

MICHIGAN
STATE HIGHWAY DEPARTMENT
Charles M. Ziegler
State Highway Commissioner

EXPERIMENTAL PATCHING OF BROKEN CONCRETE
AT EXPANSION JOINTS

US-16 - Nunica to Fruitport

Project Mc 70-28, C3

L. Allan Fickes

Cooperative Research Program between the Maintenance Division
and Testing and Research Division

(A supplemental report to Research Report 197)

Research Project 53 G-68

Research Laboratory
Testing and Research Division
Report 197A
Dec. 4, 1953

EXPERIMENTAL PATCHING OF BROKEN CONCRETE
AT EXPANSION JOINTS
US-16 - Nunica to Fruitport
Project Mc 70-28, C3

During August and September of 1953, the joints and cracks in a five-mile stretch of concrete pavement on US-16 between Nunica and Fruitport were resealed by David C. Byers, Jr. of Grand Rapids on a force account basis. The results of this work are described in Research Laboratory Report No. 197 dated October 9, 1953. In a number of places, corners were broken from slabs at the junction of an expansion joint and the pavement edges. A corner break, typical in appearance and having recent routine county maintenance treatment, is shown in Figure 1. Since the pavement was in very good general condition and resealing of the joints and cracks had eliminated the necessity of recapping, it was felt that an investigation should be made into the practicability of repairing such corner breaks. As a result, when appropriations were made for the joint and crack resealing, a small additional amount was appropriated for making a few experimental repairs on such corner breaks. This work was started on September 15, 1953 after completion of the resealing operations, and completed on September 18, 1953. The work was done by the same contractor on a force account basis and was followed by the author.

It was found that usually only one corner break was apparent at the junction of an expansion joint and the pavement edge. Removal of a section of the shoulder always indicated, however, that the other corner was broken too. It appeared that compressive stress at the joint caused the upper corner of one slab and the lower corner of the other to shear off at an angle of about 30 degrees to the horizontal. This condition is apparent in Figure 2 and is typical of all corner breaks examined



▲ Figure 1. A corner break typical in appearance, having received routine county maintenance treatment.



▲ Figure 2. A typical corner break with shoulder excavated to show details. First in a series showing steps in repair method.



▲ Figure 3. Close-up of lower break in Figure 2 with loose and decomposed material removed.



▲ Figure 4. Close-up of top break in Figure 2 with loose and decomposed material removed.



▲ Figure 5. Same break as Figure 3 with joint felt in place and Embeco cement bond coat being applied to lower break.



▲ Figure 6. Adding Embeco treated concrete grouting mixture.

in detail.

Figures 2 through 11 show the various steps used in making these repairs. The loose and decomposed concrete was removed with an air hammer (Figures 3 and 4) and the joint felt and groove form set in place (Figure 5). A wide board was used as a form for the pavement edge. A very thin water slurry of cement containing 10 percent by weight of Embeco was brushed into the faces of the old concrete for a bond coat (Figures 5 and 7). A grout made of 60 volumes of 1-inch maximum gravel, 40 volumes No. 8 sand, and 33-1/3 volumes of cement containing 10 percent by weight of Embeco was then packed into the cavity by hand and consolidated by tamping in with the end of a small board (Figures 6 and 8). This grout mixture was unusually dry, containing just enough water to retain its shape when squeezed into a ball in the hand. A 1/2-inch surface coat, in which the gravel was replaced by No. 8 sand, was used to finish off the patch (Figures 9 through 11). The patch was covered overnight with Sisalkraft paper (Figure 12) and then alternately wetted and dried for several hours in order to rust the iron in the Embeco. Figures 13, 14, and 15 show various finished patches and Figure 16 shows a general view of the barricades set up around a series of patches. These barricades were illuminated at night with flares and red lanterns.

Of the \$14,500 originally allocated to the project, \$12,856.44 was used for the actual resealing of joints and cracks, and \$1,618.03 was spent on concrete repair, leaving an unused balance of \$25.53.

Breaks at the north end of 13 different expansion joints at the locations listed below were repaired at an average cost of \$124.46 per patch.

443 / 16	442 / 18	446 / 7	451 / 06
436 / 19	443 / 19	448 / 21	453 / 63
441 / 29	444 / 15	450 / 04	460 / 00
			464 / 16



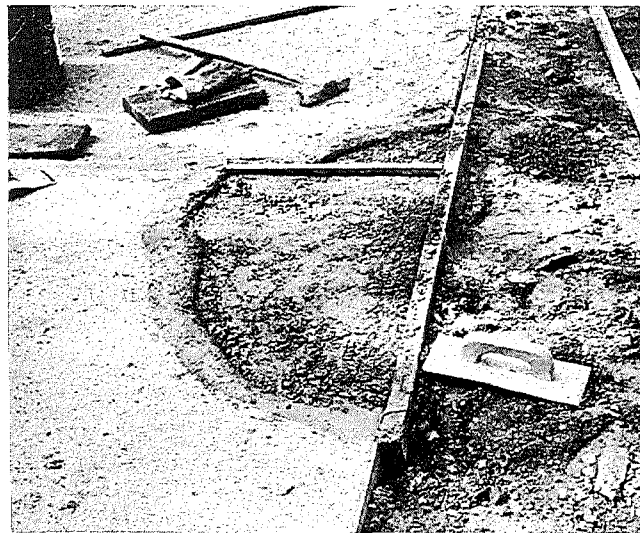
▲ Figure 7. Applying bond coat to upper corner break.



▲ Figure 8. Consolidating grouting mixture in upper corner break.



▲ Figure 9. Ready for finish coat.



▲ Figure 10. Applying finish coat to patch.



▲ Figure 11. Final finishing of patch.
Final picture of series.



▲ Figure 12. Curing of a repaired corner break by covering with Sisalkraft paper.



Figure 13. A typical repaired corner break.

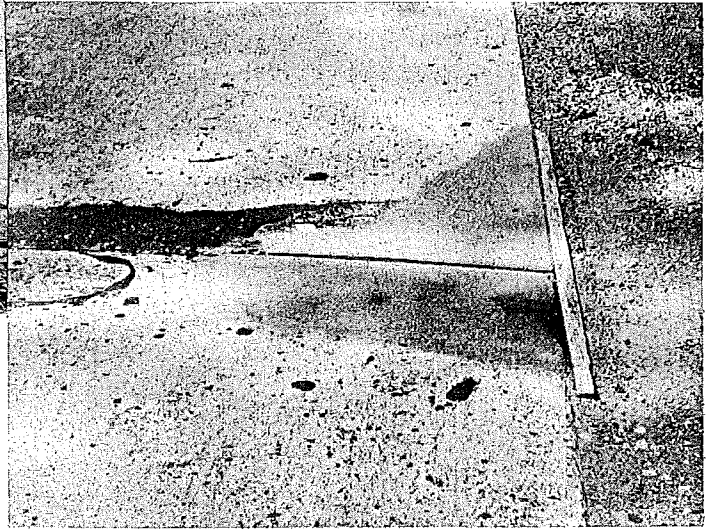


Figure 14. Another repaired corner break.

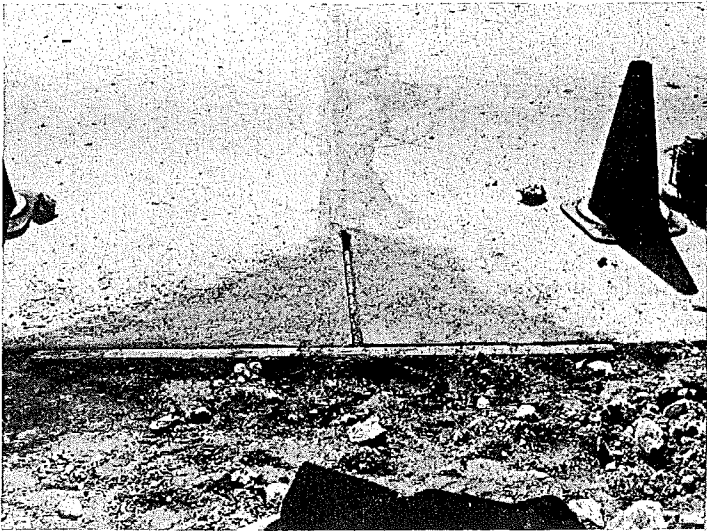


Figure 15. A corner break repair with traffic barrier in place.



Figure 16. A general view of repairs showing method of protection from traffic.

The area of the patchwork at each joint end averaged about 5 square feet which means a cost of about \$24.90 per square foot. Within very wide limits, however, the cost per patch is somewhat independent of the size of the patch since about the same amount of time was required to repair each of 15 corner breaks.