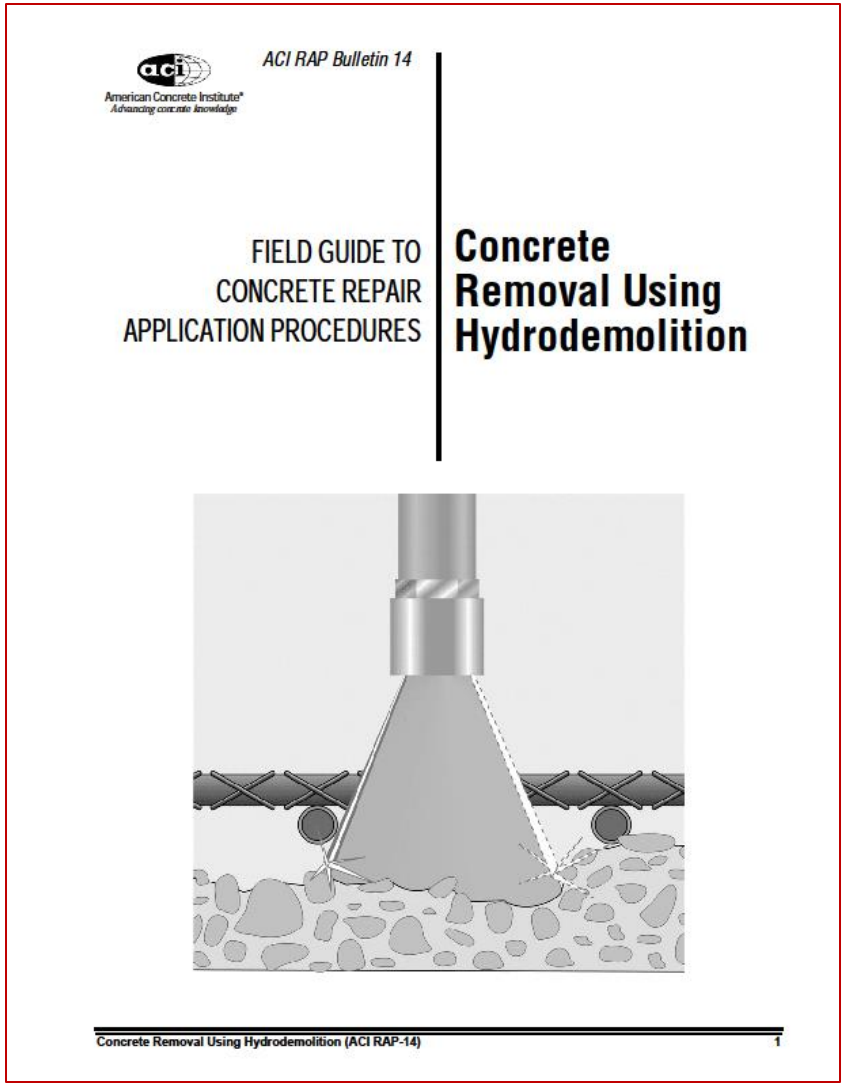
American Concrete Institute

ACI Fall 2018 Convention

Repair Application Procedures and Case Studies, Part 2 of 2

RAP 14 — Concrete Removal Using Hydrodemolition



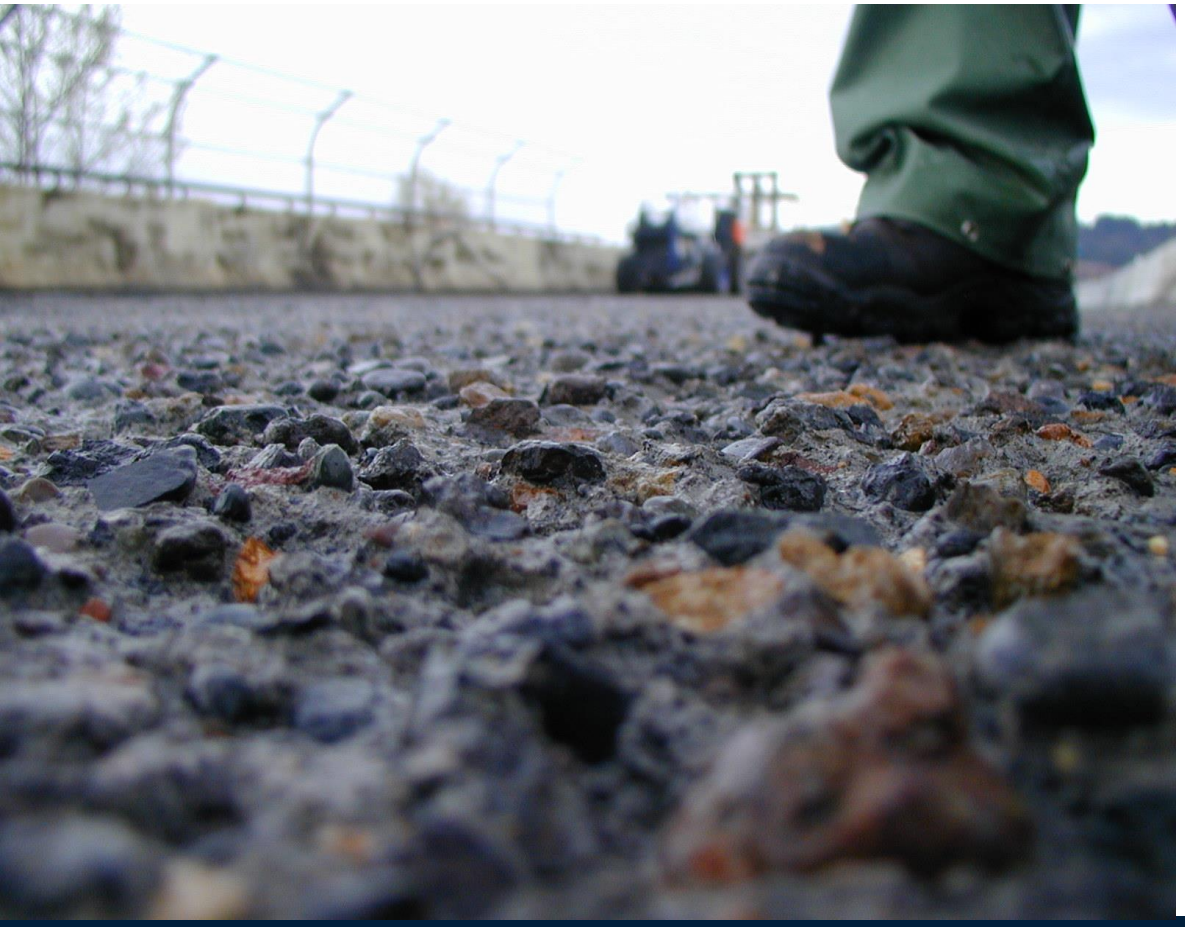
ACI RAP Bulletin 14

American Concrete Institute
Advancing concrete knowledge

FIELD GUIDE TO
CONCRETE REPAIR
APPLICATION PROCEDURES

Concrete Removal Using Hydrodemolition

WHY CHOOSE HYDRO ?



- Superior Surface Preparation
- Removes Unsound Concrete
- Eliminates Microfractures
- Enhances Bond Strength

WHY CHOOSE HYDRO ?

- Eliminates Fatigue and Soft-Tissue Injuries
- Eliminates Silicosis
- No Rebar Damage
- Fast and Efficient

WHEN TO USE HYDRO ?

During a concrete repair project to:

- Remove deteriorated concrete.
- Remove chloride contaminated or carbonated concrete.
- Remove sound concrete when clearance under reinforcing steel is required.
- Remove concrete from around other embedded metal elements; such as anchors, expansion joints, pipe conduit, welded wire mesh.

WHEN TO USE HYDRO ?

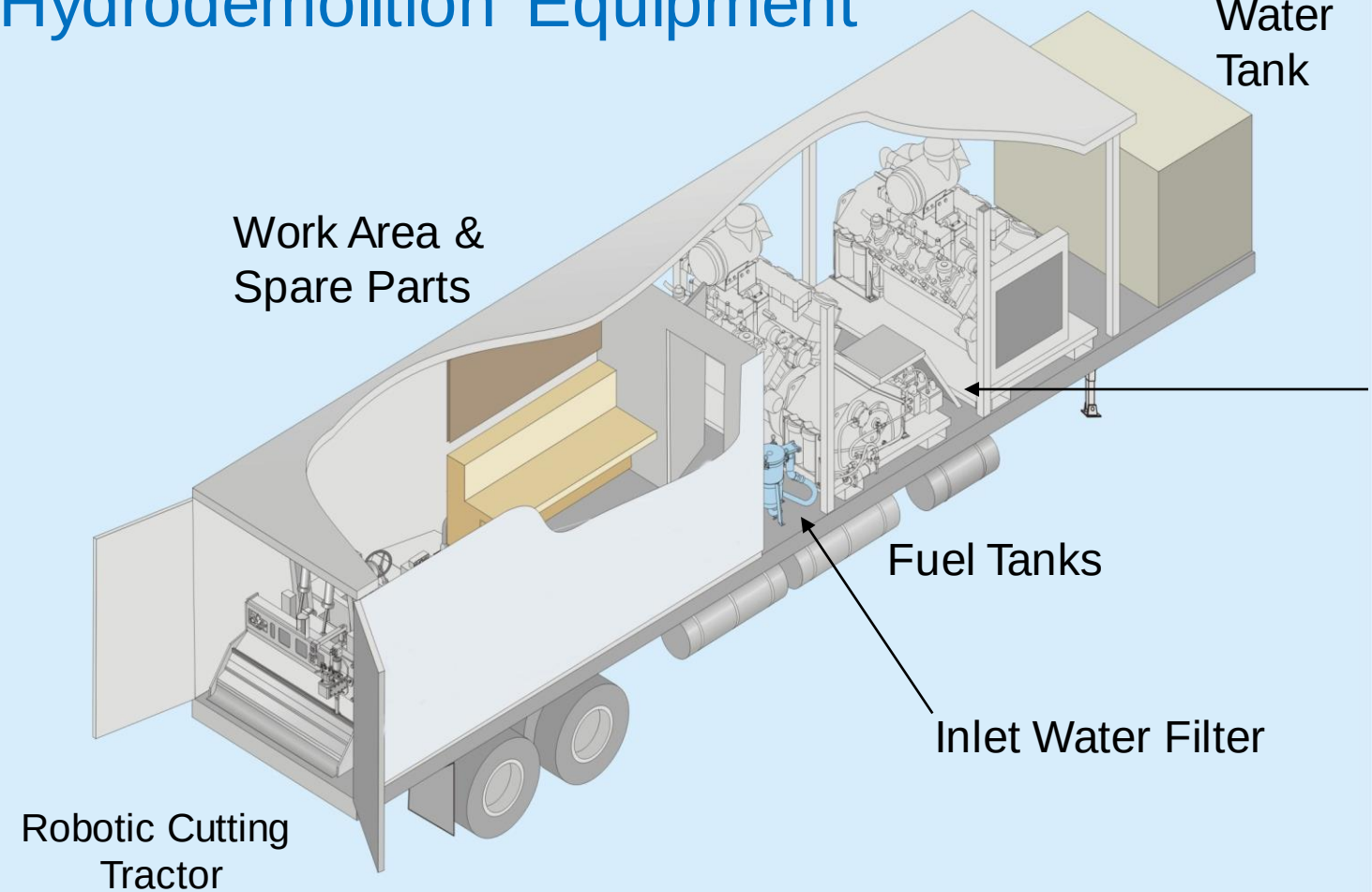
- To minimize mechanical vibrations or impacts to the structure.

- *As final surface preparation if mechanical methods (jackhammers, milling, etc.) are used to remove concrete to eliminate micro-fractures in the substrate.*

HYDRODEMOLITION CONSIDERATIONS

- Ensure wastewater runoff or leakage into surrounding areas can be controlled to avoid damage.
- In post-tensioned structures where water may enter the tendon sheathing and cause long-term durability issues.
- Hydrodemolition may free PT anchorages and lead to personal injury or loss of structural integrity.
- Shoring may be required within a particular structure.

Hydrodemolition Equipment



High Pressure Water Pumps

15,000 – 40,000 psi
7 – 100 gpm

Hydrodemolition Robots

Hydraulic Deck Mower

HAND LANCE OPERATOR

Proper PPE

- Hard Hat with Face Shield
- Suit
- Gloves
- Steel Metatarsal and Shin Protection

HOW IS CLEANUP PERFORMED ?

- Immediately Following Hydro to Prevent Re-Solidification
- Vacuum Equipment (Robotic)
- Water Blasters at 10,000 PSI (69 MPa)

HOW IS CLEANUP PERFORMED ?

- Pressure Washers
- Air Lances
- Skid Steers with Attachments (Power Broom or Bucket)

HOW TO DISPOSE OF WASTEWATER ?

- Highly variable across the nation:
    - Permitting normally required for local sanitary sewer discharge
    - Discharge on ground for evaporation or absorption
    - Never discharge into waterways
- Wastewater initially contains cements fines (~ 10,000–15,000 mg/L) with a pH level between 11 and 13.
- Common sanitary sewer discharge requirements are 300 mg/L (+/- 10%) and pH between 5 -10.
- Best practice treatment systems consist of filtration, settling, and pH neutralization.

HOW TO CHECK THE SURFACE POST-REMOVALS ?

- Verify absence of all bonding inhibitors
- *ICRI Technical Guideline* No. 210.3 “Guide for Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Surface Materials”
- *ASTM* C1583/C1583M “Standard Test Method For Tensile Strength of Concrete and the Bond Strength…”

SAFETY ! SAFETY ! SAFETY !

- Equipment should be operated by individuals experienced in the use and maintenance of the equipment.
- High Pressure and Ultra High Pressure water jet systems can cause serious injury or death.
- Always shield equipment to minimize possibility of flying debris.
- Electrical conduits should be de-energized.
- Areas below the work area must be closed.
- All personnel in the work area must wear Personal Protective Equipment (PPE): safety glasses; hearing protection; hard hat; long pants; long sleeve reflective vest; steel toe or composite boots; gloves.

PRECONSTRUCTION MEETING

With Representatives from all Participating Parties (Owner, Engineer, Contractor, etc.):

- SAFETY of all personnel, property and equipment.

- Location and layouts of the following:

  a) Work area, including schedule
  b) Shoring (if applicable)
  c) Hydrodemolition equipment
  d) Water supply, including any required permits
  e) Exhaust system (if applicable)
  f) Fuel system, including deliveries
  g) Wastewater containment system, including treatment methods, testing/permitting
  h) Debris removal equipment, including drive lanes

Thank you

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