TECHNICAL REQUIREMENTS

1 MOBILIZATION

1-1 GENERAL

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings, staging areas and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site; and for obtaining permits, insurance, and bonds as required for the proper performance and completion of the work. Payment for procuring and maintaining a staging area is included in the Bid Item entitled" Mobilization".

The City may provide a staging area for the duration of the project. The Contractor has the option to use the staging area provided by the City at no cost. Full compensation for furnishing all labor, materials, tools, equipment, fencing, signage, clean-up work and incidentals and for doing the work involved in the setup of the city provided staging area shall be considered as included as part of "Mobilization". The Contractor is responsible for restoring the City provided staging area to its original condition. Damage to the City provided staging area shall be repaired in a manner acceptable to the Engineer, at the Contractor's expense.

This item includes any de-mobilization and re-mobilization that may be required for completing various stages or work or for the suspension of work.

2 CLEARING AND GRUBBING

2-1 GENERAL

The work shall conform to the requirements of Section 17-2, "Clearing and Grubbing" of the 2018 State of California Standard Specifications and the following. In case of conflict, this provision or the decision of the Engineer shall prevail.

2-2 DESCRIPTION OF WORK

This work includes but is not limited to:

- The limits of clearing and grubbing shall be of sufficient area and depth to complete the work as shown on the plans or described in these technical requirements.
- Clearing and grubbing consisting of removal and disposal of existing weeds, brush and other unsuitable material within and along edge of pavement or concrete, traffic bars, and raised pavement markers.
- Spraying of weed killer to facilitate cleaning operations.
- Removal of pavement markers, striping and legends.
- Removal of slurry debris,
- Recycling of construction and demolition materials.
- Protection of storm Drain system from pollutants.
- Developing water supply and applying water, including water used for dust control.

2-3 REMOVAL AND DISPOSAL OF MATERIALS

Salvaging of Materials – Any existing materials that are designated to be salvaged shall be removed, cleaned and hauled to the City of Alameda Maintenance Service Center, 1616 Fortmann Way, by the Contractor unless another location is specified.

Removal and Disposal of Materials – Unless otherwise specified, all materials as shown on the drawings to be removed, or as field marked and as directed by the Engineer to be removed shall be disposed of outside the project limits, including all removed vegetation and debris. The contract work area shall be left with a neat and finished appearance.

Do not store or permit debris to accumulate on site. If Contractor fails to remove excess debris promptly, City reserves right to cause same to be removed at Contractor's expense.

2-4 REMOVAL OF PAVEMENT STRIPING, MARKINGS AND PAVEMENT MARKERS

Remove pavement striping, markings and pavement markers as follows:

All white thermoplastic striping and markings, including parking "T's" specified for removal, shall be removed using a grinder specifically designed for this purpose.

All yellow thermoplastic and yellow traffic stripe and traffic markings shall be removed as specified in Technical Requirements Section 9, Remove Yellow Traffic Stripe and Pavement Marking, of this project manual.

All raised pavement markers, object markers, channelizers and delineators shall be removed in areas to be slurried and any adjacent areas, or as shown on the project plans or as directed by the Engineer. If, in the opinion of the Engineer, the pavement surface has been damaged as the result of pavement marker removal and or pavement delineator removal, the Contractor shall repair said damage in a manner acceptable to the Engineer at the Contractor's expense.

2-5 WEED SPRAYING

All vegetation shall be removed from cracks in the pavement and at the interface of pavement and gutter prior to sweeping. To facilitate the cleaning operations, the Contractor shall use a weed spray (Round Up or its equivalent) ten days prior to asphalt rubber chip seal or slurry seal operations. Flushing with water may be required in some areas.

Do not store the weed spraying chemical on the job site.

2-6 TREE TRIMMING

Some locations may require trimming of branches above the work. Cut and trim trees or shrubs that overhang the work area and interfere with work equipment. The contractor shall prune branches according to the details shown on the exhibit attached to this project manualand under the direction of a certified arborist hired by the Contractor and as directed by the City Arborist. Contractor shall modify construction methods in locations where tree limbs cannot be trimmed. Upon completion of the tree trimming operation, each tree trimmed will be evaluated by the City project team, consisting of the Engineer, arborist and inspector. Upon completion of the tree a balanced appearance, as directed by the Engineer.

If existing trees or shrubs, including median island planting or private trees, encroach onto the public right-of-way and threaten to obstruct the Contractor's operations, the Contractor shall request permission to trim existing trees or shrubs at least five (5) working days prior to the date of scheduled tree trimming. All tree and shrub trimming must have prior approval of the Engineer and shall be performed by the Contractor or his subcontractor possessing a C-27 or a C-61 license. All costs for tree or shrub trimming and proper disposal shall be paid by the Contractor. A special notice pertaining to the tree trimming shall be delivered to the adjacent home or business at least five working days prior to the trimming of the adjacent tree. The special notice shall be approved by the Engineer prior to delivery to the resident or business.

After consultation – with the City Arborist and contractor's arborist—on-site prior to tree trimming the Contractor will be allowed to proceed with tree trimming.

The Engineer shall approve the certified arborist in advance and will be subject to verification. In the project schedule, show consultation time for the City Arborist a minimum of 3 working days prior to tree trimming and one day of inspection time after the tree trimming prior to beginning paving operations.

3 TRAFFIC AND PEDESTRIAN CONTROL

3-1 GENERAL

Contractor shall provide traffic control within the construction area in accordance with General Section II.Q, "Public Convenience and Safety" and these Technical Requirements.

The requirements in this section apply to pedestrian traffic, wheelchair access as well as vehicle traffic including bicycles and may be modified or altered if, in the opinion of the Engineer, public traffic will be better served and work expedited. Said modifications or alterations shall not be adopted until approved in writing by the Engineer.

3-2 DESCRIPTION OF WORK

The Contractor shall maintain vehicular and pedestrian access to all areas, both public right-ofway and private throughout the course of the work. The Contractor will be required to submit traffic control and pedestrian access plans to specific construction operations. For example, the Contractor must submit a traffic control plan for pavement repairs and a separate plan for asphalt rubber chip seal and slurry seal operations.

3-3 MATERIALS

The Contractor will be expected to provide all necessary materials for this work.

The Contractor must use City provided "No Parking" signs. Signs are provided at no cost to the Contractor and will be provided on request to the assigned project inspector.

3-4 CONSTRUCTION METHODS

The requirements in this section may be modified or altered if, in the opinion of the Engineer, public traffic will be better served and work expedited. Modifications or alterations shall not be adopted until approved in writing by the Engineer.

The Contractor shall conduct all operations with the least possible obstruction and inconvenience to the public. The Contractor shall have under construction no greater length or amount of work than can be completed within a workday with due regards to the rights of the public.

No excavation shall remain open longer than is necessary to perform the work as determined by the Engineer.

All excess and unsuitable material resulting from the Contractor's operations shall be removed as it develops and before the end of each day.

No material or equipment shall be stored where it will interfere with the free and safe passage of the public and at the end of each day's work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the roadway open for public use.

3-4.1 Traffic Control Plan

Contractor shall submit a traffic control plan showing the location of signs and flagmen in accordance with Part 6 of the "California Manual on Uniform Traffic Control Devices 2012 Edition (2012 CA MUTCD)," issued by the California Department of Transportation, and as necessary to keep traffic off of the asphalt rubber chip seal and slurry seal. No work will be allowed until a traffic plan that applies to each work site has been submitted to the City and approved by the City, and the traffic control has been put in place, including properly trained and equipped flagmen at their planned positions. A minimum of two flagmen are required on all streets, except for courts where the street may be barricaded and appropriate "Road Closed" signage is posted.

Traffic Control Plans for asphalt rubber chip seal and slurry seal operations shall be submitted for each day's work, showing all streets, barricades, signs, cones, flagmen and other warning devices.

The Contractor shall submit traffic control plans for each location, and obtain the Engineer's approval prior to commencing work. A checklist for completing a Traffic Control Plan is provided in the attachments to this project manual.

All traffic control plans shall be designed and implemented by a contractor in possession of a Class C31 – "Construction Zone Traffic Control Contractor" license.

Contractor shall submit traffic control plans 14 working days before work begins or at the pre-construction meeting with the City, whichever occurs earliest. Revised submittals, if necessary, will be due within 5 working days of return from City.

3-4.2 Lane Closures

Lane closures on courts and residential streets will only be permitted between the hours of 8:00 AM through 5:00 PM, unless otherwise approved by the Engineer.

Lane closures on collector streets and arterials will only be permitted between the hours of 9:00 AM through 3:30 PM, unless otherwise approved by the Engineer.

Lane closures in the following school zones will only be permitted between the hours of 9:00 AM through 2:00 PM on Mondays, Tuesdays, Thursdays and Fridays; and 9:00 AM through 12:00 PM on Wednesdays:

Kofman Parkway Dublin Way Linerick Ln

Lane closures in the following school zones will only be permitted between the hours of 9:00 AM through 2:00 PM on Mondays, Tuesdays, Thursdays and Fridays; and 9:00 AM through 1:00 PM on Wednesdays:

Encinal Ave Washington St Calhoun St Island Dr from Doolittle Dr to Oyster Shoals Packet Landing Rd Sea Bridge Sea Bridge Ct

A paved traffic lane, not less than 11 feet wide, shall be open for use by public traffic in each direction of traffic at all times.

The use of fluorescent traffic cones to direct traffic away from excavations and lanes being treated shall be considered as part of the lane closure. Cones must conform to State Standard Specification Section 12-3.02.

3-4.3 Street Closures

Asphalt rubber chip seal application operations shall terminate, street swept and opened to traffic no later than 3:30 PM of each working day, unless otherwise approved by the Engineer.

Slurry seal application operations shall terminate no later than 1:00 p.m. of each working day, unless otherwise approved by the Engineer.

No street shall be closed to traffic before 8:00 AM or after 5:00 PM, unless otherwise indicated or approved by the Engineer.

No street shall be closed to traffic until immediately prior to the application of asphalt rubber chip seal or slurry seal.

No street shall be closed to traffic for more than four hours after being treated unless approved by the Engineer.

Emergency vehicles shall be permitted to pass through the work area without delay at all times.

The Contractor shall obtain the Engineer's approval for all street closures, flagging arrangements, detours and traffic signing, including special signs, at least two working days prior to such closure.

No street shall be closed on the day of garbage collection.

3-4.4 Site Access

Work shall be accomplished in such a manner as to provide access to all intersecting streets and adjacent properties whenever possible. If access to any property cannot be provided, then adequate nearby parking shall be provided and maintained until direct access can again be restored. If during the course of the work, it is necessary to restrict access to certain driveways for an extended period of time, the Contractor shall notify the affected business/residents, in writing, at least forty-eight (48) hours in advance and post "BUSINESS IS OPEN" signs for business driveways.

When entering or leaving roadways carrying public traffic, the Contractor's equipment, whether empty or loaded, shall in all cases yield to public traffic.

The Contractor shall be required to build temporary driveways or ramps to existing vehicular access ways if necessary to maintain vehicular access to properties adjacent to the work.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way at any time including any section closed to public traffic and shall follow all laws regarding parking as designated in the California Vehicle Code and the City of Alameda Municipal Code.

3-4.5 Pedestrian Access Plan

The Contractor shall submit pedestrian access plans for each location, and obtain the Engineer's approval prior to commencing work. Pedestrian access plan may be included on the traffic control plan.

Contractor shall submit a pedestrian access plan showing the location of signs and detours in accordance with Part 6 of the "California Manual on Uniform Traffic Control Devices 2012 Edition (2012 CA MUTCD)," issued by the California Department of Transportation.

The Contractor shall be required to build temporary ramps if necessary to maintain pedestrian access to doorways adjacent to sidewalks and facilities as shown on plan. Ramps shall be constructed of plywood, wood railing and carpet, or other construction materials, and shall be submitted to the Engineer for review prior to placement. Temporary ramps shall be free of any irregularities, skid resistant and conform to Section 12-4.04 of Caltrans Standard Specifications.

3-4.6 Flaggers

Flaggers shall not be used during hours of darkness unless authorized by the City.

Flaggers are a required part of Traffic Control. The minimum number of flaggers required is one per intersection in all the areas where work is being done or as shown per plan, whichever is greater.

Flaggers must be trained for flagging duties according to the 2012 CA MUTCD and CCR Title, 8, Chapter 4, Article 11, Section 1598-1599 and have a certificate showing the training accomplished, date and name of trainer. Copies of Certificates shall be submitted to the City before beginning work. The project superintendent shall keep copies of the certificates on-site for all persons charged with flagging duties. Changes to flaggers must be coordinated through the City's project inspector.

4 TRAFFIC STRIPES, PAVEMENT MARKERS AND MARKINGS

4-1 GENERAL

This work shall be done as shown on the plans and in accordance with Sections 84 of the State Standard Specifications, and Details A20A through A20D, A24A through A24F of the State Standard Plans, as modified by these Technical Requirements and applicable City of Alameda Standard Plans.

Removal of all Non-Yellow Thermoplastic/Painted stripes and legends are included in the Item "Clearing, Grubbing and Removals." All existing thermoplastic stripes and legends that are to be re-installed must be removed prior to applying the slurry seal.

The Contractor shall review all existing striping and pavement markings in the field prior to making a bid. Quantities are provided in the bid schedule. Generally, all striping and markings will be replaced in the same locations, and shall be thermoplastic, unless otherwise noted on the plans. All the other existing paint stripes and pavement markings will be replaced with thermoplastic unless otherwise stated or specified herein. The details for any changes to the existing striping and pavement markings, if any, will be provided at the Pre-Construction Meeting. These changes should be minor and will not increase the quantities above the 25% limit allowed elsewhere in these specifications.

4-2 TEMPORARY TRAFFIC STRIPES AND PAVEMENT MARKINGS

"Chip Seal Marker," or approved equal, shall be used for temporary traffic stripes and shall be installed at 24' spacing, immediately after obliteration of any existing striping. Offset Chip Seal Markers so they will not interfere with final locations of thermoplastic striping. Completely remove the Chip Seal Marker prior to placement of slurry seal, chip seal and final thermoplastic striping.

All other traffic control and safety markings such as crosswalks, arrows, lane tapers, etc. shall be marked using paint or reflective tape.

4-3 LAYOUT

All layout and cat tracking shall be performed by and at the expense of the contractor, and shall be approved by the Engineer prior to placement of final striping or markings. Striping and marking shall be done at locations of existing striping and marking, except as modified by the Engineer. Advance spotting and recording of angle points, end points, and other control points, plus color and line detail type, shall be performed by the Contractor. Any uncertainties shall be discussed with Engineer prior to application.

4-4 TRAFFIC STRIPES

Unless otherwise stated, all striping, including bike lane buffers, shall be hot liquid thermoplastic. All areas to receive traffic stripes shall be swept immediately prior to applying thermoplastic to remove all loose rock.

4-5 CURB PAINTING

Curb painting shall be performed in accordance with Section 78-4.03 of the State Standard Specifications.

Certificates of Compliance – Contractor shall provide certificates of compliance all materials used in accordance with requirements of Section 84 and 85 of the State Standard Specification.

4-6 PAVEMENT MARKERS

All markers shall be placed using hot melt bituminous adhesive exclusively. On roadways separated by a raised median, Type C markers (red-clear) shall be used in lieu of Type G (one way clear). All non-reflective markers shall be the ceramic type.

4-7 HYDRANT MARKERS

Hydrant Markers will be blue in color are of the same basic specification Type AY or Type AW markers. Avery-Dennison model 911-AB or equal may be used. Placement of blue hydrant markers will be per California MUTCD Figure 3B-102 (CA) "Examples of Fire Hydrant Location Pavement Markers."

4-8 PAVEMENT MARKINGS

Legends, crosswalks, stop bars, parking "T's" and stall lines shall be thermoplastic unless otherwise stated.

Note 4 on State Standard Plan A24D shall not apply.

All temporary pavement markers and/or tape shall be removed when permanent striping is placed.

5 SLURRY SEAL

5-1 GENERAL

Slurry seal shall conform to the provisions in Section 37-3, "Slurry Seal and Micro-Surfacing," of the State of California Standard Specifications and these Technical Requirements.

5-1.1 Description

The work shall consist of mixing asphaltic emulsion, mineral aggregate, mineral filler, set-control additives, water, and specified additives, and spreading the mixture on the existing surfacing or pavement where shown on the plans, as specified in these Technical Requirements, and as directed by the Engineer.

5-2 CONTRACTOR EXPERIENCE

The Contractor shall be experienced with slurry seal.

Within two (2) working days after publicly opening the sealed proposals by the City, the apparent lowest bidder shall submit to the Engineer a list of at least three projects of slurry seal completed within the last 12 months. The project list shall show the name of the project, name of the owner, address, telephone number of an appropriate party to contact, year and square feet application in each case.

Personnel shall be experienced, knowledgeable, and capable in all aspects of performing the service. The same personnel that start the project shall remain on the project for the duration of the contract.

The Contractor shall perform the service in a safe, acceptable, workmanlike manner, and in accordance with the requirement of these technical requirements.

5-3 SUBMITTALS

5-3.1 General

The Contractor shall provide the following submittals:

- A construction schedule
- Notification schedule
- Traffic and pedestrian control plans
- Materials, certificate of compliance, etc.

5-3.2 Construction Schedule

The Contractor shall provide four (4) sets of construction schedule to the Engineer for his review within 10 calendar days after receipt of Notice of Award from the Engineer. The Engineer will review the schedule and either approves or returns for revisions within 10 calendar days.

In developing the construction schedule, the contractor shall be limited to scheduling slurry materials at no greater than 20,000 square yard (SY) per day for all courts and 25,000 SY

per day for all collector streets, unless otherwise approved by the Engineer. For streets with no sidewalk, the Contractor shall place slurry materials on one half of the street and complete the other half upon completion of the curing process.

Slurry seal application operations shall terminate no later than 1:00 p.m. of each working day, unless otherwise approved by the Engineer.

For streets receiving a slurry seal treatment over the asphalt rubber chip seal, the slurry seal shall be applied no sooner than seven (7) calendar days after completion of asphalt rubber chip seal per Technical Requirement Section 6, "Asphalt Rubber Chip Seal".

Construction schedule shall show all items of work, including but is not limited to:

- Award of Contract
- Notice to Proceed
- Pre-Construction Meeting
- Materials Submittals
- Color Coded Legible Maps Identifying the Slurry Seal and Chip Seal Streets
- Meeting with City Arborist Tree trimming, and consultation time for the City Arborist a minimum of three (3) working days prior to tree trimming and one day of inspection time after the tree trimming prior to beginning paving operations.
- Tree Trimming Notifications to Residents or businesses
- Tree Trimming and Weed Spray
- Install SWPPP
- Striping Removal
- Tack Coat (if required)
- Chip Seal and Slurry Seal Notifications
- Cat Track
- Striping and Signage
- Project Completion
- Garbage pick-up days for each neighborhood in the project area.

5-3.3 Traffic and Pedestrian Plans

The Contractor shall provide the traffic and pedestrian plans designed by a contractor in possession of Class C31 - "Construction Zone Traffic Control Contractor" license. To prepare the plans, refer to Technical Requirement Section 3, "Traffic and Pedestrian Control," and Special Provision Section XII, "Signs and Notices" of this project manual.

The Contractor shall provide four (4) sets of traffic and pedestrian plans to the Engineer for his review within 10 calendar days after receipt of Notice of Award from the Engineer. The Engineer will review the plans and either approves or returns for revisions within 10 calendar days.

5-3.4 Material Submittals

According to the requirements of these Technical Requirements, the Contractor shall provide four (4) sets of material or certificate of compliance submittals to the Engineer for his review within 10

calendar days after receipt of Notice of Award from the Engineer. The Engineer will review the submittals and either approves or returns for revisions within 10 calendar days. Refer to the following Technical Requirements of this section for requirements of material or certificate of compliance submittals.

5-4 PRE-CONSTRUCTION MEETING

The Contractor shall meet with the Engineer in a pre-construction meeting to present a written schedule for the work listing dates on which streets, roadways or other locations are to be closed to traffic. In addition, issues regarding safety, traffic control and access by public services shall be discussed.

5-5 POLYMER MODIFIED SLURRY

5-5.1 Materials

The materials for slurry seal immediately prior to mixing shall conform to the following requirements:

Latex emulsified asphalt

Latex emulsified asphalt shall be a quickset PMCQS1h type, shall be homogeneous co-milled and show no separation after thorough mixing. The latex asphalt emulsion shall conform to the following requirements:

QUALITY	METHOD OF TEST	REQUIREMENT
CHARACTERISTIC		
Sieve Test @ 77°F, % Max.	ASTM D244	0.30
Viscosity, SSF, @77°F, sec	ASTM D244	15 - 100
Residue by Evaporation %,	California Test 331	60
Min.		

TEST ON EMULSION:

TEST ON RESIDUE BY EVAPORATION:

QUALITY CHARACTERISTIC	METHOD OF	REQUIREMENT
	TEST	
Penetration, 77° F, 100g, 5s	ASTM D5	40-80
Softening Point (Ring & Ball), °F	ASTM D36	130
Min.		
Ductility, 75° F, 5CM/Min,	ASTM D113	25
Minimum		
Torsional Recovery, % Min.	California Test 332	20

Water

Water shall be of such quality that the asphalt will not separate from the emulsion before the slurry seal is in place in the work. Water shall be potable and free from harmful soluble salts.

Aggregate

Aggregate shall consist of sound, durable crushed stone or crushed gravel and approved mineral filler. Aggregates shall be Type II, 100% crushed with co-rounded particles, volcanic in origin and black in color as supplied by George Reed, Table Mountain Plant, Sonora, CA, Triange (Vulcan) Table Mountain Oroville, CA, or equal. The use of grey or light colored aggregate will not be allowed. The material shall be free from vegetable matter and other deleterious substances. All aggregate shall be free of cake lumps and oversized particles.

The aggregate, prior to the addition of emulsion, shall conform to the requirements of this section. Conformance with the grading requirements will be determined by California Test 202, modified by California Test 105 when there is a difference in specific gravity of 0.2 or more between blends of different aggregates.

The percentage composition by weight of the aggregate shall conform to one of the following gradings:

Percentage Passing			
Sieve Size	Туре II		
3/8"	100		
No. 4	94-100		
No. 8	65-90		
No. 16	40-70		
No. 30	25-50		
No. 50	18-30		
No. 100	10-21		
No. 200	5-15		

No single aggregate grading test shall represent more than 500 tons or one day's production, whichever is smaller.

The aggregate shall conform to the following additional quality requirements:

Tests	California Test	Requirements
Sand Equivalent	217	Type II55 Min.
Durability Index	229	55 Min.

Type II aggregate shall be used for Type II Slurry Seal.

QUALITY CONTROL PROGRAM--The Contractor shall provide evidence of the aggregate manufacturers Product Quality Control Program in effect during the processing of the aggregates. The quality control test results shall be made available to the Engineer at the pre-construction meeting. The following items shall be included in the Product Quality Control Program:

- 1. The frequency of sampling.
- 2. The manner of sampling and controlling authority, (i.e. ATSM).
- 3. The number of samples tested per production unit.
- 4. The production unit size.

- 5. The Moving Average compilation of the five most recent grading tests. Subsequent tests shall show the results for each washed control sieve analysis test and shall include all of the specification sieves.
- 6. A "Moving Average" of the five most recent cleanness value tests.
- 7. The names of those qualified employees who will perform the required testing and calculations.

The Product Quality Control Program shall remain in effect for all aggregate supplied. The test results from each production unit shall be supplied to the Engineer. The Contractor shall supply the Engineer with "split" samples of all samples from all production units from which the aggregate supply is from.

5-5.2 Proportioning

Asphaltic emulsion shall be added at the rate of one of the following percentages of the weight of the dry aggregate:

Type II 12 to 18

The exact rate will be determined by the Engineer.

At the pre-construction meeting, the Contractor shall submit a signed original laboratory report of a mix design covering the specific materials to be used on the project. This mix design shall have been performed by a laboratory capable of performing the following International Slurry Seal Association (ISSA) tests:

Quality Characteristic	Test Method	Specification	
Slurry Seal Consistency	ISSA T106	30	
(max, mm)			
Wet Stripping Test	ISSA T114	Pass	
Compatibility	ISSA T 115	Pass*	
Cohesion Test**, within	ISSA T139	200	
1 hour (min, kg-mm)			
Wet Track Abrasion	ISSA T100	810	
(max, g/sq m)			

*Mixing test must pass at the maximum expected air temperature **Using project aggregate, emulsion, set-control agents

The City will approve, disapprove or modify the proposed mix designs.

The laboratory report shall show the results of the test on individual materials, comparing their values to those required by these special provisions. The report must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) usage and asphalt based on the dry aggregate weights. The emulsion content to be used shall be determined from the design asphalt binder content and the asphalt solids content of the emulsion to be used.

Once the materials are approved, no substitutions will be permitted unless first tested and once again approved by the laboratory preparing the design and the Engineer.

If necessary for workability, a set-control agent, that will not adversely affect the seal, may be used.

Admixtures may be used as necessary to control the mixing and setting rates of the mixture. The admixture, the amount to be added, and the methods by which it is to be added, must be approved by the Engineer before the admixture is used.

Water, and set-control agent, if used, shall be added to ensure proper workability and (a) permit a traffic flow, without the assistance of a pilot car, on the slurry seal no more than 1 hour after placement without the occurrence of bleeding, raveling, separation or other distress, and (b) prevent development of bleeding, raveling, separation or other distress within 15 days after placing the slurry seal.

If more than one kind of aggregate is used, the correct amount of each kind of aggregate to produce the required grading shall be proportioned separately in a manner that will result in a uniform and homogeneous blend.

Uniformity of distribution of asphalt shall be determined by extraction test in accordance with California Test 310. The bitumen ratio (pounds of asphalt per 100 pounds of dry aggregates) shall not vary more than 0.5 pounds of asphalt above or 0.5 pound of asphalt below the amount approved by the Engineer. This requirement shall apply to representative samples taken from any location or operation designated by the Engineer.

The mixer-spreader trucks shall be equipped with a calibrated emulsion tank with a stick gauge or other measuring device that allows for a quick, accurate measurement of the volume. The mixer-spreader trucks shall be equipped with a water pressure system and fog type spray bar adequate for complete fogging of the surface preceding spreading equipment.

Mixer-spreader trucks shall be equipped to proportion emulsion, water, aggregate, and set-control additives by volume. The aggregate shall be proportioned using a belt feeder operated with an adjustable cutoff gate. The height of the gate opening shall be readily determinable. The emulsion shall be proportioned by a positive displacement pump. Water shall be introduced into the mixer by a meter registering in liters delivered.

Any variable rate emulsion pump, if used, shall be equipped with a means to seal the adjusting unit in its calibrated condition.

The delivery rate of aggregate and emulsion per revolution of the aggregate feeder shall be calibrated at the appropriate gate settings for each mixer-spreader truck used on the project in accordance with California Test 109.

The aggregate belt feeder shall deliver aggregate to the pugmill with such volumetric consistency that the deviation for any individual aggregate delivery rate check-run shall not exceed 2.0% of the mathematical average of three runs of at least 3 ton in duration each. The emulsion pump shall deliver emulsion to the pugmill with such volumetric consistency that the deviation for any individual delivery rate check-run shall not exceed 2.0% of the mathematical average of three runs of at least 500 gallons in duration each. These check runs shall be performed for each aggregate source using a vehicle scale that has been error tested in accordance with California Test 109, Part 9.

The emulsion storage located immediately before the emulsion pump shall be equipped with a device which will automatically shut down the power to the emulsion pump and aggregate belt feeder when the emulsion level is lowered sufficiently to expose the pump suction line.

A temperature-indicating device shall be installed in the emulsion storage tank at the pump suction level. The device shall indicate temperature of the emulsion and shall be accurate to 10°F.

The belt delivering the aggregate to the pugmill shall be equipped with a device to monitor the depth of aggregate being delivered to the pugmill. Said device for monitoring depth of aggregate shall automatically shut down the power to the aggregate belt feeder whenever the depth of aggregate is less than 70% of the target depth of flow. A second device shall be located where it will monitor movement of the aggregate belt by detecting revolutions of the belt feeder. The device for monitoring no flow or belt movement, as the case may be, shall automatically shut down the power to the aggregate belt movement is interrupted. This second device will not be required where the aggregate delivery belt is an integral part of its drive chain.

To avoid erroneous shutdown by normal fluctuation, a delay of three seconds between sensing less than desirable storage levels of aggregate or emulsion and shutdown of the proportioning operation will be permitted.

The mixer-spreader truck shall not be operated unless all low-flow and no-flow devices and revolution counters are in good working condition and functioning. All indicators shall be visible while walking alongside the mixer/spreader truck.

The Contractor shall furnish an aggregate moisture determination for every two hours of operation or maintain the moisture content to within a maximum daily variation of $\pm -0.5\%$.

Mineral filler shall be portland cement or aluminum sulphate and shall be considered as part of the blended aggregate. Mineral filler shall be used only if necessary to improve the workability of the mixture or gradation of the aggregate.

5-5.3 Mixing and Spreading Equipment

All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working order at all times.

5-5.3A Slurry Mixing Equipment

The slurry mixing machine (7 cubic yards or larger) shall be a continuous flow mixing unit (rotating drum mixers will not be allowed) and be capable of delivering accurately at a continuous and constant rate a pre-determined proportion of aggregate, water and asphalt emulsion to the mixing chamber and to discharge the thoroughly mixed product on a continuous basis. The aggregate shall be pre-wetted immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients together. No violent mixing shall be permitted.

Gages or approved means of measurement shall be provided on the equipment so that the proportional rates of aggregate, water and asphalt emulsion can be checked at intervals determined by the Engineer.

The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device or method to introduce a pre-determined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed. The fines feeder shall be used whenever added mineral filler is a part of the aggregate blend.

There shall be a minimum of one mixing machine in good working condition as a backup on the project at all times.

5-5.3B Mixing

The slurry seal shall be mixed in continuous pugmill mixers of adequate size and power for the type of slurry seal to be placed.

All rotating and reciprocating equipment on mixer/spreader trucks shall be covered with metal guards.

Aggregate feeders shall be connected directly to the drive on the emulsion pump. The drive shaft of the aggregate feeder shall be equipped with a revolution counter reading to the nearest full revolution of the aggregate delivery belt.

5-5.3C Spreading Equipment

The slurry mixture shall be uniformly spread by means of a controlled spreader box conforming to the following requirements:

The spreader shall be capable of spreading a traffic lane width and shall have strips of flexible rubber belting or similar material on each side of the spreader box and in contract with the pavement to positively prevent loss of slurry from the ends of the box. All spreader boxes over 7 ¹/₂ feet in width shall have baffles, reversible motor driven augers, or other suitable means, to insure uniform application on superelevated sections and shoulder slopes. The spreader shall be steerable, shall have adjustable skids, and shall have an adjustable width. Spreader box skids shall be maintained in such manner as to prevent chatter (wash boarding) in the finishing mat.

The rear flexible strike-off blade(s) shall make close contact with the pavement, and shall be capable of being adjusted to the various crown shapes so as to apply a uniform seal coat.

Flexible drags, between 18 and 24 inches in length, to be attached to the rear of the spreader box, shall be provided. All drags and strike-off blades (rubbers) shall be cleaned or changed daily if problems with cleanliness and longitudinal scouring occur, or when directed by the Engineer.

The spreader box shall be clean, free of all slurry seal and emulsion, at the start of each shift.

At least two (2) operational spreader trucks shall be available at the job site during the spreading operation except when continuous placement type mixer-spreader trucks are used.

The mixer-spreader trucks shall have legible identification, at least 2 inches in height, located on the front and rear of the vehicle.

5-5.3D Auxiliary Equipment

Hand squeegees, shovels, and other equipment shall be provided as necessary to perform the work.

5-5.4 Street Surface Preparation

Immediately prior to the application of the slurry seal and subject to the approval of the Engineer, the street surface shall be thoroughly cleaned of all foreign material such as, but not limited to, leaves, sand, gravel, and dirt. The method of street cleaning shall be by power vacuum broom and hand broom, or flushing sufficient to provide for a bond between the existing pavement surface and the slurry seal. The Contractor shall clean all streets from face of curb to face of curb in the project area to ensure the pavement surface is sufficiently cleaned to provide for a bond between the existing pavement surface and the slurry seal.

Vegetation shall be removed from cracks in pavement and at the interface of pavement and gutter prior to sweeping. To facilitate the cleaning operations, it is recommended that the Contractor use a weed spray (Round-Up or its equivalent) ten days prior to slurry operations. Flushing with water may be required in some areas.

All vegetation and debris removed from the roadway surface shall be disposed of outside of the project area. The Engineer shall approve all surface preparation prior to application of the slurry seal.

Before applying slurry seal, cover manholes, values, monument covers, grates or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured by tape or adhesive to the facility being covered. Utility covers, manholes and other permanent features shall be protected in place as per section 18-3 "Utilities Protection" of these Special Provisions. The Contractor shall be responsible for locating, removing, and cleaning protection from the above mentioned items following the slurry seal operations. The methods of protection, and referencing, locating and cleaning shall be submitted to the Engineer for approval. Remove coverings promptly to return facilities to service prior to the end of the same shift the slurry seal is placed.

Slurry seal of driveway aprons, returns, and other incidental work shall be accomplished concurrently with application of the street proper. Do not overlap slurry seal onto the lip of gutter. When slurry starts or finishes, a straight line cut-off shall be obtained by laying down a strip of building paper or other approved material. The Contractor shall remove such paper and any excess slurry to maintain a neat and uniform line.

As directed by the Engineer, the Contractor shall tack coat any areas where slurry seal will be placed over any HMA pavement area installed within 30 days of the seal coat installation date (asphalt pavement repair areas as identified by the Engineer), brick, concrete, or other highly absorbent or polished surface, with 1-part emulsion to 3-part water tack coat of the same asphalt emulsion.

The tack coat shall be SS-1h meeting the requirements of Section 94 of the State Standard Specifications or an approved equivalent. Tack coat can be applied with an asphalt distributor. The normal application rate is 0.08 gal/sq. yd. to 0.15 gal/sq. yd. of diluted emulsion.

5-5.5 Placing

Slurry seal shall not be placed when the existing pavement temperature is below 55°F or during unsuitable weather.

Slurry seal shall be applied only when the atmospheric temperature is above that listed below for corresponding wind velocity as measured in accordance with Test Method Number Contra Costa County 342 (average wind velocity measured with a hand-held anemometer).

(Degrees F)	(mph)
55	0
59	5
63	10
67	15
71	20

Minimum Atmospheric Temperature per Average Wind Velocity

Slurry seal shall not be applied when raining or foggy.

The slurry seal shall be spread at the following pounds of dry aggregate per square yard:

Type II (Black Rock Aggregate)14 – 18

All through driving lanes shall be spread in full lane width pulls only. Longitudinal joints, common to two driving lanes, shall be butt joints with overlaps not to exceed 3 inches. Building paper shall be placed at transverse joints, over previously placed slurry seal, or other suitable methods used to avoid double placement of slurry seal. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finish surface will not be permitted.

The finished surface must be smooth.

Slurry mixture, to be spread in areas inaccessible to the spreader box, shall be spread by Engineer approved methods.

The mixture shall be uniform and homogeneous after spreading on the road and shall not show separation of the emulsion and aggregate after setting.

Adequate means shall be provided to protect the slurry seal from damage by traffic until such time that the mixture has cured sufficiently so that the slurry seal will not adhere to and be picked up by the tires of vehicles.

The Contractor shall have the responsibility for the inspection and supervision necessary for controlling the characteristics of the slurry seal to conform to the mix design and the spreading of the slurry seal to meet the requirements specified herein.

The City's responsibility will include all testing and inspection necessary to establish the degree to which the materials as furnished and placed meet the requirements of the approved mix design.

During slurry sealing operations the Contractor shall provide the following:

- a. Quantity of emulsion used in each "batch,"
- b. Quantity of emulsion used daily, and
- c. Copies of all aggregate delivery tags.

If the quantity of materials being used, or the appearance of the slurry seal indicates that the mix design is not being adhered to, work shall be suspended and the Contractor shall supply the Engineer with the following samples:

- a. Slurry seal aggregate 30 pounds
- b. Asphalt emulsion 1 gallon
- c. Abrasion test pads three total

Work shall not be resumed until a modified mix design is prepared by the Contractor and is approved by the Engineer or Engineer approved corrective measures are taken to insure conformance to the approved mix design.

The surface shall be pre-wetted by fogging ahead of the slurry distributor. Water used in prewetting the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry distributor. The slurry mixture shall be of the desired consistency when deposited on the surface and no additional elements shall be added. Total time of mixing shall not exceed four minutes.

Precautions shall be taken to insure that aggregate stockpiles do not become contaminated with oversized rock, clay, silt, or excessive amounts of moisture. The stockpile shall be kept in areas that drain readily. Segregation of the aggregate will not be permitted.

Courts and other streets designated by the engineer shall be rolled with a nine-wheel pneumatic tire roller (10 to 12 ton) with tire pressure between 50 and 60 pounds per square inch (psi) once

the slurry seal has dried to the point where the road can be opened up to traffic. Roller shall make a minimum of 2 passes over the entire court immediately before it is open to traffic and prior to the first sweeping.

5-5.6 Trial Mixes

Trial mixes in the slurry machine shall be made before any major work is undertaken. Any of the proposed streets to be slurry sealed may be designated as the "test area" and all work completed and accepted by the Engineer within the "test area" will be paid for at the contract unit prices. Prior to trial mixing, the Contractor shall check the calibration, and calibrate, if necessary, the feed rate controls of the aggregate, emulsion, water, fines and admixtures. During trial mixing, the water, fine, and admixture content shall be adjusted to obtain the consistency and setting rates desired. The proportions of aggregate and emulsion may be changed only after the submittal of a new mix design.

5-5.7 Clean-Up

All construction debris, unused materials, and equipment in the area of construction and any adjacent areas used by the Contractor, shall be removed and disposed of outside of the construction area.

Gutters shall be cleaned the same day they are slurried.

All aggregate shall be removed from the stockpile areas unless the Contractor provides the Engineer written permission from the property owner permitting the Contractor to leave the aggregate.

All streets (full width and gutters), including driveways, shall be swept by power vacuum broom trucks and hand blowers. Driveways shall be cleaned by a hand blower, concurrently with the street sweeping. Debris accumulated from sweeping shall be disposed offsite and will not be stored.

Three (3) additional sweepings shall be performed. The first sweeping shall be done five (5) calendar days after slurry seal placement is complete, the second 10 calendar days after the completion of first sweeping, and the third 10 calendar days after completion of the second sweeping. The Contractor shall spray water on these subsequent sweepings for dust removal. Prior to pre-final inspection, two additional sweeping shall be performed, as required by the Engineer.

6 ASPHALT RUBBER CHIP SEAL

6-1 GENERAL

The provisions of Section 37, "Bituminous Seals," of the Caltrans Standard Specifications shall apply in their entirety except as modified or supplemented herein.

This work consists of constructing a chip seal using asphalt rubber binder. Asphalt rubber seal coat includes applying heated asphalt rubber binder followed by heated screenings pre-coated with asphalt binder.

For streets receiving a slurry seal treatment over the asphalt rubber chip seal, the slurry seal shall be applied no sooner than seven (7) calendar days after completion of asphalt rubber chip seal per Technical Requirement Section 5, "Slurry Seal".

Asphalt rubber chip seal application operations shall terminate, street swept and opened to traffic no later than 3:30 p.m. of each working day, unless otherwise approved by the Engineer.

6-2 **DEFINITIONS**

Crumb rubber modifier (CRM): crumb rubber modifier must be scrap tire crumb rubber that is processed in California from only California-generated waste tires.

Scrap tire crumb rubber: scrap tire crumb rubber must be from any combination of:

- 1. Automobile tires
- 2. Truck tires
- 3. Tire buffings

6-3 CONTRACTOR EXPERIENCE AND REQUIREMENTS

The Contractor shall be experienced with asphalt rubber chip seal. Within two (2) working days after publically opening the sealed proposals by the City, the apparent lowest bidder shall submit to the Engineer a list of at least three (3) asphalt rubber chip seal projects successfully completed in recent years. The project list shall show the name of the project, name of owner, address, telephone number of an appropriate party to contact, year and project square footage in each case.

6-4 SUBMITTALS

6-4.1 General

The Contractor shall provide the following submittals:

A construction schedule Traffic and pedestrian control plans Materials, certificate of compliance, etc.

6-4.2 Construction Schedule

The Contractor shall provide four (4) sets of construction schedule to the Engineer for his review within 10 calendar days after receipt of Notice of Award from the Engineer. The Engineer will review the schedule and either approves or returns for revisions within 10 calendar days.

Construction schedule shall show all items of work, including but is not limited to:

- Award of Contract
- Notice to Proceed
- Pre-Construction Meeting
- Materials Submittals
- Color Coded Legible Maps Identifying the Slurry Seal and Chip Seal Streets
- Meeting with City Arborist Tree trimming, and consultation time for the City Arborist a minimum of three (3) working days prior to tree trimming and one day of inspection time after the tree trimming prior to beginning paving operations.
- Tree Trimming Notifications to Residents or businesses
- Tree Trimming and Weed Spray
- Install SWPPP
- Striping Removal
- Tack Coat (if required)
- Chip Seal and Slurry Seal Notifications
- Cat Track
- Striping and Signage
- Project Completion
- Garbage pick-up days for each neighborhood in the project area.

Asphalt rubber chip seal application operations shall terminate, street swept and opened to traffic no later than 3:30 p.m. of each working day, unless otherwise approved by the Engineer.

Asphalt rubber chip seal must be completed minimum of seven (7) calendar days prior to application of polymer modified slurry seal.

6-4.3 Traffic and Pedestrian Plans

The Contractor shall provide the traffic and pedestrian plans designed by a contractor in possession of Class C31 - "Construction Zone Traffic Control Contractor" license. To prepare the plans, refer to Technical Requirement Section 3, "Traffic and Pedestrian Control," and Special Provision Section XII, "Signs and Notices" of this project manual.

The Contractor shall provide four (4) sets of traffic and pedestrian plans to the Engineer for his review within 10 calendar days after receipt of Notice of Award from the Engineer. The Engineer will review the plans and either approves or returns for revisions within 10 calendar days.

6-4.4 Material Submittals

According to the requirements of these technical requirements, the Contractor shall provide four (4) sets of material or certificate of compliance submittals to the Engineer for his review within 10 calendar days after receipt of Notice of Award from the Engineer. The Engineer will review the submittals and either approves or returns for revisions within 10 calendar days. Refer to the following technical requirements of this section for requirements of material or certificate of compliance submittals.

The Contractor shall comply with all Federal, State and Local environmental laws, rules, regulations and ordinances including, but not limited to, air quality requirements.

6-4.4A Asphalt Rubber Chip Seal

Submit SDS for each asphalt binder ingredient and the asphalt rubber binder.

Submit for each delivery of asphalt rubber binder ingredients:

- 1. A certified volume or weight slip.
- 2. Certificate of compliance with manufacturers test results for the specified quality characteristics
- 3. Certificate of Compliance, Certificate of Origin, or Bill of Lading validating that only California-generated waste tires, processed in California, were used for the crumb rubber.

Submit for each delivery of asphalt rubber binder:

- 1. A certified volume or weigh slip
- 2. Percentage of crumb rubber by weight of asphalt rubber binder
- 3. Certificate of compliance for the specified quality characteristics

At least 14 days before use, submit:

- 1. Four (4) 1-quart cans of mixed rubber asphalt binder.
- 2. Samples of each asphalt rubber binder ingredient.
- 3. SDS for each hazardous material.
- 4. Asphalt binder formulation and data as follows:
 - 4.1. For asphalt binder, submit source of and grade of asphalt binder.

4.2. For asphalt modifier, submit:

- 4.2.1. Source and type of asphalt modifier
- 4.2.2. Percentage of asphalt modifier by weight of asphalt binder
- 4.2.3. Percentage combined asphalt binder and asphalt modifier by weight of asphalt rubber binder
 - 4.2.4. Test results for the specified quality characteristics
- 4.3. For crumb rubber modifier, submit:
- 4.3.1. Each source and type of scrap tire crumb rubber and high natural rubber

4.3.2. Percentage of scrap tire crumb and high natural rubber by total weight of asphalt rubber binder

4.3.3. Test results for the specified quality characteristics.

4.4. For asphalt rubber binder, submit:

- 4.4.1. Test results for the specified quality characteristics
- 4.4.2. Minimum reaction time and temperature.
- 4.4.3. Test results for AASHTO T288. Report test results in pounds per gallon

5. Test results

5.1. Certificate of Compliance showing the asphalt binder is the required PG grade.

5.2. Test results showing the asphalt modifier meets the requirements in Table 1.

5.3. Test results showing each source of CRM meets the requirements in Tables 2, 3 and 4.

5.4. Test results showing the asphalt rubber binder meets the requirements in Tables 5 and 6.

5.5. Test results showing the screenings meet the requirements in Tables 7 and 8.

6-4.5 Air Quality

Equipment used in producing field blended asphalt rubber binder must be permitted for use by local air quality agencies.

Equipment used in spreading binder must be permitted for use by local air quality agencies.

At least 5 days before use, submit permit issued by local air quality agency for asphalt rubber binder:

- 1. Field blending equipment
- 2. Spreading equipment

If an air quality permit is not required by the local air quality agency for producing asphalt rubber binder or spray applying asphalt rubber binder, submit verification from the local air quality agency that an air quality permit is not required.

6-5 QUALITY CONTROL AND ASSURANCE

6-5.1 Quality Control Program

The Contractor shall develop, implement and maintain a quality control (QC) program.

The contractor shall prepare and maintain QC reports including:

1. Names and qualifications of:

- 1.1. Samplers
- 1.2. Testers
- 1.3. Inspectors
- 2. Testing laboratories
- 3. Testing equipment calibrations and certifications
- 4. Construction inspection reports
- 5. Sampling and testing records organized by date and type of material
- 6. Test results with comparison of quality characteristics requirements
- 7. Test results in relation to action and any suspension limits
- 8. Records of corrective actions and suspensions

9. Log of daily production data

10. Log of daily asphalt rubber binder viscosity test results

11. Test results for Vialit Test Method for Aggregate Retention in Chip Seals, French Chip

Within 24 hours, notify the Engineer if any noncompliance identified by your QC program.

6-5.2 Quality Control Manager

Assign a QC manager before the start of the affected work. The QC manager must receive, review and approve all correspondence, submittals and reports relating to the QC of materials before they are submitted to the City. The QC manager must be the sold individual responsible for:

- 1. Signing the QC plan
- 2. Implementing the QC plan
- 3. Maintaining the QC records

The QC manager must be the Contractor's employee or must be an employee of a subcontractor that is providing only QC services. The QC manager must not be employed or compensated by a subcontractor or any other persons or entities hired by subcontractors who provide services or materials for the project.

6-5.3 Acceptance Criteria

Asphalt rubber chip seal acceptance is based on:

- 1. Visual inspection of the following:
 - 1.1 Uniform surface texture throughout the work limits
 - 1.2 Raveling consists of the separation of the aggregate from the binder, caused by wearing of the surface.
 - 1.3. Flushing consists of the occurrence of the film of bituminous material on the surface of the asphalt rubber chip seal which results in a coefficient of friction.
 - 1.4 Streaking consists of alternating longitudinal bands of binder without uniform aggregate retention, approximately parallel with the lane line.

2. For field blended asphalt rubber binder, acceptance is based on the sampling and testing for compliance with the requirements for the quality characteristics shown the tables in Section 7-6, Materials, of these Technical Requirements:

- 2.1. Asphalt Rubber Binder
- 2.2. Asphalt Modifier for Asphalt Rubber Binder
- 2.3. Crumb Rubber Modifier
- 2.4. Crumb Rubber Gradation
- 2.5. Asphalt Rubber Chip Seal Screenings and Screenings Gradation Requirements

3. Sampling and testing at the specified frequency and location for the following quality characteristics:

Quality Characteristic	Test Method	Minimum	Requirement	Location of	Maximum
		Sampling		Sampling	Reporting
		and Testing			Time
		Frequency			Allowance
Asphalt binder spread	California	2 per day	Target value	Pavement	24 hours
rate (gal/sq yd)	Test 339		±0.5 gal/sq yd	surface	
Chip retention (%)	Vialit Test	1 per day	95	Pavement	48 hours
	Method for			surface	
	Aggregate in			after chip	
	Retention			application	
	Chip Seals,			and rolling	
	French Chip				

Table A: Asphalt Rubber Chip Seal Spread Rate and Chip Retention

6-6 MATERIALS

6-6.1 Asphalt Binder

Asphalt binder must be PG 64-16.

Asphalt binder must comply with Section 92 of the Caltrans Standard Specifications.

6-6.2 Asphalt Modifier

Asphalt modifier must by a resinous, high flash point and aromatic hydrocarbon. Asphalt modifier must comply with the requirements shown in the following table:

able 1. Asphalt Withhill for Asph	lan Kubbel Dii	uci
Quality Characteristic	Test Method	Requirement
Viscosity at 100 °C (m2/s x 10-6)	ASTM D445	$X \pm 3$ (see note a below)
Flash Point (CL. O.C., °C, min)	ASTM D92	207
Asphaltenes by mass (%, max)	ASTM D2007	0.1
Aromatics by mass (%, min)	ASTM D2007	55

Table 1: Asphalt Modifier for Asphalt Rubber Binder

Note:

a. X denotes the asphalt modifier viscosity from 19 to 36 as proposed by the Contractor. The proposed value "X" shall be submitted in writing to the Engineer. A change in X requires a new asphalt rubber binder submittal.

Asphalt modifier and asphalt binder must be blended at the production site. Asphalt modifier must be from 2.5 to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder. The asphalt rubber binder supplier determines the exact percentage.

If blended, the asphalt binder must be from 375 to 440 degrees when asphalt modifier is added and the mixture must circulate for at least 20 minutes. Asphalt binder, asphalt modifier and crumb rubber modifier may be proportioned and combined simultaneously.

6-6.3 Crumb Rubber Modifier

Crumb rubber modifier (CRM) shall consist of scrap tire CRM. The scrap tire CRM shall consist of ground or granulated rubber derived from any combination of automobile tires, truck tires or tire buffings. Only California-generated waste tires, processed in California, shall be used in the crumb rubber.

Crumb rubber modifier must be ground or granulated at ambient temperature.

Scrap tire crumb rubber must be delivered to the asphalt rubber binder production site and shall be sampled and tested. Provide certified volume or weight slip for each delivery of crumb rubber modifier.

Steel and fiber must be separated. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Cryogenically produced CRM particles must be large enough to be ground or granulated. Cryogenically produced CRM particles that pass through the grinder or granulator without being ground or granulated, shall not be used.

Crumb rubber modifier must be free of contaminants except wire and fabric. The length of an individual crumb rubber modifier particle must not exceed 3/16 inch.

Crumb rubber modifier must be dry, free-flowing particles that do not stick together. A maximum of 3 percent calcium carbonate or talc by weight of crumb rubber modifier may be added. Crumb rubber modifier must not cause foaming when combined with the asphalt binder and asphalt modifier.

The CRM	must comply w	ith the require	ements shown	in the follow	ving tables:
Table 2. ([¬] rumh Rubber	• Modifier Ph	vsical Requir	ements	

	iounioi i nysicui itee	unemes
Quality Characteristic	Test Method	Requirement
Wire in CRM (%, max)	California Test 385	0.01
Fabric in CRM (%, max)	California Test 385	0.05
CRM specific gravity	California Test 208	1.1-1.2

Table 3: Crumb Rubber Modifier Chemical Requirements

Quality Characteristic	Test Method	Scrap Tire	High Natural
Acetone extract (%)	ASTM D297	6.0-16.0	4.0-16.0
Rubber hydrocarbon (%, min)	ASTM D297	42.0-65.0	50.0
Natural rubber content (%)	ASTM D297	22.0-39.0	40.0-48.0
Carbon black content (%)	ASTM D297	28.0-38.0	
Ash content (%, max)	ASTM D297	8.0	

Table 4: Crumb Rubber Gradation Requirements

Percent passing by weight			
Sieve Size	Scrap Tire	High Natural	
No. 8	100	100	
No. 10	98-100	100	

No. 16	45-75	95-100
No. 30	2-20	35-85
No. 50	0-6	10-30
No. 100	0-2	0-4
No. 200	0	0-1

6-6.4 Asphalt Rubber Binder

Asphalt rubber binder shall be field blended and must be a combination of:

- 1. Asphalt binder
- 2. Asphalt modifier
- 3. Crumb rubber modifier

The blending equipment must allow the determination of weight percentages of each asphalt rubber binder ingredient. Asphalt rubber binder equipment used must be permitted by the local air quality agency.

Asphalt binder must be 79 ± 1 percent by weight asphalt binder and asphalt modifier. Asphalt binder must be 21 ± 1 percent by weight crumb rubber modifier. The minimum percentage of CRM must be 20.0 percent and lower values may not be rounded up.

CRM must be 76 ± 2 percent by weight scrap tire crumb rubber and 24 ± 2 percent by weight high natural crumb rubber.

The blend of asphalt binder and asphalt modifier must be combined with the CRM at the asphalt rubber binder production site. The asphalt binder and asphalt modifier blend must be from 375 to 440 degrees F when CRM is added. Combined ingredients must be allowed to react at least 45 minutes at temperatures from 375 to 425 degrees F except the temperature shall not be higher than 10 degrees F below the actual flashpoint of the asphalt rubber binder.

After reacting for at least 45 minutes, the asphalt rubber binder must comply with the requirements shown in the following table:

Quality Characteristic	Test Method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25-60
Resilience at 25 °C (% rebound)	ASTM D5329	18-50
Softening point (°C)	ASTM D36/D36M	55-88
Viscosity at 375 °F (Pa•s x 10 -3)	ASTM D7741/D7741M	1,500-2,500
(See note a below)		

Table 5: Asphalt Rubber Binder

Note:

a. Prepare sample for viscosity test in accordance with California Test 388.

Maintain asphalt rubber binder at a temperature from 375 to 415 degrees F.

Stop heating unused asphalt rubber binder 4 hours after the 45-minute reaction period. Reheating asphalt rubber binder that cools below 375 degrees F is a reheat cycle. Do not exceed 2 reheat cycles. If reheating, asphalt rubber binder must be from 385 to 415 degrees F before use.

During reheating, you may add scrap tire crumb rubber. Scrap tire crumb rubber must not exceed 10 percent by weight of the asphalt rubber binder. Allow added scrap tire crumb rubber to react for at least 45 minutes. Reheated asphalt rubber binder must comply with the specifications for asphalt rubber binder-field blended.

Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The profile must include the same component sources for the asphalt rubber binder used. The 24-hour (1,440-minute) interaction period determines the design profile. At a minimum, mix asphalt rubber binder components, take samples and perform and record the test shown in the following table:

Quality	Test Method	Minutes	Minutes of reaction (see note a below)					Limit	
Characteristic		45	60	90	120	240	360	1,440	
Cone penetration	ASTM D217	X (see				Х		Х	25-60
at 25 °C (0.10 mm)		note b							
		below)							
Resilience at 25 °C	ASTM D5329	Х				Х		Х	18-50
(min, % rebound)									
Softening point	ASTM	Х				Х		Х	55-88
(°C)	D36/D36M								
Viscosity at 375 °F	ASTM	Х	Х	Х	Х	Х	Х	Х	1,500-
(Pa•s x 10 -3)	D7741/D7721M								2,500
(See note a below)									

 Table 6: Asphalt Rubber Binder Reaction Design Profile

Note:

a. Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 degrees F for 16 hours. After the 16-hour (960 minutes) cool down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1,440 minutes).

b. X denotes required testing.

6-6.5 Screenings

Screenings for asphalt rubber chip seal must comply with the gradation requirements shown in the following table:

Table 7: Asphalt Rubber Chip Seal Screenings Gradation

Percent passing by weight					
Sieve Size	Coarse	Medium			
3/4"	100	100			
1/2"	85-90	95-100			
3/8"	0-15	70-85			
No. 4	0-5	0-15			
No. 8		0-5			
No. 200	0-1	0-1			

The screenings must also comply with the requirements shown in the following table: **Table 8: Asphalt Rubber Chip Seal Screenings Requirements (see note a below)**

able of Asphalt Rubber Chip Sear Servenings Requ	bie of Asphale Rubber Chip Sear Ser conings Requirements (see note a below)				
Quality Characteristic	Test Method	Requirement			
Cleanness Value (min)	California Test 227	80			
Durability (min)	California Test 229	52			
Los Angeles Rattler Loss (100 Revolutions, %, max)	California Test 211	10			
Los Angeles Rattler Loss (500 Revolutions, %, max)	California Test 211	40			
Film Stripping (%, max)	California Test 302	25			

Note:

a. Test the screenings prior to pre-coating.

6-6.6 Asphalt Rubber Chip Seal

The asphalt rubber chip seal using the proposed asphalt rubber binder and screenings must comply with the design requirements shown in the following table:

Table B: Chip Retention

Quality Characteristic	Test Method	Requirement
Chip retention (%)	Vialit Test Method for	95
	Aggregate in Retention Chip	
	Seals, French Chip	

For the Vialit Test, the asphalt rubber binder must be placed within the proposed asphalt rubber binder placement temperature range.

6-7 QUALITY CONTROL

6-7.1 Asphalt modifier

Test asphalt modifier under the test methods and frequencies shown in the following table: Table 9: Asphalt Modifier Testing Frequencies

abic 2. Asphalt Mould	able 7. Asphalt Mounter Testing Trequencies					
Quality Characteristic	Test Method	Frequency				
Viscosity	ASTM D445	1 per shipment				
Flash Point	ASTM D92					
Asphaltenes	ASTM D2007	1 per shipment				
Aromatics	ASTM D2007					

6-7.2 Crumb Rubber Modifier

If multiple sources of scrap tire CRM are used, the tests shall be performed one each source separately. Test CRM under the test methods and frequencies shown in the following table:

Table 10: Asphalt Modifier Testing Frequencies

	······································					
Quality Characteristic	Test Method	Frequency				
CRM gradation	California Test 385	1 per 10,000 lb (see note a below)				
Wire in CRM	California Test 385	or				
Fabric in CRM	California Test 385	1 per 3,400 lb (see note b below)				
CRM specific gravity	California Test 208					

Note:

a. Test scrap tire CRM at this frequency.

b. Test high natural CRM at this frequency.

6-7.3 Asphalt Rubber Binder

Test asphalt rubber binder under the test methods and frequencies shown in the following table: **Table 11: Asphalt Modifier Testing Frequencies**

Quality Characteristic	Test Method	Sampling Location	Frequency
Viscosity at 375 °F	ASTM D7741/D7741M	Distribution Truck	1 per
			distribution
			truck
Descending viscosity	ASTM D7741/D7741M	Reaction Vessel	1 per batch
(see note a below)			of asphalt
Cone penetration	ASTM D217	Distribution Truck	rubber
Resilience	ASTM D5329		binder
Softening point	ASTM D36/D36M		

Note:

a. Start taking viscosity readings at least 45 minutes after adding crumb rubber modifier and continue taking viscosity readings every 30 minutes until 2 consecutive descending viscosity readings have been obtained and the final viscosity complies with the specification requirements.

Retain the sample from each batch. Test for cone penetration, resilience, and softening point for the first 3 batches. If all 3 batches pass, the testing frequency for these three tests may be reduced to once every 3 batches. Otherwise, continue to test for cone penetration, resilience, softening point until 4 consecutive batches pass, then the testing frequency for these three test may be reduced to once every 3 batches.

Log the test results, including time of testing and temperature of the asphalt rubber binder. Submit the log of asphalt rubber binder viscosity test results each day of asphalt rubber binder application to the Engineer. The City shall be notified of the production schedule of all asphalt rubber binder produced for the work. The City reserves the right to observe QC testing of the asphalt rubber binder.

6-7.4 Screenings

Each stockpile of uncoated screenings must be sampled and tested. Make available all stockpiles to the Engineer for Quality Assurance testing and notify the Engineer a minimum of one (1) full working day prior to pre-coating. Maintain discrete stockpiles at the asphalt plant.

Test the quality characteristics of screenings under the test methods and frequencies shown in the following table:

abic 12. Scittenings Q	the 12. Servenings QC resting (see note r below)					
Quality Characteristic	Test Method	Frequency				
Gradation	California Test 202	1 per day per stockpile				
Cleanness value	California Test 227	(see note a below)				
Durability	California Test 229					

 Table 12: Screenings QC Testing (see note 1 below)

Notes:

1. Test screenings prior to pre-coating

a. The Contractor is only required to test the stockpiles from which the screenings for that day's work are being taken from.

6-8 CONSTRUCTION

6-8.1 Equipment

6-8.1A Producing Asphalt Rubber Binder

All equipment used to blend, store, and transport crumb rubber, asphalt modifier, and asphalt rubber binder shall comply with the requirements in Section 2-12 of Caltrans Material Plant Quality Program (MPQP) unless otherwise authorized in writing by the Engineer.

The Engineer reserves the right to require approval of equipment prior to use.

6-8.1B Placing and Finishing Asphalt Rubber Chip Seal

Self-propelled distributor truck for applying asphalt rubber binder must have the following features:

- 1. Heating unit
- 2. Internal mixing unit
- 3. Pumps that spray asphalt rubber binder within 0.05 gal/sq yd of the specified rate
- 4. Fully circulating spray bar that applies asphalt rubber binder uniformly
- 5. Tachometer
- 6. Pressure gauges
- 7. Volume measuring devices
- 8. Thermometer

9. Observation platform on the rear of the truck for an observer on the platform to see the nozzles and unplug them if needed

Self-propelled power brooms that clean the existing pavement and remove loose screenings without dislodging screenings set in the asphalt rubber binder. Gutter brooms or steel tinned brooms shall not be used.

Pneumatic tired rollers must be self-propelled and reversible. Pneumatic tires must be of equal size, diameter, type and ply. The roller must carry at least 3,000 lbs of load on each wheel, and each tire must have an air pressure of 100 ± 5 psi.

Screenings haul trucks must have tailgates that discharge screenings and devices to allow locking onto the rear screenings spreader hitch. The dump beds must not push down on the spreader when fully raised. Dump beds must not spill screenings on the roadway when transferred to the spreader hopper. All haul trucks must have tarpaulins to cover pre-coated screenings.

Self-propelled screenings spreader must have a screenings hopper in the rear, belt conveyors that carry the screenings to the front, and a spreading hopper capable of providing a uniform screening spread rate over the entire width of the traffic lane in the application.

6-8.2 Surface Preparation

The Contractor shall remove any existing traffic stripes, markings, crosswalks, stop bars, legends and raised pavement markers in areas to receive asphalt rubber chip seal as required in Section 2, "Clearing and Grubbing" and Section 8, "Remove Yellow Traffic Stripe and Pavement Marking" as part of these Technical Requirements.

Existing pavement striping, markings or markers which are outside the work area and not to be removed, shall be protected by the Contractor. The Contractor is responsible for restoring any striping, markings, or markers to remain that are damaged or rendered useless by the Contractor's operations at the Contractor's own expense. Restoration shall be performed to the satisfaction of the Engineer.

Vegetation shall be removed from cracks in pavement and at the interface of pavement and gutter prior to sweeping. To facilitate the cleaning operations, it is recommended that the Contractor use a weed spray (Round-Up or its equivalent) ten days prior to asphalt rubber chip seal operations. Flushing with water may be required in some areas.

All vegetation and debris removed from the roadway surface shall be disposed of outside of the project area. The Engineer shall approve all surface preparation prior to application of the asphalt rubber chip seal operations.

Immediately prior to the application of the asphalt rubber binder, the surface shall be clean and completely dry. Cleaning shall be performed by sweeping, flushing, or other means necessary to remove all foreign material such as, but not limited to, leaves, sand, gravel, and dirt and is subject to the approval of the Engineer. The Contractor shall clean all streets from face of curb to face of curb in the project area to ensure the pavement surface is sufficiently cleaned to provide for a bond between the existing pavement surface and the asphalt rubber binder. Any cleaning of the pavement surface immediately before placing asphalt rubber chip seal shall be performed without water. The application of the asphalt rubber binder on any street shall not proceed until the Engineer has approved the street cleaning.

In the event that a scheduled street should become wet due to fog, rain, or any other reason, the placement of asphalt rubber chip seal shall be suspended until the surface has completely dried as determined by the Engineer.

Before applying asphalt rubber binder, cover manholes, values, monument covers, grates or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured by tape or adhesive to the facility being covered. Utility covers, manholes and other permanent features shall be protected in place as per Section 18-3 "Utilities Protection" of these Special Provisions. The Contractor shall be responsible for locating, removing, and cleaning protection from the above mentioned items following the chip seal operations. The methods of protection, and referencing, locating and cleaning shall be submitted to the Engineer for approval.

As directed by the Engineer, the Contractor shall tack coat areas where asphalt rubber chip seal will be placed over any HMA pavement areas installed within 30 days of the asphalt rubber chip seal installation date. The tack coat shall be SS-1h meeting the requirements of Section 94 of the State Standard Specifications or an approved equivalent. Tack coat can be applied with an asphalt distributor. The normal application rate is 0.08 gal/sq. yd. to 0.15 gal/sq. yd. of diluted emulsion.

6-8.3 Pre-coating Screenings

Pre-coating of screenings is required.

Pre-coating of screenings must be performed at a central mixing plant.

For asphalt rubber chip seal, do not recombine fine materials collected in dust control systems except for primary dust collection devices such as cyclone collectors or knock-out boxes with any other aggregate used in the production of screenings.

For asphalt rubber chip seal, screenings must be preheated from 260 to 325 degrees F. Coat with any of the asphalt specified in the table titled "Performance Graded Asphalt Binder" in Section 92 of the Caltrans Standard Specifications. The asphalt must be from 0.5 to 1.0 percent by weight of dry screenings. The Engineer determines the exact rate.

Do not stockpile preheated and/or pre-coated screenings.

6-8.4 Asphalt Rubber Binder Application

The asphalt rubber binder may only be applied if:

- 1. The pavement temperature is above 55 degrees F.
- 2. The ambient temperature is above 55 degrees F.
- 3. The pavement is clean and dry.
- 4. Wind conditions are such that uniform asphalt rubber binder coverage can be achieved.
- 5. Rain is not imminent.

The asphalt rubber binder shall be applied when the temperature of the asphalt rubber binder is between 385 and 415 degrees F.

Prevent vehicles from driving on asphalt rubber binder before spreading screenings.

Do not apply asphalt rubber binder during high wind conditions. If authorized, Contractor may adjust the distributor bar height and distribution speed and use shielding equipment during high wind conditions. However, if the weather conditions do not allow for uniform placement of the asphalt rubber binder, the Engineer may decide to suspend construction activities by the Contractor at no cost to the City. The Contractor may not resume construction activities until after receiving approval from the Engineer.

In the course of construction where the asphalt rubber binder distributor truck creates a joint by stopping at some point along the length of the roadway, the screenings spreader shall stop short of this joint leaving a small strip of uncovered asphalt rubber. This is to prevent an overlapping double thickness joint from being created once work resumes. Transverse joints of this type shall be constructed by beginning spraying of the asphalt rubber binder on the uncovered asphalt rubber binder from before the work stoppage and proceed along the roadway. All reasonable precautions shall be taken to avoid skips and overlaps at joints. Any defect shall be corrected at the Contractor's expense by use of a shovel and/or broom prior to continuing operations. Plan your operations to minimize transverse joints.

The longitudinal joint between adjacent applications of screenings shall coincide with the line between designated traffic lanes. Longitudinal joints shall be overlapped for complete coverage. The overlap shall be from 2 to 4 inches. At longitudinal joints with screenings, the edge shall be broomed back and blended to eliminate differences in elevation. The joints shall be free from ridges, depressions and shall have uniform appearance consistent with the adjacent sealed surface. Defects shall be corrected at the Contractor's expense.

Hold back asphalt rubber chip seal six inches from the lip of gutter, driveway aprons, utility covers and manholes.

Joints between areas of asphalt rubber binder without screenings shall be made by overlapping asphalt rubber binder distributions. The excess material shall be properly dispersed by spreading with a squeegee or take over a larger area of freshly applied asphalt rubber binder.

If the asphalt rubber chip seal will be applied in a cul-de-sac, the Contractor shall submit plans for the construction methods in these areas. The Contractor shall submit plans that include, but not limited to, diagrams showing how the distributor truck and screenings spreader will move through the work area at least 5 days before any asphalt rubber chip seal may be placed in cul-de-sac areas. When placing asphalt rubber chip seals in cul-de-sac, asphalt rubber shall be covered in screenings within 5 minutes of application and initial rolling of the screenings shall begin within 3 minutes after spreading.

For areas not accessible to a truck's distributor bar, apply asphalt rubber binder using pressurized hand wands or other means approved by the Engineer. If using Engineer-approved methods, the Contractor will apply the asphalt rubber binder at a comparable rate and uniformly as the distributor truck in these areas. Care shall be taken to apply screenings while the binder is still hot enough to allow proper embedment.

Apply the asphalt rubber binder at a rate of 0.55 to 0.65 gallons per square yard. The Engineer determines the exact rate. The Contractor must apply binder to within 10 percent of the determined application rate.

Apply asphalt rubber binder in such a manner that the joint between the newly chip sealed pavement and the existing pavement surface is neat and uniform in appearance. The cutoff of the asphalt rubber binder shall be made on building paper or similar material spread over the surface. Prevent spray of asphalt rubber binder on curbs, sidewalks, driveways or any other unintended areas. Remove any binder overspray by the end of the day it was applied.

6-8.5 Screenings Application

During transit, cover pre-coated screenings for asphalt rubber chip seal with tarpaulins at all times. Prevent vehicles from driving on asphalt rubber binder before spreading screenings. At the time of application, pre-coated screenings for asphalt rubber chip seal must be from 225 to 325 degrees F.

Spread screenings at a uniform rate over the full lane width in one application. Operate the spreader at speeds slow enough to prevent screenings from rolling over after dropping. If the spreader is not moving, screenings must not drop. If the spreader stops and screenings drop, remove the excess screenings before resuming activities.

The screenings spreader shall be an appropriate distance behind the asphalt rubber binder distribution truck such that screenings are applied to the asphalt rubber binder within one minute. The screenings spreader shall be within 100 feet of the distribution truck at all times.

Spread screenings at a rate from 28-40 lbs/sq yd. The Engineer determines the exact rate. Spread screening to within 5 percent of the determined application rate. The application of the finished asphalt rubber chip seal shall be uniform in appearance and free of defects.

Post temporary signs indicating "LOOSE GRAVEL" once a street has received screenings.

6-8.6 Rolling and Sweeping

Perform initial rolling within 90 seconds of spreading screenings. Do not spread screenings more than 200 feet ahead of the initial rolling.

A coverage must consist of the number of passes a roller needs to cover the width. A pass must be one (1) roller movement parallel to the asphalt rubber chip seal application in either direction. Overlapping passes are part of the coverage being made and are not part of a subsequent coverage. Do not start a coverage until completing the previous coverage.

Initial rolling of the asphalt rubber chip seal shall consist of one (1) coverage with pneumatic-tired rollers. A minimum of three (3) coverages with pneumatic tired rollers, after the initial rolling, shall be made on the asphalt rubber chip seal.

The use of steel-wheeled rollers is not allowed.

Sweepings shall be a multi-step operations following final rolling of the screenings. Initial sweepings shall be performed and loose screenings shall be removed without dislodging the screenings set in the asphalt rubber binder prior to acceptance. Water may not be used during sweeping.

The exact time of sweeping will be determined by the Engineer. At a minimum, three additional sweepings shall be performed. The first sweeping shall be done one calendar day after placement of the asphalt rubber chip seal. The second sweeping shall occur two calendar days after placement of the asphalt rubber chip seal. The final sweep shall occur from five to seven calendar days after the placement of the asphalt rubber chip seal. The final sweep shall occur from five to seven calendar days after the placement of the asphalt rubber chip seal. The final sweep shall occur from five to seven calendar days after the placement of the asphalt rubber chip seal. The final sweeping must not dislodge screenings.

The Contractor must remove all loose chips from the surface by sweeping the chips off of the roadway. Removal of excess screenings shall be completed before uncontrolled traffic is permitted on the completed asphalt rubber chip seal. Excess chips located in areas not accessible with a broom sweeper shall be swept off the roadway through the use of a vacuum sweeper or other acceptable means as approve by the Engineer. Materials collected while sweeping must be disposed of offsite and may not be stored on the jobsite.

The use of any sweeper that causes damage to the asphalt rubber chip seal coat shall be immediately discontinued. Any voids caused by automobile tires, poor adhesion of chips to asphalt rubber binder, or any other cause shall be the Contractor's responsibility to patch prior to removing traffic control devices and shall be performed at no additional cost to the City.

Place temporary striping and chip seal markers before opening the street to vehicle traffic. Install temporary striping per Section 4-2 "Temporary Traffic Stripes and Pavement Markings" per these Technical Specifications.

6-9 MAINTENANCE

Asphalt rubber chip sealed surface must be maintained until the final placement of the slurry surfacing. Slurry seal shall be applied no sooner than seven (7) calendar days after completion of asphalt rubber chip seal.

7 CRACK CLEANING AND SEALING

7-1 GENERAL

Work covered in this section includes cleaning and sealing AC pavement cracks greater than 1/4inch wide on streets shown on the plans and as directed by the Engineer. Contractor shall submit certificates from suppliers stating compliance of materials with the requirements of this section.

7-2 MATERIALS

7-2.1 Crack Sealant

Nuvo CS C by Maxwell Products Inc, 650 South Delong Street, Salt Lake City, UT 84104 or equivalent as approved by the Engineer.

7-2.2 Contact Herbicide

Contact herbicide shall be Round Up or equivalent as approved by the Engineer. Apply per the manufacturer's recommendations.

7-3 EXECUTION

Clean cracks 1/4-inch and larger, to a point where crack is 3/8-inch wide. Clean loose materials with a high pressure air nozzle to the satisfaction of the Engineer. Loose materials include vegetation, dust, dirt, moisture, old sealant and foreign material. Apply herbicide at manufacturer's recommended rate.

Equipment used by the Contractor shall be specifically built for this purpose and shall be of current manufacture (Crafco Model BC - 220 or an approved equal).

Application - The crack sealant shall be applied per manufacturer recommendations. Avoid allowing the sealant to collect on the pavement, and only be applied in the crack itself. Contractor to remove sealant applied outside limits of the crack.

Cracks shall be sealed from the bottom up. Sealant material application shall be recessed 1/8 to 1/4-inch below the pavement surface to allow room for expansion.

Protection - Traffic shall not be allowed on the material until it has cured or until it has been sanded to prevent tracking. Allow two weeks cure time minimum prior to applying slurry resurfacing.

8 REMOVE YELLOW TRAFFIC STRIPE AND PAVEMENT MARKING

8-1 GENERAL

Traffic stripe and pavement marking shall be removed to accommodate the slurry seal operations, or in the areas shown on the project plans.

Attention is directed to General Requirements Section II.U, "Construction Site Controls" of these this project manual.

Waste from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking contains lead chromate in average concentrations greater than or equal to 350 mg/kg and less than 1000 mg/kg Total Lead. Yellow thermoplastic and yellow paint traffic stripe and pavement marking exist throughout the project sites. Residue produced when yellow thermoplastic and yellow paint are removed may contain heavy metals in concentrations that exceed thresholds established by the California Health and Safety Code and may produce toxic fumes when heated.

The removed yellow thermoplastic and yellow paint shall be disposed of at a Class 1 disposal facility or a Class 2 disposal facility permitted by the Regional Water Quality Control Board in conformance with the requirements of the disposal facility operator within 2 days after accumulating 220 lbs. of residue and dust. The Contractor shall make necessary arrangements with the operator of the disposal facility to test the yellow thermoplastic and yellow paint residue as required by the facility and these special provisions. Testing shall include, at a minimum, (1) Total Lead and Chromium by EPA Method 7000 series and (2) Soluble Lead and Chromium by California Waste Extraction Test. From the first 887 gallons of waste or portion thereof, if less than 887 gallons of waste are produced; a minimum of four randomly selected samples shall be taken and analyzed. From each additional 222 gallons of waste or portion thereof, if less than 222 gallons are produced; a minimum of one additional random sample shall be taken and analyzed. The Contractor shall submit the name and location of the disposal facility and analytical laboratory along with the testing requirements to the Engineer not less than 5 days prior to the start of removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking. The analytical laboratory shall be certified by the Department of Health Services Environmental Laboratory Accreditation Program. Test results shall be provided to the Engineer for review prior to signing a waste profile as requested by the disposal facility, prior to issuing an EPA identification number and prior to allowing removal of the waste from the site.

The Contractor shall prepare a project specific Lead Compliance Plan to prevent or minimize worker exposure to lead while handling removed yellow thermoplastic and yellow paint residue. Attention is directed to Title 8, California Code of Regulations, Section 1532.1, "Lead," for specific Cal-OSHA requirements when working with lead.

The Lead Compliance Plan shall contain the elements listed in Title 8, California Code of Regulations, Section 1532.1(e)(2)(B). Before submission to the Engineer, the Lead Compliance Plan shall be approved by an Industrial Hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene. The Plan shall be submitted to the Engineer at least 7 days prior to beginning removal of yellow thermoplastic and yellow paint.

Prior to removing yellow thermoplastic and yellow painted traffic stripe and pavement marking, personnel who have no prior training shall complete a safety training program provided by the Contractor that meets the requirements of Title 8, California Code of Regulations, Section 1532.1, "Lead," and the Contractor's Lead Compliance Program.

Personal protective equipment, training, and washing facilities required by the Contractor's Lead Compliance Plan shall be supplied the Contractor.

Where grinding or other methods approved by the Engineer are used to remove yellow thermoplastic and yellow painted traffic stripe and pavement marking, the removed residue, including dust, shall be contained and collected immediately. Sweeping equipment shall not be used. Collection shall be by a high efficiency particulate air (HEPA) filter equipped vacuum attachment operated concurrently with the removal operations or other equally effective methods approved by the Engineer. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow thermoplastic and yellow painted traffic stripe and pavement marking to the Engineer for approval not less than seven days prior to the start of the removal operations. Removal operations shall not be started until the Engineer has approved the work plan. The removed yellow thermoplastic and yellow painted traffic stripe and pavement marking residue shall be stored and labeled in covered containers. Labels shall conform to the provisions of Title 22, California Code of Regulations, Sections 66262.31 and 66262.32. Labels shall be marked with date when the waste is generated, the words "Hazardous Waste", composition and physical state of the waste (for example, asphalt grindings with thermoplastic or paint), the word "Toxic", the name and address of the Engineer, the Engineer's telephone number, contract number, and Contractor or subcontractor. The containers shall be a type approved by the United States Department of Transportation for the transportation and temporary storage of the removed residue. The containers shall be handled so that no spillage will occur. The containers shall be stored in a secured enclosure until disposal, as approved by the Engineer.

If the yellow thermoplastic and yellow painted traffic stripe and pavement marking residue is transported to a Class 1 disposal facility, a manifest shall be used, and the transporter shall be registered with the California Department of Toxic Substance Control. The Engineer will obtain the United States Environmental Protection Agency Identification Number and sign all manifests as the generator within 2 working days of receiving sample test results and approving the test methods.

The Contractor shall assume that the yellow paint removed is not regulated under the Federal Resource Conservation and Recovery Act (RCRA). Additional disposal costs for removal residue regulated under RCRA, as determined by test results required by the disposal facility, will be paid for as extra work as provided in this project manual.

Nothing in these special provisions shall relieve the Contractor of the Contractor's responsibilities as specified in Section 7-1.04, "Public Safety," of the State Standard Specifications.

9 TRAFFIC SIGNS

9-1 GENERAL

Roadside signs shall be installed at the locations shown on the plans or where directed by the Engineer, and shall conform to the provisions in Section 82, "Signs and Markers," of the State Standard Specifications and these Technical Specifications. Sign dimensions shall be as specified in the 2014 California MUTCD, except as modified on the City Standard Plans.

9-2 MATERIAL

9-2.1 Base Metal

The base metal shall be new sheet aluminum of alloys conforming to State of California specification numbers 6061 T6, 5154 H38. The thickness of the aluminum sheet shall be .080 gauge unless otherwise specified. The material shall be subject to inspection prior to installation.

The fabrication of all signs shall be accomplished in a uniform and workmanlike manner. The sign panels are to be cut as shown on the sign specification sheets. The dimensional tolerance of the panels shall be plus or minus 1/16". Metal panels shall be cut to size and shape and shall be free of buckles, warp, dents, cockles, burrs, and any other defects resulting from fabrication.

All possible fabrication, including shearing, cutting and punching of holes, shall be completed prior to the base metal preparation.

9-2.2 Base Metal Preparation

The aluminum base metal shall be thoroughly cleaned and anodized as per State of California Specification.

9-2.3 Metal Posts

Traffic sign posts shall be 3/4" SQ 12 GA. X 10 perforated telespar.

Post sleeve shall be 2" – 12 GA x 24 anchor welded to 2-1/4" 12 GA. X 12" sleeve with point.

The set screw for post base shall be VCB 194-5-5 5/16 -18 x 5/16" pinned set screw.

Pedestrian barricades shall be furnished and installed in conformance with the details in Caltrans Standard Plan ES-7Q, at the locations shown on the plans, specified in the State Standard Specifications or in these specifications or where designated by the Engineer. Barricade shall be galvanized after fabrication and conform to Section 83-2.08 "Tubular Handrailing," and Section 75, "Miscellaneous Metal" of the State Standard Specifications and these Specifications.

9-2.4 Street Name Signage Mounting Hardware

The post cap and street name sign holder shall be the following materials: Style # 850 long 5-1/4" blade holder for 1-3/4" square. post

Signage Mount: 90 degree crosspiece Style # 808

9-2.5 Sign Mount Rivets

Sign mounting rivets shall be VCR 221 3/8" aluminum jumbo head drive rivets.

9-2.6 Reflective Sheeting

All signs shall be constructed of high intensity reflective sheeting. The reflective sheeting shall be Scotchlite brand high intensity grade or equal, for the following signs: Guide, G1 G10, Regulatory ALL except as noted below. Warning, ALL; Informational, NONE: unless otherwise specified on plans.

The following signs shall be manufactured with engineering grade sheeting only. No Parking type signs (R22 through R32) (37 through R38), and the No Ped Xing sign, R49 and R96 series, which will use silver white 2290 Scotchlite or equal.

For engineering grade sheeting, such is permitted for parking and other informational signs, the series 700 grade process pastes shall be used for silk screening.

The surface of the reflective sheeting shall be of a flexible, transparent plastic material and shall be smooth. The backing medium shall be of synthetic sheet resin or other suitable non cellulosic material. The bonding adhesive shall have no staining effect and shall be mildew resistant. The sheeting shall permit cutting and color processing at temperatures of 60 to 100oF and relative humidities of 20 to 80 percent. The sheeting shall be heat resistant and permit force curing of unapplied sheeting at temperatures up to 150o and up to 200o F on applied sheeting. The sheeting surface shall be solvent resistant to gasoline, VM&P naphtha, mineral spirits, turpentine, and methanol.

The reflective sheeting shall be applied to the face of the sign by an approved vacuum applicator using a combination of vacuum and heat, as recommended by the reflective sheeting manufacturer. After aging for 48 hours the adhesive shall produce a durable bond equal to or greater than the strength of the reflective sheeting. No air pockets or bubbles shall exist between the sheeting and the base material.

Repairs to damaged reflective sheeting due to poor workmanship or defective material will not be allowed.

Reflective sheeting screening coats shall be oven cured as recommended by the reflective sheeting manufacturer.

9-2.7 Sign Relocation

Existing signs shown to be relocated shall be removed from existing location and relocate with new sign post and mounting at an approved location. Signs damaged by the Contractor during or prior to relocation shall be replaced by and at the Contractor's expense.

9-3 ASSEMBLY

9-3.1 Splices, Vacuum Applied Sheeting

There shall be no splices in the reflective sheeting on panels with a minor dimension of 48", the splice shall be horizontal.

No finished sign shall have more than one splice and no splice shall fall within 2 inches of the sign edge. When splices do occur, the adjoining reflective sheeting shall be color matched under both incident and reflected light.

9-3.2 Edge Sealing

The edges of each completed reflective sheeting sign face and of all cut out letters, numbers, arrows, symbols and borders shall be sealed in a manner and with a sealing solution as recommended by the manufacturer of the reflective sheeting.

9-3.3 Finish

The finished sign shall be flat within a ratio of 0.04 inches per linear foot when measured across the plane of each panel from opposite corners, or at any location on the panel. All finished signs shall have smooth flat surfaces without defects or objectionable marks of any kind on either the front or back faces.

9-4 LEGEND

All letters and designs shall be clearly cut and sharply defined. The message shall be of the following type:

For regulatory signs using high intensity sheeting, the legend may have die cut letters, numbers, and symbols using D or E series or Series 800 (3M) process colors.

For regulatory signs that are allowed to use engineering grade sheeting, the legends shall be cut out letters, numbers, and symbols using engineering grade sheeting, 605 Series Scotchcal film or Series 700 (3M) process colors. The G7 sign used at or advance of named crossroads shall have the following letter sizes: 8" upper case, 6" lower case, series E.

Length of blanks: 5 feet for 8 letters, numbers and spaces, 6 feet for 10 letters, numbers and spaces, 7 feet for 13 letters, numbers and spaces, 8 feet for 15 letters, numbers and spaces. The legend will have die cut letters, numbers and symbols using series E that are Scotchlite, high intensity grade or equal. The guide and informational signs allowed to be manufactured with engineering grade sheeting may have die cut letters, numbers, and symbols or screened letter, numbers and symbols using series 700 process paste.

9-5 MANUFACTURER'S IDENTIFICATION

The year of manufacture and the manufacturer's initial shall be permanently marked or etched on the back of the signs. All identification letters and numerals shall be so placed as not to fall behind any post or frame member.

9-6 SIGN POSTS AND MOUNTING

Except as shown on the plans, all traffic signs shall be mounted on its own post at height shown on the plans and in conformance with California MUTCD.

All posts shall be set in concrete a minimum of two feet below existing grade level. Minimum diameter of concrete footing for posts installed outside of sidewalk shall be 8 inches.

Top of post sleeves shall be installed 2" above finished grade.

Signs to be located in existing sidewalk area may be placed by drilling a hole in the sidewalk one inch (1") larger than the diameter of the post sleeve, a minimum of two feet (2") deep; fill the hole with mortar and place the pole in the hole in a plumb position.

Fasten traffic signs with at least two 3/8" aluminum jumbo head drive rivets.

Sign panels greater than 34" in width shall be installed with a back brace mounted with hardware as noted above.

9-7 INSPECTION

All materials and finished signs are subject to inspection by the City of Alameda. The finished signs shall be clean and free from all router chatter marks, burrs, sharp edges, loose rivets, delaminated reflective sheeting and aluminum marks. Signs with any defects or damage that would affect their appearance or serviceability will not be acceptable. No repairs shall be made to the face sheet without the approval of the City Inspector. All signs not conforming in all respects to the requirements of these specifications, or those damaged during installation will be rejected.

10 METHYL METHACRYLATE BIKE LANE TREATMENT

10-1 GENERAL

Methyl Methacrylate Bike Lane Treatment (the MMA Bike Lane System) is a specialized system of bike lane treatment material that combines Methyl Methacrylate resins with hardwearing aggregate and pigments to deliver a durable, highly visible and color stable, lane delineation treatment that meets the non-slip requirements needed for cyclists.

MMA Bike Lane System shall be used to delineate bike lanes and increase bicycle lane presence along the length of a bike lane or cycle track.

10-2 MATERIAL

Materials used to create MMA Bike Lane System shall consist of the MMA system resin, the MMA system Aggregate and catalyst. MMA to be CycleGrip MMAX by Ennis-Flint or approved equal.

MMA Bike Lane System resin.

MMA Bike Lane System resin shall have the following properties:

Density	12.85 +/15	Lbs/Gal
Tensile	>2000 psi	ASTM D638
Elongation	>70%	ASTM D638
Flash Point	>10°C	ASTM D1310

MMA Bike Lane System resin shall be pigmented to meet the following color coordinates:

Daytime chromaticity:

1		(2		3	4	1
Х	у	Х	у	Х	у	Х	у
0.230	0.754	0.266	0.500	0.367	0.500	0.444	0.555
TE1 1 .	1 1	0	(7.7) 1 11	1 . 1		.1	25

The daytime luminance factor (Y) shall be at least 20, but no more than 35.

Nighttime chromaticity:

1		2		3		4	
Х	у	Х	у	Х	у	Х	у
0.230	0.754	0.336	0.540	0.450	0.500	0.479	0.520

MMA Bike Lane System aggregate shall be provided by the manufacturer and will have a hardness of 9 on the Mohs scale. Aggregate shall be a neutral, light color that will not affect the color of the finished product, and will have a mesh sizing of 24 Grit.

Catalyst shall come in a powder form and be supplied in bulk at the maximum usage rate of 0.51 +/- 0.2 lbs (.23 +/- .09 kg) per pail of resin.

Ambient and surface temperatures for installation should be between 40-100°F, and should be $5^{\circ}F$ above the dew point temperature. There should also be less than 75% relative humidity when installing.

Density	18.5 +/- 0.5	Lbs / Gallon
Solids	>99%	D2205
Build	Thickness	90 +/-10 Mils
VOC	<100	Grams/Liter
Pot Life	~15min	AASHTO T237
Skid	>60	ASTM E303
Hardness	50-60	ASTM D2240
Water Absorption	<0.25%	ASTM D570

10-2.2 Packaging

MMA Bike Lane System resin must be supplied in compliant metal pails that have a UN1A2Y1.9/100 rating.

MMA Bike Lane System aggregate must be supplied in 25.5 +/- 0.5 lbs. (11.7 +/- .23 kg) prepackaged bags or pails.

10-3 APPLICATION EQUIPMENT

The following items are needed during the different stages of application

Surface prep & layout	Mixing	Installation	Clean up
Stiff broom	High speed / torque	Long handled	Solvent resistant gloves
	drill	squeegees	
Blower / compressed air			Safety glasses
	Mixing paddles	Spare rubber squeegee	
Measuring tape		blades	Acetone
	Measuring cup		
Chalk line		Straight hand trowels	Large cleaning tub
	Small tarp		
Marking crayons		Long handled roller	Solvent resistant brushes
	Screw driver/bucket	cages	
Duct tape	opener		Cloth rags
		Rollers - med. nap (5	
Roofing paper	Utility knife	per 1000 SF)	Trash bags
	Misc tools		

10-4 APPLICATION

Pre-conditions. Aged surfaces containing reflective cracking should be repaired.

Surface preparation. Clean the intended application area thoroughly. All loose particles, dirt, sand dust, etc. must be removed. Broom and use a power blower or compressed air. The surface must be clean, dry and free of all dust, oil, debris and any other material that might interfere with the bond between MMA Bike Lane System and surface to be treated.

Chemical contaminants: Clean areas containing chemical contaminants such as vehicle fluids, using a degreasing solution, and ensure removal of contaminants and degreasing solution well in advance of the application.

10-4.1 Obstacles

Pavement markings that are to be left in place, utilities, drainage structures, curbs and any other structure within or adjacent to the treatment location shall be masked to protect from application. Existing pavement markings conflicting with the surface treatment should be removed by grinding or water blasting. Extra care should be taken to thoroughly remove the dust and debris caused from grinding.

10-4.2 Surface Prep

Clean the intended application area thoroughly. All loose particles, dirt, sand dust, etc. must be removed. Concrete surfaces should be wire brushed, at minimum. Sweep completely. Use a power blower or compressed air. Clean areas containing chemical contaminants such as vehicle fluids, using a degreasing solution. Proper removal of contaminants and degreasing solution are necessary well in advance of the application.

10-4.3 Masking

Using duct tape and roofing paper, mask off perimeter of area to be colored, as well as any object not to be colored such as manhole covers, drains and existing markings.

10-4.4 Mixing

Add the supplied 25.7 lbs of CycleGrip® MMAX aggregate into the 2 gallons CycleGrip® MMAX resin and mix with clean mixing paddle, using a high speed, high torque drill. Add the recommended amount of powder catalyst, based on ambient and pavement temperature (Table 1), and mix thoroughly.

After adding the catalyst, CycleGrip® MMAX will start curing and must be applied to the pavement immediately. There will be 4 to 10 minute working time, which is temperature dependent.

Material will mix to approximately 2.79 gallons (10.55 liters), weigh 52 lbs and cover 45-50 sqft @ 90 mils.

Caution: Clean the mixing paddle between uses or understand that material will immediately initiate curing if previously exposed to catalyzed material (and not cleaned).

< 70°F / 18°C	lbs (kg)	.51 (.23)
	fl oz (liters)	12 (.365)
70-90°F / 18-32°C	lbs (kg)	0.26 (.12)
	fl oz (liters)	6 (.185)
> 90°F / 32°C	lbs (kg)	0.13 (.06)
	fl oz (liters)	3 (.09)

Table 1: Recommended catalyst by temperature range:

10-5 INSTALLATION

Immediately, pour mixed material on to pavement to be treated and use a squeegee to evenly distribute at a coverage rate of 16-18 sq. ft. per gallon, or 45-50 sq. ft. per pail. Pre-measuring / pre-marking can assist to ensure proper coverage. Use trowel in small, tight areas where squeegee cannot effectively be used. After rough distribution with squeegee, back roll material (one direction only) to remove working lines created with squeegee and create a consistent, anti-slip texture. Roller will last longer during continuous usage when it remains wetted with new matches of MMA resin, but will need to be replaced when it starts 'pulling' material or creating differences in texture. Stopping and starting will decrease the useful life of the roller.

As material gels, but before it cures, remove masking.

10-5.1 Clean Up

Clean all tooling in acetone before material is cured. Clean in well ventilated areas to reduce fume buildup and worker exposure. Do not come into direct contact with solvents - use proper personal protective equipment. Acetone is extremely flammable; take proper handling measures to reduce static discharge and combustion. Dispose of all contaminated materials in accordance with all applicable federal, state and local laws and regulations.

10-6 OPENING TO TRAFFIC

MMA Bike Lane System must be 100% cured, which will be a hardened solid state, before traffic is permitted. Curing typically takes 30-60 minutes and is based on temperature and amount of catalyst added.