



**DEVELOPMENTAL SPECIFICATIONS
FOR
RECYCLED ASPHALT SHINGLES (RAS)**

**Effective Date
February 16, 2010**

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

Add the following to Article 2303.02, Materials:

F. Recycled Asphalt Shingles (RAS)

1. Pre-consumer or post-consumer shingles that have been processed, sized, and ready for incorporation into an asphalt mixture constitute RAS material. Other than explicitly stated in this subsection and Appendix A, use RAS according to the same requirements as prescribed for RAP material.
2. Use between 2% and 5% RAS by weight of total aggregate. Consider the percentage of RAS used part of the maximum allowable RAP percentage.
3. RAS shall come from an approved supplier designated in **Materials I.M. 506 Appendix A Appendix D**.

Add the following to Article 2303.04, Method of Measurement:

I. Recycled Asphalt Shingles (RAS)

Two-thirds (67%) of the asphalt binder from RAS which is incorporated into the mixture will be included in the quantity of asphalt binder used.

Replace item 2 of Article 2303.05, B, Asphalt Binder:

2. Payment for asphalt binder will be for new asphalt binder, the asphalt binder in the RAP which is incorporated in the mixture, and two-thirds (67%) of the asphalt binder from RAS which is incorporated into the mixture. The quantity of asphalt binder in RAP, which is incorporated into the mix, will be calculated in tons (megagrams) of asphalt binder in the RAP. This will be based on the actual asphalt binder content determined for the mix design from the results of the Engineer's extraction test.

Appendix A – Instructions for RAS in HMA Mixtures

GENERAL

This Appendix describes requirements for processing, storing, documenting, and sampling & testing of RAS intended for use in asphalt mixtures.

All notifications and documentation shall be submitted to the District Materials Engineer based on the District responsible for the location of the initial RAS stockpile.

PROCESSING

End users of RAS which also receive raw, unprocessed shingles and process the material for incorporation into an asphalt mixture, shall be considered a shingle Supplier and must adhere to ~~Appendix C Materials I.M. 506.~~

STORAGE

Stockpiles shall be placed on a base with adequate drainage sufficient to prevent contamination.

Separately stockpile pre-consumer RAS from post-consumer (tear-off) RAS. RAS may be pre-blended with RAP under the direction of the Engineer. Notify the Engineer and District Materials Engineer 48 hours prior to blending RAS materials with other materials or adding to a RAS stockpile. The Engineer may require verification testing for asphalt content, gradation, aggregate specific gravity, aggregate absorption, and fine aggregate angularity before the pile may be used.

All RAS stockpiles shall be identified by maps of stockpile areas and signs placed in or near each stockpile.

STOCKPILE DOCUMENTATION

The following documentation is required for owners of stockpiled RAS:

- Form 82009ras (see Appendix B) is completed by the stockpile owner and a copy is forwarded to the District Materials Engineer within 10 calendar days of completing the stockpile.
- Any special handling, treatment or conditions of the RAS should be described on this form.
- A record of addition and consumption of the RAS stockpile should be documented on this form.
- Maps shall provide details that depict the stockpile site, including adjacent stockpiles of RAP or aggregates, permanent plant equipment, and landmarks.
- Maps and signs shall identify the stockpile by RAP Identification Number.

The District Materials Engineer will review forms for accuracy. Portions of the form including assigning the stockpile identification number, average values for extracted aggregate gradation, aggregate bulk specific gravity, aggregate absorption and asphalt binder content will be completed by the District Materials Engineer.

Notify the District Materials Engineer at least 48 hours before relocating or reprocessing a RAS stockpile for future use (not intended for a specific project). The notification shall include the estimated quantity of RAS being relocated or reprocessed and the new location of the stockpile. Relocation of RAS shall be reported on the appropriate Form (820009ras) and submitted to the District Materials Engineer within 10 calendar days of completing the relocation. Reprocessing a RAS stockpile may require additional sampling, testing, and a new Form (820009ras) with reassignment of a RAS Identification Number.

Before January 1st of each year, the Contractor shall update Form 820009ras on the status of each RAS stockpile. Report the estimated quantity of RAS removed for the construction season completed and the available RAS in each stockpile for future use.

SAMPLING AND TESTING

Mix Design

A certified Level I Aggregate Technician shall obtain the samples. Samples for mix design testing shall be obtained from at least 3 locations. A sampling plan shall be developed by the Contractor and approved by

the District Materials Engineer prior to sampling.

Obtain sufficient material for contractor mix design testing and owner agency extraction testing as recommended in Materials I.M. 510. A representative 30 pound (15 kg) sample split from the total sample shall be delivered to the District Materials Laboratory for extraction testing. Results of the extraction test will be provided to the Contractor within 4 weeks of sample delivery.

Include asphalt content, gradation, aggregate specific gravity, fine aggregate angularity and absorption of the RAS material in testing.

In lieu of a sieve analysis, the following gradation may be assumed for the RAS aggregate:

Shingle Aggregate Gradation	
Sieve Size	Percent Passing by Weight
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95
No. 8 (2.36 mm)	85
No. 16 (1.18 mm)	70
No. 30 (600 μ m)	50
No. 50 (300 μ m)	45
No. 100 (150 μ m)	35
No. 200 (75 μ m)	25

Appendix C –Recycled Asphalt Shingle Suppliers

DEFINITIONS

Deleterious Material:	Paper, plastics, wood, metal, and any other material not part of the asphalt shingle.
End User:	One who incorporates processed recycled asphalt shingles into an asphalt mixture.
RAS:	Pre-consumer or post-consumer shingles that have been processed, sized, and ready for incorporation into an asphalt mixture.
Source:	A Supplier's operational site
Supplier:	One who collects, processes, or distributes pre-consumer or post-consumer shingles for incorporation into an asphalt mixture.

SCOPE

This IM describes requirements for the collection, sorting, sizing, processing, and stockpile management of raw and recycled asphalt shingles (RAS). Secure Iowa DOT approval for each operational site (source) before furnishing RAS to the End User. Approved Suppliers and sources are listed in Appendix D.

APPLICATION FOR APPROVAL

Submit applications for approval in writing, to the DOT Office of Materials in Ames. Suppliers within the state of Iowa who are not the End User of the RAS material shall apply for a permit with the Iowa DNR Land Quality Bureau for each source. Submit proof of securing a sanitary disposal project permit or documentation from the IDNR that a permit is not needed. End Users may not collect or process raw shingle material at portable facilities. In addition to the requirements stated in this IM, all Suppliers (both in-state and out-of-state) shall comply with local, state, and federal environmental regulations, and follow IDNR asbestos testing protocols. Once the Office of Materials receives notification that the required permits have been secured, the appropriate District Materials Office may recommend the approval when assured that the Supplier has met all DOT qualifications. The Office of Materials will issue a letter of approval. This letter shall serve as a Supplier's approval until Appendix D can be updated.

Suppliers seeking source approvals may submit a written application to the District Materials Engineer (DME) in each district of operation. A sample application is provided in Appendix E.

CERTIFICATION REQUIREMENTS

Certified RAS shall meet the following requirements:

A. Pre-processing

1. Remove all visible materials not part of the shingle, including but not limited to extra wood, paper, metals, and plastics prior to processing. Unroll or remove shingles found in rolls prior to processing.
2. Follow IDNR protocols for identifying, removing, and reporting Asbestos Containing Materials (ACM).

B. Processing Operation

Process the raw shingles by ambient grinding or granulating methods such that the following gradation is met:

Sieve Size	Minimum % Passing (by weight)
1/2 - inch	100
3/8- inch	98
#4	90

Separately process pre-consumer and post-consumer raw material.

Ensure the RAS material does not contain more than 1.5% deleterious content by weight. Notify the Engineer 48 hours prior to processing.

C. Storage

Separately construct RAS stockpiles based on similarities in source (pre-consumer or post-consumer) and place them on a base with adequate drainage to prevent contamination. Assign each stockpile a unique identification number. Document the size of each stockpile by weight. Notify the Engineer 48 hours prior to adding to or moving an existing stockpile. Properly remove discarded non-shingle material from the site.

D. Stockpile Uniformity

Take proper measures to ensure a uniform stockpile.

Approval to deliver certified material may be withdrawn for inadequate compliance with these requirements.

QUALITY CONTROL PROGRAM

The Supplier has the overall responsibility of certifying that material being placed in a certified stockpile is produced under and conforms to a Quality Control (QC) Program. The Iowa DOT, through its monitoring activities (sampling/testing, visual observation, etc.), will verify the continued compliance to the program. Any certified stockpile must meet the designated quality before shipment. Intentional shipment of untested or out of specification material will constitute grounds for immediate rejection of material and placement of the source and/or the Supplier on conditional status. Develop a QC program document that contains the following aspects:

1. Knowledge of Current Specifications

Maintain up-to-date knowledge of the specifications that apply to RAS products. Maintain copies of the current Standard Specifications, all applicable Supplemental Specifications and all applicable Instructional Memorandums (IMs) at the testing lab. Be aware of any Special Provisions, which change current RAS specifications. The Supplier shall be responsible for providing these up-to-date publications to their QC representative.

2. RAS Production Log

Maintain a production log when operating under the QC program. This production log shall contain detailed information on test samples that include date, time, stockpile identification number, QC representative information, quantity, gradation results, deleterious content results, moisture content, pass/fail results, corrective actions, etc. Keep the log at a designated location and readily available to the Iowa DOT representative for review.

3. Visual Inspection

Visually inspect the shingle collection, sorting, sizing, and processing operations on a frequent basis. Visual inspection can be defined as observing the processing area, as well as the condition of the RAS in the flow stream or stockpiles. Observe the overall operation to detect oversized and deleterious materials that are detrimental to the quality of the product. Visual inspection does not replace testing, but enhances the quality control program.

4. Production

A. Testing and Reporting

Perform and report testing for deleterious content, gradation, and moisture content of the RAS

material. The Engineer may obtain a split sample to verify QC results.

Testing for RAS Certification

The Supplier shall be responsible for performing and reporting the following tests for each sample. The testing laboratory shall be approved by the Engineer.

1. Deleterious Content

Determine the percentage of deleterious material by weight of a 200 gram sample. Calculate deleterious content as follows:

$$P = \frac{C}{W} \times 100\%$$

Where P = percentage of deleterious material
C = Mass of deleterious material, g
W = Mass of test sample, g

No sample shall exceed 1.5% deleterious content.

2. RAS Particle Distribution

Determine the RAS gradation in accordance with Materials IM 302. At least 90% of the samples shall meet gradation requirements described above for the material to be certified (i.e. if 2 out of 3 samples meet requirements, the material would only be 67% compliant and thus would be rejected).

3. Determine the percentage of moisture by weight within 48 hours of delivery in accordance with Appendix H. Results shall be logged and provided to the End User.

Testing for Mix Design

Additional information on the RAS material is required before it may be used in an asphalt mixture. The Supplier may submit samples for additional testing on behalf of the End User to be performed by the Central Materials Laboratory in accordance with Appendix A.

B. Sampling

A minimum of 3 random samples or 1 per 1000 tons, whichever is greater, of each stockpile shall be tested during its construction. Collect a minimum of 20 pounds of RAS per sample. Obtain samples for moisture content within 48 hours of delivery from a cross section of the pile. A certified Level I Aggregate Technician shall obtain the samples.

Test results shall be known before delivery to the End User. All test results will be available at a designated location within 24 hours of sampling when the material is being placed into a certified stockpile.

5. Delivery

Ensure delivery of RAS material from proper stockpiles by verifying the stockpile identification number and associated test results match.

6. Quality Control Structure

In order to ensure quality as a priority, the source QC personnel shall have a line of communication directly to their management, as well as their production operation.

MONITORING ACTIVITIES

Monitoring activities of Suppliers, including inspection of test reports and shipping records will be conducted by the appropriate District Materials Engineer. The Engineer may obtain samples from the source or End User's stockpile to verify compliance to quality standards. Noncompliant verification results may require re-sampling and re-testing.

All District Materials Office monitoring activities shall be reported to the Central Materials Office.

DOCUMENTATION

Documentation shall be required to establish a chain of possession of raw shingle and processed RAS materials. Make all forms available to the Iowa DOT and Iowa DNR upon request.

A. Transactions of raw, unprocessed shingles

Keep on file a signed Form 820010a (See Appendix F) for each accepted load of unprocessed raw shingles.

B. Transactions of processed RAS

Keep on file a signed Form 820010b (See Appendix G) for each load of RAS delivered to the End User to certify compliance with DOT specifications. Suppliers who are also End Users should complete this form. Copies of this form shall be furnished to the Engineer and End User at the time of delivery.

C. RAS Stockpile Inventory

The owner of the stockpile shall document accumulation, consumption, and current testing results for each RAS stockpile in Form 820009ras (See Appendix B). A copy of this form shall be sent to the Engineer within 48 hours each time stockpile testing is completed. Before January 1st of each year, the owner shall update report form 82009ras on the status of each RAS stockpile.

ACCEPTANCE

Properly identified and certified materials may be incorporated into a project. Final acceptance will be based on the certifications and the results of tests on samples secured in accordance with IM 204 or in accordance with special requirements when specified. Verification samples with noncompliant test results may require additional tests. Continued approval of a source will be based on the following:

- A. Ability to consistently supply material meeting specifications
- B. Maintenance of required records
- C. Proper documentation of shipments
- D. Proper handling and storage of the material

Appendix D – Approved List of RAS Suppliers and Sources

*The following Suppliers have been given conditional approval pending completion of the application process:

Eastern Iowa Roofing	Marion, IA
Metro Waste Authority	Des Moines, IA
R2R Recycling, LLC	West Des Moines, IA
Waste Commission of Scott County	Davenport, IA

Appendix E – RAS SOURCE APPROVAL APPLICATION

Supplier Name _____
Phone _____
Address _____
(IF MORE THAN ONE SOURCE PLEASE ATTACH LIST AND AREA COVERED.)

1. Have the appropriate permits been obtained from the Iowa DNR Land Quality Bureau? (Yes or No) If No, explain. _____
2. Please submit proof of securing a sanitary disposal project permit or documentation from the IDNR that a permit is not needed.
3. What testing laboratory capable of determining gradation, deleterious content, and moisture content will be used?
4. Are copies of current applicable specifications, testing IMs and source information data available at the respective sources or testing facilities? (Yes or No) If No, explain. _____
5. Is a production log maintained on a daily basis and available for inspection? (Yes or No) If No, explain. _____
6. Who (position) is responsible for production notification to the District Materials Engineer?
7. Which company representative (position) is normally responsible for daily overall Quality Control processes at the source? _____
8. Describe the certified stockpile identification system in place at each source (Map, signing, etc.) _____
9. Please attach a detailed summary of your Quality Control Program and Iowa DNR asbestos testing protocol implementation plans.
10. Please attach a flow chart of your current Quality Control structure (Include names, addresses, phone numbers of appropriate management personnel, chain of command, etc., for problem resolution).

(continue)

Indicate the District(s) for which you are seeking approval.

1	2	3	4	5	6
---	---	---	---	---	---

AUTHORIZED SIGNATURE _____ DATE _____

DME RECOMMENDATIONS _____

DME SIGNATURE _____ DATE _____

APPROVAL (YES or NO) REMARKS _____

MATLS. ENGINEER SIGNATURE _____ DATE _____

Appendix F – Unprocessed Asphalt Shingles Delivery Certification Form (Form 820010a)

DELIVERING ENTITY	
Company Name	
Address	
Phone	
Contact Name	
Address of Shingle Source	

ACCEPTING ENTITY	
Company Name	
Address	
Phone	
Contact Name	
*IDNR Permit #	

*If required

Post-consumer

Pre-consumer

(Check One)

We undersigned certify the following:

1. _____ tons of whole, unprocessed asphalt shingles have been delivered for processing. *(Report number of tons)*
2. The delivered material is from a NESHAP exempt structure or documentation stating the material does not contain asbestos has been submitted. The material has not been in contact with hazardous wastes and consists of asphalt shingles and normal roofing debris only.
3. Delivered asphalt shingles have been tested or inspected in accordance with Iowa DNR protocol by _____, (provide trainee name and certification number) who has been trained to identify asbestos-containing materials (ACM) by _____ (provide training program name). Suspected ACM have been rejected.

Delivering Entity (*signature*)

Date

Accepting Entity (*signature*)

Date

Appendix G – Processed Recycled Asphalt Shingles Certification Form (Form 820010b)

RECYCLED ASPHALT SHINGLE SUPPLIER ⁽¹⁾	
Company Name	
Address	
Phone	
Contact Name	
IDNR Permit # (if required)	
RAS Stockpile ID	

(1) Required for non-End Users

END USER	
Company Name	
Address	
Phone	
Contact Name	
RAS Stockpile ID ⁽²⁾	

(2) Required if Supplier is also the End User

Pre-consumer

Post-consumer

(Check One)

We undersigned certify the following:

- _____ tons of asphalt shingles have been processed, sized (100% by weight passing the 1/2-inch sieve, 98% by weight passing the 3/8-inch sieve, and 90% by weight passing the #4 sieve), and delivered. *(Report number of tons)*
- All visible materials not part of the shingle, including but not limited to extra wood, paper, metals, and plastics were removed prior to processing.
- The material does not contain more than 1.5% deleterious material by weight.
Note: Deleterious material consists of paper, plastics, wood, metal, and any other material not part of the asphalt shingles.
- The moisture content (%) of the load is _____.
- The material meets all requirements of Materials IM 506.

Asphalt Shingle Supplier (*signature*)

Date

End User (*signature*)

Date

**Appendix H– DETERMINING THE MOISTURE CONTENT
OF AGGREGATE AND RECYCLED MATERIALS FOR USE IN HMA**

This test method is used to determine the percent of moisture in stockpiles being used in the production of HMA. The moisture contents determined are used to correct the weight of material to dry weight. Moisture correction is required for materials being fed into mixing plants that measure the weight prior to drying.

Apparatus:

Oven capable of maintaining a temperature of 275 ± 5 degrees F.
Balance capable of weighing a minimum of 1000g and accurate to 0.1g.
Sample pans
Spatula or spoon for stirring sample

Procedure for recycled materials containing asphalt:

Obtain a representative sample of the recycled material as per IM 301. Immediately reduce the sample to the test sample size, minimum of 500g, by splitting or quartering as per IM 336. Record the empty mass of the sample pan and the spatula or spoon. Tare the sample pan on the scale. Place the test sample in the pan and record the original mass of the sample to the nearest 0.1g. Place the sample in the oven maintained at 275 ± 5 degrees F. Stir the sample occasionally. Dry the sample to a constant mass defined as no change in mass exceeding 0.1% of the sample mass in 15 minutes of oven heating. Weigh the sample, pan and spatula or spoon together to avoid any loss of material.

Note: Samples must be split and weighed as quickly as possible to avoid loss of moisture. If the splitting and test sample mass determination cannot be accomplished quickly, the sample should be sealed in a plastic bag until the test sample preparation can be done.

Once the sample has achieved a constant mass, cool the sample to room temperature. Weigh the sample, pan and spatula or spoon together to the nearest 0.1g. Subtract the mass of the pan and the spatula or spoon from the total mass to obtain the final dry mass of the sample. Calculate the percent moisture by determining the difference between the original mass of the test sample and the final dry mass of the sample and dividing the result by the final dry mass. Multiply the result by 100 to convert to a percentage. Report the moisture content to the nearest 0.1%.

Procedure for aggregates:

Apparatus: Hot Plate (Optional)

Obtain a representative sample of the aggregate as per IM 301. Immediately reduce the sample to the test sample size, minimum of 500g, by splitting or quartering as per IM 336. Record the empty mass of the sample pan. Tare the sample pan on the scale. Place the test sample in the pan and record the original mass of the sample to the nearest 0.1g. Place the sample in the oven maintained at 275 ± 5 degrees F or on a hot plate. Stir the sample occasionally. Dry the sample to a constant mass defined as no change in mass exceeding 0.1% of the sample mass in 15 minutes of heating.

Note: Samples must be split and weighed as quickly as possible to avoid loss of moisture. If the splitting and test sample mass determination cannot be accomplished quickly, the sample should be sealed in a plastic bag until the test sample preparation can be done.

Once the sample has achieved a constant mass, cool the sample to room temperature. Weigh the sample to the nearest 0.1g. Calculate the percent moisture by determining the difference between the original mass of the test sample and the final dry mass of the sample and dividing the result by the final dry mass. Multiply the result by 100 to convert to a percentage. Report the moisture content to the nearest 0.1%.

$$\text{Percent Moisture} = \frac{\text{Original Wet Mass} - \text{Final Dry Mass}}{\text{Final Dry Mass}} \times 100$$