August 16, 2005

TO: John Szerlag, City Manager

FROM: Brian P. Murphy, Assistant City Manager/Services
Jeanette Bennett, Purchasing Director
Timothy L. Richnak, Public Works Director

RE: **Agenda Item** – Standard Purchasing Resolution 3: Exercise Renewal Option – Pavement Seam and Fracture Sealing Program

RECOMMENDATION

On October 18, 2004, the Troy City Council approved a contract to complete a Pavement Seam and Fracture Sealing Program with an option to renew for two (2) additional one-year periods, to the low bidder, Scodeller Construction, Inc. at an estimated total cost of $657,500.00, with authorization to change the quantity of work either additive or deductive in an amount not to exceed 25% {Resolution #2004-10-546-E7}. Scodeller Construction, Inc. has agreed to exercise the one-year option to renew under the same prices, terms, and conditions.

The Public Works Department recommends exercising the option to renew for one-year, which will expire June 30, 2006, at an estimated total cost of $500,000.00, at unit prices as contained in the attached bid tabulation opened 9/29/04. In addition, staff requests authorization to change the quantity of work either additive or deductive at unit prices contained in the attached bid tabulation, not to exceed 25% of the total project cost and within budgetary limitations.

BACKGROUND

- Scodeller Construction, Inc. has been able to produce a quality product for the City.

- Moving this work forward enhances the pavement's useful life, improves the safety for all pedestrians and reduces the liability for the City.

MARKET SURVEY

The Purchasing Department has conducted a market survey and concurs with the recommendation to exercise the option to renew as fuel prices are expected to rise in the next year.

BUDGET

Funding for this program is available in the Capital Accounts for the Pavement Seam and Fracture Sealing Program - Major and Local Roads, Account #401479.7989.200 ($100,000.00) and #401499.7989.120 ($400,000.00) respectively.

Prepared by: Marina Basta Farouk, Project Construction Manager

August 16, 2005

TO: Jeanette Bennett
Purchasing Director

FROM: Linda N. Bockstanz
Associate Buyer

RE: MARKET SURVEY – PAVEMENT SEAM & FRACTURE SEALING

MICHIGAN JOINT SEALING, INC.– Jerry (248) 476-4120

According to Jerry, all prices will be the same for materials for pavement and sealing. There maybe an increase of 10% in the next nine months, because of fuel, but as far as he's concerned he believes prices will even out by next year. As of new products coming out, he has not heard of any for this year.

Based upon the above comment, I respectfully recommend that the City accept the offer to renew the contract for Pavement Seam & Fracture Sealing to the current vendor on the fact that costs will remain the same now, but will increase in the coming nine months based upon rising transportation and fuel costs.

CC: Susan Leirstien

ATTN: DAVED K. BACCI
Scodeller Construction, Inc.
P.O. Box 448,
South Lyon MI 48178

Dear Mr. Bacci:

On October 27, 2004, the City of Troy entered into contract 20400360 OB with Scodeller Construction, Inc. to provide one (1) year requirements of the Pavement Seam and Fracture Sealing Program. This contract contained an option to renew for two (2) additional one- year periods through mutual consent of both parties, within 30 days of contract termination.

Please fax this letter back to Marina Basta Farouk at Public Works Department indicating if Scodeller Construction, Inc. wishes to renew this contract until June 30,2006. Our fax number is (248) 524-3520. It should be understood that this reques: to renew the contract is subject to a favorable market survey. A request by City staff to determine the successful bidder's interest in renewing the contract in no way obligates the City. The option cannot be exercised without Troy City Manager and City Council approval and a blanket purchase order issued.

If you have any questions please call me at (248) 524-3595.

CHECK ONE:

Scodeller Construction, Inc.. is interested in renewing the contract under the same prices, terms, and conditions: X

Scodeller Construction, Inc.. is not interested in renewing the contract: ( )

X _____
Signed: Authorized Company Representative

Date: 8-2-05 David K. Bacci

Thank you,
Marina Basta Farouk
Project Construction Manager

E-7 Standard Purchasing Resolution 1: Award to Low Bidder – Pavement Seam and Fracture Sealing Program

Resolution #2004-10-546-E-7

RESOLVED, That a contract to complete the Pavement Seam and Fracture Sealing Program with an option to renew for two (2) additional one-year periods is hereby **AWARDED** to the low bidder, Scodeller Construction, Inc., P.O. Box 448, South Lyon, MI 48178 for an estimated total cost of $657,500.00, at unit prices contained in the bid tabulation opened September 29, 2004; a copy of which shall be **ATTACHED** to the original Minutes of this meeting; and

BE IT FURTHER RESOLVED, That the award is **CONTINGENT** upon contractor submission of properly executed bid and contract documents, including bonds, insurance certificates and all other specified requirements; and if changes in the quantity of work is required either additive or deductive, such changes are authorized in an amount not to exceed 25% of the total project cost and within budgetary limitations.

E-8 Approval of Relocation Claim – William Franklin Asbury – 2956 Sparta – Sidwell #88-20-25-203-001 – Project No. 01.105.5 – Big Beaver Road Improvements – Rochester to Dequindre

Resolution #2004-10-546-E-8

RESOLVED, That as required by Michigan Laws and Federal Regulations, the City Council of the City of Troy hereby **APPROVES** the Relocation Claim from William Franklin Asbury pertaining to the City of Troy's acquisition of his property at 2956 Sparta, having Sidwell #88-20-25-203-001, and **AUTHORIZES** payment in the amount of $23,603.00.

E-9 Approval of Relocation Claim – Louis and Diana Thomas – 2863 Thames – Sidwell #88-20-25-226-007 – - Project No. 01.105.5 - Big Beaver Road Improvements – Rochester to Dequindre

Resolution #2004-10-546-E-9

RESOLVED, That as required by Michigan Laws and Federal Regulations, the City Council of the City of Troy hereby **APPROVES** the Relocation Claim from Louis and Diana Thomas pertaining to the City of Troy's acquisition of their property at 2863 Thames, having Sidwell #88-20-25-226-007, and **AUTHORIZES** payment in the amount of $27,586.40.

October 7, 2004

TO: John Szerlag, City Manager

FROM: Brian Murphy, Assistant City Manager/Services
Jeanette Bennett, Purchasing Director
Timothy Richnak, Public Works Director

RE: **Agenda Item** - Standard Purchasing Resolution 1: Award To Low Bidder – Pavement Seam and Fracture Sealing Program

RECOMMENDATION

On September 29, 2004, bids were received for the Pavement Seam and Fracture Sealing Program with an option to renew for two (2) additional one-year periods. City management recommends awarding the contract to the low bidder, Scodeller Construction, Inc. P.O. Box 448, South Lyon MI 48178 for an estimated total cost of $657,500.00, at unit prices contained in the attached bid tabulation.

In addition, staff requests authorization to change the quantity of work either additive or deductive at unit prices contained in the attached bid tabulation, not to exceed 25% of the total project cost and within budgetary limitations.

The award is contingent upon the recommended bidder submission of proper contract and bid documents, including bonds, insurance certificates and all other specified requirements. The program was bid on a low total award basis due to bonding requirements and contract size. Maintenance will be performed at the locations identified and is scheduled for completion by June 30, 2005.

BUDGET

Funds are available to complete this project in the Public Works Construction Capital Accounts for Crack and Joint Sealing Major and Local Roads, Account #401479.7989.200 and #401499.7989.120 respectfully.

57 Vendors Notified on MITN System
1 Vendor Walk-In
2 Bid Responses Rec'd

Prepared by: Marina Basta-Farouk, Project Construction Manager

CITY OF TROY ITB-COT 04-40

Opening Date -- 9-29-04
Date Prepared -- 10/7/04

BID TABULATION
PAVEMENT SEAM & FRACTURE SEALING

VENDOR NAME:	*	SCODELLER CONSTRUCTION INC	MICHIGAN JOINT SEALING INC
Ck Number		233619886	649171894
Ck Amount		**$2,500.00**	**$2,500.00**

Proposal: City of Troy Pavement Seam & Fracture Sealing Program with an Option to Renew for Two (2) Additional One-Year Periods

ITEM	DESCRIPTION	Estimated Quantities	UNIT PRICE	EXTENSION	UNIT PRICE	EXTENSION
1	**Pavement Seam & Fracture Sealing for Major Roads - Labor**	**350,000 L.F.**	**$ 0.665**	$ 232,750.00	$ 0.67	$ 234,500.00
2	**Pavement Seam & Fracture Sealing for Local Roads - Labor**	**500,000 L.F.**	**$ 0.635**	$ 317,500.00	$ 0.70	$ 350,000.00
3	**Pavement Seam & Fracture Sealing for Material for Major and Local Roads**	**275,000 LBS.**	**$ 0.39**	$ 107,250.00	$ 0.45	$ 123,750.00
4	**Traffic Control**	**Included**	**------**	**Included**	**------**	**Included**
	ESTIMATED GRAND TOTAL		*	**$ 657,500.00**		$ 708,250.00

INSURANCE: Can meet		XX	XX
Cannot Meet			
CONTACT INFORMATION:			
Hrs of Operation		7AM-7PM	7AM-4PM
Contact Number		(248)787-1139	(248)476-4120
PROGRESS PAYMENTS:	Y or N	Yes, Bi-Weekly	Upon Completion
COMPLETION SCHEDULE:			
Can Meet		XX	XX
Cannot Meet			
		First Year by June 30, 2005	
TERMS:		NET 30	NET 30
WARRANTY:		1 YEAR	1 YEAR
EXCEPTIONS:		BLANK	BLANK
ACKNOWLEDGEMENT:	Y or N	YES	YES
VENDOR QUESTIONNAIRE:	Y or N	YES	YES
LEGAL STATUS OF BIDDER	Y or N	YES	YES
NON-COLLUSION AFFIDAVIT	Y or N	YES	YES

ATTEST:
MaryAnn Hays
Marina Basta-Farouk
Tom Rosewarne
Linda Bockstanz

*** DENOTES LOW BIDDER**

Jeanette Bennett
Purchasing Director

Michigan Inter-governmental Trade Network
MITN

Downloading History for ITB-COT 04-40PavementCak

The report below shows all fax and e-mail vendors that matched this document when it was originally issued. It also shows all vendors that have downloaded or ordered the document and any subsequent amendments as of **10/7/2004.**

Document Title:	Pavement Seam & Fracture Sealing Program
Date Issued:	8/25/2004
Close Date:	9/29/2004

Click on the table headings for "Account Number" or "Company name" to re-sort this report by that column. You may also click on any vendor account number to view their account information.

Acct #	Company Name	Service	Date Obtained Document	Date Obtained Amendments
11800	ABC PAVING COMPANY	Free	8/31/2004	
18057	advanced air services,inc.	E-mail		
12964	Ajax Materials Corporation	E-mail		
12466	Al's Asphalt Paving Co., Inc.	Fax		
14279	Amerinational Community Services	E-mail		
14471	Angelo Iafrate Construction Company	E-mail		
11691	Asphalt Specialists, Inc.	Fax		
12250	Barrett Paving Materials Inc.	E-mail		
16399	Barthel Contacting Company	E-mail		
10851	BEI Associates Inc.	E-mail		
11742	Bowen Paving, Inc.	Fax		
17556	C.A. Hull Co., Inc.	E-mail		
15673	Central Contractors Inc	E-mail		
16371	Century Cement Co Inc	Fax		
16936	Crandell Bros. Trucking	Fax		
12323	D.L.F. Trucking, Inc.	E-mail		
17560	D1 Services	Free	8/31/2004	
12164	Edw. C. Levy Co.	E-mail		
16017	Fleis & Vandebrink Engineering, Inc	E-mail		
16547	Gaglio Bros. Corporation	E-mail		
13719	Giorgi Concrete LLC	E-mail		

17654	GM & Sons, Inc. Concrete Construction	Fax		
15842	Harlan Electric Company	E-mail		
10833	Hartwell Cement Company	E-mail		
11514	Highway Maintenance & Construction Co.	E-mail		
18538	J.C. Pearson & Sons Asphalt	E-mail	9/10/2004	
17898	J.P. Asphalt	Free	8/27/2004	
12021	JOHN CARLO, INC.	E-mail		
17901	MacKenzie Environmental Services	E-mail		
18159	mago construction	E-mail		
18045	Maxwell Products, Inc.	Free	9/24/2004	
11560	Michigan Joint Sealing, Inc.	E-mail	9/29/2004	
15741	MIDWEST PAVEMENT CONTRACTING, INC	Fax		
10604	nationwide fence & Supply	E-mail		
12761	Northwest Consultants, Inc.	E-mail		
18380	OccuMed3	E-mail		
11059	Pamar Enterprises, Inc.	E-mail		
13805	precision cut landscaping	E-mail	9/7/2004	
15509	Pro-Line Asphalt Paving Corp.	Fax		
15064	Protech Diamond Tools	E-mail		
11361	Quickie Carpet Cleaning	Free	9/1/2004	
13691	R & E Trucking Inc.	Fax		
14705	R. W. Armstrong and Associates, Inc.	E-mail		
12387	Rauhorn Electric, Inc.	E-mail		
15568	Rotondo Construction Corp.	E-mail		
14057	S.J.R. Pavement Repair	Fax	9/8/2004	
12265	scodeller construction, inc.	E-mail	8/26/2004	
11383	Six-S, Inc.	Free	9/1/2004	
13684	soil and materials engineers, inc	E-mail		
17956	Superior Surface Solutions, Inc.	E-mail		
10327	T & M ASPHALT PAVING, INC.	E-mail		
12535	The Stansley Group	E-mail		
11814	Tony Anthony Inc	E-mail		
15301	Tyger Excavating Inc.	E-mail		
13562	V&J Cement Construction Inc.	E-mail		
13207	Walbridge Aldinger Company	E-mail		
13711	Williams Construction	E-mail		

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Public Works Department

Memo

To: John Szerlag, City Manager

From: Brian P. Murphy, Assistant City Manager / Services
Jeanette Bennett, Purchasing Director
Timothy Richnak, Public Works Director

Date: 8/30/2005

Re: Pavement Seam and Fracture Sealing Program Background

Attached is an MDOT manual developed by Michigan Technological University providing the background as to the importance of pavement sealing programs. It also provides photos that illustrate cracks that are suitable for Sealing.

Attached there is a collection of photos from the streets that are scheduled to be sealed in the 2005/06 program and are identified as attachment “A”. These streets are but a few of the locations and are as follows:

Rockfield, Evanswood, Moringdale, Northampton.

In attachment “B” we have provided some after photos from our most resent pavement sealing program. These streets are but a few of the locations and are as follows:

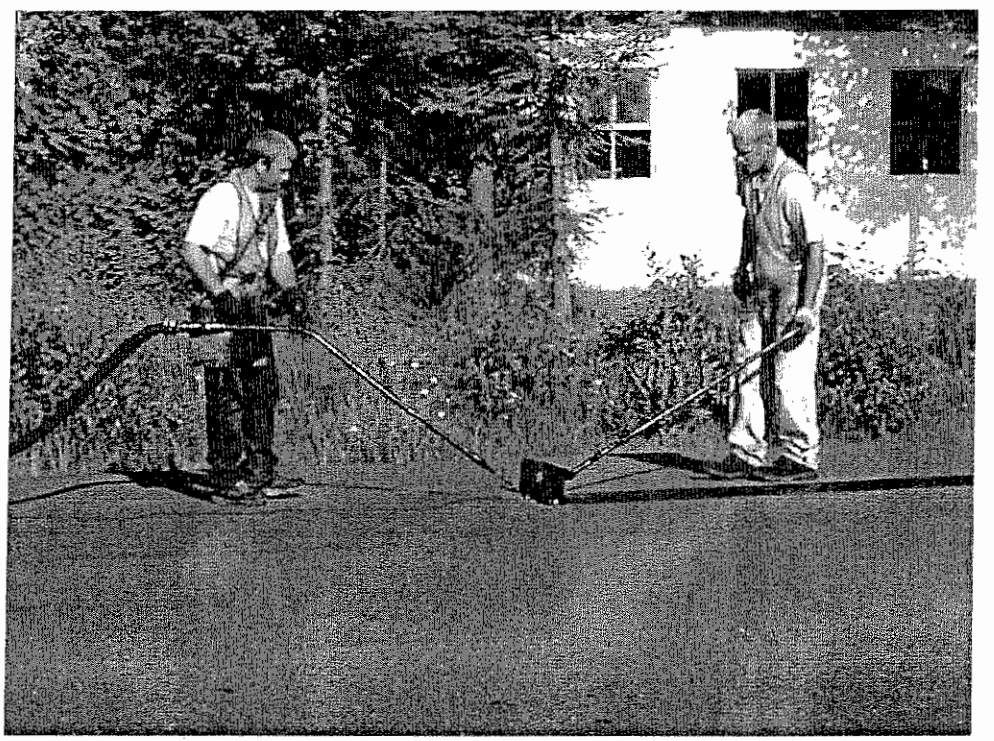
Amberwood, Caswell, Fieldstone, and Harned.

Attachment “C” provides photos of the actual seam and fracture operation.

Prepared by Timothy Richnak, Public Works Director

Sealing and Filling of Cracks for Bituminous Concrete Pavements

Selection and Installation Procedures



MDOT
Michigan Department of Transportation

Developed by Michigan Technological University in cooperation with the Michigan Department of Transportation

Acknowledgments

This manual is intended to provide basic guidelines to assist field personnel in the identification of candidate pavements for crack sealing and/or filling operations. It is also intended to provide guidelines to aid in the selection of the proper treatment. The guidelines and procedures described in this manual are supported by The Michigan Department of Transportation (MDOT). This manual was produced from materials provided by both MDOT and Michigan Technological University (MTU) by Michigan's Local Technical Assistance Program (LTAP). Non of the above mentioned parties warrant the material in this manual.

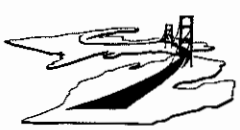
The primary source of information for this manual was the *Development of a Laboratory Screening Test for Asphalt Pavement Crack Sealants and Fillers, June 1998.* The report was submitted by:

Scott Reay
Marcy Appleyard
Dr. Thomas Van Dam
Dr. L. Bogue Sandberg
Michigan Technological University
Department of Civil and Environmental Engineering
1400 Townsend Drive
Houghton, MI 49931

Submitted To:
The Michigan Department of Transportation
Construction and Technology Division
8885 Ricks Road
Lansing, MI 48909

Michigan's LTAP serves as the Technology Transfer (T^2) effort of the Federal Highway Administration's Office of Technology Applications. The T^2 Centers' mission is to bridge the gap between research and practice by conducting training sessions and demonstrations and by serving as clearinghouses for information related to the latest state-of-the-art technology in roads, bridges and public transportation. The T^2 Centers are funded by LTAP, with matching funds from State governments, universities, State highway agencies and other organizations. The LTAP network consists of 57 T^2 Centers (one in each State, one in Puerto Rico, and six that serve Native American Tribal Governments) and serves State, county and local highway and transportation personnel.

MichiganTech



Produced by
Michigan's
Local Technical
Assistance Program

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1 INTRODUCTION

Background

Cracking is one of the most common distresses encountered on asphalt concrete (AC) pavements. Cracking can occur as single or multiple, transverse, longitudinal, block, or alligator cracks. Transverse and longitudinal cracking is usually addressed by sealing or filling the cracks with an asphalt-based material to reduce infiltration of moisture. Prevention of moisture infiltration will help mitigate the occurrence of further distresses, such as stripping of asphalt cement from aggregate particles and weakening of the pavement structure. Many methods are currently used to seal or fill cracks, and it is difficult to know which method and material will be the most cost-effective for a given situation.

Cracking in an asphalt pavement is caused when traffic and temperature fluctuations create strains that the pavement cannot accommodate. Several factors influence crack development, including temperature extremes and rate of change, pavement structural design, construction quality, temperature susceptibility, aging characteristics of the asphalt cement, and traffic characteristics (SHRP 1993). Cracking can occur as transverse, longitudinal, alligator, and block cracking.

Cracks are inevitable, and neglect will lead to a more rapid deterioration of the road surface. Preventative maintenance can help extend the life of the road and provide a smoother road surface. Maintenance activities can range from crack sealing and filling, to other, more involved surface treatments. Crack sealing and filling activities have been performed for quite some time. When performed properly, crack sealing and filling can extend the life of the pavement to the point where the cost of the activities is outweighed by the cost-benefit of the additional pavement life (SHRP 1993).

Importance of Sealing and Filling

Crack sealing and filling of asphalt pavements is a necessary and important maintenance activity that is required to mitigate the infiltration of water and incompressibles into a pavement system. Sealing/filling operations should be instituted when pavement cracks first develop, as timely treatment will help prevent further pavement deterioration. The effects of not sealing/filling cracks include increased pavement deterioration, including raveling, tenting, and migrating of cracks, along with potholes and frost heave damage.

Crack sealing and crack filling are two different activities, and the difference between them must be understood to effectively treat a pavement. Crack sealing is a rigorous operation, intended to prevent water from entering the pavement structure. It involves thorough crack preparation followed by the placement of a high-quality material in a specific configuration. Please refer to Figure 1.1 for an example of an AC pavement crack suitable for sealing. Crack sealing is normally used on working cracks. Working cracks are de-

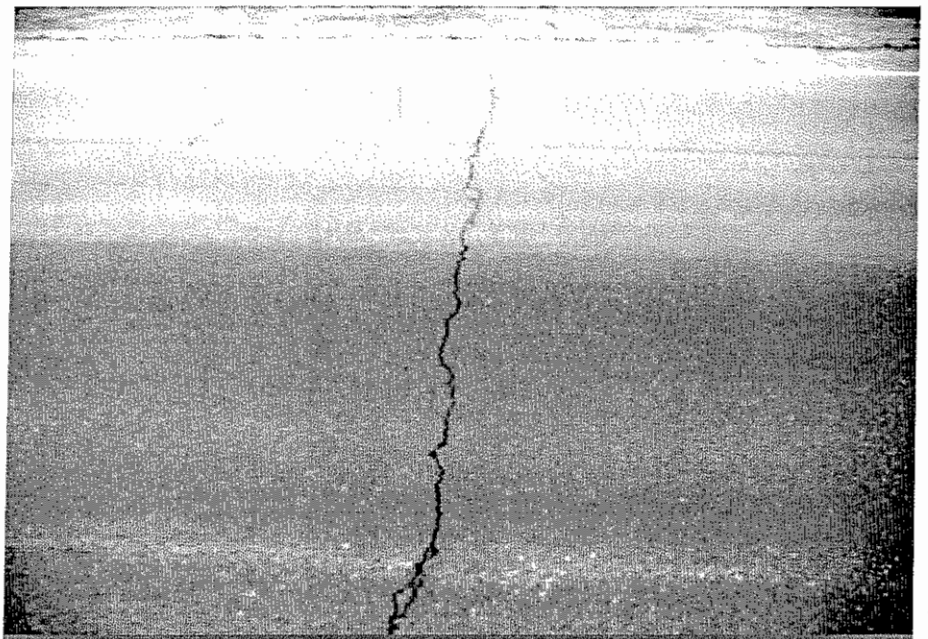

Figure 1.1 - AC pavement crack suitable for sealing

fined as those that experience considerable horizontal and/or vertical movement as a result of temperature changes and/or traffic loading. Working cracks typically have horizontal and/or vertical crack movements of 2.5 mm or more (Smith et al. 1991).

Crack filling is an activity designed to reduce the amount of water infiltrating into a pavement and reinforce the adjacent pavement. Please refer to Figure 1.2. This crack is unsuitable for sealing due to the high degree of spalling and secondary cracking present, but is a good candidate for filling. Crack filling is normally applied to cracks unsuitable for sealing and to non-working cracks. Non-working cracks are defined as those that experience relatively little horizontal and/or vertical movement as a result of temperature changes and/or traffic loading. Non-working cracks typically have horizontal and/or vertical crack movements of less than 2.5 mm (Smith et al. 1991).

Cracking can be repaired in a variety of ways, ranging from pavement maintenance activities, such as surface treatments and crack filling, to full-scale pavement rehabilitation projects, like resurfacing (Smith and Romine 1993). Alligator and longitudinal cracks in the wheel paths are indicative of structural deficiency, and require at least partial reconstruction for an effective solution (Turgeon 1989). Proper pavement design and drainage can help control these types of cracks. Transverse and longitudinal cracking are most often caused by thermal changes and are related to the cold temperature and age stiffening characteristics of the asphalt concrete, which in turn is directly related to the properties of the asphalt binder. This type of cracking should be treated soon after initiation to minimize the infiltration of water that can cause further deterioration.

Transverse and longitudinal thermal cracks can be treated through crack sealing and filling. The goal is to reduce or eliminate the infiltration of moisture into the pavement structure, and prevent incompressible materials from entering the crack. Water can lead to accelerated fatigue, stripping, pumping, and other pavement damage. It is commonly believed that sealing and filling are justified because they extend pavement life. The earlier these detrimental effects can be prevented, the better the chance that a pavement's life will be extended (Turgeon 1989).

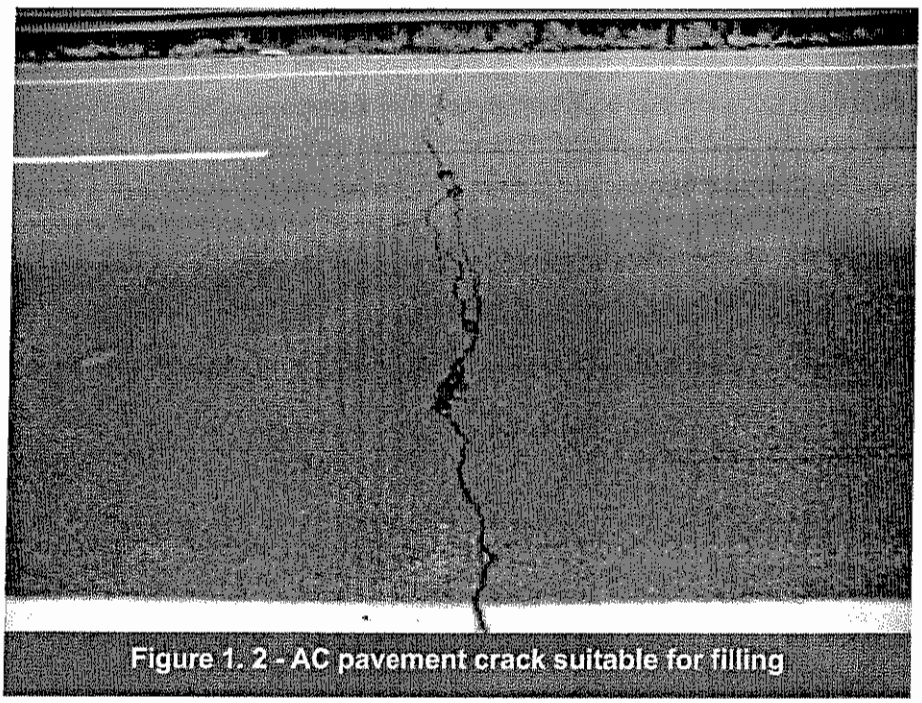

Figure 1. 2 - AC pavement crack suitable for filling

II Selection Criteria for Sealing and Filling

General Overview

The first step of any crack treatment operation is an evaluation of the pavement to assess the extent and type of cracking present and to determine the appropriate treatment(s). If a pavement is badly deteriorated, has large quantities of closely spaced or random cracking, or other major deficiencies are present, crack filling or sealing may not be appropriate and another repair should be used. Good pavement condition data is essential for proper treatment selection.

Most highway agencies have developed policies and criteria that specify the type of maintenance to be performed on cracked pavements. These criteria are often based on an assessment of the overall pavement condition and crack characteristics. These policies also specify when cracks should first be filled or sealed.

Requirements exist at most highway agencies regarding air temperatures and the seasons when crack filling/sealing operations should be conducted. In cold temperatures, the pavement contracts and the cracks open to their widest. In hot temperatures, the pavement expands, closing the cracks. To limit failures due to excessive expansion and contraction, it is preferable to perform the crack treatment activities during the moderate spring and fall temperatures when the cracks are midway between the extremes. However, given the environmental conditions that Michigan encounters, conducting these operations in the spring and fall may put the operation in the middle of a wet period. As such, care must be taken so that the sealing and filling operations are conducted in dry conditions. If a treatment is placed too early in the spring or too late in the fall, moisture may be present in the pavement creating frost action that will render a seal or fill ineffective. It is important to keep moisture out of the base for this reason. Additionally, it is important that when performing a seal/fill operation, the crack is clean. Having a clean crack permits adhesion and provides for a better overall treatment.

Although MDOT currently has no set criteria of when to perform crack sealing and filling, they typically initiate crack sealing within 2 to 3 years of a bituminous overlay over concrete, and within 3 to 8 years after a full-depth bituminous pavement construction or a bituminous overlay over a bituminous pavement.

Determining Crack Density and Edge Deterioration

The first step in the treatment selection process is to characterize the density of cracking and level of edge deterioration using the basic definitions presented in the *SHRP Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements – Manual of Practice* (Smith and Romine 1993).

Crack density thresholds are not defined in the SHRP Manual "because experienced personnel can usually make reasonable assessments of density" (Smith and Romine 1993). Although this may be true, some guidance regarding the determination of crack density is necessary. As a starting point, the threshold between moderate and high density will be established at the point where transverse and longitu-

Linear Crack Length per 100 m Pavement Section	Density
< 10 m	Low
10 m to 135 m	Moderate
> 135 m	High

Table 2.1 - Determination of Crack Density

dinal cracking will be classified as block cracking. According to the SHRP publication entitled *Distress Identification Manual for the Long-Term Pavement Performance Project* (SHRP 1993), this transition occurs at a crack spacing of 3 m. This approximately translates to 10 full width transverse cracks and one full-length longitudinal crack in a 100 m long pavement section. In a 3.5 m wide pavement lane, a total of 135 m of linear cracking in a representative 100 m of pavement is thus assumed to be a reasonable threshold value between moderate and high density. The demarcation between low and moderate density is less clear. Generally, two to three transverse cracks within a 100 m long pavement section would justify a sealing operation, and thus a reasonable threshold is 10 m of linear cracking in a representative 100 m length of pavement. Table 2.1 can be used as a general guideline when determining crack density.

Figures 2.1 - 2.6 illustrate various degrees of crack densities and edge deterioration.

Once a reasonable determination of crack density and edge deterioration is made, Figures 2.7, 2.8, and 2.9 outline the appropriate course(s) of action for low, moderate, and high density cracking, respectively. *These flow charts are meant to give a general overview of the appropriate actions. These are not hard-and-fast rules, and good engineering judgement is needed in each situation to verify that the correct course of action is being taken.*

Figure 2.1 - Example of low density cracking

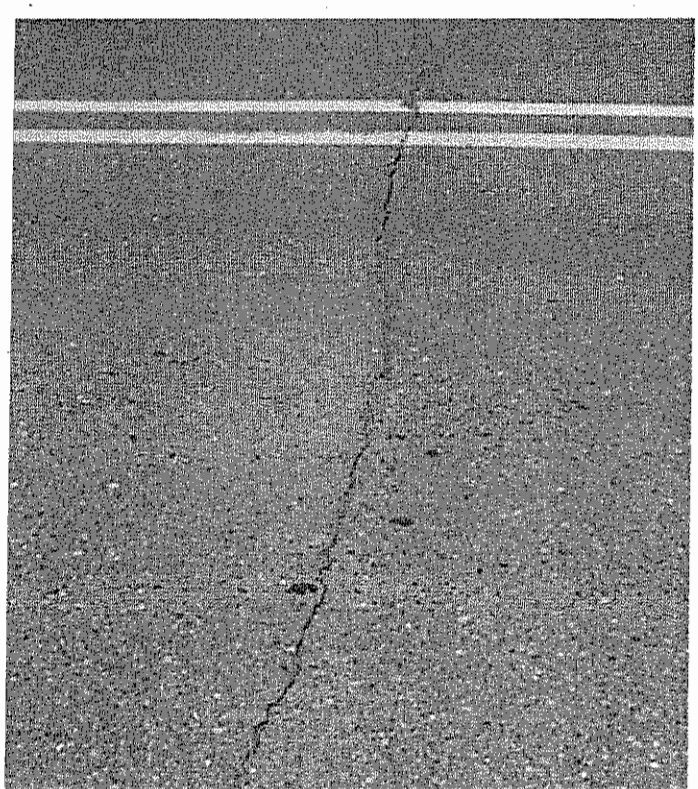

Figure 2.2 - Example of cracking with low edge deterioration

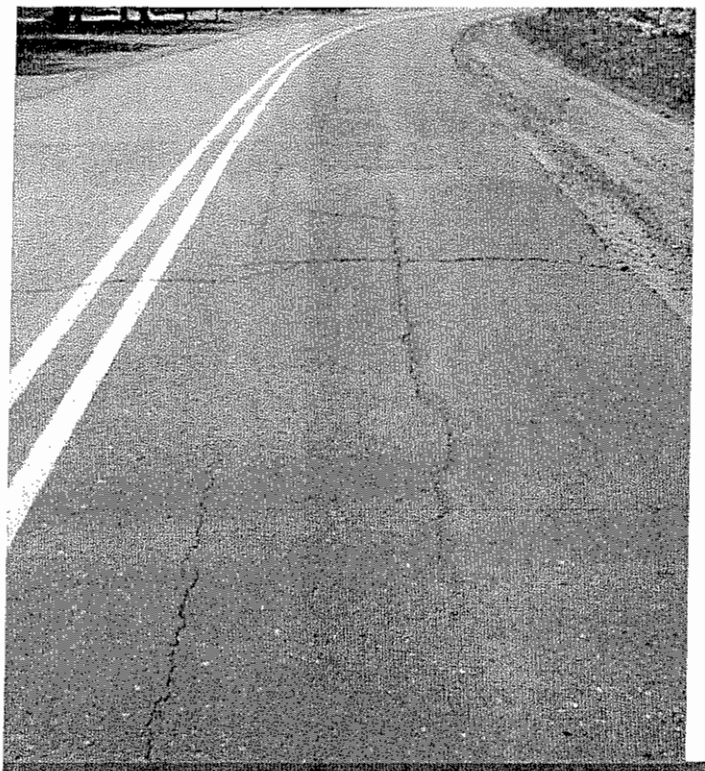

Figure 2.3 - Example of medium density cracking

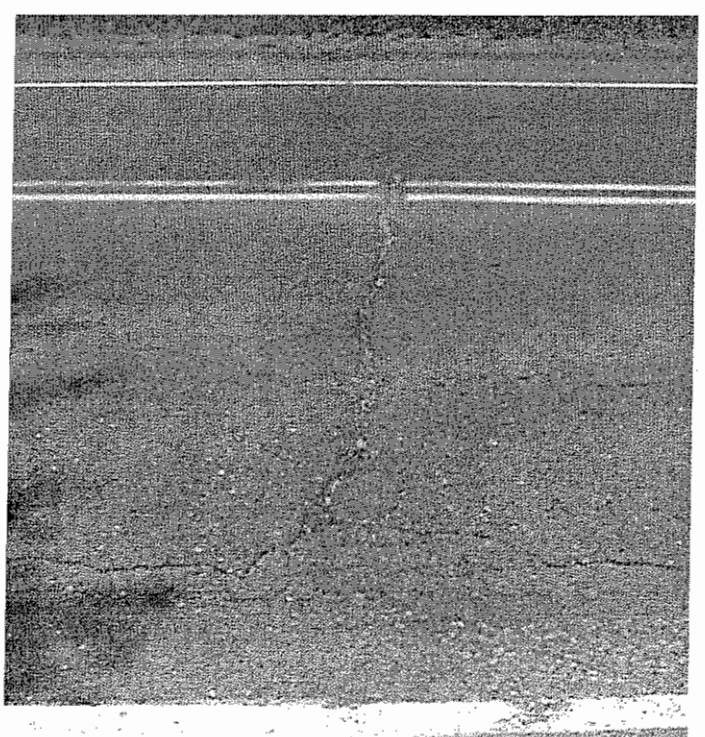

Figure 2.4 - Example of cracking with medium edge deterioration

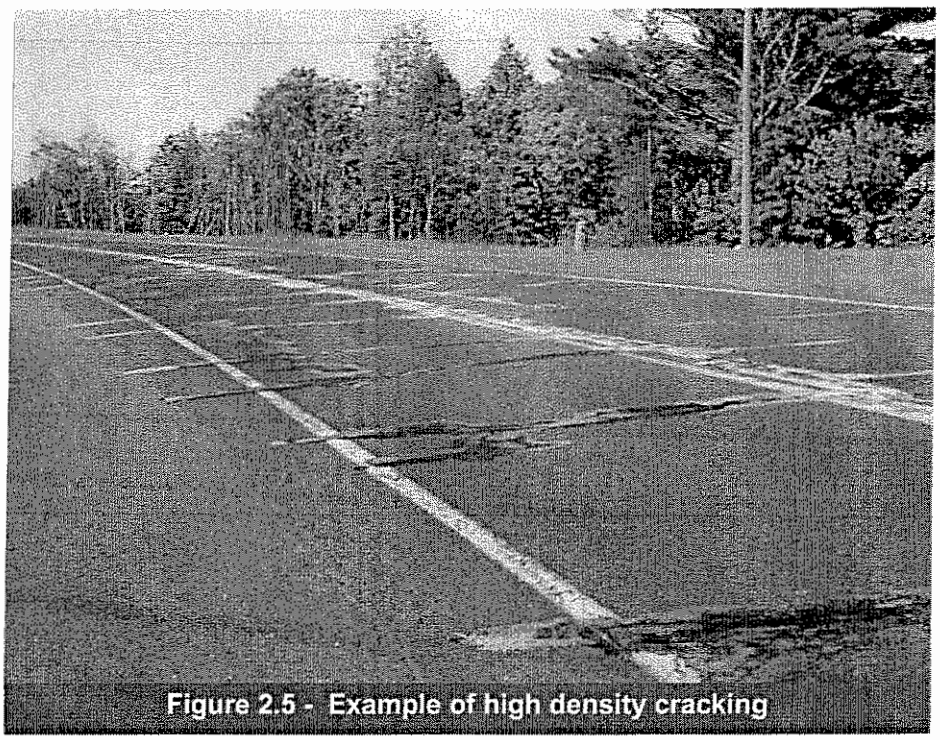

Figure 2.5 - Example of high density cracking

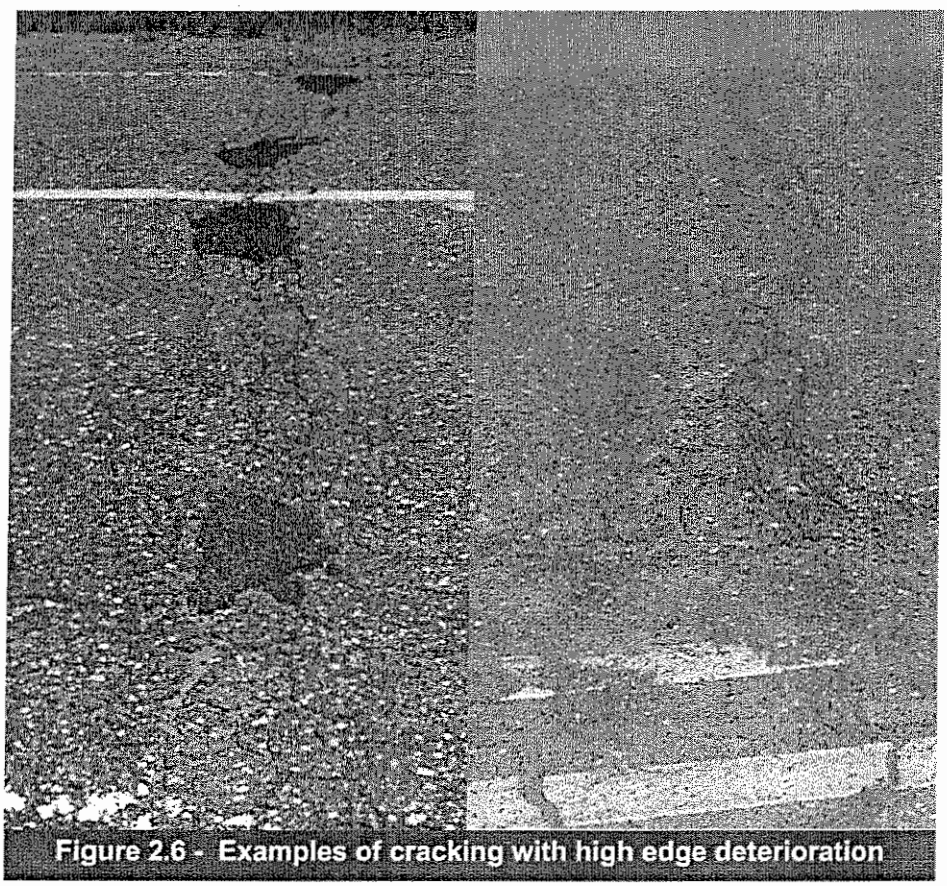

Figure 2.6 - Examples of cracking with high edge deterioration

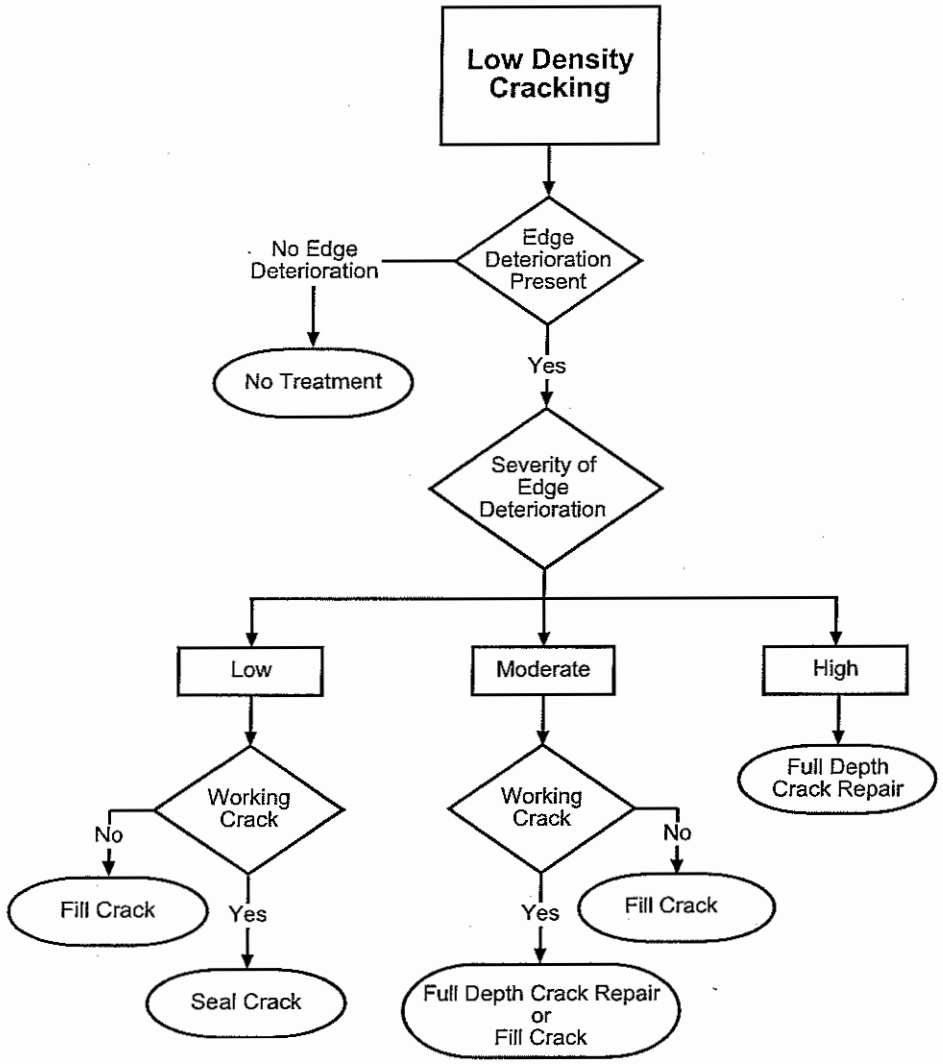

Figure 2.7 - Appropriate treatment for low density cracking

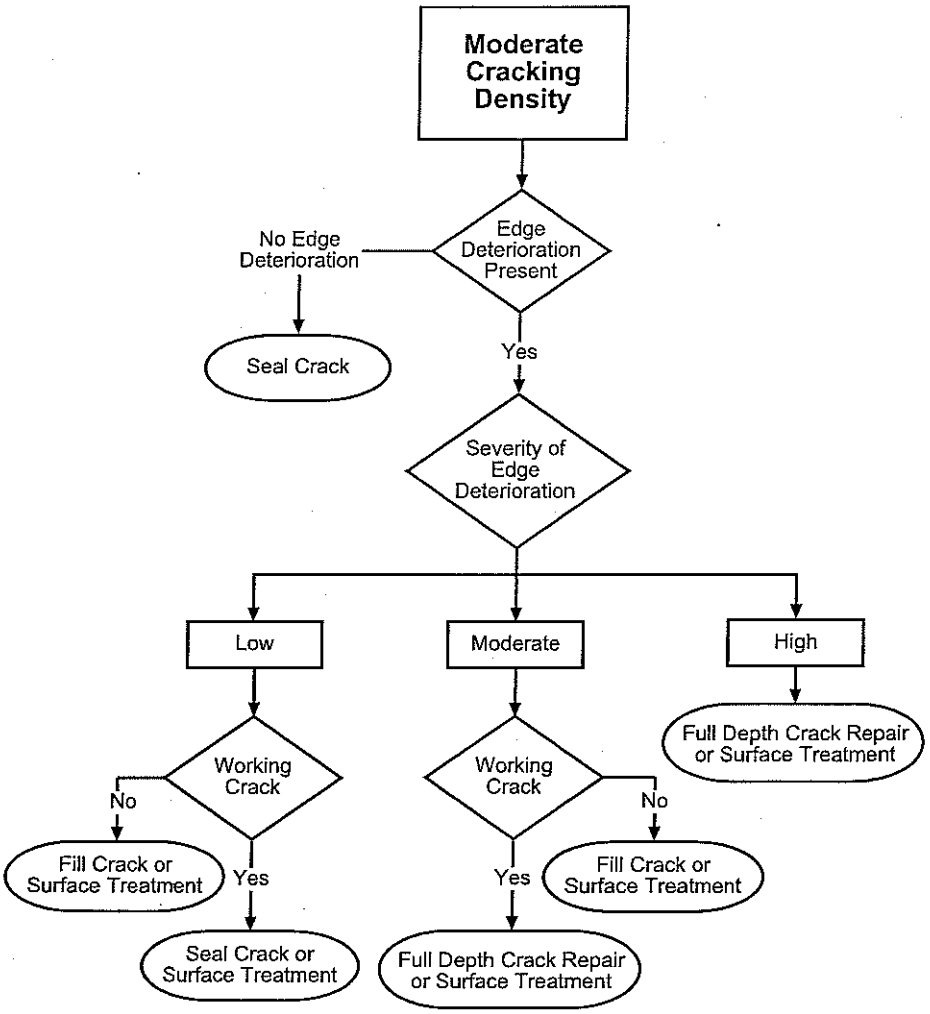

Figure 2.8 - Appropriate treatment for moderate density cracking

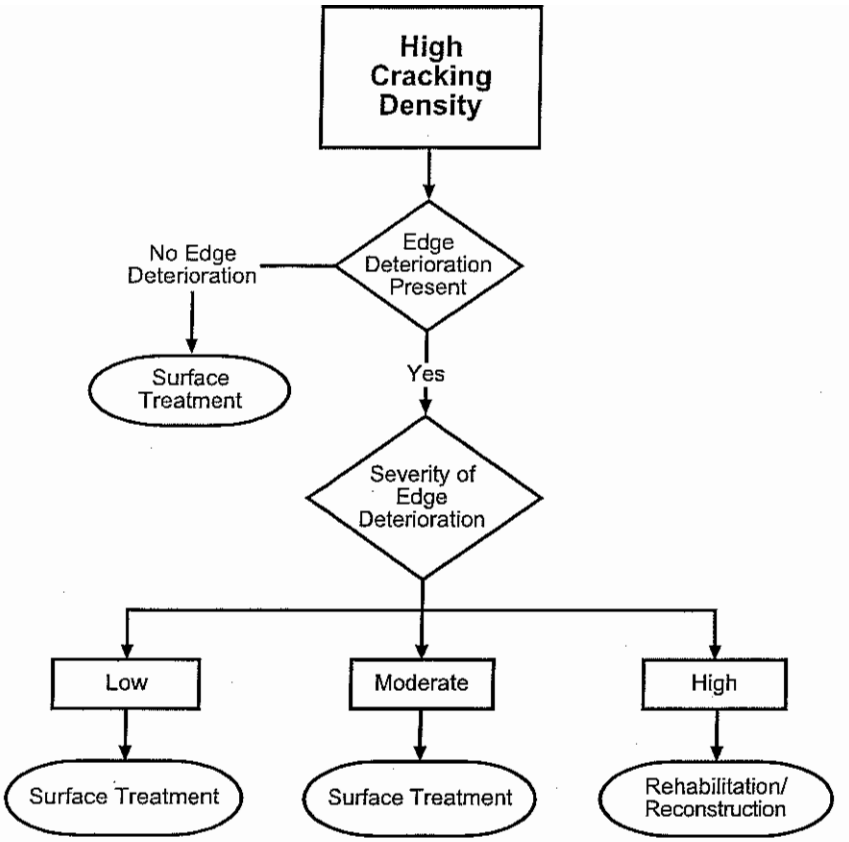

Figure 2.9 - Appropriate treatment for high density cracking

As shown in these figures, crack sealing is primarily used to address working cracks of low to medium density with low edge deterioration. Crack filling is used on low to moderate density non-working cracks with low to moderate edge deterioration, or on working cracks of low to medium density with moderate edge deterioration.

Other treatments listed include crack repair and surface treatment. Crack repairs typically involve the partial or full depth removal of the cracked material. The area is replaced with new bituminous materials. Surface seals include chip seals, slurry seals, and microsurfacing. In depth descriptions of these treatments is beyond the scope of this manual, and the above descriptions are for reference only.

SEALING AND FILLING PROCEDURES

Traffic Control and Worker Safety

Traffic control in the work zone is a vital part of any crack treatment, whether it is a stationary or a moving operation. Proper work zone operations will ensure both the safety of the work crew and motorists. The materials and equipment used in crack filling and sealing operations also present safety concerns for workers. Proper safety attire should be worn and workers should be made aware of all safety precautions related to the material and equipment used in the operation. **Please note: It is beyond the scope of this manual to instruct current MDOT policies regarding work zones and worker safety. Please refer to the appropriate MDOT publications for a detailed overview of these practices.**

Installation Procedures

Procedures vary between crack sealing and filling operations. *Regardless of the operation performed, proper execution of the procedures and quality workmanship are essential and cannot be overemphasized.* Crack sealing and filling operations consist of at least two and up to five steps, depending on the type of treatment. In order to determine the proper procedures for a particular situation, review current MDOT specifications. Given a situation where all five steps are necessary, the typical order is:

1. Crack cutting
   crack sealing only
2. Crack cleaning and drying
   crack sealing and filling
3. Material preparation
   crack sealing and filling
4. Material placement
   crack sealing and filling
5. Blotting
   possible in both crack sealing and filling

Crack Cutting

Crack cutting is performed during crack sealing operations and is done to create a uniform, rectangular reservoir, centered as closely as possible over a particular crack, while inflicting as little damage as possible to the surrounding pavement (Smith and Romine 1993). Crack cutting is done with either a diamond saw or rotary impact router. Please refer to Figures 3.1 and 3.2 for an example of a rotary impact router and to Figures 3.3 and 3.4 for an example of a diamond blade saw. The saw has a wide, small diameter blade to cut a reservoir, while a router has multiple impacting blades or teeth. The saw creates a smooth walled reservoir, while the router creates rougher edges. The saw creates a more rectangular reservoir and a higher percentage of aggregate surface area, while the router is more maneuverable, which allows it to follow the contours of the crack more closely. The router also has a higher production rate than sawing. A diamond saw can have production rates of 1.2 to 2.1 m/min, while a rotary impact router can have production rates of 3.6 to 4.6 m/min. (Smith and Romine 1993). However, the rotary

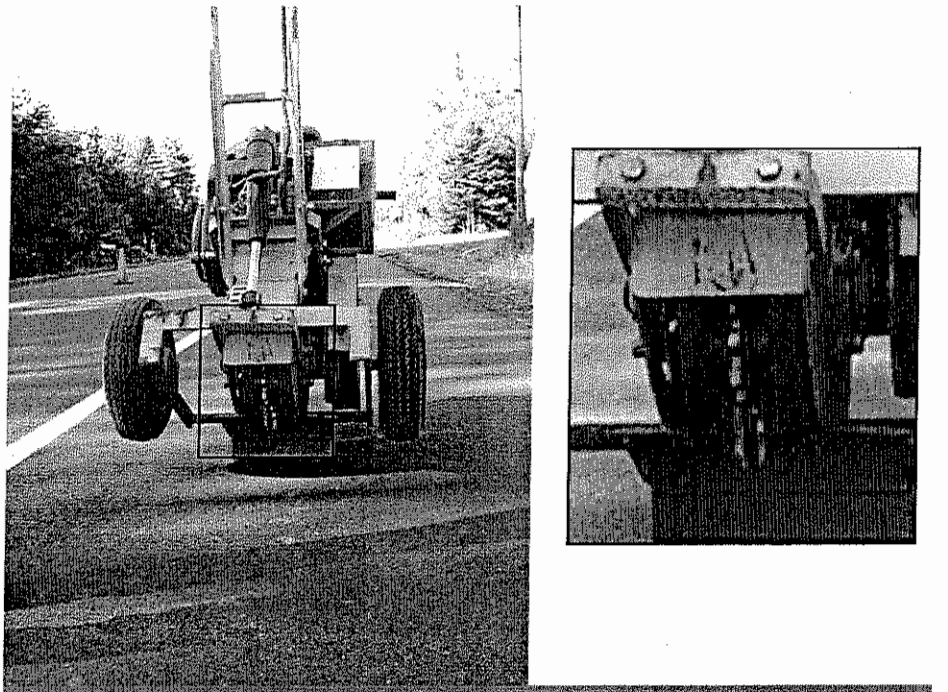

Figure 3.1 - Rotary impact router with close-up of blade

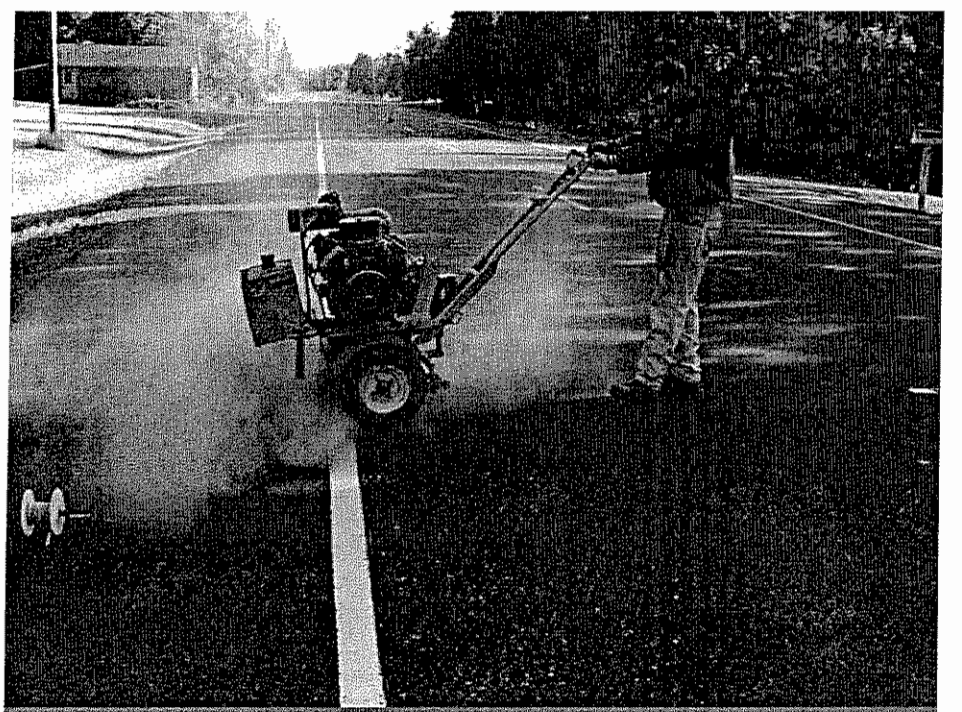

Figure 3.2 - Crack cutting using rotary impact router

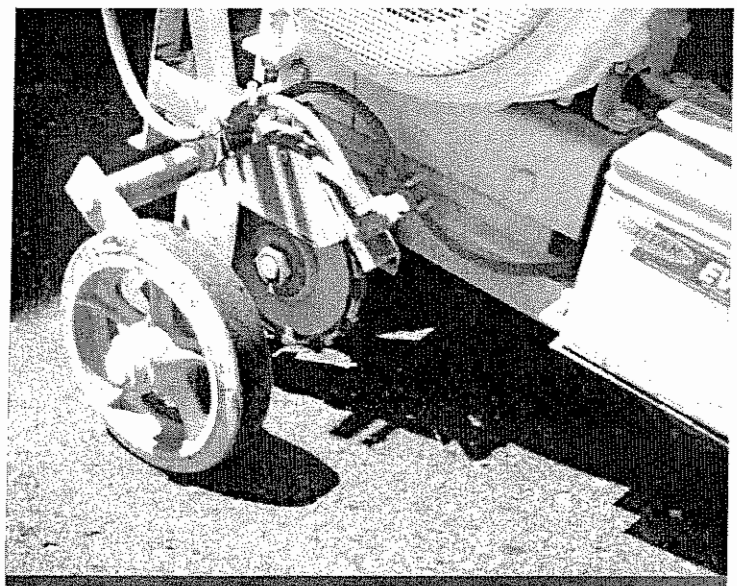

Figure 3.3 - Close-up of diamond saw blade

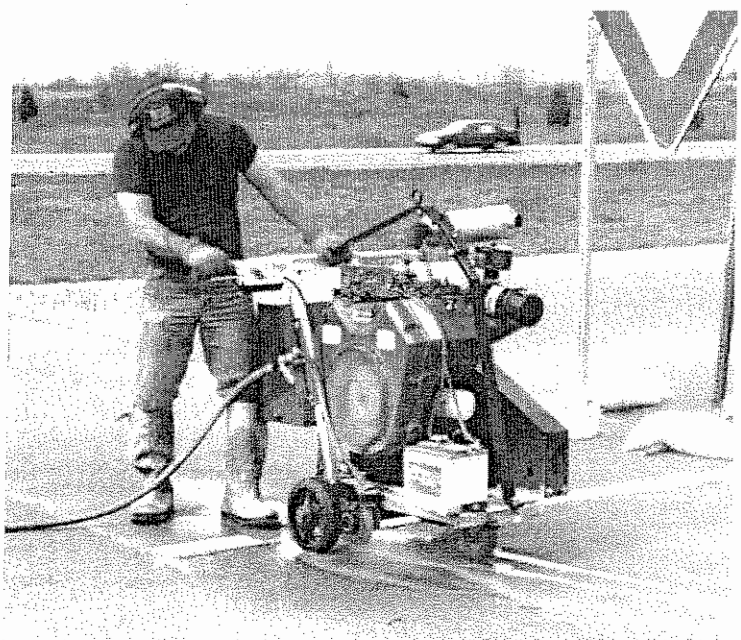

Figure 3.4 - Example of diamond saw

impact blades wear faster, and poor reservoir configurations result from worn blades. It is important to closely follow the crack when creating a reservoir to maximize the effectiveness of the operation. Figures 3.5 and 3.6 are examples of properly cut cracks. Widths and depths of the cut will vary depending on the configurations.

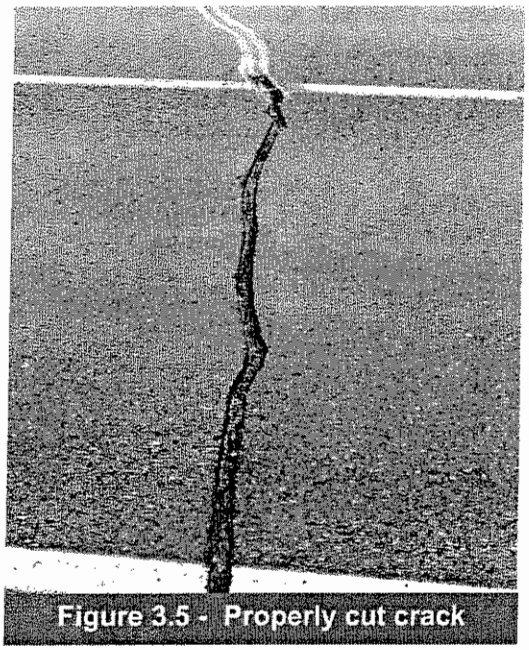

Figure 3.5 - Properly cut crack

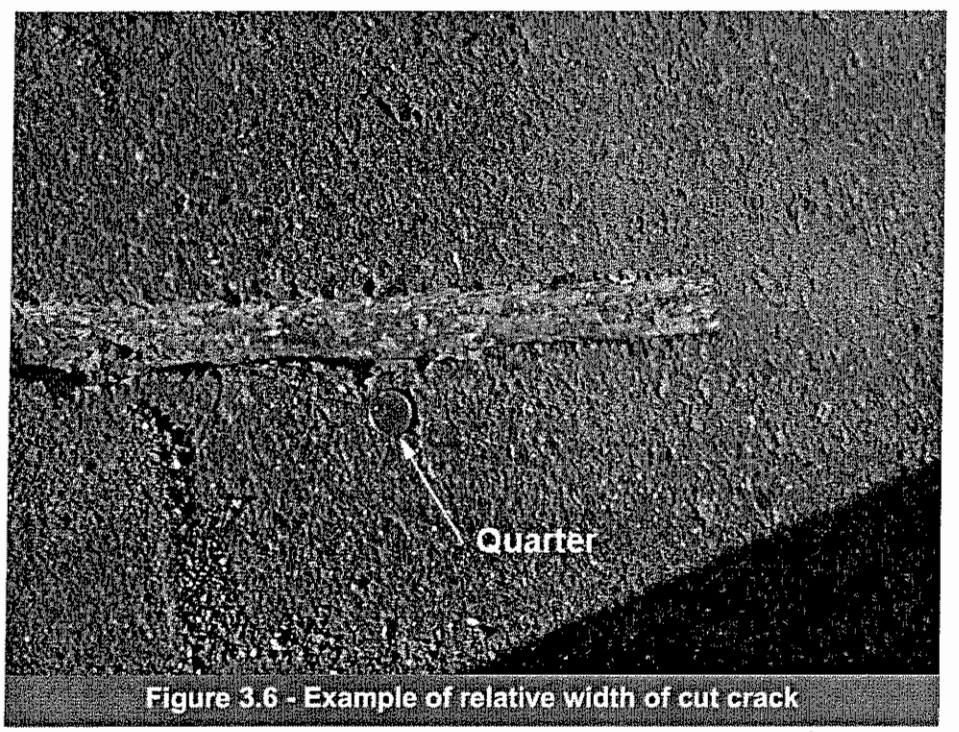

Figure 3.6 - Example of relative width of cut crack

Crack Cleaning and Drying

Crack cleaning and drying is done to provide a clean, dry crack channel and to remove any loose materials from the crack. A clean, dry crack is extremely important, as a large percentage of sealant failure is caused by adhesion failure with the crack wall. Crack cleaning can be done by hand tools, brushing or sweeping, airblasting, hot airblasting, or sandblasting.

High-Pressure Airblasting

Airblasting with compressed air is an effective method of removing particles and dust. High-pressure airblasting equipment must be able to provide a continuous, high-volume, high-pressure airstream delivering 620 kPa (90 lb/in^2) and 4.3 m^3/min (150 ft^3/min) flow (Smith and Romine 1993). Refer to Figure 3.7 for an example of high-pressure airblasting followed by hot airblasting. Please note that the worker in front is performing the high-pressure airblasting and the worker following is performing the hot airblasting. Working in tandem enables the team to effectively clean and dry cracks more quickly than performing these operations separately.

Due to the fact that most modern air compressors introduce water and oil into the air supply, it is essential that the compressors are equipped with moisture and oil filters. The presence of either water or oil in the crack will inhibit the sealing and filling material's bond (Smith and Romine 1993).

Figure 3.7 - Crack cleaning through high-pressure airblasting followed by hot airblasting

Hot-Airblasting

Hot airblasting with a hot compressed-air lance, or heat lance, is effective for both cleaning and drying a crack. The heat lance must be able to produce 1370°C (2500°F) and a blast velocity of 600 m/s (1970 ft/s). The heating provides two unique benefits. Moisture is quickly evaporated, improving potential for bond, and if the material installation follows closely behind, the heated surface can enhance the bonding of hot-applied materials (Smith and Romine 1993). Overheating is a danger and must be avoided, as it can scorch and weaken the edge of the crack or reservoir. Typically, hot airblasting is not required.

Sandblasting

Sandblasting operations should be conducted during dry weather conditions and should be followed up by airblasting to remove the sand from the crack reservoir and roadway. Sandblasting not only removes dust and debris, but also strips away any loose particles. It is a specialized procedure that is usually more costly due to the equipment and materials needed. Refer to Figure 3.8 an example of the sandblasting operation.

Figure 3.8 - Crack cleaning through sandblasting

Material Preparation

Proper material preparation is necessary for an effective seal. The specific material preparation requirements provided by the manufacturer should be followed. These include the minimum placement temperature, material heating temperatures, prolonged heating guidelines, recommended pavement temperature and recommended moisture conditions.

It is important that the specific recommendations from the material manufacturer are followed, as overheating of the material should be avoided. Overheating the material may alter the material's properties significantly. This can have a detrimental effect on the operator's ability to install the material, and adversely affect the performance of the material. If the material is overheated, it should be discarded and new material should be prepared. This will cause delays that will effect the entire operation. Furthermore, it may also necessitate repeating previous crack cleaning activities.

Material Placement

There are several configurations commonly used for the application of fillers and sealants. These configurations range from simply filling unprepared cracks, to cutting a specific size of reservoir for sealant placement. Typical placement configurations are shown in Figure 3.9. Reservoirs are generally associated with sealing operations, and simple overbands are usually used with filling operations, though this is not always the case.

Once the filling or sealing operation commences, it is important that the entire operation moves at a steady pace. It is vital that the kettle operator regularly monitors the temperature and quantity of material in the kettle. As mentioned earlier,

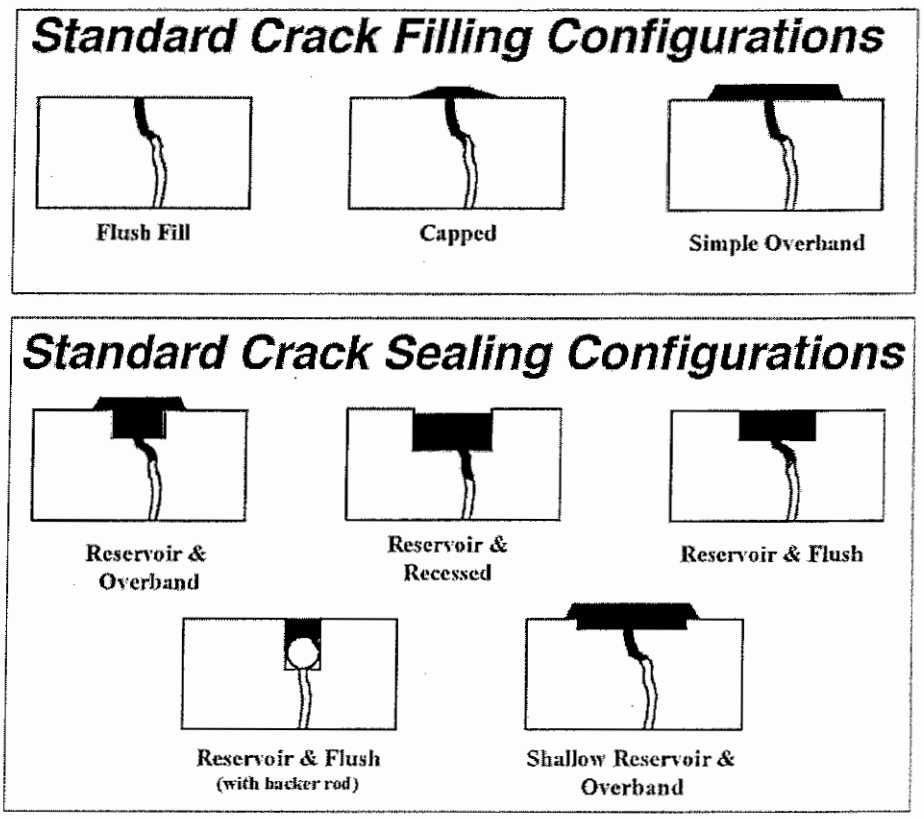

Figure 3.9 - Typical placement configurations

overheating can suspend the entire operation. Under-heated material can also produce problems as the material may not flow correctly, and it may not bond properly. This is another benefit of applying the material in the relatively mild weather of spring and fall, as maintaining material temperature in cold and hot weather is more difficult.

The application procedures for all crack sealing and filling materials are basically the same. The material should be applied in a continuous motion from the bottom of the crack up to reduce the chance of trapping air beneath the material. Enough material should be applied to provide the desired configuration. Occasionally, additional material must be applied to ensure proper coverage.

Filling Configurations

Crack filling involves either a one or two person team placing the filling material and then spreading it out over and into the crack(s) with a squeegee. Squeegees are typically U or V shaped to push the material and concentrate it over the crack. One person installation is done using an attachment to the material application wand. Refer to Figure 3.10 for an example of a filling operation. Advantages of filling include the need for less equipment and smaller installation crews.

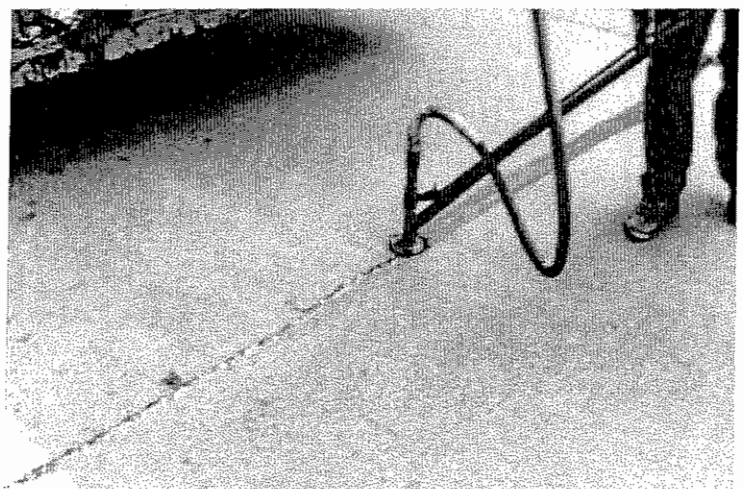

Figure 3.10 - Single operator using application wand and attachment to apply fill material

Sealing Configurations

In a sealing operation, sealant is placed either flush with the surface or slightly recessed within a cut reservoir. The purpose of the reservoir is to create room for enough material to be applied, create a desirable sealant shape, and provide a uniform surface for the sealant to adhere to. The sealant also may be recessed to prevent plow and traffic damage.

Chehovits and Manning (1984) give the following advantages of a typical sealant configuration:

> First the sealant is applied only to surface level, resulting in a neat appearance when compared with the band-aid configuration. Second, the sealant is not on top of the pavement surface, and therefore it is not directly exposed to abrasion by vehicle tires. The crack widening operation also cleans the crack faces, which provides intact surfaces for the sealant to adhere to. Another advantage when compared with the band-aid configuration is that the sealant is subjected to a lesser amount of strain when the pavement contracts in cold weather because of the increased width of the sealant.

A combination reservoir overband configuration exists in which the material is placed in a reservoir and also above the reservoir in an overband. Refer to Figure 3.11. This configuration attempts to combine the advantages and eliminate some of the disadvantages of the reservoir and overband configurations. A combined overband and reservoir will limit cohesive failures and reinforce the edges of the reservoir (Turgeon 1989).

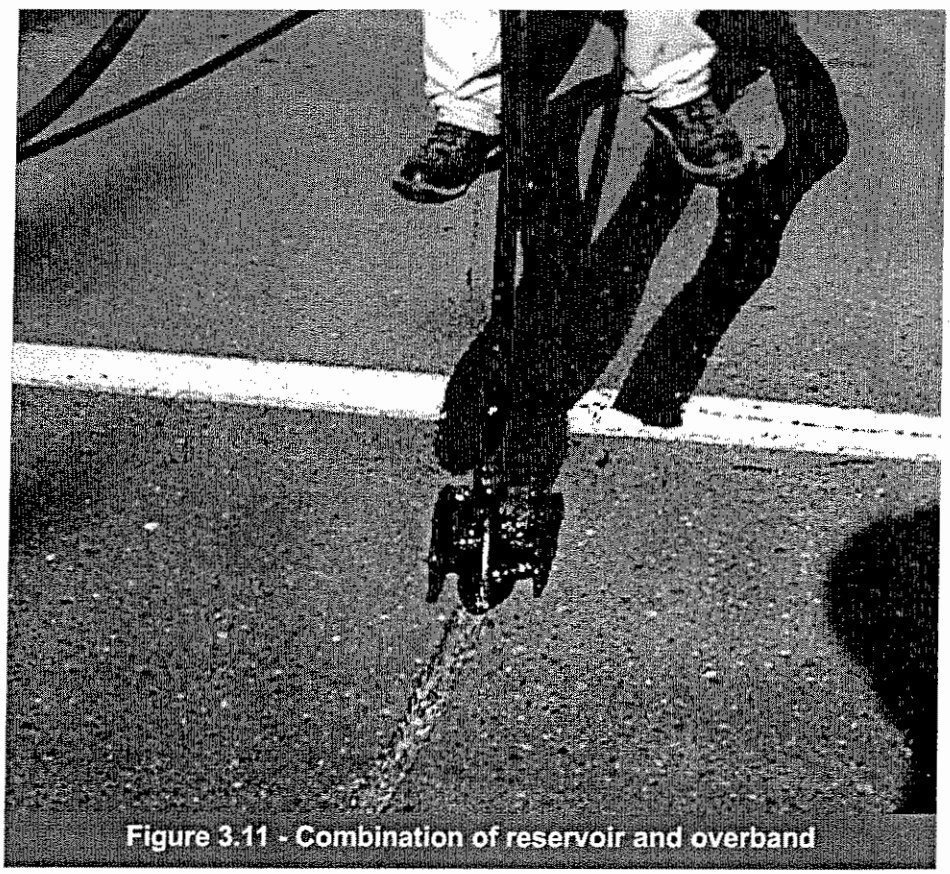

Figure 3.11 - Combination of reservoir and overband

The sealant is usually placed directly into the reservoir or crack. For cracks greater than 10 mm wide, a bond breaker, such as polyethylene foam backer rod, may be placed in the bottom of the crack. The purpose of this backer rod is to prevent the material from running down in the crack, prevent a three-sided bond, and control the shape factor (Smith and Romine 1993). A backer rod is installed after the crack has been properly cleaned and before sealant application. The backer rod should be non-absorptive, flexible, and compatible with the sealant material being used. The size should be about 25 percent larger in diameter than the crack width (ERES 1993). Refer to Figure 3.12 for example of backer rod installation.

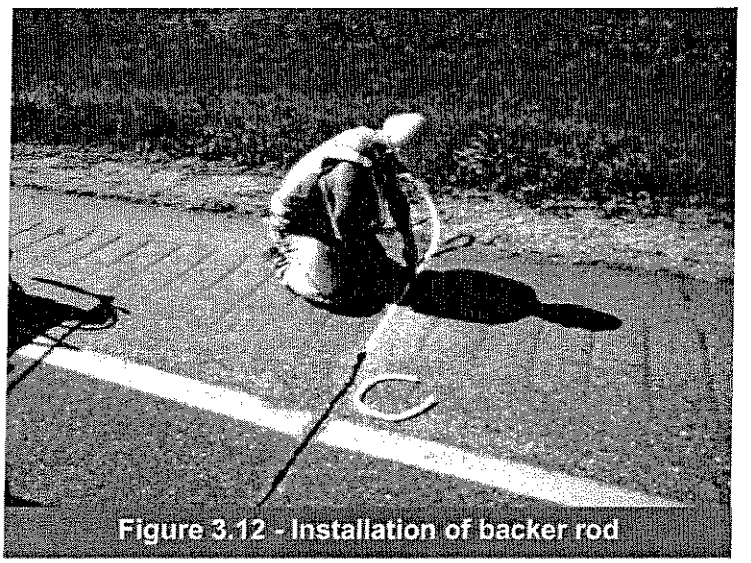

Figure 3.12 - Installation of backer rod

The shape factor is the ratio of the width to the depth of the sealant. The shape of the sealant can be controlled by using a backer rod or by specifying the dimensions of the crack reservoir. The shape factor influences stress development in a sealant, and thus the performance of the sealant system. A sealant experiences tensile stress as the pavement contracts and the crack widens. As the ratio of depth to width increases, so does the stress on the sealant/crack interface. This can lead to adhesive failure. A reservoir that is wider than it is deep will lessen the stress on the sealant (Turgeon 1989).

Reservoir dimensions may vary depending on location and/or specifications. Typical dimensions for an overband are 75-100 mm wide and a thickness of 3 mm. Reservoir dimensions are controlled by the shape factor. Typical standard reservoir widths are 12.5 – 40 mm , and 12.5 – 20 mm deep. The shallow reservoir is typically about 40 mm wide and 4 mm deep. The cutting depth may be greater for a reservoir if a backer rod is used.

Blotting

Blotting protects the uncured crack treatment material from tracking under traffic. Blotting material is typically used in areas where traffic has to travel on the material before it has had time to cure. Blotting material is also frequently used in areas of stop-and-go traffic and where there may be traffic turning on the material.

The blotting material should be applied immediately after the material is placed and finished. Toilet paper, talcum powder, lime, sand, and limestone chips are commonly used as blotting materials.

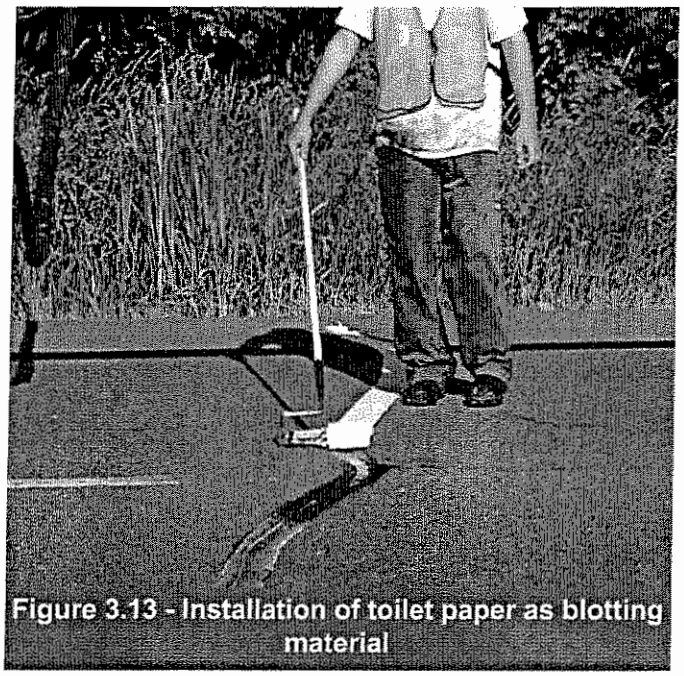

Figure 3.13 - Installation of toilet paper as blotting material

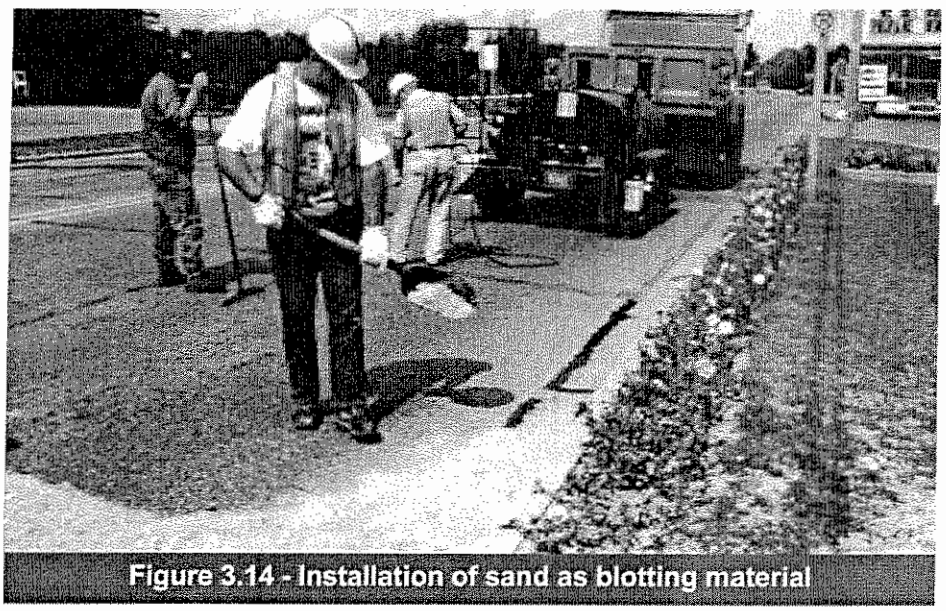

Figure 3.14 - Installation of sand as blotting material

Estimating Costs and Quantities

Estimating material requirements is a difficult task, as each situation is unique. A reliable estimate of the required materials can be the deciding factor in whether or not a certain section of road receives the appropriate maintenance activities. Table 4.1 can be used to help determine the material requirements

Determining Material Quantity Requirements

A. Length of roadway to be treated	_____ m
B. Length of sample segment inspected	_____ m
C. Amount (length) of targeted crack in sample segment inspected	_____ lin m
D. Amount (length) of targeted crack in roadway [D=C x (A/B)]	_____ lin m

Table 4.1 - Determining material quantity requirements

Sealing costs range from $3.94 to $8.20 per meter of crack, while filling costs range from $0.50 to $3.61 per meter of crack. When estimating costs, it is strongly recommended that you use a representative 100 m section (minimum) of roadway per kilometer as the sample segment. This representative section can then be used to calculate an estimate using the pay item in the specifications. If the work will not commence until the following season, it may be necessary to add 25% or more to the determined quantity.

V REFERENCES

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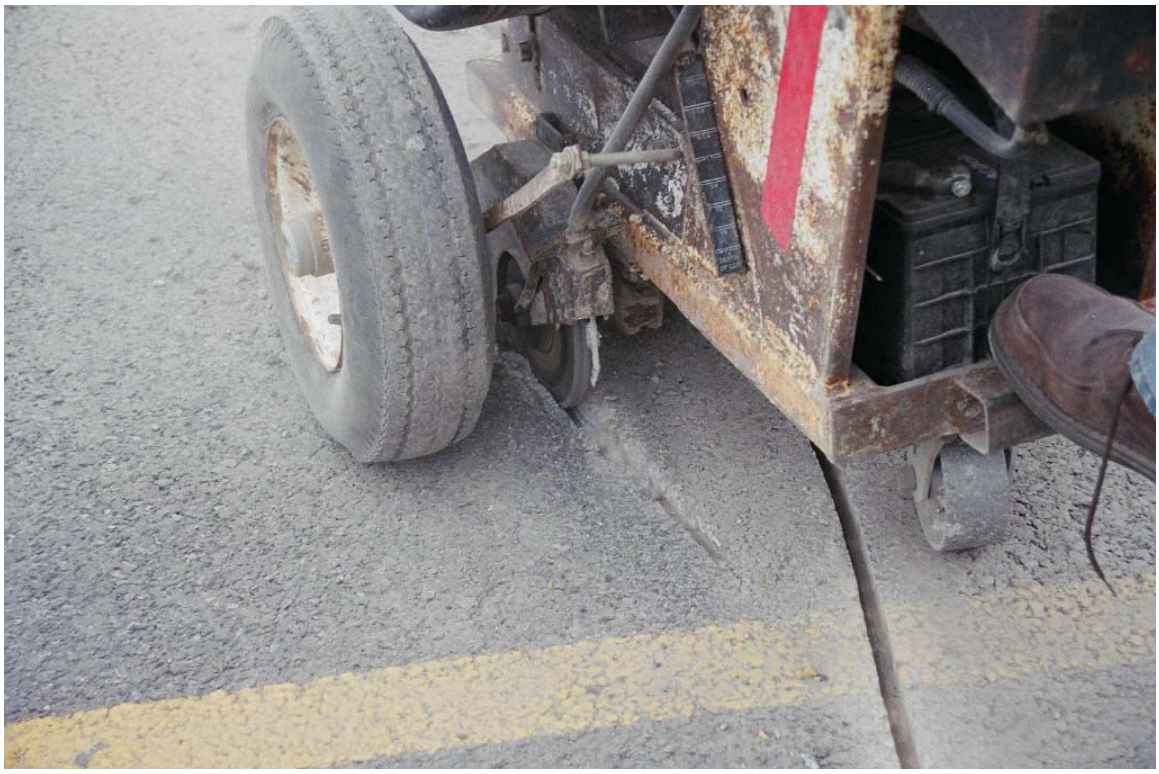

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