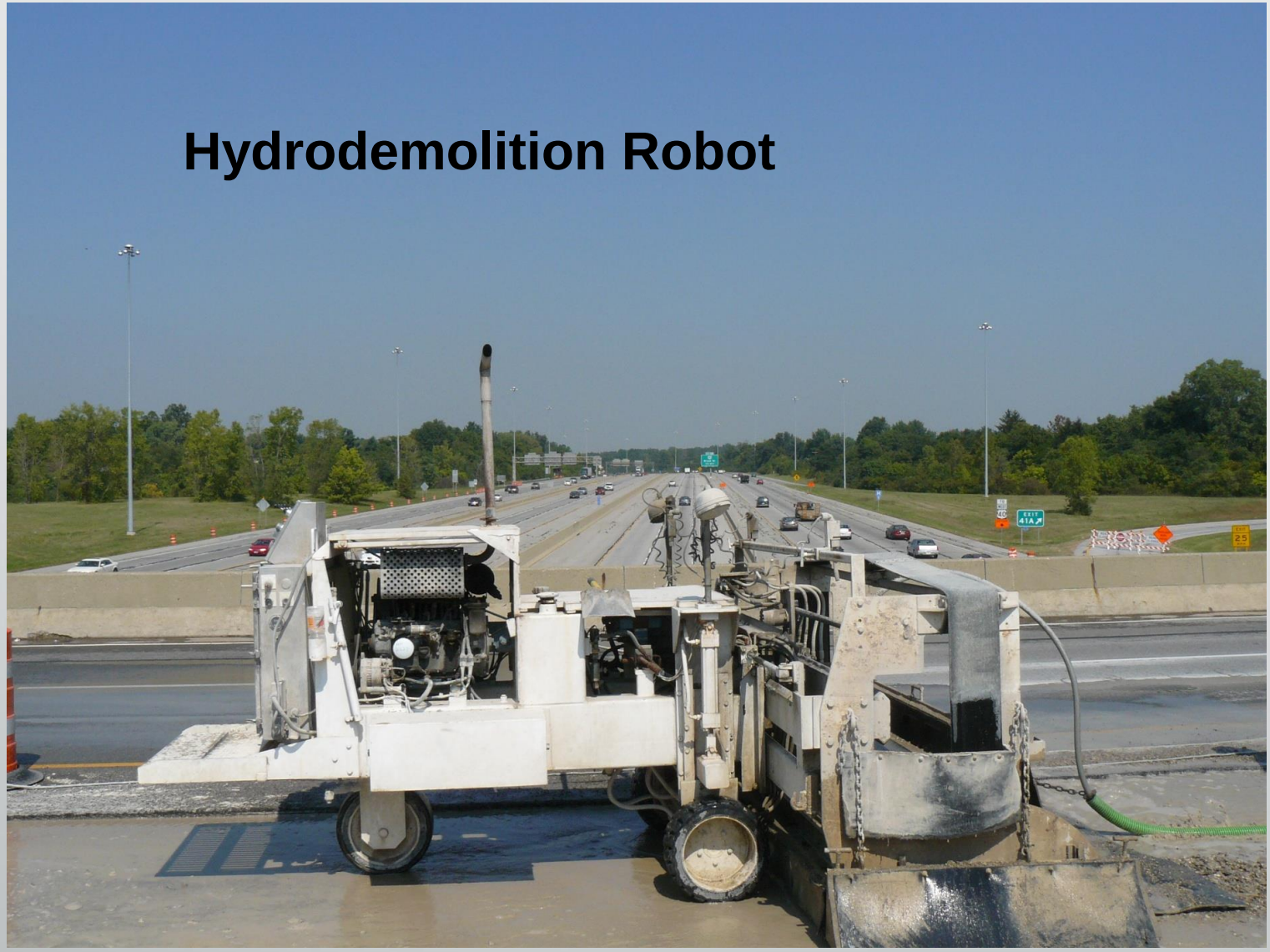

100% American Owned Corporation
team
Hydro Tech
Hydro Excavation Services
812.284.1080
Quality & Service Creates It's Own Demand


HAMMELMANN

Hydrodemolition Robot

- Computerized and Self-Propelled
- Water from the power unit exists through a ¼" jet nozzle
- Controls allow operator to control the removal depth of the concrete by adjusting the step of the machine and the glide of the water jet + pressures and flow rates.
- Safety

Hydrodemolition Robot



Hydrodemolition Vacall Unit

- Cleans and washes bridge deck surface.
- Removes all hydrodemolition debris and slurry.

Vacall Unit

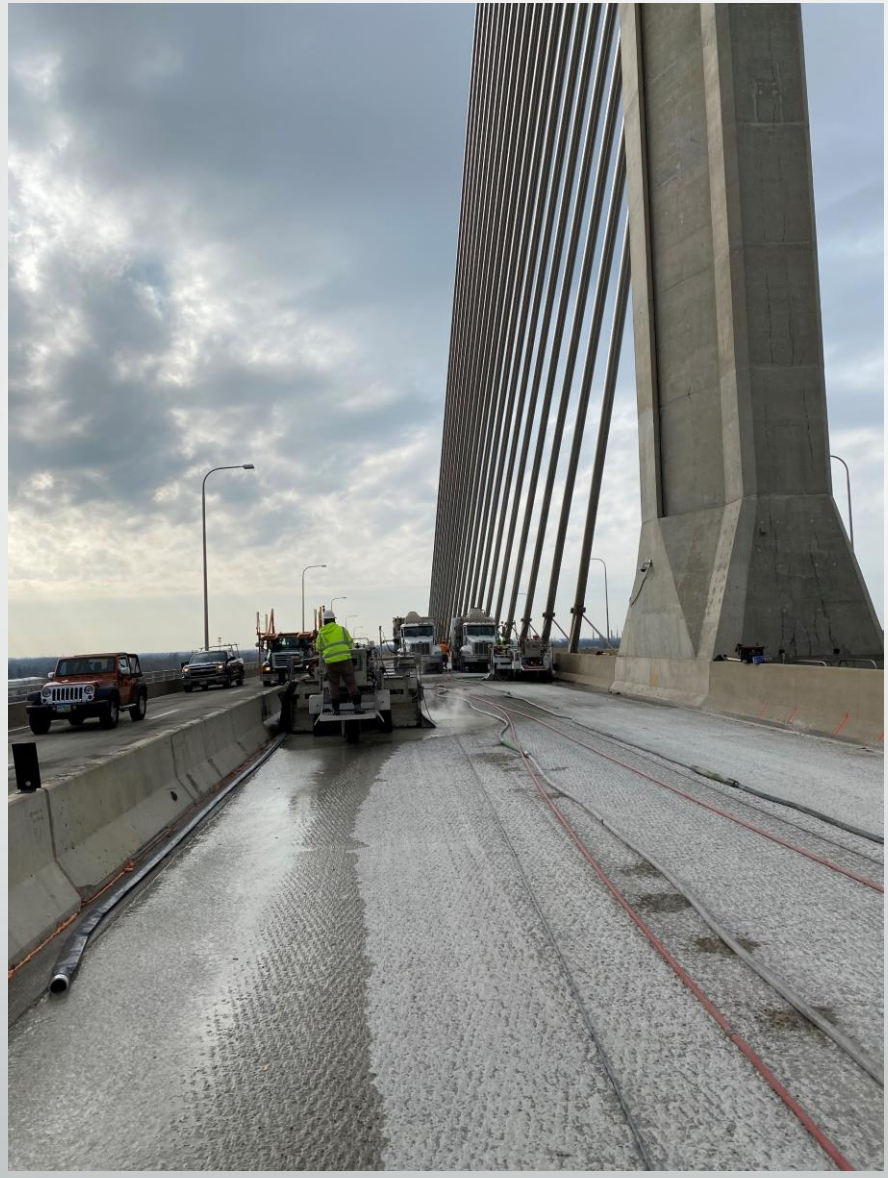
Vacuum Tube Unit

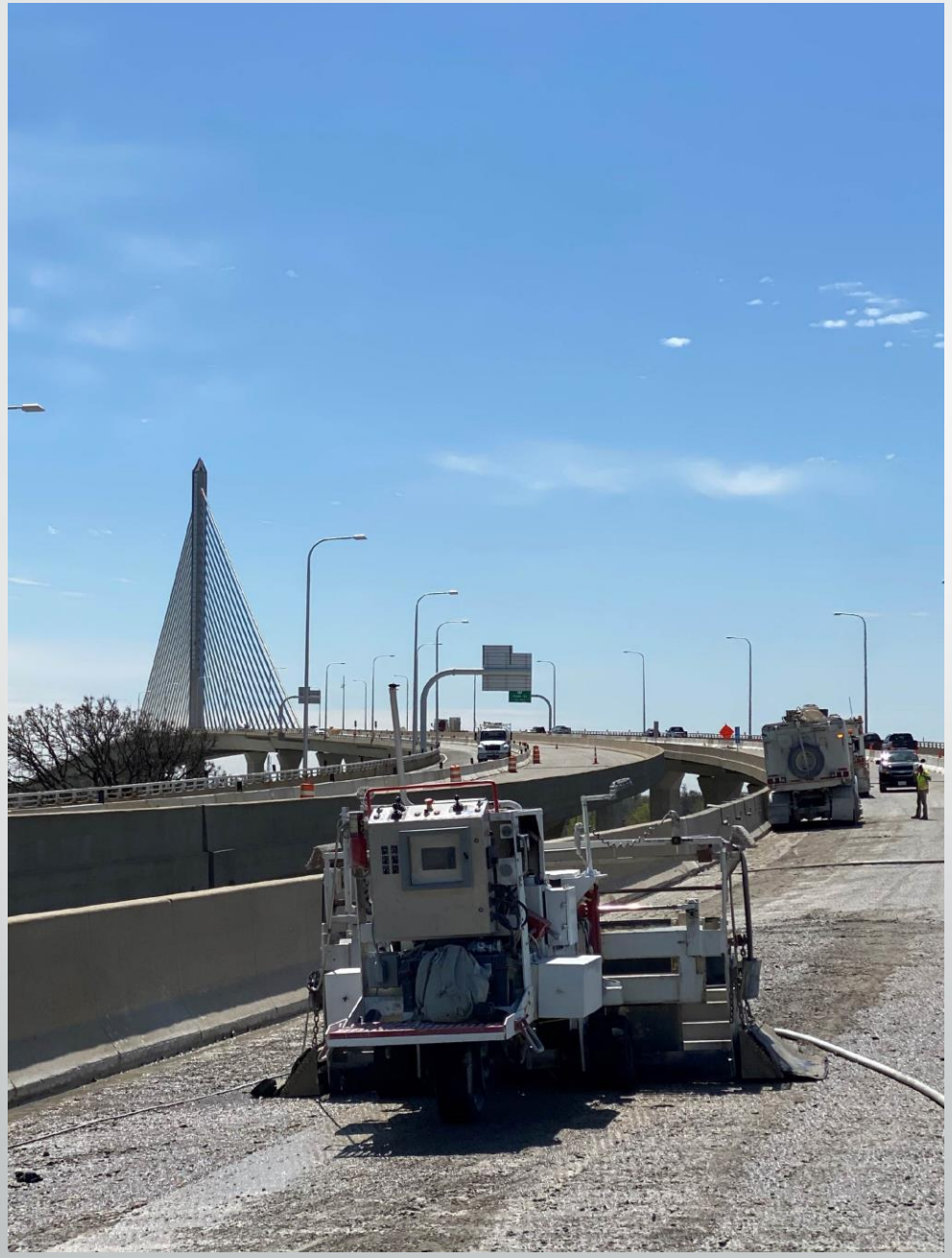
Hydrodemolition Applications

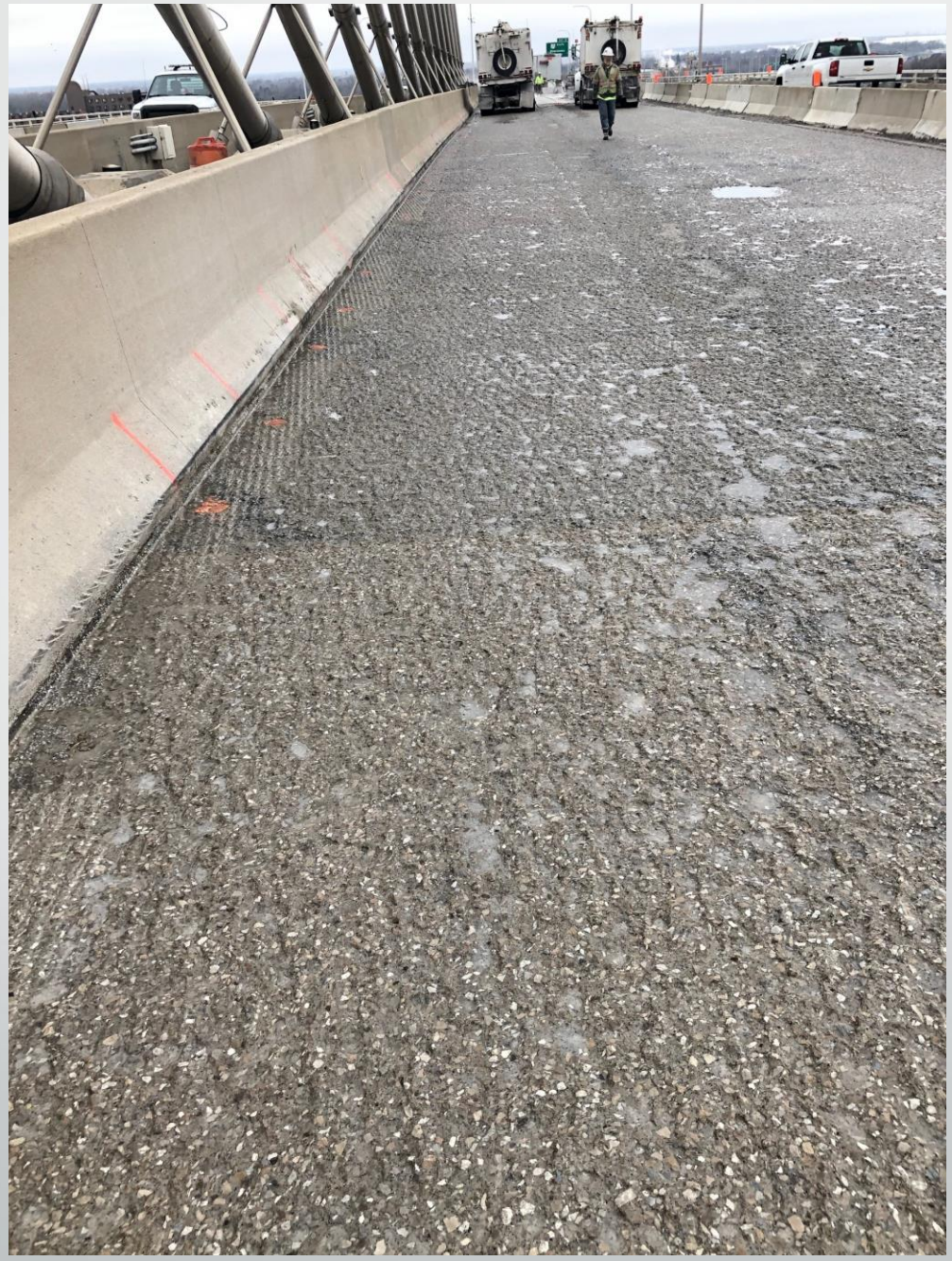
Fast-Track Hydrodemolition - Surface preparation of total bridge deck area prior to placement of overlays.

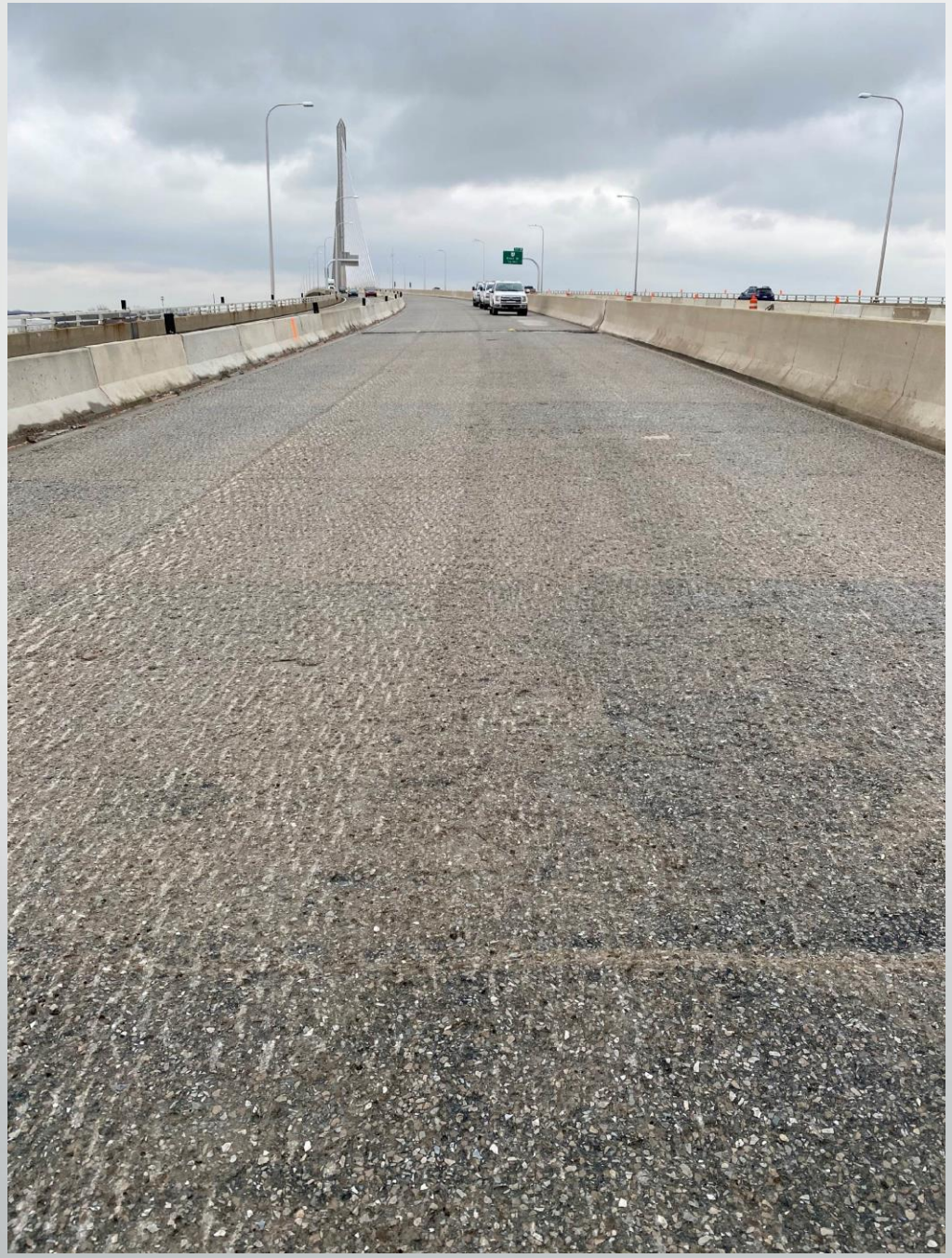
- Cost Range - $25 to $75/sy
- Production – 750 sy to 1200 sy / shift (based on calibration)
- Always milling first – mill for depth
- Highly Bondable Surface + Selective Removal
- Latex Modified Concrete Overlays
- Toledo Skyway Bridge - Ohio
- Baltimore Harbor Tunnel - Maryland

Toledo Skyway Bridge

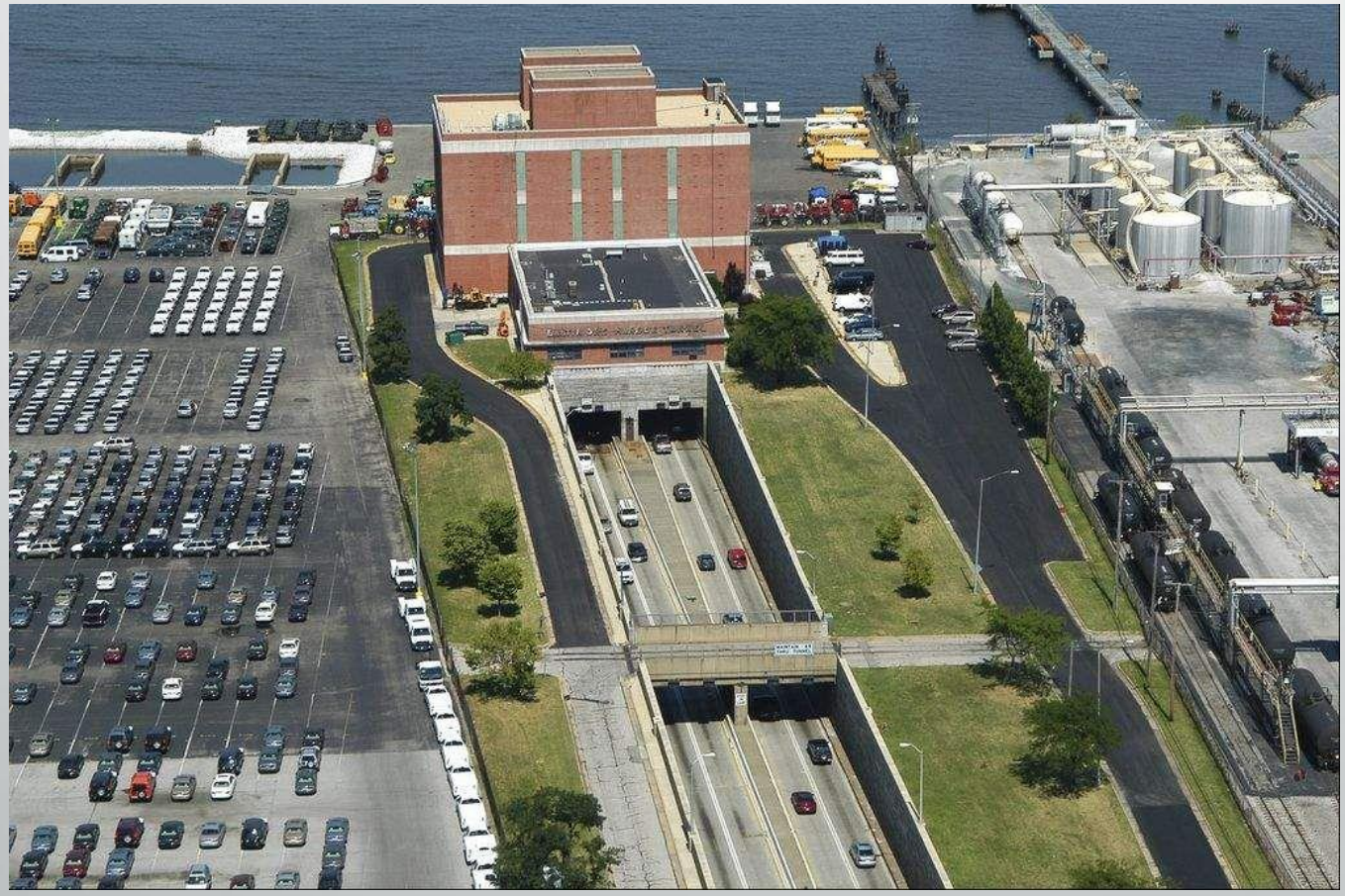


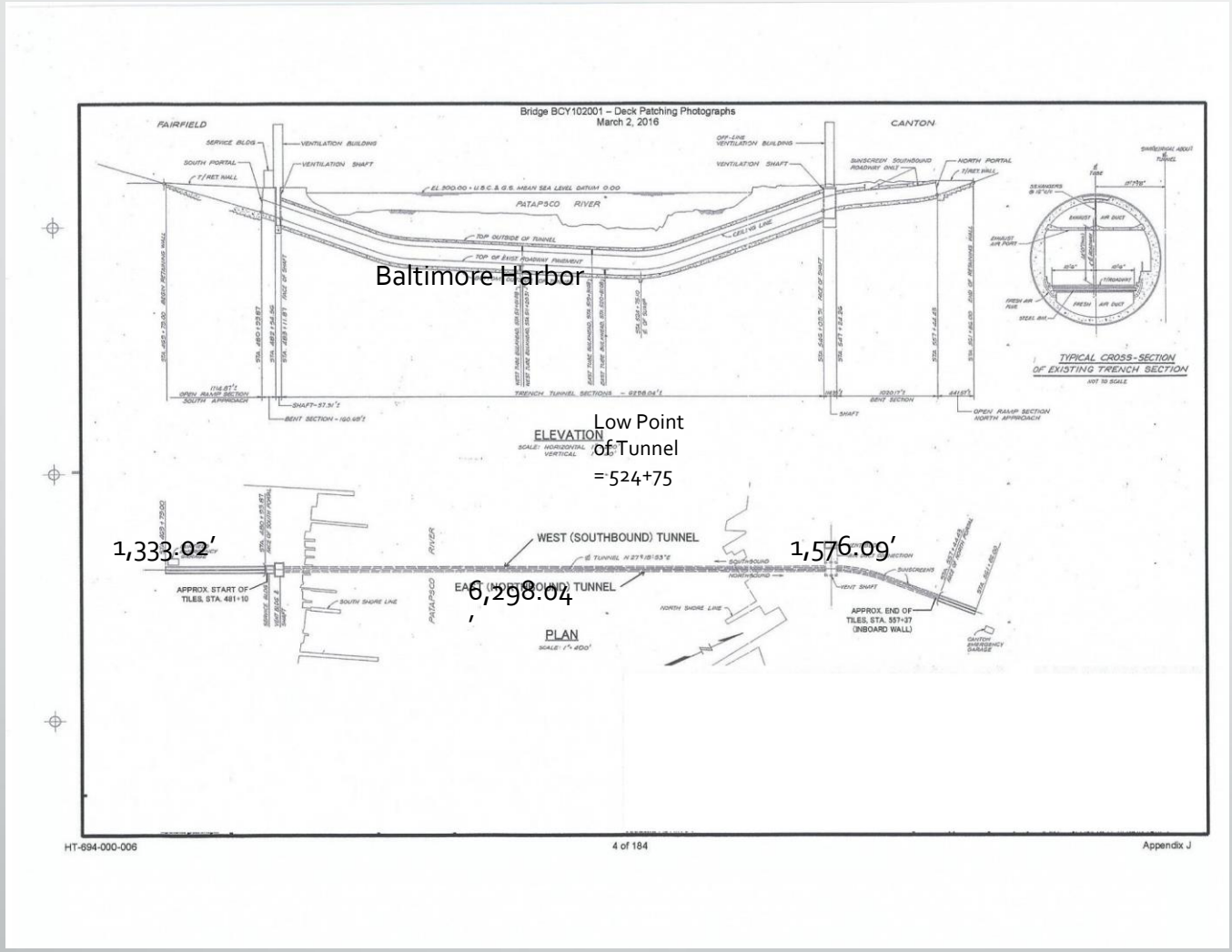


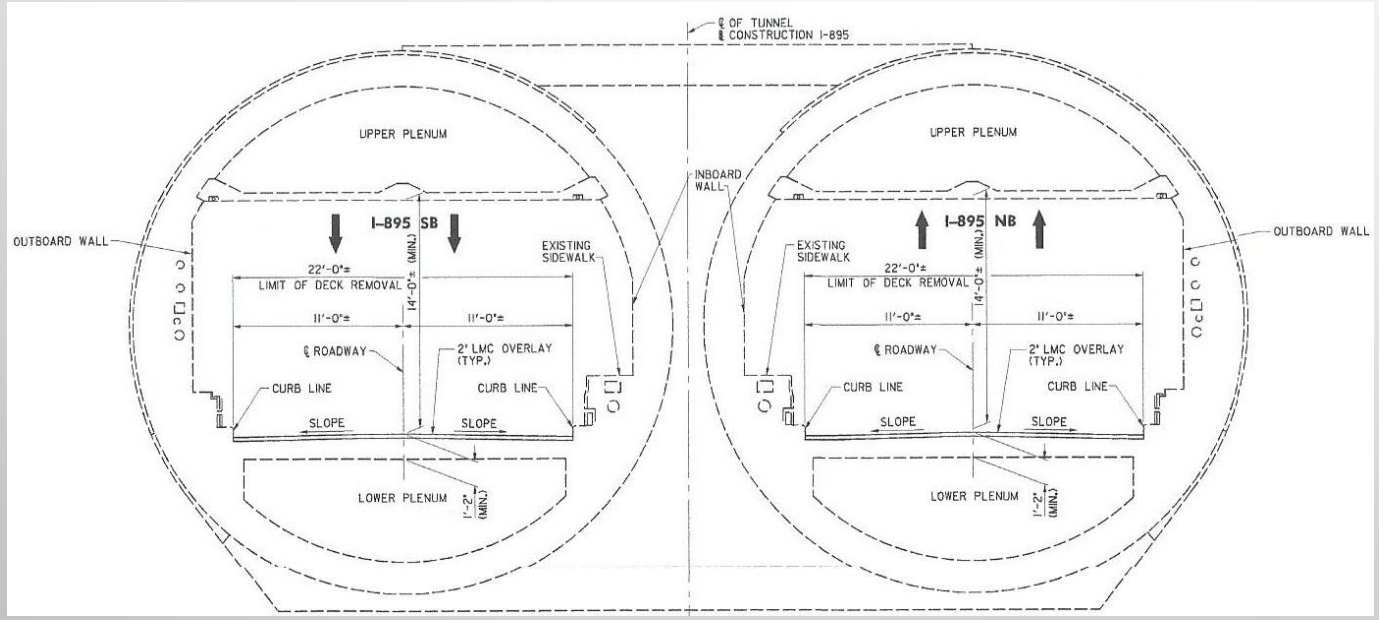




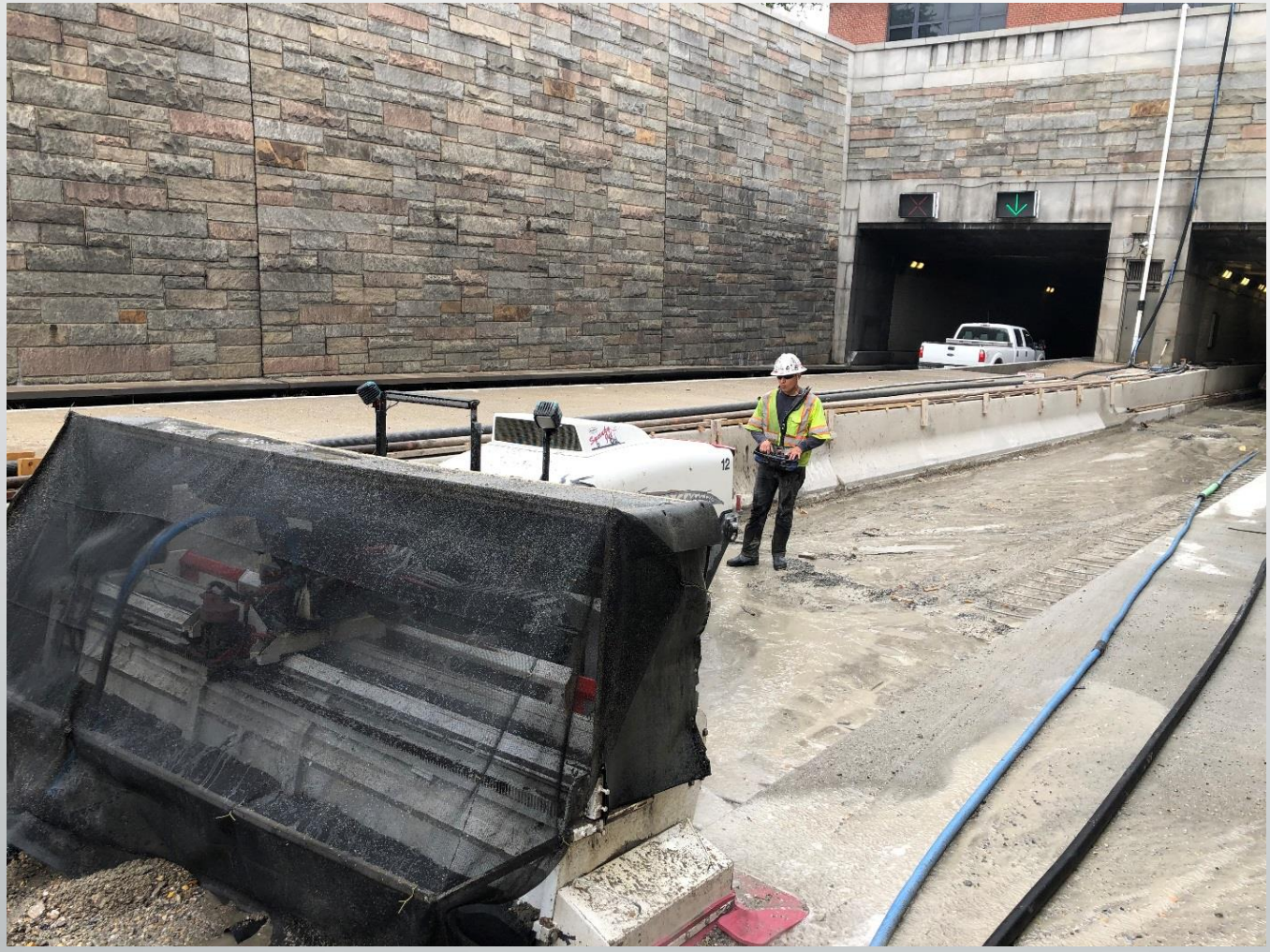
Baltimore Harbor Tunnel



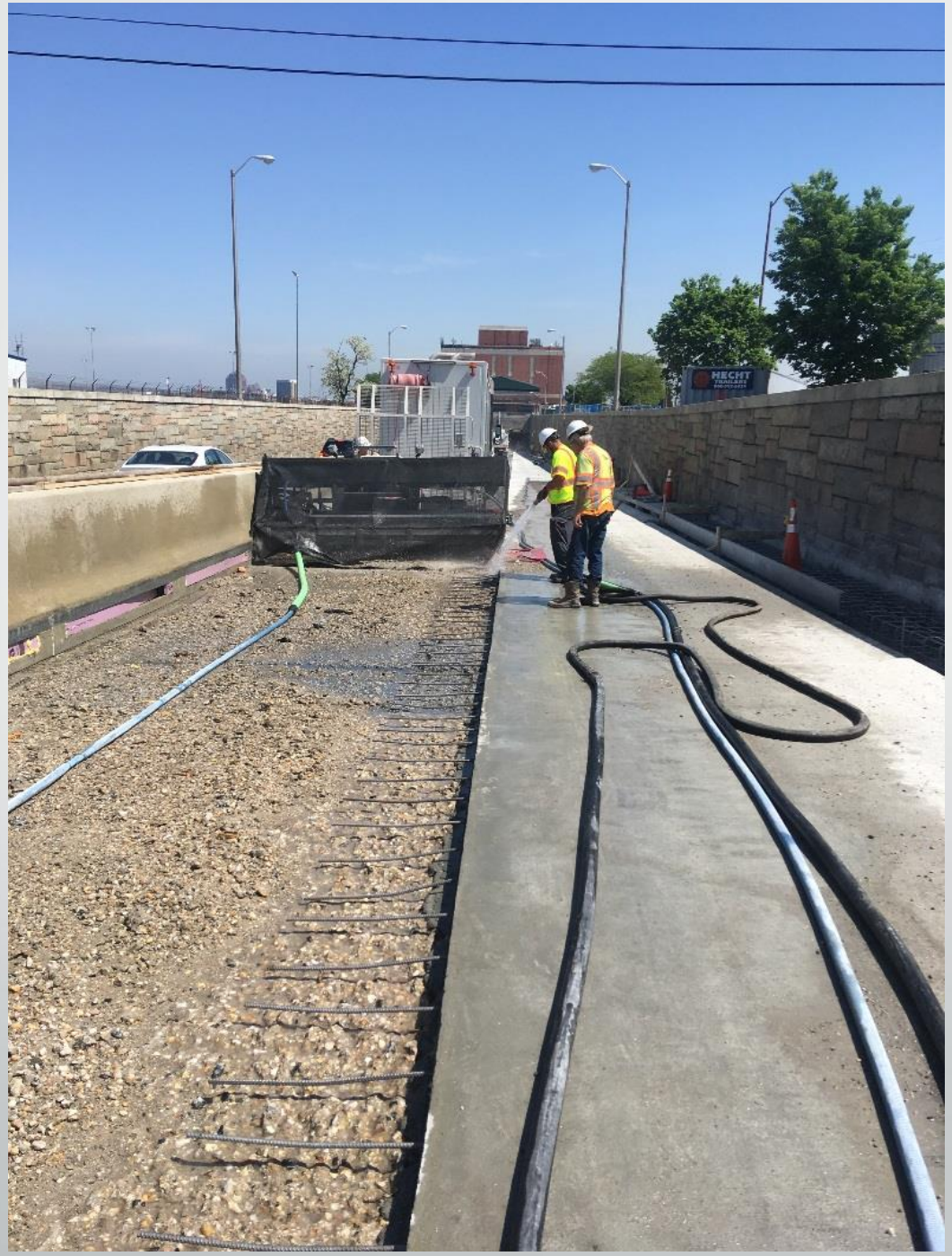

Bridge BCY102001 – Deck Patching Photographs
March 2, 2016
FAIRFIELD
CANTON
PATAPSCO RIVER
Baltimore Harbor
TYPICAL CROSS-SECTION OF EXISTING TRENCH SECTION
NOT TO SCALE
ELEVATION
Low Point of Tunnel = 524+75
1,333.02'
6,298.04'
1,576.09'
WEST (SOUTHBOUND) TUNNEL
EAST (NORTHBOUND) TUNNEL
APPROX. START OF TILES, STA. 481+10
APPROX. END OF TILES, STA. 551+27 (INBOARD WALL)
PLAN
HT-694-000-006
4 of 184
Appendix J


℄ OF TUNNEL CONSTRUCTION I-895
UPPER PLENUM
UPPER PLENUM
INBOARD WALL
OUTBOARD WALL
OUTBOARD WALL
I-895 SB
I-895 NB
EXISTING SIDEWALK
EXISTING SIDEWALK
22'-0"±
LIMIT OF DECK REMOVAL
14'-0"± (MIN.)
11'-0"±
11'-0"±
℄ ROADWAY
2" LMC OVERLAY (TYP.)
CURB LINE
CURB LINE
SLOPE
SLOPE
LOWER PLENUM
1'-2" (MIN.)

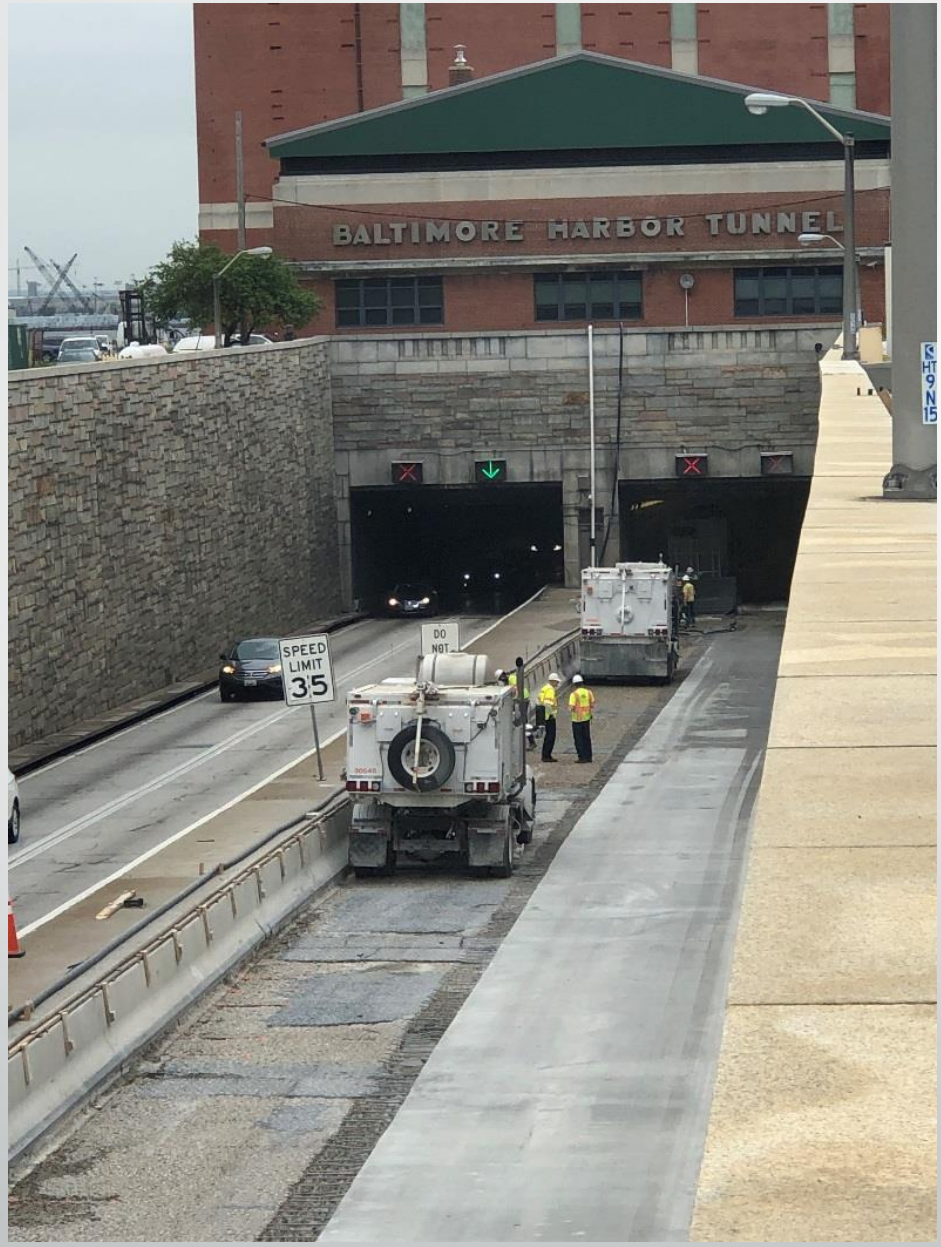

BALTIMORE HARBOR TUNNEL



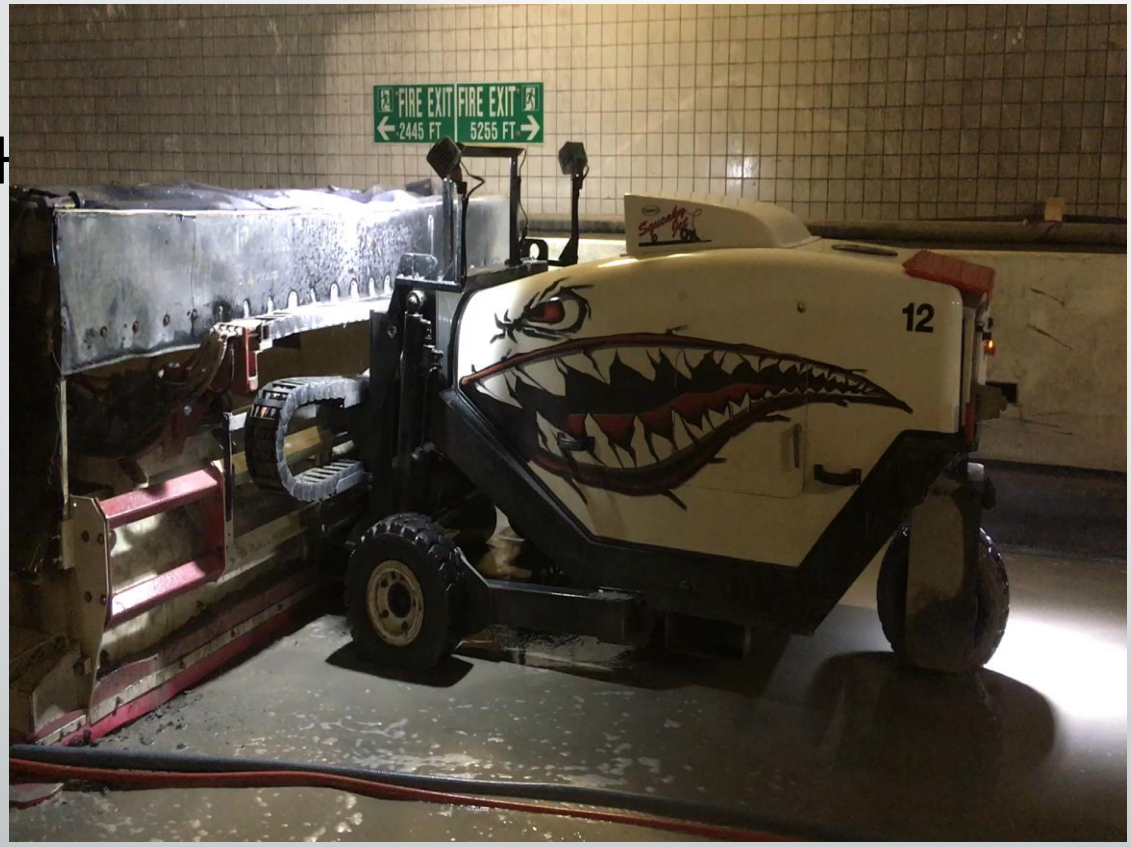

KEEP
RIGHT
12

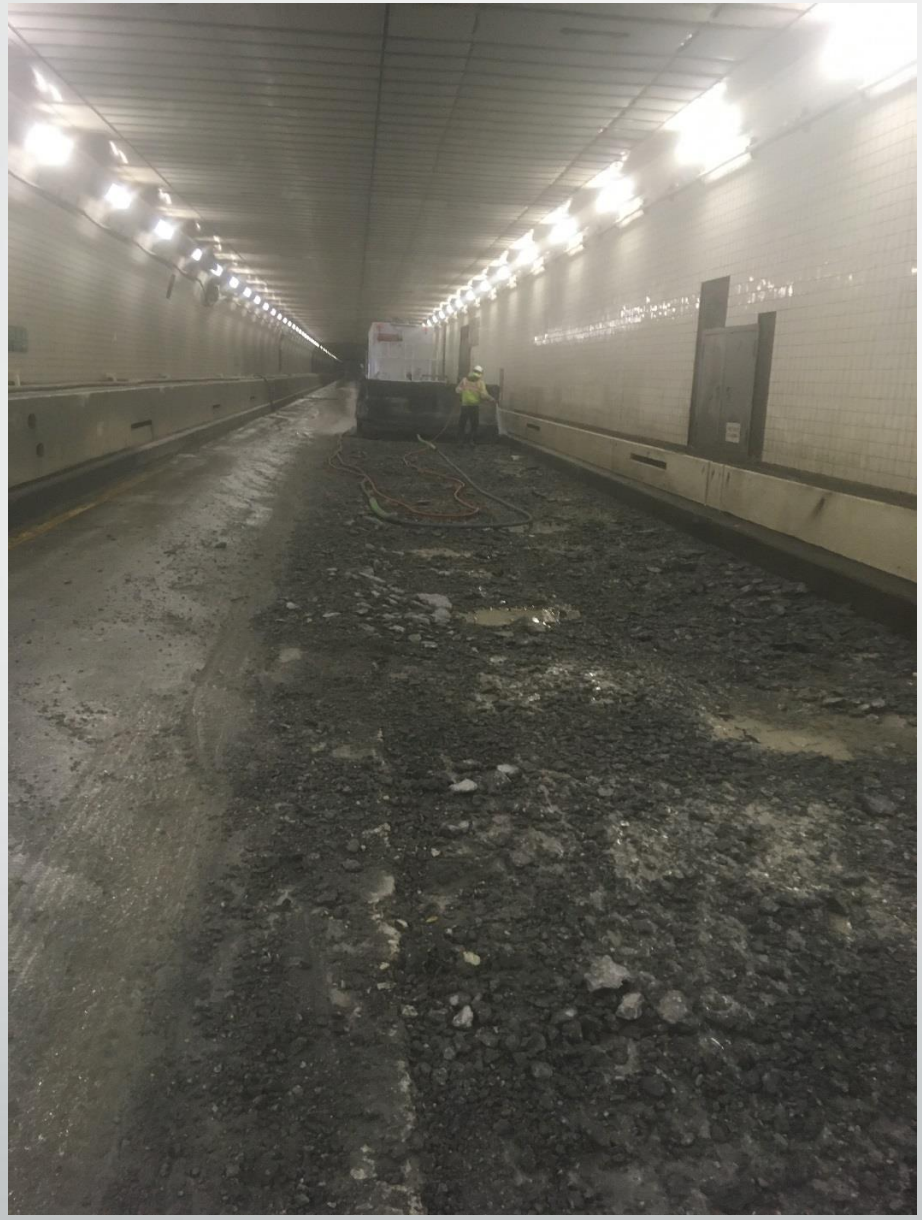

HECHT


BALTIMORE HARBOR TUNNEL


BALTIMORE HARBOR TUNNEL
SPEED LIMIT 35
DO NOT

H

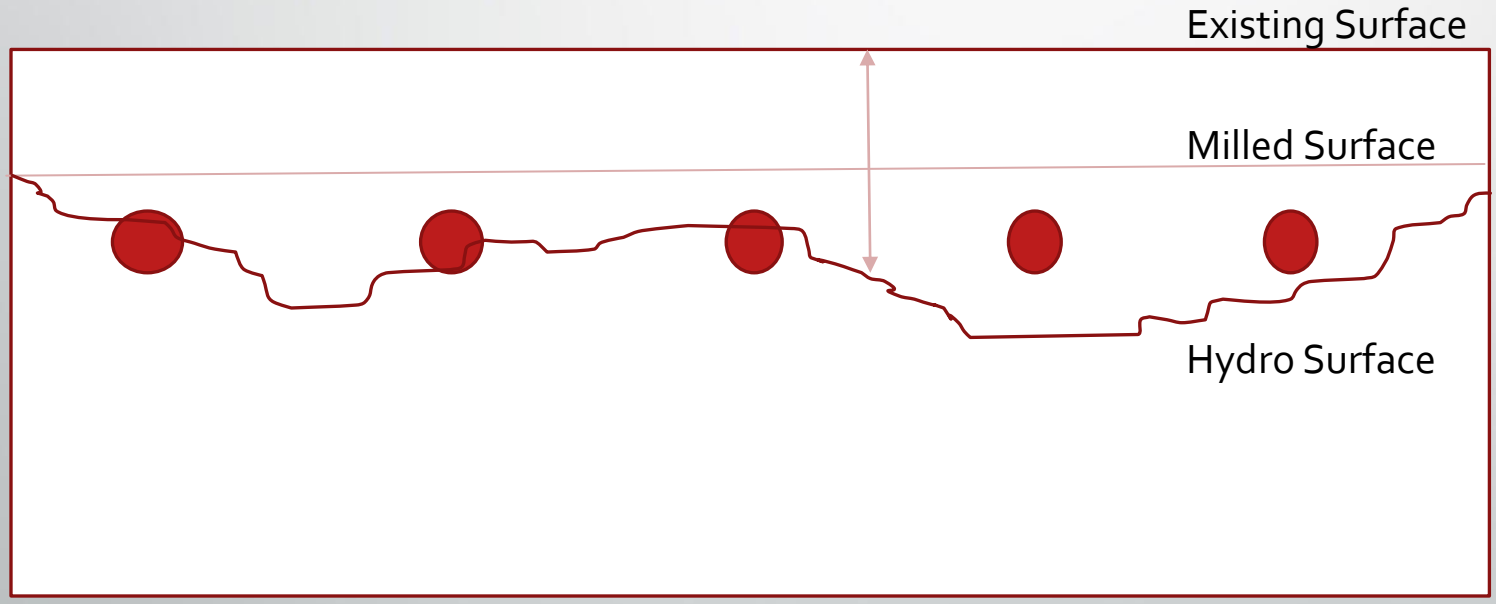




Fast-Track Hydrodemolition Surface

- Fastest way to prepare a bridge deck surface for a concrete overlay.
- Selectively removes deteriorated concrete at variable depths.
- Highly rough and bondable surface.
- Reduces Chloride Ion concentrations in the deck.
- With proper milling, only sound concrete remains.
- Has 300% to 400% more bondable area than surface milling alone.
- Stone is not cut – aggregates are protruding.
- Exposes and cleans reinforcing steel. Will not damage or dislodge reinforcing steel.

Fast Track Hydrodemolition Surface



Fast Track Hydrodemolition Midwest

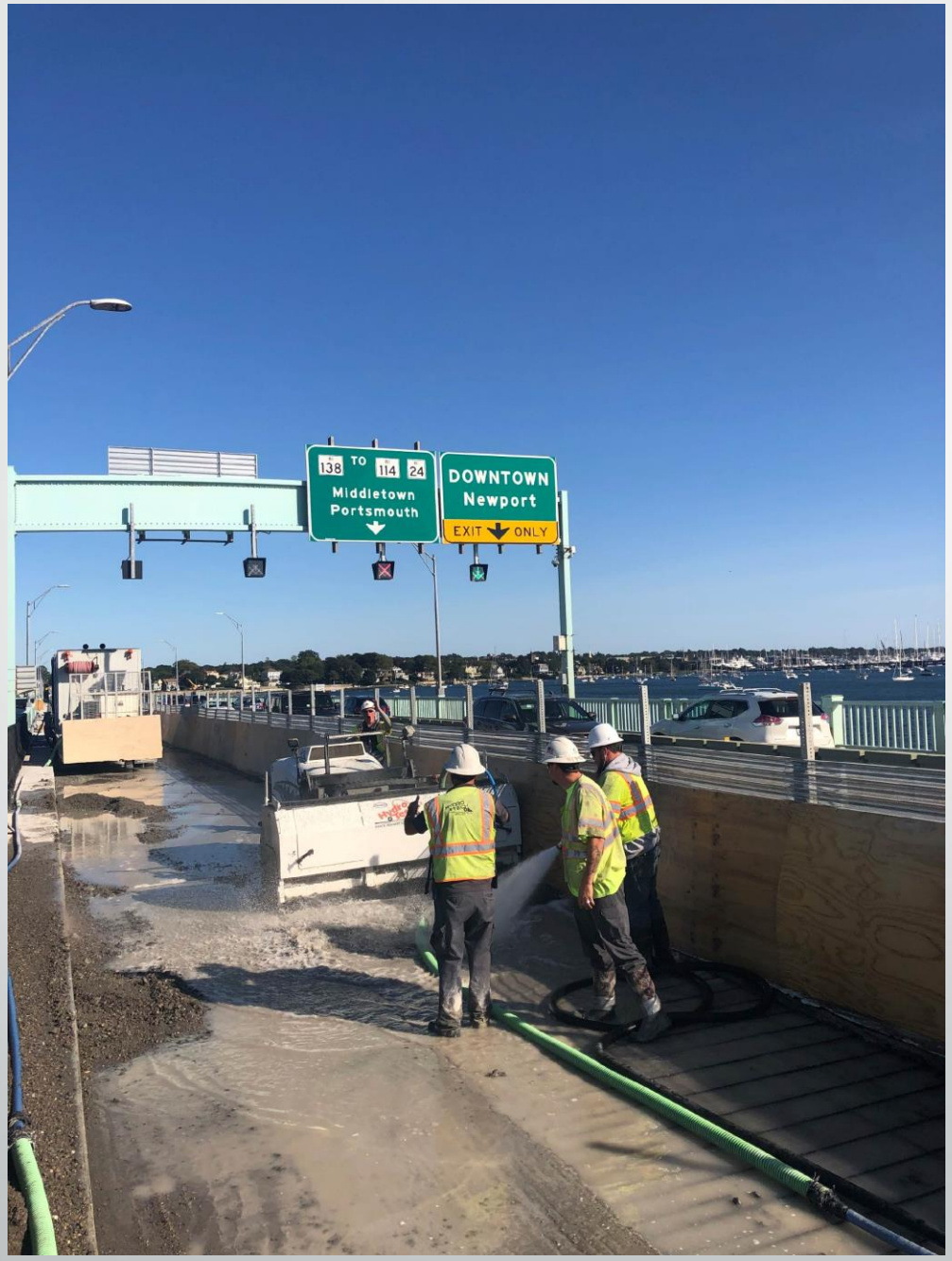
- **Indiana** – 2/10 letting= 11 projects , 1/13 letting = 7 projects
  – 2019/2020 = 166 projects, 406,000 sy of deck area
- **Illinois** – 1/15 letting = 17 projects , 47,500 sy
  – 2019/2020 = 108 projects , 220,500 sy of deck area
- **Ohio** – 2019/2020= 76 projects , 290,000 sy of deck area
- **Kentucky** – 2019/2020 = 35 projects LMC overlay
- **Missouri** – 2019/2020 = 18 projects , 62,000 sy of deck area
- **Oklahoma** – 2020 = 14,500 sy LMC – Pensacola Dam
- **Michigan** – 2019/2020 = 21 projects , 41,000 sy of deck area
- **Iowa** – 6 projects , 8028 sy

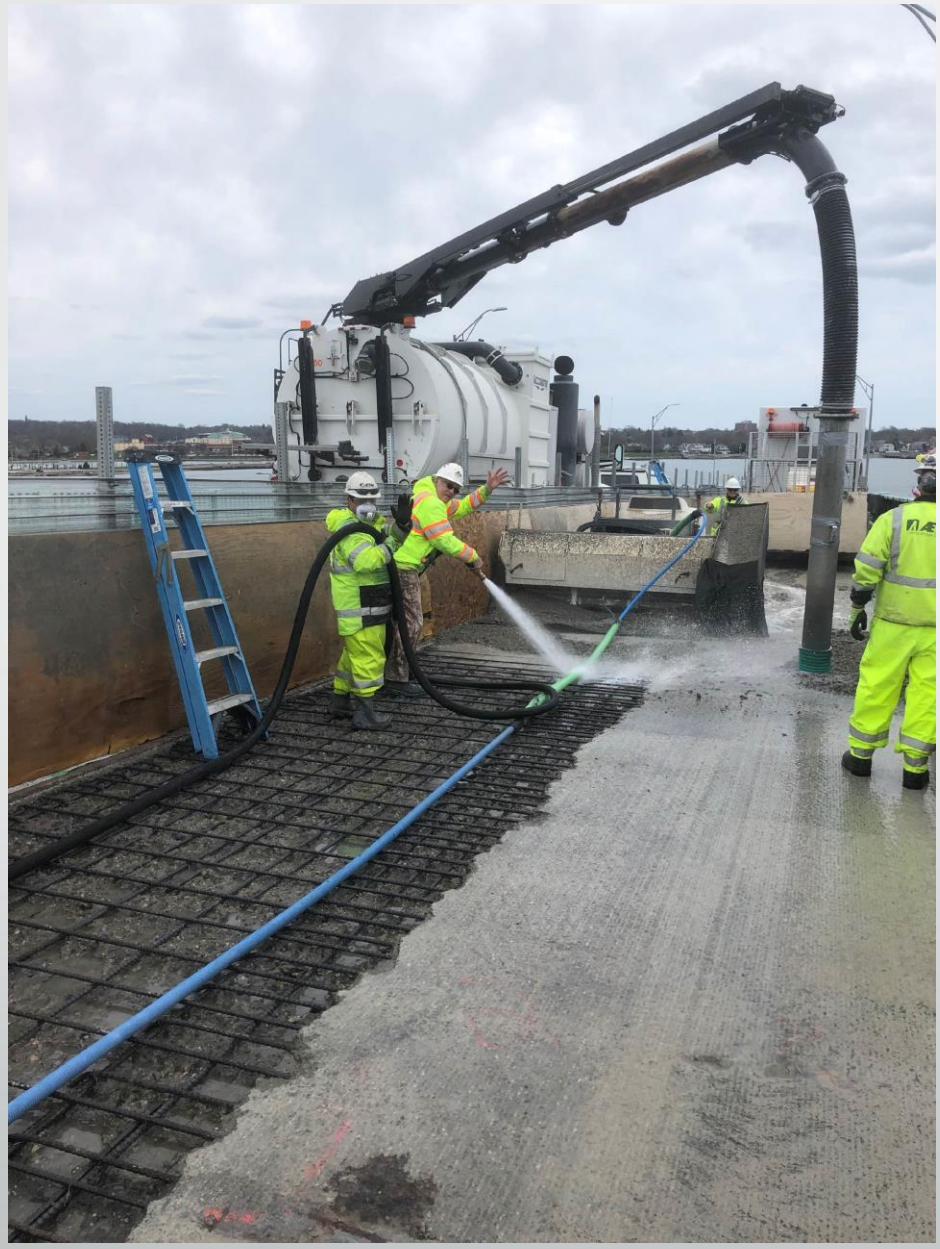
Hydrodemolition Applications

Deep-Cut Hydrodemolition - Rebar exposure of bridge deck + Selective Removal

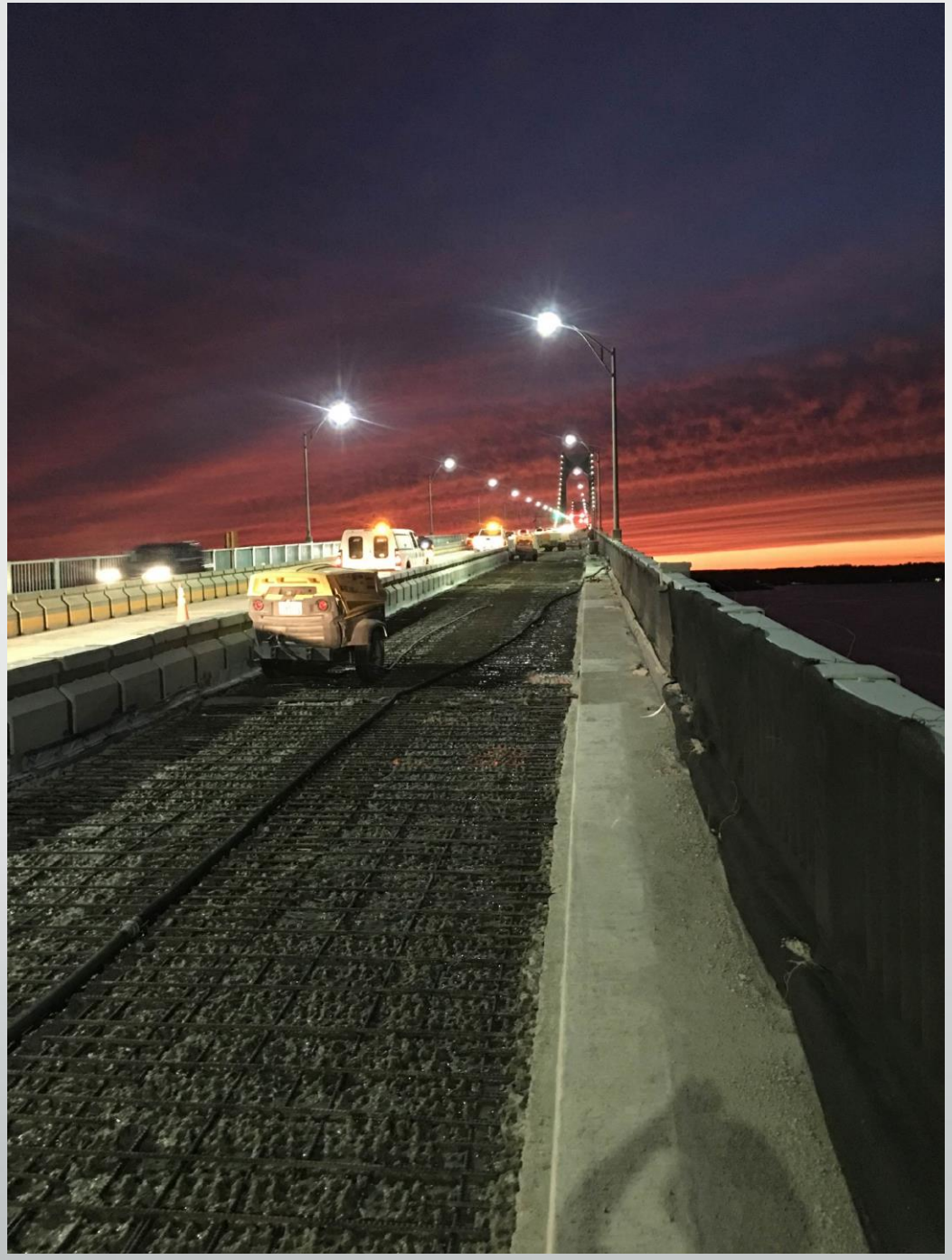
- Cost Range - $150 to $250/sy
- Production – 150 sy to 400 sy / shift
- Always milling first to top matt of resteel
- Newport Bridge – Road Island

Newport Bridge


138 TO 114 24
Middletown
Portsmouth
DOWNTOWN
Newport
EXIT ONLY



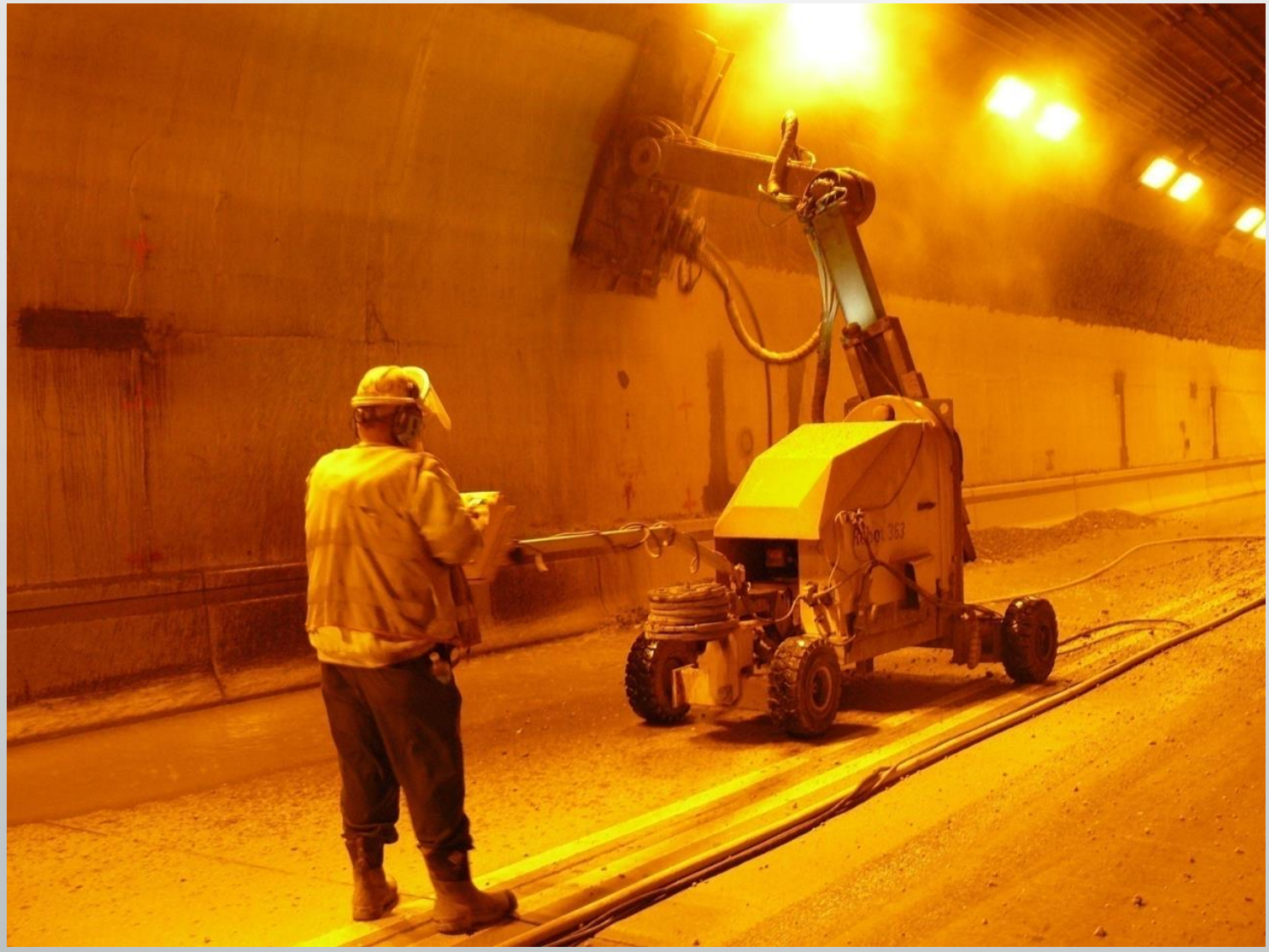

TRAFCON



Hydrodemolition Applications (less common)

- Bridge Deck Patching Surface Preparation
- Full Depth Concrete Removal
- Expansion Joint Removal & I-Beam Exposure
- Vertical Applications
  - Bridge Piers, Parapet Walls, Tunnel Walls, Dam Spillways
- Water Treatment Plant Clarifiers, Parking Garages, Factory Floors, Nuclear Power Plants


7114



Latex Concrete Mix Design

- Fine Aggregate (Sand) - 1505 - 1715 lbs/cy
- Course Aggregate (size 9-M) - 1155 - 1365 lbs/cy (
- Cement (7 bags) - 658 lbs/cy – min.
- Latex Emulsion - 24.5 gal/cy – mon.
- Water - 154 lb/cy - .40 w/c ratio max
- Maximum Air - 7 %
- Slump - 4 to 6 in – after 5 min.

* Cement = Type 1, Type 3 or Rapid Set

Latex Emulsion

- Suspension of tiny (.2 micron diam.) styrene-butadiene polymer particles in water, typically about 50% polymer solids.
- Styrene-butadiene polymers are known for their hydrophobicity or excellent water resistance.
- Polymer particles coalesce or fuse together when in intimate contact to form a highly waterproof polymer film.
- Essentially waterproofs concrete.

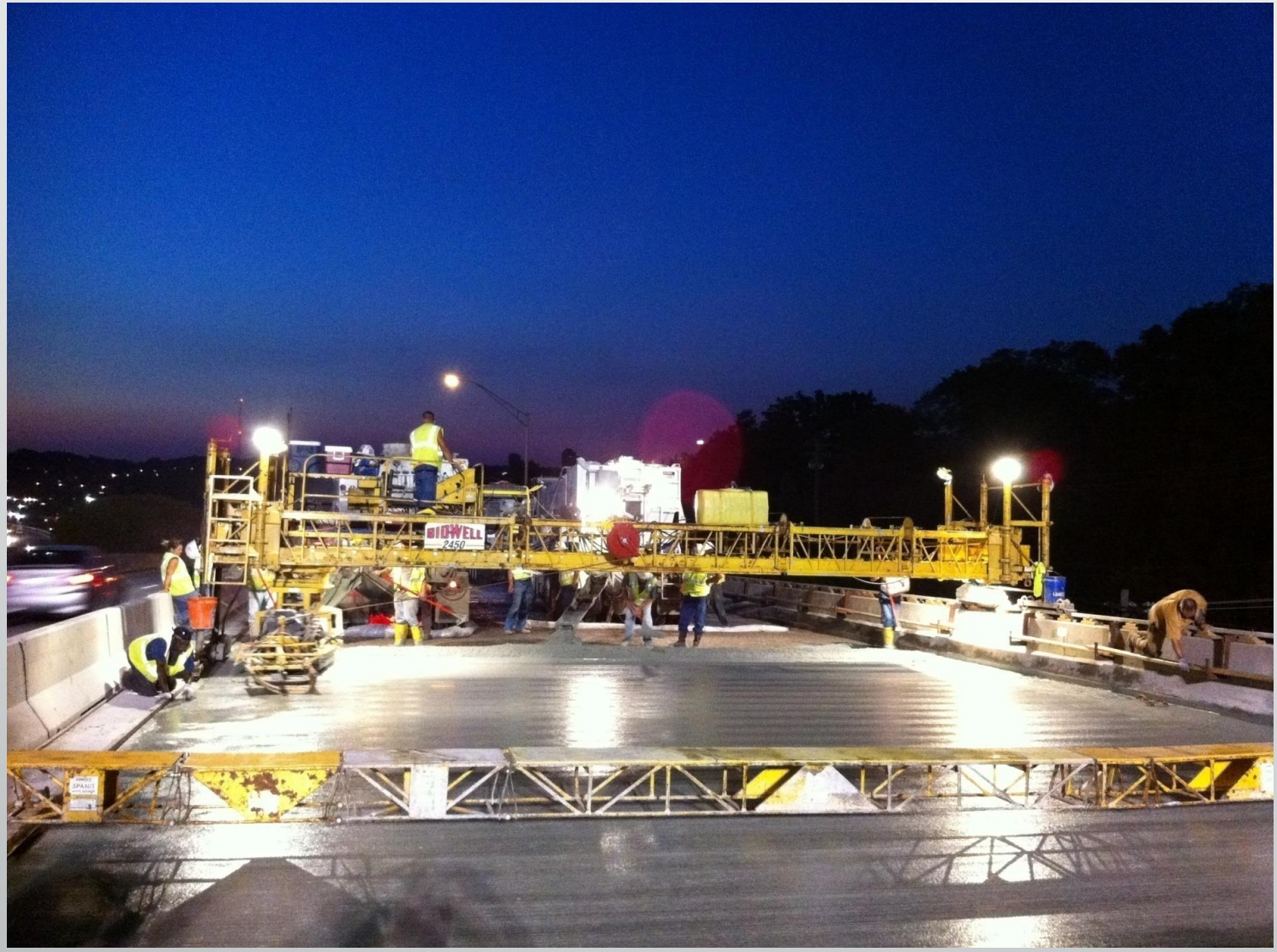
LMC Equipment

- Volumetric mixer used to produce LMC – 601.02
- Calibration of mixer
- Bidwell type finish machine used to achieve proper grade and profile – 609.02.09 (furnish a Department approved machine)

Mobile Mixer


MODIFIED
M10


SP740ABL
M-11


BIDWELL
2450

Research

Hydrodemolition for Bridge Repair
reprint Nordisk Betong no. 2-3:1988

Techniques for Concrete removal and Bar Cleaning on Bridge Rehabilitation Projects
National Research Council:SHRP-S-36:1992

Successful Approaches for the Use of Hydrodemolition for Partial Depth Removal of Bridge Decks
National Cooperative Highway Research Program:Project 20-68A, Scan 18-01:2020

Sampling and Testing LMC for Permeability to Chloride Ion
Michael M. Sprinkle – Virginia Transportation Research Council:2008

University of Texas – Austin Field Trials
Anthony F. Bentivegna, Kevin J. Folliard, Jason H. Ideker: 2010

Initial Setup

Hydro-Tech Transportation Rig

Slabs Prior to Hydro-demolition

Initial Setup

Hydro-demolition Robot on Truck Bed

Initial Setup

Calibration

Initial Depth Calibration

Hydro-demolition Robot

Finished Surface

Abraded Concrete Surface

Completed Hydro-demolition

Debris Removal

Formwork

Pre-Pour Mobilization

Rapid-Set Pour

Curing

Questions / Contact Info

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