



COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
FRANKFORT

HENRY WARD
COMMISSIONER OF HIGHWAYS

July 23, 1962

ADDRESS REPLY TO
DEPARTMENT OF HIGHWAYS
MATERIALS RESEARCH LABORATORY
132 GRAHAM AVENUE
LEXINGTON 29, KENTUCKY

C.2.8.
J.1.4.1.

MEMORANDUM

TO: T. H. Baker
Director of Construction

ATTN: G. L. Logan
Chief Construction Engineer

FROM: W. B. Drake *WBD*
Director of Research

SUBJECT: Structural Repair of Concrete Pavement
Barren County Project U 543(3)

The Research Division assisted the District Construction personnel with structural repairs of five areas of cement concrete pavement that had been adjudged unsatisfactory. I had an opportunity to observe the repaired areas on July 19, 1962, and they all appear to be performing adequately. The color of the epoxy patching material does not completely match the adjacent concrete but with normal weathering the two materials should approach a better match.

I am attaching 10 copies of a memorandum report on the pavement repairs that has been prepared by Messrs. Havens and Shepherd of this office. We have reproduced this memorandum by multilithing and have several additional copies. Please advise if you find a need for extra copies.

WBD:dl

Atts.

cc: A. O. Neiser
J. A. Bitterman
H. T. Bell

June 28, 1962

C.2.8.
J.1.4.1.

MEMORANDUM

TO: W. B. Drake
Director of Research

FROM: J. H. Havens, Assistant Director of Research *J.H.H.*
and
D. M. Shepherd, Civil Engineering Trainee

SUBJECT: Columbia Avenue, Glasgow, Barren County,
Project U 543(3), Epoxy Resin; 6-7-62 & 6-14-62

Upon request, by Mr. G. L. Logan, Construction Division, we observed the repairs on the subject project and offered some technical advice concerning the work. The operation involved the repair of four transverse contraction joints, around which some cracking had occurred, and the repair of a long shrinkage crack which formed near a fouled, unworkable contraction joint. The location of these defects in relation to the project station numbers were as follows:

Defect	Station	Patch Dimension (ft.)
Transverse Contraction Joint Repair	55+75	2.9 x 1.3 x 0.25
Transverse Contraction Joint Repair	59+75	2.0 x 0.33 x 0.30
Repair of long shrinkage crack near fouled joint	63+27	22 x 1.0 x 0.25
Transverse Contraction Joint Repair	64+25	
Transverse Contraction Joint Repair	64+75	

The repair work consisted of sawing a rectangular boundary around the defective area, removing defective concrete by means of an air-hammer, cleaning the section by hand and with a jet of air, and patching the hole with epoxy resin to which sand and pea gravel were added (i.e., epoxy mortar was used for small patches and epoxy concrete was used for large patches).

June 28, 1962

The purpose of sawing was to provide a neat, vertical margin between the "epoxy" patch and the concrete (i.e., to eliminate the necessity of feathering the patch edges). The depth of the sawed groove was about three inches, and the concrete was removed to the wire mesh. However, due to a temporary breakdown of the pavement saw, the defective areas at station 55 + 75 and 59 + 75 were cut with a Skill Saw and were not grooved quite so deeply. The "epoxy" mixture was blended in the following batch apportions:

George W. Whiteside: 1/2 gallon can (3.75 lbs.) - of epoxy component A
59-D-3, Epoxy 1 quart can (2.25 lbs.) - of polysulphide component
B (includes catalyst).

Aggregate: 1 gallon - mortar sand
1 gallon - Owensboro, Ohio River, pea gravel.

The mixing procedure involved placing the epoxy component and the polysulphide component in a polyethylene bowl and blending them together by means of a low speed drill with an adapted stirring paddle. The thoroughly blended mixture was poured into a wheelbarrow and the sand was incorporated. A small portion of the two-component epoxy blend was retained in the polyethylene bowl and was applied, by paint brush, to the surface area of the cleaned hole; this served as a primer. Last, the pea gravel was introduced and properly mixed. After priming all surfaces of the hole with the pure resin, the patches were built-up in two-inch layers. The successive layers were not applied until the underlying layer reached its thermo-maximum and started its temperature drop. The peak temperature rise of the "epoxy" was 105°F. The patch surface was brought to desired grade by smoothing with a trowel and/or by the use of a 3-foot steel straight-edge. The final step was the broadcasting of sand over the "epoxy" patch after approximately 30 minutes of elapsed curing time. This eliminated the glassy finish of the repaired surface and lightened the color tone of the epoxy which was a bluish gray. The color was somewhat objectionable; and it is recommended, in any future work of this sort, that the epoxy material be required to better match the color of concrete to which the patch is to be applied.

In all cases, except station 55 + 75, which was merely re-sawed, the grooved contraction joints were re-formed in the patched areas by inserting strips of masonite wrapped in polyethylene sheeting. Apparently, this did not prove to be a very good method inasmuch as the strips had to be sawed out after the epoxy had cured and inasmuch as it was not possible then to remove the polyethylene sheeting. Likewise, in the correction of the long transverse crack at station 63 + 27, a contraction joint was formed in this manner along the sawed edge nearest the non-functioning joint. An impromptu decision was made there to form the groove on the side of the crack nearest the fouled joint. At first, the objective was to merely form a uniform, straight groove over the crack in order to prevent spalling and

in order to be able to seal the crack with regular joint filler. However, it was apparent that this approach would not provide a significant amount of load-transfer. Ideally, the concrete lying between the joint and a line some two feet away, but completely embracing the crack, should have been removed to full depth, the face of the joint cleaned, dowels straightened, etc., the end of the broken slab painted with epoxy, and the slab restored to the joint with regular concrete. However, this would have necessitated several days curing and would have interfered with traffic. Although this kind of restoration might have been made wholly with epoxy concrete, which would have hardened sufficiently in 24 hours to permit traffic to use the pavement, the cost of this volume of epoxy concrete would have been prohibitive (perhaps \$1500 per cu. yd.). Therefore, and in order to minimize interference with traffic, the fouled joint was left undisturbed, and a left wide swath (embracing the crack) was sawed, chipped out to the depth of the wire mesh, and backfilled with the epoxy concrete. The formed groove was thus offset some six inches from the crack and toward the fouled joint and in the direction of the approach of traffic. However, the epoxy concrete bridged the crack in the underlying concrete (beneath the mesh), and it may be of some interest in the future as to the possible recurrence of a crack reflecting through the epoxy concrete patch, the possibility of a crack occurring at the formed groove at the edge of the patch, or the possibility that the crack might form at the joint as it was originally intended to do. The repairs made here are better illustrated in the attached sketch (see Fig. 9).

A series of "before" and "after" photographs are attached hereto as Figs. 1 thru 8, and 10 thru 13. These may be helpful in assessing the future performance of the patches and perhaps in acquainting others, who might be confronted with the necessity for doing similar types of repairs, with some of the procedures and details.

JHH:d1
Encs.



Fig. 1. Defective Area at Station 55 + 75. Hole has not been completely routed and cleaned, 6-7-62.



Fig. 2. Station 55 + 75. Hole has been thoroughly cleaned, primed with epoxy, and is receiving the first shovel of "epoxy" patch material, 6-7-62.

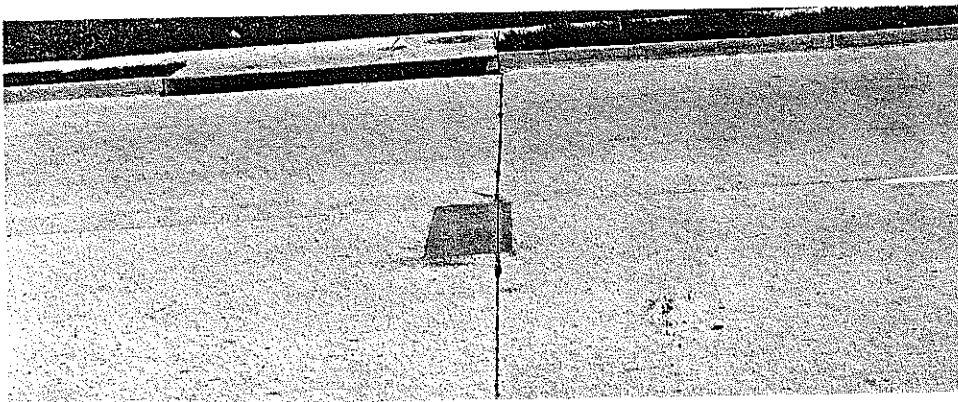


Fig. 3. Station 55 + 75. Joint was re-sawed through the epoxy patch; joint had not been sealed, 6-14-62.

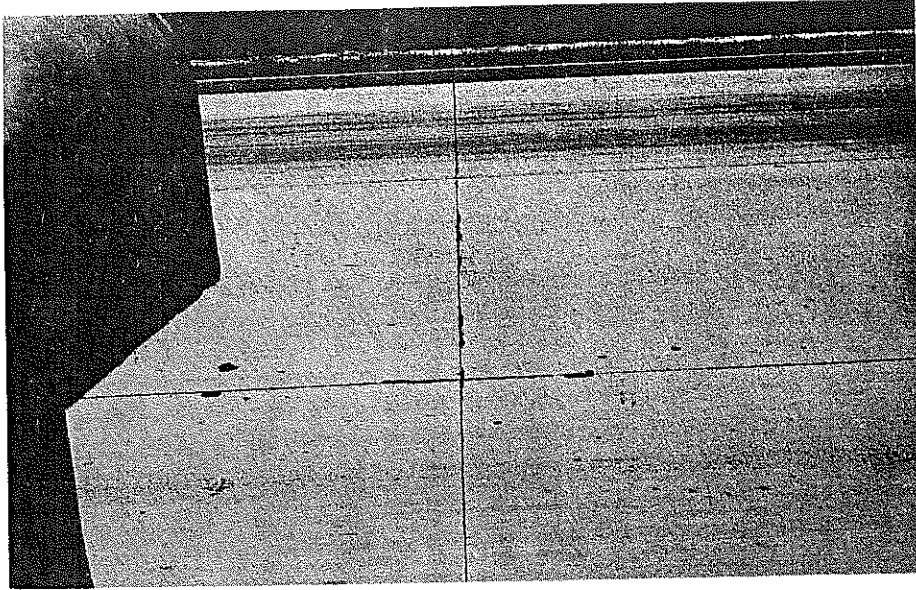


Fig. 4. Defect at Station 59 + 75, 6-7-62.



Fig. 5. Repaired Area at Station 59 + 75. Masonite divider wrapped in sheet polyethylene was used to maintain the joint; the divider has been removed but the polyethylene sheeting remains. The joint had not been sealed, 6-14-62.

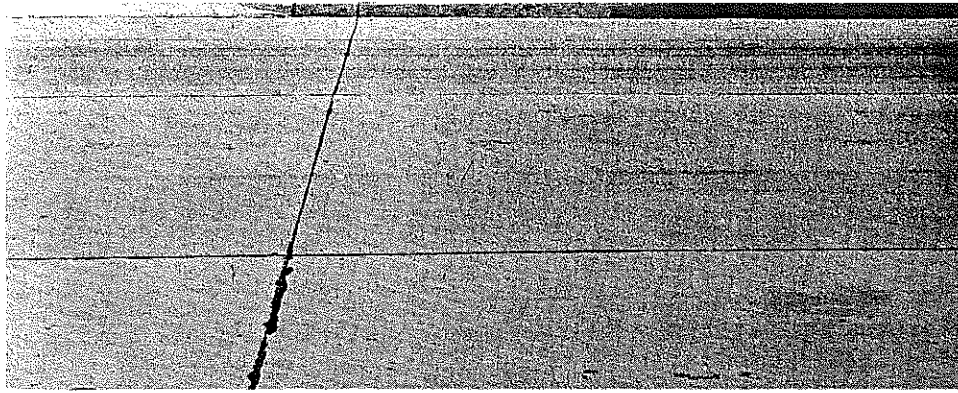


Fig. 6. Defect (transverse crack acting as a working joint) at Station 63 + 27, 6-7-62.



Fig. 7. Routed Defective Area at Station 63 + 27. A groove was formed along the right hand edge of the repair area; the hole is primed with epoxy and some epoxy patching material has been placed as backfill, 6-7-62.

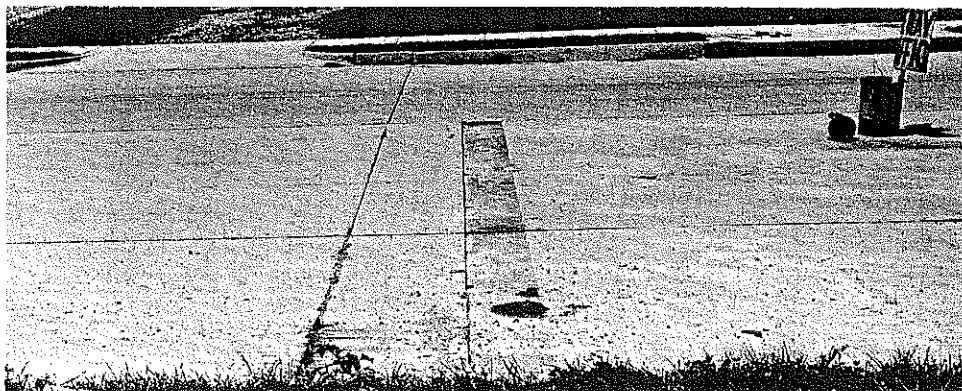


Fig. 8. Repaired Area at Station 63 + 27. Masonite divider wrapped in sheet polyethylene was used to maintain the joint; the divider has been removed but the polyethylene sheeting remains. The joint has not been sealed, 6-14-62.

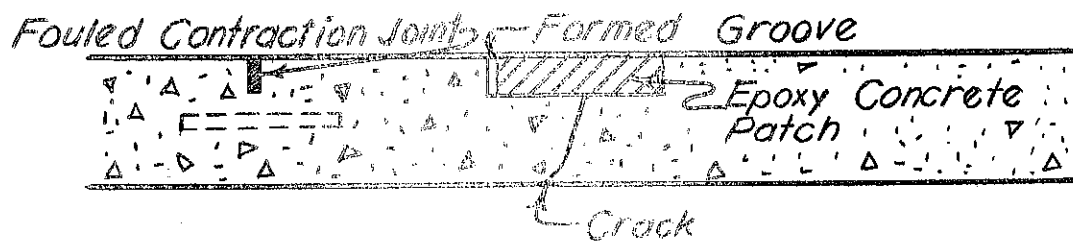
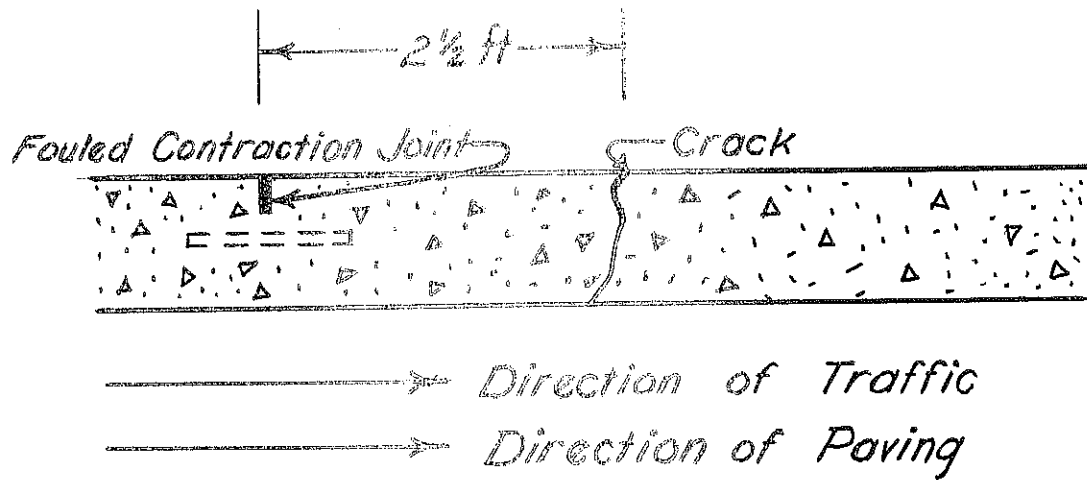


Fig. 9. Sketch Showing the Type and Location of the Crack at Station 63+27, and the Type of Repair Made.

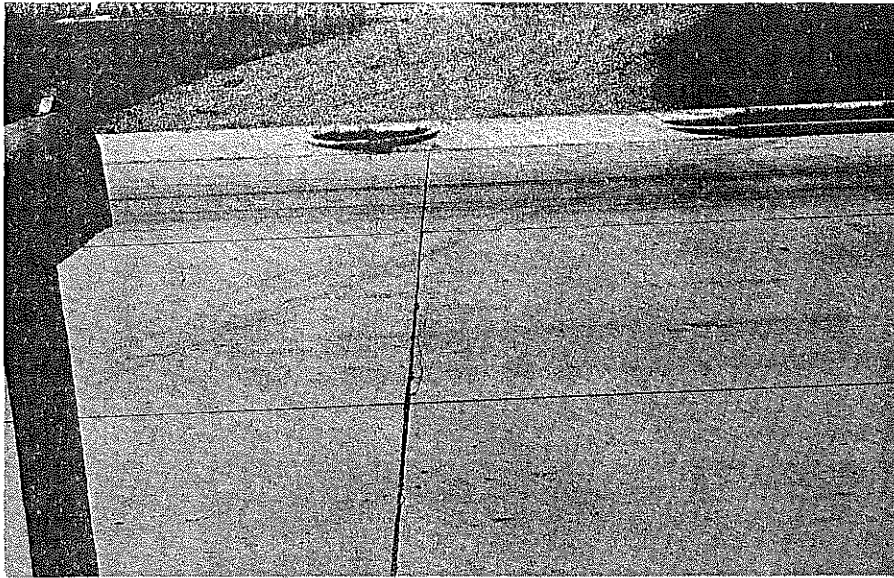


Fig. 10. Defect at Station 64 + 25, 6-7-62.

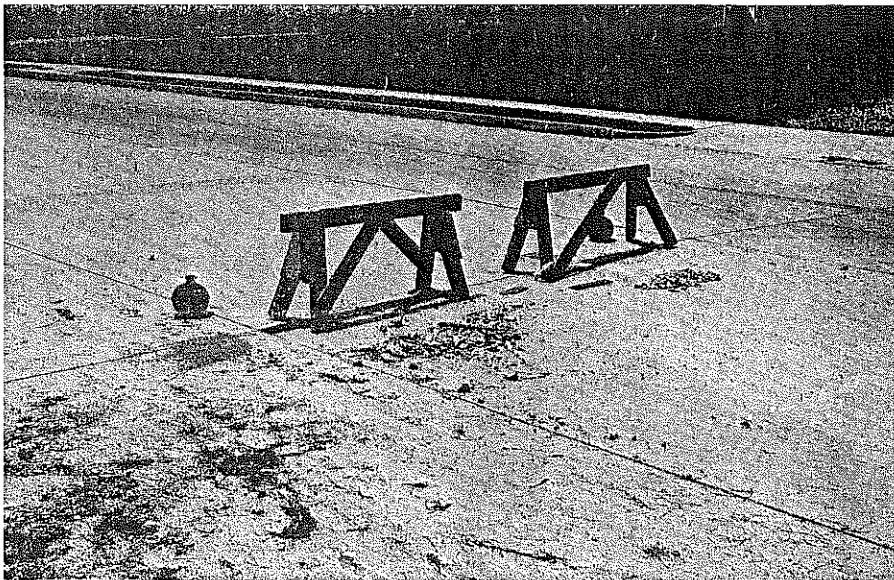


Fig. 11. Repaired Area at Station 64 + 25, 6-14-62.

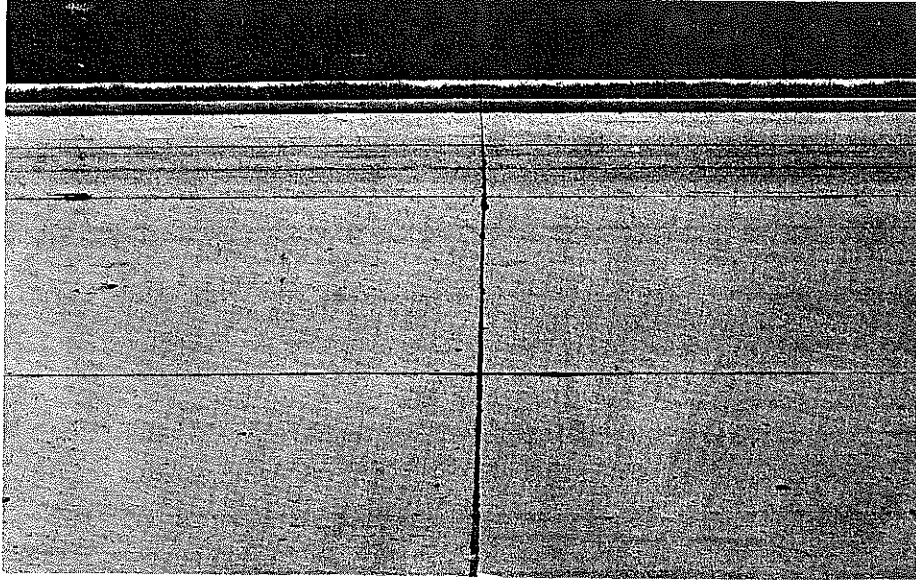


Fig. 12. Defect at Station 64 + 75, 6-7-62.

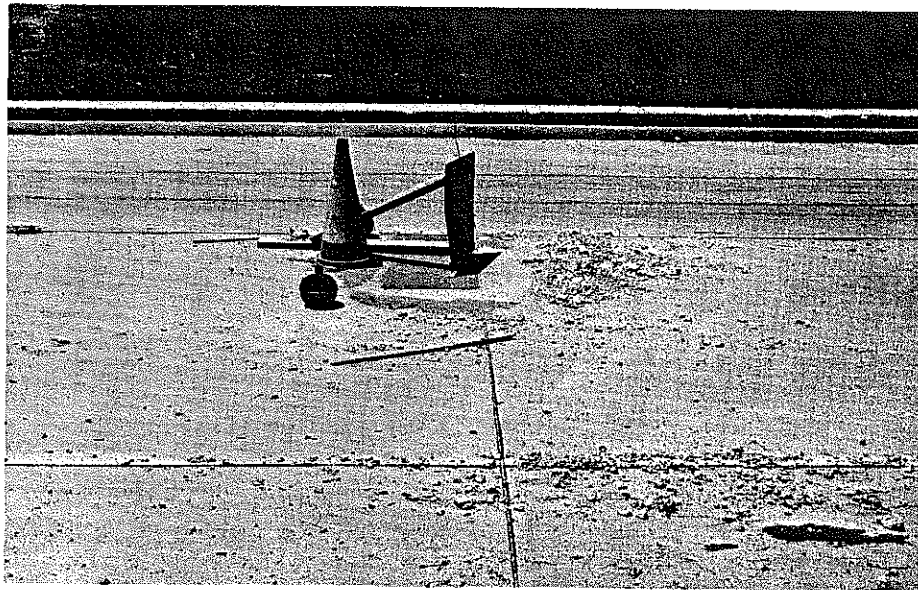


Fig. 13. Repaired Area at Station 64 + 75. Margin of patch nearest foreground was finished about 5/8" high; material was allowed to sag due to crown in pavement, 6-14-62.