

GENERAL SPECIFICATIONS
FOR
RUNWAY ASPHALT OVERLAY and MAINTENANCE
PROJECT
SEGMENT 3

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Republic of the Philippines
Department of Transportation and Communications
MACTAN-CEBU INTERNATIONAL AIRPORT AUTHORITY
Lapu-lapu City

**GENERAL SPECIFICATIONS FOR RUNWAY ASPHALT OVERLAY
And
MAINTENANCE PROJECT**

1.0 RUNWAY RUBBER REMOVAL

1.1 Scope

- 1.1.1 Work included: Furnish all labor, materials, equipment, plant and other facilities and the satisfactory performance of all work necessary to complete the removal of rubber deposits and contaminants from airfield pavements.

1.2 Examination of Site

- 1.2.1 Visit the site of the work and examine the premises to fully understand all existing conditions relative to the work.
- 1.2.2 No increase in cost or extension of performance time will be considered for failure to know its condition.

1.3 Protection

- 1.3.1 Workmen: Provide adequate measures to protect workmen and passersby by the site.
- 1.3.2 Surrounding area: Adjacent property shall be protected throughout the operation.

1.4 Description

- 1.4.1 The cleaning of asphalt pavements shall be completed without removing or altering the physical structure of the surface. The removal of rubber deposits shall be accomplished with a de-rubberizing compound specifically formulated and field tested for this purpose. Typically, the areas to be cleaned are saturated with cleaner, agitated by a mechanical scrubber using wire brushes and rinsed with clear water. The rinsing process shall use a water pressure of no more than 50 pounds per square inch (50 psi) to insure adequate non-destructive particulate removal.

1.5 Equipment

1.5.1 Brooms for scrubbing

- 1.5.1.1 Makes of brooms will be acceptable provided that they are capable of sweeping a minimum 12-foot path per swath. The size requirement is necessary to assure that the contract is completed within the time allowed.
- 1.5.1.2 Several brooms fills have been tested to determine the type most effective for chemical cleaning. A tufted all steel broom with short bristles or a 50/50 combination of poly-fiber and steel has been proven to be effective.

1.5.2 Water tanker for rinsing – supply of rinse water

- 1.5.2.1 Once the detergent has solubilized the rubber deposits and suspended the particulate, it shall be removed from the runway surface with a large volume of low-pressure water not exceeding 50 pounds per square inch (50 psi).
- 1.5.2.2 Equipment shall have a minimum capacity of 2,000 gallons and be capable of delivering rinse water a minimum of 250 gallons per minute.

1.5.3 Chemical applicator (sprayer)

- 1.5.3.1 The detergent rubber removal shall be applied with a gravity and/or low-pressure sprayer. The nozzles should be selected to prevent drifting of the detergent. It is recommended that no rubber components between the inside of the container and the nozzle of the applicator.

1.6 **Materials**

1.6.1 Chemical

- 1.6.1.1 The de-rubberizing compound shall be a non-polluting, biodegradable solubilizing surfactant. All purpose cleaner, garage floor cleaners and industrial degreasers will not be considered. The de-rubberizing compound shall have the capacity to dispense and suspend "dense" rubber build up, removing 95 percent of the contaminants in one application. It shall be safe for use on both asphalt and concrete pavements.

1.7 **Chemical's Effects Upon Surface and Equipment**

- 1.7.1 The bidder shall submit a summary of test results certifying that compound has no harmful effect upon the elasticity, elongation, or life of runway pavement.
- 1.7.2 The bidder must have tested and certified that the compound has no damaging effect upon in pavement lighting systems. Such testing shall include lenses, lens gaskets, lens housings and housing/can

gaskets, gaskets must not be deformed, softened or hardened after eight hours (8 hrs.) of exposure.

1.8 Removal of Residue

- 1.8.1 The Contractor shall remove the residue from the area cleaned by rinsing the pavement from the centerline to the pavement edge. The Contractor shall leave the pavement residues free. Water pressures for rinsing shall not exceed 250 pounds per square inch (250 psi).
- 1.8.2 The Contractor will complete the cleaning operation at no less than 600 square meters per hour of continuous runway closure.
- 1.8.3 The efficacy of the cleaning operation may be determined by visual inspection.

1.9 Environmental Compliance

- 1.9.1 It is in the best interest of the Airport Owner to have available, a qualified resource person familiar with the chemical rubber remover and its effects upon the environment.
- 1.9.2 Throughout the term of this Contract, the vendor shall make this person available to the Airport Owner on a consultant basis for any matters relative to the use of the detergent rubber removal at no cost to the Owner.

1.10 Certification of Performance

- 1.10.1 The performance of this compound must be documented by field experience. Each bidder shall submit the names and addresses of three major airports where the compound has been successfully used for at least two years for rubber removal. Each bidder shall provide a letter from at least two of the three users stating that the compound was used successfully.
- 1.10.2 The engineer at his option may require an on-site demonstration in addition to the above certification at no expense to the Owner.

1.11 Environmental Impact

- 1.11.1 The bidder shall submit a complete environmental impact study that documents the material's effect upon surface water, ground water and wildlife. This report shall be the result of scientific study and shall include a complete toxicological review of any chemical defined as hazardous by the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR).
- 1.11.2 The environmental study shall include a bioassay documenting the aquatic toxicity of the product offered to determine the long term impact upon plant life, soil studies shall have been conducted on soil immediately adjacent to an airfield runway where the compound has been used continuously for a minimum of two years. Effluent tests

shall have been conducted with EMB. These tests shall have been completed and reported by an EMB certified laboratory.

1.12 Performance

- 1.12.1 The Contractor will remove a minimum of 90 percent (90%) of the rubber build up and contaminants from the surface. All effort will be made to remove 100 percent (100%) but not at the expense of the surface integrity.

1.13 Measurement for payment

- 1.13.1 Measurement is by plan quantity, as revised by adjusted plan quantity and any unacceptable cleaned up area(s) of the rubber removal on runway pavement(s) in square meters (m²).
- 1.13.2 There shall be no payment for any unacceptable removed rubber build up area(s) that is not measured for payment.

1.14 Basis for payment

- 1.14.1 Payment at the contract price for runway rubber removal in the Contract Tender Form shall be full compensation for all labor, equipment and materials involved.
- 1.14.2 Final payment to be based on total square meters.

2.0 REMOVAL OF THERMOPLASTIC AND OTHER PAINTS

2.1 Scope

- 2.1.1 Work included:
Furnish all labor, materials, equipment, plant and other facilities and the satisfactory performance of all work necessary to complete the removal of thermoplastic and other paints from airport pavements.

2.2 Examination of site

- 2.2.1 Visit the site of the work and examine the premises to fully understand all existing conditions relative to the work.
- 2.2.2 No increase in cost or extension of performance time will be considered for failure to know its condition.

2.3 Protection

- 2.3.1 Workmen: Provide adequate measures to protect workmen and passersby by the site.
- 2.3.2 Surrounding area: Adjacent property shall be protected throughout the operation.

2.4 Description

- 2.4.1 The removal of paint shall be completed without removing or altering the physical structure of the surface. The removal of paint shall be accomplished by grinding using carbide blade to avoid any loss of aggregates.
- 2.4.2 The minimum hourly rate should be 8 square meters per unit. Minimum two (2) units are required. The operators of the equipment should have one (1) year experience for this type of work.

2.5 Measurement for payment

- 2.5.1 Measurement is by plan quantity, as revised by adjusted plan quantity and any unacceptable removed paint area(s) of the removal of thermoplastic and other paint on pavement(s) in square meters (m²).
- 2.5.2 There shall be no payment for any unacceptable removed paint area(s) that is not measured for payment.

2.6 Basis for payment

- 2.6.1 Payment at the contract price for removal of thermoplastic paint on airport pavement(s) in the Contract Tender Form shall be full compensation for all labor, equipment and materials involved.
- 2.6.2 Final payment to be based on total square meters.

3.0 BITUMINOUS TACK COAT (ITEM 302)

3.1 Description

- 3.1.1 This item shall consist of preparing and treating an existing bituminous or cement concrete surface with bituminous material in accordance with the Plans and specifications, preparatory to the construction of a bituminous surface course.

3.2 Scope of Work

- 3.2.1 This work shall consist of the tack coat to be applied on the asphalt treated course, the asphalt cement concrete surface course in accordance with the requirements designated in the drawing and as specified herein.
- 3.2.2 The contractor shall, before the work on the tack coat is started, secure the Engineer's approval of the material to be used and the method of application.

3.3 Bituminous Material

- 3.3.1 Bituminous material shall be either Rapid Curing (RC) cutback or emulsified asphalt, whichever is called for in the Bill of quantities. It

shall conform to the requirements of Item 702, bituminous materials of the standard specification as shown on Table 3-1.

Table 3-1 BITUMINOUS MATERIAL

Type & Grade	Specification	Application Temperatures (°C)
Emulsified Asphalt SS-1, SS-1h, CSS-1, CSS-1h	ASTM-D-977 ASTM-D-2397	25 to 55 25 to 55
Cutback Asphalt RC-70	ASTM-D-2028	50 to 70
Tar RTCB-5, RTCB-6	AASHTO-M-52	15 to 50

3.4 Construction Requirement and Method

3.4.1 Application rate of Bituminous Material

3.4.1.1 The application of the bituminous material by means of distributor shall be from 0.3 liter per sq.m. to 0.7 liter per sq.m.

3.4.2 Surface Condition

3.4.2.1 Tack coat shall be applied only to surfaces that are dry or slightly moist. No tack coat shall be applied when the weather is foggy or rainy.

3.4.3 Equipment

3.4.3.1 The liquid bituminous material shall be sprayed by means of a pressure distributor of not less than 1000 liters capacity, mounted on a pneumatic tire of such width and number that the load produced on the road surface will not exceed 1 KN (100 kg.) per cm width of tire.

3.4.3.2 The tank shall have a heating device able to heat a complete charge of bituminous liquid to 180 degrees centigrade. The heating device shall be such that overheating will not occur. Consequently, the flames must not directly touch the casing of the tank containing the bituminous liquid. The liquid shall be insulated in such a way that the drop in temperature when the tank is filled with bituminous liquid at 180 degrees centigrade and not heated will be less than 2 degrees centigrade per hour. A thermometer shall be fixed to the tank in order to be able to measure continuously the temperature of the liquid. The thermometer shall be placed in such a way that the highest

temperature in the tank is measured. The tank shall be furnished with a calibrated dipstick to indicate the contents. The pipes for filling the tank shall be furnished with an easily changeable filter.

- 3.4.3.3 The distributor shall be able to vary the spray width of the bituminous liquid in maximum steps of 100 mm to a total width of 4 m. The spraying bar shall have a nozzle from which the liquid is sprayed fan shaped on the runway surface equally distributed over the total spraying width.
- 3.4.3.4 For adding the liquid bituminous material, the distributor shall have a pump either driven by a separate motor or with a device to synchronize its speed with the speed of the distributor. The pump shall be furnished with an indicator showing the rate of flow. The suction side of the pump shall have an easily changeable filter. A thermometer shall be fixed, such that it indicates the temperature of the liquid immediately before it leaves the spraying bar.
- 3.4.3.5 The distributor shall be furnished with a tachometer, indicating its forward speed, which shall be visible from the driver's seat. The distributor shall be designed so that the deviation from the prescribed rate of application does not exceed 10% and shall be equipped with a device for hand spraying of the bituminous liquid.

3.4.4 Application of Bituminous Material

- 3.4.4.1 Immediately before applying the tack coat, the full width of the surface to be treated shall be cleaned of loose and foreign materials by means of a power broom or power blower, supplemented as necessary by hand sweeping. Where required by the Engineer, immediately prior to the application of the tack coat, the surface shall be lightly sprayed with water but not saturated. Bituminous material shall be applied by means of a pressure distributor at the temperature given in Item 702, Bituminous Materials, of the particular material being used. The rate of application of either the Rapid Curing Cut-Back or the Emulsified Asphalt shall be within the range of 0.2 to 0.7 liter per sq. m., the exact rate as determined by the Engineer.
- 3.4.4.2 Care shall be taken that the application of bituminous material is not in excess of the specified amount. Any excess shall be blotted by sand or removed as directed by the Engineer. All areas inaccessible to the distributor shall be treated manually using the device for hand spraying. The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a manner as to prevent their being spattered or marred.
- 3.4.4.3 Traffic shall be kept off the tack coat at all times. The tack coat shall be sprayed in advance only on the surface course scheduled to be applied with bituminous concrete for such period of time as may be necessary to permit drying out and setting and allow it to dry to a "tacky" condition. The contractor shall maintain the tack

coat until the next course has been applied. Any area that has become fouled by traffic or otherwise shall be cleaned and re-sprayed at the contractor's expense before the next course is applied.

3.5 Quality Control

3.5.1 Materials: The quality shall satisfy the standards values shown in Table 3-2.

3.5.2 Workmanship: The workmanship shall be controlled in the manner shown in Table 3-3.

3.6 Method of Measurement

3.6.1 The quantity of bituminous tack coat shall be measured by the tons (t), calculated from the actual rate of application approved by the Engineer.

3.6.2 The quantity shall be computed as the area flat on plan from the dimensions indicated in the drawings.

3.7 Basis of Payment

3.7.1 The accepted quantity, measured as prescribed in Section 3.9 shall be paid for at the contract unit price for Bituminous Tack coat, which price and payment shall be full compensation for furnishing and placing all plant, materials, labor, equipment, tools, transport, temporary works, overheads, profit and incidentals necessary to complete the work described in this Specifications.

Table 3-2 MATERIALS

Work Item	Test Item	Test Method	Frequency	Standard Values	Notes
Tack Coat	Bituminous Material	As approved by the Engineer	At every receiving	To meet the requirements of Specifications Table 3-1	Manufacturer's test data maybe substituted as directed by the Engineer
					Not permitted to use materials 3 months after delivery

Table 3-3 WORKMANSHIP

Work Item	Test Item	Test Method	Frequency	Tolerance	Notes
Tack Coat	Application of the bituminous material	As approved by the Engineer	As designed by the Engineer	0.3 liter/sq.m. 0.7 liters/sq.m.	

4.0 BITUMINOUS CONCRETE SURFACE COURSE, HOT-LAID (ITEM 310)

4.1 Description

- 4.1.1 This Item shall consist of constructing a bituminous concrete surface course composed of aggregates, mineral filler and bituminous material mixed in a central plant, constructed and laid hot on the prepared base in accordance with this specification and in conformity with the lines, grades, thickness and typical cross-section shown on the Plans.

4.2 Scope of Work

- 4.2.1 This work shall consist of the bituminous concrete surface course and shall include provision of materials, mixing plant, mixing, hauling, placing, spreading and compacting. The bituminous concrete surface course shall meet the requirements of location, thickness, line grade designed in the drawing and as specified herein.
- 4.2.2 The contractor shall, before the work on the bituminous concrete surface course is started, design the material proportions in accordance with the requirements of this section and the drawings, and secure the Engineer's approval of the materials to be used and the method of the work execution.

4.3 Material Requirements

4.3.1 Composition and Quality of Bituminous Mixture (JOB-MIX FORMULA)

The bituminous mixture shall be composed of aggregate, mineral filler, hydrated lime, and bituminous material.

At least three weeks prior to production, the Contractor shall submit in writing a job-mix formula for each mixture supported by laboratory test data along with samples and sources of the components and viscosity-temperature relationship information to the Engineer for testing and approval.

Each job-mix formula submitted shall propose definite single values for:

- a. The percentage of aggregate passing each specified sieve size.
- b. The percentage of bituminous material to be added.
- c. The temperature of the mixture delivered on the site.
- d. The kind and percentage of additive to be used.
- e. The kind and percentage of mineral filler to be used.

After the job-mix formula is established, all mixture furnished for the project shall conform thereto within the following ranges of tolerances:

- a. Passing No. 4 and larger sieves +/- 7 %

- b. Passing No. 8 to No. 100 sieves (inclusive) +/- 4 %
- c. Passing No. 200 sieve +/- 2 %
- d. Bituminous material +/- 0.4 %
- e. Temperature of Mixture +/- 10 deg. C

Should a change in source of materials be proposed or should a job-mix formula prove unsatisfactory, a new job-mix formula shall be submitted by the Contractor in writing and be approved by the Engineer prior to production.

Approval of a new job-mix formula may require laboratory testing and verification.

The mixture shall have a minimum dry compressive strength of 1.4 Mpa (200 psi).

The mixture shall have a mass percent air voids with the range of 5 to 7.

The mixture shall also be an index of retained strength of not less than 70 when tested by AASHTO T 165. For aggregates having maximum sizes over 25 mm (1 inch), T 165 will be modified to use 150 mm x 150 mm (6 x 6 inches) cylindrical specimens. The 150 mm (6 inch) cylinders will be compacted by the procedures outlined in ASSHTO T167 modified to employ ten repetitions of a molding load of 9.6 Mpa (1,400 psi), with no appreciable holding time after each application of the full load.

4.3.2 Bituminous Material

The asphalt cement to be used shall meet the requirements of the penetration grade of 60 to 70 under ASTM D 946. Asphalt cement shall conform to the requirements of AASHTO M 226.

It shall be either Medium curing (MC) Cut Back asphalt or Asphalt Cement, whichever is called for in the Bill of Quantities. It shall conform to the requirements of Item 702, Bituminous Materials. The penetration grade type and grade of bituminous material shall be specified in the Special Provisions.

4.3.2.1 Acceptance Procedures for Bituminous Materials

Bituminous materials will be accepted at the source of shipment subject to the following conditions:

- a. The supplier shall conduct laboratory tests of all materials intended for shipment to the Government and certify that the materials meet the Contract Specifications.

- b. Before loading, the producer shall examine the shipping container, remove all remnants of previous cargoes, which might contaminate the material to be loaded and certify that it was clean and free of contaminating material and loaded.
- c. The Contractor shall furnish with each shipment two copies of the delivery ticket. The delivery tickets contain the following information:

Consignee_____	Designation_____
Project Number_____	Date _____
Grade_____	Loading Temp _____
Net Liters _____	Sp. Gr. At 15.5C _____
Net Weight _____	
Identification No. (Truck, Car, Tank, etc) _____	

- d. The Contractor or the Supplier as his agent shall deliver to the Engineer or his representative a certification signed by an authorized representative of the supplier to cover the quality and quantity of material and the condition of container for each shipment. The certification shall be essential in the following form and may be stamped, written or printed on the delivery ticket.

"This to certify that this shipment of _____(tons/liters) of _____ of asphalt meets all contract specification requirements of the MCIAA, and the shipping container was clean and free from contaminating material when loaded.

Producer _____
Signed _____

Failure to sign the certification will be a cause to withhold use of the material until it can be sampled, tested and approved.

4.3.2.2 Quality Control Reviews

Quality Control Reviews will be conducted to determine the reliability of the producer's certification by the government or its authorized representative at the point of production at frequencies prescribed by the MCIAA.

If this review indicates that the certification are not reliable, the acceptance of the bituminous materials by certification will be discontinued and the contents of each shipping container will be sampled at point of delivery, tested and accepted prior to incorporation into the work. This procedure will be followed until an engineering determination is made that the supplier's quality control and testing procedure are such that material meeting Contract Specifications is being consistently produced.

4.3.2.3 Application Temperatures

Bituminous materials for the several applications indicated in the Specifications shall be applied within the temperature ranges indicated in Table 4-1

Table 4-1 Bituminous Material Temperature Range

Type and Grade of Material	Application Temperature Ranges			
	Spray		Mix	
	Minimum	Maximum	Minimum	Maximum
RT 1-2-3	15.5	54	15.5	54
RT 4-5-6	29	65.5	29	65.5
RT 7-8-9	65.5	107	65.5	107
RT 10-11-12	79	121	79	121
RTCB 5-6 30	15.5	48.9	15.5	48.9
MC 30	21	62.8	15.5	40.5
RC-MC 70	40.5	85	32	68
RC-MC 250	60	107	51.7	93
RC-MC 800	79	129	71	107
RC-MC 3000	106.7	143	93	126.7
All Emulsions	10	71	10	71
Asphalt Cement			As required to achieve viscosity of 75-150 seconds to achieve a kinematic Viscosity of 150-300 mm2/s (150-300 centi-strokes)	
(All Grades)	204 Maximum			

4.3.3 Aggregate

4.3.3.1 The aggregate shall consist of hard, durable and clean crushed stone. The material shall be free of any dirt, organic matter, chemical contaminants or other deleterious substance, resulting from the crushing of natural rocks.

4.3.3.2 If deemed necessary, and subject to the Engineer's instruction and/or approval, part of the fine aggregate shall consist of washed, sharp river sand.

4.3.3.3 The aggregate retained on the no. 9 mesh sieve shall meet the following requirements:

- a. The amount of loss is not more than 12% in the soundness test by AASHTO-T-104;
- b. The reduced amount by abrasion is not more than 30% in the abrasion test by AASHTO-T-96;
- c. The content of the aggregate at the length and width ration of more than 5 to 1 is not more than 10% (flatness).

4.3.3.4 The gradation of the aggregate shall be based on the range specified in Table 4-2. The sieve analysis of aggregate shall be executed in accordance with AASHTO-T-11 and T-27.

Table 4-2 GRADATION OF AGGREGATE

(Gradation Ranges- Hot Plant Mix Bituminous
Pavement; Mass Percentage Passing Square Sieves)

Sieve Designation (Square Openings)	Percentage by weight passing sieves (%)	Notes
40 mm	100	
25 mm	70 to 95	
20 mm	55 to 85	
4.75 mm (No. 4)	32 to 62	
No. 40	10 to 35	
0.075 mm (No. 200)	0 to 10	

4.3.3.5 Aggregates shall conform to the requirements of Item 307, Bituminous Plant-Mix surface Course – General.

a. Coarse Aggregate

Coarse aggregate retained on the 2.36 mm (no. 8) sieve shall be crushed stone, crushed slugs, or crushed or natural gravel, and unless otherwise stipulated, shall conform to the quality requirements of AASHTO M 79.

When crushed gravel is used, it shall meet the pertinent requirements of Section 2.1 and 3.1 of AASHTO M 62 and not less than 50 mass percent of the particles retained on the 4.75 mm (No. 4) sieve shall have at least one fractured face. The coarse aggregate shall be of such gradation that when combined with other required aggregate fractions in proper proportion, the resultant mixture will meet the gradation required under the composition of mixture for the specific type under contract. Only one kind shall be used on the project except by permission of the Engineer.

b. Fine Aggregates

Fine aggregates passing the 2.36 mm (No. 8) sieve shall consist of natural sand, stone, stone screenings, or a combination thereof, and unless otherwise stipulated shall conform to the quality requirements of AASHTO M 29 (ASTM D 1073). Fine aggregate shall be of such gradation that when combined with other required aggregate fractions in proper proportion, the resultant mixture will meet the gradation required under the composition of mixture for the specific type under the contract.

c. Open-Graded Asphalt Concrete Fraction Coarse

Aggregates shall conform to Subsections 4.3.3.5(a) and 4.3.3.5(b) above and the following requirements. Relatively pure carbonate aggregates or any aggregates known to polish shall not be used for the coarse aggregate fraction 9 material retained on the 2.36 mm (no. 8) sieve. In addition, the coarse aggregate fraction shall have at least 75 mass percent of weight of particles with at least two fractured faces, except that lightweight aggregates need not meet this requirement. The abrasion loss (AASHTO T 96) shall not exceed 40 mass percent.

d. Aggregate for Hot Plant-Mix Bituminous Pavement

The provisions of Subsections 4.3.3.5(a), 4.3.3.5(b) and 4.3.3.5(c) shall apply. The several aggregate fraction for the mixture shall be sized, graded, and combined in such proportions that the resulting composite blend meets one of the grading requirements of Table 703.2 as specified in the schedule

4.3.4 Mineral Filler

4.3.4.1 Description

Mineral filler shall consist of finely divided mineral matter such as rock dust, slag dust, hydrated lime, hydraulic cement, fly ash, or other suitable mineral matter. It shall be free from organic impurities, and at the time of use, shall be sufficiently dry to flow freely and shall be essentially free from agglomerations. The filler shall be stored in a damp-proof place and used on a first-in/first-out basis. The stone dust packed in bags shall be stored in the warehouse with the floor elevated 30 cm or more above the ground.

4.3.4.2 General Requirements

Filler material for bituminous bases or pavements shall meet the requirements of AASHTO M 17, Mineral Filler for Bituminous Paving Mixtures.

4.3.4.3 Physical Requirements

Mineral filler shall be graded within the following limits:

<u>Sieve</u>	<u>Maximum Percent Passing</u>
0.600 mm (no. 30)	100
0.300 mm (No.50)	95-100
0.075 mm (No. 200)	70-100

The mineral filler shall have a plasticity index not greater than 4. Plasticity index limits are not appropriate for hydraulic lime and cement.

4.3.4.4 Filler (Quarry Dust)

If filler, in addition to the fine particles naturally present in the aggregate, is necessary, it shall consist of stone dust, Portland cement, or other matter as approved by the Engineer. The mineral filler material shall meet the requirements of AASHTO-M-17.

4.3.5 Hydrate Lime

It shall conform to the requirements of Item 701.

4.3.5.1 General

Hydrated lime shall conform to the requirements of PHILSA I-1-68 or ASTM C 207-76 and shall be of the following type:

Type N – Normal hydrated lime for masonry purposes.

Type S – Special hydrated lime for masonry purposes

It is the intent of this specification to use either the Type N or S for soil stabilization and as filler requirement to bituminous plant mixtures. It is expected to provide pavements with greater resistance to the detrimental effects of water, especially flooding during the rainy season.

4.3.5.2 Chemical Requirements

Hydrated lime for construction purposes shall conform to the following standard chemical requirements:

	<u>Percentage</u>
Calcium and Magnesium Oxide (Non-volatile basis), min. %	60
Carbon dioxide (as received basis), max. %	
If sample is taken at the place of manufacture	5
If sample is taken at any other place	7
Un-hydrated oxides (as received basis) for Type S and SA, max %	8

4.3.5.3 Physical Requirements

Hydrated lime for construction purposes shall conform to the following standard physical requirements:

a. Percentage Residue

The residue retained on a 0.600 mm (No. 30) sieve shall not be more than 0.57% and not more than 15% on a 0.075 mm (No. 200) sieve.

b. Plasticity

The putty made from Type S, special hydrate, or Type SA, special air-entraining hydrate, shall have plasticity figure of not less than 200 when tested within 30 minutes after mixing with water.

c. Water Retention

Hydrated lime mortar made with Type N (normal hydrated lime) or Type NA (normal air-entraining lime), after suction for 60 seconds, shall have a water retention value of not less than 75

percent and not less than 85% for Type S and SA, when tested in a standard mortar made from the dry hydrate or from putty made from the hydrate which has been soaked for a period of 16 to 24 hours.

4.3.5.4 Grading Requirement

Hydrated lime for construction purposes shall conform to the following grading requirements shown on Table 4-3:

Table 4-3

SIEVE DESIGNATION		MASS PERCENT PASSING
Std. mm	Alternate US Std	
0.850	(No. 20)	100
0.075	(No. 200)	85-100

4.4 Storage Requirement

4.4.1 Asphalt Cement

4.4.1.1 The asphalt cement delivered in drums shall be stored in the order of deliveries as received, from the refinery which produced it and it shall be used on a first-in/first-out basis.

4.4.1.2 The asphalt cement delivered by tanker shall, when required to be stored temporarily, be heated as necessary and maintained at the optimum temperature.

4.4.2 Aggregate

4.4.2.1 The aggregate shall be stocked by size and type with separate stockpiles for similar sizes, if the material nature is substantially different from others.

4.4.2.2 In storing the aggregate, care shall be taken to minimize premature mixing and prevent contamination by any deleterious matter as well as ensuring that the storage yard is effectively drained.

4.4.3 Filler

4.4.3.1 The filler shall be stored in a damp-proof place and used on a first-in/first-out basis. The stone dust packed in bags shall be stored in a warehouse with the floor elevated 30 cm or more above the ground.

4.5 Proportioning of Mixture

4.6.1 The proportion of bituminous material on the basis of total dry aggregate shall be from 5.0 to 8.0 mass percent. The exact

percentage to be used shall be fixed by the Engineer in accordance with the job-mix formula and other quality control requirements.

- 4.6.2 During the mixing operation, one half to one (0.5 to 1.0) mass percent of hydrated lime, dry aggregate basis, shall be added to the mixtures. The lower percentage limit is applicable to aggregates that are predominantly calcareous.

4.6 Construction Method and Requirement

4.7.1 Quality and Proportioning of Hot Asphalt Cement Mixture

4.7.1.1 Quality

The hot asphalt cement mixture shall meet the standard values shown in Table 4-4.

Table 4-4 Marshall Test Standard Value

Test Item	Standard Values	Remarks
Number of Blows	75	ASTM D 1599
Marshall stability (kg)	500 or more	
Flow value (1/100 cm)	30 to 40	
Percentage of Voids (%)	3 to 8	

4.7.1.2 Proportioning in Laboratory

In determining the amount of the asphalt cement to be mixed into the hot asphalt cement mixture, the Contractor shall execute the Marshall Stability test in accordance with the requirements of Table 4-4 and submit it to the Engineer for approval.

4.7.1.3 Proportioning in Place

Before constructing the pavement, the hot asphalt cement mixture with the proportion of the material contents determined in the laboratory shall be produced in the central mixing plant to be used for the job mixing, and tested in accordance with the Marshall Stability test procedure for determining the material proportioning in place. The material proportioning in place shall be subject to the Engineer's approval.

4.7.1.4 Determination of Standard Density

The standard density of hot asphalt cement mixture shall be the mean value of densities of the specimens prepared in a set of 3 pieces, of the morning and afternoon operations respectively for 2 days after the construction work is started. The standard density shall be subject to the Engineer's approval.

The standard density shall be determined by the following formula:

$$\text{Standard density (g/cm}^3\text{)} = \frac{A}{B - C} \times \rho_w$$

Where A ; Specimen's dry weight in air (g)

B ; Specimen's weight in water (g)
(Weight of specimen measured after soaked in
Water at 20 °C for 1 hour).

C ; Weight of specimen with the water wiped off the
Surface after measuring the weight in water (g)

ρ_w ; Density of water (1.0 g/cm³)

4.7.2 Weather and Seasonal Limitations

- 4.7.2.1 Bituminous plant mix shall not be placed on any wet surface, or when weather conditions would prevent the proper handling or finishing of the bituminous mixtures.
- 4.7.2.2 The bituminous concrete surface course shall be constructed only when the atmospheric temperature is above 5 °C and the weather is not foggy or rainy. The temperature requirement may be waived, but only when so directed by the Engineer.

4.7.3 Asphalt Plant

4.7.3.1 Plant Capacity

The asphalt plant shall be designed and conditioned to be capable of producing the prescribed kind and quality of asphalt mixture. One (1) unit of asphalt plant shall be provided for the prescribed kind of asphalt mixture.

Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier. The storage yard shall be maintained neat and orderly and the separate stockpiles shall be readily acceptable.

Plants used for the preparation of bituminous mixtures shall conform to the requirements for all plants under (a) below except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the respective requirements which follow this subsection. The plant shall be provided with the accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and temperature will be obtained.

4.7.3.2 Equipment for Plant

The type, capacity and location of the asphalt plant shall be subject to the approval of the Engineer. The asphalt plant shall have the functions described below.

a. Cold Feeder

The cold feeder shall be capable of providing accurate mechanical means for uniformly feeding the aggregate into the drier and maintaining uniform levels of both the gradation and temperature.

b. Storage Tank and Heating System for Asphalt Cement

The tanks for the storage of hot asphalt cement, excluding the aggregates, shall be of sufficient capacity to hold the quantity required for a day's construction work. The heating system shall be of indirect heating to permit a whole tank content to be heated uniformly to the prescribed temperature. The storage tank for asphalt or the feeder pipeline shall be provided with a recording thermometer at suitable place to make the measurement of asphalt temperature readily available.

Tanks for the storage of bituminous material shall be equipped with the proper devices to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils; electricity or other approved means so that no flame shall be in contact with the tank. The circulation system for the bituminous materials shall be designed to assure proper and continuous during the opening period. Provision shall be made for measuring and sampling storage tanks.

c. Drier

The drier shall have sufficient capacity to thoroughly dry and heat the aggregate to the prescribed temperature and maintain the proper and satisfactory operation of the plant. The drier shall be provided with a recording thermometer at a suitable place near the outlet to allow the measurement of aggregate temperature to be readily available.

The plant shall include a drier or driers, which continuously agitate during the heating and drying process. For cold-type bituminous mix, equipment for mechanical cooling of the dried aggregate to the temperature prescribed for cold mixtures shall be capable of supplying prepared material for the mixtures shall be capable of supplying prepared material for cold mixtures shall be capable of supplying prepared material for the mixture to operate at full capacity.

d. Screen

The screening system shall have normal capacity of screening all aggregate to the sizes and proportion as specified. Plant screens capable of screening all aggregate to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.

e. Hot Bin

The hot bin shall be divided in three (3) or more compartments and have sufficient capacity for storing five (5) batches or more of various sizes of aggregates. Each compartment shall be provided with overflow pipe to prevent backup of aggregate into other compartment or bins. Also, each compartment shall be provided with its own individual sample collection system.

The plant shall include storage bins of sufficient capacity to supply the mixer when it's operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the minimal aggregates. Separate dry storage shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes, of such locations as to prevent backing up of material into other compartments or bins. Each compartment shall be provided with individual outlet gate, constructed so that when closed, there shall be no leakage. The gates shall cut off quickly and completely. Bins shall be so constructed that samples can readily obtain. Bins shall equip with adequate telltale devices to indicate the position of the aggregate in the bins at the lower quarter points.

f. Dust Collector

The plant shall be equipped with the dust collector constructed to waste or return uniformly all I any part of the material to the hot elevator collected as directed.

g. Weighing Box or Hopper for Aggregate, Filler & Asphalt

The weighing box or hopper for the aggregate, filler, and asphalt shall have sufficient capacity to weigh a full batch of material at a time and shall be equipped with a tight outlet gate so that no material is allowed to leak into the mixture while a batch is being weighed.

The equipment shall include a means for accurately weighing each size of aggregate in a weigh box or hopper suspended on scales and of ample size to hold a full batch without hand raking or running over. The gate shall close tightly so that no material is allowed to leak into the mixer while at batch is being weighed.

The asphalt weighing box or hopper shall have a capacity of 12% or more of the mixer and shall be provided with suitable heat insulation all around the outer face.

h. Scale for Aggregate, Filler & Asphalt

The scales for aggregate, filler and asphalt shall have sufficient to weigh a full batch of material at a time with reading of gradation at intervals of not more than a two hundredth ($1/200$) of the required maximum load.

Scales shall be accurate to 0.5% of the maximum load that may be required. Poises shall be designed to be locked in any position to prevent unauthorized change of position. In lieu of plant and truck scales, the Contractor may provide an approved automatic printer system, which will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weight tickets for each load.

Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand not less than ten 20-kg weights for testing the scales.

The bituminous mixture shall be weighed on approved scales furnished by the contractor or on public scales at the contractor's expense. Such scales shall be inspected and sealed as often as the engineer deems necessary to assure their accuracy.

i. Asphalt Discharging Device

The spray bar shall have a sufficient number and length of nozzle to ensure that asphalt cement is uniformly distributed.

j. Mixer

The mixer shall be a double-shaft pug mill type batching mixer and capable of producing a uniform mix as specified. The batch mixer shall be approved typed capable of producing a uniform mixture within the job mix tolerance. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust.

The clearance of blades from all fixed and moving parts shall not exceed 25 mm (1 inch) unless the maximum diameter of aggregate in the mixer exceeds 30 mm (1 1/5 inches).

k. Thermometric Equipment

An armored thermometric of adequate range in temperature reading shall be fixed in the bituminous feed line at a suitable location near the charging valve at the mixer unit.

The plant shall also be equipped with either an approved dial scale, mercury, actuated thermometer, an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregates.

The engineer may require replacement of any thermometer by an approved temperature-recording apparatus for better regulations of the temperature of aggregates.

4.7.3.3 Safety Requirements

Adequate and safe stairways to the mixer platform and sampling points shall be provided and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by a platform or other suitable device to enable the engineer to obtain sampling and mixture temperature data. A hoist or pulley system shall be provided to raise scale calibration equipment, sampling equipment and other similar equipment from ground to the mixer platform and return. All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded and protected. Angle and unobstructed space shall be provided on the mixing platforms. A clear and unobstructed passage shall be maintained at all times in and around the truck loading area. This area shall be kept free from drippings from the mixing platforms.

4.7.3.4 Requirements for Batching Plants

a. Bituminous Control.

The equipment used to measure the bituminous material shall be accurate to plus or minus 0.5 percent. The bituminous material bucket shall be a no tilting type with a loose sheet metal cover. The length of the discharge opening spray bar shall be less than $\frac{3}{4}$ the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve or valves and spray shall be adequately heated. Steam jackets, if used shall be efficiently drained and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated quick-acting, non-drip, charging valve located directly over the bituminous material bucket. The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used in a batch. The controls shall be constructed so that they may be locked at any dial setting and will automatically reset to that reading after the addition of bituminous material to each batch. This shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over. All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow should start. The size and spacing of the spray bar opening shall provide a uniform application of bituminous material the full length of the mixer. The section of the bituminous line between the charging valve

and the spray bar shall be provided with a valve and outlet for checking the meter when a metering device is substituted for a bituminous material bucket.

b. Control of Mixing Time.

The mixer shall be equipped with an accurate time lock to control the operation of a complete mixing cycle. It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material. The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixer gate. The control of the timing shall be flexible and capable of being set at intervals of 5 sec. or less throughout a total cycle of up to 3 minutes, a mechanical batch counter shall be installed as a part of the timing device and shall be so designed as to register only completely mixed batches.

The setting of time intervals shall be performed in the presence and the direction of the engineer who shall then lock the case covering the timing device until such time as a change is to make in the timing periods.

4.7.4 Mixing and Transportation

4.7.4.1 Mixing

The size of the cold feeder gate openings, volumetric amount for each bin and quantity of asphalt cement mixture per batch shall be determined by means of test mixing so as to meet the proportioning in place.

The aggregate shall be heated to complete dryness and screened for the storage in the respective bins. The amount of aggregate and dry filler shall be accurately measured to meet the proportioning requirements in place.

All aggregate and filler shall be put into the mixer and dry-mixed for 5 seconds or longer.

The asphalt shall then be added and mixed well for at least 30 seconds until a uniform asphalt cement mixture can be attained.

The temperature of mixing shall be chosen from the temperature range when the kinematic viscosity of asphalt is 150 to 300 centistroke (75 to 150 seconds, saybolt). The temperature is thereafter referred to as designated temperature.

The designated temperature shall not exceed 185 °C. The temperature of heated asphalt shall be the same as designated temperature.

4.7.4.2 Transportation

The hot asphalt cement mixture shall be transported by the truck with clean and flat metallic loading bed. The loading bed of the truck shall be provided with thin oil or solution coating on the inner face to avoid cohesion of asphalt cement mixture. The asphalt cement mixture, once loaded, shall be covered with waterproof covering sheet, when the weather condition so requires.

4.7.5 Preparation of Existing surface for Application

Immediately before placing the hot asphalt cement mixture, the existing asphalt pavement shall be cleaned of loose stones, dirt or other deleterious materials. Any unusual condition found on the pavement shall be promptly brought to the attention of the Engineer for the Contractor's corrective action.

When the existing asphalt pavement to be applied is wet due to rain or other causes, the asphalt cement mixture shall not be placed until it is dry and the engineer has approved the work execution.

4.7.6 Spreading and Compacting

The hot asphalt cement mixture shall be spread by means of paving machine with the asphalt finisher. However, where manual spreading is unavoidable, the mixture shall be spread carefully and thoroughly so that no segregation of the asphalt cement mixture occurs.

The temperature of the hot asphalt cement mixture spread and laid shall not be lower than 120 °C.

The spreading operation shall be immediately suspended when it starts raining during the operation.

The width, thickness and speed of the paving by the asphalt finisher shall be subject to the Engineer's approval. The asphalt finisher shall be operated in such manner to spread the hot asphalt cement mixture to the full width along the forms set properly meeting the designated lines in a uniform layer. When the spreading is completed, it shall have the width, thickness, proper cross fall and surface.

The portions immediately adjacent to concrete curbing, manholes or other structures shall be spread with a uniform coating of the bituminous material as accepted by the Engineer. After spreading, the hot asphalt cement mixture shall be thoroughly and uniformly compacted with the power roller to not less than 96 % of the standard density.

The temperature of initial rolling shall be from 120 °C to 140 °C as standard range, with tandem roller or triple axis roller to finish to a flat and smooth surface, eliminating the roller marks left from secondary rolling or small corrugations on the surface.

In the area not accessible to the roller, the hot asphalt cement mixture shall be thoroughly compacted with hand tamper or other suitable tools approved by the Engineer.

The finish thickness of one (1) layer is 10 cm at the maximum.

4.7.7 Joints

The hot asphalt cement mixture at the construction joints shall be thoroughly compacted to obtain sufficient adhesion between new and old portions and the finished to secure a smooth and flat surface. Where the edge of the previously paved course remains to be compacted roughly or has many cracks, the next course shall be worked on only after the defective portions are trimmed to the satisfaction of the Engineer.

4.7.8 Maintenance and Repair

When a part of the prepared surface is to be made available for Contractor's equipment or temporary works (including the transportation of materials) due to the requirements of the work, its use shall be subject to the Engineer's approval. As soon as its use is over said surface shall be restored to the original conditions. During the period of use, the base course shall be provided with the proper maintenance and repair for the protection of the surface.

The part restored shall be checked and accepted by the Engineer, upon completion of the restoration.

All holes excavated in the work required for the execution of the quality and work-done procedures shall be backfilled to the prescribed density with the hot asphalt cement mixture.

4.7.9 Quality Control

4.7.9.1 Materials

The quality shall satisfy the standard values shown in Table 4-5(A) through 4-5(C)

4.7.9.2 Workmanship

The workmanship shall be controlled in the manner shown in Table 4-6

Table 4-5(A) Materials

Work Item	Test Item	Test Method	Frequency	Standard Value	Notes
Asphalt Treated Course	Asphalt Cement	As approved by the Engineer	Once for every 500 tons at receiving materials	To meet the requirements of penetration grade 60 to 70 under ASTM D-946	Manufacturer's test data may be substituted as directed by the Engineer
	Gradation of aggregate	AASHTO-T-11 and T-27	Once for every quarry	To meet the requirements to Table 4-2 and gradation range under AASHTO-M-17 (Mineral filler)	
	Abrasion of aggregate	AASHTO-T-96	-ditto-	not more than 30%	
	Soundness of aggregate	AASHTO-T-104	-ditto-	not more than 12%	
Work Item	Test Item	Test Method	Frequency	Standard Value	Notes
Asphalt Treated Course	Flatness of aggregate	By the Engineers instruction	-ditto-	Not more than 10% by weight	
	Gradation of aggregate	AASHTO-T-84 and T-85	-ditto-	Not more than 3% (Dry specific gravity)	
	Abrasion of aggregate	AASHTO-T-84 and T-85	-ditto-	not more than 3%	
	Plasticity index of aggregate	AASHTO-T-90	-ditto-	not more than 6%	Aggregate passing No.8 sieve including mineral filler

Table 4-5(B) Materials

Work Item	Test Item	Test Method	Frequency	Standard Value	Notes
Asphalt Treated Course	Material Proportioning in laboratory	As approved by the Engineer	Once for every change in proportioning	To meet the requirements in Table 4-	
	Material Proportioning	-ditto-	-ditto-	-----	
	Report of Job	-ditto-	-ditto-	-----	
	Asphalt temperature	kettle	4 times per day	W/in +/- 15°C of the designated temperature & not more than 185°C	
	Gradation of aggregate	AASHTO-T-27	once per day at hot bins	% of wt. passing 20 mm mesh sieve is w/in +/- 8% of designated for no. 4 mesh sieve w/in +/- 4.5% of designated	Designated: represents the gradation as determined for the job mixing
	Aggregate temperature hot bins	As approved by the Engineer	Once per day	_____	

Table 4-5 (C) Materials

Work Item	Test Item	Test Method	Frequency	Standard Value	Notes
Asphalt Treated Course	Moisture content of aggregate	-ditto-	-ditto-	_____	
	Filler (stone dust) screening	AASHTO-T-37	Once for every 500 tons	To meet the requirement of AASHTO-M-17	
Asphalt Treated Course (Hot Asphalt Cement Mixture)	Heating temperature	As approved by the Engineer	At random	W/in +/- 15°C of the designated temperature & not more than 185°C	
	Marshall Stability	ASTM-D-1599	Once per day (3 pieces)	To meet the requirements in Table 4-2	
	Quantitative extraction of asphalt	AASHTO-T-164 or as approved by the Engineer	once per day	w/in +/- 0.3% of the prescribed amount of asphalt cement	
	Sample Screening	ASHTO-T-11 and T-27	Once per day in 3 times screening	%wt. passing 20 mm mesh sieve is w/in +/-8% of designated for no. 4 mesh sieve, w/in +/-7% of designated for no. 200 mesh sieve +/- 3.5% of designated	Designated: Represents the gradation as determined for the job mixing
	Percent of compaction	As approved by the Engineer	Once per day (3 pieces)	To meet the requirements in Table 4-2	
	Measurement of standard density	By method specified in Standard Density			

Table 4-6 Workmanship

Work Item	Test Item	Test Method	Frequency	Tolerance	Notes
Asphalt Treated Course	Finish Elevation	By surveying specified in General Requirements, Sec 3	One for every 400 m² at points designated by the Engineer	± 1.5 cm	
	Thickness	As approved by the Engineer	-ditto-	+ Not specified -1.5 cm	
	Width	-ditto-	At points designated by the Engineer	+ Not specified -1.5 cm	

4.8 Equipment Requirement

4.8.1 Asphalt Pavers

The equipment shall be self-contained, power-propelled units, provided with an adjustable activated screed or strike-off assembly, heated if necessary, and capable of spreading or finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the Plans.

Pavers shall be equipped with a control system capable of automatically maintaining the screed elevation as specified herein. The control shall be automatically actuated from either a reference line or surface through a system of mechanical sensors or sensor directed mechanisms or devices, which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. When directed, the transverse slope control system shall be made inoperative and the screed shall be controlled by sensor directed automatic mechanisms, which will independently control the elevation of each end of the screed reference line or surface.

The controls shall be capable of working in conjunction with any of the following attachments:

- a. Ski-type device of not less than 9 m (30 feet) in length or as directed by the Engineer
- b. Taut string line (wire) set to grade
- c. Short ski or shoe

The contractor shall furnish the long ski, the short ski or shoe and furnish and install all required stakes and wire for a taut string line.

Should the automatic control system become inoperative during the day's work using manual controls, however, work shall not be resumed thereafter until the automatic control system has been operative.

The contractor shall provide and have ready for use at all times enough cover, as may be necessary, for use in any emergency such as rain, chilling wind, or unavoidable delay, for the purpose of covering or protecting any material that may have been dumped and not spread.

4.8.2 Rollers

The equipment shall be of the steel and/or pneumatically tire type and shall be in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition the use of equipment which results in excessive crushing of the aggregate will not be permitted.

4.8.3 Dump Truck

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds, which have been thinly coated with approved material to prevent the mixture from adhering to the beds. Each truck shall have a cover of canvass or other suitable material of such size as to protect the mixture from the weather. When necessary, such that the mixture will be delivered on the road as the specified temperature, truck beds shall be insulated and covers shall be securely fastened. Trucks shall be drained prior to loading.

4.9 Method of Measurement and Rate

4.9.1 The bituminous mixture will be measured by the metric ton (m t). The quantity to be paid for shall be the number of tons of mixture placed and compacted in the accepted pavement. No deduction will be made for the weight of bituminous material in the mixture.

4.9.2 Batch weights will not be permitted as a method of measurement.

4.10 Basis of Payment

4.10.1 The accepted quantity, measured as prescribed in Section 4.9 shall be paid for at the contract unit price for Bituminous Concrete Surface Course, Hot-Laid, which price and payment shall be the full compensation for furnishing materials, handling, mixing, hauling, placing, rolling, compacting, labor, equipment, tools and incidentals necessary to complete this Item.

4.10.2 The rates shall be full compensation for all plant, materials, labor, equipment, transport, temporary works, establishment charges, overheads and profit required to complete the work described in this specifications.

Rates shall further include for:

1. Placing, spreading and compacting;
2. Side and end waste; and

5.0 PAVEMENT MARKINGS (ITEM 606)

5.1 Description

5.1.1 This item shall consist of placing markings on the finished pavement. The work shall include the furnishing of reflective pavement marking paint.

5.1.2 The paint shall be applied to the size, shape and location of the markings shown on the plans, or as required by the Engineer.

5.1.3 Paint applied at the center of the Runway

5.2 Materials Requirements

5.2.1 Paint shall be mixed at factory, ready for application without the necessity of using thinners and shall be of smooth uniform quality. It shall be mill-ground. Paint sample shall be submitted by the Contractor to the prior to application for the Engineer's Approval.

5.2.2 Beads shall be of good quality, optically clear, lead-free glass with not less than 90% reasonably spherical and free from flaws. The beads shall contain not more than one percent of sharp angular particles and

not more than one half percent of foreign matters and shall be free from flowing under normal atmospheric conditions.

5.2.3 The grading of ballotini shall be as follows:

US Standard Sieve Mm	Alternative	Percentage Passing By Weight
1.18	No. 16	100
0.850	No. 20	65-75
0.600	No. 30	45-55
0.300	No. 50	15-25
0.180	No. 80	0

The proportion of the ballotini to paint shall be not less than 500 grams per liter of paint.

5.3 Construction Requirements

5.3.1 The painting of lane markers and strips shall include the cleaning of the of the pavement surfaces, the application, protection and drying of the paint coatings, the protection pedestrians, vehicular or other traffic, the protection of all parts of the runway pavement structure and its appurtenances against disfigurement by spatters, splashes or smirches of pains or of paint materials and the supplying of all tools, labor, and traffic paint necessary for the entire work.

5.3.2 The paint shall not be applied during rain or wet weather or when the air is misty, or when in the opinion of the Engineer, conditions are unfavorable for the work. Paint shall not be applied upon damp pavement surfaces, or upon pavement which has absorbed heat sufficient to cause the paint to blister and produce a porous film of paint.

5.3.3 The application of paint shall preferably be carried out by a machine specially made for this purpose but where brushes are used; only round or oval brushes not exceeding 100 mm in width will be permitted. The paint shall be so produce a uniform, even coating in close contact with the surface being painted.

5.3.4 Paints shall be applied to the pavement at the rate of 0.33L/m² and shall dry sufficiently to be free from cracking-in from 15 to 30 minutes.

5.4 Method of Measurement

5.4.1 The quality of pavement markings to be paid for shall either be the length as shown on the Plans of painted traffic line of the stated width or the area as shown on the Plans of symbols, lettering, hatchings and the like, completed and accepted. Separate item shall be provided for cold laid and hot laid reflectorized paint.

5.5 Basis of Payment

5.5.1 The quantities measured as determined in Section 5.4, Method of Measurement, shall be paid for at the appropriate contract unit price

for the pay items shown in the Bid Schedule which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the surface, and for all labor, equipment, tools and incidentals necessary to complete the Item.

5.5.2 Payment will be made under:

Description	Unit of Measurement
5.5.2.1 Reflective Pavement Markings (Cold Laid)	Square Meter

6.0 REFLECTORIZED THERMOPLASTIC PAVEMENT MARKINGS (ITEM 612)

6.1 Description

6.1.1 This standard specifies the requirement for reflectorized thermoplastic pavement striping material that is applied to the pavement surface in a molten state by mechanical means with surface application of glass beads at a rate of not less than 350 g/L of glass beads having a size range of drop-in type and will produce an adherent reflectorized stripe of specified thickness and width capable of resisting deformation by traffic.

6.1.2 The Paint applied at the edge of the Runway, overrun and numbers

6.2 Materials Requirements

6.2.1 Reflectorized Thermoplastic Pavement Material shall be homogeneously composed of pigment, filler, resins and glass reflectorizing spheres.

6.2.1.1 The thermoplastic material shall be available to both white and yellow.

6.2.1.2 Glass Beads (Pre-mix) shall be uncoated and shall comply with the following requirements:

Refractive Index, min. – 1.50

Spheres, Percent, min. – 90

Gradation:

Sieve mm	Mass Percent Passing
0.850	100
0.600	75 – 95
0.425	-
0.300	15 – 35
0.180	-
0.150	0 - 5

6.3 General Requirements

6.3.1 Composition

The pigment, beads and filler shall be uniformly dispersed in the resin. The material shall be free from all skins, dirt and foreign objects and shall comply with the requirements as specified in Table 6.1

Table 6.1 – Composition Requirements

Component	White	Yellow
Binder, min	18.0	18.0
Glass Beads:		
Min.	30.0	30.0
Max	40.0	40.0
Titanium		
Dioxide, min.	10.0	
Chrome Yellow, Medium,min.		10.0
Calcium Carbonate and inert Fillers, max.	42.0	42.0

6.3.2 Quantitative

The material shall conform to the quantitative requirements as specified in Table 6.2

Table 6.2 – Quantitative Requirements

Property	Requirements	
	White	Yellow
Specific Gravity, max.	2.15	
Drying Time, minutes,max.	10	
Bond Strength to Portland Cement Concrete after heating for four hours ± 5 min. @ 218°C Mpa, max.	1.24	
Cracking Resistance @ low temp. after heating for four hours ± 5 min. @ $218 \pm 2^{\circ}\text{C}$,	No Cracks	
Impact Resistance after heating for four hours ± 5 min. @ $218 \pm 2^{\circ}\text{C}$ and forming test specimens, mm/kg. min.	115	
Softening Point after heating for four hours ± 5 min. @ 218°C , $\pm 2^{\circ}\text{C}$.	$102.5 \pm 9.5^{\circ}\text{C}$	
Daylight reflectant @ 45 degrees - 0 degrees,%, min.	75	75

6.3.3 Application Properties

- 6.3.3.1 The material shall readily extrude at a temperature of $211 \pm 7^{\circ}\text{C}$, from approved equipment to produce a line 3.2 to 4.8 mm thick which shall be continuous and uniform in shape having clear and sharp dimensions.
- 6.3.3.2 The material shall not exude fumes which are toxic, obnoxious or injurious to persons or property when heated during applications.
- 6.3.3.3 The application of additional glass beads by drop-in methods shall be at the rate of not less than 350 g/L of glass beads having a size range for drop-in type. The typical size range of spheres of drop-in type paint is as follows.

Passing 850 μm (#20) sieve and retained on 250 μm (#60) sieve, %	80 -100
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6.3.4 Sampling

A minimum weight of 10 kg. of Reflectorized Thermoplastic paint shall be taken for every 100 bags of fraction thereof.

6.3.5 Testing

The material shall be tested in accordance with AASHTO T250 or with the appropriate method in ASTM designation.

6.3.6 Packing the Material

The material shall be packed in a suitable container to which it will not adhere during shipment and storage. The blocks of cast thermoplastic material shall be approximately 300 x 925 by 51 mm and shall weigh approximately 23 kg. Each container label shall designate the color, manufacturer's name, batch number and date of manufacture. Each batch manufactured shall have its own separate number. The label shall warn the user that the material shall be heated to $211 \pm 7^{\circ}\text{C}$ during application

6.4 Method of Measurement

- 6.4.1 The quality of pavement markings to be paid for shall either be the length as shown on the Plans of painted traffic line of the stated width or the area as shown on the Plans of symbols, lettering, hatchings and the like, completed and accepted. Separate item shall be provided for cold laid and hot laid reflectorized paint.

6.5 Basis of Payment

- 6.5.1 The quantities measured as determined in Section 6.4, Method of Measurement, shall be paid for at the appropriate contract unit price for the pay items shown in the Bid Schedule which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the surface, and for all labor, equipment, tools and incidentals necessary to complete the Item.

- 6.5.2 Payment will be made under:

Description	Unit of Measurement
6.5.2.1 Reflective Pavement Markings (Hot Laid)	Square Meter