SECTION 32 11 23

RECYCLED CONCRETE FLEXIBLE BASE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This item governs furnishing and placing a crushed recycled concrete base course. "Recycled Concrete Flexible Base" shall be constructed on an approved, prepared surface in one or more courses conforming to the typical sections and to the lines and grades, indicated on the Drawings or established by the Engineer or designated representative.

B. ~~This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.~~

1.2 MEASUREMENT AND PAYMENT

A. Work and accepted materials as prescribed for this item will be measured by the ~~cubic~~ square yard, complete in place, as indicated in the Contract Documents.

B. ~~Prime coat will not be measured or paid for directly, but shall be included in the unit price bid for "Recycled Concrete Flexible Base."~~

C. The work performed and materials furnished as prescribed by this item, and measured as provided under "Measurement", will be paid for at the unit bid price for "Recycled Concrete Flexible Base". The unit bid price shall include full compensation for all work specified herein, including the furnishing, hauling, placing and compacting of all materials; for rolling, proof rolling, re-compacting and refinishing; for all water required; for retesting as necessary; for priming; and for all equipment, tools, labor and incidentals necessary to complete the Work.

1.3 SUBMITTALS

The submittal requirements of this specification item may include:

A. Source, gradation and test results for the crushed recycled concrete material.

B. Notification that the crushed recycled concrete stockpile is completed and ready for testing.

C. Certification of compliance with TXDOT DMS 11000, "Evaluating and Using Non-hazardous Recyclable Material Guidelines".

D. Field density test results for in-place compacted flexible base.

PART 2 – PRODUCTS

2.1 MATERIALS

A. MINERAL AGGREGATE

The material shall be crushed recycled concrete meeting the requirements specified herein. The material shall be from sources approved by the City and shall consist of durable crushed recycled concrete that has been screened to the required gradation.

The recycled concrete material shall be free from lumps of clay or other objectionable materials and shall not contain metals, wood, brick, plastics, or other unacceptable debris. Deleterious material shall meet the standards of Tex 413-A.

B. ASPHALTIC MATERIAL

Prime Coat. Prime Coat shall conform to the requirements of Section 31 12 13.23 - "Prime Coat", except for measurement and payment.

C. STORAGE OF MATERIALS

1. The stockpile shall be constructed on a relatively smooth area that has been cleared of debris, weeds, brush, trees and grass. Stockpiles shall contain between 25,000 and 50,000 cubic yards ~~(19,100 to 38,200 cubic meters)~~. The stockpile shall be constructed using scrapers, bottom dumps or other similar equipment that allows dumping and spreading without re-handling. The stockpile shall be constructed to allow dumping and spreading in one direction only. The height of the stockpile shall not exceed the capabilities of available equipment to make a full cut (bottom to top) on any of the four sides.

2. A stockpile shall be completed before being tested by the City. The Contractor's supplier shall notify the City when a stockpile has been completed and is ready to be tested. The stockpile shall not be added to after it has been tested.

3. The Contractor shall provide material only from stockpiles that have been inspected, tested and accepted by the City. A ticket showing the date, source, stockpile number, and net weight (mass) shall be provided to the Inspector with each load of material delivered to the Project.

4. Because of its high absorptive properties, the recycled concrete material contained in a stockpile can potentially lose strength with subsequent moisture addition. As a consequence the City may require additional testing if an unprotected stockpile is exposed to significant extended rainfall or a stockpile remains open for an extended period of time.

5. Material shall be loaded from the stockpile by making successive vertical cuts through its entire depth.

2.2 TESTING REQUIREMENTS

A. Recycled concrete flexible base materials shall be tested according to the following TxDoT standard test methods:

a) Preparation for Soil Constants and Sieve Analysis	Tex-101-E
b) Liquid Limit*	Tex-104-E
c) Plastic Limit	Tex-105-E
d) Plasticity Index	Tex-106-E
e) Sieve Analysis	Tex-110-E
f) Wet Ball Mill**	Tex-116-E
g) Triaxial Test	Tex-117-E, Part II
h) Deleterious Materials	Tex-413-A

* Plasticity Index shall be determined in accordance with Tex-107-E (Linear Shrinkage) when liquid limit is unattainable as defined in Tex- 104-E.

** When a soundness value is required on the drawings, the material shall be tested in accordance with Tex-411-A.

The recycled concrete base material shall be stockpiled after crushing, then tested by the City's designated laboratory and approved by the Engineer or designated representative prior to being hauled to the Project.

The recycled concrete material shall be well graded and shall meet the following requirements. Additives such as but not limited to lime, cement or fly ash shall not be used to modify the aggregates to meet the requirements unless specified otherwise on the drawings.

Sieve Designation		Other Requirements	% Retained	
US	~~SI~~			
1 3/4"	~~45 mm~~		0	
7/8"	~~22.4 mm~~		10-35	
3/8"	~~9.5 mm~~		30-50	
#4	~~4.75 mm~~		45-65	
#40	~~425 □m~~		70-85	
		Maximum Plasticity Index		10
		Maximum Wet Ball Mill		42
Maximum Increase in passing #40 (425 □m) sieve from Wet Ball Mill Test			20	

Minimum compressive strength when subjected to the triaxial test shall be 35 psi at 0 psi lateral pressure [240 kiloPascal (kPa) at 0 kPa lateral pressure] and 175 psi at 15 psi lateral pressure [1200 kiloPascal (kPa) at 100 kPa lateral pressure].

B. Test Sampling:

The Contractor's supplier may choose the method of sample gathering for testing by the City's laboratory as follows:

1. The supplier shall make a full-height cut a sufficient distance into each side of the stockpile to obtain a uniform sample. The four samples (one from each side of the stockpile) shall then be combined and mixed into a single "test" specimen from which the City's laboratory can obtain a sample.

2. As the stockpile is constructed, a perpendicular cut will be made across the spreading direction at every two feet to four feet ~~(0.6 to 1.2 meters)~~ of height and the sample used to start a "mini" stockpile. The process shall be repeated in two feet to four feet ~~(0.6 to 1.2 meter)~~ increments of height, until the stockpile and the "mini" stockpile are completed. Samples shall be obtained from the "mini" stockpile in the same manner described in (1) above.

C. Testing and Acceptance:

When initial tests indicate that the material is unacceptable, the City may, if requested by the Contractor's supplier, sample and test the material one more time. The additional sampling and testing shall be paid for by the supplier.

2.3 CONSTRUCTION METHODS

A. Preparation of Subgrade:

Recycled concrete flexible base shall not be placed until the Contractor has verified by proof rolling that the subgrade has been prepared and compacted in conformity with Standard Specification ~~Item 201S~~ Section 32 11 16, "Subgrade Preparation and Compaction," to the typical sections, lines and grades indicated on the Drawings. Any deviation shall be corrected and proof rolled prior to placement of the flexible base material.

The Contractor shall not place recycled concrete flexible base until the subgrade has cured to the satisfaction of the Engineer or designated representative, regardless of whether or not the subgrade has been successfully proof rolled. As a minimum, this will be after the surface displays no damp spots and there is no evidence of "sponginess" in the subgrade.

B. First Lift:

Immediately before placing the recycled concrete flexible base material, the subgrade shall be checked for conformity with grade and section. The thickness of each lift of flexible base shall be equal increments of the total base depth. No single lift shall be more than six inches ~~(150 mm)~~ or less than three inches ~~(75 mm)~~ compacted thickness.

The material shall be delivered in approved vehicles. It shall be the responsibility of the Contractor to deliver the required amount of material. If it becomes evident that insufficient material was placed, additional material as necessary shall be delivered and the entire course scarified, mixed and compacted.

Material deposited upon the subgrade shall be spread and shaped the same day unless otherwise approved by the Engineer or designated representative. In the event inclement weather or other unforeseen circumstances render spreading of the material impractical, the material shall be spread as soon as conditions allow.

Additionally, if the material cannot be spread and worked the same day it is deposited, the Contractor shall "close up" the dump piles before leaving the job site. "Closed up" shall be defined as the use of a motor grader to blade all dump piles together, leaving no open space between piles.

The material shall be spread, sprinkled, if required, then thoroughly mixed; bladed, dragged and shaped to conform to the typical sections indicated on the Drawings.

All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material.

Each lift shall be sprinkled as required to bring the material to optimum moisture content, and then compacted to the extent necessary to provide not less than the percent density specified in Section ~~P212S.5.D~~ 2.3.D, "Density." In addition to the requirements specified for density, the full depth of recycled concrete flexible base material shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of recycled concrete flexible base material is completed, tests, as necessary, will be made by the Engineer or designated representative. As a minimum, three in-place density tests per section per day will be taken. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. All initial density testing will be paid for by the City. All retesting shall be paid for by the Contractor.

Throughout the entire operation, the surface of the material shall be maintained by blading and, upon completion, shall be smooth and shall conform to the typical section

indicated on the Drawings and to the established lines and grades.

In that area on which pavement is to be placed, any deviation in excess of 1/4 inch ~~(6.5 mm)~~ in cross section or 1/4 inch in a length of 16 feet ~~(6.5 mm in a length of 5 meters)~~ measured longitudinally shall be corrected by loosening, adding or removing material, and by reshaping and re-compacting. All irregularities, depressions or weak spots shall be corrected immediately by scarifying the areas affected, adding suitable material as required, and by reshaping and re-compacting. Should the lift, due to any reason or cause, lose the required stability, density and/or finish before the surfacing is complete, it shall be re-compacted and refinished at the Contractor's expense.

C. Succeeding Lifts:

Construction methods for succeeding lifts shall be the same as prescribed for the first lift. For that lift of the recycled concrete flexible base upon which the curb and gutter will be constructed, as well as the last recycled concrete flexible base lift (i.e. top of the recycled concrete flexible base), the Contractor shall check the surface of the lift for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 feet ~~(15 meters)~~ on the centerline, at quarter points, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings.

When the thickness of a particular lift of the flexible base is in question, the Contractor shall check the surface of the lift for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 feet ~~(15 meters)~~ on the centerline, at quarter points, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings

D. Density:

The recycled concrete flexible base shall be compacted to not less than ~~100 percent density as determined by TxDoT Test Method Tex-113-E.~~ ninety five percent (95%) of the modified density (ASTM D1557). The allowable deviation from optimum moisture content is to +4%.

Field density determination shall be made in accordance with TxDoT Test Method Tex-115-E unless otherwise approved by the Engineer or designated representative. Each lift of the recycled concrete flexible base shall also be tested by proof rolling in conformity with Standard Specification ~~Item 236S~~ Section 32 11 29.02, "~~Proof~~ Rolling."

E. Priming:

Because of its high absorptive properties, the recycled concrete material can potentially lose strength if not protected from subsequent moisture addition. Consequently after the recycled concrete flexible base material has been compacted to not less than ~~100~~ ninety five percent (95%) density, and tested by proof rolling, a prime coat will be applied in accordance with Standard Specification ~~Item 306S~~ Section 32 12 13.23, "Prime Coat."

F. Curing:

Pavement materials, such as a tack coat or surface course, shall not be placed on the primed surface until the prime coat has been absorbed into the recycled concrete base course. At least 24 hours, or longer if designated by the Engineer or designated representative, shall be allowed when cutback asphalt is used as the prime coat.

END

~~SPECIFIC CROSS REFERENCE MATERIALS~~

~~City of Austin Standard Specifications~~

~~Designation~~	~~Description~~
~~Item No. 201S~~	~~Subgrade Preparation~~
~~Item No. 236S~~	~~Proof Rolling~~
~~Item No. 306S~~	~~Prime Coat~~

~~Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges~~

~~Designation~~	~~Description~~
~~Tex-101-E~~	~~Preparation of Soil and Flexible Base Materials for Testing Tex-~~
~~104-E~~	~~Determination of Liquid Limit of Soils~~
~~Tex-105-E~~	~~Determination of Plastic Limit of Soils~~
~~Tex-106-E~~	~~Method of Calculating the Plasticity Index of Soils~~
~~Tex-107-A~~	~~Determination of Bar Linear Shrinkage of Soils Tex-~~
~~110-E~~	~~Determination of Particle Size Analysis of Soils~~
~~Tex-113-E~~	~~Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials and Cohesionless Sands~~
~~Tex-115-E~~	~~Field Method for Determination of In-Place Density of Soils and Base Materials~~
~~Tex-116-E~~	~~Ball Mill Method for Determination of the Disintegration of Flexible Base Material~~
~~Tex-117-E~~	~~Triaxial Compression Tests for Disturbed Soils and Base Materials~~
~~Tex-411-A~~	~~Soundness of Aggregate By Use Of Sodium Sulfate Or Magnesium Sulfate~~
~~Tex-413-A~~	~~Determination of Deleterious Material in Mineral Aggregate~~

~~Texas Department of Transportation: Departmental Material Specifications~~

~~Designation~~	~~Description~~
~~DMS-11000~~	~~Guidelines for Evaluating and Using Nonhazardous Recyclable Materials (NRMs) in TxDOT Projects~~

~~American Society for Testing and Materials (ASTM)~~

~~Designation~~	~~Description~~
~~ASTM C-1580~~	~~Standard Test Method for Water-Soluble Sulfate in Soil~~

~~RELATED CROSS REFERENCE MATERIALS~~

~~City of Austin Standard Specifications~~

~~Designation~~	~~Description~~
~~Item No. 210S~~	~~Flexible Base~~

~~City of Austin Standard Details~~

~~Designation~~	~~Description~~
~~No. 1000S-2~~	~~Flexible Base with Asphalt Surface Trench Repair-Existing Pavement No. 510S-3~~
	~~Typical Trench with Paved Surface~~
~~No. 1000S~~	~~Bus Stop Paving~~
~~No. 1000S-10~~	~~Local Street Sections~~
~~No. 1000S-11(1)~~	~~Residential and City of Austin Neighborhood Collector Street Sections No.~~
~~1000S-11(2)~~	~~Industrial and Commercial Collector Street Sections~~

~~No. 1000S-12(1) Primary Collector Street Sections~~
~~No. 1000S-12(2) Primary Arterial Street Sections~~
~~No. 1000S-13(1) Minor Arterial Street Sections (4 Lanes)~~
~~No. 1000S-13(2) Minor Arterial Street Sections (4 Lanes divided) No. 1000S-14 Major Arterial Street Sections~~

~~City of Austin Utility Criteria Manual~~

~~Designation~~	~~Description~~
~~Section 5.8.2~~	~~Flexible Base~~
~~Section 5.7.3~~	~~Flexible Base with Asphalt Surface~~
~~Section 5.9.1~~	~~Excavation in Alley~~

~~City of Austin Transportation Criteria Manual~~

~~Designation~~	~~Description~~
~~Section 3.2.0~~	~~General Criteria~~
~~Section 3.4.3 .D~~	~~Layer Data-Minimum Thickness~~
~~Table 3-1~~	~~Minimum Layer Thickness Section~~
~~3.4.3 .F~~	~~Layer Data- Minimum Thickness~~
~~Table 3-2~~	~~Layer Thickness Increment Section~~
~~3.4.3 .J~~	~~Layer Data- Stiffness Coefficient~~
~~Table 3-3~~	~~Stiffness Coefficient~~
~~Table 3-9~~	~~Recommended Salvage values~~
~~Table 3-10~~	~~AASHTO Layer Coefficients~~