United States Infrastructure Preservation using Hydrodemolition

Association for Bridge Construction and Design
Central Ohio Chapter

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Ed Liberati, PE - Hydro-Technologies, Inc.

Hydrodemolition History

- Robotic Hydrodemolition Technology was first developed in Europe 1960's (selective removal).
- Developed as an alternate to large jackhammer crews.
- Introduced to the United States in the 1970's.
- Hydro-Technologies started in 1980.

Hydrodemolition Definition

- Hydrodemolition is a mechanical process by which deteriorated concrete is selectively removed utilizing a high-pressure water jet.
- 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 = Selective Removal.
- Replaces jackhammers – cost effective, efficient and precise.

Infrastructure Preservation

- It is very cost effective to preserve our transportation infrastructure rather than replace it.
- Hydrodemolition is used to selectively remove portions of reinforced concrete structures while preserving the portions of concrete to remain.
- No Micro-Cracking
- The use of Hydrodemolition on the right jobs will provide an owner with an economical, safe and very fast concrete removal method.

Bridge Deck Hydrodemolition

Hydrodemolition Equipment

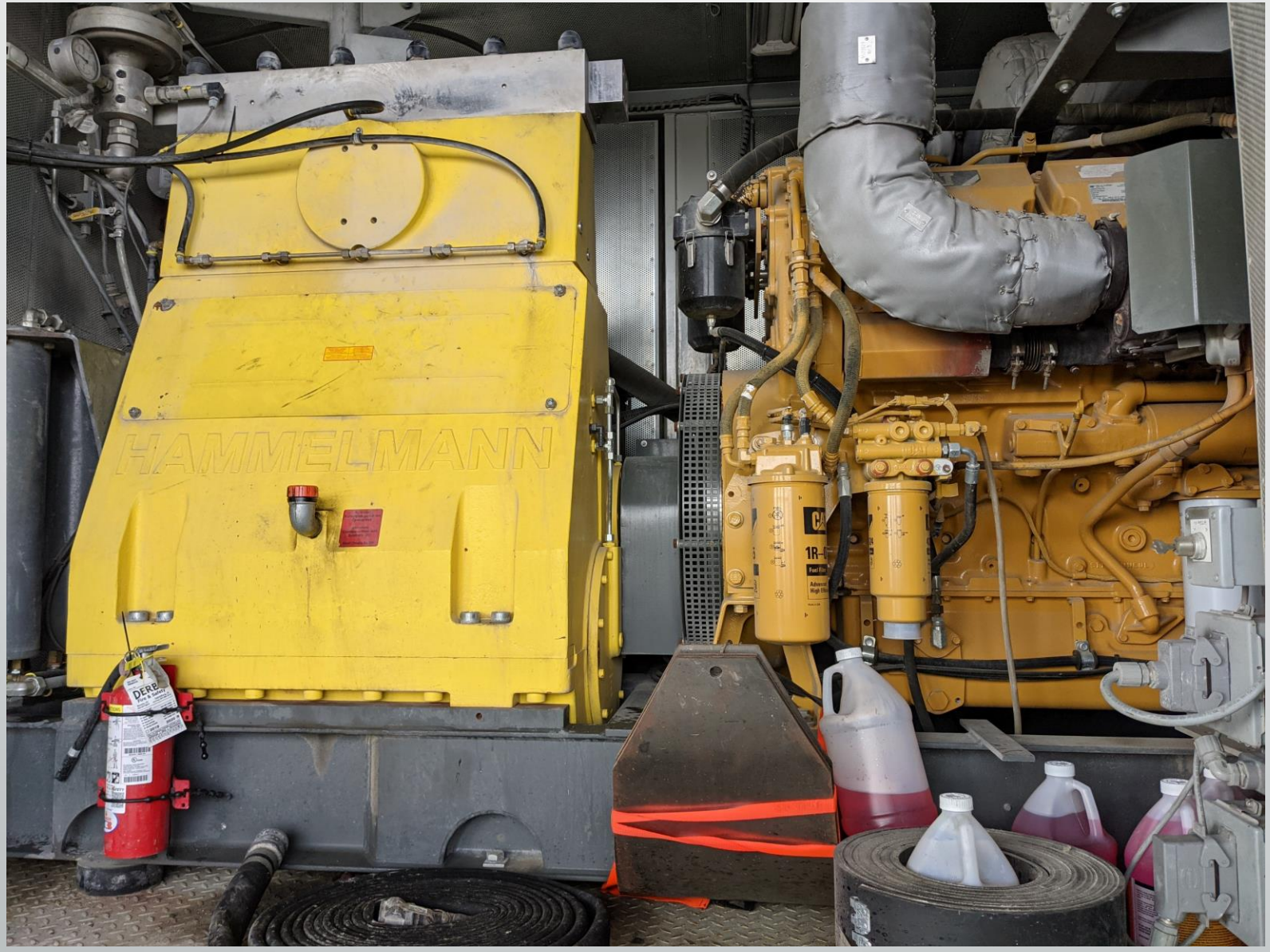
- Consists of a Pump & Power Unit, a Hydrodemolition Robot and a Vacuum Truck
- Can be readily mobilized to any project
- Set up time is quick and relatively easy

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
- Safety

Hydrodemolition Pump Unit

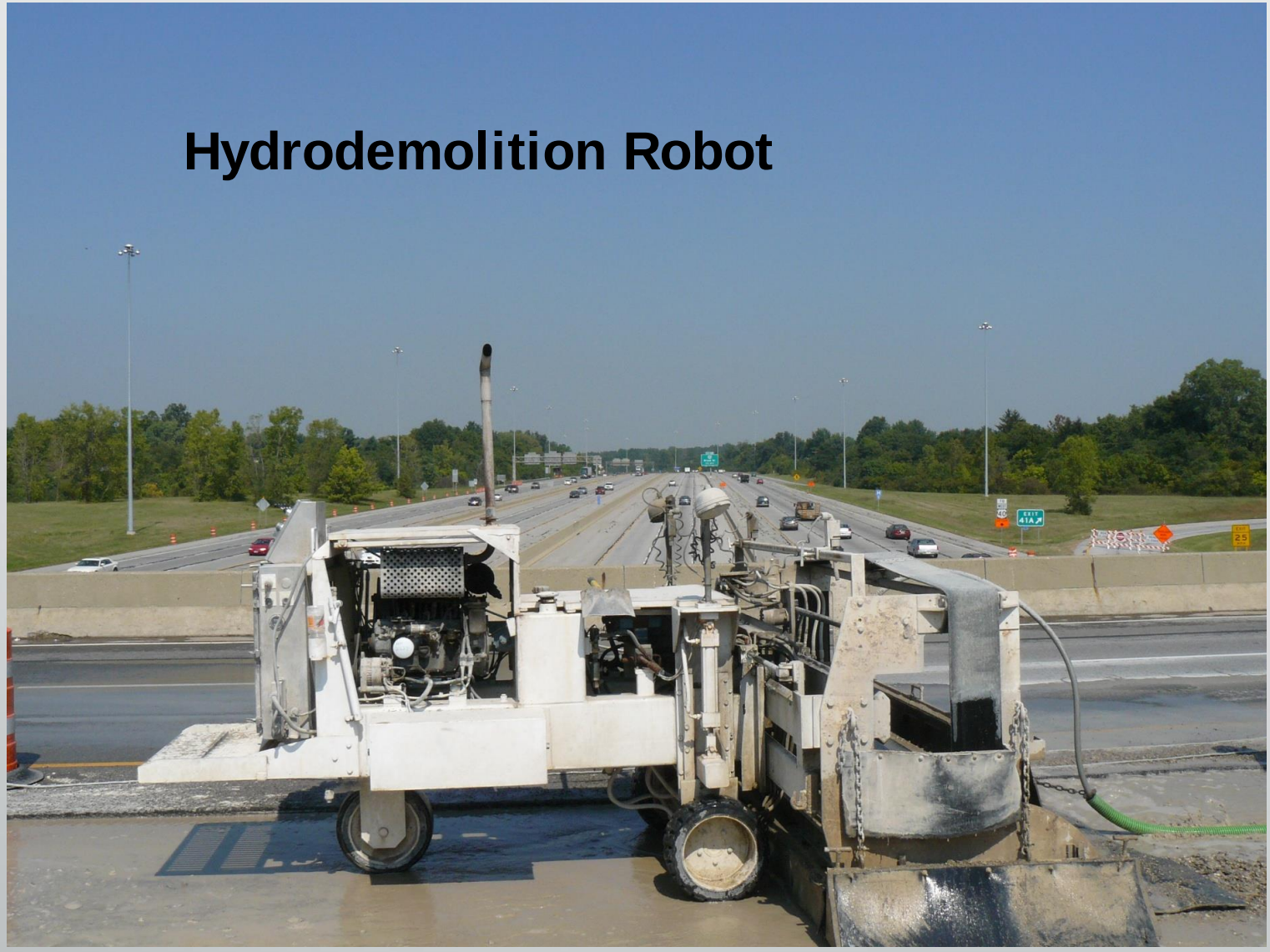

100% American Owned Corporation
team
Hydro Tech
Hydro Excavation Services
812.285.HYDRO
Quantity & Service Creates It's Own Demand


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 Vac Units

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

Vacall Surface Unit

Vacuum Tube Unit

Method 1 – Fast Track Hydrodemolition & Concrete Overlays of Bridge Decks (most common)

- Ohio 848 Specs
- Cost Range - $20 to $50/sy
- Production – 750 sy to 1200 sy / shift (based on calibration)
- Always milling first – remove existing o/l's.
- Highly rough and bondable surface + Selectively removes deteriorated concrete at variable depths.
- Reduces Chloride Ion concentrations in the deck.
- Stone is not cut – aggregates are protruding.
- Exposes and cleans reinforcing steel. Will not damage or dislodge reinforcing steel.
- Water Supply / Control

Selecting the Right Decks for Hydrodemolition / Concrete Overlays

- Bridge Deck Inspections + Bridge Data

  (National Bridge Inspection Standards)
- NBI Condition Ratings 3 through 9 = LMC Overlay
- Four times a LMC Overlay is used

NBI Rating	Description	Repair Action
9	Excellent Condition	None
8	Very Good Condition	None
7	Good Condition	Minor Maintenance
6	Satisfactory Condition	Major Maintenance
5	Fair Condition	Minor Repair
4	Poor Condition	Major Repair
3	Serious Condition	Rehabilitate
2	Critical Condition	Replace
1	Imminent Failure Condition	Close Bridge and Evacuate
0	Failed Condition	Beyond Corrective Action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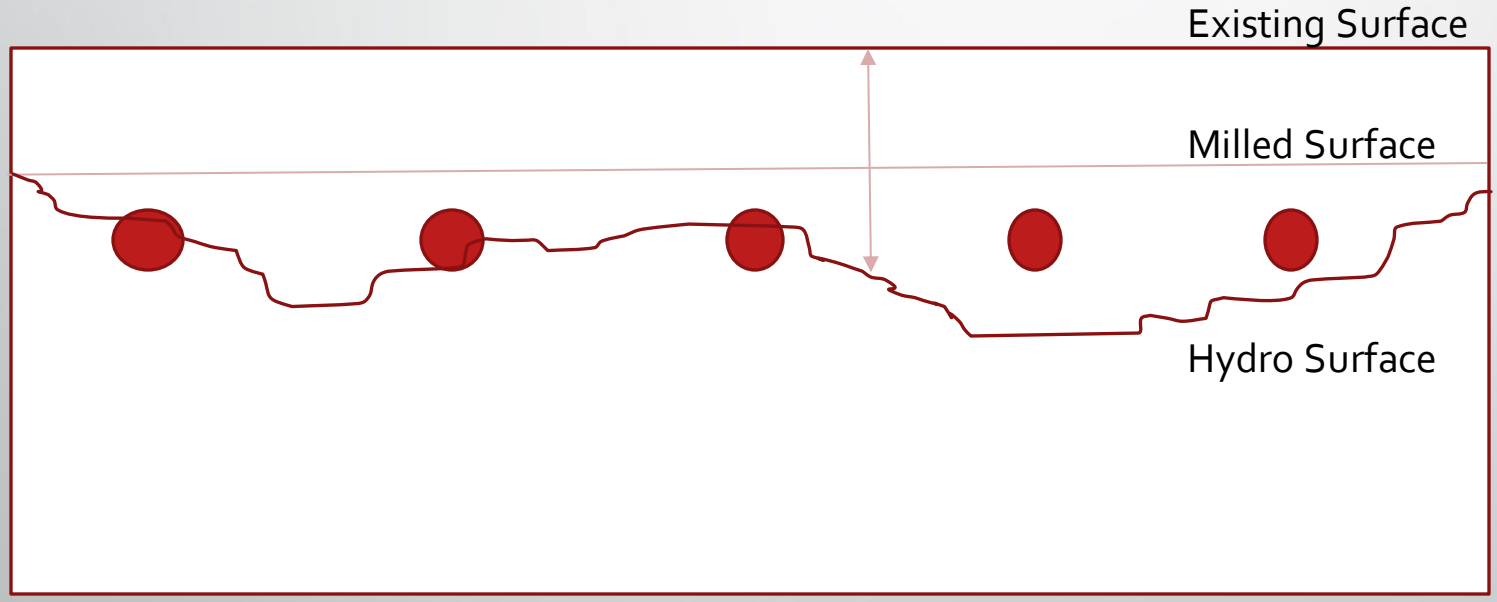
Fast Track Hydrodemolition Surface – ODOT 848 Specifications = Selective Removal



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)

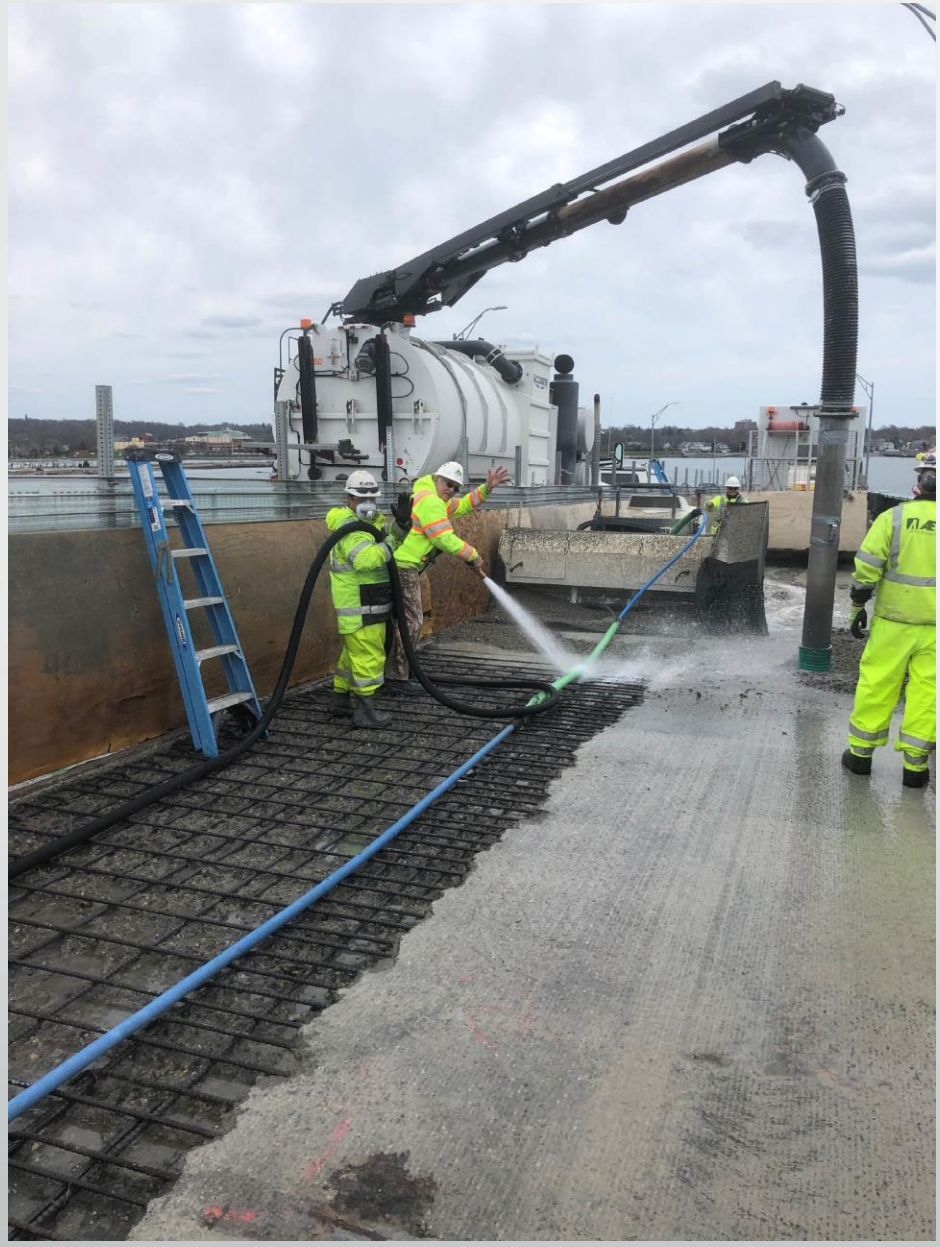
Systematic Approach – utilize bridge deck inspections.

Many LMC Overlays have elapsed 40 years of Service Life.

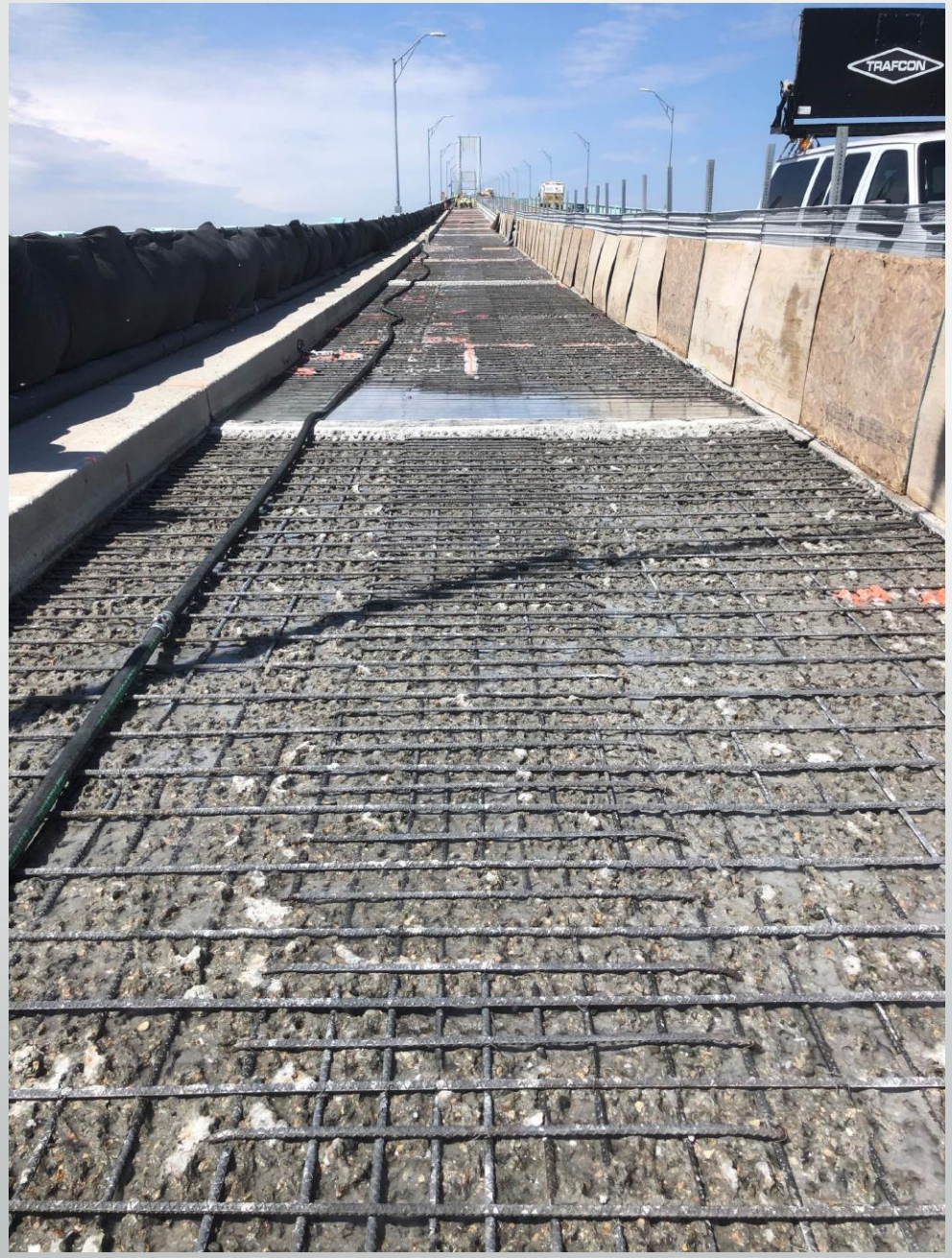
Hydrodemolition Fast Track Video – SCDOT Repairs 16 Bridge Decks in Nine days

Method 2 - Deep Cut Bridge Deck Hydrodemolition

- Cost Range - $150 to $250/sy
- Production – 150 sy to 400 sy / shift
- Milling to top matt of reinforcing steel
- Complete Rebar Exposure
- Exposes and cleans reinforcing steel. Will not damage reinforcing steel.
- Water Supply / Control




GUZZLER


TRAFCON

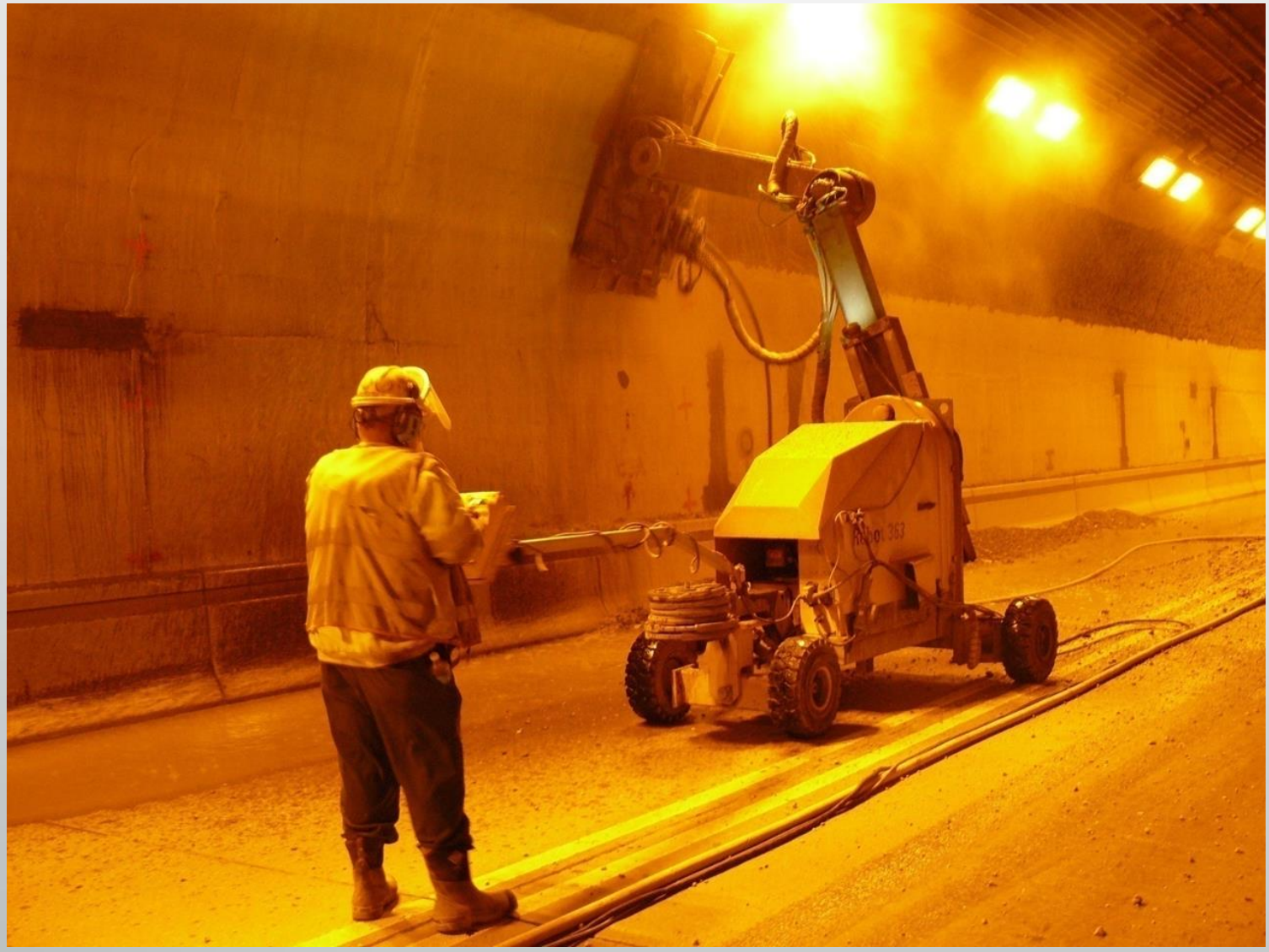
Hydrodemolition Animated Video

Method 3 – Other Hydrodemolition Applications

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


BALTIMORE HARBOR TUNNEL


7114
NO PARKING ANY TIME

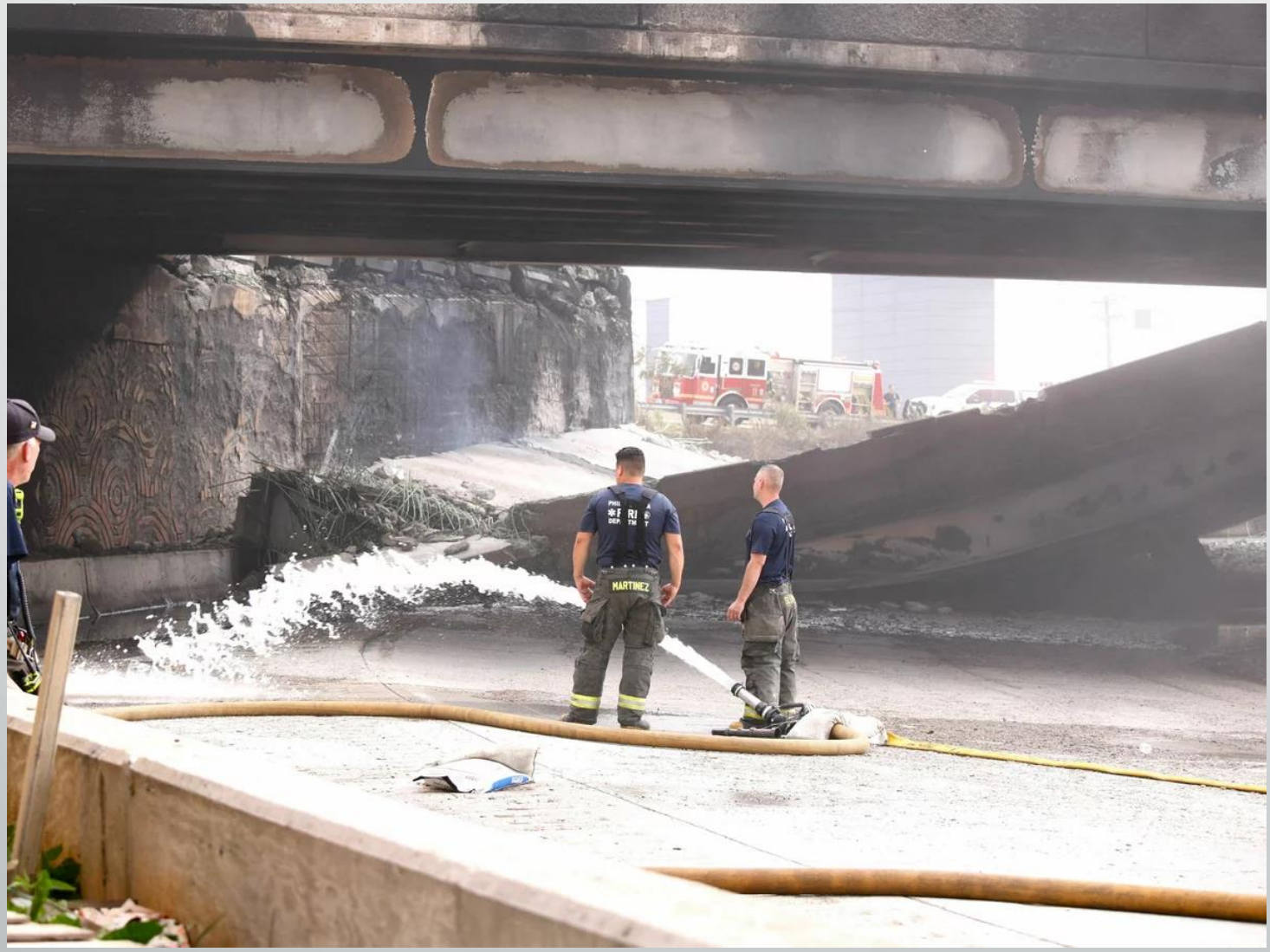


Presentation Project 1

PennDOT – I -95 Fire Damaged Abutment Repairs Philadelphia, PA

- A tanker truck carrying gasoline lost control on an I-95 exit ramp in Philadelphia, PA. The truck exploded into flames directly under the I-95 overpass. I-95 was closed in both directions – an emergency was declared.
- The bridge received extensive fire damage. I-95 was temporarily opened about a week later using a lightweight fill.
- PennDOT made the decision to reface the abutments and to rebuild the beam seats to save time and costs. This would be done in two phases.
- Vertical Robotic Hydrodemolition was used to remove fire damaged concrete at specified depths from the face of the abutments and beam seats.
- 7" depth removal for Abutment 3 (worst one) – other three abutments = 4" depth removal. 30" depth removal for the beam seats.
- Phase 1 vertical hydrodemolition took just under 2 weeks to complete about 8000 sf .

Sunday June 11, 2023 – just after the 6:30 am accident

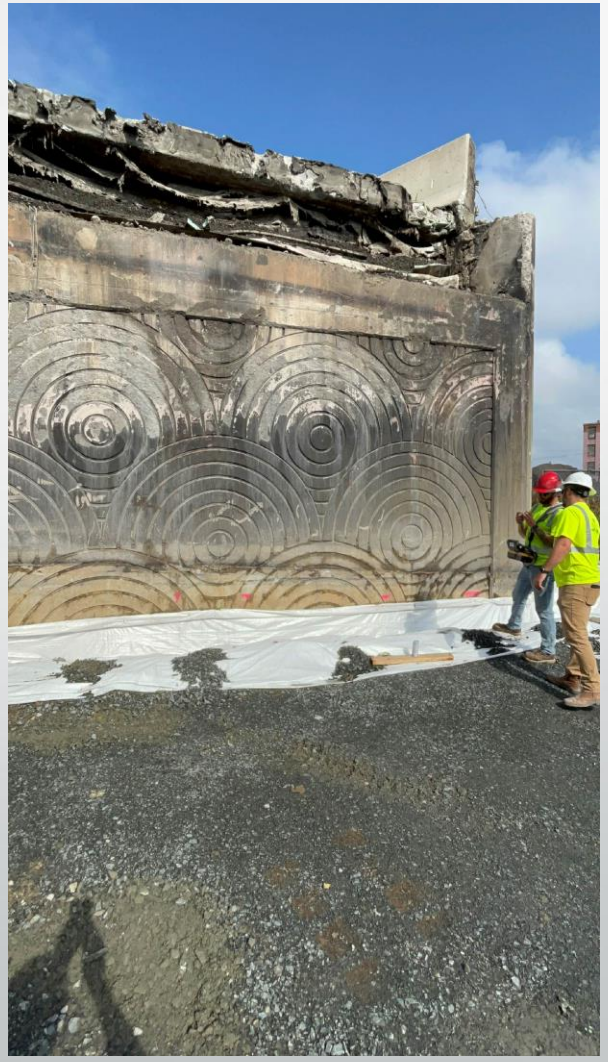

MARTINEZ

Bridge after the flames were extinguished.

Temporary Fill

Installed in just 7 days

Fire Damaged Abutment



Fire Damaged Abutment 3

Worst one = 7" Removal

Fire Damaged Abutment 3

Fire Damaged Abutment 3

Fire Damaged Abutment 4

30” Beam Seat Removals

30” Beam Seat Removals

4” to 7” Fascia Removals

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4” to 7” Fascia Removals

4” to 7” Fascia Removals

Water Control

Completed Abutment 1

Almost Completed Abutment 3

Additional Removals Abutment 3

Presentation Project 2
Franklin County Parapet Refacing
Columbus, Ohio

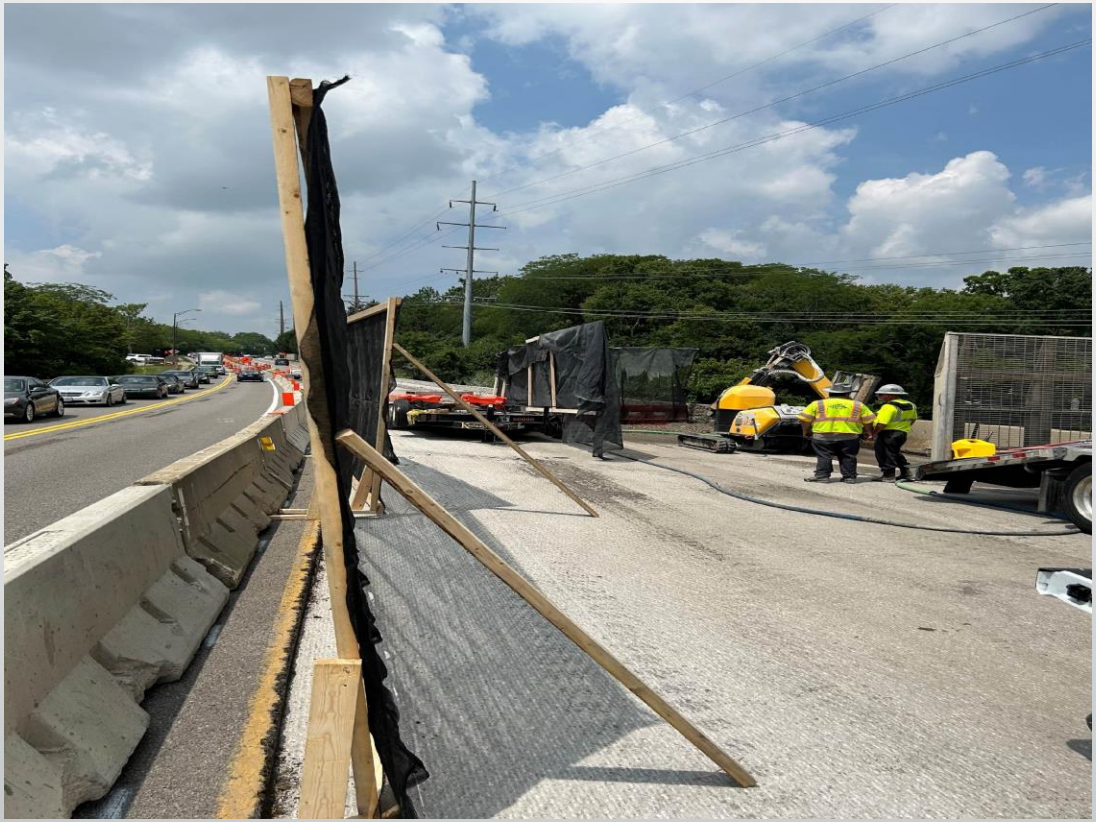
- Franklin County Engineers in Ohio needed to repair a chloride damaged parapet wall on a heavily traveled bridge located over a reservoir.
- To do the work quickly and with the least amount of impact to the environment, FCE made the decision to reface the 810' of parapet wall instead of removing and replacing the wall.
- Vertical Robotic Hydrodemolition was used to prepare the surface by providing a rough and bondable surface while selectively removing deteriorated concrete from the face of the parapet.
- The vertical robotic hydrodemolition took 2 days to prepare 810' of wall.

Existing Parapet Wall

Existing Parapet Wall

Vertical Robotic Hydrodemolition

Vertical Robotic Hydrodemolition



Vertical Robotic Hydrodemolition

Hydrodemolished Wall

Hydrodemolished Wall

Hydrodemolished Wall

Hydrodemolished Wall

Hydrodemolished Wall

Dowel/Rebar Installation

Dowel/Rebar Installation

Refaced Parapet Wall

Refaced Parapet Wall

Questions / Contact Info

Edward M. Liberati, PE

- **Cell – (502)693-3253**
- **eliberati@hughesgrp.com**