

**SUPERSEDED BY EB 23-024
EFFECTIVE 8/3/23**



New York State
Department of
Transportation
**ENGINEERING
INSTRUCTION**

EI
08-041

Title: **SPECIAL SPECIFICATION FOR FULL DEPTH RECLAMATION OF ASPHALT
PAVEMENT**

Distribution:

- | | |
|--|--|
| <input type="checkbox"/> Manufacturers (18) | <input type="checkbox"/> Surveyors (33) |
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Approved:

Robert L. Sack, P.E.
Deputy Chief Engineer (Research)

5 NOV 08

Date

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 7, 2009.
- This EI does not supersede any previous issuances.
- The information transmitted by this issuance will reside in the Special Specifications directory of the Toolbox Server.

PURPOSE: The purpose of this EI is to issue a new special specification for full depth reclamation of asphalt pavement.

TECHNICAL INFORMATION:

- The special specification was created for full depth reclamation of asphalt concrete pavement to provide a cost effective means of rehabilitating low to medium traffic volume highways. The full depth reclamation process utilizes road reclaimers, machines which use milling drums similar to those found on milling machines. However, these milling drums are designed to penetrate the entire pavement section and a predetermined portion of the subbase material, uniformly pulverizing and blending them together, and gauging precise amounts of additives to improve structural characteristics of this newly developed subbase course².

The full depth reclamation process is applicable to depths up to 12 inches, with typical applications in the range of 6 to 9 inches. It removes deep pavement cracks thereby eliminating the potential for reflective cracking. The process allows for cross-slope and profile grade adjustments. If WZTC dictates and the final surface treatment is to be applied at a later date, the road can usually be opened to traffic once the compactors complete their pass. A roadway rehabilitated utilizing the full depth reclamation process is equivalent to a traditionally reconstructed roadway in terms of life expectancy, wear and load-bearing characteristics². However, the process has less interruption of traffic, is environmentally friendly, and is completed at a fraction of the cost.

- PIN Approval: The full depth reclamation of asphalt pavement special specification is to be approved on a project-by-project basis. Designers must send their request for approval to the Design Quality Assurance Bureau (DQAB) and the Geotechnical Engineering Bureau (GEB) through the Regional Special Specification Coordinator as per Highway Design Manual (HDM) Chapter 21.

- For new and reconstructed pavements refer to the **Comprehensive Pavement Design Manual (CPDM), Chapter 4.**

TRANSMITTED MATERIALS:

Attached are the following revised Metric and US Customary special specifications:

Metric:

- Item 304.60----17: Full Depth Reclamation of Asphalt Pavement.
- Item 304.70----17: Chemical Stabilizing Agent for Full Depth Reclamation of Asphalt Pavement.
- Item 304.80----17: Bituminous Stabilizing Agent for Full Depth Reclamation of Asphalt Pavement.
- Item 304.90----17: Aggregate for Full Depth Reclamation of Asphalt Pavement.

US Customary:

- Item 304.60000017: Full Depth Reclamation of Asphalt Pavement.
- Item 304.70000017: Chemical Stabilizing Agent for Full Depth Reclamation of Asphalt Pavement.
- Item 304.80000017: Bituminous Stabilizing Agent for Full Depth Reclamation of Asphalt Pavement.
- Item 304.90000017: Aggregate for Full Depth Reclamation of Asphalt Pavement.

BACKGROUND: The Department has recently identified several low to medium traffic volume highways that are in need of pavement rehabilitation. It has been determined that full depth reclamation of asphalt pavements is a more cost effective means to rehabilitate low volume roads, proportionally increasing service life when compared to full depth reconstruction. The full depth reclamation process also conserves natural resources by recycling existing materials. The conservation of natural resources is compounded when you consider the conservation of additional natural resources (natural gas, petroleum products, etc.) necessary to produce, deliver and use new materials required in full depth reconstruction.

REFERENCES: Further information on full depth reclamation of asphalt pavement may be found in such sources as:

1. US Department of Transportation, Federal Highway Administration, Publication No. FHWA-SA-98-042: Pavement Recycling Guidelines for State and Local Governments, Reference Manual. <http://www.fhwa.dot.gov/pavement/recycling/98042/98042.pdf>
2. "What is Full-Depth Reclamation", Better Roads For the Government/Contractor Project Team, July, 2001, <http://obr.gcnpublishing.com/articles/brjul01b.htm>
3. "Full-Depth Reclamation with Cement", Portland Cement Association, http://www.cement.org/pavements/pv_sc_fdr.asp

CONTACT: Questions or comments regarding this issuance should be directed to Randall J. Romer, P.E. of the Geotechnical Engineering Bureau at (518) 457-4714, rromer@dot.state.ny.us. Questions or comments regarding the technical aspects of the special specification should be directed to Steven Riley of the Geotechnical Engineering Bureau at (518) 457-4720, sriley@dot.state.ny.us.

- ITEM 304.60 17: FULL DEPTH RECLAMATION OF ASPHALT PAVEMENT**
- ITEM 304.70 17: CHEMICAL STABILIZING AGENT FOR FULL DEPTH RECLAMATION OF ASPHALT PAVEMENT**
- ITEM 304.80 17: BITUMINOUS STABILIZING AGENT FOR FULL DEPTH RECLAMATION OF ASPHALT PAVEMENT**
- ITEM 304.90 17: AGGREGATE FOR FULL DEPTH RECLAMATION OF ASPHALT PAVEMENT**

DESCRIPTION

This work shall consist of the in-place single or multiple step sequence for full depth reclamation of asphalt pavement. This work shall include cleaning the existing pavement free of all debris and material that may interfere with the reclamations' milling process, milling, pulverizing and mixing the existing asphalt pavement, adding new aggregate and chemical or bituminous stabilizing agent(s) as required, then remixing, grading, compacting and curing in conformity with the lines, grades, depths and typical sections as shown in the plans, and as determined by the Engineer.

MATERIALS

Aggregate. The new aggregate shall be supplied from a Department approved material source consisting of crushed stone or crushed gravel or a blend thereof and meet the gradation as specified in the approved mix design.

Chemical Stabilizing Agent. Chemical stabilizing agents used shall conform to the applicable requirements of the following subsections:

Material	Subsection
Portland Cement	§701-01
Fly Ash, Class C	§711-10
Calcium Chloride	§712-02
Hydrated Lime	§712-04

Bituminous Stabilizing Agents. Bituminous stabilizing agents used shall be an asphalt emulsion, emulsified recycling agent or foamed/expanded asphalt and conform to the applicable requirements of Section 702-Bituminous Materials. Alternate bituminous materials may be substituted by the Contractor with the approval of the Director, Materials Bureau.

Water. Water used shall conform to §712-01.

Reclaimed Material. The existing asphalt pavement and portions of the underlying subbase course shall be blended into a homogenous mass and shall pass the 50 mm sieve size.

CONSTRUCTION DETAILS

Sampling and Pre-testing. The Department will take and analyze all core samples and provide the following information in the contract documents:

- Core Report which will include the location and depth of the existing asphalt in each core taken.
- Existing asphalt pavement core gradations.
- Subsurface Exploration Logs.

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- Percentage of asphalt content in the asphalt pavement cores taken.
- Plasticity Index of underlying subbase that will be reclaimed.
- Total depth of reclamation that is required, including the existing asphalt and underlying material depths and corresponding longitudinal limits.

Design Guidelines. The reclaimed mixture shall consist of reclaimed materials, new aggregate if required, chemical or bituminous stabilizing agent(s) and water if required. The final mixture shall conform to the strength parameters as outlined in Quality Control Testing section. The reclaimed mix's moisture content is determined by the Contractor and may be adjusted to account for actual field conditions.

The Contractor may take additional cores from the existing asphalt pavement to determine the full depth reclamation mix design. A 2-week notice to the Engineer-In-Charge and the Regional Materials Engineer prior to taking additional cores is required.

Based on the information provided above and prior to beginning the work, the Contractor shall submit (3) three copies of their method to satisfactorily complete the specified full depth reclamation and the full depth reclamation mix design to the Engineer for approval by the D.C.E.T.S. The submittal shall specify all the equipment and materials necessary to do the work which will include but is not limited to: the in-place single or multiple step full depth reclamation sequence; the type, brand name and model number of all equipment being used in the in-place single or multiple step sequence, including rollers and the schedule to complete the work which includes curing time based on the respective stabilizing agent. The full depth reclamation mix design shall specify the name and producer/manufacturer of the all the materials. All materials are required to be State approved.

Preconstruction Meeting. A preconstruction meeting will be held prior to the start of any work. Representatives from the Geotechnical Engineering and the Materials Bureaus shall be present.

Equipment. The Contractor shall use in-place full depth reclamation equipment approved by the DCETS. Request for approval of equipment not previously approved shall be made to the Director, Materials Bureau, prior to the start of any work. All equipment and tools shall be maintained in satisfactory working condition at all times.

The reclaimer shall be self-propelled equipped with a liquid additive system, specifically manufactured for full depth reclamation type of work. The machine shall have automatic depth controls. The cutting drum shall be variable speed and have the capability to up-cut and down-cut, pulverize and mix a minimum of 0.3 m of existing asphalt pavement and underlying subbase material(s) by a minimum of 2.4 m in width to a size that will pass the 50 mm sieve. The recommended minimum power of the reclaimer is 300 kW. The reclaimer shall have a system for adding asphalt emulsion with a full width spray bar consisting of a positive displacement pump interlocked to the machine speed so that the amount of emulsion being added is automatically

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adjusted with changes in machine speed. The additive system shall be capable of incorporating up to 31 L/m² of emulsion. Individual valves on the spray bar shall be capable of being turned off as necessary to minimize emulsion overlap on subsequent passes.

The entire operation of reclaiming the existing road, adding new aggregate, water, and asphalt emulsion can be completed in one pass if adequate mixing is achieved. If the entire operation cannot be completed in one pass, then the existing road shall be reclaimed to the depth on the plans, and during this first pass water and new aggregate shall be added; pre-shaping can also be accomplished at this time. After completion of the first pass, the road shall be shaped with a motor grader and compacted with a steel roller to provide better depth control. A second pass of a reclaimer shall be completed with the required amount of asphalt emulsion added.

Grading shall be done with a highway motor grader which has a cross slope indicator or approved substitute as allowed by the Engineer.

Calibration. The Contractor shall calibrate the mixing equipment prior to the start of work, in accordance with established calibration procedures as detailed in Procedural Directives from the Director, Materials Bureau. Submit the calibration results for approval to the Director, Materials Bureau at least 7 calendar days prior to the start of work. The first calibration of each calendar year must be witnessed by Department personnel or agency authorized representative. Submit subsequent calibrations with written certification that proper procedures were followed and that all measurements and calculations are accurate. If the results submitted in subsequent calibrations are more than 5.0% different from the first calibration of the season, the equipment must be calibrated in the presence of Department personnel or agency authorized representative. Calibration approval is valid for 90 days from the date of calibration. Provide a copy of the calibration approval letter to the Engineer or agency authorized representative before the start of work. No reclamation will be allowed until the calibration has been completed and approved. No payment will be made for material reclaimed by equipment without a valid calibration.

Stabilizing Agent Addition. When utilizing an asphalt emulsion, the amount of asphalt emulsion used shall be as recommended from the mix design. Any changes in asphalt emulsion content must be approved by the Engineer. The percentage of emulsion added shall be checked by determining the amount used by meter readings or truck weight tickets and by estimating the quantity of road reclaimed – depth, width, length, and estimated in-place density by Proctor density (mix design or field check) or nuclear density. On the first day of FDR, emulsion content shall be determined at a minimum on the first emulsion transport. Adjustments in equipment calibration shall be made if necessary. If adjustments are made, emulsion content shall be checked again. Thereafter, emulsion content shall be determined at a sampling frequency at the Engineer's discretion.

Compaction. Thorough and uniform compaction of the reclaimed material shall be achieved in accordance with §203-3.12, attaining 95% of the Standard Proctor Maximum Density, using a

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combination of the following equipment:

- Initial (breakdown) rolling shall be performed with a vibratory pad foot roller.
- Intermediate rolling shall be performed with a pneumatic-tired roller.
- Finish (final) rolling shall be performed with a tandem vibratory –steel drum roller.

A vibratory padfoot roller with 2134 mm wide drum and 9 metric ton minimum weight is required; a blade is recommended for back-dragging. A pneumatic tire roller with 18 metric ton minimum weight with water spray system is required. A double drum vibratory steel roller with 9 metric ton minimum weight with water spray system is required.

The padfoot roller, applying high amplitude and low frequency, or the pneumatic roller shall perform initial compaction at enough passes until it walks out of the material. Walking out for the padfoot roller is defined as light being clearly evident between all of the pads at the material–padfoot drum interface. Walking out for the pneumatic roller is defined as no significant wheel impressions being left on the surface. Perform the necessary number of roller passes to achieve the desired compaction for each roller type. A water truck for supplying water to the reclaimer for addition of moisture, as required, during the FDR operation shall be used. The water truck shall be capable and set up for a controlled spray on the road before compaction.

Tolerance. The reclaimed surface shall be constructed within 13 mm tolerance to the specified line and grade shown in the plans. If the pavement has not been constructed to this tolerance, the surface will be tested with a 4.5 m straight edge or string placed parallel to the centerline of the pavement and with a 3 m straight edge or string line placed transversely to the center line of the pavement on any portion of the pavement. Variations exceeding 13 mm shall be corrected at no additional cost to the Department. In order to correct cross slope to meet line and grade as shown on the typical when there is not sufficient existing reclaimed material, the Contractor shall add aggregate, then remix grade, compact and cure as required to make such corrections.

Curing. Proof roll the compacted material according to Engineer’s approval. It is recommended that proof rolling represent the type of traffic expected on the road. If deformation does not occur, moving truck traffic can be allowed on the reclaimed base. If deformation does occur, truck traffic should be kept off until the reclaimed material is firm enough. It is expected that the reclaimed base can support moving car traffic after finish rolling has occurred. The reclaimed mixture shall be allowed to cure for the specified time as in the approved full depth reclamation mix design. The provisions of the paragraph above, Tolerance, shall apply during the entire period prior to the reclaimed material being overlaid. Curing shall be the responsibility of the Contractor, who shall take into account all factors, including the weather limitations and restrictions and the project Work Zone Traffic Control plan. Before placing any pavement, the reclaimed base shall be allowed to cure for a minimum of 10 days and when no visible moisture is present, or at the discretion of the Engineer. The reclaimed base shall be paved before winter.

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Weather & Seasonal Limitations. This work will not be permitted when the existing pavement or reclaimed material contains frost, or when the air and/or surface temperature is below 7° C. The minimum air temperature must be 15° C and the relative humidity must be less than 80% when bituminous stabilizing agents are used.

Working in the rain or when rain is imminent is not allowed.

No work under this item will be permitted from September 30 to May 15.

Testing. All new aggregate must be stockpiled. A minimum of two QC aggregate gradation samples, weighing a minimum of 20 kg each in accordance with AASHTO T311, will be obtained from each stockpile and tested by the Contractor. All QC test results will be provided to the Engineer prior to the start of work and all test results shall meet the gradation as specified in the approved mix design,

When Portland Cement is used, obtain a 3.8 L sample from each delivery vehicle in accordance with §701-01 and submit to the Regional Materials Engineer for testing.

When Fly Ash, Class C is used, obtain a 0.9 L sample from each delivery vehicle in accordance with §701-01 and submit to the Regional Materials Engineer for testing.

When Bituminous Stabilizing Agents are used, obtain a sample from each delivery vehicle in accordance with §701-01 Materials Method 8.2 and submit to the Regional Materials Engineer for testing.

Quality Control Testing. The approved mix design shall conform to the following QC strength parameters and test procedures based on the stabilizing agent used:

Chemical Stabilizing Agent(s): Use Unconfined Compressive Strength Test parameters in conformance with ASTM D1633 Method A. Minimum strength shall be 2413 kPa but less than 516 kPa.

Bituminous Stabilizing Agent(s): Use Modified Proctor Density, ASTM D1557 and /or Marshall Method, ASTM D6927.

On the first day of production the Contractor will take the appropriate samples of the reclaimed mix in accordance with ASTM D1633 and or/ASTM D1557/ASTM D6927. Four additional samples will also be tested by the Contractor's laboratory for aggregate gradation and percent stabilizer content. Test results will be submitted to the Engineer before the end of the next workday. The Engineer will verify these test results comply with the approved mix design. Significant differences from the mix design shall be discussed with the Contractor and Regional Materials Engineer. For each subsequent day of production a minimum of one sample of the

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reclaimed mix will be taken from each 805 m of production, or fraction thereof. These samples will be tested as noted for the first day of production. The Engineer will receive these test results within two workdays to be verified for compliance with the approved mix design. If a second reclamation train is introduced at the contract site, QC sampling will follow the requirements needed for the first day of production.

METHOD OF MEASUREMENT

Full Depth Reclamation of Asphalt Pavement. The quantity to be paid will be measured by the number of square meters of asphalt pavement reclaimed full depth measured to the nearest square meter.

Aggregate. The quantity to be paid will be measured by the number of metric tons of aggregate required in the approved full depth reclamation mix design.

Chemical Stabilizing Agent. The quantity to be paid will be measured by the number of metric tons of dry bulk chemical stabilizing agent required in the approved full depth reclamation mix design measured to the nearest metric ton.

Bituminous Stabilizing Agent. The quantity to be paid will be measured by the number of liters of bituminous stabilizing agents measured at 15° C required in the approved full depth reclamation mix design measured to the nearest liter.

BASIS OF PAYMENT

Full Depth Reclamation of Asphalt Pavement. The unit price bid per square meter shall include the cost of furnishing all labor and equipment necessary to satisfactorily complete the work including cleaning the existing pavement free of all debris and material that may interfere with the reclamations' milling process, milling, pulverizing and mixing the existing asphalt pavement, adding new aggregate and chemical or bituminous stabilizing agent(s) as required, then remixing, grading, compacting and curing in conformity with the lines, grades, depths and typical sections as shown in the plans. Aggregates, chemical and bituminous stabilizing agents will be paid for under their appropriate pay items. No separate payment will be made for the use of water in the full depth reclamation process. No direct payment will be made for any loss of materials resulting in shrinkage, compaction, foundation settlement, erosion or any other cause. No deductions will be made for the volumes occupied by manholes, catch basins and other such objects.

Aggregate. The unit price bid per metric ton shall include the cost of furnishing all labor, materials and equipments necessary to add aggregate as required to satisfactorily complete the work. No direct payment will be made for any loss of materials resulting in shrinkage, compaction, foundation settlement, erosion or any other cause. No deductions will be made for

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the volumes occupied by manholes, catch basins and other such objects.

Chemical Stabilizing Agent. The unit price bid per metric ton shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work. No separate payment will be made for water to mix the chemical stabilizing agent into a slurry.

Bituminous Stabilizing Agent. The unit price bid per liter shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work

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DESCRIPTION

This work shall consist of the in-place single or multiple step sequence for full depth reclamation of asphalt pavement. This work shall include cleaning the existing pavement free of all debris and material that may interfere with the reclamations' milling process, milling, pulverizing and mixing the existing asphalt pavement, adding new aggregate and chemical or bituminous stabilizing agent(s) as required, then remixing, grading, compacting and curing in conformity with the lines, grades, depths and typical sections as shown in the plans, and as determined by the Engineer.

MATERIALS

Aggregate. The new aggregate shall be supplied from a Department approved material source consisting of crushed stone or crushed gravel or a blend thereof and meet the gradation as specified in the approved mix design.

Chemical Stabilizing Agent. Chemical stabilizing agents used shall conform to the applicable requirements of the following subsections:

Material	Subsection
Portland Cement	§701-01
Fly Ash, Class C	§711-10
Calcium Chloride	§712-02
Hydrated Lime	§712-04

Bituminous Stabilizing Agents. Bituminous stabilizing agents used shall be an asphalt emulsion, emulsified recycling agent or foamed/expanded asphalt and conform to the applicable requirements of Section 702-Bituminous Materials. Alternate bituminous materials may be substituted by the Contractor with the approval of the Director, Materials Bureau.

Water. Water used shall conform to §712-01.

Reclaimed Material. The existing asphalt pavement and portions of the underlying subbase course shall be blended into a homogenous mass and shall pass the 2 in. sieve size.

CONSTRUCTION DETAILS

Sampling and Pre-testing. The Department will take and analyze all core samples and provide the following information in the contract documents:

- Core Report which will include the location and depth of the existing asphalt in each core taken.
- Existing asphalt pavement core gradations.
- Subsurface Exploration Logs.

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- Percentage of asphalt content in the asphalt pavement cores taken.
- Plasticity Index of underlying subbase that will be reclaimed.
- Total depth of reclamation that is required, including the existing asphalt and underlying material depths and corresponding longitudinal limits.

Design Guidelines. The reclaimed mixture shall consist of reclaimed materials, new aggregate if required, chemical or bituminous stabilizing agent(s) and water if required. The final mixture shall conform to the strength parameters as outlined in Quality Control Testing section. The reclaimed mix's moisture content is determined by the Contractor and may be adjusted to account for actual field conditions.

The Contractor may take additional cores from the existing asphalt pavement to determine the full depth reclamation mix design. A 2-week notice to the Engineer-In-Charge and the Regional Materials Engineer prior to taking additional cores is required.

Based on the information provided above and prior to beginning the work, the Contractor shall submit (3) three copies of their method to satisfactorily complete the specified full depth reclamation and the full depth reclamation mix design to the Engineer for approval by the D.C.E.T.S. The submittal shall specify all the equipment and materials necessary to do the work which will include but is not limited to: the in-place single or multiple step full depth reclamation sequence; the type, brand name and model number of all equipment being used in the in-place single or multiple step sequence, including rollers and the schedule to complete the work which includes curing time based on the respective stabilizing agent. The full depth reclamation mix design shall specify the name and producer/manufacturer of the all the materials. All materials are required to be State approved.

Preconstruction Meeting. A preconstruction meeting will be held prior to the start of any work. Representatives from the Geotechnical Engineering and the Materials Bureaus shall be present.

Equipment. The Contractor shall use in-place full depth reclamation equipment approved by the DCETS. Request for approval of equipment not previously approved shall be made to the Director, Materials Bureau, prior to the start of any work. All equipment and tools shall be maintained in satisfactory working condition at all times.

The reclaimer shall be self-propelled equipped with a liquid additive system, specifically manufactured for full depth reclamation type of work. The machine shall have automatic depth controls. The cutting drum shall be variable speed and have the capability to up-cut and down-cut, pulverize and mix a minimum of 1 ft. of existing asphalt pavement and underlying subbase material(s) by a minimum of 8 ft. in width to a size that will pass the 2 in. sieve. The recommended minimum power of the reclaimer is 400 hp. The reclaimer shall have a system for adding asphalt emulsion with a full width spray bar consisting of a positive displacement pump interlocked to the machine speed so that the amount of emulsion being added is automatically

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adjusted with changes in machine speed. The additive system shall be capable of incorporating up to 7 gal./yd² of emulsion. Individual valves on the spray bar shall be capable of being turned off as necessary to minimize emulsion overlap on subsequent passes.

The entire operation of reclaiming the existing road, adding new aggregate, water, and asphalt emulsion can be completed in one pass if adequate mixing is achieved. If the entire operation cannot be completed in one pass, then the existing road shall be reclaimed to the depth on the plans, and during this first pass water and new aggregate shall be added; pre-shaping can also be accomplished at this time. After completion of the first pass, the road shall be shaped with a motor grader and compacted with a steel roller to provide better depth control. A second pass of a reclaimer shall be completed with the required amount of asphalt emulsion added.

Grading shall be done with a highway motor grader which has a cross slope indicator or approved substitute as allowed by the Engineer.

Calibration. The Contractor shall calibrate the mixing equipment prior to the start of work, in accordance with established calibration procedures as detailed in Procedural Directives from the Director, Materials Bureau. Submit the calibration results for approval to the Director, Materials Bureau at least 7 calendar days prior to the start of work. The first calibration of each calendar year must be witnessed by Department personnel or agency authorized representative. Submit subsequent calibrations with written certification that proper procedures were followed and that all measurements and calculations are accurate. If the results submitted in subsequent calibrations are more than 5.0% different from the first calibration of the season, the equipment must be calibrated in the presence of Department personnel or agency authorized representative. Calibration approval is valid for 90 days from the date of calibration. Provide a copy of the calibration approval letter to the Engineer or agency authorized representative before the start of work. No reclamation will be allowed until the calibration has been completed and approved. No payment will be made for material reclaimed by equipment without a valid calibration.

Stabilizing Agent Addition. When utilizing an asphalt emulsion, the amount of asphalt emulsion used shall be as recommended from the mix design. Any changes in asphalt emulsion content must be approved by the Engineer. The percentage of emulsion added shall be checked by determining the amount used by meter readings or truck weight tickets and by estimating the quantity of road reclaimed – depth, width, length, and estimated in-place density by Proctor density (mix design or field check) or nuclear density. On the first day of FDR, emulsion content shall be determined at a minimum on the first emulsion transport. Adjustments in equipment calibration shall be made if necessary. If adjustments are made, emulsion content shall be checked again. Thereafter, emulsion content shall be determined at a sampling frequency at the Engineer's discretion.

Compaction. Thorough and uniform compaction of the reclaimed material shall be achieved in accordance with §203-3.12, attaining 95% of the Standard Proctor Maximum Density, using a

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combination of the following equipment:

- Initial (breakdown) rolling shall be performed with a vibratory pad foot roller.
- Intermediate rolling shall be performed with a pneumatic-tired roller.
- Finish (final) rolling shall be performed with a tandem vibratory –steel drum roller.

A vibratory padfoot roller with 84 in. wide drum and 10 ton minimum weight is required; a blade is recommended for back-dragging. A pneumatic tire roller with 20 ton minimum weight with water spray system is required. A double drum vibratory steel roller with 10 ton minimum weight with water spray system is required.

The padfoot roller, applying high amplitude and low frequency, or the pneumatic roller shall perform initial compaction at enough passes until it walks out of the material. Walking out for the padfoot roller is defined as light being clearly evident between all of the pads at the material–padfoot drum interface. Walking out for the pneumatic roller is defined as no significant wheel impressions being left on the surface. Perform the necessary number of roller passes to achieve the desired compaction for each roller type. A water truck for supplying water to the reclaimer for addition of moisture, as required, during the FDR operation shall be used. The water truck shall be capable and set up for a controlled spray on the road before compaction.

Tolerance. The reclaimed surface shall be constructed within ½ in. tolerance to the specified line and grade shown in the plans. If the pavement has not been constructed to this tolerance, the surface will be tested with a 15 ft. straight edge or string placed parallel to the centerline of the pavement and with a 10 ft. straight edge or string line placed transversely to the center line of the pavement on any portion of the pavement. Variations exceeding ½ in. shall be corrected at no additional cost to the Department. In order to correct cross slope to meet line and grade as shown on the typical when there is not sufficient existing reclaimed material, the Contractor shall add aggregate, then remix grade, compact and cure as required to make such corrections.

Curing. Proof roll the compacted material according to Engineer's approval. It is recommended that proof rolling represent the type of traffic expected on the road. If deformation does not occur, moving truck traffic can be allowed on the reclaimed base. If deformation does occur, truck traffic should be kept off until the reclaimed material is firm enough. It is expected that the reclaimed base can support moving car traffic after finish rolling has occurred. The reclaimed mixture shall be allowed to cure for the specified time as in the approved full depth reclamation mix design. The provisions of the paragraph above, Tolerance, shall apply during the entire period prior to the reclaimed material being overlaid. Curing shall be the responsibility of the Contractor, who shall take into account all factors, including the weather limitations and restrictions and the project Work Zone Traffic Control plan. Before placing any pavement, the reclaimed base shall be allowed to cure for a minimum of 10 days and when no visible moisture is present, or at the discretion of the Engineer. The reclaimed base shall be paved before winter.

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Weather & Seasonal Limitations. This work will not be permitted when the existing pavement or reclaimed material contains frost, or when the air and/or surface temperature is below 45° F. The minimum air temperature must be 60° F and the relative humidity must be less than 80% when bituminous stabilizing agents are used.

Working in the rain or when rain is imminent is not allowed.

No work under this item will be permitted from September 30 to May 15.

Testing. All new aggregate must be stockpiled. A minimum of two QC aggregate gradation samples, weighing a minimum of 45 lbs. each in accordance with AASHTO T311, will be obtained from each stockpile and tested by the Contractor. All QC test results will be provided to the Engineer prior to the start of work and all test results shall meet the gradation as specified in the approved mix design,

When Portland Cement is used, obtain a 1 gal. sample from each delivery vehicle in accordance with §701-01 and submit to the Regional Materials Engineer for testing.

When Fly Ash, Class C is used, obtain a 1 qt. sample from each delivery vehicle in accordance with §701-01 and submit to the Regional Materials Engineer for testing.

When Bituminous Stabilizing Agents are used, obtain a sample from each delivery vehicle in accordance with §701-01 Materials Method 8.2 and submit to the Regional Materials Engineer for testing.

Quality Control Testing. The approved mix design shall conform to the following QC strength parameters and test procedures based on the stabilizing agent used:

Chemical Stabilizing Agent(s): Use Unconfined Compressive Strength Test parameters in conformance with ASTM D1633 Method A. Minimum strength shall be 350 psi but less than 800 psi.

Bituminous Stabilizing Agent(s): Use Modified Proctor Density, ASTM D1557 and /or Marshall Method, ASTM D6927.

On the first day of production the Contractor will take the appropriate samples of the reclaimed mix in accordance with ASTM D1633 and or/ASTM D1557/ASTM D6927. Four additional samples will also be tested by the Contractor's laboratory for aggregate gradation and percent stabilizer content. Test results will be submitted to the Engineer before the end of the next workday. The Engineer will verify these test results comply with the approved mix design. Significant differences from the mix design shall be discussed with the Contractor and Regional Materials Engineer. For each subsequent day of production a minimum of one sample of the

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reclaimed mix will be taken from each ½ mile of production, or fraction thereof. These samples will be tested as noted for the first day of production. The Engineer will receive these test results within two workdays to be verified for compliance with the approved mix design. If a second reclamation train is introduced at the contract site, QC sampling will follow the requirements needed for the first day of production.

METHOD OF MEASUREMENT

Full Depth Reclamation of Asphalt Pavement. The quantity to be paid will be measured by the number of square yards of asphalt pavement reclaimed full depth measured to the nearest square yard.

Aggregate. The quantity to be paid will be measured by the number of tons of aggregate required in the approved full depth reclamation mix design.

Chemical Stabilizing Agent. The quantity to be paid will be measured by the number of tons of dry bulk chemical stabilizing agent required in the approved full depth reclamation mix design measured to the nearest ton.

Bituminous Stabilizing Agent. The quantity to be paid will be measured by the number of gallons of bituminous stabilizing agents measured at 60° F required in the approved full depth reclamation mix design measured to the nearest gallon.

BASIS OF PAYMENT

Full Depth Reclamation of Asphalt Pavement. The unit price bid per square yard shall include the cost of furnishing all labor and equipment necessary to satisfactorily complete the work including cleaning the existing pavement free of all debris and material that may interfere with the reclamations' milling process, milling, pulverizing and mixing the existing asphalt pavement, adding new aggregate and chemical or bituminous stabilizing agent(s) as required, then remixing, grading, compacting and curing in conformity with the lines, grades, depths and typical sections as shown in the plans. Aggregates, chemical and bituminous stabilizing agents will be paid for under their appropriate pay items. No separate payment will be made for the use of water in the full depth reclamation process. No direct payment will be made for any loss of materials resulting in shrinkage, compaction, foundation settlement, erosion or any other cause. No deductions will be made for the volumes occupied by manholes, catch basins and other such objects.

Aggregate. The unit price bid per ton shall include the cost of furnishing all labor, materials and equipments necessary to add aggregate as required to satisfactorily complete the work. No direct payment will be made for any loss of materials resulting in shrinkage, compaction, foundation settlement, erosion or any other cause. No deductions will be made for the volumes occupied by

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manholes, catch basins and other such objects.

Chemical Stabilizing Agent. The unit price bid per ton shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work. No separate payment will be made for water to mix the chemical stabilizing agent into a slurry.

Bituminous Stabilizing Agent. The unit price bid per gallon shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work