Report

White Paper

On Results of Recycled Asphalt Shingles In Hot Mix Asphalt Compost Pad Construction

Project I.D.: 05S005

Waste Commission of Scott County
Davenport, Iowa

October 2006

Foth & Van Dyke

White Paper on Results of Recycled Asphalt Shingles in Hot Mix Asphalt Compost Pad Construction

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White Paper

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1 Introduction

The Waste Commission of Scott County (Commission) received a grant from the Iowa Department of Natural Resources (DNR) to establish a facility for the processing of construction and demolition materials (C&D). As an initial step in this project, the Commission determined that an understanding of the markets for highly recoverable C&D materials was key to developing a process for producing marketable end-products. In July of 2003 Foth & Van Dyke prepared a report for the Commission titled "Construction and Demolition Recycling Program Market Analysis," which identified market conditions for the recoverable fraction of the incoming C&D waste stream. Once the potential markets were understood, in conjunction with the make-up of the Commission's C&D waste stream, equipment was selected which would allow targeted materials to be processed to match the existing markets

One of the materials targeted for recovered was asphalt shingle waste from roof "tear-off" projects Some of the benefits of recovering asphalt shingles for recycling include:

- Reducing the amount of C&D waste, especially asphalt shingles landfilled;
- Achievement toward increased goal progress percentage (diversion of material from the landfill);
- Reduced virgin material costs for manufacturers utilizing recycled asphalt shingles (RAS) As a feedstock material in hot mixed asphalt (HMA)

In the market study Foth & Van Dyke noted that recycled asphalt shingles have been successfully added to hot mix asphalt (HMA) paving projects in other locations throughout the U.S. There are two HMA supply companies located near the Scott County Landfill that can realize the benefits of utilizing RAS as a feedstock material The McCarthy Improvement Company indicated an interest in using the RAS.

In 2004 the Commission and the City of Davenport constructed a finished compost curing and storage pad at the Davenport Compost Facility to give local asphalt suppliers and users the opportunity to observe how RAS would perform in HMA pavement projects.

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2 Recycled Asphalt Shingles (RAS)

2.1 Background

Asphalt shingles are the most common type of roofing material used in new home construction and re-roofing projects, accounting for over 60 percent of the residential roofing market. Recycled asphalt shingles can be a significant portion of a C&D waste stream and are typically delivered in segregated loads, which make them ideal for processing and reuse. One of the benefits of using waste shingles in HMA is that the shingles contain similar ingredients (asphalt cement, rock granules and fiber) to those purchased by producers to enhance their asphalt mixtures. In addition, RAS are quite dense, which make them more valuable in a weight based diversion system

Research has been conducted in at least 17 other states (e g , Florida, Georgia, Maine, Massachusetts, Missouri, Minnesota, Nevada, New Jersey, New York, Pennsylvania, Maryland, North Carolina, Indiana, Michigan, Tennessee, Vermont and Texas) on using RAS in HMA applications for road projects. In 1997, the Iowa Department of Transportation researched the viability of using asphalt shingles as a dust control material on a rural Benton County granular surfaced roadway The ground shingles proved to be effective at minimizing dust As asphalt shingles become more recognized as a beneficial product, more landfill operations will begin to process shingles, and as the end products are more commonly used, additional market opportunities will develop over time

The National Asphalt Pavement Association, reports that scrap shingles can be added to HMA in an effective and economical manner The percentage of scrap asphalt shingles that can be added depends on such local conditions as the availability of scrap shingles, the form of the shingles, the type of HMA mix, whether the HMA is being used in surface or base layers, and the equipment available to process and add the scrap asphalt shingles at the HMA facility It has been documented that the addition of 5 percent scrap shingles to HMA is easily accomplished and that greater percentages of RAS in HMA can also be accommodated with success For the Davenport Compost Facility HMA ratios of 0 (control), 5, 10, and 15 percent RAS were used in the construction of a storage and curing pad for finished compost material

2.2 Asbestos Testing

One common concern related to the reuse of RAS is the potential for asbestos to be present in waste shingles. While it is true that asbestos was used in shingle manufacturing in the past, the incidence of asbestos-containing shingles in roof tear-off projects today is low On properties acquired for right-of-ways, the Iowa Department of Transportation (IDOT) is required to test all materials that may contain asbestos From 1994 to 1997, the IDOT tested 368 bituminous shingles for asbestos and only 0 8 percent (3 samples) came up positive for asbestos Also, Central C&D Recycling of Des Moines tested nearly 2,000 samples of asphalt shingles during the operation of its C&D recycling facility in 2001 and found no samples to contain asbestos Since 2004, the Commission has tested over 750 samples and has discovered asbestos in less than 2 percent (1 67%) of the samples

To ensure a quality and safe product Commission staff take representative samples from each incoming asphalt shingle load and tests for the presence of asbestos fibers In order to effectively and economically complete the testing of shingles for asbestos, the Commission constructed an on-site testing laboratory as part of an expansion of the existing Administration Building. The on-site laboratory includes a ductless countertop fume hood manufactured by Air Science Technologies (photo in Appendix A). An electrostatic pre-filter and HEPA carbon filter captures harmful vapors. Commission staff are trained to perform asbestos testing on-site and produce results within hours of taking a representative sample from each load of shingles

2.3 Asbestos Sampling and Analysis Plan

The Special Waste Manager implements and manages the Commission's Bulk Asbestos Sampling and Analysis Plan (Plan) Under the Plan a representative sample of shingles is taken from each discrete pile by a Commission staff person trained in asbestos sampling and analysis All types of shingles and backing materials present in the pile are selected for testing The sample is placed into a container and labeled with a unique sample number, grid location, and date sample was collected. The sample is then taken to the asbestos laboratory and stored in the staging area until testing is completed. A picture of a representative sample can be found in Appendix A.

In the laboratory, under the ventilation hood, a small representative sample is removed from the sampling container and placed in a crucible The sample is then placed in a muffle furnace and baked at 500 degrees Centigrade for 2 hours Once the sample has cooled a slide sample is created for viewing under a stereo microscope (photo in Appendix A) Commission staff visually examines the sample and conducts tests to determine if asbestos fibers are present If the sample is positively identified to contain asbestos fibers additional testing is conducted to verify the results.

A record of all observations and tests are logged on sampling sheets and lab worksheet logs and filed for a minimum of 5 years. A copy of the Commission's Bulk Asbestos Sampling and Analysis Plan is located in Appendix B.

2.4 Handling and Processing Asphalt Shingle Loads

Shingles delivered to the landfill in source separated loads are handled separately from other incoming mixed C&D loads Loads of asphalt shingles are inspected by the scale attendant and identified as acceptable or unacceptable for further processing Acceptable loads contain approximately 15 percent or less contaminant materials (e g. wood, metal, plastic, and paper) by volume and are sent to the asphalt shingle storage area for further processing. Unacceptable loads are directed to a designated C&D area of the landfill for disposal. Since the Commission began processing shingles in 2004 approximately 1 in 8 loads or 12.5 percent have been identified as being too contaminated for processing manually by landfill staff. The Commission is working to educate contractors on delivering cleaner loads of shingles to the landfill for processing.

An area north of the landfill administrative office was designated as a location for receiving and storing loads of acceptable shingles. A concrete pad (Appendix C), approximately 108 feet by

216 feet, was constructed and walled-off on three sides by concrete barriers. The concrete pad area is laid-out in a grid system. Each grid section is 12 feet by 12 feet and numbered according to a grid number and letter coordinate to identify and track incoming loads. Individual loads of shingles are deposited and managed in discrete piles until results of asbestos testing are secured, typically a 24 hour process. A litter fence was also constructed around the pad on the north, south and west sides to prevent debris from blowing throughout the site.

Shingle piles testing positive for asbestos are handled and landfilled in accordance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. The end loader operator and Special Waste Manager are notified and the pile of asphalt shingles is identified for disposal. Asphalt shingles that are asbestos free are moved to the temporary stockpile area for grinding at a later date.

Appendix A contains photos of the concrete storage pad, asphalt shingle load, and contamination material.

The initial pile of asphalt shingles stockpiled for processing by the Commission in 2005 was ground and screened by Recycling & Processing Equipment of Peru, Indiana, a company specializing in the grinding of asphalt shingles. Approximately 1,600 tons of waste asphalt shingles were ground in October 2005. A 3680 Beast recycler manufactured by Bandit Industries was used to grind the asphalt shingles to a 3/8 inch minus size to ensure the shingles mixed well at the HMA plant. The grinder was equipped with a head pulley magnet to remove nails and other metal items from the RAS product.

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3 Hot-Mix Asphalt (HMA)

Roofing shingles are approximately 20 percent asphalt, while asphaltic concrete (AC) is approximately 6 percent asphalt, so a small percentage of shingles (5 percent by weight of aggregate) can displace a large percentage of asphalt binder (approximately 20 percent). Hot-mix asphalt (HMA) is the most common process to which shingles can be added. Waste shingles are typically ground and screened to produce ½"-minus-size pieces for batch plants, or 1/4"-minus-size pieces for continuous feed plants. The ground shingles are usually fed into and mixed with the aggregate before adding the virgin asphalt binder. Various states, including Minnesota and Texas, have completed studies which indicate that shingles can be added at a rate of up to 5 percent with no negative impact to the AC pavement. A Massachusetts study showed that the properties of HMA using 7 percent RAS had similar properties to conventional mixes.

3.1 McCarthy Improvement Company

Contact was made with two local asphalt paving companies to discuss their receptiveness to the use of RAS material in their HMA process. The McCarthy Improvement Company (McCarthy) was interested in the potential for using this material, was familiar with its use in the asphalt industry, and understood the issues related to the use of recycled shingles in asphalt hot mix. McCarthy is located on the Linwood Mining and Minerals site adjacent to the Scott Area Landfill, which also made the decision to use RAS more economical, due to reduced material transportation costs. Also, the National Asphalt Pavement Association estimates that using 5 percent asphalt shingle waste in HMA saves an asphalt manufacturer between $1.00 per ton to $2.80 per ton in raw material costs.

Approximately 1,600 tons of RAS material was delivered to McCarthy for use in development of HMA design mixes using 5%, 10%, and 15% RAS in construction of a 2 acre pad at the Davenport Compost Facility.

3.2 HMA Mix Ratios

Research studies and test applications have shown that from 5 percent to as much as 20 percent of waste shingles can be used in HMA projects, depending upon the specific application. In general, a base mix may contain a higher percentage of waste shingles than a surface mix. An off-road (parking lot) project may contain a higher percentage compared to a roadway project. For HMA projects, especially those using waste shingles, the mix design must take into consideration all the ingredients that will be used in the mixture. Therefore, the composition of the shingles and the percentage used must be factored into the HMA design calculation.

For the Davenport Compost Facility storage and curing pad mix design ratios of 0, 5, 10 and 15 percent recycled asphalt shingles were developed by McCarthy. The maximum aggregate size for the base mix was ¾ inches. In HMA mixes containing RAS, McCarthy assumed the shingles contained at least 10 percent asphalt content (AC). Appendix D contains the mix design and test data for the different shingle percentage mixes used in construction of the pad.

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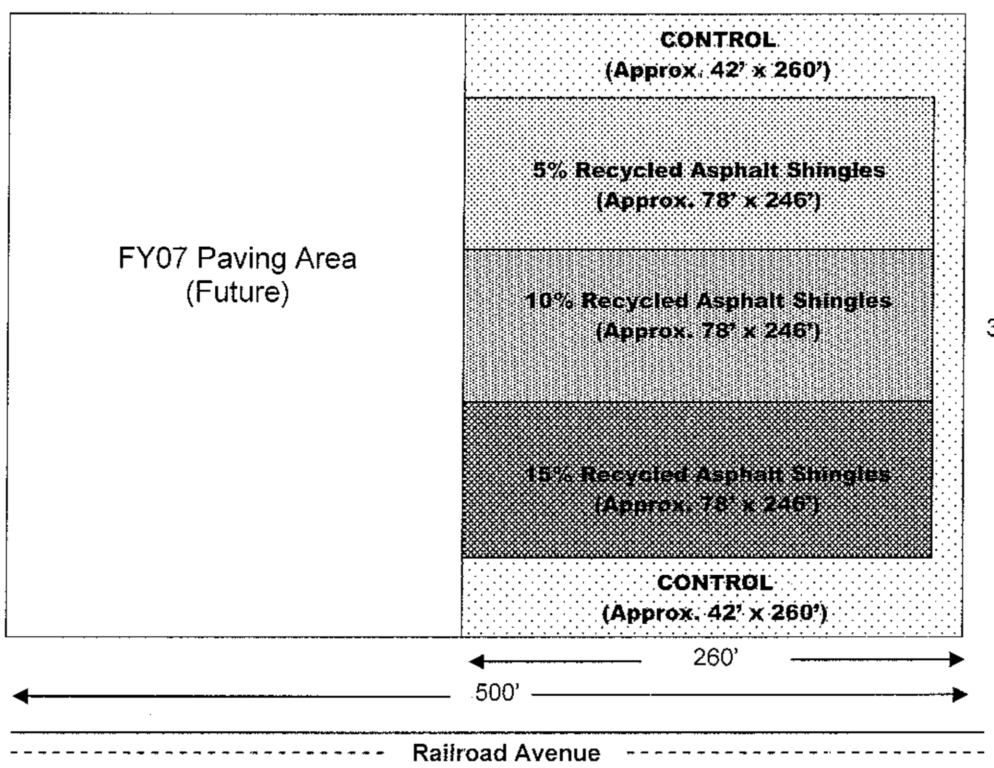
4 Compost Storage and Curing Pad

In order to provide local asphalt suppliers and users with the ability to observe the use of shingles in asphalt pavement, the Commission constructed a compost storage and curing pad at the Davenport Compost Facility in 2004 Not only would this installation provide a local supplier with the opportunity to work with the HMA and RAS shingle mixes, but the performance of the test pad's ability to support heavy equipment (front-end loaders and haul trucks) also aids in the marketing of shingles for HMA projects

For the Davenport Compost Facility finished compost storage pad McCarthy Improvement produced three HMA products containing 5, 10 and 15 percent RAS material A 3 5 acre site located adjacent to the compost facility was used to construct a 1 85 acre test pad for storing compost during the final curing stage of the composting process Figure 1 shows the approximate dimensions and layout of the HMA control and RAS pad areas Each area was constructed in 14 foot sections with the control areas approximately 42 feet in width (3 asphalt paver passes) and the RAS areas approximately 78 feet in width (6 asphalt paver passes) HMA control areas were built on the edges of the pad and are approximately 42 feet by 246 feet in size The RAS hot-mix pad areas are approximately 78 feet by 246 feet with mix grades of 5, 10, and 15 percent asphalt shingles.

Figure 4-1 Title Compost Storage and Curing Pad Dimensions



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5 Results

The McCarthy Improvement Company was pleased with the ground RAS received from the Commission. RAS were fed directly into the plant's mix process with no further handling or processing of the material required. The final job mix formulations for each of the three RAS percentage mixes met all test parameters and quality control requirements. The specific density (94%) was met by all RAS mix products, along with the control. McCarthy experienced no difference in the way the RAS mixes handled during the construction process.

After six months of heavy loader traffic and windrows of finished compost being stored on the pad, there appears to be no visible deterioration or breakdown of the rows of RAS mixes verses the control. The City of Davenport will evaluate the compost storage and curing pad for fatigue and stress annually until 2011.

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6 Conclusions

This project demonstrated that HMA with RAS performed as well as HMA with virgin feedstock material in the mix design process, during construction phases, and in its ability to support heavy equipment traffic. The Commission will need to continue to work with local contractors in minimizing the amount of contaminants received in loads of shingles delivered to the landfill. The Commission has shown that it can produce a quality RAS product for use by asphalt paving companies on HMA projects, especially non-roadway projects such as parking lots, driveways, low traffic residential streets, and recreational courts.

The Davenport Compost Facility plans to use RAS in expanding the existing compost storage and curing pad (Figure 1). On future low-traffic residential streets the City of Davenport is considering specifying a 5 – 10 percent RAS in their HMA mix design.

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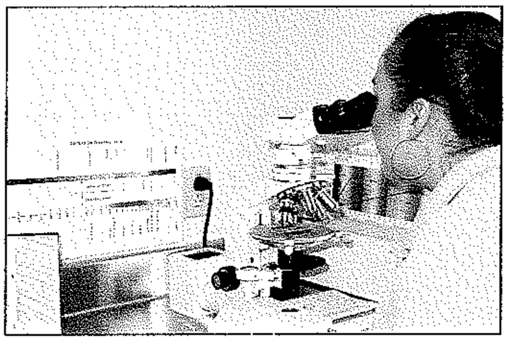
Appendix A

Project Photos

Asphalt Shingle Project Photos

Fume hood manufactured by
Air Science Technologies.

Asbestos sample with grid location
and date sample was taken.



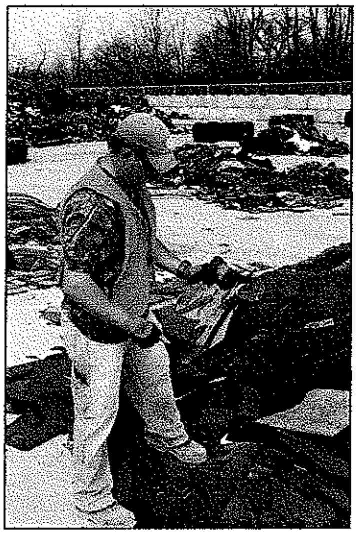
Stereo microscope for viewing
samples for asbestos fibers.

Contamination from asphalt shingle loads

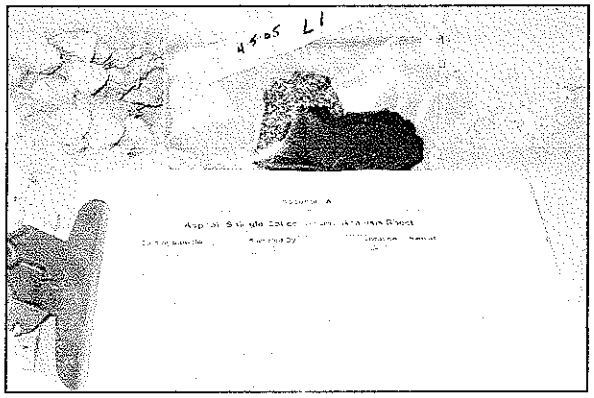
Asphalt shingle storage pad area.

Asphalt shingle load on storage pad.

Asphalt Shingle Project Photos



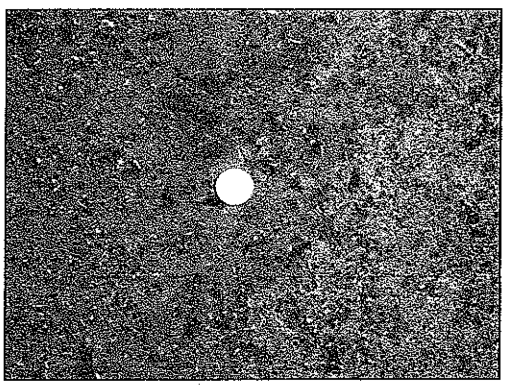
Asphalt shingle load Inspection
and collection of sample material.



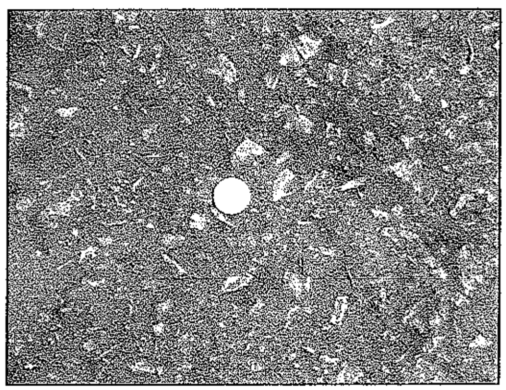
Asphalt shingle sample and sampling sheet.

Compost storage and curing pad area.

5000 pound loader used to move compost.



Compost pad area with 0%
recycled asphalt shingles.



Compost pad area with 10%
recycled asphalt shingles.

Appendix B

Bulk Asbestos Sampling And Analysis Plan

Bulk Asbestos Sampling and Analysis Plan

A) Introduction

The Waste Commission of Scott County, as part of an effort to reduce the volume of solid waste being landfilled in Scott County, established a Construction and Demolition (C&D) Program. The program recycles metal, wood, cardboard and asphalt shingles that normally would be buried in the Scott Area Landfill.

To ensure the Commission provides a quality and safe product, the C&D Program will include sampling and analysis of asphalt shingles for asbestos. The following operating procedures outline how the Commission will accept, sample and test asphalt shingles.

B) Program Administrator

The Program Administrator has the responsibility of administrating the Bulk Asbestos Sampling and Analysis Plan. Duties include:

- Implementing the plan.
- Reviewing and updating the written plan.
- Monitoring the workplace for compliance of the plan.
- Arranging for or conducting training.

The Program Administrator may assign other employees to oversee parts of the Bulk Asbestos Sampling and Analysis Plan. The Program Administrator will perform periodic checks to ensure the employees who have been assigned tasks in the plan are fulfilling their responsibilities. The Program Administrator for the Waste Commission of Scott County's Bulk Asbestos Sampling and Analysis Plan is Keith Krambeck, Special Waste Manager.

C) Operating Procedures

a) <u>Receiving</u>

i) Loads of asphalt shingles that are identified by the scale attendant as being acceptable for recycling shall be directed to the asphalt shingle storage area.

(1) Criteria for recycling

- Asphalt shingles
- Minimum amounts of contaminates
    - Wood
    - Metal
    - Plastic
    - Paper

ii) Customers shall be instructed to pad area to unload their asphalt shingle load on a grid space near the clean shingles taking care not to mix piles.

b) Sampling

i) Sampling will only be performed by trained Commission personnel using the form contained in Appendix A. A list of trained Commission personnel can be found in Appendix B.

ii) A representative sample will be taken from the pile of asphalt shingles. This would include taking a sample of all the types of asphalt shingles present and any backing material.

iii) At time of sampling a unique sample number will be assigned to the collected sample and the pile of asphalt shingles.

iv) The sample number along with the grid location of the asphalt shingles will be recorded on the sampling form.

v) Each sample will be placed into a container and labeled with the sample number and date.

vi) The sampling form shall accompany the sample container.

vii) The sample will be taken to the asbestos laboratory and stored in the staging area until testing is completed.

c) Testing

i) Testing will only be conducted by trained Commission personnel. A list of trained personnel can be found in Appendix B.

ii) Sample Preparation

(a) Under a ventilation hood, open the sampling container and remove some of the sample.

(b) Place the sample in a crucible.

(c) Place the crucible in the muffle furnace and record the sample number on the furnace layout chart. See Appendix C.

(d) Set the furnace temperature to 500 degrees Centigrade.

(e) Allow the sample to bake for 2 hours.

(f) Remove the sample from the furnace.

(g) Allow the sample to cool down.

(h) Create slides of the sample in the following refractive index liquids of 1.550, 1.605 and 1.680. Prepare a slide by placing a few drops of a refractive index liquid on the slide.

(i) Visually examine the sample under the stereo microscope or equivalent magnification glass. Using tweezers remove any material and place in the refractive index liquid. Break the sample up and spread the sample out. Place a cover slip on the slide.

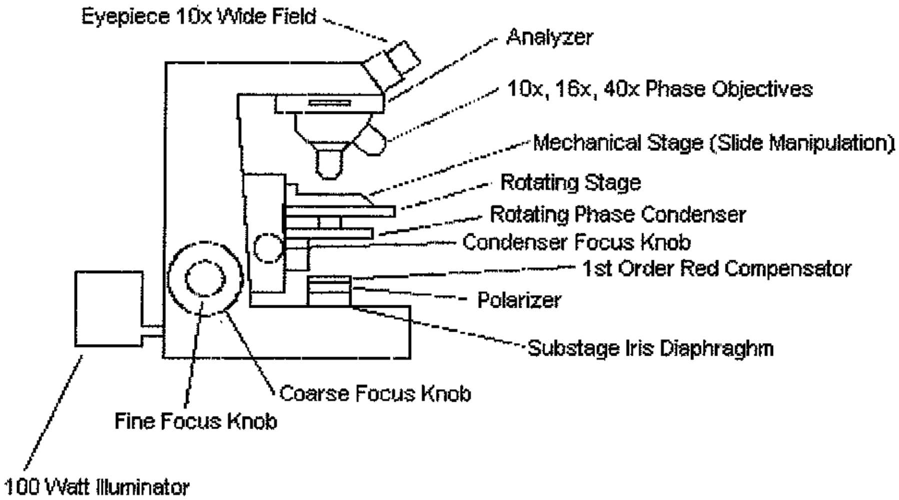
(j) Label the slide with the sample number and the refractive index liquid.

iii) Asbestos identification

(a) Microscope Setup

(i) Setup shall be done before use and recorded on the microscope calibration sheet found in Appendix D.

Typical Polarized Light Microscope



(ii) Turn on lamp.
(iii) Adjust the intraocular distance for your eyes and focus the 10x objective on an uncrowded field of particles. Use a reference slide.
(iv) Rotate the 40x objective into position and refocus slightly as necessary using the fine focus to achieve a focused image.
(v) Focus ocular cross lines for you right eye by rotating the top lens of the right ocular.
(vi) Focus the microscope on a single particle using the right eye and right ocular only. Use the fine focus to focus.
(vii) Look through only the left ocular with your left eye at the same particle but focus using the diopter adjustment on the left ocular tube.
(viii) Using both eyes on the focused preparation, and with a particle centered under the cross lines, rotate the stage. If all particles do not rotate about the center of the cross lines, bring the center of rotation to the center of the cross lines using the objective centering screws.
(ix) Close the field diaphragm on the microscope base and focus its image in the field of view by raising or lowering the substage condenser using its focusing knob.
(x) Center the field diaphragm until the focused diaphragm leaves are just outside of the edge of view.
(xi) Introduce the Bertrand lens to check the focus and centration of the filaments.
(xii) Remove the Bertrand lens after the filaments have been focused.
(xiii) Repeat step viii for the remaining objectives.

(b) Observations

(i) Use the shingles testing sheet found in Appendix E to record results of observations.

(ii) The following tests will be performed on each sample and the results recorded.

- Morphology
- Color
- Pleochroism
- Birefringence
- Extinction Angle
- Sign of Elongation
- Dispersion Staining Colors

(iii) Identification of a Fiber

1. Place the slide with the refractive index liquid of 1.550 on the microscope and scan the slide to see if any fibers are present.
2. If no fibers are present then the sample does not contain asbestos. Inspect the remaining slides to confirm the absence of fibers in the sample.

(iv) Differentiating between Chrysotile and the Other Asbestos Fibers.

1. If fibers are founds adjust the polarizing filter such that the polars are fully crossed by inserting the analyzer. If all of the fibers are isotropic (disappear at all angles of rotation) then those fibers are not asbestos. Scan the other prepared slides to confirm that all fibers present are isotropic. The sample is asbestos free.
2. If anisotropic fibers are found, rotate the stage to determine the angle of extinction. Except for tremolite and actinolite asbestos, all other forms of asbestos will have near parallel extinction.
3. Insert the first order red compensator plate in the microscope to determine the sign of elongation. All forms of asbestos have a positive sign of elongation except for crocidolite.
4. If the sign of elongation is negative go to step vi.

(v) Identification of Chrysotile.

1. Remove the analyzer and the first order red compensator plate and perform the Becke Line test by raising the focus up. If the refractive index of the liquid and solid is nearly the same when perpendicular or parallel then continue. If the fibers appear to have a higher refractive index go to step vii.

    - <u>Note:</u> If the Halo goes inside the refractive indices (solid) > refractive indices (liquid).

- If the Halo goes outside the refractive indices (solid) < refractive indices (liquid).

2. Insert the central stop dispersion staining objective. Record the colors when the fiber is parallel and perpendicular to the cross lines. Chrysotile is magenta when parallel and blue when perpendicular. Stop

(vi) Identifying Crocidolite.

1. Place the slide with the refractive index liquid of 1.680 on the microscope.
2. Remove the analyzer and the first order red compensator plate. Check the fiber for color and pleochroism by rotating the stage to see if the color changes as the fiber moves from parallel to perpendicular position. If no pleochroism is present stop, no regulated asbestos is present in the sample.
3. Insert the central stop dispersion staining objective. Record the colors when the fiber is parallel and perpendicular to the cross lines. Crocidolite will have golden yellow color when parallel and pale yellow color when perpendicular. Stop

(vii) Differentiating between Amosite and the Remaining Asbestos Fibers

1. Place the slide with the refractive index liquid of 1.680 on the microscope.
2. Insert the central stop dispersion staining objective. Record the colors when the fiber is parallel and perpendicular to the cross lines. Amosite will have golden yellow color when parallel and blue color when perpendicular.
3. If the fibers dispersion staining colors do not match Amosite follow step viii.

(viii) Differentiating between Anthophyllite and the Remaining Asbestos Fibers.

1. Place the slide with the refractive index liquid of 1.605 on the microscope.
2. If the fiber had both parallel and oblique extinction stop, go to step ix.
3. Anthophyllite will have only parallel extinction.
4. Insert the central stop dispersion staining objective. Record the colors when the fiber is parallel and perpendicular to the cross lines. Anthophyllite will have yellow color when parallel and blue magenta color when perpendicular. Stop

(ix) Identifying Tremolite and Actinolite

1. Place the slide with the refractive index liquid of 1.605 on the microscope.
2. Insert the central stop dispersion staining objective. Record the colors when the fiber is parallel and perpendicular to the cross lines.
   a. Tremolite will have yellow color when parallel and blue magenta color when perpendicular. Stop
   b. Actinolite will have pale yellow color when parallel and yellow color when perpendicular. Stop

iv) Results

(1) Compare the observations record on the lab work sheet to the known asbestos characteristics. See table 1

Table 1

Asbestos	Mounting Media	Morphology	Color	Pleochroism	Birefringence	Extinction Angle	Sign of Elongation	Dispersion Staining Colors	
								Parallel	Perpendicular
Chrysotile	1.550	Long, curly, wavy, sticky	No	No	Low – Moderate	Parallel	Positive	Magenta	Blue
Amosite	1.680	Straight needles	No	No	Moderate	Parallel and oblique	Positive	Golden yellow	Blue
Heated Amosite	1.680	Straight needles broken	Yes – Brown	Yes Parallel – Brown Perpendicular – Tan	Moderate – High	Parallel and oblique	Positive	Yellow	Pale yellow
Crocidolite	1.680	Needles	Yes Blue – Green	Yes Parallel – blue Perpendicular – Gray	Low	Parallel and Oblique	Negative	Golden yellow	Pale yellow
Anthophyllite	1.605	Straight or slightly curved long needles	No	No	Moderate	Always parallel	Positive	Yellow	Blue, Magenta
Tremolite	1.605	Straight of slightly curved needles	No	No	Moderate	Parallel and oblique	Positive	Yellow	Blue, Magenta
Actinolite	1.605	Straight or slightly curved needles	No	No	Moderate	Parallel and oblique	Positive	Pale yellow	Yellow, Pale yellow

(2) If a sample is positively identified to contain one or more asbestos fibers prepare two more samples in the appropriate refractive index liquid to confirm the presence of asbestos. If the total number of asbestos fibers found on all three slides is one, than the sample is non-asbestos. If the total is two or more asbestos fibers for all three slides than the asphalt shingles are considered to be asbestos containing.

(3) After the sample has been tested for the presence of asbestos the sample's paper work should be marked with the name of who tested the sample, the date of testing and whether or not the sample contained asbestos.

d) Processing

i) If the asphalt shingles contain asbestos the end loader operator and Program Administrator should be notified and the pile of asphalt shingles identified for disposal.
ii) Asbestos asphalt shingles shall be transported to the landfill for immediate burial following landfill procedures for the disposal of non-friable asbestos. Paper work will be completed by the Scale Attendant and filed with the Special Waste Coordinator.
iii) Asphalt shingles that are asbestos free shall be identified and the end loader operator informed.
iv) The end loader operator shall move the non-asbestos asphalt shingles to the temporary stockpile area until grinding.
v) The Commission shall employ an outside contractor to grind the asphalt shingles which shall be done during the fall and winter months.
vi) Ground shingles shall be stored on the concrete pad until delivery to a recycling outlet.

Training

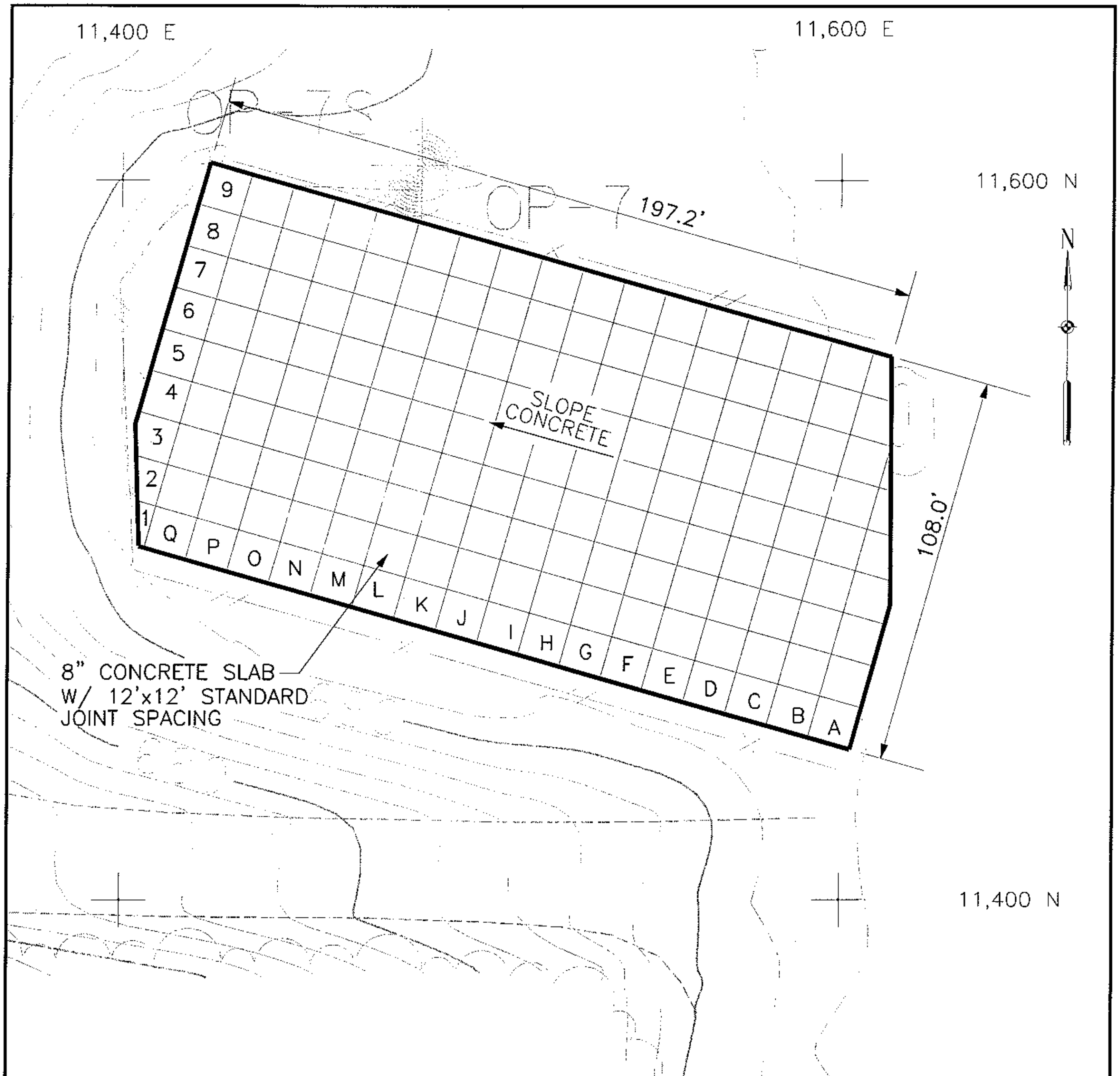
All employees that participate in the program will receive training based on their assigned duties. Any employee involved with the identification of asbestos through polarized light microscopy will received specialized training on proper microscope setup and the characteristics of asbestos fibers when viewed through a polarized light microscope.

Record Keeping

All sampling sheets and corresponding lab work sheets shall be attached to each other and maintained for 5 years.

Appendix C

Asphalt Shingle Storage And Sampling Pad Area With Grid Layout



LEGEND

- EXISTING GRADE
- EXISTING SPOT ELEVATION
- EXISTING TREE/BRUSH
- EXISTING CONCRETE
- EXISTING GRAVEL ROAD
- OP-7 EXISTING MONITORING WELL NUMBER AND LOCATION

WASTE COMMISSION OF SCOTT COUNTY

FIGURE A

EXISTING CONCRETE PAD
SCOTT COUNTY, IOWA

Scale: 0 20' 40'		Date: AUGUST, 2006	
Prepared By: Foth & Van Dyke		By: JOW	02S013

L:\05s005\Figures\5s05 pad area f2.dgn
8/7/2006 jow

Appendix D

Recycled Asphalt Shingle
Hot-Mix Design and Test Data

McCarthy Improvement Company
PAVING • GRADING • HEAVY CONSTRUCTION

Kathy:

Here is all the information I have for the mix placed at the Davenport Compost Facility. I have included a copy of the mix design for both Iowa and Illinois. I also included a summary sheet with all the test data for the different shingle percentages. There are plant reports also for the various shingle percentages. If there is any questions feel free to contact me at 563-529-9861.It was wonderful working with you and your company on this project and look forward to working with you again in the future.

Thanks Again

Ryan T. Inskeep

5401 Victoria Avenue, Suite 700 • Davenport, Iowa 52807-2991 • Phone: 563-359-0321 • Fax: 563-344-3740
Engineers and General Contractors Since 1897
www mccarthy-improvement com

84 BIT 202 S

DATE:**************

SEQ NO:

Bituminous Mixture Design

Design Number:----> 01us67b

Lab preparing the design?(PP,PL,IL ect.) PL

Producer Name & Number> 1181-03 McCarthy Improvement Linwood

Material Code Number---> 19522M BITCONC BC N70 19.0

Agg No.	#1	#2	#3	#4	#5	#6	ASPHALT	
Size (e.g. 032CAM16)	042CAM11	032CMM16	039FAM20	037FAM01	004MFM01		10127M	PG-64-22
Source (PROD#)	52202-09	52202-08	52202-11	51610-26	52202-08		5627-01	
(NAME)	LINWOOD	LINWOOD	Blackheart	MOL. CONS.	LINWOOD		BP AMOCO	
(LOC)	LINWOOD	LINWOOD	LINWOOD	Big Island	LINWOOD		Davenport	
					RAP in Mix:			
Aggregate Blend	30.5	40.5	13.5	12.0	3.5		100.0	

Agg No. / Sieve Size	#1	#2	#3	#4	#5	#6	Blend	Sieve Size	Mixture Composition Specification	Formula	Formula Range Min	Formula Range Max
1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1	100	100	100	100
3/4	79.9	100.0	100.0	100.0	100.0	100.0	93.9	3/4	82-100	94	94	94
1/2	37.4	100.0	100.0	100.0	100.0	100.0	80.9	1/2	50-85	81	75	87
3/8	17.5	97.0	100.0	100.0	100.0	100.0	73.6	3/8		74	74	74
#4	1.3	45.0	98.0	96.0	100.0	100.0	46.9	#4	24-50	47	42	52
#8	0.5	9.0	62.0	88.0	100.0	100.0	26.2	#8	16-36	26	21	31
#16	0.4	3.4	33.7	77.0	100.0	100.0	18.8	#16	10-25	19	19	19
#30	0.3	2.4	18.7	51.0	100.0	100.0	13.2	#30		13	13	13
#50	0.3	2.2	10.1	11.0	100.0	100.0	7.2	#50	4-12	7	3	11
#100	0.3	2.0	5.1	0.9	90.0	100.0	4.8	#100	3-8	5	5	5
#200	0.3	1.8	2.6	0.4	73.0	100.0	3.8	#200	2-6	3.8	2.3	5.3

	#1	#2	#3	#4	#5	#6	Blended SpGr	Dust AC Ratio
Bulk Sp Gr	2.676	2.665	3.125	2.624	2.750	1.000	2.720	
Apparent Sp Gr	1.000	1.000	1.000	1.000	1.000	1.000		
Absorption, %	0.60	0.80	3.20	0.60	1.00	1.00	1.000	
					SP GR AC		1.037	0.84

BITUMINOUS MIXTURE AGED HOW LONG? HOURS @ C

SUMMARY OF SUPERPAVE GYRATORY TEST DATA

	N-Initial 10				N-design 70			
PB:	4	4.5	5	5.5	4	4.5	5	5.5
Gmb (corr):	2.224	2.264	2.270	2.286	2.430	2.469	2.487	2.501
Gmm:	2.601	2.578	2.562	2.542	2.601	2.578	2.562	2.542
Pa:	14.5	12.2	11.4	10.1	6.6	4.2	2.9	1.6
VMA:	21.5	20.5	20.7	20.6	14.2	13.3	13.1	13.1
FIELD VMA:	23.1	22.0	22.4	22.2	16.0	14.9	14.9	14.9
VFA:	32.6	40.7	45.0	51.1	53.8	68.3	77.7	87.7
Vbe:	7.0	8.3	9.3	10.5	7.7	9.1	10.2	11.5
Pbe:	3.3	3.8	4.3	4.8	3.3	3.8	4.3	4.8
Gse:	2.776	2.772	2.777	2.777	2.776	2.772	2.777	2.777
Pba:	0.8	0.7	0.8	0.8	0.8	0.7	0.8	0.8

Slope: 9.4

NUMBER OF REVOLUTIONS:

	% AC	Gmm	Gmb	% Voids Pa	VMA	Design Field VMA	VFA	Gse	Gsb
OPTIMUM DESIGN DATA:	4.5	2.577	2.469	4.2	13.3	14.9	68.5	2.772	2.720

REMARKS:

TSR = 0.83

Form 956 [illegible]

Iowa Department of Transportation

Highway Division - Office of Materials

HMA Gyratory Mix Design

County	Scott	Project : FM-CO82(26)--55-82	Mix No. ABD2-0006
Mix Size (in)	3/4	Contractor : McCarthy Imp Co	Contract No 82-CO82-02(
Mix Type	HMA 1M	Design Life ESAL's : 610,000	Date Reported 05/06/02
Intended Use	Base	Project Location : On F65; from I 280, West to Y 40 4.44 miles	

Aggregate Source IDs Source Loc Beds & % in Mix					
3/4" Clean	A82008	Linwood Mining and Minerals	20-25		30.5%
3/8" Chips	A82008	Linwood Mining and Minerals	20-25		40.5%
Slag Sand	A70008	Harsco Corp /Heckett Div			13.5%
Natural Sand	AIL504	Milan- Big Island			12.0%
Mineral Filler	A82008	Linwood Mining and Minerals			3.5%

Job Mix Formula - Combined Gradation (Sieve Size in)

	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
Upper Tolerance	100	100	88	81	54	31		17			5.8
	100	94	81	74	47	26	19	13	7.2	4.8	3.8
Lower Tolerance	100	87	74	67	40	21		9			1.8

Asphalt Binder Source and Grade: Amoco 58-28

	Gyratory Data				Interpolated
% Asphalt Binder	4.50	4.00	5.00	5.50	4.84
Gmb @ N-Des	2.470	2.429	2.487	2.501	2.478
Max Sp Gr (Gmm)	2.578	2.601	2.562	2.542	2.568
% Gmm @ N- Initial	86.6	84.2	86.9	88.5	86.5
%Gmm @ N-Des	95.8	93.4	97.1	98.4	96.5
% Air Voids	4.2	6.6	2.9	1.6	3.5
% VMA	13.3	14.3	13.1	13.1	13.3
% VFA	68.4	53.7	77.7	87.7	74.0
Film Thickness	10.1	8.7	11.3	12.6	10.9
Filler Bit Ratio	0.99	1.15	0.89	0.79	0.93
Gsb	2.720	2.720	2.720	2.720	2.720
Gse	2.772	2.775	2.777	2.777	2.775
Pbe	3.82	3.27	4.26	4.76	4.10
Pba	0.72	0.76	0.78	0.78	0.76
% New Asphalt Binder	100.0	100.0	100.0	100.0	100.0
Asphalt Binder Sp Gr @ 25c	1.037	1.037	1.037	1.037	1.037
% Water Abs	1.05	1.05	1.05	1.05	1.05
S A m^2 / Kg	3.78	3.78	3.78	3.78	3.78
% + 4 Type 4 Agg					
% + 4 Type 2 or 3 Agg					
Angularity-method A	40	40	40	40	40
% Flat & Elongated					
Sand Equivalent					

Number of Gyrations

N-Initial

N Design

68

N-Max

104

Gsb for Angularity Method A

[illegible]

Pba / %Abs Ratio

0.72

%Gmm @ N-Max

#VALUE!

Disposition An asphalt content of 4.8% is recommended to start this project

Data shown in 4.84% column is interpolated from test data

Comments This mix transferred from Illinois N -70 {Design # 82Bit202S}

Copies to: McCarthy Imp Co, District 6 lab, Scott Co Eng, Producer's, Roger Boulet, Davenport Materials, D. Lohrer

Signed : [signature] 5-6-02

Form 955 ver. 6.5r

Iowa Department of Transportation

Highway Division-Office of Materials

Proportion & Production Limits For Aggregates

County: Scott | Project No.: Davenport Compost | Date: 10/17/05

Project Location: Davenport Compost Facility | Mix Design No.: 84Bit 202 S

Contract Mix Tonnage: 4,000 | Course: Base | Mix Size (in.): 3/4

Contractor: McCarthy Improvement Co. | Mix Type: HMA 1M | Design Life ESAL's:

Material	Ident #	% in Mix	Producer & Location	Type (A or B)	Friction Type	Beds	Gsb	%Abs
3/4" Clean Chip	A 82008	30.5%	Linwood Mining	A	5	27-30 B	2.677	0.50
3/8" Clean Chip	A 82008	40.5%	Linwood Mining	A	5	27-30 B	2.659	0.80
Slag Sand	A 70008	13.5%	Blackheart	A	2		3.240	3.36
Mineral Filler	A 82008	3.5%	Linwood Mining	B			2.750	1.00
Natural Sand	A IL 520	12.0%	River Stone - Cordova	B			2.616	0.79
RAP		0.0%	Compost Shingles	B			2.776	1.00

Type and Source of Asphalt Binder: PG 58-22 Koch

Individual Aggregates Sieve Analysis - % Passing (Target)

Material	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
3/4" Clean Chip	100	87	37	14	2.1	0.8	0.5	0.3	0.3	0.2	0.2
3/8" Clean Chip	100	100	100	98	38	12	5.9	4.2	3.3	2.0	1.6
Slag Sand	100	100	100	100	99	65	37	21	12	7.2	4.2
Mineral Filler	100	100	100	100	100	100	100	100	100	90	73
Natural Sand	100	100	100	100	99	93	83	49	14	2.3	0.5
RAP	100	100	100	100	100	100	77	51	44	38	31

Preliminary Job Mix Formula Target Gradation

	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
Upper Tolerance	100	100	88	80	52	34		18			5.9
Comb Grading	100	96	81	73	45	29	21	14	8.2	5.3	3.9
Lower Tolerance	100	89	74	66	38	24		10			1.9
S.A.sq. m/kg	Total	4.01		+0.41	0.18	0.23	0.34	0.40	0.50	0.65	1.28

Production Limits for Aggregates Approved by the Contractor & Producer

Sieve Size in.	30.5% of mix 3/4" Clean Chip		40.5% of mix 3/8" Clean Chip		13.5% of mix Slag Sand		3.5% of mix Mineral Filler		12.0% of mix Natural Sand		0.0% of mix RAP	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1"	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
3/4"	80.0	94.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
1/2"	30.0	44.0	98.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
3/8"	7.0	21.0	91.0	100.0	98.0	100.0	100.0	100.0	100.0	100.0		
#4	0.0	9.1	31.0	45.0	92.0	100.0	100.0	100.0	100.0	100.0		
#8	0.0	5.8	7.0	17.0	60.0	70.0	100.0	100.0	92.0	100.0		
#30	0.0	4.3	0.2	8.2	17.0	25.0	100.0	100.0	88.4	100.0		
#200	0.0	2.2	0.0	3.6	2.2	6.2	71.0	75.0	44.9	52.9		
									0.0	2.5		

Comments:

Copies to: McCarthy Improvement Co.

The above target gradations and production limits have been discussed with and agreed to by an authorized representative of the aggregate producer.

Signed: ____________________ Producer

Signed: ____________________ Contractor

Davenport Compost
Shingle Experiment

	Base 5%	Base 10%	Base 15%	Base Control	Surface 5%	Surface 10%	Surface 15%	Surface Control
Gmm	2.540	2.472	2.412	2.598	2.497	2.433	2.406	2.556
Gmb	2.525	2.444	2.375	2.547	2.472	2.409	2.369	2.529
Voids	0.6	1.1	1.5	2.0	1.0	1.0	1.5	1.1
I / O AC	7.14	8.92	10.04	5.53	6.74	8.59	10.99	5.46

Combined Belt Gradations

Sieve	Base 5%	Base 10%	Base 15%	Base Control	Surface 5%	Surface 10%	Surface 15%	Surface Control
3/4	97	95	95	97	94	95	95	94
1/2	87	83	84	86	76	77	84	75
3/8	80	76	77	79	69	71	77	68
# 4	53	56	58	51	47	49	58	44
# 8	35	38	41	32	31	35	41	28
# 16	26	28	30	24	23	25	30	20
# 30	16	17	19	14	15	16	19	13
# 50	8.6	10	12	6.9	8.1	9.8	12	6.4
# 100	5.4	7.0	8.5	3.9	5.0	6.7	8.5	3.5
# 200	4.1	5.3	6.5	2.8	3.8	5.1	6.5	2.5

Ignition Oven Burn - Offs

Sieve	Base 5%	Base 10%	Base 15%	Base Control	Surface 5%	Surface 10%	Surface 15%	Surface Control
3/4	99	99	97	98	94	95	99	96
1/2	93	90	89	89	83	84	93	89
3/8	87	86	82	84	76	76	86	81
# 4	60	66	63	59	52	56	66	57
# 8	40	46	47	38	36	41	49	35
# 16	29	34	36	27	27	31	37	24
# 30	19	22	23	17	18	20	24	15
# 50	11	14	16	8.8	10	13	16	8.2
# 100	7.3	10	12	5.1	6.9	9.7	13	5.1
# 200	5.5	8.1	9.6	3.6	5.2	7.4	9.7	3.9

VERIFICATION

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
TEST REPORT - ASPHALT CONCRETE
LAB LOCATION - AMES

MATERIAL........:SHREDDED SHINGLES
INTENDED USE...:VARIOUS MIX DESIGNS
PRODUCER........:MCCARTHY BUSH @ LINNWOOD
COUNTY..........:SCOTT
UNIT OF MATERIAL:40LBS+
SAMPLED BY......:D. LOHRER
DATE SAMPLED: 11/01/05

LAB NO....:ABC05-0338

CONTRACTOR:MCCARHTY BUSH @ LINNWOOD

SENDER NO.:CR5VS-842

DATE RECEIVED: 11/08/05 DATE REPORTED: 11/23/05

LOCATION OF PRODUCING PLANT: LINWOOD QRY.

SIEVE ANALYSIS PERCENT PASSING

SIEVE	IGNITION GRADATION	REFLUX GRADATION	COLD-FEED GRADATION	TARGET GRADATION	SPEC LOW LIMIT	SPEC HIGH LIMIT
1/2	100.0					
3/8	99.0					
4	98.0					
8	95.0					
16	78.0					
30	55.0					
50	48.0					
100	40.0					
200	28.0					

% EXTRACTED AGGREGATE	66.32
% AC IGNITION METHOD	45.56
% AC REFLUX METHOD	33.68

COPIES TO:
CENTRAL LAB D. LOHRER DIST6

DISPOSITION:

SIGNED: KEVIN B. JONES
TESTING ENGINEER

11-2-05

84 Bit 202 s N-68 3/4" Surface
Davenport Compost

	A	B
D	2.540	2.598
d	2.525	2.547
V	0.6	2.0
GRAD	FINE	—
I/O	FINE	FINE
I/O AC	7.14	5.53

3/4"	30.5	30.5
3/8"	40.5	40.5
S-20	14	14
F-01	15	15
AC	5.1	5.1
Shingles	5%	Virgin

Tons at 5% = 489.32
Tons at Virgin = 397.14

11-3-05

84 Bit 202 s N-68 3/4" Surface
Davenport Compost

	A	B	C
D	2.472	2.412	2.406
d	2.444	2.375	2.369
V	1.1	1.5	1.5
GRAD	Fine	Fine	Fine
I/O	Fine	Fine	Fine
I/O AC	8.92	10.04	10.99

3/4"	30.5	30.5	35.5
3/8"	40.5	40.5	40.5
S-20	14	14	10
F-01	15	15	14
AC	4.9	5.1	5.1
Shingles	10	15	15

Tons at 10% 443.60
Tons at 15% 487.17

11-4-05

84 BIT 202s N-68 3/4" Surface
Davenport Compost

	A	B	C
D	2.433	2.556	2.497
d	2.409	2.529	2.472
V	1.0	1.1	1.0
GRAD	Fine	Coarse	Coarse
I/O	Fine	Fine	Fine
I/O AC	8.59	5.46	6.74
3/4	35.5	35.5	35.5
3/8	40.5	40.5	40.5
S-20	10	10	10
F-01	14	14	14
AC	5.1	4.8	5.1
Shingles	10	Virgin	5

800241 - 04/04 ver. 2.2

DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 1
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-2 A				
Date Sampled:		11/02/05				
Gradation ID:	Specs	CF 11-2 A	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	97	98			
1/2 in. (12.5mm) Sieve	81(74-88)	86	89			
3/8 in. (9.5mm) Sieve	73(66-80)	79	84			
* #4 (4.75mm) Sieve	45(38-52)	51	59			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	32	38			
* Moving Average						
#16 (1.18mm) Sieve		24	27			
* #30 (600um) Sieve	14(10-18)	14	17			
* Moving Average						
#50 (300um) Sieve		6.9	8.8			
#100 (150um) Sieve		3.9	5.1			
* #200 (75um) Sieve	3.9(1.9-5.9	2.8	3.6			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder						
Actual Added, % Binder		5.10				
Intended Total, % Binder	5.10					
Actual Total, % Binder		5.10				
Gmb:		2.547				
Gmm:		2.598				
Pa:		2.0				
Moving Average	3.5					
Time		12:30 PM				This
Station						Column
Side						Is For
Sample Tons		126.00				Dist. Lab
Sublot Tons		397.14				Test
Tons to Date						Results
Fines / Bitumen Ratio	0.6-1.4	0.73				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/02/05   Date Tested:

Course Placed: Surface   Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.547   Avg. Field Density:
Gmm (Lot Avg.): 2.598   Avg. % Density:
Dist. Labs Pa: Avg. % Field Voids:
Target % RAP: Specified % Density: 94

Q.I. = ______ - 2.394 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 11.0 VMA: 11.4 D.O.T. Results Used: [ ]

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 3.84

Mix Change Information: Control Mix. No shingles. Virgin Mix.

Remarks:

Certified Tech: R. Inskeep   EC 739 Cert. No.
Certified Tech: Jerry Adkins   EC 538 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

800241 - 04/04 ver. 2.2

DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 2
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-4 B				
Date Sampled:		11/04/05				
Gradation ID:	Specs	CF 11-4 B	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	94	96			
1/2 in. (12.5mm) Sieve	81(74-88)	75	89			
3/8 in. (9.5mm) Sieve	73(66-80)	68	81			
* #4 (4.75mm) Sieve	45(38-52)	44	57			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	28	35			
* Moving Average						
#16 (1.18mm) Sieve		20	24			
* #30 (600um) Sieve	14(10-18)	13	15			
* Moving Average						
#50 (300um) Sieve		6.4	8.2			
#100 (150um) Sieve		3.5	5.1			
* #200 (75um) Sieve	3.9(1.9-5.9)	2.5	3.9			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder						
Actual Added, % Binder		4.80				
Intended Total, % Binder	4.80					
Actual Total, % Binder		4.80				
Gmb:		2.529				
Gmm:		2.556				
Pa:		1.1				
Moving Average	3.5					
Time						
Station						This
Side						Column
Sample Tons						Is For
Sublot Tons		0.50				Dist. Lab
Tons to Date						Test
Fines / Bitumen Ratio	0.6-1.4	0.57				Results

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 4.38

Mix Change Information: Control mix. No shingles. Virgin mix.
5% aggregate interchange plus lowered AC from 5.1 to 4.8.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/04/05 Date Tested:

Course Placed: Surface Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.529 Avg. Field Density:
Gmm (Lot Avg.): 2.556 Avg. % Density:
Dist. Labs Pa: Avg. % Field Voids:
Target % RAP: Specified % Density: 94

Q.I. = ______ – 2.377 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 13.9 VMA: 11.7 D.O.T. Results Used: [ ]

Remarks:

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 1
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-2 A				
Date Sampled:		11/02/05				
Gradation ID:	Specs	CF 11-2 A	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	97	99			
1/2 in. (12.5mm) Sieve	81(74-88)	87	93			
3/8 in. (9.5mm) Sieve	73(66-80)	80	87			
* #4 (4.75mm) Sieve	45(38-52)	53	60			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	35	40			
* Moving Average						
#16 (1.18mm) Sieve		26	29			
* #30 (600um) Sieve	14(10-18)	16	19			
* Moving Average						
#50 (300um) Sieve		8.6	11			
#100 (150um) Sieve		5.4	7.3			
* #200 (75um) Sieve	3.9(1.9-5.9	4.1	5.5			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	4.60					
Actual Added, % Binder		4.60				
Intended Total, % Binder	5.10					
Actual Total, % Binder		5.08				
Gmb:		2.525				
Gmm:		2.540				
Pa:		0.6				
Moving Average	3.5					
Time		8:00 AM				
Station						This
Side						Column
Sample Tons		140.00				Is For
Sublot Tons		0.50				Dist. Lab
Tons to Date						Test
Fines / Bitumen Ratio	0.6-1.4	0.86				Results

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/02/05 Date Tested:

Course Placed: Surface Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.525
Gmm (Lot Avg.): 2.540
Dist. Labs Pa:
Target % RAP: 5.0

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 94

Q.I. = ______ – 2.374 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 10.9 VMA: 12.1 D.O.T. Results Used: [ ]

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 4.74

Mix Change Information: 5% Shingles in the mix. Assuming 10% AC in the shingles.

Remarks:

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 2
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-4 B				
Date Sampled:		11/04/05				
Gradation ID:	Specs	CF 11-4 B	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	94	94			
1/2 in. (12.5mm) Sieve	81(74-88)	76	83			
3/8 in. (9.5mm) Sieve	73(66-80)	69	76			
* #4 (4.75mm) Sieve	45(38-52)	47	52			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	31	36			
* Moving Average						
#16 (1.18mm) Sieve		23	27			
* #30 (600um) Sieve	14(10-18)	15	18			
* Moving Average						
#50 (300um) Sieve		8.1	10			
#100 (150um) Sieve		5	6.9			
* #200 (75um) Sieve	3.9(1.9-5.9	3.8	5.2			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	4.60					
Actual Added, % Binder		4.60				
Intended Total, % Binder	5.10					
Actual Total, % Binder		5.08				
Gmb:		2.472				
Gmm:		2.497				
Pa:		1.0				
Moving Average	3.5					
Time						
Station						This
Side						Column
Sample Tons						Is For
Sublot Tons		0.50				Dist. Lab
Tons to Date						Test
Fines / Bitumen Ratio	0.6-1.4	0.70				Results

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/04/05
Date Tested:
Course Placed: Surface
Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.472
Gmm (Lot Avg.): 2.497
Dist. Labs Pa:
Target % RAP: 5.0

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 94

Q.I. = ______ − 2.324 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 13.6 VMA: 14 D.O.T. Results Used: ☐

Remarks:

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 5.45

Mix Change Information: 5%shinglesin the mix. Assuming 10% Ac in the shingles.
5% aggrgate interchange for the surface lift.

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 1
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-3 A				
Date Sampled:		11/03/05				
Gradation ID:	Specs	CF 11-3 A	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	95	99			
1/2 in. (12.5mm) Sieve	81(74-88)	83	90			
3/8 in. (9.5mm) Sieve	73(66-80)	76	86			
* #4 (4.75mm) Sieve	45(38-52)	56	66			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	38	46			
* Moving Average						
#16 (1.18mm) Sieve		28	34			
* #30 (600um) Sieve	14(10-18)	17	22			
* Moving Average						
#50 (300um) Sieve		10	14			
#100 (150um) Sieve		7	10			
* #200 (75um) Sieve	3.9(1.9-5.9	5.3	8.1			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	3.90					
Actual Added, % Binder		3.90				
Intended Total, % Binder	4.90					
Actual Total, % Binder		4.86				
Gmb:		2.444				
Gmm:		2.472				
Pa:		1.1				
Moving Average	3.5					
Time		7:45 AM				
Station						This
Side						Column
Sample Tons		168.00				Is For
Sublot Tons		0.50				Dist. Lab
Tons to Date						Test
Fines / Bitumen Ratio	0.6-1.4	0.92				Results

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/03/05

Date Tested:

Course Placed: Surface

Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.444
Gmm (Lot Avg.): 2.472
Dist. Labs Pa:
Target % RAP: 10.0

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 94

Q.I. = ________ - 2.297 = ________

Low Outlier: ________ High Outlier: ________ New Q.I. = ________

Film Thickness (FT): 11.3 VMA: 14.8 D.O.T. Results Used: [ ]

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 5.78

Mix Change Information: 10% shingles in the mix.. Assuming 10% AC in the Shingles.

Remarks:

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

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DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 2
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		11-4 B					
Date Sampled:		11/04/05					
Gradation ID:	Specs	CF 11-4 B	IGNITION				
1 in. (25mm) Sieve	100	100	100				
3/4 in. (19mm) Sieve	96(89-100)	95	95				
1/2 in. (12.5mm) Sieve	81(74-88)	77	84				
3/8 in. (9.5mm) Sieve	73(66-80)	71	76				
* #4 (4.75mm) Sieve	45(38-52)	49	56				
* Moving Average							
* #8 (2.36mm) Sieve	29(24-34)	35	41				
* Moving Average							
#16 (1.18mm) Sieve		25	31				
* #30 (600um) Sieve	14(10-18)	16	20				
* Moving Average							
#50 (300um) Sieve		9.8	13				
#100 (150um) Sieve		6.7	9.7				
* #200 (75um) Sieve	3.9(1.9-5.9)	5.1	7.4				
* Moving Average							
Compliance (VN)							
Intended Added, % Binder	4.10						
Actual Added, % Binder		4.10					
Intended Total, % Binder	5.10						
Actual Total, % Binder		5.06					
Gmb:		2.409					
Gmm:		2.433					
Pa:		1.0					
Moving Average	3.5						
Time							
Station							This
Side							Column
Sample Tons							Is For
Sublot Tons		0.50					Dist. Lab
Tons to Date							Test
Fines / Bitumen Ratio	0.6-1.4	0.78					Results

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/04/05 Date Tested:

Course Placed: Surface Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.409 Avg. Field Density:
Gmm (Lot Avg.): 2.433 Avg. % Density:
Dist. Labs Pa: Avg. % Field Voids:
Target % RAP: 10.0 Specified % Density: 94

Q.I. = ______ - 2.264 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 13.4 VMA: 16.2 D.O.T. Results Used: ☐

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 6.53

Remarks:

Mix Change Information: 10% shingles in the mix. Assuming 10% Ac in the shingles. Made 5% aggregate interchange for the surface lift.

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.

Distribution: ___ Central Materials ___ Dist. Materials ___ Proj. Engineer ___ Contractor ___ Plant

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DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 1
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-3 A				
Date Sampled:		11/03/05				
Gradation ID:	Specs	CF 11-3 A	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	95	97			
1/2 in. (12.5mm) Sieve	81(74-88)	84	89			
3/8 in. (9.5mm) Sieve	73(66-80)	77	82			
* #4 (4.75mm) Sieve	45(38-52)	58	63			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	41	47			
* Moving Average						
#16 (1.18mm) Sieve		30	36			
* #30 (600um) Sieve	14(10-18)	19	23			
* Moving Average						
#50 (300um) Sieve		12	16			
#100 (150um) Sieve		8.5	12			
* #200 (75um) Sieve	3.9(1.9-5.9)	6.5	9.6			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	3.60					
Actual Added, % Binder		3.60				
Intended Total, % Binder	5.10					
Actual Total, % Binder		5.05				
Gmb:		2.375				
Gmm:		2.412				
Pa:		1.5				
Moving Average	3.5					
Time		11:30 AM				
Station						This
Side						Column
Sample Tons		210.00				Is For
Sublot Tons		0.50				Dist. Lab
Tons to Date						Test
Fines / Bitumen Ratio	0.6-1.4	0.94				Results

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 6.90

Mix Change Information: 15% shingles in the mix. Assuming 10% Ac in the shingles.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/03/05 Date Tested:

Course Placed: Surface Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.375
Gmm (Lot Avg.): 2.412
Dist. Labs Pa:
Target % RAP: 15.0

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 94

Q.I. = ______ – 2.233 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 11.6 VMA: 17.3 D.O.T. Results Used: [ ]

Remarks:

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.

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DAILY HMA PLANT REPORT

Project No.: Davenport Compost
Contract ID:
Mix Design No.: 84 BIT 202 S

Contractor: McCarthy Improvement Co.
County: Scott
Recycle Source: Compost Shingles

Class:
Size: 3/4"
Mix Type: IMA 300K 3/4" Surfac

Report No.: 2
Design Blows:
Design Gyrations: 68

Hot Box I.D. No.:		HB 11-3 B				
Date Sampled:		11/03/05				
Gradation ID:	Specs	CF 11-3 B	IGNITION			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	96(89-100)	95	99			
1/2 in. (12.5mm) Sieve	81(74-88)	84	93			
3/8 in. (9.5mm) Sieve	73(66-80)	77	86			
* #4 (4.75mm) Sieve	45(38-52)	58	66			
* Moving Average						
* #8 (2.36mm) Sieve	29(24-34)	41	49			
* Moving Average						
#16 (1.18mm) Sieve		30	37			
* #30 (600um) Sieve	14(10-18)	19	24			
* Moving Average						
#50 (300um) Sieve		12	16			
#100 (150um) Sieve		8.5	13			
* #200 (75um) Sieve	3.9(1.9-5.9	6.5	9.7			
* Moving Average						
Compliance (Y/N)						
Intended Added, % Binder	3.60					
Actual Added, % Binder		3.60				
Intended Total, % Binder	5.10					
Actual Total, % Binder		5.05				
Gmb:		2.369				
Gmm:		2.406				
Pa:		1.5				
Moving Average	3.5					
Time		12:30 PM				
Station						This
Side						Column
Sample Tons						Is For
Sublot Tons		0.50				Dist. Lab
Tons to Date						Test
Fines / Bitumen Ratio	0.6-1.4	0.93				Results

Gsb: 2.728 Gb: 1.0370 Effective % Binder (Pbe): 7.01

Mix Change Information: 15% shingles in the mix. Assuming 10% Ac in the shingles. Made 5% Aggregate interchange for surface lift.

Distribution: ____ Central Materials ____ Dist. Materials ____ Proj. Engineer ____ Contractor ____ Plant

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °F							
Binder Temp. °F							
Mix Temp. °F							

Date Placed: 11/03/05 Date Tested:

Course Placed: Surface Tested By: Jerry Adkins

Density Record

Core No.:	1	2	3	4	5	6	7
Station							
CL Reference							
W 1 Dry							
W 2 in H20							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.369
Gmm (Lot Avg.): 2.406
Dist. Labs Pa:
Target % RAP: 15.0

Avg. Field Density:
Avg. % Density:
Avg. % Field Voids:
Specified % Density: 94

Q.I. = ______ − 2.227 = ______

Low Outlier: ______ High Outlier: ______ New Q.I. = ______

Film Thickness (FT): 11.8 VMA: 17.5 D.O.T. Results Used: [ ]

Remarks:

Certified Tech: R. Inskeep EC 739 Cert. No.
Certified Tech: Jerry Adkins EC 538 Cert. No.