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Revision of Section 202 Removal of Portions of Present Structure (Class 2) (Hydrodemolition)

Revise Section 202 of the Standard Specifications for this project to include the following:

Description

This work consists of total bridge deck surface preparation over the entire top surface of the bridge deck using hydrodemolition.. The work includes removing sound concrete to a constant minimum depth, as shown on the plans, and selectively removing unsound concrete at variable depths to provide a rough, bondable surface.

Qualifications

At least 10 working days before the start of work, the Contractor shall submit written documentation proving experience with at least ten successful and verifiable projects similar in size and scope to this work within the last three years. Perform work under the immediate control of a supervising person experienced in this type of work. The supervising person shall have supervised five verifiable projects of similar magnitude and type. The supervising person shall be present during all operations. The hydrodemolition system shall be operated by an operator trained and certified by the equipment manufacturer and have a minimum of two years of experience with the machinery used for the performance of the hydrodemolition.

The documentation for the Contractor, supervising person, and operator shall include the following:

- (1) Years of Experience with hydrodemolition of bridge decks
- (2) Project names and construction dates
- (3) List of bridges and deck areas
- (4) Reference name and contact information for owner representatives
- (5) Certification by equipment manufacturer as applicable

Construction Requirements

(a) *Hydrodemolition Equipment.* The hydrodemolition equipment shall consist of a water supply system, a high-pressure water pumping system, a demolition unit, and a vacuum system capable of quickly removing all debris generated by the demolition unit and water supply system. The equipment shall be a computerized, self-propelled robotic machine that utilizes a high-pressure water jet stream capable of selectively removing the unsound concrete and the sound concrete to the minimum depth specified and attaining pressures in the range of 13,000 to 20,000 PSI. Also, it shall be capable of cleaning rust and concrete particles from all exposed reinforcing steel. The machine shall have

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forward and backward motion capable of moving the water jet transversely across the concrete surface.

The equipment shall be capable of removing all unsound concrete at variable depths and all sound concrete to the depth of removal specified in the plans. A single pass shall achieve all removal.

At least 10 working days before the start of work, the Contractor shall submit a method statement including;

- A list of all equipment to be used in the hydrodemolition process.
- The manufacturer's certification that the hydrodemolition equipment is intended for use on bridge decks; and
- The equipment can complete the work as described in a single pass.

Hydrodemolition shall not begin until the Engineer's written approval of these documents is received.

(b) Calibration. The hydrodemolition equipment shall be calibrated on an area of sound concrete having dimensions of seven feet by seven feet, as designated by the Engineer to demonstrate the desired surface removal and roughness. The hydrodemolition equipment shall then be moved to a second area (seven feet by seven feet) that is unsound, as designated by the Engineer, to demonstrate the ability to selectively remove all unsound concrete without damaging the adjacent sound concrete during the initial pass and providing a rough and bondable surface.

A qualified Manufacturer's representative shall be present on the project site during the calibration and the hydrodemolition surface preparation demonstration. Remove the equipment from the project site if it does not demonstrate the ability to produce the desired results, as deemed by the Engineer. The Contractor shall provide other equipment for calibration and demonstration. No additional contract time or compensation will be allowed for re-mobilization and the re-calibration process if required.

The hydrodemolition total bridge deck surface preparation may begin after the Engineer has approved the calibration and has confirmed the equipment and its associated settings remove the sound concrete to the depth shown on the plans while simultaneously removing unsound concrete.

After attaining the designated level of removal, record and maintain the settings throughout the hydrodemolition operation. The calibration procedure specified shall be required on each structure, each time hydrodemolition is performed. Check the minimum depth of removal and document readings every 30 feet along the cutting path. If

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necessary, re-calibrate the equipment to ensure the minimum removal of sound concrete to achieve the desired roughness for a bond, as approved.

- (c) *Special Traffic Considerations.* Removal operations shall be conducted to protect and minimize interference with the traveling public using the structure. Traffic shall continue to operate in at least one lane on the structure during construction when called for on the plans. Hydrodemolition shall not impede or interfere with traffic in the vicinity of the work. The Contractor shall provide shielding, as necessary, to ensure containment of all dislodged concrete and water spray within the removal area to protect the traveling public from flying debris both on and under the work site. If the Engineer approves nighttime work, the Contractor shall provide adequate lighting as required for nighttime removal. Avoid allowing hazardous glare in the direction of oncoming traffic.
- (d) *Hydrodemolition.* The Contractor shall apply hydrodemolition to the entire bridge deck. Remove all unsound concrete as shown on the plans or as directed by the Engineer. As approved, only remove sound concrete to the depth shown on the plans to achieve a rough and bondable surface. Unless shown on the plans, do not remove concrete below the bottom of the slab around concrete girders and diaphragms.

The Contractor shall provide and use potable water for hydrodemolition. It is the Contractor's responsibility to contact and make the appropriate arrangements with the area water company for the use of water.

Completely remove and dispose of all debris resulting from hydrodemolition outside the project limits per all applicable regulations. Perform cleaning of the hydrodemolition debris using a vacuum system equipped with fugitive dust control devices capable of removing wet debris and water in the same pass. Then blow dry the deck with filtered, oil-free compressed air to remove excess water. Complete cleaning promptly, before debris and water are allowed to dry on the deck surface. This operation shall leave a clean surface suitable for immediate repair. The Contractor shall carefully remove debris that is allowed to re-settle or re-adhere to the surface of sound concrete at no additional expense to the Department.

The Contractor shall take all steps necessary to prevent cutting or otherwise damaging reinforcing steel, including any vertical stirrups structural steel, and welded shear connectors projecting into the bridge deck. All bars or shear connectors damaged by the Contractor's operations shall be repaired or replaced at the Contractor's expense with no allowance for contract time extension.

The Department will pay to replace any bar that has lost more than 25 percent of its cross-sectional area due to deterioration as approved by the Engineer. Replacement shall be made by lap splicing as shown in the plans, on each side of the deterioration, with

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new bars of the same size. New reinforcing bars shall have a minimum of 1-inch clearance around each bar.

The clearance requirement around the existing reinforcing steel will be waived where the bond between exposed reinforcing steel and sound concrete has not been compromised. It is acceptable to have partially exposed reinforcing.

Stop the work and adjust to correct the problem if the Engineer determines that the equipment is not working correctly or compromising the structure's integrity at the Contractor's expense. Before making repairs, the Contractor shall submit a methods statement describing the corrections or repairs to the equipment. Repair work shall not begin until the Engineer approves.

- (e) *Deck Blowout.* The Contractor shall immediately stop the equipment, prevent the water flow through the hole with sandbags or other approved methods, and notify the Engineer if removal blows completely through the bridge deck (blowout).
- (f) *Containment.* The Contractor shall be fully responsible for preventing debris and effluent from falling into rivers, streams, waterways, pedestrian areas, traffic areas, or railroad tracks. The Contractor shall provide secondary containment below the bridge to protect these areas and the river bottom outside the active channel from debris and effluent escaping from the removal process. All captured material shall become the property of the Contractor for off-site disposal. The Contractor shall provide a method statement to describe and show details of the containment. Provide the method statement to the Engineer for review and comment four weeks before starting hydrodemolition work. All penalties resulting from debris contamination shall be at the Contractor's expense.

The Contractor shall take necessary precautions during hydrodemolition to prevent damage to the remaining structure and adjacent property due to runoff. All deck drains shall be temporarily blocked, and water shall be prevented from running over or leaking through the existing bridge deck joints.

The Contractor shall control dust and runoff per applicable governmental agencies. The Contractor is responsible for the proper disposal of all material removed, including but not limited to, material collected by vacuuming the deck.

- (g) *Water Quality Control.* Water quality control shall conform to subsection 107.25. The Contractor shall be responsible for all labor, materials, equipment, and supervision necessary to treat the hydrodemolition wastewater to meet the State and local discharge requirements, including but not limited to:

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1. Transportation, treatment, and disposal of hydrodemolition wastewater, including all temporary drains, piping, pumps, filters, debris and effluent containment, and containment tanks for a complete and operational system.
2. Reduction of the PH level of the wastewater per State regulations.
3. Reduction of the total suspended solids per State regulations.

The Contractor shall be responsible for compliance with all environmental laws and regulations regarding the water discharge into the environment. Provide specific details showing the method of water and debris collection, filtering, treatment, and legal disposal. The disposal of all concrete debris and securing any applicable permits which may be required is the Contractor's responsibility.

Do not permit the hydrodemolition runoff water or any debris to enter a waterway of the State of Colorado. The Contractor shall adhere to subsection 107.25.

- (h) *Limitations on Equipment Staging.* The Contractor shall take steps to prevent damage to existing reinforcing steel and shall not place wheels from heavy equipment, such as vacuum trucks, on deck areas where the top layer of slab reinforcement has been left unsupported by the hydrodemolition process. Operate equipment at speeds and in a manner that will not cause damage to girders and portions of the deck that are to remain. Do not permit vehicles other than approved construction equipment on deck sections where hydrodemolition is being or has been performed.
- (i) *Other Demolition.* To remove remaining unsound concrete, use hand-held high-pressure wands or 15-pound maximum jackhammers operated at no more than a 45-degree angle from horizontal, in areas inaccessible to the hydrodemolition equipment or for preparing deck repair areas requiring minor trim work to remove. Jackhammers can be started vertically but shall be immediately positioned as described above for concrete removal.
- (j) *Sounding.* After hydrodemolition and appropriate cleaning, perform sounding once the deck is clean, dry, and frost-free. The Contractor shall sound the bridge deck for delamination per ASTM D4580. Mark the areas of deteriorated concrete to be removed as directed by the Engineer.
- (k) *Removal of Remaining Unsound Material.* Where existing patches have deboned or previous unsound overlay material is found below the top mat of reinforcing steel, remove that material using pneumatic hammers or hydrodemolition. Sound bonded patches may remain. Remove any loose or deteriorated concrete that remains after hydrodemolition to sound concrete. Perform Class 3 Removal as required and as defined in the plans.

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(l) *Final Cleaning Before Placement of New Concrete.* Perform this work in conjunction with the installation of the Bridge Deck Overlay. After completion of hydrodemolition and associated clean-up of debris, but not more than 12 hours before the overlay placement, thoroughly clean the entire deck surface by either abrasive blasting or high-pressure water blasting (7,500 psi minimum). All horizontal and vertical surfaces to which the overlay is to bond, including exposed reinforcing steel, shall be blasted clean. Upon cleaning, thoroughly saturate the deck surface to the point that the surface does not dry out and remove any excess water with compressed air. Then, use clean polyethylene sheeting to cover the deck entirely until pouring the overlay. If the deck is allowed to dry out, it shall be re-blasted at the Contractor's expense. No ponding of water is allowed.

Method of Measurement

Removal of Portions of Present Structure (Class 2) (Hydrodemolition) will not be measured but will be the accepted quantities specified in the plans, removed to the required depths specified on the plans and these provisions.

Basis of Payment

The accepted quantities will be paid for at the contract unit price.

Payment will be made under:

Pay Item	Pay Unit
Removal of Portions of Present Structure (Class 2) (Hydrodemolition)	Square Yards

Payment for Removal of Portions of Present Structure (Class 2) (Hydrodemolition) will be total compensation for all work, materials, and equipment required to prepare the bridge deck for overlay, including removal and disposal of debris and effluents, vacuuming, shielding, water quality control, and jack hammering as needed.

Class 3 Removal as defined in the plans will be paid for as Removal of Portions of Present Structure Class 3.

Containment of debris and effluent will not be paid for separately but shall be included in the work.

All water required for hydrodemolition will not be measured and paid for separately but shall be included in the work.

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Payment for the new reinforcement steel will be made per Section 602. Payment for the mechanical splice will be as the weight of reinforcing steel for the designated lap splice for that bar size.

Traffic control will be measured and paid for per Section 630.

Instructions to Designers (delete instructions and symbols from the final draft):

Use this project special provision when hydrodemolition is required or optional to remove the top portions of a bridge deck. This method of hydrodemolition is called “Deep Cut” because, at a minimum, the top half of the bridge deck is removed and classified as Class 2 Deck Removal/Repair.

Use Concrete Class DT (Deck Topping) to replace the bridge deck material removed by this method.

Use Revision of Section 202 Removal of Asphalt Mat (Planing) (Special) to remove the top 1/2” of the deck surface deck. This is required before the hydrodemolition process and reduces the water pressure required for hydrodemolition.

This is an aggressive and invasive form of removal and should be discussed with the Region and Staff Bridge before including in a repair project.

Special consideration should be given to any bridge with post-tensioning.

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Permanent Changes to Project Dated Special Provisions

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<u>Date</u>	<u>Author</u>	<u>Description of Change</u>
1/14/19	BPM Cons.	Initial Website Issue
11.1.21	M. Kayen	Revisions to grammar, format as per CDOT Style Guide (4.22.21)
04.06.2023	M. Kayen	Revisions to make spec online accessibility-compliant. 5.22.23 Additional accessibility work.