

ARTICLE 8

PAVEMENT

8.1 ASPHALT PAVEMENT

8.1.1 DESCRIPTION

Asphalt concrete pavement shall consist of asphalt cement uniformly mixed with well-graded aggregate and laid upon a prepared surface, along the lines and to the thickness as shown on the approved plans.

8.1.2 SUBMITTALS

Asphalt suppliers furnishing asphalt for placement within any City right-of-way shall provide to the City, once every two years, asphalt mix designs for asphalt intended for use within the City right-of-way.

8.1.3 MATERIALS

8.1.3.1 Asphalt Cement

Asphalt cement for the pavement mixture shall be SPG 58-28 (residential streets) or SPG 64-22 or SX PG 64-28 (arterial, collector, and industrial streets) unless otherwise specified in Article 2 - Special

Provisions and shall conform to the requirements of Table 2 of AASHTO M-226 (latest revision). The asphalt cement shall be homogeneous, free from water, and show no tendency to foam when heated to 347°F. The spot test shall be negative for all grades when conducted with a naphthylene solvent containing not more than 10% xylene by volume.

Asphalt cement shall not be heated during the process of its manufacture, storage or during construction, to a temperature that will cause the formation of carbonized particles. After loading in a tank for transportation from the refinery to the purchaser at no time shall the temperature of the asphalt cement be raised above 375°F

Written Certification of Compliance with these specifications shall be provided to the City Engineer. The City Engineer may, in the absence of written certification, require that samples of the asphalt cement be delivered to an approved testing laboratory to ensure compliance with these specifications. Costs for testing shall be paid for by the Contractor/Developer.

8.1.3.2 Aggregate

The coarse and fine aggregates for hot bituminous pavement mixtures shall be graded and combined in such proportions that the resulting composite blend meets the grading requirements of the job mix formula. The job mix formula, with the aggregate tolerances, shall be within the master range set forth in the following table:

Table 8.1. Percent by weight passing square mesh sieves

Sieve Size	Grading SF	Grading ST	Grading SX	Grading S
1 1/2"				
1"				100
3/4"			100	90-100
1/2"		100	90-100	*
3/8"	100	90-100	*	*
No. 4	90-100	*	*	*
No. 8	*	28-58	28-58	23-49
No. 16	30-54			
No. 30	*	*	*	*
No. 200	2-12	2-10	2-10	2-8

The grading of the aggregate shall be Grading SX unless otherwise approved by the City Engineer.

Coarse aggregate (material retained on the No. 8 sieve) shall have a "Los Angeles Abrasion Test" (AASHTO T-96) percentage of wear not exceeding 45%. Fine aggregate (material passing the No. 8 sieve) shall have a maximum of 12% wear at five cycles in the sodium sulfate solution by the "Soundness Aggregate Test (AASHTO T-104). The aggregate shall be free from clay balls, organic matter, or other deleterious substances. At least 60% of the aggregate retained on the No. 4 sieve, and larger, shall have at least two fractured faces.

8.1.3.3 Asphalt-Aggregate Mixture (Job Mix Formula)

The Contractor/Developer shall furnish to the City Engineer a mix design, from an approved independent testing laboratory, of the hot bituminous pavement proposed for use. This job mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature for the mixture at the discharge point at the plant. The job mix formula shall also give recommended temperatures for delivery and compaction. The job mix formula shall be determined a minimum of once per year, or when the asphalt supplier or aggregate characteristics change. **After the job mix formula has been established, all mixtures furnished for respective projects shall conform to within the following range of tolerances:**

Table 8.2. Percent by weight passing square mesh sieves

Maximum Size	± 0%
Passing No. 8 and larger sieves	± 8%
No. 8 to No. 200	± 6%
Passing No. 200	± 2%

Asphalt Content	± 0.5%
Discharge Mix Temperature	± 20°F

The job-mix formula may be changed by the City Engineer for either of the following reasons:

- (a) Change in the job-mix formula will produce material of equal or better quality and will provide for more efficient pit operations.
- (b) Change in the job-mix formula will produce material of equal or better quality and will result in a cost savings to the City through an adjustment in unit price.

Asphalt mix designs containing reclaimed asphalt pavement (RAP) materials greater than 20% will only be allowed with written approval from the City Engineer.

8.1.3.4 Quality Control

All samples and tests described herein shall be made in accordance with approved ASTM/AASHTO procedures. The Contractor/Developer shall provide for all testing laboratory services in connection with tests verifying conformance of proposed materials with project requirements. The City may also provide for testing laboratory services in connection with tests on materials after incorporation into the project.

Additional tests may be required at the direction of the Engineer. If additional tests are required, the financial burden will be borne by the Contractor/Developer if the testing results fail to meet minimum city specifications. If the testing results meet or exceed the city specifications the additional testing costs will be paid for by the requesting entity.

Table 8.3. Minimum Project Testing

Gradation	1/1,000 Tons or 1/project site
Asphalt Content	1/1,000 Tons or 1/project site
In-Place Density (including cores & comparative lab densities)	1/1,000 Tons or min. 1/500 L.F. of paving

8.1.4 MIXING PLANT

The requirements of this section shall be the same as Section 401.08 "Asphalt Mixing Plant" of the Standard Specifications for the Road and Bridge Construction, by the Colorado Department of Transportation, 1991 edition, or as amended. For plant inspection, the Engineer or approved laboratory shall have full right to enter at any time and conduct necessary tests to ensure compliance with these specifications.

8.1.5 CONSTRUCTION METHODS

8.1.5.1 Hauling Equipment

Trucks used for hauling the asphalt concrete mixture shall be equipped with tight, clean, smooth metal beds. When directed by the Engineer, the beds shall be coated with an oil or other approved material to prevent the mixture from adhering to the beds. Each load shall be covered

with canvas or other suitable material of sufficient size to protect it from inclement weather conditions.

8.1.5.2 Paving Machines

Unless otherwise permitted by the Engineer, the mixture shall be spread by means of a self-propelled laydown machine equipped with a screed or strike-off assembly and capable of spreading and finishing the asphalt concrete mixture to the line, grade, and crown as shown on the plans.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The mixture shall be dumped in the center of the hoppers, and care exercised to avoid overloading and spilling over of the mixture onto the base.

The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

When laying mixtures, the paver shall be capable of being operated at the necessary forward speeds for satisfactory placement. The operation of the paver shall be as such to attain continuous paving.

8.1.5.3 Rollers

Rollers shall be steel wheeled and/or pneumatic tire type and be in good condition, capable of reversing without backlash. They shall weigh not less than 8 tons. All rollers shall have a water system capable of keeping the wheels properly moistened to prevent adhesion of the mixture to the wheels.

8.1.5.4 Paving Surface

After the pavement base has been prepared, it shall be made ready for paving by clearing any loose material off as directed by the Engineer. Edges of all contact surfaces such as curb and gutter, manholes, cross pans and other structures shall be coated with the tack coat material as described herein before paving. When more than one lift is required, a tack coat shall be used between courses of pavement in accordance with Section 8.2 of these specifications as directed by the Engineer.

Asphalt pavement shall be a minimum of 2" compacted thickness and shall be laid in one lift. If a thickness greater than 3" is specified, separate courses shall be laid; each course shall be not less than 1-1/2" compacted thickness, nor greater than 3" compacted thickness or three times the nominal aggregate size.

For overlays the material shall be placed in a maximum compacted thickness of 3" and a minimum compacted thickness of twice the diameter of the aggregate unless otherwise directed by the Engineer.

8.1.5.5 Spreading, Finishing, and Compaction

The mixture shall be laid upon the approved base surface, spread, and struck off to the grade and elevation required. Pavers shall be used to distribute the mixture over the entire surface except where hand placing is necessary.

The longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed. If directed, the joints shall be coated with tack coat material.

On the areas where the use of mechanical pavers cannot be used, the mixture shall be spread, raked and luted by hand tools. When material is shoveled, it shall be deposited by turning the shovel over above the desired area. No "slinging" of the shovel will be permitted. The hand placed material shall be smoothed and left higher than the machine laid material by about 1/4" per inch of depth prior to rolling. If the machine laid mixture has been rolled, then the hand laid mixture shall be smoothed and left higher than the rolled pavement by about 1/4" per inch depth. The majority of the raker's work shall be done with a lute rather than a tined rake.

Segregation of materials shall not be permitted. If segregation occurs, the spreading operation shall be immediately suspended until the cause is determined and corrected.

Placement of the mixture shall be as continuous as possible. All surface irregularities shall be adjusted by the addition or removal of mixture prior to rolling. After the mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled at a specified breakdown temperature which shall be determined by the Contractor's foreman and the Engineer at the beginning of the job. The breakdown temperature shall be such that the required density is obtained without displacement, cracking, or shoving of the mixture. The rollers shall operate at a speed slow enough to avoid displacements or "crawl" of the mixture. Any displacement shall be immediately corrected by means suitable to the Engineer.

The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The minimum number of rollers shall be two. Heavy equipment or rollers shall not be allowed to stand on freshly placed pavement.

Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the street centerline, each pass overlapping one-half the roller width, gradually progressing to the crown of the street. When paving adjacent to a previously placed lane, the longitudinal joint shall be rolled first followed by the regular rolling procedure.

Rolling shall be continued until all roller marks are eliminated and no further compression is possible. The minimum density of the compacted mixture shall be 95% of the maximum density required to provide laboratory compacted specimen made in the same proportions as the job mix formula (AASHTO T-209). However, if in the opinion of the Engineer a 95% density would prove to be detrimental to the asphalt cement pavement, then a density of 93% will be allowed. Along forms, curbs, manholes, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hand tampers or with mechanical tampers. The joints between these structures shall be effectively sealed.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area.

8.1.5.6 Asphalt Temperature

The minimum and maximum delivery and discharge temperatures of the asphalt to the jobsite shall comply with CDOT Section 401.15 "Mixing".

8.1.5.7 Joints

Transverse joints shall be formed by cutting through the previously laid course to expose the full depth of the course. A coat of tack coat material shall be used on contact surfaces of all joints just before additional mixture is placed.

8.1.5.8 Weather Limitations

Hot mix asphalt shall be placed only on properly prepared unfrozen surfaces that are free of water, snow, and ice. The hot mix shall be placed only when both the air and surface temperatures equal or exceed the temperatures specified in Table 8.4 and the City Engineer determines that the weather conditions permit the pavement to be properly placed and compacted. If the temperature falls below the minimum air or surface temperature, paving shall stop. The temperature of the hot mix asphalt delivered to the jobsite shall not be less than 235°F.

Table 8.4. Minimum Surface and Air Temperature

Compacted Layer Thickness	Minimum Surface and Air Temperature	
	Top Layer	Layers Below Top Layer
1-1/2"	60°F	50°F
2" - <3"	50°F	40°F
Note: Air temperature is taken in the shade. Surface is defined as the existing base on that the new pavement is to be placed.		

8.1.5.9 Surface and Thickness Tolerances

The surface of the finished pavement shall be free from depressions exceeding 3/16" in 10', when tested with a straight-edge. All depressions exceeding the specified tolerances shall be corrected by removing defective work and replacing it with new material as directed. The surface shall be smooth and true to the established crown and grade. The required compacted thickness shall be as specified on the construction drawings.

8.1.6 RESTRICTION OF TRAFFIC

The Contractor shall arrange the work in such a manner as to cause a minimum of inconvenience to the traveling public and the abutting property owners. The Contractor shall submit to the Engineer a plan of this operation. In general, the Contractor shall be allowed to proceed as they propose. However, the Engineer retains the authority to order the Contractor to schedule the proposed operation in another manner if such a change in schedule is to the

benefit of the City and is beneficial to the interests of a good project. The Contractor shall arrange to have the haul vehicles operate over roads which will not be damaged by such vehicles. The Contractor shall provide all necessary Traffic Control in conformity with these provisions and specifications and with the ordinances and regulations of the *City of Pueblo, MUTCD and ARTICLE 9 –Traffic Control*; shall be paid for as specified in the contract documents.

8.1.7 PATCHING

For warranty work or patching repairs, the requirement is for the patching to be equal to the existing pavement thickness or Table 3-1 from the design criteria, whichever is greater.

Remove the backfill material to the depth and extent required in accordance with the drawings. Prepare the subsurface with the required base course, Flowfill, and/or Portland Cement concrete subsurface in accordance with the drawings. Depths and/or thickness of base course, Portland Cement concrete and/or asphalt pavement shall be as indicated on the drawings. The asphalt pavement shall conform to the *Pavement Design Criteria for the City of Pueblo* or equal to the existing pavement thickness, whichever is greater. The backfill and base coarse material shall be thoroughly compacted to the densities specified in *ARTICLE 6 – Aggregate Base Course* with a roller for large areas and smaller hand operated compactor for small patches.

Existing pavement may be rough cut initially in conjunction with trenching; however, a square, even, vertical saw cut shall be made in the existing asphalt pavement after placement of backfill and prior to pavement replacement. The square, vertical saw cut shall be made at a minimum of 1' back from the trench line into good pavement (not required if using CLSM). Before placement of the new pavement, the cut edges shall be thoroughly cleaned, and a tack coat shall be uniformly and evenly applied to any vertical faces in accordance with Section 8.2. The patch shall be made with the placement of a hot asphalt cement and aggregate mixture as described in this Article. If asphalt cut is within 2' of the lip of curb & gutter, a new asphalt patch shall extend to the lip of the curb & gutter in a continuous patch.

In large patches or whenever possible, a self-propelled paving machine shall be used to place the mixture. In small patches, the material shall be hand placed or placed with a spreader box without separation of the mixture. The material shall be placed to the grade and thickness required to allow for compaction after rolling. The hot mix material shall be compacted using the number, weight and type of rollers required to provide 95% of the maximum density of a laboratory compacted specimen made in the same proportions as the job mix formula (AASHTO T-209). Rolling shall continue until all roller marks are eliminated and no further compression is possible in the pavement. After rolling the surface, a straight-edge or a stringline shall be used to check the grade and riding quality of the patch.

8.1.8 RECYCLED PLANT MIX BITUMINOUS PAVEMENTS

Plant mixed bituminous pavements shall not contain more than 20% reclaimed asphalt pavement. The reclaimed asphalt pavement shall meet all the requirements for hot bituminous pavement, as contained herein.

8.1.8.1 Reclaimed Asphalt Pavement (RAP) Material

The Engineer may require the Contractor to maintain separate stockpiles for each type of RAP material. All processed material shall be free of foreign materials and segregation shall be minimized. The RAP material shall be processed, if needed, so that at least 95% passes through a 5/8" sieve. Any RAP material that cannot be readily broken down in the mixing process and/or affects the paving operation, shall be processed prior to mixing with the virgin material.

8.1.8.2 Composition of Mixtures

Tests for cleanliness, abrasion loss, and the percentage of fractured faces will be made on representative samples of aggregate taken during production or from the stockpiles. Proportions of the reclaimed and virgin material shall be determined and proposed by the Contractor/Developer to meet the mix composition requirements of CDOT Standard Specifications for Road and Bridge Construction - Section 400. The maximum aggregate size contained in the combination of reclaimed asphalt pavement and new aggregate shall not exceed the maximum specified in the gradations presented in these specifications.

- (a) **Job-Mix Formula.** See Section 8.1 of these specifications for approval of mix design. The cost for this testing shall be the responsibility of the Contractor/Developer.
- (b) **Uniformity.** After the job-mix formula has been approved, the owner shall implement an acceptable quality control plan as detailed in Section 8.1.3.4 of these specifications. Deviations from the final approved design for bitumen content and gradation of aggregates shall not be greater than the tolerances listed in Section 8.1.3.3 of these specifications and shall be based on the extraction test.
- (c) **Bituminous Mixing Plant**
 - (1) **Batch Plant.** The batch plant shall be modified to allow weighing the reclaimed asphalt pavement (RAP) material prior to incorporation into the pugmill. The cold feed bin, conveyor system and the special bin adjacent to the weigh box, if used, shall be designed to avoid segregation and stocking of the RAP material. The virgin aggregates shall be dried and heated to a suitable temperature so that on combining with the RAP material at ambient temperature the resulting mix temperature of successive loads may not be a cause for a rejection of the mix by the Engineer. The virgin aggregates shall be free of unburned fuel oil when delivered to the pugmill.
 - (2) **Drum Mixer Plant.** The drum mixer plant shall be modified to prevent direct contact of the RAP material with the burner flame and/or overheating of the RAP material in the process.

8.1.9 MEASUREMENT AND PAYMENT

Asphalt concrete pavement courses measured by the square yard will be paid for at the contract unit price per square . This payment shall be full compensation for all materials, tools, equipment, and labor necessary to complete the work under this section in accordance with the plans and these specifications. The payment shall be full compensation for all coats applied in accordance with these specifications.

If there is no pay item for asphalt concrete pavement of the type specified, it will not be measured and paid for separately but shall be included in the pay item most closely associated with the work. Payment will be made under:

Table 8.5. Payment Units

Pay Item	Pay Unit
Asphalt Pavement (Asphalt)	Ton
Asphalt Pavement (RAP) (Asphalt)	Ton
Asphalt Pavement (Patching) (Asphalt)	S.F.

8.2 ASPHALTIC TACK COAT

8.2.1 TACK COAT

8.2.1.1 Description

Existing asphalt surfaces receiving an asphalt overlay, existing vertical concrete surfaces (such as curb and gutter, crosspans and manholes) or between layers of multi-course asphaltic pavement structure, shall receive a tack coat consisting of an emulsified asphalt in accordance with these specifications at the locations shown on the plans, or as directed by the Engineer. Tack coat may be eliminated between successive lifts if the Contractor protects the surface from contamination.

8.2.1.2 Surface Preparation

Before applying the tack coat, surfaces shall be thoroughly cleaned of all dirt and other debris to ensure an adequate bond between the tack surface and asphaltic mat. The surface of the existing asphalt must be completely dry before placing tack coat.

8.2.1.3 Liquid Asphalt

The liquid asphalt used for the tack coat shall be an emulsified asphalt whose grade conforms to *CDOT Specifications Section 407* and shall satisfy the requirements of AASHTO M-140 or M-208. Other emulsified asphalts may be used with written permission of the Engineer.

8.2.1.4 Placing

The rate of application shall be 0.1 to 0.3 gallons per square yard and shall provide a uniform and even coating of the surface. The surface shall be allowed to cure to permit drying and setting of the tack coat prior to the paving operation.

8.2.2 MEASUREMENT AND PAYMENT

Payment for the tack coat shall be included in the unit price bid for asphalt pavement, and shall include all materials, tools, equipment, and labor necessary to complete the work in accordance with the plans and specifications, and as directed by the Engineer.

8.3 CONCRETE PAVEMENT

8.3.1 DESCRIPTION

The work performed under this section shall consist of the construction of a pavement composed of Portland cement concrete, with or without reinforcement as specified, on a prepared subgrade or base course in accordance with these specifications. The work performed will be in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or as established.

8.3.2 MATERIAL

8.3.2.1 General

The specifications presented in this section are performance oriented. The City's objective in setting forth these specifications is to achieve an acceptable quality of streets. All sources for the mined or manufactured materials must be annually approved by the City as having met the appropriate materials performance specifications. This approval is a condition of using those material sources for public improvement construction.

8.3.2.2 Procedure for Material Source Approval

On or before April 1st of each year, a material supplier for any City improvement shall supply written documentation and material test results from a qualified, independent materials testing laboratory that describes:

- (a) Material(s) being tested to meet City specifications.
- (b) The test procedures employed.
- (c) The supplier(s) manufacturing, mining, or treating process by which the tested materials were created.
- (d) The material test results.
- (e) A signed statement by the material supplier that the materials produced and tested for this certification are truly representative of the materials to be provided for public improvements in the City during the coming 365-day period.

8.3.2.3 Portland Cement Concrete

This material shall consist of a mixture of fine and coarse aggregates, Portland cement, water and other materials or admixtures as required. Comply with ARTICLE 4 – Concrete and ARTICLE 5 – Structural Concrete.

8.3.3 CONSTRUCTION REQUIREMENTS

Materials shall be proportioned, handled, measured, batched, placed, finished and cured in accordance with Section 412 of the CDOT and ASTM C-94 (whichever is more stringent).

8.3.4 QUALITY CONTROL

All samples and tests described herein shall be made in accordance with approved ASTM/AASHTO procedures. The Contractor/Developer shall provide for all testing laboratory services in connection with tests verifying conformance of the proposed materials with the project requirements. The Contractor/Developer shall also provide for testing laboratory services in connection with tests on materials after incorporation into the project, on a first-time basis only. Additional tests may be required at the direction of the Engineer. If additional tests are required, the financial burden will be borne by the Contractor/Developer if the testing results fail to meet minimum city specifications. If the testing results meet or exceed the city specifications the additional testing costs will be paid for by the requesting entity.

During the placement of Portland cement concrete pavement, observation and testing shall be on a full-time basis. For each day of production, aggregate samples shall be obtained for gradation of both the coarse and fine aggregates.

Testing shall be done per ARTICLE 4 – Concrete.

Thickness of fresh concrete must be checked a minimum of every 300 linear feet each traffic lane according to the CDOT Section 412.24. Any noted deficient areas shall be corrected at that time. Surface smoothness shall be tested and corrected as necessary according to CDOT Section 412.16. The Engineer will decide when the pavement shall be opened to traffic; otherwise, the pavement shall not be opened to traffic until 14 days after the concrete was placed, or until the compressive strength of the laboratory cured 6 x 12 cylinders (ASTM C-39) averages 3000 psi. Prior to opening to traffic, the pavement shall also be cleaned, and all joints sealed.

8.3.5 FINAL ACCEPTANCE

All test results shall be submitted to and reviewed by the City. Provided all tests are acceptable, the pavement will be accepted. Should testing indicate unsatisfactory work, the removal, replacement, or grinding of the pavement or reduced payment will be required.

8.3.6 MEASUREMENT AND PAYMENT

The accepted quantities of concrete pavement will be paid for at the contract unit price per square yard. Price and payment shall be full compensation for furnishing and placing all materials, including any dowels, tie bars and joint material.

No additional payment over the unit contract bid price will be made for any pavement which has an average thickness in excess of that shown on the plans. Reinforcing steel, other than as mentioned above, will be measured and paid for in accordance with *ARTICLE 5 – Structural Concrete*.

8.4 PAVEMENT MARKING

See Article 9.3.5

8.5 CRACK SEALING

8.5.1 DESCRIPTION

This item shall consist of furnishing all materials, equipment, labor, cleaning and clean up, traffic control and incidental items necessary for the sealing or filling of cracks in asphalt pavements. The purpose of crack sealing and crack filling is to prevent the intrusion of water and other materials. Crack sealing shall be applicable for cracks 1/4" to 3/4" wide or as recommended by the manufacturer. Crack filler is recommended for cracks that are 1" or wider and/or exhibit edge deterioration.

Crack **Sealer** is used for working cracks, those cracks that have more than 1/4" seasonal movement. Both hot and cold materials are currently available for crack sealing. However, this specification is meant to only apply to hot applied materials.

Crack **Filler** should be used for non-working cracks. Non-working cracks are cracks that have annual movement less than 1/4". Non-working crack types may include wide transverse cracks. If a crack exhibits edge deterioration it should be filled not sealed.

8.5.2 MATERIALS

Materials used for crack sealing shall meet or exceed the requirements of ASTM D 6690 for Type II Material as specified. Crack sealers are typically viscous at high temperatures and applied with a wand and any excess material is spread with a squeegee. The Contractor/Developer shall provide material certifications and manufacturer's instructions for heating and application.

Materials used for crack filling shall be a premixed blend of polymer modified asphalt binder and wear resistant aggregates heated and mixed in a specialized melter. They are usually applied using a specialized device and smoothed with a heated float. The Contractor/Developer shall provide material certifications and manufacturer's instructions for heating and application. Material shall be approved by the Engineer prior to application.

8.5.3 EQUIPMENT

Equipment shall be as specified by the sealant manufacturer and approved by the Engineer. All equipment and machinery shall be kept in good working order, free of leaks and properly muffled. All taxes, licenses and fees shall have been paid and proper licenses and permits shall be posted as required by law.

An oil jacketed type melting unit equipped with both agitation and recirculation systems shall be used to heat the sealant. Direct Fire Melters will not be allowed. The unit shall be equipped with separate thermometers for both the oil bath and the crack sealing material. Thermometers shall be calibrated on a weekly basis to ensure the proper heating of the material.

Materials shall be heated according to the manufacturer's specifications. Fresh material shall not be added to material that was overheated to make it acceptable. Material that has been overheated shall be removed and discarded.

8.5.4 CONSTRUCTION REQUIREMENTS

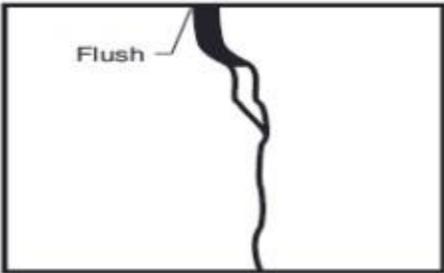
Prior to sealing, all loose material shall be blown out of cracks using a heat lance. Care shall be taken not to burn or scorch the pavement. Torches shall not be used. The Contractor/Developer shall ensure that blown debris shall not strike pedestrians, workers, or cause damage to vehicles and/or private property during cleaning and sealing operations. The Contractor/Developer shall clean debris from the streets and sidewalks as soon as the sealant has hardened sufficiently.

Cracks shall be free of moisture, residue from deicing chemicals, vegetation and loose matter prior to sealing. If sealant boils when applied, additional drying is required before sealing resumes.

Cracks shall be sealed to a minimum depth equal to two times the crack width or the full thickness of the pavement. Overband, if used, shall not exceed 3" in width and 1/8" in height above the pavement surface. Overband width is critical when sealing longitudinal cracks or in stopping zones to avoid creating hazards for cyclists or reducing tire friction.

When the Engineer specifies routing of cracks, routing shall precede blowing out cracks.

Engineer shall specify if routing is required prior to placement of Crack Seal and the type of sealant or filler application to be installed:

Flush Fill	Routed and Flush Filled
	
Overband (also referred to as "Band Aid")	Routed and Overband
	

The finished level of Crack Seal or Crack Filler shall be flush to an 1/8" above the asphalt surface. Excess material shall be removed by the Contractor/Developer at the Contractor's/Developer's expense.

The Contractor/Developer shall apply the sealant material according to manufacturer's recommendations with approval by the Engineer. The Contractor/Developer shall be solely

responsible for safety during all operations and making sure that the material is placed only in cracks with or without overband as shown above. Costs of damage, cleanup and/or material placed incorrectly shall be borne by the Contractor/Developer.

Traffic shall be kept off the sealant until it is sufficiently hard to not be picked up by traffic. Cooling of sealant can be accelerated using a commercial solution or water. Blotting with sand or paper is not acceptable.

QUALITY CONTROL REQUIREMENT CHECKLIST

Climatic Conditions:

- Surface temperature is at least 45°F and rising or per manufacturer's recommendations.
- No moisture, fog or dew is present.
- Early morning operations should be performed in direct sunlight.

Routing

- Cutting tips are sufficiently sharp to minimize spalling and cracking.
- Proper safety garments are worn (hard hat, reflective vest, long-sleeved shirt, pants, steel toed boots, safety goggles, and hearing protection).
- Guards and safety mechanisms on equipment work properly.
- Router follows cracks without difficulty.
- Routed cracks do not exhibit spalling.

Material Preparation

- Proper safety garments are worn (hard hat, reflective vest, long-sleeved shirt, pants, steel toed boots, safety goggles, and hearing protection).
- Heating oil in melter jacket is not fuming and level is adequate.
- Temperature gauge on the melter has been calibrated to the satisfaction of the AGENCY.
- If the temperature gauge has not been calibrated:
 - Measure sealant temperature with a thermometer.
 - Ensure that the reading on the thermometer is the same as the reading on the melter temperature gauge.
- Sealant is never heated above the manufacturer's recommended pouring temperature.
- Material safety data sheet (MSDS) is available on-site.

Cleaning of Cracks and Routs

- Proper safety garments are worn (hard hat, reflective vest, long-sleeved shirt, pants, steel toed boots, safety goggles, and hearing protection).
- A power sweeper or vacuum cleaner is being used to remove dirt and debris from the pavement surface.
- Compressor for high-pressure air provides at least 100 psi.
- Oil and moisture filters on compressor work properly.
- Temperature of the hot-air lance is below 930°F and the tip is 2 to 4 inches from the crack or rout.
- The cleanliness of the crack or rut is being checked every 30 minutes.
- The crack or rout is dry.
- No deicing chemical residue is present.

Sealant Application

- Hot-pour sealant is poured at the manufacturer's recommended temperature.
- The material is applied to the inside of the cracks.
- Ensure that sealant is placed up to the asphalt surface.
- There is sufficient sealant to allow for overband (if applicable). □ There are no bubbles due to moisture present.

Overbanding of Sealant (if applicable)

- Over band is not more than 3 inches wide.
- Over band is not more than 1/8 inch above the pavement surface.
- Over band is formed during, or immediately after, sealant application. □ Excess sealant is removed before hardening.

Sealant Protection

- Traffic is rerouted until sealant is set.

8.5.5 MEASUREMENT

Crack sealant shall be measured and paid by the ton completed in place and accepted. If routing is specified it will not be measured and paid separately but shall be included in the cost of material.

The Contractor/Developer shall measure and the inspector verify the following:

Before work starts each day:

- Amount of material in melter
- Number and weight of containers of material on site
- All containers are clearly marked with manufacturer's information.

At the end of work each day:

- Amount of material in melter.
- Number of containers of material not used.

The Contractor/Developer shall certify that material in the melter is per the specifications and has not been overheated.

Measurement will not begin before the Inspector arrives.

The inspector shall be given adequate notice if material is to be delivered during the workday and have the opportunity to verify quantity.

Counting or delivering boxes or lids shall not be an acceptable method of verifying quantity of material.

8.5.6 TESTING AND INSPECTION - GUIDANCE

When pulled vertically using a flattened sharp tipped ¼" rod bent at 90° the bond between the sealant and asphalt should be stronger than the sealant or the asphalt. Sealant or existing asphalt pavement should fail before the bond is broken.