

May Miscellaneous Soils



This packet provides information about how and why to use miscellaneous soils in roadway construction and maintenance projects.

Case Study	Use of Petroleum Hydrocarbon Affected Material in Asphalt Stabilized Base, Mitchell County
TxDOT Experience	Summary of TxDOT experience using miscellaneous soils in various applications
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Specifications	Draft Special Specification: Cold Processed-Recycled Paving Material (RPM) for Use as Aggregate Base Course

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Material Brief

Each day throughout the United States soils are generated as the by-products of industrial plant expansions, underground petroleum storage tank cleanups and other remediation and construction operations. These waste soils may contain petroleum hydrocarbons, or they may contain no foreign substances at all.

Though it is difficult to determine the exact volume of soil available, it is safe to assume that the overall amount is quite large. In many instances hundreds of thousands of cubic yards may be available from a single source.

These soils can frequently be used as fill material. The case study in this packet highlights an example of petroleum-containing soils, mixed with other recycled materials such as concrete debris, to produce Asphalt Stabilized Base (ASB).

Under Texas laws and regulations, any waste generated from an industrial facility is considered an industrial waste, even office paper and uncontaminated dirt. These regulations encourage the search for recycling options in order to avoid the additional cost of waste disposal.

The Texas Department of Transportation (TxDOT) is finalizing procedures that out-

**Thanks to those of you who sent in your survey responses.
Your input was encouraging and helpful.**

line the environmental review steps necessary to incorporate miscellaneous soils or other recycled materials into TxDOT road construction and maintenance projects. These procedures are meant to encourage the increased use of recycled materials while ensuring that appropriate environmental safeguards are in place. (The procedures will be classified as a Department Material Specification [DMS 11000] when they are finalized and will reference a special provision to Item 6, Control of Materials.)



Overview

Research studies have shown that petroleum-containing soils can make satisfactory ingredients for use in hot mix asphalts and ASB without jeopardizing the stability, durability or workability of the mix design. The resulting mixes can surpass the requirements set forth by the Texas Natural Resource Conservation Commission (TNRCC) and TxDOT. Soils with wide variation in gradation have been shown to make effective ingredients for use in flowable fills or traditional backfill material.

The resulting high-quality mixes utilizing miscellaneous soils mean that money will be saved on roadway construction.

When miscellaneous soils are recycled into useful end products, they become classified as a resource rather than a waste.



Case Study

Use of Petroleum Hydrocarbon Affected Material in Asphalt Stabilized Base, Mitchell County

Project Overview

A pilot project to remediate soil impacted with petroleum hydrocarbons, liquids and semi-solid asphalt residuals by recycling it into ASB was successfully completed at the Col-Tex II site in Colorado City in Mitchell County. The site is being studied under the Texas State Superfund program with work proceeding under an Administrative Order issued in 1993 by the state of Texas.

NOTE: The Col-Tex site was designated as Texas' number one State Superfund

site primarily because of its proximity to the Colorado River, not because it contains large quantities of hazardous materials.

The Col-Tex Refinery Impoundment Recycling Project was an environmental action, which exemplifies the successes obtainable through cooperative efforts between industry, local government and regulatory agencies. At the Col-Tex II site located on a 12-acre tract immediately west of Colorado City, the Texas FINA Oil and Chemical Co., TNRCC, TxDOT and the local community worked constructively to achieve a common goal—the improvement of the environment in Colorado City and Texas. In doing so they have provided Texas with a powerful tool in restoring the quality of the environment through recycling.

The Impoundment Recycling Project's objective was to consume otherwise useless and unsightly materials left behind by the former Col-Tex Refinery. As a result, 7,138 tons of petroleum hydrocarbon affected material located at the refinery site were transformed into 13,328 tons of safe usable ASB. The road base was produced on-site and exceeded all environmental and engineering requirements set forth by

TNRCC and TxDOT. More than seven miles of Mitchell County roadways were constructed utilizing the ASB, and the recycling rate for the entire project was 99.82 percent, with only 130 tons of non-recyclable metal, plastic and wood-waste disposed of.

The goal of the remediation project was to clean up hydrocarbon-containing impoundments and soils in a manner that was environmentally correct, cost effective, time efficient and under exemptions set forth by TNRCC and the Texas Administrative Code (TAC). Recycling the impacted soils into ASB met this goal.

Specifications

A special specification is being developed for the use of petroleum hydrocarbon affected material in cold process ASB as a result of this project. A draft, which is currently under review by the TxDOT Specification Committee, is included at the back of this packet.

Test Data

TNRCC approved a recycling work plan developed for the project. The plan included how the work was to be accomplished and a health and safety plan to

protect on-site workers and the off-site public. Air monitoring at the site was a major element in this plan. Thirty-seven air monitoring sites were checked twice daily during the project, resulting in only one operation shutdown due to a high volume of dust in the air. The initial phase of the manufacturing process began February 23, 1998, and ended July 13, 1998.

The project also included an erosion-control plan to contain runoff on-site and prevent it from entering the Colorado River. In addition, the erosion-control plan provided guidelines for preventing erosion on the site, and the three asphalt impoundments alongside the river are now growing sorghum and rye grass as a vegetative cover.

Some 7,000 to 9,000 in-place tons of petroleum hydrocarbons, liquids and semi-solid asphalt residuals contained in the three impoundments within the refinery site were nonhazardous.

The components for the ASB were 48 percent Col-Tex impoundment materials, 48 percent concrete or caliche aggregate, two percent portland cement, and two percent water-based asphalt emulsion. Impoundment materials were mixed in place to a uniform consistency and combined with

aggregate. These components were then mixed in a pugmill with cement and emulsion to form ASB. No product left the site for use until it had met or exceeded the TNRCC environmental and TxDOT engineering standards.

For TNRCC, samples were composited at 1,500-ton production intervals or less and subjected to either Toxicity Characteristic Leaching Procedure (TCLP) or Synthetic Precipitation Leaching Procedure (SPLP) extraction. The leachate was analyzed for permissible concentrations of relevant volatile and semi-volatile organic compounds and for the eight Resource Conservation and Recovery Act metals. Samples passing the test were considered nonhazardous.

For TxDOT, samples were also composited at 1,500-ton production intervals or less and analyzed for compressive strength and Marshall Stability Index.

A complete record was kept of the materials entering the site (aggregate, cement and emulsion), the soil excavated on-site, and the materials leaving the site.

Results

This project received a great deal of local support from the city, county and area representatives because the process utilized materials formerly classified as waste and recycled them into ASB, a desirable end product. The ASB was of better engineering quality than that commonly available in the Mitchell County area. By recycling the waste materials, Mitchell County produced a resource that exempted the material from classification as a waste. Although this technology has been utilized for small-scale cleanup of leaking petroleum storage tank sites (LPSTs), this is the first on-site application of this technology to a Superfund site.

City and county governments were eager to participate in the project and contributed labor, equipment and materials. An agreement was reached between FINA and Mitchell County whereby FINA provided the ASB end product to Mitchell County in return for the use of dump trucks and other heavy equipment used in the manufacturing and transportation process. Mitchell County also provided some aggregate for use in the ASB mix.

The recycling process benefits the environment by using waste in the form of contaminated soils and hydrocarbons as an ingredient to produce a usable end product. Less environmentally acceptable alternatives, such as landfilling of the waste, were totally eliminated.

A special thanks to Texas FINA Oil and Chemical Co. and ARCADIS Geraghty and Miller for providing information in this case study.

Contact Persons

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TxDOT Experience

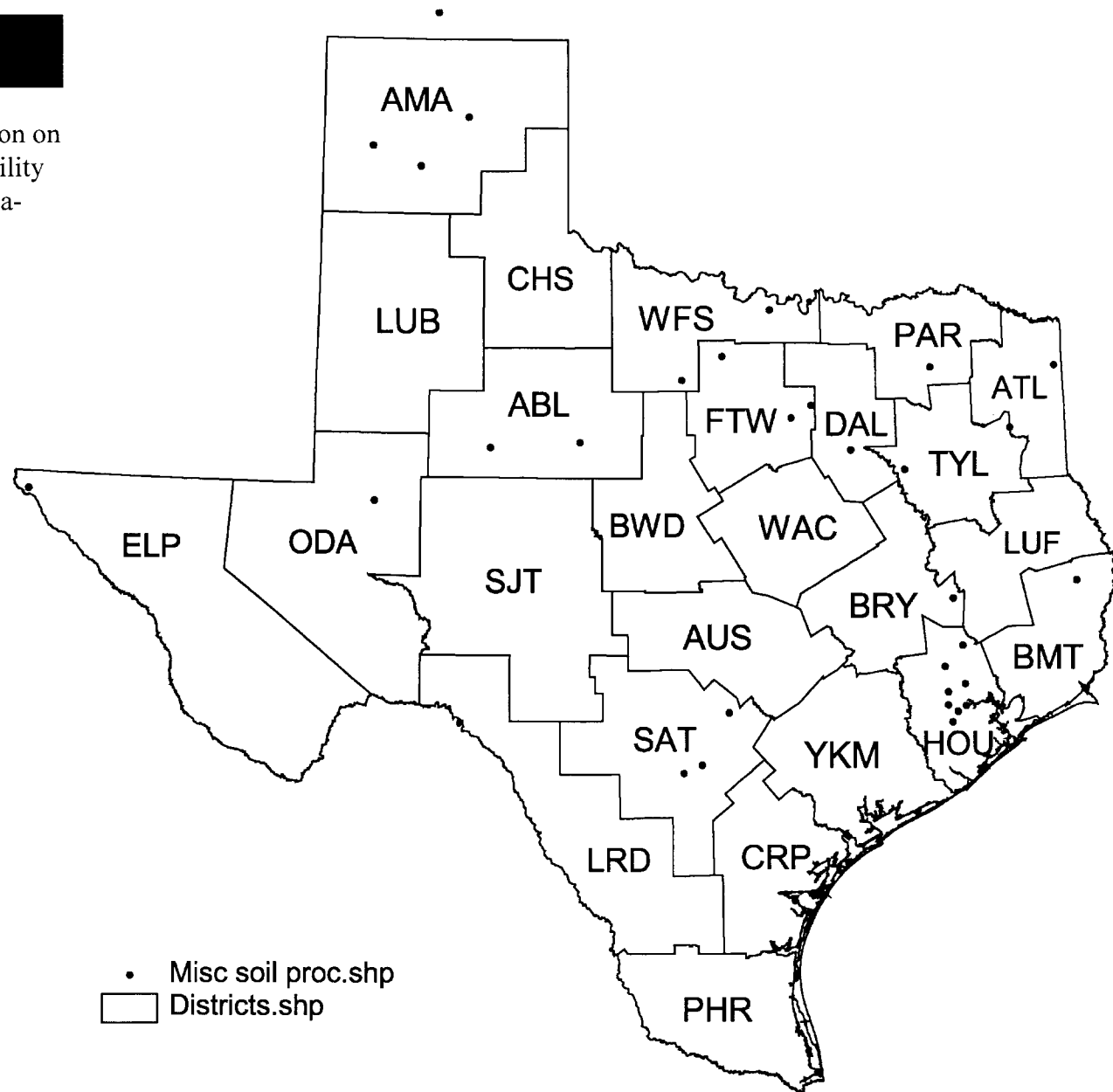
Construction Application: Embankments & Backfill						
Material	District Name	Results	Yrs. Exp.	Specification	Location	Additional Comments
Petroleum Contaminated Soils	San Antonio	Good	3	None	Bexar	Low level hydrocarbon soil embanked.

Another project currently in the works in the East Harris County area office involves the donation of uncontaminated soil from a petroleum refinery. A plant expansion project generated the soil, which will be used as fill on Spur 330. The material was tested to ensure no environmental problems existed. It will also be tested to verify that it meets TxDOT compaction requirements prior to installation. This project, which is not yet finalized, has been developing for months and has required coordination between the area engineer, the contractor and the refinery generating the soil. As these parties become familiar with the procedures for incorporating recycled materials into construction and maintenance projects, the process will become shorter and simpler.



Material Processors

The map and table provide information on companies that have expressed an ability and/or willingness to process miscellaneous soils.



Companies with the Ability and/or Willingness to Process Miscellaneous Soils

Name	City	State	Zip	TxDOT District	Miscellaneous Soils	Mobile Processing
Garrett Construction	Ingleside	TX	78362	Corpus Christi	Ability	TRUE
Palo Alto Sand Inc.	Poteet	TX	78065	San Antonio	Maybe	FALSE
Espey Silica Sand Co.	San Antonio	TX	78264	San Antonio	Ability / Willingness	FALSE
Amarillo Road Co. - Rock Crusher	Amarillo	TX		Amarillo	Ability / Willingness	TRUE
Southern Crushed Concrete - Gasmer	Houston	TX	77035	Houston	Ability / Willingness	TRUE
Southern Crushed Concrete - Griggs	Houston	TX	77021	Houston	Ability / Willingness	TRUE
Southern Crushed Concrete - Wilcrest	Houston	TX	77072	Houston	Ability / Willingness	TRUE
Southern Crushed Concrete - Tanner Road	Houston	TX	77041	Houston	Ability / Willingness	TRUE
Southern Crushed Concrete - Chrisman	Houston	TX	77039	Houston	Ability / Willingness	TRUE
Texas Industries (TXI)	Tomball	TX	77375	Houston	Ability / Willingness	TRUE
Pavers Supply Co. - Conroe Plant	Conroe	TX	77303	Houston	Ability / Willingness	TRUE
Recycled Stone Co. - Huntsville Plant	Huntsville	TX	77340	Bryan	Ability / Willingness	TRUE
Mathews Construction Company	Jasper	TX	75951	Beaumont	Willingness	FALSE
Jobe Concrete Products, Inc	El Paso	TX	79930	El Paso	Ability / Willingness	TRUE
King Sand & Gravel	Malakoff	TX	75148	Tyler	Ability / Willingness	FALSE
Nobles Road Construction, Inc.	Colorado City	TX	79512	Abilene	Ability / Willingness	TRUE
J.H. Strain & Sons Inc. #1 Crusher	Tye	TX	79563	Abilene	Ability / Willingness	TRUE
Russell & Sons Construction Co.	Longview	TX	75602	Tyler	Ability	TRUE
Theelin Recycling	Fort Worth	TX	76115	Fort Worth	Ability	TRUE
Archer-Western Contractor	Arlington	TX	76006	Fort Worth	Ability / Willingness	TRUE
Zack Burkett Co. - Perry Pit	Graham	TX	76450	Wichita Falls	Willingness	TRUE
H.V. Caver, Inc.	Atlanta	TX	75551	Atlanta	Willingness	FALSE
Compost Cooperative Marketing Assoc.	Sulphur Springs	TX	75482	Paris	Ability / Willingness	TRUE
Zack Burkett Co. - Richards Pit	Jacksboro	TX	76458	Fort Worth	Willingness	TRUE
J.R. Thompson, Inc. - Running N Quarry	Saint Jo	TX	76265	Wichita Falls	Ability / Willingness	FALSE
L.A. Fuller & Sons Construction, Inc.	Amarillo	TX	79107	Amarillo	Willingness	TRUE
Vega Sand and Gravel Inc.	Vega	TX	79092	Amarillo	Ability / Willingness	TRUE
E.D. Baker Corporation	Borger	TX	79007	Amarillo	Ability / Willingness	TRUE
Highway Contractors, Inc.	Guymon	OK	73942		Ability / Willingness	TRUE
John Stuart Sitework	New Braunfels	TX		San Antonio	Willingness	TRUE
Jones Brothers	Odessa	TX	79760	Odessa	Ability / Willingness	TRUE
M. Hanna Construction Company	Ennis	TX		Dallas	Ability / Willingness	TRUE
Mendez Construction Company	Corpus Christi	TX	78469	Corpus Christi	Ability / Willingness	TRUE



**SPECIAL SPECIFICATION
COLD PROCESSED - RECYCLED PAVING MATERIAL (RPM)
FOR USE AS AGGREGATE BASE COURSE**

Description: This item, Cold Processed - Recycled Paving Material (RPM), shall govern the construction of base course, sub-base course or foundation course, each course being composed of a compacted mixture of emulsified asphalt cement, aggregate, which may include non-hazardous recycled materials mixed cold in a central mixing plant, or on site, in accordance with the details as shown on the plans and the requirements set forth herein.

Materials: The Contractor shall furnish materials to the project meeting the following requirements prior to mixing. Additional test requirements, affecting the quality of individual materials, may be required based on the plans, at the discretion of the Engineer, and in accordance with requirements established in Item 6.

- (1) **Coarse Aggregate:** Coarse aggregate shall be composed of naturally occurring gravels, crushed stone, crushed concrete, processed recycled asphalt pavements, bottom ash, foundry slag, glass, recycled crumb rubber or other non-hazardous recycled materials so as to produce a composite mixture conforming to the grading requirements listed below or as shown on plans:

**COLD PROCESSED RECYCLED PAVING MATERIALS
AGGREGATE BASE GRADING REQUIREMENTS
(Percent Passing by Weight)**

Sieve Size

1 3/4-inch	100
No. 4	* 60 maximum
No. 40	* 50 maximum

* These percentages may be adjusted as per the discretion of the Engineer; however, the stabilized base course must conform to the minimum strength and stability requirements of this item or as shown on the plans.

- (2) **Asphaltic Materials:** The asphaltic material for this item shall be of the grade shown on the plans or as approved by the Engineer and shall meet the applicable requirements of Item 300, "Asphalt, Oils and Emulsions". The Contractor shall notify the Engineer of the source of the asphaltic material prior to design of the stabilized base course. This source shall not be changed during production without the authorization of the Engineer.
- (3) Pozzolans such as fly ash, bottom ash, lime or portland cement may be added to the processed base course mixture to improve mixing and workability properties.

Mixture Design: The Contractor shall furnish the Engineer with a mixture design formulated to comply with the following properties prior to production:

- Specified gradation or as approved by the Engineer as determined by test method Tex-200.
- Minimum compressive strength of 35 psi for secondary roads and streets and 50 psi for primary highways, major arteries and heavy wheel load traffic areas, as defined by the project engineer, when tested in accordance with test method Tex-126-E as modified in "Test Procedures" section.
- Minimum Hveem stability value of 35 when tested in accordance with Tex-208-F as modified in the "Test Procedures" section.

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The mixture design shall be adjusted or redesigned as necessary to accommodate changes in the materials or to ensure compliance with the specifications.

Mandatory Trial Batch: To substantiate the original design and/or any changes and adjustments necessary for field production, a mandatory test production of a minimum of 100 tons shall be batched and tested using all of the proposed project materials and equipment, prior to any placement. The Engineer may waive trial mixtures if similar designs with the same materials have proven satisfactory.

Tolerances: Gradation approval may be based on unstabilized stockpile samples of the processed coarse aggregate and environmentally affected recyclable materials. Other methods of proven accuracy such as cold feed belt samples may be used. The gradation of the processed unstabilized base course shall not vary from the grading established for the mix design by more than (\pm) 10 percent for the No. 4 and No. 40 sieves as long as the strength and stability specifications are met.

The emulsified asphalt content shall not vary by more than (\pm) 1.0 percent from the design asphalt content, unless authorized by the Engineer, when tested in accordance with Tex-210-F, or Tex-236-F. In any event, regardless of the asphalt content tolerances, the Contractor is still responsible for producing a final product conforming to the minimum test requirements.

Test Procedures: Test procedures used to develop the design mixture and evaluate the mixture quality during production will be modified as follows:

Tex-126-E: The stabilized mixture shall be molded at room temperature ($77^{\circ} \pm 5^{\circ}\text{F}$) and allowed to cure for 72 ± 4 hours at room temperature prior to compressive strength testing.

Tex-208-F: The stabilized mixtures shall be molded at room temperature ($77^{\circ} \pm 5^{\circ}\text{F}$) and allowed to cure 72 ± 4 hours at room temperature prior to 3 1/2 to 4 hours of oven curing at 140°F for Hveem stability determination.

Equipment General: All equipment for the handling of all materials, mixing, placing and compacting of the mixture shall be maintained in good repair and operating condition and subject to the approval of the Engineer. Any equipment found to be defective and potentially having a negative effect on the quality of the base material mixture will not be allowed. When permitted by the Engineer, equipment other than that specified herein which will consistently produce satisfactory results may be used.

- (1) **Mixing Plants:** Mixing plants may be the weigh-batch type, the modified weigh-batch type or continuous pug mill mixer type. All plants shall be equipped with the necessary equipment to consistently produce stabilized base course conforming to the design mixture proportions.

The Contractor is responsible for state certified accuracy verification of all weighing and metering devices utilized in the production of the product. Such certification shall be provided to the Engineer prior to commencement of production. Additional or subsequent certifications may be required during production or at the discretion of the Engineer. The accuracy of the weighing and metering devices shall conform to the tolerances established in Item 520, "Weighing and Measuring Equipment".

The Contractor shall provide safe and accurate means to enable inspection forces to take all required samples and to provide for a means of checking the accuracy of metering devices and to perform calibration and weight checks as required by the Engineer.

Recording devices to indicate the date, project identification number, vehicle identification, total weight of the load, tare weight of the vehicle, the net weight of the mixture in each load in units established by the plans, and the load number for the day will be furnished by the Contractor unless otherwise shown on the plans or waived by the Engineer.

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- (2) Motor Grader: The motor grader, when used, shall be a self propelled power motor grader and shall be equipped with smooth thread pneumatic tired wheels unless directed otherwise by the Engineer.
- (3) In-Place Road Mixer/Pulverizers must be used for in-place mixing when required. The degree of pulverization and mixing shall be sufficient to ensure encapsulation by the emulsified asphalt of the fine and coarse aggregate to produce a final product conforming to the minimum requirements established in this specification or as shown on the plans. The environmentally affected recyclable material of the mixture shall be pulverized to the extent that a minimum of 80 percent by weight of the particles pass the 3/8-inch sieve or as approved by the Engineer.
- (4) Rollers: Rollers used for the compaction of this item shall be pneumatic, vibratory steel wheeled, tandem roller or any combination of these types providing the necessary compactive effort throughout the entire depth of the lift as required in the "Compaction" section of this item or as determined by the Engineer.

Construction Methods:

General: It shall be the responsibility of the Contractor to produce, procure, transport, mix, place and compact the specified base material in accordance with these requirements.

- (1) Stockpiling of Base Material: Prior to stockpiling of materials, the area shall be cleaned of trash, weeds, grass and shall be relatively smooth and well drained. The stockpiling shall be done in a manner that will minimize aggregate degradation, segregation and preclude contamination by foreign materials. Feeding from a stockpile shall be done so as to avoid any contamination from underlying in-place materials not intended for use as base course.
- (2) Preparation of In-Place Subgrade of Existing Road Bed: Prior to delivery of the Cold Processed - RPM, the subgrade of existing roadbed shall be shaped to conform to the typical sections shown on the plans or established by the Engineer. The Contractor shall proof-roll the roadbed in general accordance with Item 216, "Rolling (Proof)". Soft spots shall be corrected as directed by the Engineer.
- (3) First, Succeeding or Finish Courses: Cold Processed - RPM will be spread uniformly and shaped the same day as delivered. Should inclement weather or other unforeseen circumstances render this impractical, the material shall be shaped as soon as practical. All segregated material shall be corrected as directed by the Engineer.
- (4) Compaction: The Cold Processed - RPM shall be compacted to the extent necessary to provide no less than 98 percent density as determined by Tex-113-E for primary highways and a minimum of 95 percent density for secondary roadways and measured in place by Test Method Tex-115-E, Part II. A minimum of one density test for each 10,000 sq.ft. of Cold Processed - RPM placed and compacted shall be taken. In-place moisture content shall be within 2.0 percent of the optimum moisture content established by Tex-113-E. Additional tests shall be taken if directed by the Engineer. If the material fails to meet the density requirements, or it loses the required stability, density or finish before the next course is placed or the project is completed, it shall be reworked and retested until the compaction requirements are met. The Quality Control shall be performed by an independent testing firm or agency, approved by the Engineer, at the expense of the Contractor, unless otherwise directed by the Engineer.
- (5) Grade and Thickness Tolerances: In areas on which surfacing is to be placed, any deviation in excess of 1/4-inch in cross section or 1/4-inch in a length of 16-ft measured longitudinally, as referenced in Item 247, shall be corrected by loosening, adding or removing material, reshaping and recompacting. Any area of base where thickness' are deficient by more than 1/16-inch per inch, the deficiency shall be corrected by scarifying, adding material as required, reshaping, recompacting and refinishing at the Contractor's expense.
- (6) Plant Production Quality Control: Cold Processed - RPM mixtures produced at the plant shall be tested for the requirements established in the "Strength and Stability" section of this item for every 800 tons of stabilized base course produced for a given project. The 800-ton lot sample shall be composed of a composite of four sub-samples obtained at 200-ton intervals. A minimum of one compressive strength test, Tex-126-E, and one set of

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Hveem stability specimens, Tex-208-F, shall be tested on days that production exceeds 200 tons. If production does not exceed 200 tons, that day's production will be included into the following day's production. The Quality Control shall be performed by an independent testing firm or agency, approved by the engineer, at the expense of the Contractor, unless otherwise directed by the project specifications.

- (7) Moisture Content: Moisture content of the mixture, prior to addition of the emulsified asphalt, shall be continually monitored in order to produce a uniformly mixed and stabilized final product. Moisture contents shall be performed at a minimum frequency of 1 per 200 tons.
- (8) Environmental Regulations: The Contractor is responsible to ensure that all aspects of production of cold processed-RPM must be managed to comply with requirements of this Special Specification, Standard Specification Item 6 and related Special Provision, and all environmental remediation requirements established by the Texas Natural Resources and Conservation Commission and/or other environmental regulatory agencies.

Measurement: This item will be measured by the composite weight or composite volumetric method.

- (1) Composite Weight Method: This item will be measured by the ton of 2000 pounds of the composite mixture used in the completed and accepted work in accordance with the plans and specifications for the project. The composite mixture is hereby defined as the asphalt, aggregates, recycled materials and additives as noted in the plans and/or approved by the Engineer.
- (2) Composite Volumetric Method: This item will be measured by cubic yard of materials measured by the average-end-area method in the stockpile or in haul vehicles or by the square yard in its original position.

Payment: The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard or square yards or tons as applicable for "Cold Processed-Recycled Materials". This price shall be full compensation for furnishing all materials, additives, freight involved and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.