



Public Works Department – Engineering Division

May 2, 2024

ADDENDUM NO. 3

PROJECT 2040, 2023/24 PAVEMENT MANAGEMENT

NOTICE TO BIDDERS:

The following clarifications, amendments, additions and/or deletions as set forth herein shall apply to the above project contract documents and shall be made a part thereof and shall be subject to all the requirements thereof as though originally specified and/or shown. Submitters shall assure themselves that all addendum changes have been incorporated into their proposal.

A. ADDITIONS/DELETIONS

1. **Additions:** the attached Specification was added for asphalt rubber chip seal. See attachment.

B. CLARIFICATIONS/QUESTIONS

Please be advised of the following clarifications to the contract documents:

1. Question: "What aggregate size does the City want? Addendum #2 states "Chip seal must be rubberized. Rubberized chip seal ingredients must be in compliance with CalRecycle Grant and the authorized mix design. Cal Recycle does not have a specification, please clarify."

Answer: The attached specification shall be used for chip seal mix design.

BIDDERS MUST SIGN AND ATTACH one (1) copy of this addendum document to the proposal as acknowledgment of receipt of these instructions and that said addendum was properly evaluated in the proposal.

ANY PROPOSAL NOT IN COMPLIANCE WITH THIS ADDENDUM MAY BE REJECTED.



Issued: 05/02/24

Dayne Johnson, P.E.
Assistant City Engineer

ADDENDUM NO. 3, PROJECT 2040, 2023/24 PAVEMENT MANAGEMENT is hereby acknowledged and was considered in this Project Proposal.

Bidder's Signature

Date

Firm Name

Mailing Address

City/State/Zip+4

SPECIFICATION FOR ASPHALT RUBBER CHIP SEAL

1. DESCRIPTION

GENERAL

This project shall consist of a bituminous surface Stress Absorbing Membrane Interlayer (SAMI) composed of a single application of Asphalt-Rubber material and hot pre-coated 3/8" aggregate.

This specification requires the application of a specified blend of asphalt-rubber binder material (i.e. a field blend product). This specification expressly determines that the asphalt-rubber binder material specified herein (i.e. a field blend product) and modified binder, rubber modified asphalt or PG 76-22TR (i.e. terminal blend products) are sufficiently different such that they are not functionally equivalent. Therefore, any substitutions for the asphalt-rubber binder material specified herein, such as but not limited to any rubber modified asphalt binder (i.e. a terminal blend product) will not be accepted.

This project requires the application of asphalt rubber binder at a reduced rate in the wheel path of up to 0.15 gal/sq yd. Asphalt rubber binder seal coats applied to roadways with high truck traffic volume and high pavement temperatures may be susceptible to bleeding and/or flushing in the wheel paths. The Department's specification for asphalt rubber binder neither specifies nor requires patented or proprietary materials, equipment, devices, or processes.

2. MATERIAL COMPONENTS

2.1 ASPHALT CEMENT

The type and grade of PG asphalt cement utilized to manufacture the Asphalt Rubber binder shall be PG 58-22, PG 64-16, or PG 70-10 which shall comply with requirements in Table #1.

Table #1 – PG Asphalt Cement Grading Requirements

Climate	PG Grading
Cold	PG 58-22
Moderate	PG 64-16
Hot	PG 70-10

- *The exact grade of PG asphalt cement, if different than PG 64-16, shall be determined by the Asphalt Rubber supplier dependant on the specific project requirements.*

2.2 GRANULATED RECLAIMED TIRE RUBBER

The CRM shall be produced primarily from the processing of whole automobile and truck tires. The rubber shall be produced by ambient temperature grinding processes only. The gradation of the CRM when tested in accordance with ASTM C-136 (dry sieve only) and using a 100 gram sample, shall meet the requirements in Table #2.

Table #2 - CRM Grading Requirements

Sieve Size	Reclaimed Tire CRM Percent Passing
#8 (2.36 mm)	100
#10 (2 mm)	95 - 100
#16 (1.18 mm)	45 - 75
#20 (. mm)	---
#30 (600 μm)	2 - 20
#50 (300 μm)	0 - 10
#200 (75 μm)	---

The use of CRM from multiple sources is acceptable provided that the overall blend of rubber meets the gradation requirements.

The individual CRM particles, irrespective of diameter, shall not be greater in length than 3/16 of an inch (5mm).

The CRM shall have a specific gravity of 1.15 ± 0.05 as determined by, and shall be free of loose fabric, wire and other contaminants except that up to 4 percent (by weight of rubber) calcium carbonate or talc may be added to prevent the rubber particles from sticking together. The rubber shall be sufficiently dry so as to be free flowing and not produce a foaming problem when blended with the hot asphalt cement. The CRM shall be accepted by certification from the approved supplier. The Reclaimed Tire CRM material shall conform to the chemical analysis in Table # 3.

Table #3 - Reclaimed Tire CRM Chemical Requirements

Test	ASTM Test Method	Minimum	Maximum
Acetone Extract	D 297	6.0 %	16.0 %
Ash Content	D 297	---	8.0 %
Carbon Black Content	D 297	28.0 %	38.0 %
Rubber Hydrocarbon	D 297	42.0 %	65.0 %
Natural Rubber Content	D 297	22.0 %	39.0 %

2.3 ASPHALT RUBBER BINDER

The temperature of the blended PG asphalt cement shall not be less than 375° F nor more than 450° F when the CRM is homogeneously blended, in the field. The combined materials shall be reacted for a minimum of 120 minutes after the incorporation of all the CRM. The Asphalt Rubber binder shall meet the requirements in Table #4, when the reaction/interaction is complete.

Table #4 - Specification Limits for (Asphalt Rubber Binder)

		Hot Climate	Moderate Climate	Cold Climate
Apparent viscosity, 347° F Spindle 3 @ 12 RPM: cps (ASTM D2669)	Min	1500	1500	1500
	Max	3500	3500	3500
Cone Penetration, 77° F (25° C), 150g, 5 sec; 1/10 dm (ASTM D217)	Min	15	20	25
	Max	45	70	100
Softening Point, (° C) (ASTM D36)	Min	64° C	62° C	60° C
Resilience, 77° F (25° C), % (ASTM D3407)	Min	40	35	25

The viscosity shall be conducted by using a hand held HAAKE VISCOMETER, with rotor 1, 24mm in depth x 53mm in height, or equivalent. When applying Asphalt Rubber, the reacted Asphalt Rubber binder shall be maintained at a temperature of not less than 375° F and no more than 425° F. If material in a batch of Asphalt Rubber binder is not used within six hours after the reaction period is complete, heating of the material shall be discontinued. When applying Asphalt Rubber, if the Asphalt Rubber binder temperature cools below 300° F and is then reheated, it shall be considered a reheat cycle. The total number of reheat cycles shall not exceed two (2). The binder materials shall be uniformly reheated to a temperature of not less than 320° F for application. Additional scrap tire CRM may be added to the reheated Asphalt Rubber binder and reacted for a minimum of 120 minutes and shall not exceed 10 percent of the total binder weight. Reheated Asphalt Rubber binder shall conform to the requirements for blended Asphalt Rubber binder.

2.4 ASPHALT RUBBER BINDER FORMULATION

The Asphalt Rubber binder supplier, shall furnish to the Engineer within 15 days of the notice to proceed, the Asphalt Rubber binder formulations which shall contain the following information:

PG Asphalt Cement

Source of PG Asphalt

Grade of PG Asphalt

Percentage of PG Asphalt by total weight of the Asphalt Rubber mixture

Reclaimed Tire Rubber (CRM)

Source of CRM

Grade of CRM

Percentage of CRM by total weight of the Asphalt Rubber mixture

2.5 AGGREGATE COVER MATERIAL

Aggregate shall be composed of clean and durable crushed rock or crushed gravel conforming to the following requirements:

If the aggregate is to be crushed stone, it shall be manufactured from sound, hard, durable material of accepted quality and crushed to specification size. All strata, streaks and pockets of clay, dirt, sandstone, soft rock or other unsuitable material accompanying the sound rock shall be discarded and not allowed to enter the crusher.

If the aggregate material is to be crushed gravel, it shall consist of hard, durable fragments of stone or gravel of accepted quality and crushed to specification size. All strata, streaks, pockets of sand, excessively fine gravel, clay or other unsuitable material including all stones, rocks and boulders of inferior quality shall be discarded and not allowed to enter the crusher. The crushing of the gravel shall separate the #4, 3/8 and 1/2 inch sieves and shall have a minimum 95% of the particles with a minimum of one mechanically fractured face and 90% of the particles shall have a minimum of two mechanically fractured faces.

The crushed aggregate or crushed gravel shall not contain more than 8% by weight of flat or elongated pieces and shall be free from wood, roots and vegetable or other organic extraneous matter. The 3/8 inch crushed aggregate or crushed gravel shall have a minimum Cleanliness Value (CV) of 80 and shall have a percentage of wear not more than 7 percent at 100 revolutions and not more than 30 percent at 500 revolutions, as determined by ASTM C131 or California Test Method 211.

The crushed aggregate for Asphalt Rubber binder applications shall meet the requirements for gradation given in Table 5.

Table 5 - Aggregate Gradation Requirements –Asphalt Rubber

1/2 inch Asphalt Rubber Aggregate Gradation	
Sieve Size	Percent Passing
1/2 inch (12 mm)	95-100
3/8 inch (9 mm)	70 – 85
1/4 inch (4.75 mm)	0 – 15
#8 (2.36 mm)	0 – 5
#200 (75 µm)	0 – 1
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The aggregate to be utilized shall be hot pre-coated with 0.5 to 1.0 percent PG asphalt cement. The Engineer shall determine the appropriate amount of pre-coat. At no time shall the bag house fines be allowed to be reintroduced back into the hot coated aggregate. The pre-coated aggregate shall have a “salt and pepper” appearance and shall be supplied to the project site at 225° F to 325° F.

3. EQUIPMENT

3.1 GENERAL

The equipment used by the contractor for pavement cleaning and excess aggregate removal shall include operational top dumping pick-up brooms.

3.2 ASPHALT RUBBER EQUIPMENT

All equipment utilized in the production and application of AR binder material shall be described as follows:

- a) A PG asphalt cement heating tank with a hot oil heat transfer system or a retort heating system capable of heating the PG asphalt cement to the proper temperature for blending with the CRM.
- b) An Asphalt Rubber mechanical blender shall have a two-stage continuous mixing process capable of producing a homogenous blend of PG asphalt cement and CRM, at the mix design specified ratios, as directed by the engineer. The mechanical blender shall be equipped with a dual hopper granulated rubber feed system capable of supplying the PG asphalt cement feed system, as not to interrupt the continuity of the blending process. The maximum capacity of the primary blending vessel shall be 500 gallons. Both the primary and secondary blenders shall be equipped with an agitation device orientated vertically in the blending vessel. The mechanical blender shall be capable of fully blending the individual modifier particles (CRM) with the PG asphalt cement. A separate PG asphalt cement feed pump and finished product pump are required. This unit shall have a PG asphalt cement totalizing meter in gallons and a flow rate meter in gallons per minute.
- c) A distributor truck equipped with a heating unit, and an internal mixing device capable of maintaining a uniform mixture of PG asphalt cement and CRM. It shall be equipped with a full circulating spreader bar and pumping system capable of applying the Asphalt Rubber binder material within a 5% tolerance of the specified application rate, and must achieve a uniform covering of the surface to be treated. The distributor shall have a boot board on the rear of the vehicle and a bootman shall accompany the distributor. The bootman shall ride in a position so that all the spray bar tips are in full view and readily assessable for unplugging, if a plugged tip should occur. The distributor truck shall also require a thermometer and a computer rate control (CRC)

3.3 AGGREGATE COVER MATERIAL SPREADER

The cover material (chip) spreader shall be a self-propelled machine with an aggregate receiving hopper in the rear, belt conveyors to carry the pre-coated aggregate to the front, and a full width spreading hopper. The spreader shall be in good mechanical condition and shall be capable of applying the cover aggregate uniformly across the spread width and at the specified application rate, and heat-treated belts should be installed on the chip spreader.

3.4 ROLLING EQUIPMENT

Sufficient rollers shall be used to cover the width of the aggregate spread with one pass. The first pass shall be made immediately behind the aggregate spreader as the aggregate is being placed. Three (3) complete passes with the pneumatic tire rollers shall be made. The pneumatic-tired rollers' shall carry a minimum loading of 3,000 pounds on each wheel and a minimum pressure of 90 pounds per square inch in each tire. Foam filled tires can be utilized.

3.5 HAULING EQUIPMENT

Trucks for hauling the pre-coated cover aggregate shall be tailgate discharge and shall be equipped with a device to lock onto the hitch of the cover material spreader. Haul trucks shall also be compatible with the cover aggregate spreader so that the dump bed will not push down on the spreader when fully raised, or have too short of a bed which results in aggregate spillage while dumping into the receiving hopper.

4. **CONSTRUCTION METHODS**

4.1 GENERAL

Immediately prior to the application of the Asphalt Rubber binder chip seal application, the surface shall be clean in order to insure adequate adhesion of the Asphalt Rubber to the existing pavement surface.

WEATHER CONDITIONS

Asphalt Rubber binder material shall be applied only when the existing surface is dry and the atmospheric temperature is above 50° F and rising. No material shall be applied when predicted chance of rain is higher than 75 % or when the wind is in excess of 20 mph, as directed by the Engineer.

4.2 ASPHALT RUBBER BINDER - MIXING AND REACTION

Concerning the Asphalt Rubber binder, the percentage of Reclaimed Tire Rubber CRM shall be a minimum of 18 percent by weight of the total Asphalt Rubber mixture; the exact CRM content shall be determined by the binder design submitted by the Asphalt Rubber supplier. During Asphalt Rubber binder manufacture the CRM percentage shall not fluctuate by more than 1 (one) percent by weight of total Asphalt Rubber mixture, as determined by the original laboratory binder design. .

The temperature of the PG asphalt cement shall be between 375° F and 450° F at the addition of the CRM. The PG asphalt cement, CRM shall be combined and mixed together in the Asphalt Rubber binder, and reacted in the distributor truck or a reaction vessel for a minimum period of 120 minutes from the time the CRM is blended with the PG asphalt cement. The temperature of the Asphalt Rubber binder shall be above 375° F during the reaction period, but shall not exceed 425° F at any time.

When a job delay occurs after full reaction, the Asphalt Rubber binder may be allowed to cool. For application, the Asphalt Rubber binder shall be re-heated slowly just prior to application to a temperature between 375° F and 425° F. An additional quantity of PG asphalt cement and/or CRM may be added to only to Asphalt Rubber binder as required to produce a material with the appropriate viscosity.

4.4 APPLICATION OF ASPHALT RUBBER BINDER

Placement of the Asphalt Rubber shall proceed only under the following conditions:

- a) The pavement surface temperature shall be 60° F and rising.
- b) The pavement surface is clean and dry.
- c) The wind conditions do not exceed 20 mph.
- d) All of the construction equipment such as the Asphalt-Rubber distributor, aggregate spreader, haul trucks loaded with cover material, rollers and brooms are in position and ready to commence placement operations.
- e) Chance of rain does not exceed 75%.

Asphalt Rubber binder shall be applied to the roadway following the mixing, reacting and blending of Asphalt Rubber binder at a rate of 0.55 to 0.65 gallons per square yard.

Distributor bar height, tip size, distribution, speed and shielding materials shall be utilized to reduce the effects of excess wind upon the spray distribution (fan), of each binder. The Engineer shall delay or reschedule work when high gusting or dusty winds in excess of 20 mph prevent or adversely affect binder or aggregate application.

The application of Asphalt Rubber binder to areas not accessible with the distributor bar on the distributor truck shall be accomplished by using a squeegee or other means approved by the Engineer. The application width shall not exceed 12 feet at any time. Spreader trucks must be equipped with a 12-foot spray bar and single fold wings. Other spray bar configurations will not be allowed.

This project allows the application of asphalt rubber binder at a reduced rate in the wheel path of up to 0.15 gal/sq yd. Asphalt rubber binder seal coats applied to roadways with high truck traffic volume and high pavement temperatures may be susceptible to bleeding and/or flushing in the wheel paths.

Apply the asphalt rubber binder at a reduced rate in the wheel path of up to 0.15 gal/sq yd. The Engineer determines the exact rate. Verify the application rate in the wheel path and the non-wheel path daily, by the California Test 339M, modified as follows:

A. Scope

Modified California Test 339 describes the procedure for determining the transverse spread rate of a bituminous distributor in gallons per square yard.

B. Apparatus

1. Balance sensitive to 0.1 gram with a minimum capacity of $\pm 2,000$ grams.
2. Suitable weighing box with windshield or enclosed area for balance to ensure no impacts from wind conditions.
3. Balance table and/or work bench.

C. Materials

1. 8" x 12" Galvanized Sheet Metal Plates -28 gauge. Verify size of the metal plates used in calculations in Section F.
2. Polyester Filter Roll material.
3. Cementing material.
4. 10" x 13" min. - Manila Envelopes.
5. 30 pound Roofing Felt

Paper. Note:

The roofing felt paper is available at most home supply stores or roofing suppliers.

D. Preparation of the Test Plates

1. Cut the polyester material from the roll to an 8" x 12" size and cement to the 8" x 12" plate.
2. Number the bottom of each metal plate. One plate for each one (1) foot of roadway surface to be sprayed.
3. Number each manila envelope.
4. Weigh each test plate + polyester filter placed in each manila envelope.
5. Cut the roofing felt paper to a width of 18".

E. Sampling

1. Prior to the distributor approaching, place the roofing felt paper transversely across the pavement surface at the test location and secure with duct tape.
2. Place the metal plates with the 12" width, transversely across the pavement surface, centered on the roofing felt paper.
3. If desired, mark the test location outside the spray area for future reference.
4. After the distributor vehicle has passed, slide the roofing felt paper off the roadway with the test plates remaining in place, and let cool for a minimum of five minutes.
5. Remove each separate metal plate with the polyester material and binder and place in the properly numbered manila envelope. Care should be taken to ensure that each plate has no material loss.
6. Proceed to weighing area and weigh each of the test plates and the manila envelopes and record as the Gross Weight.
7. Determine the Net Weight of the binder.

F. Calculations

To determine the spread rate the following is required:

1. The Specific Gravity of the binder.
2. The field application temperature.

Calculate the spread rate as follows for each plate:

1. _____ Sp.Gr.
$$\times 62.4 \text{ lbs/cf} \times \frac{1}{7.48 \text{ lbs/gal}} \times \text{ATF} = \text{_____ lbs/gal at } 60^\circ\text{F.}$$

Where:

Sp. Gr. – Binder Specific Gravity

lbs – pounds

cf – cubic feet

gal – gallon

ATF – Application Temperature Factor. Use Column A from Temperature Conversion Table in Section 93 of the Standard Specifications when the density at 60°F is greater than 60.3 lbs/cf (0.9963).

2. _____ lbs/gal x 0.074 sq.yd** x 454 grams/lbs = _____ grams x sq.yd/gal

Where:

** Test Plate 8" x 12" = 96 sq. in.

$$\frac{96 \text{ sq.in.}}{1,296 \text{ sq.in./sq.yd}} = 0.0741 \text{ sq.yd}$$

sq.yd – square yard

sq. in. – square inches

Verify plate dimensions and adjust accordingly.

3.
$$\frac{\text{Net Weight of Binder grams}}{\text{\#2 Above grams x sq.yd/gal}} = \text{_____ gal/sq.yd (spread rate).}$$

4. Record the spread rate for each plate across the lane.

The contractor shall comply with all Federal, State and Local environmental laws, regulations and ordinances.

4.5 APPLICATION OF AGGREGATE COVER MATERIAL

The 3/8 inch cover material shall be applied immediately onto the Asphalt Rubber membrane at a rate of 28 to 34 pounds per square yard. The actual rate selected within this range will be determined in the field based on the appearance of the Asphalt Rubber chip seal after initial rolling.

At the time of application the temperature of the aggregate shall range from 225° F to 325° F.

4.6 ROLLING

Sufficient rollers shall be used for the initial rolling to cover the width of the aggregate spread with one pass. The first pass shall be made immediately behind the cover material spreader (chip-box) as the aggregate is being placed. If the spreading is stopped for an extended period, the cover material spreader (chip-box) shall be moved ahead or off the chip seal surface so that all cover material may be immediately rolled. Three complete passes shall be made with the pneumatic rollers.