HOUSTON AIRPORTS

City of Houston - Department of Aviation – Infrastructure Division

PROJECT MANUAL

HOU TNC LOT PAVING
WILLIAM P. HOBBY AIRPORT (HOU)

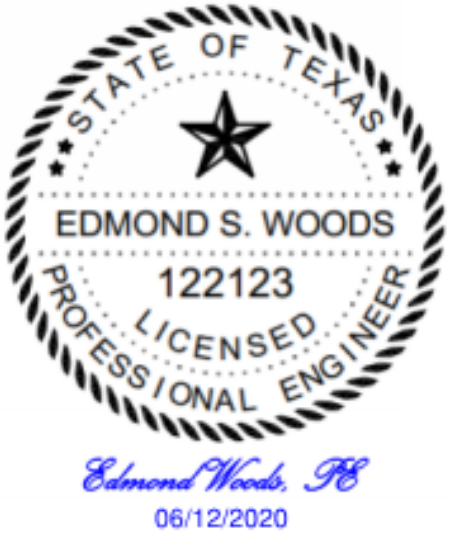
PROJECT No.: 238

TIP-20-121-HOU

VOLUME NO. 3 OF 3 TOTAL VOLUMES

Divisions 02-16

June 2020



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Section 02221

REMOVING EXISTING PAVEMENTS, STRUCTURES, WOOD, AND DEMOLITION DEBRIS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, brick pavement and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.

C. Removing pipe culverts, sewers, and sewer leads.

D. Removing waterlines and water services lines including asbestos cement pipe per OSHA guidelines.

E. Removing existing inlets and manholes.

F. Removing and disposing of pre-stressed concrete beams and drill shafts.

G. Removing miscellaneous structures of concrete or masonry.

H. Removing existing bridge.

I. Removing existing wood and demolition debris.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removing and disposing of asphaltic surfacing with or without base, regardless of thickness encountered, is on square yard basis measured between lips of gutters.

2. Payment for removing and disposing of reinforced concrete pavement, with or without asphalt overlay, regardless of its thickness, is on square yard basis measured from back-to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.

3. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on square yard basis.

4. Payment for removing and disposing of concrete sidewalks and driveways is on square yard basis.

5. Payment for removing asphaltic pavement surface by milling shall be in accordance with Section 2960.

6. Payment for removing and disposing of miscellaneous concrete and masonry is on cubic yard basis of structure in place.

7. Payment for removing and disposing of pipe culverts, sewers, and sewer leads, is on linear foot basis for each diameter and each material type of pipe removed.

8. Payment for removing and disposing of waterlines and water service lines including asbestos cement pipe is on linear foot basis for each diameter pipe and each material type of pipe removed.

9. Payment for removing and disposing of existing inlets is on unit price basis for each inlet removed.

10. Payment for removing and disposing of prestressed concrete piles and drill shafts is on linear foot basis.

11. Payment for removing and disposing of existing bridge, including piles and abutments to minimum of 4 feet below ground level, is on a lump sum basis.

12. Payment for removing and disposing of existing manholes is on unit price basis for each manhole removed.

13. Payment for removing and disposing of miscellaneous wood and demolition debris is on cubic yard basis.

14. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Include cost of such work in unit prices for items listed in bid form requiring saw cutting.

15. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for Contractor's convenience.

    a. For utility installations: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings. Limits of measurement will be as shown on Street Cut Pavement Replacement Rules.

16. Refer to Section 01270 - Measurement and Payment for unit price procedures

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.

C. For removal of asbestos containing materials, or material that could potentially contain asbestos, comply with applicable provisions of OSHA 29 CFR 1926.1101 – Asbestos, OSHA 29 CFR 1926.32 – General Safety and Health Provisions, and EPA 40 CFR 61 Subpart M – National Emission Standard for Asbestos.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Obtain advance approval from Project Manager for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

C. For removal of asbestos-containing materials, or materials that could potentially contain asbestos, comply with the following:

1. Crew members must be trained in accordance with OSHA 29 CFR 1926.1101 – Asbestos.

2. Conduct negative exposure assessment to demonstrate asbestos exposure below permissible exposure limit (PEL) in accordance with OSHA 29 CFR 1926.1101 – Asbestos and EPA 40 CFR 763 – Asbestos.

3. If negative exposure assessment not conducted, or if results are above PEL, provide respiratory protection in accordance with Paragraph 3.02 of this Section.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Adjacent public and private property.

2. Trees, plants, and other landscape features designated to remain.

3. Utilities designated to remain.

4. Pavement and utility structures designated to remain.

5. Bench marks, monuments, and existing structures designated to remain.

B. When required, provide respiratory protection in accordance with OSHA 29 CFR 1910.134 – Respiratory Protection, and National Institute of Occupational Safety and Health (NIOSH).

3.03 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to minimum depth of 2 inches.

D. When street and driveway saw cut location is greater than one-half of pavement lane width, remove pavement for full lane width or to nearest longitudinal joint as directed by Project Manager.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install 8-inch-thick masonry plug in pipe end prior to backfill in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

G. Labeling of Asbestos Cement (AC) Pipe:

1. Label leak-tight container with warning statement of hazardous asbestos content in accordance with OSHA 29 CFR 1926.1101 and as noted below.

2. Label waste material with following warning:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

3. Neatly print labels in letters of sufficient size and contrast so label is easily visible and legible.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.05 DISPOSAL

A. Inlet frames, grates, and plates; and manhole frames and covers, may remain City property. Disposal shall be in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove from site, debris resulting from work under this section in accordance with requirements of Section 01576 - Waste Material Disposal.

C. For asbestos-containing materials:

1. Comply with 40 CFR Part 61 and 30 TAC Sections 330.137(b) for Industrial Class 1 waste.

2. Inspect load to ensure correct packaging and labeling.

3. Line vehicles with two layers of 6-mil polyethylene sheeting.

4. Remove asbestos-containing waste from site daily.

END OF SECTION

Section 02621

GEOTEXTILE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Geotextile, also called filter fabric, in applications including pipe embedment wrap, around exterior of tunnel liner, around foundations of pipeline structures, and slope stabilization.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Work performed under this Section. Include cost of Work in unit prices for Work requiring geotextile.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AASHTO M 288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

C. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

D. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles (Grab Method).

E. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of Geotextiles.

F. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit standard manufacturer's catalog sheets and other pertinent information, for approval, prior to installation.

C. Submit installation methods, as part of Work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Project Manager for filter fabric material and proposed installation method prior to use of filter fabric.

PART 2 P R O D U C T S

2.01 GEOTEXTILE

A. Provide geotextile (filter fabric) designed for use in geotechnical applications. Filter fabric shall provide permeable layer or media while retaining soil matrix.

B. Use fabric which meets physical requirements for Class A subsurface drainage installation conditions as defined in AASHTO M 288 and as specified in Paragraph 2.02, Properties.

2.02 PROPERTIES

A. Material: Nonwoven, nonbiodegradable, fabric consisting of continuous chain polymer filaments or yarns, at least 85 percent by weight polyolefins, polyesters or polyamide, formed into dimensionally stable network.

B. Chemical Resistance: Inert to commonly encountered chemicals and hydrocarbons over pH range of 3 to 12.

C. Physical Resistance: Resistant to mildew and rot, ultraviolet light exposure, insects and rodents.

D. Minimum Test Values:

Property	Value (Min.)	Test Method
Grab Strength	180 lbs.	ASTM D 4632
Trapezoidal Tear Strength	50 lbs.	ASTM D 4533
Puncture Strength	80 lbs.	ASTM D 4833
Mullen Burst Strength	290 psi.	ASTM D 3786
Apparent Opening Size(1)	0.25 mm	ASTM D 4751
Permittivity (sec^{-1})	0.2	ASTM D 4491
(1) Maximum average roll value.		

PART 3 E X E C U T I O N

3.01 LINE WORK

A. Conform use of geotextile to backfill for utilities to Section 02317 - Excavation and Backfill for Utilities.

3.02 TUNNEL WORK

A. Use geotextile outside of tunnel primary liner to prevent migration of soil fines into excavated tunnel resulting in voids or settlement. Select geotextile, subject to minimum requirements of Paragraph 2.02, meeting tunnel liner design requirements and installation conditions.

1. Sewers: Conform to Section 02426 - Sanitary Sewer Line in Tunnel.

2. Waterlines: Conform to Section 02517 - Waterline in Tunnels.

END OF SECTION

Section 02712

CEMENT STABILIZED BASE COURSE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of cement stabilized crushed stone.

B. Foundation course of cement stabilized bank run gravel.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for cement stabilized base course is on square yard basis. Separate pay items are used for each different required thickness of base course.

2. Payment for asphaltic seal cure is by gallon.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

4. Refer to Paragraph 3.09, Unit Price Adjustment.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in Los Angeles Machine.

B. ASTM C 150 - Standard Specification for Portland Cement.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft^3 (600kN kN-m/m^3).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

H. TxDOT Tex-110-E - Particle Size Analysis of Soils.

I. TxDOT Tex-120-E - Soil-Cement Testing.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit samples of crushed stone, gravel, and soil binder for testing.

C. Submit manufacturer's description and characteristics for pug mill and associated equipment, spreading machine, and compaction equipment for approval.

1.05 TESTS

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform tests and analysis of aggregate and binder materials in accordance with ASTM D 1557 and ASTM D 4318.

1.06 DELIVERY, STORAGE AND HANDLING

A. Make stockpiles from layers of processed aggregate to eliminate segregation of materials. Load material by making successive vertical cuts through entire depth of stockpile.

B. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 P R O D U C T S

2.01 CEMENT

A. ASTM C 150 Type I; bulk or sacked.

2.02 WATER

A. Clean, clear; and free from oil, acids, alkali, or vegetable matter.

2.03 AGGREGATE

A. Crushed Stone: Material retained on No. 40 Sieve meeting following requirements:

1. Durable particles of crusher-run broken limestone, sandstone, or granite obtained from approved source.

2. Los Angeles abrasion test percent of wear not to exceed 40 when tested in accordance with ASTM C 131.

B. Gravel: Durable particles of bank run gravel or processed material.

C. Soil Binder: Material passing No. 40 Sieve meeting following requirements when tested in accordance with ASTM D 4318:

1. Maximum Liquid limit: 35.

2. Maximum Plasticity index: 10.

D. Mixed aggregate and soil binder shall meet the following requirements:

1. Grading in accordance with TxDOT Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Retained			
	Crushed Stone	Processed G. 1	Gravel G. 2	Bank run Gravel
1 3/4 inch	0 to 10	0 to 5	-	0 to 5
1/2 inch	-	-	0	-
No. 4	45 to 75	30 to 75	15 to 35	30 to 75
No. 40	55 to 80	60 to 85	55 to 85	65 to 85

2. Obtain prior permission from Project Manager for use of additives to meet above requirements.

2.04 ASPHALT SEAL CURE

A. Cutback Asphalt: MC30 conforming to requirements of Section 02742 - Prime Coat.

B. Emulsified Petroleum Resin: EPR-1 Prime conforming to requirements of Section 02742 - Prime Coat.

2.05 MATERIAL MIX

A. Design mix for minimum average compressive strength of 200 psi at 48 hours using TxDOT Tex-120-E unconfined compressive strength testing procedures. Provide minimum cement content of 1 1/2 sacks, weighing 94 pounds each, per ton of mix.

B. Increase cement content when average compressive strength of tests on field samples fall below 200 psi. Refer to Part 3 concerning field samples and tests.

C. Mix in stationary pug mill equipped with feeding and metering devices for adding specified quantities of base material, cement, and water into mixer. Dry mix base material and cement sufficiently to prevent cement balls from forming when water is added.

D. Resulting mixture shall be homogeneous and uniform in appearance.

2.06 SOURCE QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform testing for unconfined compressive strength by TxDOT Test Method Tex-120-E as follows:

1. Mold three samples each day or for each 300 tons of production.

2. Compressive strength shall be average of three tests for each production lot.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation.

C. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

3.03 PLACEMENT

A. Do not mix and place cement stabilized base when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Place material on prepared subgrade in uniform layers to produce thickness indicated on Drawings. Depth of layers shall not exceed 6 inches.

C. Spread with approved spreading machine. Conduct spreading so as to eliminate planes of weakness or pockets of non-uniformly graded material resulting from hauling and dumping operations.

D. Provide construction joints between new material and stabilized base that has been in place 4 hours or longer. Joints shall be approximately vertical. Form joint with temporary header or make vertical cut of previous base immediately before placing subsequent base.

E. Use only one longitudinal joint at center line under main lanes and shoulder unless shown otherwise on Drawings. Do not use longitudinal joints under frontage roads and ramps unless indicated on Drawings.

F. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure firm bond between reinforcement and base.

3.04 COMPACTION

A. Start compaction as soon as possible but not more than 60 minutes from start of moist mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow stabilized base to mix with underlying material.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 2 percent above optimum moisture as determined by ASTM D 698. Mix in with spiked tooth harrow or equal. Reshape surface and lightly scarify to loosen imprints made by equipment.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers which are sufficiently light to prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

F. Compact to minimum density of 95 percent of maximum dry density at moisture content of treated material between optimum and 2 percent above optimum as determined by ASTM D 1557, unless otherwise indicated on Drawings.

G. Maintain surface to required lines and grades throughout operation.

3.05 CURING

A. Moist cure for minimum of 7 days before adding pavement courses. Restrict traffic on base to local property access. Keep subgrade surface damp by sprinkling.

B. If indicated on Drawings, cover base surface with curing membrane as soon as finishing operation is complete. Apply with approved self-propelled pressure distributor at following rates, or as indicated on Drawings:

1. MC30: 0.1 gallon per square yard.

2. EPR-1 Prime: 0.15 gallon per square yard.

C. Do not use cutback asphalt during period of April 16 to September 15.

3.06 TOLERANCES

A. Smooth and conform completed surface to typical section and established lines and grades.

B. Top surface of base course: Plus or minus 1 1/4 inch in cross section, or in 16 foot length.

3.07 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Take minimum of one core at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Request additional cores in vicinity of cores indicating nonconforming in-place depths at no extra cost to City. When average of tests fall below required depth, place additional material and compact at no additional cost to City.

D. Perform compaction testing in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017 at randomly selected locations. Remove and replace areas that do not conform to compaction requirements at no additional cost to City.

E. Fill cores and density test sections with new compacted cement stabilized base.

3.08 NONCONFORMING BASE COURSE

A. Remove and replace areas of base course found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with cement-stabilized base of thickness shown on Drawings.

B. Replace nonconforming base course sections at no additional cost to City.

3.09 UNIT PRICE ADJUSTMENT

A. Make unit price adjustments for in-place depth determined by cores as follows:

1. Adjusted unit price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.

2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.

3.10 PROTECTION

A. Maintain stabilized base in good condition until completion of Work. Repair defects immediately by replacing base to full depth.

B. Protect asphalt membrane, when used, from being picked up by traffic. Membrane may remain in place when proposed surface courses or other base courses are to be applied.

END OF SECTION

Section 02713

RECYCLED CRUSHED CONCRETE BASE COURSE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Recycled crushed concrete base (RCCB) course.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for RCCB is on per ton basis furnished and compacted in place.

2. Payment for RCCB for transitions and base repairs, if required, is on a per ton basis.

3. No separate payment will be made for RCCB for temporary driveway, temporary detour pavement, temporary road shoulders and etc. Include payment in unit price for related work.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM C 150 - Standard Specification for Portland Cement.

B. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.

D. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

E. TxDOT Tex-113-E - Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials.

F. TxDOT Tex-115-E - Field Method for Determining In-place Density of Soils and Base Materials.

G. TxDOT Tex-120-E - Soil-Cement Testing.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit representative samples of crushed concrete for testing.

C. Submit weight tickets, certified by supplier, for each delivery of recycled crushed concrete, gravel, and soil binder.

D. Submit manufacturer's description and characteristics for pug mill and associated equipment, mixer trucks, spreading and compaction equipment for approval.

1.05 TESTS

A. Follow Section 01454 - Testing Laboratory Services.

B. Test and analyze aggregate and binder products following TxDOT Tex-110-E.

1.06 DELIVERY, STORAGE AND HANDLING

A. Provide materials from stockpiles that are protected during storage from contaminates detrimental to concrete base.

B. Load material from same area of stockpile to maintain uniformity of each successive delivery to Project site.

C. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 P R O D U C T S

2.01 SYSTEM DESCRIPTION

A. Provide RCCB with following performance:

1. Minimum 7 percent cement.

2. Minimum compressive strength: 650 psi at 14 days following TxDOT Tex-120-E.

3. Prepare concrete product in on-site or off-site pug mill, or in on-site or off-site portable concrete mixer.

B. Preliminary Design: Prepare preliminary mix with minimum cement to crushed concrete ratios of 5 percent by dry mass of materials.

1. Designate source of concrete for crushing. Follow Section 01454 - Testing Laboratory Services for tests of concrete from source.

2. Results of laboratory and compression tests will be used by Project Manager to select final mix design.

2.02 PORTLAND CEMENT

A. ASTM C 150 Type I, II, or III; bulk or sacked.

2.03 WATER

A. Potable.

2.04 AGGREGATE

A. Recycled Crushed Concrete: Material retained on No. 40 Sieve, and durable coarse particles of crusher-run reclaimed cured Portland cement concrete, obtained from approved source. Organic material is prohibited. The crushed concrete shall be substantially free of foreign matter including but not limited to asphalt, base, and dirt.

B. Soil Binder (classified below): Meeting following requirements when tested following TxDOT Tex-106-E:

1. Maximum liquid limit: 35

2. Maximum plasticity index: 10

C. Mixed Aggregate and Soil Binder: Grading following TxDOT Tex-101-E and Tex-110-E within following limits:

Sieve	Percent Crushed Concrete Retained
1 3/4 inch	0 to 10
No. 4	45 to 75
No. 40	55 to 80; classified as Soil Binder

2. Bank sand may be added to mix at pug mill.

2.05 ASPHALTIC SEAL CURE

A. Acquire written approval from Project Manager before curing and before proceeding with curing.

B. Use following as option to curing by sprinkling:

1. Cut-back asphalt: MC30 following Section 02742 - Prime Coat.

2. Emulsified petroleum resin: EPR-1 Prime following Section 02742 - Prime Coat.

2.06 MATERIAL MIX

A. Design mix for minimum compressive strength of 650 psi at 14 days following TxDOT Tex-120-E unconfined compressive strength.

B. Cement Ratio: Follow Paragraph 2.01A. Increase cement content in two percent steps up to 9 percent maximum when compressive strength of design mix samples fail TxDOT Tex-120E test.

2.07 MIXING EQUIPMENT

A. Mix following Paragraph 2.01A, with metering devices adding specified quantities of crushed concrete, cement, and water into mixer. Dry mix crushed concrete and cement prior to adding water. Produce homogeneous and uniformly mixed product.

2.08 SOURCE QUALITY CONTROL

A. Test following Section 01454 -Testing Laboratory Services.

B. When directed by Project Manager, test for unconfined compressive strength following Test Method TxDOT Tex-120-E as follows:

1. Mold minimum of three samples each day or for each 500 tons of production or one for each day.

2. Compressive strength: average of 3 specimens for each sample lot.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Follow Section 01452 - Inspection Services.

B. Verify buried utility work is complete.

C. Verify lime treatment of base is complete.

D. Verify subgrade is ready to support imposed loads.

E. Verify flatwork, foundations, projecting reinforcement and similar Work interfacing with base is in place.

F. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation, or Section 02336 - Lime Stabilized Subgrade and Section 02337 - Lime-Fly Ash Stabilized Subgrade and Section 02338 - Portland Cement Stabilized Subgrade.

C. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

E. Have sufficient products and equipment on hand to expeditiously apply base.

3.03 MIXING

A. Maintain moisture content of between optimum and 5 percent above optimum.

3.04 PLACEMENT

A. Place mixture with approved spreading equipment. Spread to eliminate planes of weakness or pockets of nonuniformly graded material resulting from hauling and dumping operations.

B. Provide approximately vertical construction joints between fresh base and base-in-place 4 hours or longer. Form joint with temporary header or make vertical cut of in-place base immediately before placing fresh base.

C. Make cold joints at center line of head-to-head parking stalls.

D. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Provide proper bond between reinforcement and base.

E. Transverse and longitudinal joints shall be vertical.

F. Unless noted otherwise, place recycled crushed concrete base in courses not to exceed 8 inches in depth. All courses shall be placed on same working day unless approved by Project Manager. Construction joints between new base and base previously placed shall be wetted and coated with dry cement prior to addition of new base.

G. Complete finishing operations within period of 6 hours after cement is added to base materials.

3.05 COMPACTION

A. Start compaction maximum 3 hours after start of mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow base to mix with underlying material.

1. Do not rework uncompacted material that has set up for more than 30 minutes.

2. Complete placement and compaction work within 6 hours from start of moist mixing.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 5 percent above optimum moisture.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers or flat wheel rollers which are sufficiently light to prevent surface hair line cracking.

F. Compact to minimum density of 95 percent of dry density, following TxDOT Tex -113-E, at moisture content of treated material between optimum and 5 percent above optimum.

G. Test roadway base course compaction in accordance with TxDOT Tex-115-E.

H. Maintain surface to required lines and grades throughout operation.

3.06 CURING

A. Moist cure for minimum of 72 hours before adding pavement courses.

B. Use sprinkling or, at option, apply following curing membrane as soon as initial set begins, using approved light-weight self-propelled pressure distributor:

1. MC30: 0.1 gallon per square yard.

2. EPR-1 Prime: 0.15 gallon of asphalt residual per square yard.

C. Do not use cut-back asphalt during period of April 16 through September 15.

3.07 TOLERANCES

A. Completed Surface: Smooth and conform to typical section and established lines and grades.

B. Top Surface of Base Course: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.08 FIELD QUALITY CONTROL

A. Test following Section 01454 - Testing Laboratory Services.

B. Perform compaction tests following TxDOT Tex-113-E at randomly selected locations. Remove and replace areas failing compaction requirements at no additional cost to City.

3.09 PROTECTION

A. Maintain base in proper condition until surface is placed. Surface must be placed within 14 days after final mixing and compaction unless otherwise approved by Project Manager. Repair unacceptable base course immediately by replacing base to full depth.

B. Curing membrane may remain in place at areas where surface courses or other base courses are applied.

C. Prevent construction traffic on base for minimum 3 days. Light vehicles, used to maintain proper cure, are permitted on base after initial set or as permitted by Project Manager.

END OF SECTION

Section 02743

TACK COAT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Tack coat for asphalt concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for tack coat under this Section. Include payment in unit price for asphaltic pavements.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ASTM D 244 - Standard Test Methods for Emulsified Asphalts.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed tack coat.

C. Submit report of recent calibration of distributor.

PART 2 P R O D U C T S

2.01 EMULSION

A. Provide homogeneous material which shows no separation of asphalt after mixing and meets viscosity requirements within 30 days after delivery.

B. Emulsion material for tack coat.

1. Emulsified asphalt: SS-1 or SS-1h meeting following criteria:

PROPERTIES	SS-1		SS-1h	
	MIN.	MAX.	MIN.	MAX.
Furol Viscosity at 77°F, sec.	20	100	20	100
Residue by Distillation, %	60	--	60	--
Oil Portion of Distillate, %	--	1/2	--	1/2
Sieve Test, %	--	0.10	--	0.10
Miscibility (Standard Test)	Passing			
Cement Mixing, %	--	2.0	--	2.0
Storage Stability, 1 Day, %	--	1	--	1
Test on Residue: Penetration at 77°F, 100g, 5 sec. Solubility in Trichloroethylene, % Ductility at 77°F, 5 cm/min., cms	 120 97.5 100	 160 -- --	 70 97.5 80	 100 -- --

2. Polymer Modified Emulsion, SS-1P, for use where thin overlays (less than or equal 2 inches) are placed on collector or arterial streets and for speed humps, especially over existing Portland cement concrete pavement.

PROPERTIES	SS-1P	
	MIN.	MAX.
Furol Viscosity at 77 F, sec.	30	100
Residue by Distillation, %	60	--
Oil Portion of Distillate, %	--	1/2
Sieve Test, %	--	0.10
Miscibility (Standard Test)	Passing	
Cement Mixing, %	--	2.0
Storage Stability, 1 Day, %	--	1
Test on Residue: Penetration at 77°F, 100g, 5 sec.; Solubility in Trichloroethylene, %Ductility at 77°F, 5 cm/min., cms; Viscosity at 140 F, poises	100 97 50 1300	140 -- -- --

3. For emulsions used for tack coats during period of April 16 through September 15,

volatile organic compound solvents (VOC) shall not exceed 12 percent by weight when tested in accordance with ASTM D 244.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course or concrete surface of loose material by brooming prior to tack coat application.

3.03 APPLICATION

A. Apply tack coat uniformly by use of approved distributor at rate not to exceed 0.05 gallons per square yard of surface depending on texture of underlying surface. Select an application rate that will provide appropriate asphalt residual.

B. Paint contact surfaces of curbs, structures, and joints with thin uniform coat of tack coat.

3.04 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied tack coat until authorized by Project Manager.

END OF SECTION

Section 02762

BLAST CLEANING OF PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removal of existing pavement markings.

B. Preparation of pavement surfaces for new pavement markings.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for blast cleaning of roadway lanes is on linear foot basis for each width, measured in place.

2. Payment for blast cleaning of symbols and legends is on square foot basis, measured in place.

3. Payment for removal of raised pavement markings, all types, is on a lump sum basis.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description and characteristics of proposed blasting medium and equipment for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Blasting Media: Quality commercial product capable of producing specified surface cleanliness without deposition of deleterious materials on cleaned pavement surface. Do not use high silica content sand that may result in high levels of free crystalline silica dust particles as blasting agent.

2.02 EQUIPMENT

A. Equipment shall be power driven and of sufficient capacity to remove pavement markings. Equipment shall utilize moisture and oil traps of sufficient capacity to remove contaminants from air and prevent deposition of moisture, oil, or other contaminants on pavement surface.

PART 3 E X E C U T I O N

3.01 REMOVAL OF EXISTING MARKINGS

A. Remove pavement markings where necessary to prevent driver confusion, or where indicated on Drawings. Included are areas where it will be necessary for drivers to cross existing markings which they would not normally cross. Remove or obliterate markings. Do not damage pavement surface.

3.02 CLEANING FOR PLACEMENT OF MARKERS

A. Remove old pavement markings, loose material, and other contaminants deleterious to adhesion of new pavement markings to be placed. On Portland cement concrete pavement, minimize over blasting to prevent damage to pavement surface. Small particles of tightly adhering existing pavement markings may remain when complete removal will result in pavement surface damage.

B. Follow manufacturer's written instructions for proper cleaning of pavement surfaces to receive pavement marking.

END OF SECTION

Section 02764

RAISED PAVEMENT MARKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Raised pavement markers which include reflectorized and nonreflectorized traffic buttons, pavement markers and jiggle bars all of which are capable of being attached to a roadway surface by an adhesive.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment will be based on the number of satisfactorily installed pavement markers.

2. Unit price bid for each item shall be full compensation for materials, application of raised pavement markings, equipment, labor, tools, and incidentals necessary to complete Work in accordance with the plans and specifications.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for work in the Section is included in total Stipulated Price.

1.03 MATERIAL

A. All Jiggle Bar Tiles shall conform to the requirements of TxDOT DMS-4100, “Jiggle Bar Tiles.”

B. Raised Pavement Markers shall conform to the requirements of TxDOT DMS-4200, “Pavement Markers (Reflectorized).”

C. Traffic Buttons shall conform to the requirements of TxDOT DMS-4300, Traffic Buttons.”

D. Testing. The Engineer reserves the right to perform any or all tests required by this item as a check on the tests reported by the manufacturer. Upon request, the Contractor shall furnish, free of charge, samples of the material of the size and in the amount determined by the Engineer for test purposes. In case of any variance, the Engineer’s tests will govern.

1.04 EQUIPMENT

A. Provide the necessary equipment to conduct the work specified herein.

PART 2 PRODUCTS

2.01 CONSTRUCTION

A. The Contractor shall establish guides to mark the lateral location of pavement markings as shown on the plans or as directed by the Engineer. The Engineer shall approve locations of these markings and may authorize necessary adjustments from the plans.

B. The reflective faces of all Type II markers shall be positioned so that the direction of reflection of one (1) face shall be directly opposite to the direction of reflection of the other face.

C. Raised Pavement markers Type I-C shall have clear reflector face towards traffic. Raised pavement markers Type II C-R, shall have the clear face toward the normal traffic flow and the red face toward wrong-way traffic.

D. Unless otherwise shown on the plans or specified by the Engineer, all raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes. The first and last raised pavement marker in a no-passing line shall be a reflective marker. Buttons used to simulate a 10 feet skip lane lines shall be spaced at 40 inches.

E. The pavement markers not placed in accordance with the plans or as directed by the Engineer shall be removed by the Contractor at the Contractor's expense.

F. Removal of existing pavement markers or residual adhesive from a missing pavement marker prior to placement of new or replacement marker(s) shall be in conformance with Section 02762, "Blast Cleaning of Pavement." The portion of the highway surface to which the raised pavement marker is attached by the adhesive shall be clean and free of dirt, grease, oil, and moisture at the time of installation. Surface preparation for installation of raised pavement markers will not be paid for directly, but shall be considered subsidiary to this item. Unsound pavement or other materials that would adversely affect the bond of the adhesive shall not be an acceptable surface.

G. The hot epoxy adhesive shall be applied so that 100 percent of the bonding area of the raised pavement marker will be in contact and shall be of sufficient thickness so that excess adhesive shall be forced out around the perimeter of the raised pavement marker but without impairing the functional capability of the reflectivity of the pavement marker. When the project is complete, the raised pavement marker shall be firmly bonded to the pavement; lines formed by the raised pavement markers shall be true, and the entire installation shall present a neat appearance.

H. Where required by the Engineer, pavement markings outside the limits of this project will be removed or adjusted to provide for a proper tie into this project. The old markings shall be removed or defaced in such a manner that they do not give the appearance of traffic pavement markings.

END OF SECTION

Section 02765

PREFORMED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install preformed pavement markings, a long-term tape and sheeting pavement marking material to be used for permanent type longitudinal or transverse lines and word/symbol legends.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for preformed pavement markings is on a linear foot basis.

2. Payment for words and symbols is for each word or symbol.

3. Unit price bid for each item shall be full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals necessary to complete Work in accordance with the plans and specifications.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for work in the Section is included in total Stipulated Price.

1.03 MATERIALS

A. All materials shall conform to the requirements of TxDOT DMS-8240 “Permanent Prefabricated Pavement Markings” as shown on the plans. Type A, B, or C prefabricated markings shall be indicated on the plans based upon the traffic conditions of the roadway and the placement method indicated.

1.04 EQUIPMENT

A. Provide the necessary equipment to conduct the work specified herein.

PART 2 PRODUCTS

2.02 CONSTRUCTION

A. General: All markings shall be located as shown in the plans. The contractor shall install the preformed plastic pavement markings to newly paved hot-mix asphaltic concrete pavements by the in-laid method unless the temperature of the pavement has

reached or fallen below the minimum allowable pavement temperature shown in Table 1.

Table 1
Acceptable Pavement Temperatures for Application of Pavement Markings

Hot Mix Asphalt Type Upon Which the Performed Pavement Marking is to be Applied	Surface Temperature Range for Inlaid Method, °F	Minimum Allowable Pavement Temperature for Inlaid Method, °F	Surface Temperature Range for Cold Laid Method, ° F
Open-Graded Friction Course (OGFC)	160 °F to 180 °F	160 °F	60 °F to 120 °F
Stone Matrix Asphalt (SMA)			
Dense Graded Hot Mixed Aspahlt w/PG 76- or 82-XX Asphalt Cement			
Dense Graded Hot Mixed Asphalt w/PG 70-, 64-, or 58-XX Asphalt Cement	120 °F to 155 °F	120 °F	

All material shall be placed according to the manufacturer's instructions, and in accordance with the surface condition, moisture and temperature requirements listed below:

B. Inlaid Preformed Pavement Markings.

This installation procedure shall apply to streets with newly paved asphaltic concrete surfaces that have attained the temperature ranges shown in Table 1 from initial placement. If at any time after initial placement the pavement cools to below the minimum allowable temperature as shown in Table 1, the markings shall be installed as Thermoplastic Pavement Markings per Section 02767 requirements. For portland cement concrete streets, see Cold-Laid Preformed Pavement Markings (next section) below.

The contractor shall place and inlay all pavement markings on the newly placed asphaltic concrete pavement prior to the final rolling of the asphalt.

The preformed pavement markings shall be applied after the newly placed asphaltic concrete pavement has been adequately compacted and within the temperature range specified in Table 1. The Contractor will be required to install temporary pavement markings at no additional cost to the City if the cold-laid method is used. Preformed pavement line markings shall be installed with a mechanical applicator which shall be capable of placing pavement lines in a neat, accurate and uniform manner. The mechanical applicator shall be equipped with a film cut-off device. Word legends and arrows shall be installed by hand and result in neat, accurate and uniform words and arrows. The preformed pavement markings shall be inlaid into the asphaltic concrete surface by means of a mechanical roller. The roller shall be of sufficient weight capacity to inlay the pavement marking to a minimum depth of 65% of the material

thickness, and to not more than 80% of the material thickness while the temperature range of the pavement surface is within the ranges specified in Table 1. In the event the inlaid markings are distorted or discolored to the point that cleaning does not restore its initial appearance by the contractor's operations, fail to provide a uniform appearance, or are installed improperly, such markings shall be removed and replaced in the finished surface of the pavement as Thermoplastic Pavement Markings per Section 02767 requirements at no additional expense to the City.

C. Cold-Laid Preformed Pavement Markings.

This installation procedure applies to all portland cement concrete pavements, existing asphaltic concrete pavement, and newly placed asphaltic concrete that at any time has fallen below the minimum allowable temperature specified in Table 1 after initial placement.

Pavement on which pavement markings are to be placed shall be cleaned and prepared prior to placement of markings. Cleaning shall be in conformance with Section 02762, “Blast Cleaning of Pavement” such that contaminants, loose materials, and conditions deleterious to proper adhesion are removed. When blast cleaning is required, it shall be done to the extent that a sound pavement surface is exposed. Surfaces shall be further prepared after cleaning by sealing or priming, as recommended by the manufacturer. Pavement to which materials to be applied shall be completely dry. Materials shall not be applied until concrete pavement has appeared to be dry for a minimum of four hours and until asphaltic concrete pavement has appeared to be dry for a minimum of two hours.

Pavement and ambient air temperature requirements recommended by the manufacturer shall be observed. If no temperature requirements are established by the manufacturer, material shall not be placed if the surface temperature is outside the acceptable range shown in Table 1 (see column 4 of this table).

END OF SECTION

Section 02767

THERMOPLASTIC PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item includes the application of thermoplastic pavement markings, in conformance with the minimum optical and physical properties required for a thermoplastic road marking compound described herein, in a molten state, onto a pavement surface.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for thermoplastic pavement markings is on a linear foot basis.

2. Payment for words and symbols is for each word or symbol.

3. Payment for green colored pavement markings is on a square foot basis.

4. Payment for railroad crossing markings, to include stop line and two transverse lines, is for each crossing marked. For multi-lane approaches to railroad crossings, the solid 8-inch lines will be measured in linear feet, complete in place.

5. Unit price bid for each item shall be full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals necessary to complete Work in accordance with the plans and specifications.

B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for work in the Section is included in total Stipulated Price.

1.03 MATERIAL

A. All materials shall conform to the requirements of TxDOT DMS-8220 "Hot Applied Thermoplastic." Thermoplastic materials shall be stored in a dry environment to minimize the amount of moisture retained during storage.

B. Materials used for green colored pavement (bicycle green) shall be manufactured with appropriate pigment to ensure that the resulting colors comply with the Light Green color as specified in the FHWA memorandum dated 4/15/2011: "Interim Approval for Optimal Use of Green Colored Pavement for Bike Lanes (IA-14)". Green colored pavement to be defined as transverse markings.

1.04 EQUIPMENT

A. Provide the necessary equipment to conduct the work specified herein. All equipment shall be maintained in good working order such that neat and clean thermoplastic markings are applied at the proper thicknesses and glass beads are placed at the correct rate. Equipment that is deemed deficient by the Engineer shall be replaced immediately.

PART 2 PRODUCTS

2.01 CONSTRUCTION

The appearance of the finished markings shall have a uniform surface, crisp edges with a minimum over-spray, clean cut-off, meet straightness requirements and conform to the design drawings and/or engineer instructions.

The contractor shall provide the Engineer with certification from the marking manufacturer that contractor has been adequately trained and certified to apply the manufacturer's material. This certification shall be considered current if the certification date provided by the manufacturer is within two years of the date of marking application.

All striping and pavement markings shall be placed in accordance with the requirements of this specification, the detailed plans, and the current edition of the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD). The Contractor shall provide all other engineering services necessary for pre-marking of all proposed stripe within the limits of the designated work.

Unless authorized otherwise in writing by the Engineer, striping shall be accomplished during daylight hours. Approved lighting arrangements will be required for night time operations when allowed. The Contractor may be required to place markings over existing markings, as determined by the Engineer. The Contractor shall adjust the operation of the thermoplastic screed shoe to match the previous lengths of stripes and skips, when necessary.

Failure of the striping material to adhere to the pavement surface during the life of the contract shall be prima facie evidence that the materials, even though complying with these specifications, or the application thereof, was inconsistent with the intent of the requirements for the work under the latest City specifications and shall be cause for ordering corrective action or replacement of the marking without additional cost to the City.

Unless otherwise approved by the Engineer, permanent pavement markings on newly constructed pavements surfaced with asphaltic concrete or bituminous seals shall not be applied for a minimum of 14 days or a maximum 35 days. Temporary pavement marking shall be provided during the 14 to 35-day period.

A. Surface Preparation.

1. Moisture**.** All surfaces shall be inspected for moisture content prior to application of thermoplastic. Approximately two square feet of a clear plastic or tar paper shall be laid on the road surface and held in place for 15 to 20 minutes. The underside of the plastic or tar paper shall then be inspected for a buildup of condensed moisture from the road surface. Pavement is considered dry if there is no condensation on the underside of the plastic or tarpaper. In the event of moisture, this test shall be repeated until there is no moisture on the underside of the plastic or tar paper.

2. Cleaning. All surfaces shall be clean and dry, as defined in Section 535.4.A.1, before thermoplastic can be applied. Loose dirt and debris shall be removed by thoroughly blowing compressed air over the area to be striped. If the thermoplastic is to be applied over existing paint lines, the paint line shall be swept with a mechanical sweeper or wire brush to remove poorly adhered paint and dirt that would interfere with the proper bonding or the thermoplastic. Additional cleaning through the use of compressed air may be required to remove embedded dirt and debris after sweeping. Latence and curing compound shall be removed from all new Portland cement concrete surfaces in accordance with Section 02762, "Blast Cleaning of Pavement."

3. Layout. The pavement markings shall be placed in proper alignment with guidelines established on the roadway. Deviation from the alignment established shall not exceed 2 inches and, in addition, the deviation in alignment of the marking being placed shall not exceed 1 inch per 200 feet of roadway nor shall any deviation be abrupt.

   No striping material shall be applied over a guide cord; only longitudinal joints, existing stripes, primer, or other approved type guides will be permitted. In the absence of a longitudinal joint or existing stripe, the Contractor shall mark the points necessary for the placing of the proposed stripe. Edge striping shall be adjusted as necessary so that the edge stripe will be parallel to the centerline and shall not be placed off the edge of the pavement.

   Longitudinal markings shall be offset at least 2-inches from construction joints of Portland cement concrete surfaces and joints and shoulder breaks of asphalt surfaces.

4. Primer Sealer. Primer sealer shall be used on all Portland cement concrete surfaces. A primer sealer shall be used on asphalt surfaces that are over two years old and/or on asphalt surfaces that are worn or oxidized to a condition where 50 percent or more of the wearing surface is exposed aggregate. Existing pavement markings may act as the primer sealer if, after cleaning, more than 70 percent of the existing pavement marking is still properly bonded to the asphalt surface.

5. Primer Sealer Application. When required as described, the primer-sealer shall be applied to the road surface in a continuous film at a minimum thickness of 3 to 5 mils. Before the Thermoplastic is applied, the primer-sealer shall be allowed to dry to a tacky state. The thermoplastic shall be applied within 4 hours after the primer application.

B. Temperature Requirements.

1. Ambient Conditions. The ambient air and road surface shall be 55°F and rising before application of thermoplastic can begin.

2. Material Requirements. Unless otherwise specified by the material manufacturer, the thermoplastic compound shall be heated from 400°F to 450°F and shall be a minimum of 400°F as it makes contact with road surface during application. An infrared temperature gun shall be used to determine the temperature of the thermoplastic as it is being applied to the road surface.

C. Drop-on Glass Sphere Application.

1. Application Rate. Retro-reflective glass spheres shall be applied at the rate of 10 pounds per 100 square feet of applied markings. This application rate shall be determined by confirming the following consumption rates:

   a. 200 pounds of drop on glass spheres per ton of applied thermoplastic when the thermoplastic is being applied at 0.090 inch film thickness.

   b. 150 pounds of drop on glass spheres per ton of applied thermoplastic when the thermoplastic is being applied at 0.125 inch thickness.

2. Application Method. Retro-reflective glass spheres shall be applied by a mechanical dispenser property calibrated and adjusted to provide proper application rates and uniform distribution of the spheres across the cross section of the entire width of the line. To enable the spheres to embed themselves into the hot thermoplastic, the sphere dispenser shall be positioned immediately behind the thermoplastic application device. This insures that the spheres are applied to the thermoplastic material while it is still in the molten state.

D. Application Thickness.

1. Longitudinal and Transverse Markings. On previously unmarked pavements or pavements where markings have been effectively removed, all lane lines, center lines, transverse markings and pavement markings in traffic areas with :S 1 ,000 vehicles per day per lane shall have a minimum film thickness of 0.090 inch at the edges and a maximum of 0.145 inch at the center. A minimum average film thickness of 0.090 inch shall be maintained. On pavements with existing markings, meeting the traffic requirements stated above, all lane lines, center lines, transverse markings and pavement markings shall have a minimum film

thickness of 0.060 inch for re-application over existing strip line.

2. High Wear Longitudinal and Transverse Marking. On previously unmarked pavements or pavements where markings have been effectively removed, all lane lines, center lines, transverse markings and pavement markings in high traffic areas (>1,000 vehicles per day per lane) shall have a minimum film thickness of 0.125 inch at the edges and a maximum of 0.188 inch at the center. A minimum average film thickness of 0.125 inch shall be maintained. On pavements with existing markings, meeting the traffic requirements stated above, all lane lines, center lines, transverse markings and pavement markings shall have a minimum film thickness of 0.090 inch for re-application over existing strip line.

E. Packaging.

1. Containers. The thermoplastic material shall be delivered in 50 pound containers or bags of sufficient strength to permit normal handling during shipment and handling on the job without loss of material.

2. Labeling. Each container shall be clearly marked to indicate the color of the material, the process batch number and/or manufacturer's formulation number, the manufacturer's name and address and the date of manufacture.

F. Acceptance.

1. Sampling Procedure. Random samples may be taken at the job site at the discretion of the City Traffic Engineer for quality assurance. The City reserves the right to conduct the tests deemed necessary to identify component materials and verify results of specific tests indicated in conjunction with the specification requirements.

   The sample(s) shall be labeled as to the shipment number, lot number, date, quantity, and any other pertinent information. At least three randomly selected bags shall be obtained from each lot. A 10 pound) sample from the three bags shall be submitted for testing and acceptance. The lot size shall be approximately 44,000 pounds unless the total order is less than this amount.

2. Manufacturer's Responsibility.

   a. Sampling and Testing. The manufacturer shall submit test results from an approved independent laboratory. All material samples shall be obtained 20 days in advance of the pavement marking operations. The cost of testing shall be included in the price of thermoplastic material. The approved independent laboratory's test results shall be submitted to the City Traffic Engineer in the form of a certified test report.

b. Bill of Lading. The manufacturer shall furnish the Material and Tests Laboratory with copies of Bills of Lading for all materials inspected. Bill of lading shall indicate the consignee and the destination, date of shipment, lot numbers, quantity, type of material, and location of source.

c. Material Acceptance. Final acceptance of a particular lot of thermoplastic will be based on the following.

(1) Compliance with the specification for material composition requirements verified by approved independent laboratory with tests results.

(2) Compliance with the specification for the physical properties required and verified by an approved independent laboratory with test results.

(3) Manufacturer's test results for each lot thermoplastic have been received.

(4) Identification requirements are satisfactory.

3. Contractor's Responsibility.

a. Notification. The contractor shall notify the Construction Inspector 72 hours prior to the placement of the thermoplastic markings to enable the inspector to be present during the application operation. At the time of notification, the Contractor shall indicate the manufacturer and the lot numbers of the thermoplastic that will be used.

A check should be made by the contractor to insure that the approved lot numbers appear on the material package. Failure to do so is cause for rejection.

b. Warranty or Guarantee. If the normal trade practice for manufacturers is to furnish warranties or guarantees for the materials and equipment specified herein, the Contractor shall turn the guarantees and warranties over to the Engineer for potential dealing with the manufacturers. The extent of such warranties or guarantees will not be a factor in selecting the successful bidder.

END OF SECTION

Section 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for curbs, curbs and gutter, and esplanade curbs is on linear foot basis measured along face of curb.

2. Payment for 3 foot concrete valley gutter is on a linear foot basis.

3. Payment for mountable concrete curbs is on a square foot basis.

4. Payment for concrete paving headers and concrete railroad headers is on a linear foot basis.

5. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to concrete pavement.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit details of proposed form work for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Grout: Nonmetallic, non-shrink grout containing no chloride producing agents conforming to following requirements.

1. Compressive strength

a. at 7 days: 3500 psi

b. at 28 days: 8000 psi

2. Initial set time: 45 minutes

3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.

F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Project Manager.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.02 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Section 02752 - Concrete Pavement Joints. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4-inch deep using approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.03 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4-inch edger. Finish edges with tool having 1/4 inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.04 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Project Manager. Use of mechanical methods shall provide specified curb design and finish.

3.05 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 - Concrete Pavement Curing.

3.06 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.07 PROTECTION

A. Maintain curbs and gutters in good condition until completion of Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

Section 02951

PAVEMENT REPAIR AND RESTORATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Repairing and replacing streets, highways, and other pavements as required per street cut ordinance that have been cut, broken, or damaged due to utility excavation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pavement repair and replacement for utility projects is on a square yard basis and includes surface and base materials as required per street cut ordinance.

2. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits in accordance with the street cut ordinance or otherwise shown on drawings.

3. Refer to Section 01270 - Measurement and Payment for other unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Subgrade:

1. Provide backfill material as required by applicable excavation and fill sections (Sections 02315 through 02319) and Section 02330 - Embankment.

2. Provide material for stabilization as required by applicable portions of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and Section 02338 - Portland Cement Stabilized Subgrade.

B. Base: Provide base material as required by applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Crushed Concrete Base Course.

C. Pavement: Provide paving materials as required by applicable portions of Section 02741 - Asphaltic Concrete Pavement, Section 02751- Concrete Paving, Section 02754 - Concrete Driveways, and Section 02771 - Curb, Curb and Gutter, and Headers, and Section 02775 - Concrete Sidewalks.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Notify City prior to commencement of excavation in pavement for which an Excavation in Public Way permits has been obtained. Follow directions contained in the permit.

B. Conform to requirement of Section 02221 - Removing Existing Pavements and Structures, for removals.

C. Saw cut pavement 18 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.

D. When removing pavement to existing deformed metal strip (i.e. dummy joint), saw cut pavement minimum 2 inches deep on opposite side of deformed metal strip. Place saw joint far enough behind deformed metal strip to obtain continuously straight joint. Remove damaged portion of deformed metal strip as required to provide proper joint. Saw cut and remove metal strip before placement of new concrete pavement.

E. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, protect undisturbed subgrade that is to remain to support replacement slab.

F. Dowel in existing pavement where no reinforcement is found or is broken due to construction activities. Unless otherwise directed by Project Manager, provide No. 6 bars 24 inches long, drilled and embedded 8 inches into center of existing slab with 'PO-ROC' epoxy grout or approved equal. Space dowels to match new pavement reinforcement spacing.

G. Provide transitional paving and earthwork as required to tie proposed pavement to existing pavement when unable to dowel new pavement into existing pavement.

3.02 INSTALLATION

A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.

B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings and City of Houston Standard Detail 02951.01. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.

C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings and City of Houston Standard Detail 02751.01. Place types and spacing of joints to match existing or as indicated on Drawings.

D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2 inch depth asphaltic pavement.

E. Repair state highway and county crossings in accordance with TxDOT permit or county requirements as appropriate and within 1 week after utility work is installed.

3.03 WASTE MATERIAL DISPOSAL

A. Dispose of waste material in accordance with requirements of Section 01576 - Waste Material Disposal.

3.04 PROTECTION

A. Maintain pavement in good condition until completion of Work.

B. Replace pavement damaged by Contractor's operations at no cost to City.

END OF SECTION

Section 02960

MILLING PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Milling of existing asphalt or concrete pavement surface as required for installation of speed humps or pavement overlay.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removing existing pavement surface by milling is on a square yard basis. Separate pay items and measurements will be made for milling of asphalt surface or milling of concrete surface as applicable.

2. No separate payment under this section for milling associated with installation of speed humps. Payment for installation of speed humps including cost for milling of existing asphalt or concrete pavement shall be per Section 02741 – Asphaltic Concrete Pavement.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. For milling and installing of speed humps, the contractor shall use an appropriate type of milling machine to remove the existing asphalt or concrete surface as shown. The milling machine shall be capable of milling a minimum 18 inch wide path and also shall be able to turn in tight corners.

B. The teeth of the machine shall be capable of milling concrete or asphalt as appropriate. The equipment for removing the pavement surface shall be a power operated planing machine with a minimum six-foot cutting width. For detail work and for cutting widths less than six feet, equipment with less than six-foot cutting widths will be allowed. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment self-propelled with sufficient power, traction and stability to

maintain accurate depth of cut and slope. The equipment shall be capable of cutting four inches of asphaltic concrete pavement, one inch of portland cement concrete pavement, or a combination of two inches of asphaltic concrete pavement and one half inch portland concrete pavement in one continuous operation.

C. The equipment shall be equipped with an approved automatic dual longitudinal grade control system and a transverse control system unless otherwise directed by the project manager. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including stringline, ski, mobile stringline, or matching shoe. The transverse controls shall have an automatic system for controlling cross slope at a given rate.

D. The grade reference used by the Contractor may be of any type approved by the project manager. Control points shall be established for the finished profile. These points shall be set at intervals not to exceed 50 feet. The Contractor shall set the grade reference from the control points. The grade reference shall have sufficient support so that the maximum deflection shall not exceed 1/16 inch between supports.

E. The machine shall have a manual system providing for uniformly varying the depth of cut while the machine is in motion, thereby making it possible to cut flush to all inlets, manholes, or other obstructions within the paved area. The speed of the machine shall be variable in order to leave the desired grid pattern.

F. The machine shall be equipped with integral loading and reclaiming devices to immediately remove material being cut from the surface of the roadway and discharge the cuttings into a truck, all in one operation. The machine shall be equipped with devices to control dust created by the cutting action.

G. Various machines may be permitted to make trail runs to demonstrate the capabilities of that machine. Any machine that is incapable of meeting the requirements of this Section, in the opinion of the project manager, will not be permitted.

H. A street sweeper equipped with a water tank, spray assembly to control dust, a pick-up broom, a gutter broom, and a dirt hopper shall be provided by the Contractor. The street sweeper shall be capable of removing cuttings and debris from the planed pavement. Other sweeping equipment may be provided in lieu of the street sweeper when approved by the project manager in writing.

I. The Contractor shall provide any other equipment and personnel necessary for proper operation of the planing machine, to minimize dust and to remove cuttings.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. The Contractor shall not mill roadway more than 7 calendar days prior to construction.

B. If Contractor does not install speed hump in the specified time, the City, without notice to the Contractor, may effect repairs to the milled area and deduct the cost of the expense incurred by the City for repair work from currently due or future invoiced amounts.

3.02 MILLING

A. The existing pavement to within 1 foot of the face of the curb shall be removed for a depth of one inch or otherwise designated or shown on drawing for milling of the existing pavement.

B. The pavement surface shall be removed for the length, depth and width and to the typical section shown on drawings. The planed surface shall provide a satisfactory riding surface free from gouges, continuous longitudinal grooves, ridges, oil film and other imperfections of workmanship and shall have a uniform textured appearance.

C. When removing an asphaltic concrete pavement from an underlying portland cement concrete pavement, all of the asphaltic concrete pavement shall be removed, leaving a uniform surface of portland cement concrete, unless otherwise directed by the project manager.

D. Any vertical or near vertical longitudinal face exceeding 1 ¼ inches in height in the pavement surface open to traffic at the end of a work period shall be sloped a minimum of 1:1. Transverse faces that are present at the end of a work period shall be tapered in a manner acceptable to the project manager.

E. Loose portland cement concrete material from the operation shall be disposed of at sites obtained by the Contractor or otherwise approved by the project manager. All materials removed under this contract become the property of the Contractor. Contractor shall legally dispose of all such removed materials.

F. Pavement that is not removed by the planing machine adjacent to steep curbs, inlets, manholes or other obstructions shall be removed by other methods acceptable to the project manager.

G. The pavement and curb surfaces shall be swept with a street sweeper or other sweeping equipment to remove all debris leaving a clean and presentable condition.

H. Milling is required along the outside perimeter of the hump to the depth of one inch on both concrete and asphalt pavement. Mill the existing pavement to within one foot of the curb face.

3.03 PROTECTION

A. Damage to water valve, water meters, manholes, curbs or other improvements shall be repaired or replaced at no additional cost to the City.

3.04 SURFACE TEXTURE AND TESTS

A. In areas where traffic will be permitted, the texture product shall be a grid pattern or any other pattern with discontinuous longitudinal striations that will provide, in the opinion of the project manager, a satisfactory temporary riding surface.

B. The surface of the pavement, after planing, shall be ready for HMAC overlay and shall be true to the established line, grade and cross section. The pavement surface, when tested with a 10-foot straightedge placed parallel to the centerline of the roadway or tested by other equivalent or acceptable means, shall not have any deviation greater than 1/8 inch in 10 feet. The deviations shall be measured from the top of the texture. Any point in the surface not meeting this requirement shall be corrected as directed by the project manager at the Contractor's expense.

END OF SECTION