

SECTION 300

BASES

CONSTRUCTION MANUAL

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 304 ASC-Gravel -- 5 Pages

AGGREGATE BASE AND SUBBASE **COURSE**

304-1 GENERAL

References:

- (1) Construction Manual
Section 106
- (2) Standard Specifications
Sections 105, 106, 304, and 700
- (3) Special Provisions & Supplemental Specifications
- (4) Standard Details Highways and Bridges
- (5) Project Plans, Particularly the Typical Sections

This work consists of placing Aggregate Base and/or Aggregate Subbase material above subgrade and below the pavement grade. The material used is granular, screened or crushed material and must conform to the specification requirements.

304-2 LAYOUT AND CONTROL

Layout for line and grade, break points, and other control points is done by the Contractor.

304-3 TESTING REQUIREMENTS

Aggregate Base and Aggregate Subbase

- (1) Gradations: As per list of Minimum Testing Requirements; sampled in roadway as it is being placed.
- (2) Compaction: As per List of Minimum Testing Requirements, each layer

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Preliminary samples taken in pits are informational only.

304-4 CONSTRUCTION

Contractors sometimes stockpile crushed or screened base material before placing it on the roadway. Constant attention by the contractor to proper methods of stockpiling, thus preventing segregation of fine or coarse aggregates is very important. Aggregates must pass Specifications when placed on the roadway. If a retest of a failing graduation fails, the material must be removed. If the retest passes, the material is assumed to be passing Specifications.

Aggregates are placed on a fine-graded subgrade full width, but where maintaining traffic is a concern, only one side at a time can be placed. Specifications require layers to not exceed 300 mm [12"] in depth, but the Resident may allow placing the gravel full depth if tests show densities can be obtained, and the Contractor agrees to digging to test the lower portion. Vibratory rollers, often used for compacting, are more capable of achieving passing densities than static machines, providing rolling is done before traffic gets on the course. The aggregates should be dumped on top of the layer being placed and pushed ahead to mix the material; end dumping is not permitted. Leveling equipment should cut into the edge material of the previously placed side, while placing the second side, to achieve uniformity.

Special Provisions usually require a surcharge of material placed above grade, if traffic is to be routed on the base or aggregate subbase for a designated period of time. The surcharge of material is removed in the fine grading operation and may be placed in areas designated in the Special Provisions. The placement of a surcharge may be avoided by placing milled or reclaimed pavement as the top of the Aggregate Subbase Gravel.

Fine grading of the base or subbase is usually done with a grader and checked by using a string set on rail grades on side stakes.

304-5 INSPECTION, MEASUREMENT & FIELD DOCUMENTATION

The grade of the top of the fill or the bottom of the cut [subgrade] must be checked for grading within tolerances of the Specifications before the Base or Subbase is placed. This is done using a hand level and rule, or stringline and rule from grades set on side stakes. The inspector should document the area checked in a construction book; noting the grade was within specifications and to plan, and signing and dating the entry.

The inspector should observe placement of the gravel for procedure, segregation, oversize rocks or clay balls. Fine grading of a lower Aggregate Subbase Type "E" course, if used, is not necessary before placing the upper, Type "D" course. Density testing is required on the lower and upper layers as per the Minimum Testing Schedule.

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a. Field Documentation

Project Diary, Inspector's Diary/Daily Report: The Resident or Inspector will keep notes describing the Contractor's aggregate base and subbase operations. Information recorded will be: name of pit the material is coming from, station to station limits where it is placed, and whether placed in one lift or two lifts.

The Resident is responsible for quality assurance testing; he/she must assure that a Technician from the Department is available to do the testing required. Tests the Contractor may take are not to be counted toward the total number needed; these tests are to be considered as quality control for the Contractor's benefit only. Reference is made to Section 901 of this Manual for further discussion of "Minimum Testing requirements".

Gravel can fail gradation or density or both. Corrective action directed by the Resident will be documented; more compactive effort may be required or material failing in gradation may have to be removed.

Grade Check Book: The Department requires that the Resident or Inspector do random checks of subgrade and top of gravel to assure that the Contractor is placing gravel within construction tolerances. Checks should be done between stations as well as on station. Reference is made to Section 203 (Excavation) and to Section 901 of this Manual for further discussion of the Grade Check book.

b. Measurement and Payment

Final quantity for aggregate base and subbase can be figured by any one or a combination of the following methods:

1. Plan Quantity

Quantity for payment can be plan quantity providing the Engineer's Estimate is accurate and the work is done to the limits estimated. It is often the situation that side street and mainline approaches and drives are changed to match field conditions; the Estimate should be adjusted to meet these field conditions as necessary. Payment by plan quantity should be documented by written agreement in the form of a Resident's Work Order or a memo to the Contractor. The agreement should state that the plan quantity will be adjusted upward or downward if changes are made in the field. Changes will be measured by three dimensions or load count described below.

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Gravel can also be bid plan quantity. The quantity on the schedule of items is the final quantity with adjustments made upward or downward if changes are made in the field. Changes are documented as described above.

2. In-Place Measurement

If the estimated quantity has no basis, commonly referred to as a “throw in” figure, gravel for the project will have to be refigured. Typical factors, derived from the typical sections, should be used for mainline travelway and shoulders where possible. Three-dimensional measurements and/or plan dimensions can be used for drives, approaches and intersection areas. Gravel used to backfill undercut areas or to provide bedding for drainage can also be measured and computed by three dimensions to limits authorized. For drainage, depth will be figured from flow line of the pipe and width will be figured to the lateral pay limits defined in Subsection 206.04 of the Standard Specifications.

3. Load Count

Gravel can be measured load count if there is not a large quantity involved. By specification, gravel measured load count will be reduced 20 percent for payment to arrive at an equivalent quantity measured in its final position. Refer to the Standard Specifications, Subsection 304.06 for clarification.

4. Pit Measure

Gravel can be bid pit measure. Original sections must be taken before the pit is utilized on the Project. Care must be taken that any overburden, tailings, or unacceptable materials are left in the pit to be deducted from the total during the taking of final sections. Gravel stockpiled before original sections are taken will be paid for at 90%. Gravel can be deducted from the pit total at 90% for truck measure or 115% for in-place measure. Tailings used as stone ditch protection will be deducted at 100%.

Standard Specifications provide a mechanism for paying for specific items added to the contract without requiring a quote from the Contractor. The following is list of items commonly used and how to pay for them:

<u>To Pay For</u>	<u>Use item</u>	<u>Unit Price</u>
Aggre Sub Crse – For Foundations	304.10 Aggr Subbase Crse – Gravel	2 x Bid
Aggre Sub Crse – Slope Blanket	304.10 Aggr Subbase Crse – Gravel	2 x Bid

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Final quantity for payment will be entered in the Final Quantity Book and labeled as such. Reference will be made to grade checks, measurements, load count delivery slips, and computations in the project records, as necessary. Measurements and delivery slip totals must be entered in a bound book, which can be the Final Quantity Book or the Construction Book. Reference is made to Section 901 of this Manual for further discussion of field books. **All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.**

**Maine Department of Transportation
Bureau of Project Development
Pit Authorization**

PROJECT NUMBER: _____

DATE: _____
TOWN: _____

_____ is authorized to haul _____ from _____ in accordance with the State of Maine, Department of Transportation, Standard Specifications, Highways and Bridges, Revision of December, 2002, and applicable DEP regulations.

Pit size over 30 Acres:

DEP Permit No: _____

Pit size 5-30 Acres:

Notice of intent, filed with DEP, to comply with Performance Standards: _____

Date received by DEP: _____

or in lieu of above, DEP Permit No.: _____

Rehabilitation, Section 106, Standard Specifications:

- ☐ Grading 1:1 slope
- ☐ Complete Rehabilitation

Pit size less than 5 Acres:

Rehabilitation, Section 106, Standard Specifications

- ☐ Grading 1:1 slope
- ☐ Complete Rehabilitation

Pit operation meets local ordinances ☐

Contractor's Representative

Date

Resident Engineer

Date

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Section 307 Full Depth Recycled Pavement -- 3 Pages

FULL DEPTH RECYCLED PAVEMENT

307-1 GENERAL

References

(1) Construction Plans

(2) Special Provisions

307-2 LAYOUT AND CONTROL

Control reference points for centerline control will be established by the MDOT. These reference points could range from telling the Contractor to split the existing pavement to having a MDOT survey crew establish centerline. The Contractor will be responsible for all other survey work, construction layout, staking out work, setting grades (profile grades), and quality control to assure accuracy. It is recommended that the Contractor's work be spot checked for accuracy.

307-3 MATERIALS

The existing bituminous pavement and 50 mm \pm [2 in] of the underlying gravel shall be pulverized into a homogeneous mass so that 100 % of the material will pass a 50 mm [2 in] square mesh sieve.

If pavement conditions warrant (such as poor \times -slope), new aggregate may be added prior to the pulverizing operation. In general, new aggregate shall meet subsection 411.02 Untreated Aggregate Surface Course of the Standard Specifications. Reclaimed pavement or pavement millings (which may be available from previous projects or a current one) are also a good material to consider using in these instances.

307-4 TESTING REQUIREMENTS

Refer to the Minimum Testing requirements to determine the type and quantity of tests required. Refer to the Special Provisions for any other requirements. Generally speaking, the minimum testing requirements are 1 compaction test per 600 meters [2000 ft] per lane width for mainline, and 1 per 1200 meters [4000 ft] for shoulders.

At this time, the method for determining compaction begins with a proctor or target density determined in the field. This is accomplished by designating a 90 meter [300 ft] section as the control section. The contractor

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then pulverizes this section, grades the section, adds water to get material up to optimum moisture content (water may be added prior to grading), and compacts with vibratory roller (meeting specifications) until the nuclear density readings show an increase in dry density of less than 16 kg/m^3 [1 pcf] for the final 4 vibratory roller passes. Once this target density is determined, the remaining tests must meet 98 % of the target density.

307-5 CONSTRUCTION AND INSPECTION

The contractor is responsible for the following:

1. All lay out is done prior to starting work.
2. Maintaining control points and layout throughout construction.
3. Assuring that the pavement is pulverized full depth.
4. Assuring the material is blended into a homogeneous mass.
5. Assuring 100 % of the material will pass a 50 mm [2 in] square mesh sieve.
6. Grading the pulverized material ($10 \text{ mm} \pm$ [? in] typical grading tolerance) to the lines and grades set forth by the contract and by MDOT personnel.
7. Compacting the pulverized material to meet density requirements.
8. Maintaining until paving can be completed.

The Inspector/project personnel are responsible for enforcing all specifications and requirements and accepting the quality of work done. Grading operations (both profile and x-sectional) should be carefully checked, as this will have a great impact of the smoothness of the finished product. Compaction should be closely monitored.

307-6 MEASUREMENT AND DOCUMENTATION

Project Diary, Inspector's Diary/Daily Report: The Resident or Inspector will keep notes describing the Contractor's operations on the road and in the plant.

Cold In-Place Recycled Pavement. Field notes will include weather conditions, station to station limits of work, and description of equipment used: pulverizer, grader/spreader, rollers. The Inspector will also document inspection procedures and check measurements of work done, such as: depth of grinding operations, cross-

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slope, and density of the finished product. Any added aggregate or recycled pavement used as necessary to restore cross-slope will also be noted, tested, and measured for payment if required.

Plant Mixed Recycled Pavement. Field notes will be the same as for cold in-place recycled pavement with additional documentation regarding plant inspections.

Method of Measurement

Final quantity of recycled pavement can be figured by either of the two following methods:

Plan Quantity. Quantity for payment can be “plan quantity” providing the estimated quantity shown in the Schedule of Items is reasonably accurate and work is done to the limits estimated. Payment by plan quantity should be documented by written agreement such as a memo or Resident’s Work Order, between the Resident and the Contractor. The agreement must stipulate that the plan quantity will be adjusted upward or downward if changes are made in the field. Quantities paid “plan quantity” will be documented by notes of inspection and acceptance entered in the Project Diary, or directly in the Final Quantity Book.

In-Place Measurement. If the estimated quantity is not figured accurately enough to pay as a final figure, the final pay quantity will be determined from field measurements, or will be refigured from the plans, or a combination of both. Length will be distance between stations and width will be field measured. Frequency of width measurements will depend on road width consistency. All measurements, and sketches if required, will be recorded in a Construction Book or directly in the Final Quantity Book and signed and dated. Irregularly shaped areas such as ramp and side street approaches and intersections will be broken down into basic geometric shapes and measured by length and width. Dimensions taken from the plans, and corresponding notes of inspection and acceptance are also recorded in a Construction Book or the Final Quantity Book.

Added Material. If specified in the contract, material added to maintain cross-slope in areas not designated on the plans or in the construction notes will be paid separately under the item used. Measurement will be by load count reduced by 20 percent for final payment. Every load will be documented by a delivery slip that has been signed and dated at the point of delivery by the Resident or Inspector. Daily totals will be entered in the Final Quantity Book. Refer to Section 304.06 - Method of Measurement of the Standard Specifications for further explanation of shrinkage factors.

Final Quantity. Final quantity for payment will be entered in the Final Quantity Book and so labeled. References will be made to statements of inspection and acceptance, plan dimensions, field measurements, and delivery slips, as necessary. **All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.**

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PM-RAP

308-1 GENERAL

References

(1) Construction Plans

(2) Special Provisions

308-2 LAYOUT AND CONTROL

Control reference points for centerline control will be established by the MDOT. These reference points could range from telling the contractor to split the existing pavement to having an MDOT survey crew establish centerline. The contractor will be responsible for all other survey work, construction layout, staking out work, setting grades (profile grades), and quality control to assure accuracy. It is recommended that the contractor's work be spot checked for accuracy.

308-3 MATERIALS

Recycled Asphalt Pavement (RAP) that has been milled from this Project or other Projects will be screened or crushed, mixed with emulsified or foamed asphalt and placed as a base course of pavement.

Prior to construction, a mix design must be developed. Samples of the RAP are sent to the Department's Central Laboratory, where the optimum emulsion or foamed asphalt content will be determined. This process should be started at least two weeks prior to the start of the work.

If pavement conditions warrant (such as poor x-slope), new aggregate may be added prior to placement. In general, new aggregate shall meet Section 411.02 Untreated Aggregate Surface Course of the Standard Specifications. Reclaimed pavement or pavement millings (which may be available from previous projects or a current one) are also a good material to consider using in these instances.

308-4 EQUIPMENT

The plant will typically consist of a continuous flow pugmill mixer. The plant should be inspected by Testing personnel prior to paving. The plant should be capable of metering the correct amount of asphalt material

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according to the mix design. Pavers and rollers should meet the requirements outlined in Section 401 of the Specifications.

308-5 TESTING REQUIREMENTS

Refer to the Minimum Testing requirements to determine the type and quantity of tests required. Refer to Special Provisions for any other requirements. Generally speaking, the minimum testing requirements are 1 compaction test per 600 meters [2000 ft] per lane width for mainline and 1 per 1200 meters [4000 ft] for shoulders.

The method for determining compaction begins with a target density determined in the field. This is accomplished by designating a 100 meter [300 ft] section as the control section. The contractor places the Plant Mixed RAP and compacts with vibratory and pneumatic-tired rollers (meeting specifications) until the nuclear density readings show an increase in dry density of less than 16 kg/m³ [1 pcf] for the final 4 roller passes. Once this target density is determined, the remaining tests must meet 98 % of the target density.

308-6 CONSTRUCTION AND INSPECTION

The contractor is responsible for the following:

1. All layout is done prior to starting work.
2. Maintaining control points and layout throughout construction.
3. Identifying the source of RAP (this may be supplied by the Department).
4. Assuring the material is stockpiled properly.
5. Assuring 100 % of the material will pass a 37.5 mm [1 ½ in] square mesh sieve.
6. Assuring that the mixing plant is capable of producing a uniform mixture that meets the mix design requirements.
7. Compacting the material to meet density requirements.
8. Maintaining until paving can be completed.

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The inspector/project personnel are responsible for enforcing all specifications and requirements and accepting the quality of work done. Placing operations (both profile and x-sectional) should be carefully checked, as this will have a great impact of the smoothness of the finished product. Compaction should be closely monitored.

After a section of the Plant Mixed RAP is placed on the roadway, it must be allowed to cure for at least seven days prior to application of the Hot Mix Asphalt Pavement.

308-7 MEASUREMENT AND DOCUMENTATION

Project Diary, Inspector's Diary/Daily Report: The Resident or Inspector will keep notes describing the Contractor's operations on the road and in the plant.

Cold In-Place Recycled Pavement. Field notes will include weather conditions, station to station limits of work, and description of equipment used: pulverizer, grader/spreader, rollers. The Inspector will also document inspection procedures and check measurements of work done, such as: depth of grinding operations, cross-slope, and density of the finished product. Any added aggregate or recycled pavement used as necessary to restore cross-slope will also be noted, tested, and measured for payment if required.

Plant Mixed Recycled Pavement. Field notes will be the same as for cold-in-place recycled pavement with additional documentation regarding plant inspections.

Method of Measurement

Final quantity of recycled pavement can be figured by either of the two following methods:

Plan Quantity. Quantity for payment can be "plan quantity" providing the estimated quantity shown in the Schedule of Items is reasonably accurate and work is done to the limits estimated. Payment by plan quantity should be documented by written agreement such as a memo or Resident's Work Order, between the Resident and the Contractor. The agreement must stipulate that the plan quantity will be adjusted upward or downward if changes are made in the field. Quantities paid "plan quantity" will be documented by notes of inspection and acceptance entered in the Project Diary, or directly in the Final Quantity Book.

In-Place Measurement. If the estimated quantity is not figured accurately enough to pay as a final figure, the final pay quantity will be determined from field measurements, or will be refigured from the plans, or a combination of both. Length will be distance between stations and width will be field measured. Frequency of width measurements will depend on road width consistency. All measurements, and sketches if required, will be recorded in a Construction Book or directly in the Final Quantity Book and

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signed and dated. Irregularly shaped areas such as ramp and side street approaches and intersections will be broken down into basic geometric shapes and measured by length and width. Dimensions taken from the plans and corresponding notes of inspection and acceptance also recorded in a Construction Book or the Final Quantity Book.

Added Material. If specified in the contract, material added to maintain cross-slope in areas not designated on the plans or in the construction notes will be paid separately under the item used. Measurement will be by load count, reduced by 20 percent for final payment. Every load will be documented by a delivery slip that has been signed and dated at the point of delivery by the Resident or Inspector. Daily totals will be entered in the Final Quantity Book. Refer to the Standard Specifications, Subsection 304.06 - Method of Measurement, for further explanation of shrinkage factors. Refer to the Special Provision for the latest method of paying for added materials.

Final Quantity. Final quantity for payment will be entered in the Final Quantity Book and so labeled. References will be made to statements of inspection and acceptance, plan dimensions, field measurements, and delivery slips, as necessary. **All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.**

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FULL DEPTH RECYCLED PAVEMENT **WITH ADDITIVES**

308-1 GENERAL

References

(1) Construction Plans

(2) Special Provisions

308-2 LAYOUT AND CONTROL

Control reference points for centerline control will be established by the MDOT. These reference points could range from telling the Contractor to split the existing pavement to having a MDOT survey crew establish centerline. The Contractor will be responsible for all other survey work, construction layout, staking out work, setting grades (profile grades), and quality control to assure accuracy. It is recommended that the Contractor's work be spot checked for accuracy.

308-3 MATERIALS

The existing bituminous pavement and 50 mm \pm [2 in] of the underlying gravel shall be pulverized into a homogeneous mass so that 100 % of the material will pass a 50 mm [2 in] square mesh sieve.

If pavement conditions warrant (such as poor \times slope), new aggregate may be added prior to the pulverizing operation. In general, new aggregate shall meet Section 411.02 Untreated Aggregate Surface Course of the Standard Specifications. Reclaimed pavement or pavement millings (which may be available from previous projects or a current one) are also a good material to consider using in these instances.

308-4 TESTING REQUIREMENTS

Refer to the Minimum Testing requirements to determine the type and quantity of tests required. Refer to the Special Provisions for any other requirements. Generally speaking, the minimum testing requirements are 1 compaction test per 600 meters [2000 ft] per lane width for mainline and 1 per 1200 meters [4000 ft] for shoulders.

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At this time, the method for determining compaction begins with a proctor or target density determined in the field. This is accomplished by designating a 90 meter [300 ft] section as the control section. The contractor then pulverizes this section, grades the section, adds water to get material up to optimum moisture content (water may be added prior to grading), and compacts with a vibratory roller (meeting specifications) until the nuclear density readings show an increase in dry density of less than 16 kg/m^3 [1 pcf] for the final 4 vibratory roller passes. Once this target density is determined, the remaining tests must meet 98 % of the target density.

308-5 CONSTRUCTION AND INSPECTION

The contractor is responsible for the following:

1. All lay out is done prior to starting work.
2. Maintaining control points and layout throughout construction.
3. Assuring that the pavement is pulverized full depth.
4. Assuring the material is blended into a homogeneous mass.
5. Assuring 100 % of the material will pass a 50 mm [2 in] square mesh sieve.
6. Grading the pulverized material ($10 \text{ mm} \pm$ [? in] typical grading tolerance) to the lines and grades set forth by the contract and by MDOT personnel.
7. Compacting the pulverized material to meet density requirements.
8. Maintaining until paving can be completed.
9. Assuring the right quantities of additives are added and mixed thoroughly.

The inspector/project personnel are responsible for enforcing all specifications and requirements and accepting the quality of work done. Grading operations (both profile and x-sectional) should be carefully checked, as this will have a great impact of the smoothness of the finished product. Compaction should be closely monitored.

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308-6 CONSTRUCTION SEQUENCING

In general, the following sequence has been followed with success. The Contractor shall pulverize existing pavement and grade the material to within $25 \text{ mm} \pm [2 \text{ in}]$ of the profile and x-slope grade. Additives shall be added at an even rate of application and mixed thoroughly with the pulverizer. The Contractor shall then compact this material with a padfoot roller and then fine grade the material to within $\pm 10 \text{ mm} [? \text{ in}]$ of finish grade. The contractor will then continue to compact this material until passing density tests are obtained. Compaction equipment may consist of a vibratory steel drum roller, rubber tired pneumatic roller, and a padfoot vibratory roller (all meeting minimum size requirements). Small amounts of water may be added at any time to aid in the mixing of the additives and in the compaction of materials. Subsequent pavement courses shall not be placed until the proper curing time has elapsed. Curing time depends on the weather conditions, type of additives, contract requirements, and other situations/conditions.

308-7 ADDITIVES

The following are some examples of additives used to date.

- A. Emulsion
- B. Cement
- C. Lime
- D. Calcium Chloride
- E. Asphalt

308-8 MEASUREMENT AND DOCUMENTATION

Project Diary, Inspector's Diary/Daily Report: The Resident or Inspector will keep notes describing the Contractor's operations on the road and in the plant.

Cold In-Place Recycled Pavement. Field notes will include weather conditions, station to station limits of work, and description of equipment used: pulverizer, grader/spreader, rollers. The Inspector will also document inspection procedures and check measurements of work done, such as: depth of grinding operations, cross-slope, and density of the finished product. Any added aggregate or recycled pavement used as necessary to restore cross-slope will also be noted, tested, and measured for payment if required.

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Plant Mixed Recycled Pavement. Field notes will be the same as for cold in-place recycled pavement with additional documentation regarding plant inspections.

Method of Measurement

Final quantity of recycled pavement can be figured by either of the two following methods:

Plan Quantity. Quantity for payment can be “plan quantity” providing the estimated quantity shown in the Schedule of Items is reasonably accurate and work is done to the limits estimated. Payment by plan quantity should be documented by written agreement such as a memo or Resident’s Work Order, between the Resident and the Contractor. The agreement must stipulate that the plan quantity will be adjusted upward or downward if changes are made in the field. Quantities paid “plan quantity” will be documented by notes of inspection and acceptance entered in the Project Diary, or directly in the Final Quantity Book.

In-Place Measurement. If the estimated quantity is not figured accurately enough to pay as a final figure, the final pay quantity will be determined from field measurements, or will be refigured from the plans, or a combination of both. Length will be distance between stations and width will be field measured. Frequency of width measurements will depend on road width consistency. All measurements, and sketches if required, will be recorded in a Construction Book or directly in the Final Quantity Book and signed and dated. Irregularly shaped areas such as ramp and side street approaches and intersections will be broken down into basic geometric shapes and measured by length and width. Dimensions taken from the plans and corresponding notes of inspection and acceptance are also recorded in a Construction Book or the Final Quantity Book.

Added Material. If specified in the contract, material added to maintain cross-slope in areas not designated on the plans or in the construction notes will be paid separately under the item used. Measurement will be by load count reduced by 20 percent for final payment. Every load will be documented by a delivery slip that has been signed and dated at the point of delivery by the Resident or Inspector. Daily totals will be entered in the Final Quantity Book. Refer to the Standard Specifications Section 304.06 - Method of Measurement, for further explanation of shrinkage factors. Refer to the Special Provision for the latest method of paying for added materials.

Final Quantity. Final quantity for payment will be entered in the Final Quantity Book and so labeled. References will be made to statements of inspection and acceptance, plan dimensions, field measurements, and delivery slips, as necessary. **All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.**

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FOAMED ASPHALT

309-1 GENERAL

References

(1) Construction Notes

(2) Special Provisions

309-2 LAYOUT AND CONTROL

Control reference points for centerline control will be established by the MDOT. These reference points could range from telling the contractor to split the existing pavement to having an MDOT survey crew establish centerline. The contractor will be responsible for all other survey work, construction layout, staking out work, setting grades (profile grades), and quality control to assure accuracy. It is recommended that the contractor's work be spot checked for accuracy.

309-3 MATERIALS

Pulverized material shall consist of a portion, or the entire existing bituminous pavement and, if specified, a designated portion of the underlying gravel, pulverized and blended into a homogenous mass. Pulverized material will be processed to 100 percent passing a 50 mm [2 in] square mesh sieve.

New aggregate, if required by the contract or job mix, shall meet the requirements of Section 411.02 Untreated Aggregate Surface Course.

Recycled material shall consist of material from the project or from off-site stockpiles that have been processed, prior to use, to 100 percent passing a 50 mm [2 in] square mesh sieve. The Resident shall conditionally accept recycled material at the source; it shall be free of winter sand, granular fill, construction debris, and other materials not generally considered to be bituminous pavement.

The Department will supply a mix design for the foamed asphalt based on test results from pavement and soil analysis taken to the design depth. The mix design, including the determination of optimum foaming characteristics of the asphalt binder, will be carried out using a Wirtgen WLB10 Foamed Bitumen Laboratory. The Department will provide the following information prior to construction:

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1. Percent of bitumen to be used.
2. Percent of water to be used in the foaming process.
3. Quantity (if any) of crusher dust to be used.
4. Quantity of lime or cement to be added.
5. Optimum moisture content for proper compaction and dispersion of foamed asphalt.
6. Additional aggregate (if required).

After a test strip has been completed, it may be necessary for the Resident to make adjustments to the design water and/or additive quantities being incorporated into the reclaim material.

309-4 EQUIPMENT

Pulverizer The modified milling or recycling machine shall be a Wirtgen Model WR2500, Caterpillar Model RR350, or equal, and, as a minimum, shall have the following features:

- A. A minimum power capability of 600 horsepower;
- B. Where the recycling depth exceeds 250 mm [10 in], the effective volume of the mixing chamber shall be increased in relation to the depth of cut;
- C. Two microprocessor-controlled systems, complete with 2 independent pumping systems and spraybars, to regulate the application of foamed bitumen stabilizing agent, separate from water (for increasing the moisture content of the recycled material), in relation to the forward speed and mass of the material being recycled;
- D. Two spraybars shall each be fitted with self-cleaning nozzles at a maximum spacing of one nozzle for each 155 mm [6 in] width of the chamber;
- E. The foamed bitumen shall be produced at the spraybar in individual expansion chambers into which both hot bitumen and water are injected under pressure through individual and separate small orifices that promote atomization. The rate of addition of water into hot bitumen shall be kept at a constant (percentage by mass of bitumen) by the same microprocessor;
- F. An inspection (or test) nozzle shall be fitted at one end of the spraybar that produces a representative sample of foamed bitumen;
- G. An electrical heating system capable of maintaining the temperature of all bitumen flow components above 150°C [300°F];
- H. A single bitumen feed pipe installed between the modified milling or recycling machine and the supply tanker. Circulating systems that incorporate a return pipe to the supply tanker shall not be used;
- I. The operator cabin shall be variable from right to left;
- J. A printer shall be included to record amounts of materials used.
- K. The recycler shall be fitted with a front breaker bar system to ensure that the reclaimed material is broken down to the sizing outlined in 309.02.

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In addition to the above features, it is an essential part of this specification that the recycler be capable of exactly reproducing the foaming characteristics produced by the foam lab, to ensure compliance with the mix design as well as correct dispersion of the foamed asphalt. To ensure that the recycling process in the field reproduces the lab mix design, the recycler shall be fitted with the same type of foam expansion chambers as the lab foaming unit.

Liquid Mixer Unit or Distributor Only tankers with a capacity exceeding 10,000 L [2500 gal] shall be used to supply the recycling machine with bitumen. Each tanker shall be fitted with two recessed pin-type tow hitches, one in front and the other behind, thereby allowing the tanker to be pushed from behind by the recycling machine, and to push a water tanker in front. No leaking tanker will be permitted on the job site. In addition, each tanker shall be equipped with the following:

- A. A thermometer to show the temperature of the contents in the bottom third of the tank;
- B. A rear feed valve, with a minimum internal diameter of 75 mm [3 in], capable of draining the contents of the tank when fully opened;
- C. Insulation to retain heat; and
- D. A calibrated dipstick marked at intervals of no more than 100 L [25 gal], for measuring the contents of the tank.

Placement Equipment Placement of the full depth recycled material to the required slope and grade shall be done with an approved highway grader or by another method approved by the Resident.

Rollers The full depth recycled material shall be rolled with a vibratory pad/tamping foot roller, a vibratory steel drum soil compactor and a Type II pneumatic tire roller. The pad/tamping foot roller drum shall have a minimum of 112 tamping feet 73 mm [3 in] in height and a minimum contact area per foot of 110 cm² [17 in²]. The vibratory steel drum roller shall have a minimum 2.15 meter [84 in] width single drum. The pneumatic tire roller shall meet the requirements of Section 401.10 and the minimum allowable tire pressure shall be 586 kPa [85 psi].

309-5 TESTING REQUIREMENTS

Refer to the Minimum Testing requirements to determine the type and quantity of tests required. Refer to Special Provisions for any other requirements. Generally speaking, the minimum testing requirements are 1 compaction test per 600 meters [2000 ft] per lane width for mainline and 1 per 1200 meters [4000 ft] for shoulders.

The method for determining compaction begins with a target density determined in the field. This is accomplished by designating a 100 meter [300 ft] section as the control section. The contractor places the

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material and compacts with pad/tamping foot, vibratory, and pneumatic-tired rollers (meeting specifications) until the nuclear density readings show an increase in dry density of less than 16 kg/m^3 [1 pcf] for the final 4 roller passes. Once this target density is determined, the remaining tests must meet 98 % of the target density.

309-6 CONSTRUCTION AND INSPECTION

The contractor is responsible for the following:

1. All layout is done prior to starting work.
2. Maintaining control points and layout throughout construction.
3. Identifying the source of additional material if required (this may be supplied by the Department).
4. Assuring 100 % of the material will pass a 25 mm [2 in] square mesh sieve.
5. Assuring that the pulverizer is capable of producing a uniform mixture that meets the mix design requirements.
6. Assuring the addition of materials (lime, asphalt, dust, and water) meet the mix design requirements.
7. Compacting the material to meet density requirements.
8. Maintaining until paving can be completed (minimum of 36 hours cure time).

The inspector/project personnel are responsible for enforcing all specifications and requirements and accepting the quality of work done. Placing operations (both profile and x-sectional) should be carefully checked, as this will have a great impact of the smoothness of the finished product. Compaction should be closely monitored.

It is advisable to talk with other Residents/Inspectors who have placed foamed asphalt to incorporate their suggestion and to get ideas about potential problem areas and solutions.

309-7 MEASUREMENT AND DOCUMENTATION

Project Diary, Inspector's Diary/Daily Report: The Resident or Inspector will keep notes describing the Contractor's operations. Field notes will include weather conditions, station to station limits of work, and description of equipment used: pulverizer, grader/spreader, rollers. The Inspector will also document inspection

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procedures and check measurements of work done, such as: weight checks of added material, cross-slope, and density of the finished product. Any added aggregate or recycled pavement used as necessary to restore cross-slope will also be noted, tested, and measured for payment if required.

Method of Measurement

Final quantity can be figured by either of the two following methods:

Plan Quantity. Quantity for payment can be “plan quantity” providing the estimated quantity shown in the Schedule of Items is reasonably accurate and work is done to the limits estimated. Payment by plan quantity should be documented by written agreement such as a memo or Resident’s Work Order, between the Resident and the Contractor. The agreement must stipulate that the plan quantity will be adjusted upward or downward if changes are made in the field. Quantities paid “plan quantity” will be documented by notes of inspection and acceptance entered in the Project Diary, or directly in the Final Quantity Book.

In-Place Measurement. If the estimated quantity is not figured accurately enough to pay as a final figure, the final pay quantity will be determined from field measurements, or will be refigured from the plans, or a combination of both. Length will be distance between stations and width will be field measured. Frequency of width measurements will depend on road width consistency. All measurements, and sketches if required, will be recorded in a Construction Book or directly in the Final Quantity Book and signed and dated. Irregularly shaped areas such as ramp and side street approaches and intersections will be broken down into basic geometric shapes and measured by length and width. Dimensions taken from the plans and corresponding notes of inspection and acceptance also recorded in a Construction Book or the Final Quantity Book.

Added Material. If specified in the contract, material added to maintain cross-slope in areas not designated on the plans or in the construction notes will be paid separately under the item used. Measurement will be by load count, reduced by 20 percent for final payment. Every load will be documented by a delivery slip that has been signed and dated at the point of delivery by the Resident or Inspector. Daily totals will be entered in the Final Quantity Book. Refer to the Standard Specifications, Section 304.06 - Method of Measurement, for further explanation of shrinkage factors. Refer to the Special Provision for the latest method of paying for added materials.

Final Quantity. Final quantity for payment will be entered in the Final Quantity Book and so labeled. References will be made to statements of inspection and acceptance, plan dimensions, field measurements, and delivery slips, as necessary. **All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.**