

PROJECT MANUAL

For

Primrose Park Phase One Trail & Parking

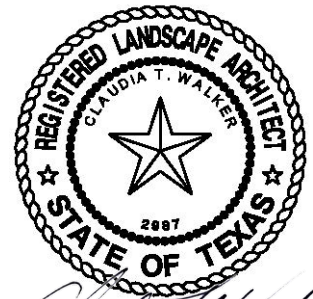
Located in
City of Fulshear
Fort Bend County, Texas

Prepared for

The City of Fulshear

Project No.: 1340.001

August 23, 2019



A handwritten signature in black ink, appearing to read "Claudia T. Walker".

Date Signed:
Aug. 14, 2019



BURDITT Consultants, LLC

310 Longmire Rd., Conroe, TX 77304
P: (936) 756-3041 F: (936) 539-3240

SECTION 00 62 93

SITE SURVEY CERTIFICATION

PROJECT: Primrose Park Phase One Trails & Parking

PROJECT No.: 1340.001

FROM:
CONTRACTOR and
Address for Written Notice

TO:
Claudia Walker, Landscape Architect
Burditt Consultants, LLC
310 Longmire
Conroe, Texas 77304

1.01 DESCRIPTION OF REQUIREMENTS

CONTRACTOR shall verify all existing site conditions, and confirm points of connections to existing improvements, including confirmation of elevations and grades of existing facilities and utilities prior to starting any grading, paving or utility installation. Verification of locations and functions of each existing structure or system and all existing utility grades and invert elevations is the contractor's responsibility. Notify the engineer of any discrepancies immediately. Any conflicts or errors between existing field conditions and engineering plans must be resolved prior to starting excavation.

This applies to all contracts that involve connections to, or installation of:

- a. _____
- b. _____
- c. _____
- d. _____

1.02 ACKNOWLEDGMENT BY CONTRACTOR (Signed at Award)

CONTRACTOR hereby acknowledges this requirement and agrees to perform necessary topographic and site surveys prior to commencing work on the specified items. **This Certification will not change the total Contract Price or Time of Performance.**

CONTRACTOR Signature

Date

CONTRACTOR Title

SECTION 01 55 13

TEMPORARY ACCESS ROADS

PART 1 GENERAL

1.01 Scope

- A. This specification includes installation of erosion and sediment control for stabilized construction exit used during construction and until final development of the site.
- B. The work includes stabilized construction roads, parking areas, exits, and truck washing areas. The work is to be complete in place, including, but not limited to embankment and excavation, maintenance requirements, repair and replacement of damaged sections, removal of sediment deposits, redressing of aggregates and stones, cleaning of streets, and removal of erosion and sediment control systems at the end of construction.

1.02 References

ASTM D4632 -Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

1.03 Related Sections

SECTION 01 33 00 – Submittal Procedures
SECTION 01 56 16 – Temporary Dust Barriers

PART 2 PRODUCTS

2.01 Geotextile Fabric

- A. Provide woven or non-woven geotextile fabric made of polypropylene, polyethylene, ethylene, or polyamide material as manufactured by Mirafi, Inc., or approved equal.
- B. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632), and the equivalent opening size between 50 and 140.
- C. Both the geotextile and threads shall be resistant to chemical attack, mildew, and rot, and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable life at a temperature range of 0°F to 120°F.

2.0 Course Aggregate

- A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to the following gradation requirements.

Sieve Size (Square Mesh)	Percent Retained (By Weight)
2-1/2"	0
2"	0-20
1-1/2"	15-50
3/4"	60-80
No. 4	95-100

2.03 Alternate Methods

A. Alternative methods of construction may be utilized when shown on Drawings, or when approved by the LANDSCAPE ARCHITECT. These methods include the following:

1. Cement-Stabilized Soil - Compacted cement-stabilized soil or other fill material in an application thickness of at least 8 inches.
2. Wood Mats/Mud Mats - Oaks or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.
3. Steel Mats - Perforated mats placed across perpendicular support members.

PART 3 EXECUTION

3.01 General

- A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, CONTRACTOR shall provide stabilized construction roads and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.
- B. Provide stabilized construction exits, and truck washing areas when approved by OWNERS REPRESENTATIVE, of the sizes and locations where shown on Drawings or as specified in this Section. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

3.02 Submittals

- A. In accordance with Section 01 33 00, Submittals Procedures, submit the following:
1. Manufacturer's catalog sheets and other product data on geotextile fabric.
 2. Sieve analysis of aggregates conforming to requirements of this Specification.

3.03 Preparation and Installation

- A. No clearing and grubbing or rough cutting is permitted until erosion and sediment control systems are in place, other than as specifically directed by the OWNERS REPRESENTATIVE to allow soil testing and surveying.

3.04 Duration

- A. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the OWNERS REPRESENTATIVE to remove and discard the existing system.

3.05 Maintenance

- A. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.
- B. Regularly inspect and repair or replace components of stabilized construction exits. Unless otherwise directed, maintain the stabilized construction roads and exits until the project is accepted by the OWNER.
- c. Remove stabilized construction roads and exits promptly when directed by the OWNERS REPRESENTATIVE.
- D. Discard removed materials off-site.

3.06 Vehicle Access

- A. CONTRACTOR shall not maneuver equipment and vehicles on areas outside of dedicated rights-of-way and easements for construction.
- B. CONTRACTOR shall also not permit vehicular access outside of areas protected by soil erosion protection.

3.07 Cleaning Tires

- A. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, CONTRACTOR shall construct a truck washing area. Truck washing shall be done on stabilized areas that drain into a drainage system protected by erosion and sediment control measures.

3.08 Details

- A. Details for stabilized construction exit are shown on the Drawings. Construction of all stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlying soil. Limit exposure of geotextile fabric to the elements between spreading fabric and covering to a maximum of 14 days to minimize damage potential. Install and maintain filter fabric fence in accordance with Section 01 56 16 – Temporary Dust Barrier.

3.09 Grading

- A. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

3.10 Inspections

- A. The stabilized areas shall be inspected and maintained daily. A daily written report shall be made and filed with OWNERS REPRESENTATIVE weekly.

3.11 Periodic Repairs

- A. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

3.11 Dimensions

- A. The length of the stabilized area shall be as shown on the Drawings, but not less than 50 feet. The thickness shall be as shown on the drawings, but shall not be less than 8 inches. The width shall not be less than full width of all points of ingress or egress.
- B. Stabilized area may be widened or lengthened to accommodate truck-washing area when authorized by OWNERS REPRESENTATIVE.
- C. Stabilization for other areas shall have the same course aggregate, thickness, and width requirements as the stabilized construction exit, except where shown otherwise on the Drawings.

PART 4 MEASUREMENT AND PAYMENT

- A. No measurement or separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items for TPDES Requirements or as called out on the Proposal.

END OF SECTION

SECTION 01 56 16

TEMPORARY DUST BARRIERS

PART 1 GENERAL

1.1 Scope

This specification includes installation of erosion and sediment control filter fabric fences used during construction and until final development of the site. The purpose of filter fabric fences is to contain pollutants from overland flow. Filter fabric fences are not for use in channelized flow areas.

1.2 Related Sections

SECTION 01 33 00 – Submittal Procedures

1.3 References

ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.

ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 PRODUCTS

2.1 Filter Fabric

Provide woven or nonwoven geotextile filter fabric made of polypropylene, polyethylene, ethylene, or polyamide material as manufactured by Mirafi, Inc., or approved equal.

Geotextile fabric shall have a grab strength of 100 psi in any principal direction (ASTM D-4632), Mullen burst strength exceeding 200 psi (ASTM D-3786), and the equivalent opening size between 50 and 140.

Filter fabric material shall contain ultraviolet inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

PART 3 EXECUTION

3.1 Submittals

In accordance with Section 01 33 00, Submittal Procedures, submit manufacturer's catalog sheets and other product data on geotextile fabric.

3.2 Preparation and Installation

Provide erosion and sediment control systems at the locations shown on Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and specified in this section.

No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than site work specifically directed by the ENGINEER to allow soil testing and surveying.

Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the ENGINEER to remove and discard the existing system.

Regularly inspect and repair or replace damaged components of filter fabric fences as specified in this Section. Unless otherwise directed, maintain the erosion and sediment control systems until the project area stabilization is accepted by the OWNER. Remove erosion and sediment control systems promptly when directed by the ENGINEER. Discard removed materials off site.

Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil is not designated on the Drawings, dispose of sediment off site at a location not in or adjacent to stream or floodplain. Off-site disposal is the responsibility of the CONTRACTOR. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into a stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local rules and regulations.

Equipment and vehicles shall be prohibited by the CONTRACTOR from maneuvering on areas outside of dedicated rights-of-ways and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

3.3 Construction Methods

Provide filter fabric fence systems in accordance with the Drawing detail for Filter Fabric Fences. Filter fabric fences shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

Attach the filter fabric to 1-inch by 2-inch wooden stakes spaced a maximum of 3 feet apart and embedded a minimum of 8 inches. If filter fabric is factory preassembled with support netting, then maximum spacing allowable is 8 feet. Install wooden stakes at a slight angle toward the source of anticipated runoff.

Trench in the toe of the filter fabric fence with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. The v-trench configuration as shown on the Drawings may also be used. Lay filter fabric along the edges of the trench. Backfill and compact trench.

Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

Provide the filter fabric in continuous flows and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall and at a minimum once each week. Repair or replace damaged sections immediately. Remove sediment deposits when silt reaches a depth one-third the height of the fence or 6 inches, whichever is less.

PART 4 MEASUREMENT AND PAYMENT

Unless indicated in the Proposal as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items of which this work is a component.

When indicated in the Unit Price Schedule as pay item, measure and pay for the filter fabric fence by the linear foot of completed and accepted filter fabric fence between the limits of the beginning and ending of wooden stakes. Filter fabric fence, measured as stated, will be paid for at the unit price bid for Filter Fabric Fence, complete in place.

Payment for filter fabric fence will include an be full compensation for all labor, equipment, materials, supervision, and all incidental expenses for construction of these items, complete in place, including, but not limited to protection of trees, maintenance requirements, repair and replacement of damaged sections, removal of sediment deposits, and removal of erosion and sediment control systems at the end of construction.

END OF SECTION

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SECTION 015639 - TREE PROTECTION

PART 1 – GENERAL

1.1 SUMMARY

A. Work includes:

1. Removal operation.
2. Maintenance pruning.
3. Fertilization treatment.
4. Tree protection fencing installation.
5. Mulching operation.
6. Root pruning operation.
7. Utility boring operation.
8. Transplant operation.
9. New sidewalk installation.
10. Repair/replacement operation.

- B. All Contractors shall meet with the Urban Forester or Owner's Representative to review the Tree Preservation Plan for the site before startup of site work.
- C. No site construction shall begin in any areas where tree preservation and treatment measures have not been implemented and approved.
- D. Tree preservation and treatment measures shall be reviewed and approved by the Urban Forester or Owner's Representative prior to and immediately following installation.
- E. Contractor shall be responsible for compliance to and maintenance of the Tree Preservation Plan.
- F. The areas protected by the tree protection fencing are the tree preservation areas. No access to these areas shall be permitted during the construction period without first consulting with the Urban Forester or Owner's Representative.
- G. Any roots of preservation trees exposed by construction activity shall be covered with a layer of light topsoil or 6 mil. polyethylene sheeting to prevent desiccation and loss of exposed roots.
- H. Any work, excavation, or grading required by construction within the tree preservation areas shall be limited to 2' cut or fill with no roots over ½" being cut. This work shall be by hand or with approved equipment and root protection.
- I. Trees damaged or lost due to Contractor's negligence during the construction period shall be appraised by the Urban Forester or Owner's Representative and the Owner compensated.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Fertilizer – “XL Injecto Feed” (32-7-7), a product of Dogget Corporation, Lebanon, NJ, (800) 448-1862.
- B. Mycorrhizal Fungi – MycorTree Ecto-Injectable, a product of Plant Health Care, Inc., (800) 421-9051.
- C. Tree Protection Fencing:
 - 1. 4’ tall plastic, 1” mesh fence.
 - i. Part Number Color Roll Size
 - ii. 1410-O Orange 4’ x 100’ 1.2m x 30m Diamond Mesh
 - 2. Iron U-bar posts, 6’ tall.
 - 3. Wire, 16 gauge ties. Or 11-inch plastic zip-ties
- D. Mulch: First run mulch or site generated mulch.
- E. Products of the same type from other sources shall not be excluded, provided they have like physical and functional characteristics and are approved by the Urban Forester or Owner’s Representative.
- F. Every effort shall be made to utilize chemicals of an organic or biodegradable nature in order to offer the least impact to the environment.

PART 3 – IMPLEMENTATION

3.1 TREATMENTS

A. Removal Operation

- 1. Trees designated to be removed by hand on the Tree Preservation Plan shall be painted with an “X” by the Urban Forester or Owner’s Representative.
- 2. All tree removals shall be done by a Certified Arborist.
- 3. All wood and debris from tree removal shall be removed from the site immediately.
- 4. All stumps shall be ground down to 12” below grade.
- 5. Any damage to preservation trees occurring during the removal operation shall be repaired.

B. Maintenance Pruning

- 1. Trees to be pruned are designated on the Tree Preservation Plan and will be identified by the Urban Forester or Owner’s Representative.
- 2. All maintenance pruning work shall be done by a certified Arborist.
- 3. A Tree Treatment Schedule listing the preservation trees and treatments will be provided.
- 4. Pruning shall consist of the following method:
 - (a) Pruning as defined by the American National Standard for Tree Care Operations – Tree Shrub and Other Woody Plant Maintenance Standards. This would include:

- (1) Crown raising or clearance pruning shall consist of the removal of the lower branches of a tree to provide clearance for streets, sidewalks buildings and playground areas while maintaining a balanced form.
- (b) All hazard wood shall be removed from designated trees.
- (c) All pruning cuts on Oak trees shall be covered with a thin coat of water-based black paint approved by Urban Forester or Owner's Representative if pruning is to occur in April, May, or June.
- (d) All wood and debris from pruning operations shall be removed from the site.

C. Fertilization Treatment

1. Preservation trees shall be treated as designated on the Tree Treatment Schedule.
2. Injection of the fertilizer into the root zone of a tree shall consist of the following methods:
 - (a) Mix in a tank with agitation capability:
 - (1) Fertilizer – 9 pounds by weight per 100 gallons water.
 - (2) Mycorrhizal Fungi – 1 lb. per 100 gallons water.
 - (b) Inject the Mixture on a 2.5 ft. square grid at 1/2 gallon of mix per hole or 8 gallons per 100 square feet.
 - (c) Injection pressure shall be 100-150 PSI as soil conditions warrant.
 - (d) Depth of injection shall be 6 – 12 inches.
 - (e) Inject the root zone areas, where possible, in the available canopy areas plus 10 feet beyond dripline, but not in root loss zone.
3. Contractor is responsible for mixing, applying and disposal of all chemicals in accordance with strict adherence to manufacturer's directions and/or State and Federal Regulations.

D. Tree Protection Fencing Installation (refer to Tree Preservation Details).

1. Tree protection fencing is designated in the Tree Preservation Plan.
2. Fencing as follows:
 - (a) Fabric, 4' tall plastic fence.
 - i. Part Number Color Roll Size
 - ii. 1410-O Orange 4' x 100' 1.2m x 30m Diamond Mesh
 - (b) Steel U-bar posts, 6' tall, placed 8' – 0" on center, 24" into the ground.
 - (c) Fence is to be attached to posts with wire or plastic zip- ties placed every 24" on center.
 - (d) Fence is to be placed a minimum of 1 foot from all root prune lines.

3. No access to fenced areas shall be permitted without prior approval of the Urban Forester or Owner's Representative.
4. Contractor shall provide for maintenance and repair of fencing during site work construction.
5. Contractor shall remove fence after completion of the site work unless otherwise notified by the Owner.

E. Mulching Operations

1. A 4" layer of mulch shall be placed in the canopy area of trees where exposed soil or roots are present.
2. Approved access through the canopy areas for construction equipment or vehicles shall be covered with 6" of mulch covered by 3/4" plywood.

F. Root Pruning Operation (refer to Tree Preservation Details).

1. Trenching areas are designated in the Tree Preservation Plan and exact locations will be marked in the field by the Urban Forester or Owner's Representative.
2. Trenching depth shall be 2 ft. minimum, not to exceed 6" in width.
3. Trenching shall be backfilled and compacted immediately after trenching.

G. Utility Boring

1. All utilities will be bored through the Critical Root Zone (CRZ) of all protected trees.
2. Bore pits will be outside the CRZ of each protected tree.
3. Bore layout must be approved in the field by the Urban Forester or Owner's Representative.
4. Any necessary excavations within the CRZ of protected trees will require the approval of the Urban Forester or Owner's Representative.

H. Transplant Operation

1. Trees designated for transplanting are designated on the Tree Preservation Plan and Tree Treatment Schedule.
2. Transplants are to be relocated on site to a permanent location determined by the Owner's Representative.
3. Contractor shall be responsible for proper relocation, planting, and maintenance of the transplanted trees for one (1) year and guarantee replacement.

I. New Sidewalk Installation

1. Removal of old sidewalks in the canopy areas will be done in the following manner:
 - (a) Removal all sidewalks and debris by hand without disturbing the underlying roots.

- (b) Exposed roots shall be covered immediately with sand or 6 mil. polyethylene sheeting to prevent desiccation.
2. New sidewalks in the canopy of preservation trees shall be installed on grade with a maximum of 1” cut.
- (a) No roots shall be cut for the installation of new sidewalks.
 - (b) All exposed roots shall be around with 6 polyethylene or sand to prevent desiccation of roots.
 - (c) No stabilized sand shall be used for base in the canopy of trees.
 - (d) Provide for positive drainage of canopy areas of trees.

J. Repair/Replacement Operations

- 1. If any damage to preservation trees should occur beyond what is expected during the construction period, the Urban Forester or Owner’s Representative shall appraise the damage and order the repair by the contractor or responsible party.
- 2. Trees other than those designated for removal that are destroyed or irreparably damaged as a result of construction operations, shall be removed and replaced with the same size species and variety up to and including 8 inches in diameter. Trees larger than 8 inches in diameter shall be replaced with an 8-inch diameter tree of the same species and variety and total contract amount will be reduced as determined by a qualified appraiser using the Guide for Plant Appraisal published by the International Society of Arboriculture (9th Edition 2000).
- 3. Owner shall be compensated for all costs involved in mitigation of damages and the appraisal thereof by the Urban Forester or Owner’s Representative.

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SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SCOPE

- A. Install, maintain, and remove erosion, sedimentation, and environmental control devices. Remove accumulated sediment and debris.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Rock Filter Dams.
1. Aggregate. Furnish aggregate with hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding acceptable to the ENGINEER. Provide the following:
 - a. Types 1, 2, and 4 Rock Filter Dams. Use 3 to 6 in. aggregate.
 - b. Type 3 Rock Filter Dams. Use 4 to 8 in. aggregate.
 2. Wire. Provide minimum 20 gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:
 - a. a double-twisted, hexagonal weave with a nominal mesh opening of 2-1/2 in. x 3-1/4 in.;
 - b. minimum 0.0866 in. steel wire for netting;
 - c. minimum 0.1063 in. steel wire for selvages and corners; and
 - d. minimum 0.0866 in. for binding or tie wire.
 3. Sandbag Material. Furnish sandbags meeting Section 506.2.I, "Sandbags," except that any gradation of aggregate may be used to fill the sandbags.
- B. Temporary Pipe Slope Drains. Provide corrugated metal pipe, polyvinyl chloride (PVC) pipe, flexible tubing, watertight connection bands, grommet materials, prefabricated fittings, and flared entrance sections that conform to the Drawings. Recycled and other materials meeting these requirements are allowed if approved.
- C. Baled Hay. Provide hay bales weighing at least 50 lb., composed entirely of vegetable matter, measuring 30 in. or longer, and bound with wire, nylon, or polypropylene string.
- D. Temporary Paved Flumes. Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material that conforms to the Drawings. Provide rock or rubble with a minimum diameter of 6 in. and a maximum volume of 1/2 cu. ft. for the construction of energy dissipaters.
- E. Construction Exits. Provide materials that meet the details shown on the Drawings and this Section.
1. Rock Construction Exit. Provide crushed aggregate for long and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such

- as salt, alkali, dirt, clay, loam, shale, soft, or flaky materials and organic and injurious matter. Use 4- to 8-in. aggregate for Type 1 and 2- to 4- in. aggregate for Type 3.
2. Timber Construction Exit. Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers with nuts and bolts or lag bolts, of at least 1/2 in. diameter, unless otherwise shown on the Drawings or allowed. For short-term exits, provide plywood or pressed wafer board at least 1/2 in. thick.
 3. Foundation Course. Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the Drawings or directed.
- F. Embankment for Erosion Control. Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.
- G. Pipe. Provide pipe outlet material in accordance with details shown on the Drawings.
- H. Construction Perimeter Fence.
1. Posts. Provide essentially straight wood or steel posts that are at least 60 in. long. Furnish soft wood posts with a minimum diameter of 3 in. or use 2 x 4 boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 x 1-1/5 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.3 lb. per foot.
 2. Fence. Provide orange construction fencing as approved by the ENGINEER.
 3. Fence Wire. Provide 12-1/2 gauge or larger galvanized smooth or twisted wire. Provide 16 gauge or larger tie wire.
 4. Flagging. Provide brightly-colored flagging that is fade-resistant and at least 3/4 in. wide to provide maximum visibility both day and night.
 5. Staples. Provide staples with a crown at least 1/2 in. wide and legs at least 1/2 in. long.
 6. Used Materials. Previously used materials meeting the applicable requirements may be used if accepted by the ENGINEER.
- I. Sandbags.
1. Bags. Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 oz. per square yard, a Mullen burst-strength exceeding 300 psi, and an ultraviolet stability exceeding 70%.
 2. Sand. Use natural coarse sand or manufactured sand meeting the gradation given in Table 1 to fill sandbags. Filled sandbags must be 24 to 30 in. long, 16 to 18 in. wide, and 6 to 8 in. thick.

Table 1 - Sand Gradation

Sieve #	Maximum Retained (% by Weight)
4	3%
100	80%
200	95%

- J. Temporary Sediment Control Fence. Provide a net-reinforced fence using woven geo-textile fabric. Logos visible to the traveling public will not be allowed.
1. Fabric. Provide fabric materials in accordance with DMS-6230, "Temporary Sediment Control Fence Fabric."

2. Posts. Provide essentially straight wood or steel posts with a minimum length of 48 in., unless otherwise shown on the Drawings. Soft wood posts must be at least 3 in. in diameter or nominal 2 x 4 in. Hardwood posts must have a minimum cross-section of 1-1/2 x 1-1/2 in. T- or L-shaped steel posts must have a minimum weight of 1.3 lb. per foot.
3. Net Reinforcement. Provide net reinforcement of at least 12-1/2 gauge galvanized welded wire mesh, with a maximum opening size of 2 x 4 in., at least 24 in. wide, unless otherwise shown on the Drawings.
4. Staples. Provide staples with a crown at least 3/4 in. wide and legs 1/2 in. long.
5. Used Materials. Use recycled material meeting the applicable requirements if accepted by the ENGINEER.

2.02 EQUIPMENT.

- A. Provide a backhoe, front end loader, blade, scraper, bulldozer, or other equipment as required when "Earthwork for Erosion Control" is specified on the Drawings as a bid item.

PART 3 EXECUTION

3.01 GENERAL.

- A. Implement control measures in the area to be disturbed before beginning construction, or as directed. Limit the disturbance to the area shown on the Drawings or as directed. If, in the opinion of the ENGINEER, the CONTRACTOR cannot control soil erosion and sedimentation resulting from construction operations, the ENGINEER will limit the disturbed area to that which the CONTRACTOR is able to control. Minimize disturbance to vegetation.
- B. Immediately correct ineffective control measures. Implement additional controls as directed. Remove excavated material within the time requirements specified in the applicable storm water permit.
- C. Stabilize disturbed areas where construction activities will be temporarily stopped in accordance with the applicable storm water permit. Establish a uniform vegetative cover. The project will not be accepted until a 70% density of existing adjacent undisturbed areas is obtained, unless otherwise shown on the Drawings. When shown on the Drawings, the ENGINEER may accept the project when adequate controls are in place that will control erosion, sedimentation, and water pollution until sufficient vegetative cover can be established.
- D. Upon acceptance of vegetative cover, remove and dispose of all temporary control measures, temporary embankments, bridges, matting, falsework, piling, debris, or other obstructions placed during construction that are not a part of the finished work, or as directed.
- E. Do not locate disposal areas, stockpiles, or haul roads in any wetland, water body, or streambed. Do not install temporary construction crossings in or across any water body without the prior approval of the appropriate resource agency and the ENGINEER. Restrict construction operations in any water body to the necessary areas as shown on the Drawings or applicable permit, or as directed. Use temporary bridges, timber mats, or other structurally sound and non-eroding material for stream crossings.

- F. Provide protected storage area for paints, chemicals, solvents, and fertilizers at an approved location. Keep paints, chemicals, solvents, and fertilizers off bare ground and provide shelter for stored chemicals.

3.02 INSTALLATION, MAINTENANCE, AND REMOVAL WORK.

- A. Perform work in accordance with the specific or general storm water permit.
- B. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until earthwork construction and permanent erosion control features are in place or the disturbed area has been adequately stabilized as determined by the ENGINEER.
- C. If a device ceases to function as intended, repair or replace the device or portions thereof as necessary. Remove sediment, debris, and litter. When approved, sediments may be disposed of within embankments, or in the right of way in areas where the material will not contribute to further siltation. Dispose of removed material in accordance with federal, state, and local regulations.
- D. Remove devices upon approval or when directed. Upon removal, finish-grade and dress the area. Stabilize disturbed areas in accordance with the permit, and as shown on the Drawings or directed. The CONTRACTOR retains ownership of stockpiled material and must remove it from the project when new installations or replacements are no longer required.

3.03 ROCK FILTER DAMS FOR EROSION CONTROL.

- A. Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams.
- B. Place sandbags as a foundation when required or at the CONTRACTOR's option.
- C. For Types 1, 2, 3, and 5, place the aggregate to the lines, height, and slopes specified, without undue voids. For Types 2 and 3, place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side with wire ties, or hog rings, or as directed. Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed.
- D. Construct filter dams according to the following criteria, unless otherwise shown on the Drawings:
 - 1. Type 1 (Non-reinforced).
 - a. Height. At least 18 in. measured vertically from flow line to top of filter dam.
 - b. Top Width. At least 2 ft.
 - c. Slopes. At most 2:1.
 - 2. Type 2 (Reinforced).
 - a. Height. At least 18 in. measured vertically from flow line to top of filter dam.
 - b. Top Width. At least 2 ft.
 - c. Slopes. At most 2:1.
 - 3. Type 3 (Reinforced).

- a. Height. At least 36 in. measured vertically from flow line to top of filter dam.
- b. Top Width. At least 2 ft.
- c. Slopes. At most 2:1.
4. Type 4 (Sack Gabions).
 - a. Unfold sack gabions and smooth out kinks and bends.
 - b. For vertical filling,
 - i. connect the sides by lacing in a single loop–double loop pattern on 4- to 5-in. spacing.
 - ii. At one end, pull the end lacing rod until tight, wrap around the end, and twist 4 times.
 - iii. At the filling end, fill with stone, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires 4 times.
 - c. For horizontal filling,
 - i. place sack flat in a filling trough, fill with stone, and connect sides and secure ends as described above.
 - d. Lift and place without damaging the gabion.
 - e. Shape sack gabions to existing contours.
5. Type 5. Provide rock filter dams as shown on the Drawings.

3.04 TEMPORARY PIPE SLOPE DRAINS.

- A. Install pipe with a slope as shown on the Drawings or as directed.
- B. Construct embankment for the drainage system in 8-in. lifts to the required elevations.
- C. Hand-tamp the soil around and under the entrance section to the top of the embankment as shown on the Drawings or as directed.
- D. Form the top of the embankment or earth dike over the pipe slope drain at least 1 ft. higher than the top of the inlet pipe at all points.
- E. Secure the pipe with hold-downs or hold-down grommets spaced a maximum of 10 ft. on center.
- F. Construct the energy dissipators or sediment traps as shown on the Drawings or as directed.
- G. Construct the sediment trap using concrete or rubble riprap in accordance with “Riprap,” when designated on the Drawings.

3.05 BALED HAY FOR EROSION AND SEDIMENTATION CONTROL.

- A. Install hay bales at locations shown on the Drawings by embedding in the soil at least 4 in. and, where possible, approximately 1/2 the height of the bale, or as directed. Fill gaps between bales with loose hay.

3.06 TEMPORARY PAVED FLUMES.

- A. Construct paved flumes as shown on the Drawings or as directed. Provide excavation and embankment (including compaction of the subgrade) of material to the dimensions shown on the Drawings, unless otherwise indicated. Install a rock or rubble riprap energy dissipater, constructed from the materials specified above to a minimum depth of 9 in. at the flume outlet to the limits shown on the Drawings or as directed.

3.07 CONSTRUCTION EXITS.

- A. When tracking conditions exist, prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits. Construct exits for either long or short-term use.
 - 1. Long-Term. Place the exit over a foundation course, if necessary. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the Drawings or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.
 - a. Type 1. Construct to a depth of at least 8 in. using crushed aggregate as shown on the Drawings or as directed.
 - b. Type 2. Construct using railroad ties and timbers as shown on the Drawings or as directed.
 - 2. Short-Term.
 - a. Type 3. Construct using crushed aggregate, plywood, or wafer board. This type of exit may be used for daily operations where long-term exits are not practical.
 - b. Type 4. Construct as shown on the Drawings or as directed.

3.08 EARTHWORK FOR EROSION CONTROL.

- A. Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.
 - 1. Excavation and Embankment for Erosion Control Features. Place earth dikes, swales, or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover. Place swales and dikes at other locations as shown on the Drawings or as directed to prevent runoff spillover or to divert runoff. Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides. Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the Drawings or as directed.
 - 2. Where required, create a sediment basin providing 3,600 cu. ft. of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at one time, not including offsite areas.
 - 3. Excavation of Sediment and Debris. Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.

3.09 CONSTRUCTION PERIMETER FENCE.

- A. Construct, align, and locate fencing as shown on the Drawings or as directed.
 - 1. Installation of Posts. Embed posts 18 in. deep or adequately anchor in rock, with a spacing of 8 to 10 ft.

2. Wire Attachment. Attach the top wire to the posts at least 3 ft. from the ground. Attach the lower wire midway between the ground and the top wire.
3. Flag Attachment. Attach flagging to both wire strands midway between each post. Use flagging at least 18 in. long. Tie flagging to the wire using a square knot.

3.10 SANDBAGS FOR EROSION CONTROL.

- A. Construct a berm or dam of sandbags that will intercept sediment-laden storm water runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Fill each bag with sand so that at least the top 6 in. of the bag is unfilled to allow for proper tying of the open end. Place the sandbags with their tied ends in the same direction. Offset subsequent rows of sandbags 1/2 the length of the preceding row. Place a single layer of sandbags downstream as a secondary debris trap. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.

3.11 TEMPORARY SEDIMENT-CONTROL FENCE.

- A. Provide temporary sediment-control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion-control measures used to control sediment in areas of higher flow. Install the fence as shown on the Drawings, as specified in this Section, or as directed.
 1. Installation of Posts. Embed posts at least 18 in. deep, or adequately anchor, if in rock, with a spacing of 6 to 8 ft. and install on a slight angle toward the run-off source.
 2. Fabric Anchoring. Dig trenches along the uphill side of the fence to anchor 6 to 8 in. of fabric. Provide a minimum trench cross-section of 6 x 6 in. Place the fabric against the side of the trench and align approximately 2 in of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.
 3. Fabric and Net Reinforcement Attachment. Unless otherwise shown under the Drawings, attach the reinforcement to wooden posts with staples, or to steel posts with T-clips, in at least 4 places equally spaced. Sewn vertical pockets may be used to attached reinforcement to end posts. Fasten the fabric to the top strand of reinforcement by hog rings or cord every 15 in. or less.
 4. Fabric and Net Splices. Locate splices at a fence post with a minimum lap of 6 in. attached in at least 6 places equally spaced, unless otherwise shown under the Drawings. Do not locate splices in concentrated flow areas. Requirements for installation of used temporary sediment control fence include the following:
 - a. fabric with minimal or no visible signs of biodegradation (weak fibers),
 - b. fabric without excessive patching (more than 1 patch every 15 to 20 ft.),
 - c. posts without bends, and
 - d. backing without holes.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. Rock Filter Dams. Installation or removal of rock filter dams will be measured by the foot or by the cubic yard. The measured volume will include sandbags, when used.

1. Linear Measurement. When rock filter dams are measured by the foot, measurement will be along the centerline of the top of the dam.
 2. Volume Measurement. When rock filter dams are measured by the cubic yard, measurement will be based on the volume of rock computed by the method of average end areas.
 - a. Installation. Measurement will be made in final position.
 - b. Removal. Measurement will be made at the point of removal.
- B. Temporary pipe slope drains will be measured by the foot.
- C. Baled hay will be measured by each bale or by the foot along the top of hay bale berms or dams.
- D. Temporary Paved Flumes. Temporary paved flumes will be measured by the square yard of surface area. The measured area will include the energy dissipater at the flume outlet.
- E. Construction Exits. Construction exits will be measured by the square yard of surface area.
- F. Earthwork for Erosion Control.
1. Equipment. Equipment use will be measured by the actual number of hours the equipment is operated.
 2. Volume Measurement.
 - a. In Place.
 - i. Excavation. Excavation will be measured by the cubic yard in its original position and the volume computed by the method of average end areas.
 - ii. Embankment. Embankment will be measured by the cubic yard in its final position by the method of average end areas. The volume of embankment will be determined between the original ground surfaces or the surface upon that the embankment is to be constructed for the feature and the lines, grades and slopes of the accepted embankment for the feature.
 - b. In Vehicles. Excavation and embankment quantities will be combined and paid for under "Earthwork (Erosion and Sediment Control, In Vehicles)." Excavation will be measured by the cubic yard in vehicles at the point of removal. Embankment will be measured by the cubic yard in vehicles measured at the point of delivery. Shrinkage or swelling factors will not be considered in determining the calculated quantities.
- G. Construction perimeter fence will be measured by the foot.
- H. Sandbags will be measured as each sandbag or by the foot along the top of sandbag berms or dams.
- I. Temporary sediment-control fence will be measured by the foot.

4.02 PAYMENT

- A. The following will not be paid for directly but are subsidiary to pertinent Items:
1. erosion-control measures for CONTRACTOR project-specific locations (PSLs) inside and outside the right of way (such as construction and haul roads, field offices, equipment and supply areas, plants, and material sources);
 2. removal of litter;

3. repair to devices and features damaged by CONTRACTOR operations;
 4. added measures and maintenance needed due to negligence, carelessness, lack of maintenance, and failure to install permanent controls;
 5. removal and reinstallation of devices and features needed for the convenience of the CONTRACTOR;
 6. finish grading and dressing upon removal of the device; and
 7. minor adjustments including but not limited to plumbing posts, reattaching fabric, minor grading to maintain slopes on an erosion embankment feature, or moving small numbers of sandbags.
- B. Stabilization of disturbed areas will be paid for under pertinent Items.
- C. Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly but is subsidiary to the excavation and embankment under this Item.
- D. Rock Filter Dams. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows:
1. Installation. Installation will be paid for as "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.
 2. Removal. Removal will be paid for as "Rock Filter Dams (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.
 3. When the ENGINEER directs that the rock filter dam installation or portions thereof be replaced, payment will be made at the unit price bid for "Rock Filter Dams (Remove)" and for "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.
- E. Temporary Pipe Slope Drains.
1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Pipe Slope Drains" of the size specified. This price is full compensation for furnishing materials, removal and disposal, furnishing and operating equipment, labor, tools, and incidentals.
 2. Removal of temporary pipe slope drains will not be paid for directly but is subsidiary to the installation Item.
 3. When the ENGINEER directs that the pipe slope drain installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Pipe Slope Drains" of the size specified, which is full compensation for the removal and reinstallation of the pipe drain.
 4. Earthwork required for the pipe slope drain installation, including construction of the sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."
- F. Baled Hay.
1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Baled Hay." This

price is full compensation for furnishing and placing bales, excavating trenches, removal and disposal, equipment, labor, tools, and incidentals.

2. When the ENGINEER directs that the baled hay installation (or portions thereof) be replaced, payment will be made at the unit price bid for "Baled Hay," which is full compensation for removal and reinstallation of the baled hay.

G. Temporary Paved Flumes.

1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Paved Flume (Install)" or "Temporary Paved Flume (Remove)." This price is full compensation for furnishing and placing materials, removal and disposal, equipment, labor, tools, and incidentals.
2. When the ENGINEER directs that the paved flume installation or portions thereof be replaced, payment will be made at the unit prices bid for "Temporary Paved Flume (Remove)" and "Temporary Paved Flume (Install)." These prices are full compensation for the removal and replacement of the paved flume and for equipment, labor, tools, and incidentals.

H. Construction Exits.

1. CONTRACTOR-required construction exits from off right of way locations or on-right of way PSLs will not be paid for directly but are subsidiary to pertinent Items.
2. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" for construction exits will be paid for at the unit price bid for "Construction Exits (Install)" of the type specified or "Construction Exits (Remove)." This price is full compensation for furnishing and placing materials, excavating, removal and disposal, cleaning vehicles, labor, tools, and incidentals.
3. When the ENGINEER directs that a construction exit or portion thereof be removed and replaced, payment will be made at the unit prices bid for "Construction Exit (Remove)" and "Construction Exit (Install)" of the type specified. These prices are full compensation for the removal and replacement of the construction exit and for equipment, labor, tools, and incidentals.
4. Construction of sediment traps used in conjunction with the construction exit will be measured and paid for under "Earthwork for Erosion and Sediment Control."

I. Earthwork for Erosion and Sediment Control.

1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Excavation (Erosion and Sediment Control, In Place)," "Embankment (Erosion and Sediment Control, In Place)," "Earthwork (Erosion and Sediment Control, In Vehicles)," "Backhoe Work (Erosion and Sediment Control)," "Excavator Work (Erosion and Sediment Control)," "Front End Loader Work (Erosion and Sediment Control)," "Blading Work (Erosion and Sediment Control)," "Scraper Work (Erosion and Sediment Control)," or "Bulldozer Work (Erosion and Sediment Control)."
2. This price is full compensation for excavation including removal of accumulated sediment in various erosion control installations as directed, hauling, and disposal of material not used elsewhere on the project; excavation for construction of erosion-control features; embankments including furnishing material from approved sources and construction of

erosion-control features; sandbags; plywood; stage construction for curb inlets involved in curb-inlet sediment traps; and equipment, labor; tools, and incidentals.

3. Earthwork needed to remove and obliterate of erosion-control features will not be paid for directly but is subsidiary to pertinent Items unless otherwise shown on the Drawings.
4. Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

J. Construction Perimeter Fence.

1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Construction Perimeter Fence." This price is full compensation for furnishing and placing the fence; digging, fence posts, wire, and flagging; removal and disposal; and materials, equipment, labor, tools, and incidentals. Removal of construction perimeter fence will be not be paid for directly but is subsidiary to the installation Item.
2. When the ENGINEER directs that the perimeter fence installation or portions thereof be removed and replaced, payment will be made at the unit price bid for "Construction Perimeter Fence," which is full compensation for the removal and reinstallation of the construction perimeter fence.

K. Sandbags for Erosion Control.

1. Sandbags will be paid for at the unit price bid for "Sandbags for Erosion Control" (of the height specified when measurement is by the foot). This price is full compensation for materials, placing sandbags, removal and disposal, equipment, labor, tools, and incidentals. Removal of sandbags will not be paid for directly but is subsidiary to the installation Item.
2. When the ENGINEER directs that the sandbag installation or portions thereof be replaced, payment will be made at the unit price bid for "Sandbags for Erosion Control," which is full compensation for the reinstallation of the sandbags.

L. Temporary Sediment-Control Fence.

1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Sediment-Control Fence." This price is full compensation for furnishing and placing the fence; trenching, fence posts, fabric and backfill; removal and disposal; and equipment, labor, tools, and incidentals.
2. Removal of temporary sediment-control fence will not be paid for directly but is subsidiary to the installation Item.
3. When the ENGINEER directs that the temporary sedimentation control fence installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Sediment-Control Fence," which is full compensation for the removal and reinstallation of the temporary sediment-control fence.

END OF SECTION

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.01 Scope

- A. This Item covers maintaining the job site clean and in usable condition during the progress of the work. After construction work is completed, all debris, trash, excess materials, equipment, etc., is to be cleared from the site.
- B. All debris, trash and excess materials not usable by the OWNER shall be the property of the CONTRACTOR.

PART 2 PRODUCTS (not used)

PART 3 EXECUTION

- A. Haul all debris, trash and excess material from the Project. Remove these materials from the project area in a timely fashion. Dispose of all material off-site in accordance with all local, State and Federal Rules and Regulations.

4.0 MEASUREMENT AND PAYMENT

Measure and pay for "Clean-Up" as part of the Item for which work is done. No separate payment for this Item is allowed. Include costs of "Clean-Up" in cost of Item for which work is done.

END OF SECTION

Item 247

Flexible Base



1. DESCRIPTION

Construct a foundation course composed of flexible base.

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer may sample and test project materials at any time before compaction throughout the duration of the project to assure specification compliance. Use [Tex-100-E](#) material definitions.

- 2.1. **Aggregate.** Furnish aggregate of the type and grade shown on the plans and meeting the requirements of Table 1. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives, such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1 unless shown on the plans.

Table 1
Material Requirements

Property	Test Method	Grade 1-2	Grade 3	Grade 4 ²	Grade 5
Sampling	Tex-400-A				
Master gradation sieve size (cumulative % retained)	Tex-110-E			As shown on the plans	
2-1/2"		0	0		0
1-3/4"		0-10	0-10		0-5
7/8"		10-35	-		10-35
3/8"		30-65	-		35-65
#4		45-75	45-75		45-75
#40	65-90	50-85	70-90		
Liquid Limit, % Max	Tex-104-E	40	40	As shown on the plans	35
Plasticity Index, Max ¹	Tex-106-E	10	12	As shown on the plans	10
Plasticity index, Min ¹		As shown on the plans	As shown on the plans	As shown on the plans	As shown on the plans
Wet ball mill, % Max	Tex-116-E	40	-	As shown on the plans	40
Wet ball mill, % Max increase passing the #40 sieve		20	-	As shown on the plans	20
Min compressive strength, psi	Tex-117-E			As shown on the plans	
lateral pressure 0 psi		35	-		-
lateral pressure 3 psi		-	-		90
lateral pressure 15 psi		175	-		175

- Determine plastic index in accordance with [Tex-107-E](#) (linear shrinkage) when liquid limit is unattainable as defined in [Tex-104-E](#).
- Grade 4 may be further designated as Grade 4A, Grade 4B, etc.

- 2.1.1. **Material Tolerances.** The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation.

When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4.

The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

- 2.1.2. **Material Types.** Do not use fillers or binders unless approved. Furnish the type specified on the plans in accordance with the following:
- 2.1.2.1. **Type A.** Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.
- 2.1.2.2. **Type B.** Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.
- 2.1.2.3. **Type C.** Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by [Tex-460-A](#), Part I. Blending of 2 or more sources is allowed.
- 2.1.2.4. **Type D.** Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in Section 247.2.1.3.2., "Recycled Material (Including Crushed Concrete) Requirements," and be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.
- 2.1.2.5. **Type E.** Caliche, iron ore or as otherwise shown on the plans.
- 2.1.3. **Recycled Material.** Reclaimed asphalt pavement (RAP) and other recycled materials may be used when shown on the plans. Request approval to blend 2 or more sources of recycled materials.
- 2.1.3.1. **Limits on Percentage.** Do not exceed 20% RAP by weight, when RAP is allowed, unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.
- 2.1.3.2. **Recycled Material (Including Crushed Concrete) Requirements.**
- 2.1.3.2.1. **Contractor-Furnished Recycled Materials.** Provide recycled materials, other than RAP, that have a maximum sulfate content of 3,000 ppm when tested in accordance with [Tex-145-E](#). When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of Table 1 for the grade specified. Certify compliance with [DMS-11000](#), "Evaluating and Using Nonhazardous Recyclable Materials Guidelines," for Contractor furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with [Tex-413-A](#). For RAP, do not exceed a maximum percent loss from decantation of 5.0% when tested in accordance with [Tex-406-A](#). Test RAP without removing the asphalt.
- 2.1.3.2.2. **Department-Furnished Required Recycled Materials.** When the Department furnishes and requires the use of recycled materials, unless otherwise shown on the plans:
- Department-required recycled material will not be subject to the requirements in Table 1,
 - Contractor-furnished materials are subject to the requirements in Table 1 and this Item,
 - the final product, blended, will be subject to the requirements in Table 1, and
 - for final product, unblended (100% Department-furnished required recycled material), the liquid limit, plasticity index, wet ball mill, and compressive strength is waived.

Crush Department-furnished RAP so that 100% passes the 2 in. sieve. The Contractor is responsible for uniformly blending to meet the percentage required.

2.1.3.2.3. **Department-Furnished and Allowed Recycled Materials.** When the Department furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of Table 1 and the plans.

2.1.3.3. **Recycled Material Sources.** Department-owned recycled material is available to the Contractor only when shown on the plans. Return unused Department-owned recycled materials to the Department stockpile location designated by the Engineer unless otherwise shown on the plans.

The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of them in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with Department-owned recycled material unless approved.

2.2. **Water.** Furnish water free of industrial wastes and other objectionable matter.

2.3. **Material Sources.** Expose the vertical faces of all strata of material proposed for use when non-commercial sources are used. Secure and process the material by successive vertical cuts extending through all exposed strata, when directed.

3. EQUIPMENT

Provide machinery, tools, and equipment necessary for proper execution of the work.

3.1. Provide rollers in accordance with Item 210, "Rolling." Provide proof rollers in accordance with Item 216, "Proof Rolling," when required.

3.2. When ride quality measurement is required, provide a high speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute. Provide equipment certification documentation. Display a current decal on the equipment indicating the certification expiration date.

4. CONSTRUCTION

Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 ft. thick. Stockpiles must have a total height between 10 and 16 ft. unless otherwise approved. After construction and acceptance of the stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

Do not add or remove material from temporary stockpiles that require sampling and testing before delivery unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted from the Contractor's estimates.

Haul approved flexible base in clean trucks. Deliver the required quantity to each 100-ft. station or designated stockpile site as shown on the plans. Prepare stockpile sites as directed. When delivery is to the 100-ft. station, manipulate in accordance with the applicable Items.

4.1. **Preparation of Subgrade or Existing Base.** Remove or scarify existing asphalt concrete pavement in accordance with Item 105, "Removing Treated and Untreated Base and Asphalt Pavement," when shown on

the plans or as directed. Shape the subgrade or existing base to conform to the typical sections shown on the plans or as directed.

When new base is required to be mixed with existing base, deliver, place, and spread the new flexible base in the required amount per station. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

Proof roll the roadbed in accordance with Item 216, "Proof Rolling," before pulverizing or scarifying when shown on the plans or directed. Correct soft spots as directed.

- 4.2. **Placing.** Spread and shape flexible base into a uniform layer with an approved spreader the same day as delivered unless otherwise approved. Construct layers to the thickness shown on the plans. Maintain the shape of the course. Control dust by sprinkling, as directed. Correct or replace segregated areas as directed, at no additional expense to the Department.

Place successive base courses and finish courses using the same construction methods required for the first course.

- 4.3. **Compaction.** Compact using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. When necessary, sprinkle the material in accordance with Item 204, "Sprinkling."

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. Begin rolling at the low side and progress toward the high side on superelevated curves. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed.

Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish requirements before the next course is placed or the project is accepted. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

Before final acceptance, the Engineer will select the locations of tests and measure the flexible base depth in accordance with [Tex-140-E](#). Correct areas deficient by more than 1/2 in. in thickness by scarifying, adding material as required, reshaping, recompacting, and refinishing at the Contractor's expense.

- 4.3.1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.
- 4.3.2. **Density Control.** Compact to at least 100% of the maximum dry density determined by [Tex-113-E](#), unless otherwise shown on the plans. Maintain moisture during compaction within ± 2 percentage points of the optimum moisture content as determined by [Tex-113-E](#). Measure the moisture content of the material in accordance with [Tex-115-E](#) or [Tex-103-E](#) during compaction daily and report the results the same day to the Engineer, unless otherwise shown on the plans or directed. Do not achieve density by drying the material after compaction.

The Engineer will determine roadway density and moisture content of completed sections in accordance with [Tex-115-E](#). The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

- 4.4. **Finishing.** After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is

attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the plans or as directed.

Correct grade deviations greater than 1/4 in. in 16 feet measured longitudinally or greater than 1/4 in. over the entire width of the cross-section in areas where surfacing is to be placed. Correct by loosening and adding, or removing material. Reshape and re-compact in accordance with Section 247.4.3., "Compaction."

4.5. **Curing.** Cure the finished section until the moisture content is at least 2 percentage points below optimum or as directed before applying the next successive course or prime coat.

4.6. **Ride Quality.** This section applies to the final travel lanes that receive a 1 or 2 course surface treatment for the final surface, unless otherwise shown on the plans. Measure ride quality of the base course after placement of the prime coat and before placement of the surface treatment, unless otherwise approved. Use a certified profiler operator from the Department's MPL. When requested, furnish the Engineer documentation for the person certified to operate the profiler.

Provide all profile measurements to the Engineer in electronic data files within 3 days after placement of the prime coat using the format specified in [Tex-1001-S](#). The Engineer will use Department software to evaluate longitudinal profiles to determine areas requiring corrective action. Correct 0.1-mi. sections having an average international roughness index (IRI) value greater than 100.0 in. per mile to an IRI value of 100.0 in. per mile or less for each wheel path, unless otherwise shown on the plans.

Re-profile and correct sections that fail to maintain ride quality until placement of the next course, as directed. Correct re-profiled sections until specification requirements are met, as approved. Perform this work at no additional expense to the Department.

5. MEASUREMENT

Flexible base will be measured as follows:

- **Flexible Base (Complete In Place).** The ton, square yard, or any cubic yard method.
- **Flexible Base (Roadway Delivery).** The ton or any cubic yard method.
- **Flexible Base (Stockpile Delivery).** The ton, cubic yard in vehicle, or cubic yard in stockpile.

Measurement by the cubic yard in final position and square yard is a plans quantity measurement. The quantity to be paid for is the quantity shown in the proposal unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Measurement is further defined for payment as follows.

- 5.1. **Cubic Yard in Vehicle.** By the cubic yard in vehicles of uniform capacity at the point of delivery.
- 5.2. **Cubic Yard in Stockpile.** By the cubic yard in the final stockpile position by the method of average end areas.
- 5.3. **Cubic Yard in Final Position.** By the cubic yard in the completed and accepted final position. The volume of base course is computed in place by the method of average end areas between the original subgrade or existing base surfaces and the lines, grades, and slopes of the accepted base course as shown on the plans.
- 5.4. **Square Yard.** By the square yard of surface area in the completed and accepted final position. The surface area of the base course is based on the width of flexible base as shown on the plans.

- 5.5. **Ton.** By the ton of dry weight in vehicles as delivered. The dry weight is determined by deducting the weight of the moisture in the material at the time of weighing from the gross weight of the material. The Engineer will determine the moisture content in the material in accordance with [Tex-103-E](#) from samples taken at the time of weighing.

When material is measured in trucks, the weight of the material will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the types of work shown below. No additional payment will be made for thickness or width exceeding that shown on the typical section or provided on the plans for cubic yard in the final position or square yard measurement.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans. When proof rolling is shown on the plans or directed, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade will be paid in accordance with pertinent Items or Article 4.4., "Changes in the Work."

- 6.1. **Flexible Base (Complete In Place).** Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. For square yard measurement, a depth will be specified. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, spreading, blading, mixing, shaping, placing, compacting, reworking, finishing, correcting locations where thickness is deficient, curing, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.
- 6.2. **Flexible Base (Roadway Delivery).** Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.
- 6.3. **Flexible Base (Stockpile Delivery).** Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle" or "In Stockpile" will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing and disposing of materials, preparing the stockpile area, temporary or permanent stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials to the stockpile, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

Item 265

Fly Ash or Lime-Fly Ash Treatment (Road-Mixed)



1. DESCRIPTION

Mix and compact water, fly ash (FA) or lime and fly ash (LFA), and subgrade or base (with or without asphalt concrete pavement) in the roadway.

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of proposed material sources and of changes in material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Changes in material suppliers may require a new mix design. Use [Tex-100-E](#) for material definitions.

- 2.1. **Lime.** Furnish lime that meets the requirements of [DMS-6350](#), "Lime and Lime Slurry," and [DMS-6330](#), "Pre-Qualification of Lime Sources." Use hydrated lime, commercial lime slurry, or quicklime as shown on the plans. When furnishing quicklime, provide it in bulk.
- 2.2. **Fly Ash.** Furnish FA that meets the requirements of [DMS-4615](#), "Fly Ash for Soil Treatment." Use Class CS or FS as shown on the plans.
- 2.3. **Subgrade.** The Engineer will determine the sulfate content in accordance with [Tex-145-E](#) and organic content in accordance with [Tex-148-E](#) before addition of lime or fly ash. Suspend operations when material to be treated has a sulfate content greater than 7,000 ppm or an organic content greater than 1.0% and proceed as directed.
- 2.4. **Flexible Base.** Unless otherwise shown on the plans, furnish base material that meets the requirements of Item 247, "Flexible Base," for the type and grade shown on the plans, before the addition of lime or FA.
- 2.5. **Water.** Furnish water free of industrial wastes and other objectionable matter.
- 2.6. **Asphalt.** When permitted for curing purposes, furnish asphalt or emulsion in accordance with Item 300, "Asphalts, Oils, and Emulsions," as shown on the plans or as directed.
- 2.7. **Mix Design.** The Engineer will determine the target FA or LFA content and optimum moisture content in accordance with [Tex-127-E](#) or prior experience with the project materials. The Contractor may propose a mix design developed in accordance with [Tex-127-E](#). Meet strength requirements when shown on the plans. The Engineer will use [Tex-127-E](#) to verify the Contractor's proposed mix design before acceptance and will establish the approved additive blend and quantity. Reimburse the Department for subsequent mix designs or partial designs necessitated by changes in the material or requests by the Contractor. Limit the amount of recycled asphalt pavement to no more than 50% of the mix unless otherwise shown on the plans or directed.

3. EQUIPMENT

Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with Item 210, "Rolling." Provide proof rollers in accordance with Item 216, "Proof Rolling," when directed.

- 3.1. **Storage Facility.** Store quicklime, dry hydrated lime, and FA in closed, weatherproof containers.
- 3.2. **Slurry Equipment.** Use slurry tanks equipped with agitation devices to slurry hydrated lime or quicklime on the project or other approved location. The Engineer may approve other slurring methods.
- Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator. Equip the distributor truck with a sampling device in accordance with [Tex-600-J](#), Part I, when using commercial lime slurry.
- 3.3. **Distribution Equipment.** Provide equipment to spread lime and fly ash evenly across the area to be treated. Provide equipment with a rotary vane feeder to spread lime, when shown on the plans.
- 3.4. **Pulverization Equipment.** Provide pulverization equipment that:
- cuts and pulverizes material uniformly to the proper depth with cutters that will plane to a uniform surface over the entire width of the cut,
 - provides a visible indication of the depth of cut at all times, and
 - uniformly mixes the materials.

4. CONSTRUCTION

Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

- 4.1. **Preparation of Subgrade or Existing Base for Treatment.** Before treating, remove existing asphalt concrete pavement in accordance with pertinent Items and the plans or as directed. Shape existing material in accordance with applicable bid items to conform to typical sections shown on the plans and as directed.

When shown on the plans or as directed, proof-roll the roadbed in accordance with Item 216, "Proof Rolling," before pulverizing or scarifying existing material. Correct soft spots as directed.

When material is imported from a borrow source, notify the Engineer of the location of the borrow source well in advance to allow time for testing and approval to avoid delay to the project. Stockpile as directed. The Engineer will test the borrow source and determine the sulfate and organic contents. When the borrow source has a sulfate content greater than 3,000 ppm or an organic content greater than 1.0%, proceed as directed.

When new base material is required to be mixed with existing base, deliver, place, and spread the new material in the required amount per station. Manipulate and thoroughly mix new base with existing material to provide a uniform mixture to the specified depth before the addition of lime or FA.

- 4.2. **Pulverization.** Pulverize or scarify material after shaping so that 100% passes a 2-1/2 in. sieve. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.

- 4.3. **Application and Mixing of FA or LFA.** When treating with LFA, apply, mix, and mellow lime first unless otherwise directed.

Start treatment operations only when the air temperature is at least 35°F and rising or is at least 40°F. Cease operations if the 24-hour projected air temperature is less than 32°F for more than 4 hours. The temperature will be taken in the shade and away from artificial heat. Suspend operations when the Engineer determines that weather conditions are unsuitable.

Minimize dust and scattering by wind. Do not apply lime or FA when wind conditions, in the opinion of the Engineer, cause blowing lime or FA to become dangerous to traffic or objectionable to adjacent property owners.

During the interval between application and mixing, sections treated with hydrated lime or fly ash that have been exposed to the open air for a period of 6 hr. or more, or that experience excessive loss due to washing or blowing, will not be accepted for payment.

After mixing and required mellowing, the Engineer may sample the mixture at roadway moisture and test in accordance with [Tex-101-E](#), Part III, to determine compliance with the gradation requirements in Table 1.

Table 1
Gradation Requirements (Minimum % Passing)

Sieve Size	Base	Subgrade
1-3/4"	100	100
3/4"	85	85
#4	–	60

- 4.3.1. **Application of Lime.** Uniformly apply lime using dry or slurry placement as shown on the plans or as directed. Add lime at the percentage determined in Section 265.2.7., "Mix Design." Apply lime only on an area where mixing can be completed during the same working day.
- 4.3.1.1. **Dry Placement.** Before applying lime, bring the prepared roadway to approximately 2 percentage points above optimum moisture content. When necessary, sprinkle in accordance with Item 204, "Sprinkling." Distribute the required quantity of hydrated lime or pebble-grade quicklime with approved equipment. Only hydrated lime may be distributed by bag. Do not use a motor grader to spread hydrated lime.
- 4.3.1.2. **Slurry Placement.** Provide slurry free of objectionable materials, at or above the approved minimum dry solids content, and with a uniform consistency that will allow ease of handling and uniform application. Deliver commercial lime slurry to the jobsite or prepare lime slurry at the jobsite or other approved location by using hydrated lime or quicklime, as specified. When dry quicklime is applied as slurry, use 80% of the amount shown on the plans.
- Distribute slurry uniformly by making successive passes over a measured section of roadway until the specified lime content is reached. Uniformly spread the residue from quicklime slurry over the length of the roadway being processed unless otherwise directed.
- 4.3.2. **Mixing of Lime.** Begin mixing within 6 hr. of lime application. Thoroughly mix the material and lime using approved equipment. When treating subgrade, bring the moisture content above the optimum moisture content to insure adequate chemical reaction of the lime and subgrade materials. Allow the mixture to mellow for 1 to 4 days as directed. When pebble-grade quicklime is used, allow the mixture to mellow for 2 to 4 days as directed. Sprinkle the treated materials during the mixing and mellowing operation, as directed, to achieve adequate hydration and proper moisture content. When the material to be treated has a sulfate content greater than 3,000 ppm but less than or equal to 7,000 ppm, mellow for a minimum of 7 days. Maintain in a continuously moist condition by sprinkling in accordance with Item 204, "Sprinkling." After mellowing, resume mixing until a homogeneous, friable mixture is obtained.
- 4.3.3. **Application of Fly Ash.** Uniformly apply FA in dry form unless otherwise approved. Apply at the percentage determined in Section 265.2.7., "Mix Design." Apply FA only on that area where the mixing and compacting operations can be completed during the same working day. Do not use a motor grader to spread FA.

For LFA treatment, begin FA application within 4 days after the lime mixing operation has been completed unless otherwise approved.

- 4.3.4. **Mixing of Fly Ash.** Thoroughly dry-mix the material and fly ash using approved equipment until a loose, homogeneous mixture is obtained. Sprinkle in accordance with Item 204, "Sprinkling," as directed, to achieve adequate mixing and hydration moisture. Prevent formation of fly ash balls.
- 4.3.5. **Final Mixture.** After mixing and required mellowing, the Engineer may sample the mixture at roadway moisture and test in accordance with [Tex-101-E](#), Part III, to determine compliance with the gradation requirements in Table 1.
- 4.4. **Compaction.** Compact immediately after mixing the last stabilizing agent. Use density control unless otherwise shown on the plans. Complete all compaction operations within 6 hr. of FA application for type FS and within 2 hr. when using type CS. Multiple lifts are permitted when shown on the plans or approved by the Engineer. Sprinkle the treated material in accordance with Item 204, "Sprinkling," or aerate to bring each layer to the moisture content directed. Measure the moisture content of the material in accordance with [Tex-115-E](#) or [Tex-103-E](#) during compaction daily and report the results the same day to the Engineer, unless otherwise shown on the plans or directed.
- Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 to 6 mph as directed.
- Before final acceptance, the Engineer will select the locations of tests in each unit and measure the treated depth in accordance with [Tex-140-E](#). Correct areas deficient by more than 1/2 in. in thickness or more than 1/2% in target lime or fly ash content by adding lime or fly ash as required, reshaping, recompacting, and refinishing at the Contractor's expense.
- Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted. Continue work until specification requirements are met. Rework in accordance with Section 265.4.5., "Reworking a Section." Perform the work at no additional expense to the Department.
- 4.4.1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.
- 4.4.2. **Density Control.** The Engineer will determine roadway density of completed sections in accordance with [Tex-115-E](#). Perform measurements immediately following completion of layer compaction. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.
- 4.4.2.1. **Subgrade.** Compact to at least 95% of the maximum density determined in accordance with [Tex-127-E](#) unless otherwise shown on the plans.
- 4.4.2.2. **Base.** Compact the bottom course to at least 95% of the maximum density determined in accordance with [Tex-127-E](#) unless otherwise shown on the plans. Compact subsequent courses treated under this Item to at least 98% of the maximum density determined in accordance with [Tex-127-E](#) unless otherwise shown on the plans.
- 4.5. **Reworking a Section.** Reworking includes loosening, adding material or removing unacceptable material if necessary, mixing as directed, compacting, and finishing. The Contractor has the option of removing failing material and replacing it with acceptable material.

Add LFA when reworking LFA-treated sections, or FA when reworking FA-treated sections, at the rate of at least 25% of the percentage determined in Section 265.2.7., "Mix Design," as directed. When repulverization of the failing section is not achievable, remove failing material and replace with acceptable treated material.

When density control is specified, determine a new maximum density of the reworked material in accordance with [Tex-127-E](#), and compact in accordance with Section 265.4.4.2., "Density Control." Compact as directed when ordinary compaction is specified.

- 4.6. **Finishing.** Complete finishing operations within 2 hr. after final compaction. Immediately after completing compaction of the final course, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. When finishing treated base, use a steel wheel roller before rolling with the pneumatic tire roller. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades.

Finish grade of constructed subgrade to within 0.1 ft. in the cross-section and 0.1 ft. in 16 ft. measured longitudinally.

Correct grade deviations of constructed base greater than 1/4 in. in 16 ft. measured longitudinally or greater than 1/4 in. over the entire width of the cross-section in areas where surfacing is to be placed. Remove excess material, reshape, and roll with a pneumatic-tire roller. Correct as directed if material is more than 1/4 in. low. Do not surface patch.

- 4.7. **Curing.** Cure by maintaining in a thorough and continuously moist condition by sprinkling in accordance with Item 204, "Sprinkling." When permitted, cure with an asphalt material applied at a rate of 0.05 to 0.20 gal. per square yard as approved. Do not allow equipment on the finished course during curing except as required for sprinkling, unless otherwise approved.
- 4.7.1. **FA or LFA-Treated Sections with FS.** Cure the finished section for 7 days before adding another course or opening to traffic unless otherwise directed. Apply subsequent courses within 14 calendar days of completion of final compaction of the underlying treated course unless otherwise approved.
- 4.7.2. **FA-Treated Sections with CS.** Cure the finished section for at least 24 hr. before opening to traffic unless otherwise directed. Curing may be accomplished by placing material to be used in the subsequent course instead of moist-curing. Allow the treated course to dry for at least 48 hr. before applying a prime coat.

5. MEASUREMENT

- 5.1. **Lime.** When lime is furnished in trucks, the weight of lime will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."
- When lime is furnished in bags, each bag must indicate the manufacturer's certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer's certified weight.
- 5.1.1. **Hydrated Lime.**
- 5.1.1.1. **Dry.** Lime will be measured by the ton (dry weight).
- 5.1.1.2. **Slurry.** Lime will be measured by the ton (dry weight) of the hydrated lime used to prepare the lime slurry at the jobsite.

- 5.1.2. **Commercial Lime Slurry.** Lime slurry will be measured by the ton (dry weight) as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.
- 5.1.3. **Quicklime.**
- 5.1.3.1. **Dry.** Lime will be measured by the ton (dry weight).
- 5.1.3.2. **Slurry.** Lime slurry will be measured by the ton (dry weight) of the quicklime used to prepare the slurry, multiplied by a conversion factor of 1.28 to give the quantity of equivalent hydrated lime, which will be the basis of payment.
- 5.2. **Fly Ash.** FA will be measured by the ton (dry weight). When FA is furnished in trucks, the weight of FA will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."
- When fly ash is furnished in bags, each bag must indicate the manufacturer's certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer's certified weight.
- 5.3. **FA and LFA Treatment.** FA and LFA treatment will be measured by the square yard of surface area. The dimensions for determining the surface area are established by the widths shown on the plans and the lengths measured at placement.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid in accordance with Section 265.6.1., "Lime"; Section 265.6.2., "Fly Ash"; and Section 265.6.3., "FA and LFA Treatment."

Furnishing and delivering new base will be paid for in accordance with Section 247.6.2., "Flexible Base (Roadway Delivery)." Mixing, spreading, blading, shaping, compacting, and finishing new or existing base material will be paid for under Section 265.6.3., "FA and LFA Treatment." Removal and disposal of existing asphalt concrete pavement will be paid for in accordance with pertinent Items or Article 4.4., "Changes in the Work."

Asphalt used solely for curing will not be paid for directly but will be subsidiary to this Item. Asphalt placed for curing and priming will be paid for under Item 310, "Prime Coat."

Lime and FA used for reworking a section in accordance with Section 265.4.5., "Reworking a Section," will not be paid for directly but will be subsidiary to this Item.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans. When proof rolling is shown on the plans or directed by the Engineer, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade or existing base will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade or existing base will be in accordance with pertinent Items or Article 4.4., "Changes in the Work."

Where subgrade to be treated under this Contract has sulfates greater than 7,000 ppm, work will be paid for in accordance with Article 4.4., "Changes in the Work."

- 6.1. **Lime.** Lime will be paid for at the unit price bid for "Lime" of the specified type (Hydrated (Dry), Hydrated (Slurry), Commercial Lime Slurry, Quicklime (Dry), Quicklime (Slurry)). This price is full compensation for furnishing lime.
- 6.2. **Fly Ash.** FA will be paid for at the unit price bid for "Fly Ash" of the type specified. This price is full compensation for furnishing FA.
- 6.3. **FA and LFA Treatment.** FA and LFA treatment will be paid for at the unit price bid for "LFA Treated Subgrade," "FA Treated Subgrade," "LFA Treatment for Base Courses (Existing Base)," "FA Treatment for Base Courses (Existing Base)," "LFA Treatment for Base Courses (New Base)," "FA Treatment for Base Courses (New Base)," "LFA Treatment for Base Courses (New and Existing Base)," and "FA Treatment for Base Courses (New and Existing Base)," for the depth specified. No payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, spreading, applying LFA, compacting, finishing, curing including curing materials, water, drying, blading, shaping and maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, reworking if required, preparing secondary subgrade, equipment, labor, tools, and incidentals.

Item 340

Dense-Graded Hot-Mix Asphalt (Small Quantity)



1. DESCRIPTION

Construct a hot-mix asphalt (HMA) pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder mixed hot in a mixing plant. This specification is intended for small quantity (SQ) HMA projects, typically under 5,000 tons total production.

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate.** Furnish aggregates from sources that conform to the requirements shown in Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse, intermediate, or fine aggregate. Aggregate from reclaimed asphalt pavement (RAP) is not required to meet Table 1 requirements unless otherwise shown on the plans. Supply aggregates that meet the definitions in [Tex-100-E](#) for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in [Tex-200-F](#), Part II.

2.1.1. **Coarse Aggregate.** Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance; and
- once approved, do not add material to the stockpile unless otherwise approved.

Provide aggregate from non-listed sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes. SAC requirements apply to aggregates used on surfaces other than travel lanes when shown on the plans. The SAC for sources on the Department's *Aggregate Quality Monitoring Program* (AQMP) ([Tex-499-A](#)) is listed in the BRSQC.

- 2.1.1.1. **Blending Class A and Class B Aggregates.** Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate to meet requirements for Class A materials. Ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source when blending Class A and B aggregates to meet a Class A requirement. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Coarse aggregate from RAP and Recycled Asphalt Shingles (RAS) will be considered as Class B aggregate for blending purposes.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

- 2.1.2. **Intermediate Aggregate.** Aggregates not meeting the definition of coarse or fine aggregate will be defined as intermediate aggregate. Supply intermediate aggregates, when used that are free from organic impurities.

The Engineer may test the intermediate aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. Supply intermediate aggregate from coarse aggregate sources, when used that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve, and verify that it meets the requirements in Table 1 for crushed face count ([Tex-460-A](#)) and flat and elongated particles ([Tex-280-F](#)).

- 2.1.3. **Fine Aggregate.** Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with [Tex-408-A](#) to verify the material is free from organic impurities. No more than 15% of the total aggregate may be field sand or other uncrushed fine aggregate. Use fine aggregate, with the exception of field sand, from coarse aggregate sources that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve, and verify that it meets the requirements in Table 1 for crushed face count ([Tex-460-A](#)) and flat and elongated particles ([Tex-280-F](#)).

Table 1
Aggregate Quality Requirements

Property	Test Method	Requirement
Coarse Aggregate		
SAC	Tex-499-A (AQMP)	As shown on the plans
Deleterious material, %, Max	Tex-217-F , Part I	1.5
Decantation, %, Max	Tex-217-F , Part II	1.5
Micro-Deval abrasion, %	Tex-461-A	Note 1
Los Angeles abrasion, %, Max	Tex-410-A	40
Magnesium sulfate soundness, 5 cycles, %, Max	Tex-411-A	30
Crushed face count, ² %, Min	Tex-460-A , Part I	85
Flat and elongated particles @ 5:1, %, Max	Tex-280-F	10
Fine Aggregate		
Linear shrinkage, %, Max	Tex-107-E	3
Combined Aggregate³		
Sand equivalent, %, Min	Tex-203-F	45

1. Not used for acceptance purposes. Optional test used by the Engineer as an indicator of the need for further investigation.
2. Only applies to crushed gravel.
3. Aggregates, without mineral filler, RAP, RAS, or additives, combined as used in the job-mix formula (JMF).

Table 2
Gradation Requirements for Fine Aggregate

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70–100
#200	0–30

- 2.2. **Mineral Filler.** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime or fly ash unless otherwise shown on the plans. Use no more than 1% hydrated lime if a substitute binder is used unless otherwise shown on the plans or allowed. Test all mineral fillers except hydrated lime and fly ash in accordance with [Tex-107-E](#) to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:
- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
 - does not exceed 3% linear shrinkage when tested in accordance with [Tex-107-E](#); and
 - meets the gradation requirements in Table 3.

Table 3
Gradation Requirements for Mineral Filler

Sieve Size	% Passing by Weight or Volume
#8	100
#200	55–100

- 2.3. **Baghouse Fines.** Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.
- 2.4. **Asphalt Binder.** Furnish the type and grade of performance-graded (PG) asphalt specified on the plans.
- 2.5. **Tack Coat.** Furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized or preferred tack coat materials may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

The Engineer will obtain at least one sample of the tack coat binder per project in accordance with [Tex-500-C](#), Part III, and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will obtain the sample from the asphalt distributor immediately before use.

- 2.6. **Additives.** Use the type and rate of additive specified when shown on the plans. Additives that facilitate mixing, compaction, or improve the quality of the mixture are allowed when approved. Provide the Engineer with documentation, such as the bill of lading, showing the quantity of additives used in the project unless otherwise directed.
- 2.6.1. **Lime and Liquid Antistripping Agent.** When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.
- 2.6.2. **Warm Mix Asphalt (WMA).** Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215°F and 275°F using approved WMA additives or processes from the Department's MPL.

WMA is allowed for use on all projects and is required when shown on the plans. When WMA is required, the maximum placement or target discharge temperature for WMA will be set at a value below 275°F.

Department-approved WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures above 275°F; however, such mixtures will not be defined as WMA.

- 2.7. **Recycled Materials.** Use of RAP and RAS is permitted unless otherwise shown on the plans. Do not exceed the maximum allowable percentages of RAP and RAS shown in Table 4. The allowable percentages shown in Table 4 may be decreased or increased when shown on the plans. Determine asphalt binder content and gradation of the RAP and RAS stockpiles for mixture design purposes in accordance with [Tex-236-F](#). The Engineer may verify the asphalt binder content of the stockpiles at any time during production. Perform other tests on RAP and RAS when shown on the plans. Asphalt binder from RAP and RAS is designated as recycled asphalt binder. Calculate and ensure that the ratio of the recycled asphalt binder to total binder does not exceed the percentages shown in Table 5 during mixture design and HMA production when RAP or RAS is used. Use a separate cold feed bin for each stockpile of RAP and RAS during HMA production.

Surface, intermediate, and base mixes referenced in Tables 4 and 5 are defined as follows:

- **Surface.** The final HMA lift placed at or near the top of the pavement structure;
- **Intermediate.** Mixtures placed below an HMA surface mix and less than or equal to 8.0 in. from the riding surface; and
- **Base.** Mixtures placed greater than 8.0 in. from the riding surface.

- 2.7.1. **RAP.** RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Crush or break RAP so that 100% of the particles pass the 2 in. sieve. Fractionated RAP is defined as 2 or more RAP stockpiles, divided into coarse and fine fractions.

Use of Contractor-owned RAP, including HMA plant waste, is permitted unless otherwise shown on the plans. Department-owned RAP stockpiles are available for the Contractor's use when the stockpile locations are shown on the plans. If Department-owned RAP is available for the Contractor's use, the Contractor may use Contractor-owned fractionated RAP and replace it with an equal quantity of Department-owned RAP. This allowance does not apply to a Contractor using unfractionated RAP. Department-owned RAP generated through required work on the Contract is available for the Contractor's use when shown on the plans. Perform any necessary tests to ensure Contractor- or Department-owned RAP is appropriate for use. The Department will not perform any tests or assume any liability for the quality of the Department-owned RAP unless otherwise shown on the plans. The Contractor will retain ownership of RAP generated on the project when shown on the plans.

The coarse RAP stockpile will contain only material retained by processing over a 3/8-in. or 1/2-in. screen unless otherwise approved. The fine RAP stockpile will contain only material passing the 3/8-in. or 1/2-in. screen unless otherwise approved. The Engineer may allow the Contractor to use an alternate to the 3/8-in.

or 1/2-in. screen to fractionate the RAP. The maximum percentages of fractionated RAP may be comprised of coarse or fine fractionated RAP or the combination of both coarse and fine fractionated RAP.

Do not use Department- or Contractor-owned RAP contaminated with dirt or other objectionable materials. Do not use Department- or Contractor-owned RAP if the decantation value exceeds 5% and the plasticity index is greater than 8. Test the stockpiled RAP for decantation in accordance with [Tex-406-A](#), Part I. Determine the plasticity index in accordance with [Tex-106-E](#) if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction or ignition.

Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles. Remove unused Contractor-owned RAP material from the project site upon completion of the project. Return unused Department-owned RAP to the designated stockpile location.

Table 4
Maximum Allowable Amounts of RAP¹

Maximum Allowable Fractionated RAP ² (%)			Maximum Allowable Unfractionated RAP ³ (%)		
Surface	Intermediate	Base	Surface	Intermediate	Base
20.0	30.0	40.0	10.0	10.0	10.0

1. Must also meet the recycled binder to total binder ratio shown in Table 5.
2. Up to 5% RAS may be used separately or as a replacement for fractionated RAP.
3. Unfractionated RAP may not be combined with fractionated RAP or RAS.

2.7.2.

RAS. Use of post-manufactured RAS or post-consumer RAS (tear-offs) is permitted unless otherwise shown on the plans. Up to 5% RAS may be used separately or as a replacement for fractionated RAP in accordance with Table 4 and Table 5. RAS is defined as processed asphalt shingle material from manufacturing of asphalt roofing shingles or from re-roofing residential structures. Post-manufactured RAS is processed manufacturer's shingle scrap by-product. Post-consumer RAS is processed shingle scrap removed from residential structures. Comply with all regulatory requirements stipulated for RAS by the TCEQ. RAS may be used separately or in conjunction with RAP.

Process the RAS by ambient grinding or granulating such that 100% of the particles pass the 3/8 in. sieve when tested in accordance with [Tex-200-F](#), Part I. Perform a sieve analysis on processed RAS material before extraction (or ignition) of the asphalt binder.

Add sand meeting the requirements of Table 1 and Table 2 or fine RAP to RAS stockpiles if needed to keep the processed material workable. Any stockpile that contains RAS will be considered a RAS stockpile and be limited to no more than 5.0% of the HMA mixture in accordance with Table 4.

Certify compliance of the RAS with [DMS-11000](#), "Evaluating and Using Nonhazardous Recyclable Materials Guidelines." Treat RAS as an established nonhazardous recyclable material if it has not come into contact with any hazardous materials. Use RAS from shingle sources on the Department's MPL. Remove substantially all materials before use that are not part of the shingle, such as wood, paper, metal, plastic, and felt paper. Determine the deleterious content of RAS material for mixture design purposes in accordance with [Tex-217-F](#), Part III. Do not use RAS if deleterious materials are more than 0.5% of the stockpiled RAS unless otherwise approved. Submit a sample for approval before submitting the mixture design. The Department will perform the testing for deleterious material of RAS to determine specification compliance.

2.8.

Substitute Binders. Unless otherwise shown on the plans, the Contractor may use a substitute PG binder listed in Table 5 instead of the PG binder originally specified, if the substitute PG binder and mixture made with the substitute PG binder meet the following:

- the substitute binder meets the specification requirements for the substitute binder grade in accordance with Section 300.2.10., "Performance-Graded Binders;" and
- the mixture has less than 10.0 mm of rutting on the Hamburg Wheel test ([Tex-242-F](#)) after the number of passes required for the originally specified binder. Use of substitute PG binders may only be allowed at the discretion of the Engineer if the Hamburg Wheel test results are between 10.0 mm and 12.5 mm.

Table 5
Allowable Substitute PG Binders and Maximum Recycled Binder Ratios

Originally Specified PG Binder	Allowable Substitute PG Binder	Maximum Ratio of Recycled Binder ¹ to Total Binder (%)		
		Surface	Intermediate	Base
HMA				
76-22 ²	70-22 or 64-22	20.0	20.0	20.0
	70-28 or 64-28	30.0	35.0	40.0
70-22 ²	64-22	20.0	20.0	20.0
	64-28 or 58-28	30.0	35.0	40.0
64-22 ²	58-28	30.0	35.0	40.0
76-28 ²	70-28 or 64-28	20.0	20.0	20.0
	64-34	30.0	35.0	40.0
70-28 ²	64-28 or 58-28	20.0	20.0	20.0
	64-34 or 58-34	30.0	35.0	40.0
64-28 ²	58-28	20.0	20.0	20.0
	58-34	30.0	35.0	40.0
WMA³				
76-22 ²	70-22 or 64-22	30.0	35.0	40.0
70-22 ²	64-22 or 58-28	30.0	35.0	40.0
64-22 ⁴	58-28	30.0	35.0	40.0
76-28 ²	70-28 or 64-28	30.0	35.0	40.0
70-28 ²	64-28 or 58-28	30.0	35.0	40.0
64-28 ⁴	58-28	30.0	35.0	40.0

1. Combined recycled binder from RAP and RAS.
2. Use no more than 20.0% recycled binder when using this originally specified PG binder.
3. WMA as defined in Section 340.2.6.2., "Warm Mix Asphalt (WMA)."
4. When used with WMA, this originally specified PG binder is allowed for use at the maximum recycled binder ratios shown in this table.

3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a pre-paving meeting with the Engineer on or before the first day of paving unless otherwise directed.

- 4.1. **Certification.** Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 6. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist.

Table 6
Test Methods, Test Responsibility, and Minimum Certification Levels

Test Description	Test Method	Contractor	Engineer	Level ¹
1. Aggregate and Recycled Material Testing				
Sampling	Tex-221-F	✓	✓	1A
Dry sieve	Tex-200-F, Part I	✓	✓	1A
Washed sieve	Tex-200-F, Part II	✓	✓	1A
Deleterious material	Tex-217-F, Parts I & III	✓	✓	1A
Decantation	Tex-217-F, Part II	✓	✓	1A
Los Angeles abrasion	Tex-410-A		✓	TxDOT
Magnesium sulfate soundness	Tex-411-A		✓	TxDOT
Micro-Deval abrasion	Tex-461-A		✓	2
Crushed face count	Tex-460-A	✓	✓	2
Flat and elongated particles	Tex-280-F	✓	✓	2
Linear shrinkage	Tex-107-E	✓	✓	2
Sand equivalent	Tex-203-F	✓	✓	2
Organic impurities	Tex-408-A	✓	✓	2
2. Asphalt Binder & Tack Coat Sampling				
Asphalt binder sampling	Tex-500-C, Part II	✓	✓	1A/1B
Tack coat sampling	Tex-500-C, Part III	✓	✓	1A/1B
3. Mix Design & Verification				
Design and JMF changes	Tex-204-F	✓	✓	2
Mixing	Tex-205-F	✓	✓	2
Molding (TGC)	Tex-206-F	✓	✓	1A
Molding (SGC)	Tex-241-F	✓	✓	1A
Laboratory-molded density	Tex-207-F	✓	✓	1A
VMA ² (calculation only)	Tex-204-F	✓	✓	2
Rice gravity	Tex-227-F	✓	✓	1A
Ignition oven correction factors ³	Tex-236-F	✓	✓	2
Indirect tensile strength	Tex-226-F	✓	✓	2
Hamburg Wheel test	Tex-242-F	✓	✓	2
Boil test	Tex-530-C	✓	✓	1A
4. Production Testing				
Mixture sampling	Tex-222-F	✓	✓	1A
Molding (TGC)	Tex-206-F		✓	1A
Molding (SGC)	Tex-241-F		✓	1A
Laboratory-molded density	Tex-207-F		✓	1A
VMA ² (calculation only)	Tex-204-F		✓	1A
Rice gravity	Tex-227-F		✓	1A
Gradation & asphalt binder content ³	Tex-236-F		✓	1A
Moisture content	Tex-212-F		✓	1A
Hamburg Wheel test	Tex-242-F		✓	2
Boil test	Tex-530-C		✓	1A
5. Placement Testing				
Trimming roadway cores	Tex-207-F	✓	✓	1A/1B
In-place air voids	Tex-207-F		✓	1A/1B
Establish rolling pattern	Tex-207-F	✓		1B
Ride quality measurement	Tex-1001-S	✓	✓	Note 4

1. Level 1A, 1B, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.

2. Voids in mineral aggregates.

3. Refer to Section 340.4.8.3., "Production Testing," for exceptions to using an ignition oven.

4. Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.

4.2.

Reporting, Testing, and Responsibilities. Use Department-provided templates to record and calculate all test data pertaining to the mixture design. The Engineer will use Department templates for any production and placement testing. Obtain the current version of the templates at <http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html> or from the Engineer.

The maximum allowable time for the Engineer to exchange test data with the Contractor is as given in Table 7 unless otherwise approved. The Engineer will immediately report to the Contractor any test result that requires suspension of production or placement or that fails to meet the specification requirements.

Subsequent mix placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Article 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 7
Reporting Schedule**

Description	Reported By	Reported To	To Be Reported Within
Production Testing			
Gradation	Engineer	Contractor	1 working day of completion of the test
Asphalt binder content			
Laboratory-molded density			
VMA (calculation)			
Hamburg Wheel test			
Moisture content			
Boil test			
Binder tests	Placement Testing		
In-place air voids	Engineer	Contractor	1 working day of completion of the test ¹

1. 2 days are allowed if cores cannot be dried to constant weight within 1 day.

4.3. Mixture Design.

4.3.1. **Design Requirements.** The Contractor may design the mixture using a Texas Gyrotory Compactor (TGC) or a Superpave Gyrotory Compactor (SGC) unless otherwise shown on the plans. Use the dense-graded design procedure provided in [Tex-204-F](#). Design the mixture to meet the requirements listed in Tables 1, 2, 3, 4, 5, 8, 9, and 10.

4.3.1.1. **Target Laboratory-Molded Density When The TGC Is Used.** Design the mixture at a 96.5% target laboratory-molded density. Increase the target laboratory-molded density to 97.0% or 97.5% at the Contractor's discretion or when shown on the plans or specification.

4.3.1.2. **Design Number of Gyration (Ndesign) When The SGC Is Used.** Design the mixture at 50 gyrations (Ndesign). Use a target laboratory-molded density of 96.0% to design the mixture; however, adjustments can be made to the Ndesign value as noted in Table 9. The Ndesign level may be reduced to no less than 35 gyrations at the Contractor's discretion.

Use an approved laboratory from the Department's MPL to perform the Hamburg Wheel test in accordance with [Tex-242-F](#), and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the laboratory mixture design.

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- asphalt binder content and aggregate gradation of RAP and RAS stockpiles;
- the target laboratory-molded density (or Ndesign level when using the SGC);
- results of all applicable tests;

- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

Table 8
Master Gradation Limits (% Passing by Weight or Volume) and VMA Requirements

Sieve Size	A Coarse Base	B Fine Base	C Coarse Surface	D Fine Surface	F Fine Mixture
2"	100.0 ¹	–	–	–	–
1-1/2"	98.0–100.0	100.0 ¹	–	–	–
1"	78.0–94.0	98.0–100.0	100.0 ¹	–	–
3/4"	64.0–85.0	84.0–98.0	95.0–100.0	100.0 ¹	–
1/2"	50.0–70.0	–	–	98.0–100.0	100.0 ¹
3/8"	–	60.0–80.0	70.0–85.0	85.0–100.0	98.0–100.0
#4	30.0–50.0	40.0–60.0	43.0–63.0	50.0–70.0	70.0–90.0
#8	22.0–36.0	29.0–43.0	32.0–44.0	35.0–46.0	38.0–48.0
#30	8.0–23.0	13.0–28.0	14.0–28.0	15.0–29.0	12.0–27.0
#50	3.0–19.0	6.0–20.0	7.0–21.0	7.0–20.0	6.0–19.0
#200	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0
Design VMA, % Minimum					
–	12.0	13.0	14.0	15.0	16.0
Production (Plant-Produced) VMA, % Minimum					
–	11.5	12.5	13.5	14.5	15.5

1. Defined as maximum sieve size. No tolerance allowed.

Table 9
Laboratory Mixture Design Properties

Mixture Property	Test Method	Requirement
Target laboratory-molded density, % (TGC)	Tex-207-F	96.5 ¹
Design gyrations (Ndesign for SGC)	Tex-241-F	50 ²
Indirect tensile strength (dry), psi	Tex-226-F	85–200 ³
Boil test ⁴	Tex-530-C	–

1. Increase to 97.0% or 97.5% at the Contractor's discretion or when shown on the plans or specification.
2. Adjust within a range of 35–100 gyrations when shown on the plans or specification or when mutually agreed between the Engineer and Contractor.
3. The Engineer may allow the IDT strength to exceed 200 psi if the corresponding Hamburg Wheel rut depth is greater than 3.0 mm and less than 12.5 mm.
4. Used to establish baseline for comparison to production results. May be waived when approved.

Table 10
Hamburg Wheel Test Requirements

High-Temperature Binder Grade	Test Method	Minimum # of Passes @ 12.5 mm ¹ Rut Depth, Tested @ 50°C
PG 64 or lower	Tex-242-F	10,000 ²
PG 70		15,000 ³
PG 76 or higher		20,000

1. When the rut depth at the required minimum number of passes is less than 3 mm, the Engineer may require the Contractor to increase the target laboratory-molded density (TGC) by 0.5% to no more than 97.5% or lower the Ndesign level (SGC) to no less than 35 gyrations.
2. May be decreased to no less than 5,000 passes when shown on the plans.
3. May be decreased to no less than 10,000 passes when shown on the plans.

4.3.2.

Job-Mix Formula Approval. The job-mix formula (JMF) is the combined aggregate gradation, target laboratory-molded density (or Ndesign level), and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When

WMA is used, JMF1 may be designed and submitted to the Engineer without including the WMA additive. When WMA is used, document the additive or process used and recommended rate on the JMF1 submittal. Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide approximately 10,000 g of the design mixture and request that the Department perform the Hamburg Wheel test if opting to have the Department perform the test. The Engineer will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise determined. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. Provide split samples of the mixtures and blank samples used to determine the ignition oven correction factors. The Engineer will determine the aggregate and asphalt correction factors from the ignition oven used for production testing in accordance with [Tex-236-F](#).

The Engineer will use a TGC calibrated in accordance with [Tex-914-K](#) in molding production samples. Provide an SGC at the Engineer's field laboratory for use in molding production samples if the SGC is used to design the mix.

The Engineer may perform [Tex-530-C](#) and retain the tested sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.

4.3.3. **JMF Adjustments.** If JMF adjustments are necessary to achieve the specified requirements, the adjusted JMF must:

- be provided to the Engineer in writing before the start of a new lot;
- be numbered in sequence to the previous JMF;
- meet the mixture requirements in Table 4 and Table 5;
- meet the master gradation limits shown in Table 8; and
- be within the operational tolerances of the current JMF listed in Table 11.

The Engineer may adjust the asphalt binder content to maintain desirable laboratory density near the optimum value while achieving other mix requirements.

Table 11
Operational Tolerances

Description	Test Method	Allowable Difference Between Trial Batch and JMF1 Target	Allowable Difference from Current JMF Target
Individual % retained for #8 sieve and larger	Tex-200-F or Tex-236-F	Must be within master grading limits in Table 8	±5.0 ^{1,2}
Individual % retained for sieves smaller than #8 and larger than #200			±3.0 ^{1,2}
% passing the #200 sieve	±2.0 ^{1,2}		
Asphalt binder content, %	Tex-236-F	±0.5	±0.3 ²
Laboratory-molded density, %	Tex-207-F	±1.0	±1.0
VMA, %, min	Tex-204-F	Note 3	Note 3

1. When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 will be considered out of tolerance when outside the master grading limits.
2. Only applies to mixture produced for Lot 1 and higher.
3. Mixture is required to meet Table 8 requirements.

4.4. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification. Submit a new mix design and perform a new trial batch when the asphalt binder content of:

- any RAP stockpile used in the mix is more than 0.5% higher than the value shown on the mixture design report; or
- RAS stockpile used in the mix is more than 2.0% higher than the value shown on the mixture design report.

4.4.1. **Storage and Heating of Materials.** Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless

otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.

- 4.4.2. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F (or 275°F for WMA) and is not lower than 215°F. The Department will not pay for or allow placement of any mixture produced above 350°F.

Produce WMA within the target discharge temperature range of 215°F and 275°F when WMA is required. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor's corrective action is not successful at controlling the production temperature within the target discharge range. Note that when WMA is produced, it may be necessary to adjust burners to ensure complete combustion such that no burner fuel residue remains in the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. The Engineer may determine the moisture content by oven-drying in accordance with [Tex-212-F](#), Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. The Engineer will obtain the sample immediately after discharging the mixture into the truck, and will perform the test promptly.

- 4.5. **Hauling Operations.** Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary.

Use equipment for hauling as defined in Section 340.4.6.3.2., "Hauling Equipment." Use other hauling equipment only when allowed.

- 4.6. **Placement Operations.** Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed. Use a hand-held thermal camera or infrared thermometer to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket unless otherwise directed. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly.

Place the mixture at the rate or thickness shown on the plans. The Engineer will use the guidelines in Table 12 to determine the compacted lift thickness of each layer when multiple lifts are required. The thickness determined is based on the rate of 110 lb./sq. yd. for each inch of pavement unless otherwise shown on the plans.

Table 12
Compacted Lift Thickness and Required Core Height

Mixture Type	Compacted Lift Thickness Guidelines		Minimum Untrimmed Core Height (in.) Eligible for Testing
	Minimum (in.)	Maximum (in.)	
A	3.00	6.00	2.00
B	2.50	5.00	1.75
C	2.00	4.00	1.50
D	1.50	3.00	1.25
F	1.25	2.50	1.25

- 4.6.1. **Weather Conditions.** Place mixture when the roadway surface temperature is at or above 60°F unless otherwise approved. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. The Engineer may allow mixture placement to begin before the roadway surface reaches the required temperature if conditions are such that the roadway surface will reach the required temperature within 2 hr. of beginning placement operations. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the ambient temperature is likely to drop below 32°F within 12 hr. of paving.
- 4.6.2. **Tack Coat.** Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller to remove streaks and other irregular patterns when directed.
- 4.6.3. **Lay-Down Operations.**
- 4.6.3.1. **Windrow Operations.** Operate windrow pickup equipment so that when hot-mix is placed in windrows substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.
- 4.6.3.2. **Hauling Equipment.** Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture; however, with exception of paving miscellaneous areas, end dump trucks are only allowed when used in conjunction with an MTD with remixing capability unless otherwise allowed.
- 4.6.3.3. **Screed Heaters.** Turn off screed heaters, to prevent overheating of the mat, if the paver stops for more than 5 min.
- 4.7. **Compaction.** Compact the pavement uniformly to contain between 3.8% and 8.5% in-place air voids.
- Furnish the type, size, and number of rollers required for compaction as approved. Use a pneumatic-tire roller to seal the surface unless excessive pickup of fines occurs. Use additional rollers as required to remove any roller marks. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.
- Use the control strip method shown in [Tex-207-F](#), Part IV, on the first day of production to establish the rolling pattern that will produce the desired in-place air voids unless otherwise directed.
- Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.
- Complete all compaction operations before the pavement temperature drops below 160°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 160°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

4.8. **Production Acceptance.**

4.8.1. **Production Lot.** Each day of production is defined as a production lot. Lots will be sequentially numbered and correspond to each new day of production. Note that lots are not subdivided into sublots for this specification.

4.8.2. **Production Sampling.**

4.8.2.1. **Mixture Sampling.** The Engineer may obtain mixture samples in accordance with [Tex-222-F](#) at any time during production.

4.8.2.2. **Asphalt Binder Sampling.** The Engineer may obtain or require the Contractor to obtain 1 qt. samples of the asphalt binder at any time during production from a port located immediately upstream from the mixing drum or pug mill in accordance with [Tex-500-C](#), Part II. The Engineer may test any of the asphalt binder samples to verify compliance with Item 300, "Asphalts, Oils, and Emulsions."

4.8.3. **Production Testing.** The Engineer will test at the frequency listed in the Department's *Guide Schedule of Sampling and Testing* and this specification. The Engineer may suspend production if production tests do not meet specifications or are not within operational tolerances listed in Table 11. Take immediate corrective action if the Engineer's laboratory-molded density on any sample is less than 95.0% or greater than 98.0%, to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

The Engineer may use alternate methods for determining the asphalt binder content and aggregate gradation if the aggregate mineralogy is such that [Tex-236-F](#) does not yield reliable results. Use the applicable test procedure if an alternate test method is selected.

Table 13
Production and Placement Testing

Description	Test Method
Individual % retained for #8 sieve and larger	Tex-200-F
Individual % retained for sieves smaller than #8 and larger than #200	or
% passing the #200 sieve	Tex-236-F
Laboratory-molded density	Tex-207-F
Laboratory-molded bulk specific gravity	
In-Place air voids	
VMA	Tex-204-F
Moisture content	Tex-212-F , Part II
Theoretical maximum specific (Rice) gravity	Tex-227-F
Asphalt binder content	Tex-236-F
Hamburg Wheel test	Tex-242-F
Recycled Asphalt Shingles (RAS) ¹	Tex-217-F , Part III
Asphalt binder sampling and testing	Tex-500-C
Tack coat sampling and testing	Tex-500-C , Part III
Boil test	Tex-530-C

1. Testing performed by the Construction Division or designated laboratory.

4.8.3.1. **voids in Mineral Aggregates (VMA).** The Engineer may determine the VMA for any production lot. Take immediate corrective action if the VMA value for any lot is less than the minimum VMA requirement for production listed in Table 8. Suspend production and shipment of the mixture if the Engineer's VMA result is more than 0.5% below the minimum VMA requirement for production listed in Table 8. In addition to suspending production, the Engineer may require removal and replacement or may allow the lot to be left in place without payment.

4.8.3.2. **Hamburg Wheel Test.** The Engineer may perform a Hamburg Wheel test at any time during production, including when the boil test indicates a change in quality from the materials submitted for JMF1. In addition to testing production samples, the Engineer may obtain cores and perform Hamburg Wheel tests on any areas of the roadway where rutting is observed. Suspend production until further Hamburg Wheel tests meet the specified values when the production or core samples fail the Hamburg Wheel test criteria in Table 10. Core samples, if taken, will be obtained from the center of the finished mat or other areas excluding the vehicle wheel paths. The Engineer may require up to the entire lot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.

If the Department's or Department-approved laboratory's Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Department confirm the results by re-testing the failing material. The Construction Division will perform the Hamburg Wheel tests and determine the final disposition of the material in question based on the Department's test results.

4.8.4. **Individual Loads of Hot-Mix.** The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 11, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

4.9. **Placement Acceptance.**

4.9.1. **Placement Lot.** A placement lot is defined as the area placed during a production lot (one day's production). Placement lot numbers will correspond with production lot numbers.

4.9.2. **Miscellaneous Areas.** Miscellaneous areas include areas that typically involve significant handwork or discontinuous paving operations, such as temporary detours, driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. Miscellaneous areas also include level-ups and thin overlays when the layer thickness specified on the plans is less than the minimum untrimmed core height eligible for testing shown in Table 12. The specified layer thickness is based on the rate of 110 lb./sq. yd. for each inch of pavement unless another rate is shown on the plans. Compact miscellaneous areas in accordance with Section 340.4.7., "Compaction." Miscellaneous areas are not subject to in-place air void determination except for temporary detours when shown on the plans.

4.9.3. **Placement Sampling.** Provide the equipment and means to obtain and trim roadway cores on site. On site is defined as in close proximity to where the cores are taken. Obtain the cores within one working day of the time the placement lot is completed unless otherwise approved. Obtain two 6-in. diameter cores side-by-side at each location selected by the Engineer for in-place air void determination unless otherwise shown on the plans. For Type D and Type F mixtures, 4-in. diameter cores are allowed. Mark the cores for identification, measure and record the untrimmed core height, and provide the information to the Engineer. The Engineer will witness the coring operation and measurement of the core thickness.

Visually inspect each core and verify that the current paving layer is bonded to the underlying layer. Take corrective action if an adequate bond does not exist between the current and underlying layer to ensure that an adequate bond will be achieved during subsequent placement operations.

Trim the cores immediately after obtaining the cores from the roadway in accordance with [Tex-207-F](#) if the core heights meet the minimum untrimmed value listed in Table 12. Trim the cores on site in the presence of the Engineer. Use a permanent marker or paint pen to record the date and lot number on each core as well as the designation as Core A or B. The Engineer may require additional information to be marked on the core and may choose to sign or initial the core. The Engineer will take custody of the cores immediately after they are trimmed and will retain custody of the cores until the Department's testing is completed. Before turning the trimmed cores over to the Engineer, the Contractor may wrap the trimmed cores or secure them in a manner that will reduce the risk of possible damage occurring during transport by the Engineer. After testing, the Engineer will return the cores to the Contractor.

The Engineer may have the cores transported back to the Department's laboratory at the HMA plant via the Contractor's haul truck or other designated vehicle. In such cases where the cores will be out of the Engineer's possession during transport, the Engineer will use Department-provided security bags and the Roadway Core Custody protocol located at <http://www.txdot.gov/business/specifications.htm> to provide a secure means and process that protects the integrity of the cores during transport.

Instead of the Contractor trimming the cores on site immediately after coring, the Engineer and the Contractor may mutually agree to have the trimming operations performed at an alternate location such as a field laboratory or other similar location. In such cases, the Engineer will take possession of the cores immediately after they are obtained from the roadway and will retain custody of the cores until testing is completed. Either the Department or Contractor representative may perform trimming of the cores. The Engineer will witness all trimming operations in cases where the Contractor representative performs the trimming operation.

Dry the core holes and tack the sides and bottom immediately after obtaining the cores. Fill the hole with the same type of mixture and properly compact the mixture. Repair core holes with other methods when approved.

4.9.4. **Placement Testing.** The Engineer may measure in-place air voids at any time during the project to verify specification compliance.

4.9.4.1. **In-Place Air Voids.** The Engineer will measure in-place air voids in accordance with [Tex-207-F](#) and [Tex-227-F](#). Cores not meeting the height requirements in Table 12 will not be tested. Before drying to a constant weight, cores may be pre-dried using a Corelok or similar vacuum device to remove excess moisture. The Engineer will use the corresponding theoretical maximum specific gravity to determine the air void content of each core. The Engineer will use the average air void content of the 2 cores to determine the in-place air voids at the selected location.

The Engineer will use the vacuum method to seal the core if required by [Tex-207-F](#). The Engineer will use the test results from the unsealed core if the sealed core yields a higher specific gravity than the unsealed core. After determining the in-place air void content, the Engineer will return the cores and provide test results to the Contractor.

Take immediate corrective action when the in-place air voids exceed the range of 3.8% and 8.5% to bring the operation within these tolerances. The Engineer may suspend operations or require removal and replacement if the in-place air voids are less than 2.7% or greater than 9.9%. The Engineer will allow paving to resume when the proposed corrective action is likely to yield between 3.8% and 8.5% in-place air voids. Areas defined in Section 340.9.2., "Miscellaneous Areas," are not subject to in-place air void determination.

4.9.5. **Irregularities.** Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities and areas where the mixture does not bond to the existing pavement. If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.6. **Ride Quality.** Use Surface Test Type A to evaluate ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

5. MEASUREMENT

Hot mix will be measured by the ton of composite hot-mix, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Article 340.5., "Measurement," will be paid for at the unit bid price for "Dense Graded Hot-Mix Asphalt (SQ)" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, materials including tack coat, placement, equipment, labor, tools, and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality, if applicable, will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."