

OFFICE MEMORANDUM



MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

November 9, 1971

To: H. H. Cooper
Engineer of Traffic & Safety

From: Max N. Clyde

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Subject: Installation of Traffic Loop Detectors
Research Project 71 TI-33. Research Report No. R-794.

This brief summary report and attached supplemental specification draft prepared by M. G. Brown, Research Laboratory Section, is submitted to complete your original request to determine a sealant material having the desired properties to encapsulate traffic loop detector wires in both concrete and bituminous pavement. This request was detailed in your letter to me dated April 30, 1971. This supplemental could then become a part of the one submitted by you on September 30, 1971 for review by prospective bidders.

As mentioned in your letter, an initial meeting took place on April 20 at the Research Laboratory to discuss the problem. M. G. Brown and L. E. DeFrain of the Laboratory staff reviewed the problem with H. L. Crane and D. Campbell of the Detroit Freeway Operation Unit and R. E. Addy, L. A. Tiedeman, and W. I. Caruss of the Traffic and Safety Division. The group also inspected existing wire loops at W. Saginaw (M 43) at Waverly, W. Saginaw at Rosemary, and S. Pennsylvania at Jolly, all in Lansing. About 14 traffic loops had been installed in bituminous concrete saw cuts at the W. Saginaw - Waverly installation using a gray, fairly rigid epoxy grout. This two-component epoxy was designated "SP-12 ES" as supplied by Diamond Distributors of Chicago. It was evident this material was losing bond with the bituminous concrete and breaking out of the saw cuts. A loop was inspected in the concrete pavement of Rosemary Street to the south of W. Saginaw. The edges of the concrete saw cut appeared to be in good shape and the soft asphaltic sealant was bonded to the saw cut faces and flush with the surface. The installation appeared to be intact.

An asphaltic sealant was also observed in the traffic loops in bituminous pavement at S. Pennsylvania and Jolly. There appeared to be some bond loss at the sealant-saw cut face and some cracking in the bituminous concrete adjacent to the sawed slot. We have learned that this asphalt sealant used by the City of Lansing is a No. 0 grade asphalt cement of medium hardness. Lansing seems to think this hot-applied sealant is working in bituminous projects but would appear to depend on width, depth, and location of saw cuts.

It became evident that an ideal sealant material would require the following properties:

1. Good bond to both portland cement concrete and bituminous concrete.
2. Flexibility but sufficient strength to support the edges of sawed slots, especially in bituminous concrete, and withstand volumetric changes from temperature extremes.
3. Should be fast-setting to allow for quick opening to traffic.
4. Should be waterproof and stable under all types of weathering.

After numerous contacts, and in particular, with Curt Rozier of the Structural Bonding Co., Flint, and Adhesives Engineering of San Carlos, California, we have detailed a supplemental specification attached to this report which is based on a California Highway Department traffic loop sealant. We have run laboratory tests on a sample of "Concresive 1216" which is Adhesives Engineering material furnished to the California Highway specification. This material appears to have all the desired properties for a fast-setting machine applied system to seal sawed slots in both concrete and bituminous pavements. The 1216 appears to have some superior properties to several coal-tar modified epoxies which were also considered and have been used in California and described in FAA Specification E-2373, dated December 26, 1968. Cost data are not available but it is anticipated installed costs of this type sealant application would be in the \$12-14.00 per ft range, presently bid in Chicago traffic loop contracts.

The attached supplemental is based on a fast-setting machine applied type epoxy for use probably on a contract basis. The specification can be finalized by our Specification Section after review by your Division and H. L. Crane in particular. We believe the cure rate can be adjusted so that a "hand mix" type could also be described. We understand that there would be some need for this type of sealant for isolated traffic loop installations by Department personnel. As soon as we have the required information the attached supplemental could be expanded to include the hand mixed type.

TESTING AND RESEARCH DIVISION

M. G. B.

Engineer of Testing & Research

MNC:MGB:bf

cc: L. T. Oehler
H. L. Crane

STATE OF MICHIGAN
DEPARTMENT OF STATE HIGHWAYS
Henrik E. Stafseth
State Highway Director

California spec. shall

SUPPLEMENTAL SPECIFICATIONS
FOR
INSTALLATION OF TRAFFIC LOOP DETECTORS

10/23/71

DESCRIPTION

This specification describes a fast-setting, two component epoxy resin sealant and specialized pumping equipment to be used in the embedment of inductive wire traffic loops in either portland cement concrete or bituminous concrete pavement. The wire loops and the epoxy resin sealant shall be installed in saw cut grooves in the pavement as described herein and as shown on the plans.

MATERIALS

The flexible epoxy resin sealant shall be a two-component system, containing no solvents, factory packaged in containers plainly marked part "A" and "B" to be machine mixed at a 1:1 ratio by volume as it is injected into the pavement sawed groove. The epoxy sealant shall be a rapid cure system even at temperatures down to 35 F to allow a minimum traffic delay. It is recommended in freeze-thaw areas and can be used on grades up to 20 percent without excessive flow of material. The epoxy sealant components and mixture shall have the following composition and properties.

Part A, Modified Epoxy Resin

The modified epoxy resin component containing filler shall have the composition specified in California State Spec. 701-80-36, as follows:

	<u>Parts by Wt.</u>
Epoxy resin (100-160 poise 77 F)	100.0
Nonyl phenol	20.0
Alkylbenzene	20.0
Titanium dioxide, TTP-442, type III or IV	1.62
Colloidal Silica (175-225 sq.m./gm)	3.0
Glycerine, ASTM D 1257	0.5
Silicone anti-foam Type Q	0.01

The part A, as produced, shall have a Brookfield viscosity at 77 F of 150-300 poise.

Part B, Modified Curing Agent

The modified curing agent component as described in the above California spec. shall have the following composition:

	<u>Parts by Wt.</u>
High functionality polymericaptan	40.0
N-Aminoethyl piperazine	17.0
2, 4, 6-Tri (dimethylaminomethyl) phenol	2.0
Nonyl phenol	34.6
Alkylbenzene	34.6
Colloidal silica (175-225 sq.m./gm)	4.0
Glycerine, ASTM D 1257	0.5
Furnace Black	0.03
Silicone anti-foam type Q	0.01

The part B, as produced, shall have a Brookfield viscosity at 77 F of 100-250 poise.

When requested, infra-red curves of the vehicle components shall match those on file in the Research Laboratory Section of the Testing and Research Division.

Mixed Parts A and B

The combined parts A and B when properly mixed at 1:1 ratio by volume to a uniform gray color and cured 24 hours at 77 F shall meet the following requirements.

Gel time, minutes (100 gms. at 77 F)	13-16
Tensile strength at yield, psi at 77 F	700 min.
Elongation, ultimate, percent	70 min.
Shore D hardness, 1-1/2 hr. at 77 F	10 min.
Shear Bond to concrete, (sawed faces), psi	400 min.
Bond to bit. conc., FAA E 2373	Passes (when required)
Absorption, percent by wt. (24 hrs. in water at 77 F)	0.6 max.
Weight loss, percent (24 hrs. at 158 F)	0.8 max.
Color, Fed. Std. 595	36314-36492

Note: Viscosity tests are run by ASTM D 1084, Method B. The above tests shall be run on specimens cut from a poured and cured sheet 1/8 inch thick. Tensile tests shall be run according to ASTM D 638 using type 4 specimens, at a speed of 0.2 inch/min.

A sample of epoxy resin sealant shall consist of one quart of each batch of each component represented in each shipment. Test samples must be received by the Testing and Research Division at least two weeks prior to intended use.

Method of Installation

For repairing damaged saw cuts, all loose spalled material shall be cleaned away to sound pavement and patched with the above epoxy sealant pre-mixed with 1-2 parts of dry, fine quartz sand by volume.

All sawed slots shall be dry and clean of dirt, dust, and any other material that could affect bonding of the sealant such as oil, grease, etc. They must be blown clean and dry with compressed air prior to sealing.

After conductors are installed in the slots cut in the pavement, the slots shall be filled with epoxy sealant, described under "Materials", to within 1/8 inch of the pavement surface. The sealant shall be at least 1/2 inch thick above the top conductor in the saw cut. Before setting, surplus sealant shall be removed from the adjacent road surfaces without the use of solvents. The sealed area may be opened to traffic as soon as the epoxy sealant has set hard as determined by the Engineer (usually 1-2 hours).

The equipment used to process and place the encapsulation material shall be capable of performing as follows:

1. Automatic meter mixing and dispensing of the two-component epoxy type sealant. The machine must meter the two components at proper pressure and ratio by volume within 2%.
2. Mixing of the two components shall be in-line, and complete to the point of no streaking or mottling when examined visually.
3. The hoses and nozzle shall be of such design as to insure proper delivery of the processed material at all times. This method of slot filling shall only be performed by contractors or a process which has been successfully used on at least three similar slot filling jobs, 1000' or longer, and which has not failed in a minimum of 1-1/2 years.

It is required that a manufacturer's representative or factory-trained authorized applicators with past experience be present at all times on the job.

No solvents, thinners or other solids shall be mixed with this sealant for encapsulation. During cold weather epoxy components may be heated by indirect heat to not more than 90°F to facilitate mixing.

WARNING:

This material can cause severe dermatitis if proper precautions are not followed. Do not let it come in contact with the skin or eyes. Use gloves and protective creams on the hands. If contact with the skin occurs, wash thoroughly with soap and water. If any gets in the eyes, flush for 10 minutes with water and secure immediate medical attention. Do not try to remove this material from the skin with solvents.

METHOD OF MEASUREMENT

"Installation of Traffic Loop Detectors" shall be measured by lineal feet of sealed saw cuts.

BASIS OF PAYMENT

"Installation of Traffic Loop Detectors" shall be paid for by the contract price per lineal foot, which price shall include the sawing to depth and slot width shown on the plans, cleaning and drying with compressed air, insertion of loop wires, and sealing by injection with metered two-component pumping equipment complete.