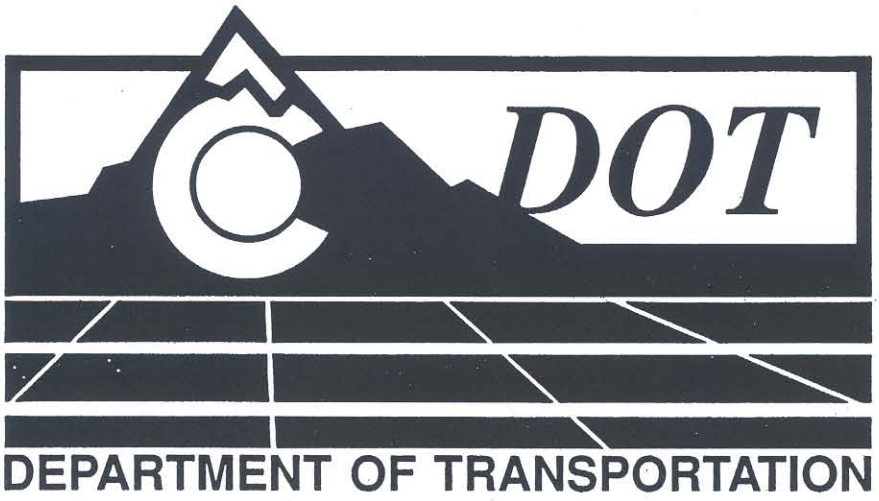
POLICY & PROCEDURES FOR CRACK FILLING & JOINT RESEALING



MARCH 1991

MEMORANDUM

DEPARTMENT OF HIGHWAYS
4201 East Arkansas Ave.
Denver, Colorado 80222

Date: March 1, 1991

To: District Engineers

From: Doug Shaffer

Subject: POLICY AND PROCEDURES FOR CRACK FILLING AND JOINT RESEALING IN COLORADO

PURPOSE

This policy establishes the basis and procedures for both crack filling and joint resealing in conjunction with the Department's Roadway Surface Maintenance requirements.

Crack and joint maintenance at the proper time with proper material and methods will reduce overall maintenance cost and prolong the life of pavements. Crack filling and joint resealing is high priority routine maintenance which is both corrective and preventive. Crack filling and joint resealing can correct the problem of moisture intrusion and help prevent or slow the development of more serious problems thereby extending the life of the pavement.

PRIORITY

Crack filling and joint resealing operations are to be performed as part of a comprehensive maintenance program. This will take time to accomplish and a greater dedication of resources to crack filling and joint resealing until we achieve the goal of making these operations a routine maintenance function throughout the State. Each District will develop an implementation plan as funds are budgeted on a yearly basis for crack filling and joint resealing.

ASPHALT PAVEMENTS

Criteria for Crack Filling

Crack filling on newer pavements should be considered a high priority item and cracks should be filled as soon as possible after detection, preferable in the first fall crack filling period after they initially appear.

Priority for crack filling on older pavements should be based on the condition of the pavement and on the condition of the cracks. The potential for moisture related pavement damage must be evaluated in order to establish both the need and urgency for resealing.

The factors the should be considered in establishing the priority for crack filling on older pavements include:

1. Climate
2. General pavement condition
3. Subgrade type, characteristics (permeable, impermeable).
4. Type and condition of crack.

Chip and slurry seals may be used in conjunction with crack filling; however, cracking may be so severe or of such a nature that crack filling is not appropriate and other repair methods such as blade or full depth patching must be considered.

When

When the air temperature is below freezing, or when excessive moisture is present in the pavement crack fill is difficult to perform correctly and is not considered appropriate. For these reasons crack filling operations should take place in the fall or spring of the year during periods when the pavement is dry and air temperatures are above 35°F. Fall crack filling is preferred over spring work for the reason that work done in the fall will help keep water out of the pavement during winter snows and especially during spring thaws.

The extent of the crack opening produced by thermal expansion or contraction is an important factor in crack filling. Operations conducted during the appropriate time of year (fall or spring), will provide approximately average openings. Therefore, neither winter or summer is the right time for crack filling. When cracks are poured in the summer, the crack is narrow and it is difficult for the sealant to penetrate down through the crack. Cracks in winter are open their widest resulting in too much sealant being poured.

Although crack filling is not totally dependent upon the upon the crack opening, and crack filling can be done (if necessary) in all times of the year, the most critical factor is moisture.

To minimize the problem of moisture in the crack, a commercial heating unit (heat lance) can be used. Heat lances capable of producing approximately 3,000 °F air with operating velocities of approximately 3,000 fps at the nozzle orifice have produced good results. Direct flame dyers are not to be used. A few too many seconds at 2500 °F to 3000 °F on the side wall of a crack, i.e. to burn out a weed or for any reason will oxidize the AC exposed on the side wall; therefore, the heat lance must be continually moved along the crack.

Material

To obtain a good seal, it is important to use a quality product.

For cracks 1/4" or less, an ASTM D 1190 or an CDOH approved cold pour sealant. Rubberized high-float emulsion with a dilution rate in excessive of 30% are not to be used. Application should be made under pressure using a 1/8" to 3/16" nozzle. The use of pour pots is discouraged because very little material gets into the crack and a lot is wasted on the surface.

For cracks greater than 1/4" use either an ASTM D 1190, D 3405 or D 5078 rubber asphalt material. Cracks in excess of 1" wide can be filled with 1/2" minus road mix or suitable patching material. Asphalt with crumb rubber has been shown to work satisfactory on cracks over 1" wide and up to 1-1/2", but caution must be used. With rubber asphalt products it is very important to follow the manufacture's recommended specification for handling and placing the sealants.

Procedure

Before crack filling, a pavement evaluation should be made to determine the type and scope of work. This evaluation is made to determine if crack filling will be cost-effective.

Crack filling can only be effective as long as the sealant prevents the intrusion of water. It cannot be effective when the pavement integrity has failed due to very extensive cracking. The pavement analysis may indicate that a chip seal, slurry seal, or an overlay may be needed with badly deteriorated areas being appropriately patched. Even with chip seals or slurry seals crack filling on cracks 3/8" and greater prior to surface sealing operations will prevent further moisture intrusion into the subgade.

Clean and dry are important factors when crack filling. Using compressed air is a good method for removing moisture, dirt and sand, and will usually provide a clean face for bonding. A heat lance can be used to dry cracks when excessive moisture is a problem. In addition to drying the crack, the asphalt surface is heated and the asphalt binder softened which helps bond the sealant. A heat lance is to be used with caution as to not burn the exposed AC in the side walls.

Routing of cracks is not recommended because of the cost and lack of effectiveness. The pounding produced by routing causes a fracture or weakening of the sidewall and a subsequent sealant failure. Irregular crack patterns are difficult to follow and if the router misses the crack the result is a second crack which also must be filled.

General

Crack filling should be performed well in advance and independent of any type of overlay operation in order to allow sufficient cure time for the sealant. This is particularly important on overlays of two (2) inches or less in thickness where tearing, shoving, and/or washboarding can occur during rolling due to the influence of crack filler material expanding up into the fresh hot asphalt pavement.

When traffic picks up or pulls out filler material, sand should be used for blotting, but in general this situation should be avoided by using squeegees on the freshly filled cracks and confining any excess to within a 4" band over the crack. Use of filler materials that continue to bleed or track should be discontinued and the material checked. This may be an indicator that the materials being used have been diluted too much or there are other material property problems.

Filling cracks 1/2" wide and less can be easily accomplished with maintenance forces. Cracks wider than 1/2" which require higher quality type materials and lend themselves to contract methods or to maintenance sections the appropriate equipment. Sealant placement equipment shall be double jacketed using hot circulating heat transfer oil to melt the sealant. No direct fired kettles (tar pots) shall be used.

Filling cracks in conjunction with resurfacing projects can be done if the project provisions allow for the early filling of cracks in the fall or spring well in advance of paving. Districts must keep this in mind when advertising paving projects and are encouraged to either advertise projects early to accommodate proper crack filling or by separate contract when crack filling has not been accomplished by routine maintenance.

CONCRETE PAVEMENT

Criteria for Joint Resealing

Serious distress in concrete pavement can be caused by water which has entered through unsealed joints and the intrusion of incompressibles into the unsealed joints.

Proper resealing of joints removes incompressibles from joints and reduces water infiltration into the joint.

To increase the pavement life all the potential sources of water infiltration through the pavement surface should be sealed. These include:

(1) Transverse joints
(2) Longitudinal joint between lane and shoulder joint
(3) Longitudinal joint between traffic lanes
(4) Random cracks

How well the sealant will perform will depend on the movement of the joint, the shape of the sealant reservoir, the bond between the sealant and the concrete, and the properties of the sealant material. Many of the same principles which apply to new construction also apply in joint resealing work.

Joint resealing operations on concrete pavements is as important as crack filling is to asphalt pavements. Resealing operations will be based on actual needs as determined from field inspections. Initial inspections should be made within five (5) years from construction and every year there after.

When

Cool concrete and air temperatures will hinder the development of bond with the hot applied sealant and will retard the curing rate. The manufacture of the sealant material will normally specify a minimum temperature allowable for sealing. A general recommendation is an air temperature of 50°F. and preferably rising. If the joint walls are too cold they will chill the hot sealant when it is applied. This chilling prevents the sealant from developing a good bond with the concrete; this inhibits the development of the bond between the sealant and concrete.

Material

The sealing material should be installed in accordance with the manufactures's recommendations. Field poured liquid sealants as specified for the original joint sealing are also used for resealing operations. These include ASTM D 1190 and ASTM D 3405.

Procedure

Joint Preparation

Previously sealed joints require more work to seal than new joints. The normal procedure necessary for resealing old joints that are debonded is:

(1) Remove old sealant
(2) Reface the joint
(3) Rebuild defective joints
(4) Clean the joints
(5) Apply backup material

The depth of sealant to be removed is approximately twice the final with of the joint. Normally this depth ranges from 3/4 to 1 inch.

Sealant is often removed with a joint plow attachment. Care must be exercised in using the joint plow. If the tools are of the proper size, it will not be necessary to exert extra force to remove the old sealant. If a seal is particularly hard to remove, a smaller size tool should be used. the tools must not be V-shaped as these will spall the concrete without removing the sealant deep in the joint. All sealant debris should be removed from the joint with compressed air.

An optional removal procedure is the use high-pressure water blasting. This will remove all sealant and backup material in the joint. The old sealant may extend deeper than the amount to be removed to get the proper shape factor. If so, water blasting would blow out too much material and other equipment may be better suited for only partial depth removal. Water blasting on older pavements may cause spalling of the pavement and should be discontinued.

In some cases the joint may have to be widened and deepened to provided the required shape factor. A diamond blade saw is the best tool for widening and refacing joints. Most other tools will spall the joint.

Once the old sealant has been removed and the joints have been refaced or rebuilt, the joints are ready for cleaning. Sandblasting is the most common method for cleaning joints; however, high pressure water blasting is another option. (Water used in the sawing operation must be allowed to evaporate before sandblasting.)

The joints should be cleared of any remaining debris just before the joint is sealed using compressed air.
After blowing out the joint a backer rod should be installed. The purpose of the backer rod is to:

(1) support the sealant until it cures
(2) provide a means to control the depth of the sealant section
(3) provide a surface to which the sealant will not bond

Generally, the size of the backer rod material is 1/8 inch diameter greater than the joint width.

Sealing Operation

When the joints have been properly prepared, the actual sealing can begin. The joint preparation and sealing operation are a continuous process and unsealed joints should not be left open. Final preparation must not be completed on more joints than can be sealed during the working day. This help prevent unnecessary intrusion of moisture, incompressibles and dust. The joints must be completely dry when they are sealed.

As in new construction, the sealant should be applied in the joint from the bottom up under pressure to prevent trapping air bubbles in the sealant. The sealant being applied must not be allowed to overfill the joint. The sealant should come up to within 1/4 inch below the surface of the pavement at the joint .

Any excess sealant that gets onto the pavement should be removed. Heated blades will remove hot poured sealant. Cold applied sealant can be merely scraped off before it has a chance to cure.

Random Cracks

Sealing of random cracks should only be considered for cracks that are open wide enough to allow the sealant material to entire the crack. Widening a tightly closed crack is difficult and can result in a maintenance problem where none previously existed. Thighly closed cracks are often nonstructural cracks which occurred soon after construction. These cracks should be monitored and sealed only if they open up or show shown signs of spalling.

Wide cracks should be cleaned with water blasting or compressed air before sealing. As with joint sealing, the crack must be dry and completely free of dirt, dust and any other material that might prevent bonding of the sealant.

The same procedures and sealant materials (ASTM D 1190 and ASTM D 3405) are suitable for filling random cracks. Care should be used when filling random cracks as excess material will need to be removed from the surface.

Depth of random crack filling can be difficult to control and overfilling can result in the wasting of material. When cracks are greater than 3/4 inch wide a backer rod should be used to control the depth of material.

Crack filling operations is not to be used in place of proper repair techniques. Where random cracking has resulted in untied and moving pieces of concrete pavement, the appropriate patching methods must be used to repair the pavement.

cc: Maintenance Superintendents
Staff Maintenance (Fraser)