

STATE FUNDED PROJECT ATTACHMENT 12

DIVISION 200 – EARTHWORK

SECTION 201 – CLEARING SITE

201.01 DESCRIPTION THE FOLLOWING IS ADDED:

This Section also describes the requirements for removing existing bridge overlays, and for utilizing hydro-demolition (used interchangeably with hydrodemolition) to remove at least ½ inch of concrete deck to be removed (or as shown on the Plans) measured from the top of highest aggregate of sound concrete and all unsound material to prepare existing structural slabs and approach slabs for a specialized concrete overlay. Provide a highly rough and bondable surface using the hydrodemolition equipment. Exposure of reinforcement is not required but may occur depending on the condition of the existing concrete. This section also includes the milling and subsequent hydrodemolition required for transition areas.

201.02.01 Materials THE FOLLOWING IS ADDED:

Polyethylene Sheeting..... 919.12

THE FOLLOWING SECTION IS ADDED:

201.02.02 Equipment

Milling Machine 1008.01

Hydro-demolition Equipment1008.07

201.03.02 Clearing Site, Bridge and Clearing Site, Structure THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH:

The work to be performed under clearing site, bridge (multiple structures) includes removal and disposal of bridge overlay material and deck joint removal with full depth removal of concrete at deck joints only for the structures identified on the Plans. Removal is to be carried out in stages as indicated in the Plans. Submit calculations (if needed) and working drawings, sealed and signed by a Professional Engineer licensed to practice in New Jersey, for the methods of demolition including equipment, materials, and any special methods of removal and/or disposal. Methods that may require permitting and/or special coordination and approval of any regulatory Agencies are entirely the Contractor's responsibility. Submit a demolition plan detailing the methods and equipment to be used to the Engineer for approval 30 days before mobilization for demolition operations.

This item also includes the reconstruction of hot poured joints and milling and resurfacing of approach asphalt adjacent to hot poured joints, as shown on the Plans, for a minimum width of 1'-0".

201.03.09 Temporary Shielding THE FOLLOWING IS ADDED:

Make all necessary efforts to prevent debris from falling into the areas adjacent to or below the work area. Safely remove any debris falling outside the work area immediately. If found to be required, in areas other than covered by the limits identified on the Plans, the cost of providing temporary shielding such as tarpaulin or an approved equal, will be included in the item "Temporary Shielding". Develop a contingency plan to collect any material that escapes the temporary shielding immediately surrounding the work area.

Submit for approval detailed working drawings showing all elements of the temporary shielding system, including design calculations as necessary, demonstrating compliance with OSHA scaffold requirements if it will be used as a platform for workers. Sign and seal the calculations by a Professional Engineer licensed in the State of New Jersey. The selection of sizes, materials, their arrangements, and details shall be the Contractor's option and responsibility, but subject to approval by the Engineer.

At a minimum, provide temporary shielding for a longitudinal distance of 5' on either side of the deck joints, or a total distance of 10' centered at each deck joint, for the full width of the work zone. Provide additional shielding if needed to properly contain debris based upon the Contractor's proposed demolition and hydrodemolition procedures. Provide

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vertical shielding the full length of the bridge if needed to contain the Contractor's proposed methods for existing overlay and/or existing deck removal to protect active traffic lanes or environmentally sensitive areas.

THE FOLLOWING SECTION IS ADDED:

201.03.10 Hydro-demolition

- A. Working Drawings.** At least two weeks prior to the employment of any hydrodemolition equipment, submit to the RE, for Certification, a comprehensive plan for the proposed hydrodemolition operations and procedures.

Within this plan demonstrate how all deck surfaces will be prepared to the removal depths specified, including locations at stage lines, parapets, sidewalks, construction joints and/or headers.

- B. Construction.** Remove existing overlays using mechanical milling or other means that does not damage the concrete deck prior to hydrodemolition surface preparation. Final ½ inch must be removed using hydrodemolition. The top surface of the concrete deck may be mechanically milled if desired, and if applicable, to within 0.5-inch of the final removal depth. If milling the deck surface is pursued, use equipment for removal of existing overlays and concrete as specified in Section 1008.01. Prevent damage to the existing reinforcing steel and the existing concrete deck that is to remain, repair any damage to permanent elements to the satisfaction of the RE at no additional cost to the Department. Within the working drawing submittal, propose a pressure for the hydro-demolition operations that will remove the desired concrete, and avoid damage to reinforcement steel.

Provide inlet seals using polyethylene sheeting (or other approved material) as part of this work to prevent debris and water from the hydro-demolition process from entering the drainage system.

- C. Calibration of Hydrodemolition Equipment.** Remove all construction debris, milling debris, and dust from the bridge deck prior to calibration and commencement of the hydrodemolition surface preparation operation.

Calibrate the equipment on 2 sections designated by the RE to demonstrate that equipment, personnel, and methods of operation can produce satisfactory results before the start of the removal operations via hydrodemolition. On a 7-foot x 7-foot area of sound concrete as designated by the RE, calibrate the hydrodemolition equipment to remove 95% of the concrete surface in one pass, removing 0.5-inch minimum depth of sound concrete and all unsound concrete. Move the hydrodemolition equipment to a second 7-foot x 7-foot area that is deemed unsound, as designated by the RE, to demonstrate the ability of the equipment to remove all unsound concrete and provide a highly rough and bondable surface. Where removal of greater than 0.5" inches is required repeat the calibration equipment test for each separate removal depth and approved by the RE before proceeding with work.

If the equipment does not provide satisfactory results, repeat the above calibrations. If satisfactory results cannot be obtained within three attempts, remove the hydrodemolition equipment from the project site and provide another hydrodemolition unit for calibration.

Employ a representative of the hydrodemolition equipment company to provide on-site guidance to the Contractor with the calibration. After successful calibration, provide the RE with a listing of the equipment settings including:

1. Water pressure gauge
2. Machine staging control (step)
3. Nozzle size
4. Nozzle speed (travel)
5. Water flow rate

The calibration procedure specified is required for each separate span of a structure or once per week, whichever is greater.

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Begin the hydrodemolition surface preparation operation only after the RE has approved the calibration.

D. Hydrodemolition Water.

1. **Water Filtration and Disposal.** At least two weeks prior to the employment of any hydrodemolition equipment, submit to the RE, for approval, a comprehensive plan for the filtration and disposal of hydrodemolition water.

Within this plan demonstrate how all debris particles will be removed from hydrodemolition water, prior to its being introduced into any lake, river, stream, or any drainage system which empties into a lake, river or stream. Water used for the hydrodemolition will be considered debris that must be removed.

Use of the existing bridge or roadway drainage system for hydrodemolition water disposal will not be permitted.

As specified in N.J.A.C 7:9B or other applicable jurisdictional regulations, provide filtration to release clean and clear water into adjacent streams or other waterbodies. Install floating turbidity barriers where the basin outfall flows into a receiving waterbody. Ensure that the outfall of the basin does not cause erosion to or scour of the area onto which the water is being discharged.

Dispose of the wastewater and spoils off-site at an authorized treatment or recycling facility. Disposal into storm or sanitary system is strictly prohibited.

2. **Water Retention.** Prevent hydrodemolition water from running onto, or over all portions of the project site not immediately subject to hydrodemolition work. In addition, provide shielding, acceptable to the RE, that protects traffic and prevents all debris from escaping the immediate work location. Submit a comprehensive plan for accomplishing these requirements to the RE for approval at least two weeks prior to the beginning of any hydrodemolition work.

Use of the existing bridge or roadway drainage system, for this purpose, will not be permitted.

Prevent hydrodemolition water from entering adjacent inlets.

The plan for this work may be submitted as part of the hydrodemolition water disposal submittal.

3. **Adherence.** Once approved strictly adhere to the water disposal, as well as the water retention, plans. Should the RE determine that these plans are not being followed as approved, the Contractor will be required to immediately cease work until the conditions are rectified in a manner satisfactory to the RE.

Should the Contractor fail to rectify the situations to the RE's satisfaction, the RE may require the Contractor to use different hydrodemolition equipment.

No extension of time will be granted, nor will any additional compensation be granted, for either the ceasing of work, or the substitution of equipment, if either one is required as a result of the Contractor's failure to follow the approved plans.

- E. **Concrete Removal and Cleaning.** Perform hydrodemolition over the entire top surface of the structural slab to provide a rough and bondable surface. Remove a minimum 0.5-inch of concrete or to the depth specified in the plans, and any unsound concrete, using one hydrodemolition pass. Stop the surface preparation operation if it is determined that sound concrete below the removal depth is being removed or unsatisfactory results are being obtained. Perform recalibration or changes to equipment and method as necessary to maintain acceptable removal results.

After the hydrodemolition surface preparation operation has completed the initial pass, and the deck is dry and frost free, sound the deck in the presence of the RE to ensure all unsound material has been removed. Remove unsound materials detected by the RE at no additional cost to the Department. Remove any unsound concrete or original slab surface remaining after the hydrodemolition pass using additional hydrodemolition passes. Use a hydrodemolition hand lance operated at no more than a 45-degree angle from horizontal in areas that are inaccessible to the

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hydrodemolition equipment. Pneumatic hammers may only be used in inaccessible areas for removals greater than 0.5-inch thick, and the final 0.5-inch thick removal must be performed by a hydrodemolition hand lance. Unsound concrete is defined as existing structural slab concrete that is deteriorated, unbounded, or spalled.

Clean the hydrodemolition and any milling debris with a vacuum system equipped with fugitive dust control devices and capable of removing wet debris and water all in the same pass. Remove all standing water with oil-free compressed air. Perform cleaning in a timely fashion before the debris and water is allowed to dry on the deck surface. Remove any material allowed to dry at no additional cost to the Department. Splice or replace any reinforcing steel damaged or dislodged by these operations with the same size bar, at no additional cost to the Department.

Where reinforcing steel is exposed and the steel is not bonded to the concrete, remove any concrete to clear at least 0.75 inch around the exposed bars. Unbonded bars will be identified by the Contractor or the RE, and verified by the RE if applicable. Less than one-half of the bar perimeter may be exposed and still be determined to be bonded. Do not use chipping hammers heavier than 15 lbs. to remove concrete. Take extreme care to ensure that no damage is done to any reinforcing bars exposed during the removal process and the contractor must submit a corrective action plan if any reinforcements were damaged. Remove all loose concrete around reinforcing bars. Water blast clean any exposed reinforcement with a 7,000-psi water jet within 48 hours prior to placement of new concrete.

Where hydrodemolition results in excess removal of concrete, provide sketches of excess removal to the RE for approval. If hydrodemolition equipment over excavates the bridge deck, the RE will require the Contractor to conduct another calibration or replace the equipment. Repair the approved limits for patching up to the plan removal depth following the requirements of Section 551.03.01 and as modified by the contract drawings using UHPC or Class A concrete, except curing will be a minimum of 24 hours prior to any other concrete placement work. Use UHPC to repair patches 2-inches deep or less during the UHPC overlay placement operation. Place set retarder on the top surfaces of repair patches during concrete placement and wash the top surfaces using water jets no sooner than after the patches reach final set to remove the surface paste and expose the aggregate (in concrete) or the fiber (in UHPC). Delay washing or use a lower water pressure to ensure that the aggregate or fiber is not loosened or completely removed.

Repair material designated to be left in place which is damaged by the debris removal work in a manner satisfactory to the RE at no cost to the Department.

Dispose of all concrete and debris, vacuuming, water control, additional jack hammering and concrete hand removal, installation and removal of inlet seals, and cleaning and any other work incidental to the work shown on the Plans necessary to prepare the structural slab and approach slabs (if applicable) for the placement of a specialized overlay.

201.04 MEASUREMENT AND PAYMENT THE FOLLOWING IS ADDED:

<i>Item</i>	<i>Pay Unit</i>
HYDRO-DEMOLITION	SQUARE YARD

The Department will not make payment for the Item CLEARING SITE in excess of \$50,000 until Completion.

The Department will not make payment for the Item CLEARING SITE, BRIDGE (STRUCTURE NO. 2106-164) in excess of \$15,000 until Substantial Completion.

The Department will not make payment for the Item CLEARING SITE, BRIDGE (STRUCTURE NO. 0914-155) in excess of \$90,000 until Substantial Completion.

The Department will not make payment for the Item CLEARING SITE, BRIDGE (STRUCTURE NO. 1430-153) in excess of \$34,000 until Substantial Completion.

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The Department will not make a separate payment for furnishing, installing, maintaining, and removing any type of temporary shielding, but the costs thereof shall be included in the lump sum price bid for "TEMPORARY SHIELDING".

The Department will make payment for any shielding during hydro-demolition under the item "TEMPORARY SHIELDING".

The Department will measure hydro-demolition as the area of concrete removed shown on the plans regardless of the number of passes required or optional additional removal by methods other than hydro-demolition.

The Department will make payment for removal of existing overlays under CLEARING SITE, BRIDGE.

The Department will make payment for repairs under Items CONCRETE DECK REPAIR, TYPE B and CONCRETE DECK REPAIR, TYPE C.

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SECTION 507 – CONCRETE BRIDGE DECK, BRIDGE PARAPET AND APPROACHES

507.02 MATERIALS

THE FOLLOWING IS ADDED:

Ultra-High Performance Concrete for Overlay.....	903.11
Welded Wire Reinforcement.....	905.01.03

507.03.01 Joint Assemblies

A. Working Drawings

THE FOLLOWING IS ADDED:

Perform a detailed survey of the existing joints to confirm the dimensions and geometry of the existing joint configuration prior to submitting working drawings. Account for all existing conditions in the working drawing submission. Any work performed prior to the submission of working plans and approval as per section 201.03.10 will be done at the contractor's own risk.

507.03.02 Concrete Bridge Deck

H. Placing Deck Concrete

THE FOLLOWING IS ADDED:

Install UHPC headers at locations of deck joint reconstruction with UHPC, as shown in the Plans. The same UHPC overlay material may be used, or a standard UHPC mix may be used for this area. Protect and preserve all existing reinforcement at the header locations, and epoxy-coat.

507.04 MEASUREMENT AND PAYMENT

THE FOLLOWING IS ADDED:

The Department will measure and make payment for Items as follows:

<i>Item</i>	<i>Pay Unit</i>
CONCRETE BRIDGE DECK, UHPC	CUBIC YARD

UHPC installed for the headers will be paid for under the Concrete Bridge Deck, UHPC pay item.

THE FOLLOWING SECTION IS ADDED:

SECTION 515 – UHPC OVERLAY

515.01 DESCRIPTION

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This specification consists of supplying, mixing, transporting, placing, finishing, curing, and diamond grinding of UltraHigh Performance Concrete (UHPC) for use as an overlay and a deck rehabilitation material if the intent is rehabilitation and riding surface in accordance with the Contract Documents and as directed by the RE. It also includes the construction of stage line construction joints including placing galvanized reinforcement for these joints.

UHPC is a cementitious composite material composed of an optimized gradation of granular constituents, a water-to-cementitious materials ratio less than 0.25 and a high percentage of discontinuous internal fiber reinforcement.

515.02 MATERIALS

515.02.01 Materials

Ultra-High Performance Concrete for Overlay.....	903.11
Curing Materials.....	903.10
Reinforcement Steel	905.01

515.02.02 Equipment

Provide equipment as specified:

Spreading and Finishing Machine	1005.02
Spreading and Finishing Machine for Concrete Bridge Decks	1005.03
Slip-Form (Extrusion) Machine	1005.06
Vibrator	1005.04
Hydro-demolition Equipment	1008.07
Straightedge	1008.02
Concrete Trucks	1010.02

If the Contractor elects to use a Spreading and Finishing Machine for Concrete Bridge Decks (1005.03) or a Slip-Form (Extrusion) Machine (1005.06), the machines must be specifically designed or modified for use with UHPC overlays.

Provide a minimum of two portable units for mixing the UHPC. Mixing equipment that is not supplied by the UHPC manufacturer must be reviewed and approved by the UHPC manufacturer for adequacy. During mixing keep the temperature of the UHPC below 85°F or the recommendation of the UHPC manufacturer; ice may be added to the mix as recommended by the UHPC manufacturer's representative.

515.03 CONSTRUCTION

515.03.01 Storage

Assure proper storage of all materials including but not limited to cement, aggregate, fibers and additives, as required by the supplier's recommendation in order to protect the integrity of the materials against the loss of physical and mechanical properties.

515.03.02 Placement Plan

Submit a Placement Plan with a detailed construction work schedule to the RE for review and approval at least 30 days prior to the scheduled UHPC placement. No UHPC placement will be permitted until the Placement Plan has been submitted by the Contractor and approved by the RE.

Provide the UHPC overlay installer's has previous experience on a minimum of 3 UHPC overlay projects, each using a fully automated paving machine similar to the machine required in Section 1005.03 or other means approved for this project by the Department. The following list is intended as a guide to what should be included in the Placement Plan and may not address all of the means and methods the contractor may elect to use. The Contractor is expected to assemble a comprehensive list of all necessary items for executing the placement of UHPC.

1. Responsible personnel and hierarchy.
2. Equipment – including but not limited to pumps, hoses, mixers, holding tanks, generators, wheelbarrows, scales, meters, thermometers, floats, screeds, plastic, heaters, blankets, high-capacity mixers, etc.
3. Quality Control of batch proportions - including dry ingredients, fibers, water and admixtures.
4. Quality Control of mixing time and batch times.
5. Qualification testing results

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6. Testing Facility (AMRL Certified) for compressive strength, Rapid Chloride Ion Penetrability testing, Dynamic Flow and Bond Strength.
7. Batch procedure sequence.
8. Form work – including materials and removal.
9. Placement procedure – including but not limited to surface preparation of existing concrete surfaces and prewetting of the existing concrete interface to a saturated-surface- dry (SSD) condition before the placement of UHPC, spreading, overpour, finishing, and curing protection. Include provisions for acceptable ambient conditions and batch temperatures and corrective measures as appropriate. Describe the screed equipment to be used, along with the proposed support configurations. Any embedment into the existing structural components must include a repair procedure and will be subject to the Department's approval. Include method and timing to be employed to achieve exposed fiber finish for joint construction.
10. Threshold limits for ambient temperature, ambient relative humidity, batch consistency, batch temperature, batch times and related corrective actions.
11. Cold weather placement procedures if appropriate.
12. Repair procedures anticipated to alleviate common or anticipated surface anomalies. Note that surface anomalies near any negative moment regions of the deck will require structural repair. Ensure surface defects, even if considered aesthetic in nature (such as cracks, drying cracks, air bubbles, etc.) , are repaired to the RE's satisfaction.

Pumping of UHPC will not be allowed unless it is successfully demonstrated for approval at least 30 days prior to the scheduled UHPC placement. The demonstration must take place under ambient temperature conditions that are similar to those anticipated for the scheduled UHPC placement. If ambient temperatures during the scheduled UHPC placement exceed those during the pumping demonstration by more than 7°F, pumping will not be permitted without another demonstration at the higher temperature.

Ensure the UHPC overlay is placed and finished using a self-propelled fully automated paving machine or demonstrated equal, that spreads, consolidates, and finishes the UHPC overlay and that is specifically designed and constructed for placing UHPC overlays. Ensure the amplitude and frequency of vibrations and the height of the paver via hydraulic legs are adjustable. Ensure the machine is capable of placing the UHPC overlay full width from each of the stage lines to the adjacent stage line in a single pass. Conduct a dry-run through with the approved paving machine within 48 hours of each scheduled placement.

Before placing the UHPC, pre-wet the exposed deck surfaces to a saturated surface dry (SSD) condition, using methods recommended by the UHPC manufacturer. Ensure the minimum pre-wetting period includes a continuous wetting period of at least 24 hours immediately before the placement of the UHPC. Remove all standing water before UHPC placement.

Construction loads applied to the bridge during UHPC placement and curing are the responsibility of the Contractor. Submit the weight and placement of concrete buggies, grinding equipment and other significant construction loads for review as part of the proposed Placement Plan. Loads should be kept at a minimum and only necessary equipment are allowed, any distress observed from early loading will be repaired at the contractor's expense.

515.03.03 Survey

Perform surveys of the bridge surface according to Section 157 – Construction Layout. Submit the surveys to the RE for approval prior to undertaking any further work on the deck or roadway surface. The Department will not make payment of UHPC overlay until all surveys are complete and approved by the RE. The Department will pay for survey separately.

515.03.04 Surface Preparation

Roughen the concrete deck surface during the hydro-demolition operation. Repair any remaining delaminations or spalls on the deck surface in accordance with the Plans and these Special Provisions so that the new overlay is placed on sound concrete.

After performing any concrete deck repairs and prior to placing UHPC, pre-wet the deck surface to a saturated surface dry (SSD) condition and maintain a fully saturated condition for at least 24-hour before placement. Remove all standing water before UHPC placement.

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515.03.05 Forming, Mixing, Transporting, Placing, and Curing

Arrange for an on-site meeting with the UHPC manufacturer's representative one day before the start of the UHPC placement. The Contractor's staff and representatives from the Department will attend the meeting. The objective of the meeting will be to review the approved Placement Plan and clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC.

Design and fabricate formwork, if required, to adhere to these specifications and the recommendations of the UHPC manufacturer. Construct forms from nonabsorbent material that are properly sealed and capable of resisting the hydrostatic pressures from UHPC in the unhardened state.

Ensure that a representative of the UHPC manufacturer knowledgeable in supplying, mixing, transporting, placing, finishing and curing of the UHPC material is present during mixing, transporting and placing of the UHPC to ensure the UHPC operations conform to the manufacturer's recommendations. Do not start mixing or placing UHPC until the manufacturer's representative is on-site. Place UHPC in accordance with the approved Placement Plan using one continuous pour per each stage of construction. The Department will not permit use of bulkheads. Keep UHPC from freezing until it has achieved a minimum compressive strength of 11.0 ksi.

If the ambient temperature and/or the deck temperature is less than 50°F during the day of placement or is expected to drop below 50°F during the two days following placement, then ensure that the cold weather placement procedures are in place to maintain the temperature of the UHPC and of the deck above 50°F until the UHPC has reached a minimum compressive strength of 11.0 ksi.

Ensure that forming, mixing, placing, and curing are in accordance with the UHPC manufacturer's recommendations and as submitted to and accepted by the RE.

Progressively apply a curing compound to the UHPC overlay surface as the UHPC is being placed and screeded and then cover the overlay with waterproof sheeting as soon as practical afterwards. Ensure that the UHPC overlay surface is continuously covered by the waterproof sheeting and it is the contractor's responsibility to make sure that the sheeting stays securely in place until the UHPC has achieved a minimum compressive strength of 11.0 ksi

Provide construction joints in the overlay at the stage line in accordance with the details shown on the Plans, including the installation of galvanized reinforcement steel. The RE will allow joints only at stage lines to facilitate construction, but will not allow additional joints in the overlay without prior approval. Any additional joints installed for the Contractor's convenience or means and methods will not be the basis for additional payment or an extension of time unless approved by the RE or the Department. Ensure plastic sheeting is secured promptly; if not properly applied, it may result in dehydration cracks/surface anomalies in the UHPC structural overlay that will be repaired at the Contractor's expense.

Overlay Pre-Placement Meeting. Arrange for an on-site meeting with the UHPC overlay installer 1 day before the start of the UHPC structural overlay placement. The Contractor's staff and representatives from the Department will attend the meeting. The purpose of the meeting will be to review the approved Placement Plan and to outline the procedures for transporting, placing, paving, finishing, and curing of the UHPC overlay.

If exposed fiber finishes are required to accommodate connection and/or joint strength, promptly perform the approved method to achieve the finish. Should the method employed not achieve the desired result, alert the RE immediately and develop a revised plan. There will be no additional compensation for any revision to the method of achieving the exposed fiber finish.

515.03.06 Material Acceptance Testing

The Department Division of Construction and Materials will be on site during the placement of UHPC. To schedule a representative, contact the Division of Construction and Materials a minimum of 48 hours prior to the anticipated UHPC placement.

28-day compressive strength will be the basis for final material acceptance. The Department will not allow field coring of UHPC to determine compressive strength for dispute resolution.

Ensure that the entire UHPC overlay is fully bonded to the substrate concrete. Any evidence of lack of bond between the UHPC and the substrate concrete will require remedial action as directed by the RE. The RE reserves the right to sound or request NDE testing to verify the adequacy of the work.

The Contractor is responsible for providing an adequate location to place acceptance specimens for initial curing prior to transport to the lab. Cure specimens in accordance with ASTM C1856 in the same environment as the field-placed material they represent. Perform testing and obtain approval from the RE. Ensure that all testing are carried out on a set consisting

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of a minimum of three samples. Testing is summarized in Table 516.03.05-1. The numbers of each test listed in the table are a minimum value. The RE may require more tests are performed than described in the table at his/her discretion.

Table 515.03.06-1: UHPC Acceptance Testing			
Description	Test Method	Acceptance Criteria	Number
Compressive Strength	ASTM C1856	≥ 18 ksi at 28 days	4 sets of 3 samples for each day of placement
Rapid Chloride Ion Penetrability	AASHTO T 277/ ASTM C1202	≤ 250 coulombs (w/o steel fibers)	2 samples, once per project (during field placement)
Slump Flow and Visual Stability	ASTM C1437	Acceptable Range per Manufacturer's Recommendation; No Bleed Water; Consistent Fiber Distribution	1 per batch
Bond Strength	ASTM C 1583	> 400 psi or failure in substrate concrete with $f'_c > 4$ ksi	2 samples per day- one per deck unit

If the UHPC overlay does not meet the requirements as described herein, remove and replace or remediate the UHPC overlay to the satisfaction of the RE at no additional cost. Repair all forms of cracking, drying ruts, voids, or other anomalies in the surface even if the repair is considered to be an aesthetic repair.

515.03.07 Surface Profile and Finish

Match the finished surface of the UHPC overlay with the proposed UHPC overlay surface profile to within $\pm 1/8$ inch. Meet existing grades with the finish performed and conform to the deck finish tolerances and rideability requirements as specified in Section 507.03.

If asphalt is to be placed on top of the UHPC overlay, then no further surface preparation is required unless the condition of the UHPC overlay will inhibit the ability to properly install the asphalt to the minimum thickness shown. For HMA placement a tack coat is necessary and the contractor shall clean the surface of foreign and loose materials, vibratory rollers are not permitted on the structures, achieve compaction limits using static rollers. If surface remediation is pursued by the Contractor to facilitate asphalt placement on top of UHPC, it will be performed at no additional cost to the Department.

Where the UHPC overlay is the final riding surface, diamond grind the entire top surface of the UHPC overlay in accordance with Section 454. Perform the grinding of the UHPC surface after the UHPC overlay has achieved a minimum compressive strength of 11.0 ksi. Install a temporary (and integral) surface above the final grade to facilitate the diamond grinding procedure to ensure the profile is met while the entire surface is ground. Provide a minimum overpour of $1/4$ " above the proposed profile. Ensure the proposed overpour thickness is adequate to remove surface anomalies and describe the proposed overpour thickness in the placement procedures. The Contractor shall provide additional overpour material if their methods require more depth for diamond grinding.. The Department will not make additional payment for the temporary surface/overpour of UHPC regardless of depth of the overpour.

It is the contractor's responsibility to ensure that the final riding surface of the reconstructed deck and joints are smooth and free of noise and bumps.

Traffic or other loading will not be permitted directly on the UHPC overlay until the UHPC achieves a minimum compressive strength of 11.0 ksi, unless otherwise approved by the RE. Shifting traffic will not be permitted until the surface has been finished with UHPC (and diamond grinding) and/or asphalt pavement in accordance with these specifications.

515.04 MEASUREMENT AND PAYMENT

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The Department will measure and make payment for Items as follows:

<i>Item</i>	<i>Pay Unit</i>
CONCRETE OVERLAY, UHPC	SQUARE YARD

The unit price bid for this work shall include surface preparation, supplying, mixing, transporting, placing, finishing, curing, grinding, grooving, and for furnishing all equipment, tools, labor, and incidentals required to complete the work as shown on the Plans. Include all costs to install the overlay in the square yard bid price for the pay item Concrete Overlay, UHPC. Any deviation for material placed within 20 percent of the estimated average thickness for each bridge as shown on the Plans will not be considered for additional payment (this may be modified to specify a minimum thickness above the top of the hydrodemolition peaks. Extra material placed for temporary surface/overpours and/or any over-milling beyond the minimum deck hydro-demolition limits shown on the Plans will not count towards this 20 percent value. Additional material needed for stage construction joints must be added to the anticipated overlay material and included in the square yard bid price for the overlay.

Additional quantity of material used in the determination of material properties and for acceptance testing as described herein will be furnished at no additional cost to the Department. No additional payment will be made for surface preparation or for grinding procedures.

DIVISION 550 – STRUCTURE REHABILITATION

SECTION 551 - BRIDGE DECK REHABILITATION

551.01 DESCRIPTION

This Section also describes the requirements for cleaning or replacement of existing reinforcement steel and placement of repair materials (including Concrete Overlay, UHPC) where shown on the plans or as directed by the Engineer. Disposal of debris shall be as per Section 201.

551.02 MATERIALS

551.02.01 Materials

THE FOLLOWING IS ADDED:

Concrete Overlay, UHPC 903.11

UHPC concrete shall conform to Section 903.11. Class A Concrete shall conform to Section 903.03 except that in Table 903.03.06-2, the coarse aggregate size for the item "Concrete Patch" shall be No. 8 when Type A Concrete is used and the percentage of air entrainment shall be 7.0 +/- 1.5.

In designing Class A or Class A-1 high early strength concrete mix, the Contractor may use Type III Portland Cement and a chloride-free accelerating admixture.

In order for the Engineer to maintain a record of strength gain of all concrete and/or patch materials placed, the Contractor shall make 3" x 6" test cylinders for compressive strength of concrete used in the course of construction, for each concrete batch used. The Contractor shall provide all the materials, labor, equipment and molds necessary for making test cylinders; the Contractor shall also be responsible for the handling, curing and protection of the cylinders on the job site, and shall arrange delivery of the cylinders to the testing laboratory. The making of test cylinders shall be done under the supervision of the Engineer; any cylinders not made in the presence of the Engineer shall be rejected. The testing laboratory shall be selected by the Contractor and shall be subject to the approval by the Engineer.

The test cylinders shall be made in accordance with the requirements of ASTM Designation C31 with the following exceptions: the tamping rod shall be a round straight steel rod, 3/8 in. (10 mm) in diameter and approximately 12 in. (305 mm) long, with the tamping end rounded to a hemispherical tip of the same diameter; and the sample shall be taken in three separate, but equal layers per cylinder and rodded 25 times per layer.

A sampling group shall be taken for every 100 square feet or portion thereof of patching materials or concrete placed each day. The Contractor shall cast sufficient samples of each sampling group so as to tested at the approximate time the 3,000psi strength level is obtained and to also be tested at 1, 3 and 28 days. For each testing period or level, two cylinders shall be tested. The cylinders shall be tested in accordance with the requirements of ASTM C39.

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At least two weeks prior to the commencement of work at any bridge, the Contractor shall make up four separate batches of the proposed patching material in accordance with the manufacturer's instructions at the site of the testing laboratory. The Contractor shall make a sufficient number of test cylinders of each batch to meet the following testing requirements. Three cylinders from each batch shall be tested every half-hour after initial mixing up until two hours after the time the manufacturer estimate their product will obtain 3,000 psi; then three cylinders from each batch shall be tested at 12, 24 and 72 hours after the initial mixing. All mixing, sampling and the initial testing shall be witnessed by the Engineer. All test results shall be immediately reported to the Engineer in writing. Three copies of test results shall be furnished to the Engineer.

The Contractor shall take every precaution to prevent injury to the test specimens while handling, storing, curing and transporting specimens. The cost of taking test specimens, furnishing molds, equipment, materials and equipment, preparing and curing specimens, protecting, packing and transporting the specimens, and arranging the tests to be conducted, including laboratory charges, shall be at the expense of the Contractor.

The Contractor is expressly prohibited from using different types or sources of patch materials for deck repairs.

551.03.01.B Saw Cut and Removal

THE FOLLOWING IS ADDED AFTER THE THIRD PARAGRAPH:

The Contractor is alerted to the fact that no concrete coring was performed on existing concrete to determine its strength and the existing strengths are unknown. However, strengths in excess of 5,000 psi shall be expected and planned for accordingly. The presence of high strength concrete shall not be used as the basis for additional payment or any schedule extension.

551.03.01.D Patching

THE FIRST PARAGRAPH IS DELETED AND REPLACED BY THE FOLLOWING:

All top of deck spall and deck joint repairs shall be constructed using Class A Concrete, Class A-1 High Early Strength Concrete, or the UHPC material used for the bridge overlays. Quick-setting patching materials will not be allowed. All concrete repairs and joint armoring shall be flush with adjacent existing concrete surfaces.

THE LAST PARAGRAPH IS DELETED AND REPLACED BY THE FOLLOWING:

Plan and schedule repair operations bearing in mind the manufacturer's recommendations regarding cure times for the patches. Do not open repair to traffic until compressive strength as measured by the average of 2 test cylinders is more than 3000 pounds per square inch for Class A Concrete/7000 pounds per square inch for UHPC, or the initial set has been achieved.

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SECTION 702 – TRAFFIC SIGNALS

702.03.11 Temporary and Interim Traffic Signal Systems

THE FOLLOWING IS ADDED:

- 3. Portable Traffic Signal System.** Furnish, install, move, and remove portable trailer-mounted traffic signals and necessary components as directed by the RE for the NJ Route 57 over Hances Brook (Structure No. 2106-164). The portable traffic signal system shall be Model SQ3TS, as manufactured by Horizon Signal Technologies, 216 Line Road, Malvern, Pennsylvania 19355 (1.800.852.8796) or approved equal. The portable trailer-mounted traffic signal system is to consist of four (4) towable trailers equipped with two, 12-inch signal heads, one of which is mounted on a mast arm that is capable of extending over the traveled lane with a minimum vertical clearance of 20 feet, a battery case, and charger. The lower signal head contains the controller with the conflict monitor. Program each unit with a movable module, called the microterminal. Include video detection for each portable trailer-mounted traffic signal and a remote module switch with the portable trailer-mounted traffic signals. The remote module switch shall be capable of freezing the signal heads on the units on a red interval.

The trailer unit should be capable of operating from an AC voltage source of 117 volts, 10 percent. If the unit is not to be wired to a continuous source of 117 volts, 10 percent power, it is to be equipped with solar panels capable of maintaining sufficient battery charge to operate the system. It shall be the Contractor's responsibility to ensure that the signal system receives and maintains sufficient power to function continuously.

The Contractor may use his own portable traffic signal system. If the Contractor provides his own signal system, it shall conform to the requirements as noted herein.

The portable traffic signal system equipment and operation shall be approved by NJDOT, Bureau of Traffic Engineering prior to the installation in the field. Obtain all approval necessary for the operations of the portable traffic signal system.

Install the four (4) portable traffic signal units with control features as described herein above for each roadway approach. Install each traffic signal unit with a signal display above the traffic lane and a display to the right of the traffic lane.

Install, as part of the traffic signal system, wiring required for the connection of the four (4) units to allow for hard-wired operation. The wiring installation shall conform to all applicable local and state codes for portable traffic signal installations.

Install the trailer-mounted signals in such a manner that the trailers do not block the sidewalk or encroach on the travel lanes. Operate and maintain the portable traffic signal system for as long as required to construct the project and take responsibility for its removal when no longer needed. If the portable traffic signal system malfunctions, immediately provide trained flaggers at each end of the project to control the flow of traffic until the signal system is repaired and operating at the Contractor's expense.

Prior to activation of the signal, provide the RE at least 7 days' notice.

DIVISION 900 – MATERIALS

SECTION 903 – CONCRETE

903.11 ULTRA-HIGH PERFORMANCE CONCRETE FOR OVERLAY

Provide materials as follows. Ensure all materials in items 1 and 2 below are preblended and proportioned in bags or supersacks and come from the same batch or lot. Ensure that all of the components of the UHPC mixture are supplied by a single material manufacturer with at least 5 years' experience in manufacturing and the commercial supply of UHPC, as well as successful previous applications of bridge deck UHPC overlays.

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1. Fine Aggregate
2. Cementitious Material
3. Fibers – Supplied by or as recommended by the UHPC manufacturer. Ensure fiber content is at least 3 percent of the mix's dry volume. Ensure fibers are a high-carbon steel with a tensile strength of at least 290,000 pounds per square inch (200MPa). Fiber geometry shall be provided. Provide steel fibers which are Buy America compliant such that all steel and iron components used to make the fibers are mined, melted and manufactured in the United States of America as documented by submitted steel mill certifications.
4. Water – per Section 919.08 and as specified by the manufacturer for use in the UHPC mix.
5. Admixtures - Only as specified by the UHPC Manufacturer.

The mix must be capable of being placed on an 8% grade while maintaining the required profile.

The UHPC mixture shall meet the material properties listed in Table 515.02.01-1 after 28 days, unless otherwise noted in the contract documents or as directed by the Engineer. Material properties listed below will be verified by the manufacturer and submitted for approval in the Placement Plan.

Table 903.11-1: UHPC Material Properties		
Description	Test Method	Acceptance Criteria
Compressive Strength	C39 as modified by ASTM C 1856	Minimum requirements: -12,000 psi at 2-day moist cure -18,000 psi at 28-day moist cure
Direct Tension 1st Cracking Strength	AASHTO T 397	$f_{cr} > 1,000$ psi
Direct Tension Post-Cracking Hardening Ratio	AASHTO T 397	$F_p/f_{cr} \geq 1.25$
Bond Strength	ASTM C 1583, Bonded to an Exposed Aggregate Concrete Surface	100% failure in substrate concrete with concrete compressive strength ≥ 4 ksi, or > 400 psi
Modulus of Elasticity	C469 as modified by ASTM C 1856	$\geq 6,500$ ksi
Long-Term Shrinkage	C157, initial reading after set, as modified by ASTM C 1856	≤ 800 micro-strain
Rapid Chloride Ion Penetrability	AASHTO T277/ASTM C1202	≤ 250 coulombs (w/o steel fibers)
Scaling Resistance	ASTM C672	≤ 3
Freeze-Thaw Resistance	C666A, 600 cycles, as modified by ASTM C1856	Relative Dynamic Modulus of Elasticity $> 95\%$
Alkali-Silica Reaction	ASTM C1567	Innocuous

At least 60 days before the proposed placement, place a rectangular test slab of UHPC that is 4 feet by 12 feet, with a grade of 8% in the longitudinal direction, with a thickness of 3 inches. After the UHPC has achieved final set, take six cores at locations chosen by the RE, such that two cores are taken in each third of the slab, as measured longitudinally. The depth of all cores must be within $\frac{1}{2}$ inch of 3 inches.

If the Contractor does not achieve the required tolerance, procedures must be changed to assure the material can meet the tolerance, and the test slab repeated. Subsequent failures must be followed by placement of a new test slab, until the Contractor is successful.

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Submit the results of all the tests above, conducted by an AASHTO accredited testing lab to the Department for review and approval a minimum of 30 days prior to the use of UHPC in the field. Should the tests not meet the specified criteria, additional testing will be required prior to placement of UHPC to demonstrate compliance with these specifications.

903.11.01 Storage

Ensure the proper storage of premix, fibers, and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.

903.11.02 Qualification Testing

Complete the testing of the UHPC a minimum of one month before production placement of UHPC. The testing sequence will include the submission of a plan for casting and testing procedures to the RE for review and approval followed by casting and testing according to the approved plan.

Casting and testing must include the following:

Cure all cylinders using the same method of curing proposed to be used in the field. The temperature during the curing to be within 18° Fahrenheit of the low end of the proposed temperature range for curing in the field.

Compression Test: Prepare a minimum of 12 cylinders 3 inches in diameter and 6 inches deep. Test three (3) cylinders at each time interval. The time intervals and minimum strength requirements are given above. Measure the compressive strength by ASTM C39. Use only a UHPC mix design that passes these tests.

Submit results of all the tests above, conducted by an AASHTO accredited testing lab (or equivalent as approved by the Engineer), to the NJDOT ME and NJDOT Structural Value Solutions Unit for approval at least 30 days before the start of field placement. Provide to the ME a list of bridge projects in which the proposed UHPC material has been used for bridge overlays (within or outside the USA). The ME reserves the right to reject a proposed UHPC material which lacks a proven track record for use in bridge overlays. Use only a UHPC mix design that passes these tests.

903.11.03 Quality Control

Measure the dynamic flow on each batch of UHPC. Conduct the dynamic flow using a mini-slump cone according to ASTM C230 and ASTM C1437 with 20 drops or a number recommended by the UHPC supplier over a period of 10 seconds, subject to the Department's approval. Ensure that the flow for each batch is between 7 inches and 10 inches, or as specified by the manufacturer. The specified spread is to be confirmed during the mock-up trials. Record the flow for each batch in the QA/QC log. Provide a copy of the log to the RE.

Take a minimum of four (4) sets of compressive strength test samples for each day of placement. Each set must consist of a minimum of 3 cylinders 3 inch x 6 inch. Provide molds as required. Cure all sets in an environment similar to the material they represent. After removal from the molds, grind the ends of the cylinders per ASTM C1856 so that the ends are ground parallel and planer prior to testing.

Perform compressive strength testing according to ASTM C39 as modified by C1856. Ensure that the timing of the testing is as required to demonstrate design strength prior to loading; test multiple sets of cylinders if different loading periods will be proposed based on the magnitude of loading. Perform the testing of the second set at 28 days. Submit the third set to the Materials Bureau between the 4th day and the 14th day. Treat the fourth set as a reserve set.

UHPC is a non-pay-adjustment item. All requirements and procedures of Section 903.03.05 F apply. The re-test limit is 11,600 pounds per square inch .

DIVISION 1000 – EQUIPMENT

SECTION 1008 – MISCELLANEOUS EQUIPMENT

THE FOLLOWING SUBSECTION IS ADDED:

1008.07 HYDRO-DEMOLITION EQUIPMENT

Provide high-pressure jets capable of developing a nozzle pressure of at least 20,000 psi and ensure water flow rates are capable of 5 cubic feet per minute or greater larger. Provide hand-held lances for use in tight spaces or where minimal removal depth is needed, flow rates may be reduced to 0.5 cubic feet per minute while providing a minimum nozzle

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pressure of 20,000 psi. Provide working pressure gauges and staging control for any equipment used. Similar equipment may be necessary to develop an exposed fiber finish where specified, based on the Contractor's means and methods.