DESCRIPTION

This specification covers the requirements for central plant mixing, without the addition of heat, of recycled asphalt pavement (RAP). This work shall consist of preparing a mix design, mixing the RAP with bituminous material (unmodified or modified) and aggregate, and placing and compacting the recycled mix. All work under this item shall be in accordance with these specifications and in reasonably close conformity with the limits established by the Engineer.

MATERIALS

Bituminous Material. Liquid bituminous material shall be obtained from a Department approved facility. All bituminous material proposed for use on Department projects shall be approved by the Director, Materials Bureau. The engineer shall take one sample from each tank truck of bituminous material arriving on the project in accordance with Materials Method - NY 8.2. The sample shall be sent to the Materials Bureau with a completed BR170d attached.

Additives. Additives may be used to improve the quality of the resulting recycled pavement. Additives may be combined with the bituminous material prior to mixing or may be added to the recycled mix through the central plant. The proportion and amounts of additive shall be determined by the Contractor and approved by the Director, Materials Bureau.

Aggregates. Additional aggregates for central plant recycling of pavements shall be crushed stone or crushed gravel conforming to the requirements of Section 703-02, Coarse Aggregate, of the Standard Specifications. The gradation and source of the aggregates shall be specified by the Contractor and included in the proposed mix design.

Reclaimed Material. Asphalt pavement and any milled material which has been removed and/or processed from the pavement will be referred to as RAP. The RAP shall pass the 2 inch sieve size.

Design Guidelines. The recycled mixture consists of RAP, additional aggregate, liquid bituminous material, additives and water.

The minimum design liquid bituminous material content is 3% for asphalt emulsions, and 2% for performance-graded binders. The liquid bituminous material is calculated as a percentage of the dry mass of millings:

\[
\text{mass of liquid bituminous material/mass of RAP} \times 100 = \% \text{ liquid bituminous material}
\]

Recycled mixtures may be designed with or without additional aggregate, depending on the RAP’s gradation. When additional aggregate is used, the minimum content is 5.0% and the
maximum content is 20.0%, regardless of the recycled mixture’s design gradation. The percentage of additional aggregate is calculated as a percentage of the dry mass of millings:

\[
\text{[mass of additional aggregate} / \text{mass of RAP]} \times 100 = \% \text{ additional aggregate}
\]

Design the recycled mixture to conform to the following gradation.

<table>
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<tr>
<th>Percent Passing</th>
<th>Minimum</th>
<th>Maximum</th>
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<td>½</td>
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<td>80</td>
<td>4</td>
<td>14</td>
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<tr>
<td>200</td>
<td>2</td>
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The Department shall supply the average RAP gradation and asphalt content to the Contractor for the determination, by the Contractor, of the amount and type of bituminous material to properly recycle the pavement.

**CONSTRUCTION**

**Equipment.** Use equipment capable of:
- processing the RAP to pass a 2 inch sieve
- mixing the RAP with bituminous material and aggregate
- Paving the recycled material to the correct grade

**Calibration.** Calibrate the mixing equipment prior to the start of work, in accordance with established calibration procedures as detailed in the Procedural Directives of the Director, Materials Bureau. Submit the calibration results for approval to the Director, Materials Bureau at least 7 days prior to the start of work. The first calibration of each calendar year must be witnessed by Department personnel. 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. Calibration approval is valid for 90 days from the date of calibration. Provide a copy of the calibration approval letter to the Engineer before the start of work. No central plant recycling will be allowed under this contract until the calibration has been completed and approved. No payment will be made for material recycled by equipment without a valid calibration.
Weather Limitations. This work will not be permitted when the existing pavement contains frost, or when the air or surface temperature is below 45 °F or expected to drop below 45 °F within 24 hours. No material shall be placed from the last Saturday in September to May 1.

Testing. Prior to starting central plant recycling operations, test two aggregate samples to verify the gradation. Supply the test results to the Engineer before the start of work.

Once continuous production has been achieved, test four samples of the recycled mixture for gradation and total asphalt content. Submit the test results to the Engineer and Regional Materials Engineer before the end of the next workday. For each subsequent day of production, take a minimum of one sample of the recycled mixture from each one half mile, or fraction thereof, of recycled mix placed. Test each sample for gradation and total asphalt content and submit the test results within two workdays.

Make adjustments to the mix proportions or additional aggregate gradation based on the test results to comply with the approved mix design and construct a stable pavement layer.

Spreading. Recycled material will be loaded onto an acceptable haul vehicle and delivered to the construction site immediately after mixing. No stockpiling of recycled material will be allowed.

The recycled mixture shall be deposited directly into an approved bituminous paver equipped with a 30 foot moving reference and mechanically spread in a uniform layer so as to produce the specified thickness and surface tolerance after compaction.

Suitable means shall be provided to keep pavers and other equipment and tools free from bituminous accumulations. The surface of the pavement shall be protected from drippings of oil, kerosene, or other materials used in paving and cleaning operations.

Bituminous Application Rate. The Contractor shall be allowed to adjust the application rate of the bituminous material from the design value. The bituminous application rate may be allowed to drop below the minimum design value. The Contractor shall inform the Engineer of any changes to the bituminous application rate.

Compaction. After the recycled mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. All courses shall be initially rolled with the roller traveling parallel to the centerline of the pavement beginning at each edge and working toward the center. Banked curves shall be rolled starting at the low side edge and working toward the super-elevated edge. The roller drive roll or wheel shall be nearest the paver.
A pneumatic tire roller with a minimum ground contact pressure (GCP) of 80 psi will be supplied by the Contractor for compacting the recycled mix. The Contractor may choose to use vibratory compaction equipment for initial or intermediate rolling. The vibratory roller shall appear on the current Approved List - Bituminous Concrete Vibratory Compaction Equipment.

Initial and intermediate rollers shall operate at a uniform speed not to exceed 2.5 miles per hour (220 feet per minute). All turning of the compaction equipment shall be completed on material which has had a minimum of one roller pass. The Contractor shall note that if vibratory compaction equipment is used, they assume full responsibility for the cost of repairing all damages which may occur to highway components and adjacent property.

The pavement course shall be finish rolled with a steel wheel tandem roller having a minimum weight of 8 tons. This finish roller shall add a minimum of two passes. Dual vibrating drum rollers meeting the requirements of a tandem roller and operating in the static mode may be used for the finished roller. This vibratory roller may be used as the initial or intermediate roller and the finish roller.

The rolling sequence and number of passes to achieve the desired compaction shall be approved by the Engineer. It may be necessary to complete or finish roll the material on a subsequent day at no additional expense to the State. When the compaction procedure used by the Contractor fails to produce results acceptable to the Engineer, the procedure shall be adjusted to obtain the desired results. Material that cannot be properly and adequately compacted to a stable condition shall be removed and replaced, as ordered by the Engineer, at the Contractor’s expense.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers as directed by the Engineer. On depressed areas, a trench roller or a small vibratory roller approved by the Engineer may be used.

Any displacement occurring as a result of reversing the direction of the roller, or from other causes shall be corrected at once by the use of rakes and addition of fresh mixture as required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with small quantities of detergent or other approved material, but in no case shall a solvent having an adverse affect upon the bituminous pavement be used.

**Longitudinal Joints.** Plan the paving operation to ensure that the longitudinal joints in the recycled course will correspond with the edges of the proposed traffic lanes. Other joint arrangements require the Engineer’s approval.
Paving operations shall match multiple lanes at the completion of the work day to minimize the exposure of longitudinal joints to traffic overnight. If any length of longitudinal joint is exposed at the end of the working day, construct the joint using a pneumatic tire roller to form the joint into a wedge shape and provide a smooth transition for traffic. Construct the wedge of recycled material at a slope of 1 on 8 or flatter to meet the existing pavement elevation. As a minimum, post W8-39, “UNEVEN LANES” warning signs and R4-1, “DO NOT PASS” regulatory signs on both sides of the roadway to alert drivers of the uneven edge. Post W8-39 signs at a maximum spacing of 1000 feet. Post R4-1 signs at a maximum spacing as listed in Table 212-1 of the MUTCD for the speed limit.

**Brooming.** The pavement and shoulders shall be broomed by the Contractor, as ordered by the Engineer, to remove loose stone or recycled material resulting from the paving process.

**Tolerance.** The recycled surface shall be constructed to a 3/8 inch tolerance. The elevation difference at the longitudinal joint shall be constructed to a 3/16 inch tolerance. If, in the opinion of the Engineer, the pavement has not been constructed to these tolerances based upon visual observation or upon riding quality he/she may test the surface with a 15 foot straight edge or string line placed parallel to the center line of the pavement. He/she may also test with a 10 foot straight edge or string line placed transversely to the center line of the pavement on any portion of the pavement. Variations exceeding 3/8 inch shall be satisfactorily corrected or the pavement re-laid at no additional cost to the Department as ordered by the Engineer.

**Existing Pavement Cross Slopes.** The existing pavement's cross slopes shall be an item of discussion at the pre-paving meeting. If the existing pavement's cross slopes are according to the appropriate standards, then the cross slopes of the finished recycled course shall match the existing. If the existing pavement's cross slopes are not in accordance with the appropriate standards, then the Contractor shall present a plan to the Engineer that attempts to bring the cross slopes of the finished recycled course into conformance with the appropriate standards. The Engineer will be responsible for providing the Contractor with the target cross slopes.

**Curing.** Allow the recycled material to cure for a minimum of 10 days before placing the next paving course. The provisions of the paragraphs above, Brooming and Tolerance, apply from the time of paving until the recycled material is overlaid, not to exceed 30 days.

**Fog Seal.** If the Contractor determines that fog seal is necessary and the Engineer agrees, fog seal may be applied. Fog seal material cost is paid for only when the originally estimated amount for liquid bituminous material has not been totally utilized. The amount of bituminous material that may be paid for fog seal and for the recycling is limited to an amount equal to 110% of the originally estimated amount of liquid bituminous material.
The liquid bituminous material and rate of application for the fog seal shall be chosen by the Contractor. The Contractor shall be responsible for maintenance and protection of traffic for the fog seal operation. A maintenance and protection of traffic plan for the fog seal operation shall be developed by the Contractor and submitted to the Engineer for approval. No extra payment shall be made for the fog seal application or the maintenance and protection of traffic.

**Damaged or Deficient Areas.** Any mixture that ravel, becomes loose or broken, mixed with dirt, or is in anyway defective shall be reworked or removed and replaced with fresh recycled mix or fresh hot mixture and shall be compacted to conform with the surrounding area.

Any area showing an excess or deficiency of bituminous material shall be corrected to the satisfaction of the Engineer.

Ruts 3/8 inch or greater in depth which occur in the recycled mixture which cannot be corrected by rolling shall be corrected by a method approved by the Engineer.

All repairs or remedial actions necessary to correct damaged or deficient areas of recycled pavement shall be carried out at the Contractor’s expense. The Contractor shall not be responsible for damage to the recycled mix as a result of other work performed on the pavement or shoulders.

**Repairs.** Immediately after becoming aware of damage or deficiencies in the recycled mix the Engineer will notify the Contractor or the Contractor’s designated representative. The Contractor shall make arrangements to repair the damaged or deficient areas to the satisfaction of the Engineer.

**METHOD OF MEASUREMENT**

**Central Plant Mixing of Recycled Asphalt Pavement.** Measurement will be the number of square yards of pavement surface placed in accordance with the specifications and contract documents.

**BASIS OF PAYMENT**

**Central Plant Mixing of Recycled Asphalt Pavement.** Payment will be made at the unit price per square yard for the quantities measured. The unit price bid shall include the cost of all labor, materials, equipment and incidentals necessary to complete the work except that Bituminous Material and Aggregate will be paid for under their appropriate pay items. No separate payment will be made for the use of water in the mixing process. Any work required for the maintenance, replacement, or repair of the recycled pavement prior to the acceptance of the contract, shall be done at no additional cost to the State.