OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT

July 6, 1965

To: E. A. Finney, Director
Research Laboratory Division

From: F. Copple

Subject: Inspection of Pavement Joint Blowup on US 131 North of Grand Rapids (Construction Project 41-90, C4). Research Project 39 F-7(14). Research Report No. R-533.

In accord with your verbal request of May 10, 1965, repair operations by the Kent County Road Commission were observed on May 12 at a blown joint located at Sta. 58+35 in Project 41-90, C4, in US 131 north of Grand Rapids.

The blowup extended across both lanes at this night joint on the southbound roadway (Fig. 1). Measurements showed that this construction joint was formed by a 150-ft slab at the south (50 percent over maximum length) which was the final pour of June 19, 1956, and a conventional 99-ft slab to the north. The joints immediately north and south of the blowup both were open and full of debris. Because no basket was found during repair of the joint it is assumed that dowel bars were placed through holes in the bulkhead at the end of the slab during construction. Coarse aggregate used in the concrete was taken from the Pickett Pit (No. 41-38), located in Kent County.

The repair work consisted of breaking out the damaged concrete and replacing it with cold mix asphalt. Fig. 3 shows dowel bars removed from the damaged joint. Some were rusted over their entire length, and almost no lubricant remained on the dowel surfaces. Corrosion had reduced the diameter of some dowels by 1/8 in. or about 10 percent. Concrete beneath the dowels was disintegrated (Fig. 4).

The joint blowup may be attributed to a combination of factors:

1. One of the slabs forming the joint was 150 ft long, and thus cumulative movement caused by its expansion would be greater than normally expected from a standard 99-ft slab.

2. The slab was poured during warm summer weather and would contract considerably during cold winter months. As a result, contraction joints would open very wide during cold weather, probably resulting in failure of the hot-pour joint sealer used in 1956. Subsequently, large quantities of water might enter, including de-icing chemicals in season, which would attack both the concrete and the dowels.

Since the base plate under the joint might impound this salty water, the lower part of the slab would resist longitudinal movement, and the disintegrated joint edge would provide a smaller bearing area to support large, thermally caused compressive stresses.

3. The open joint would permit infiltration of incompressible debris which would resist slab movement to relieve thermal expansion forces.

4. This was a night construction joint and no basket was used to maintain alignment of the load transfer bars during construction. Thus, the bars might easily have been misaligned.

Numerous other joints in the area also appeared to be on the verge of blowup failure (Fig. 5).

OFFICE OF TESTING AND RESEARCH

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Figure 1. Transverse joint blowup (Sta. 58+36).

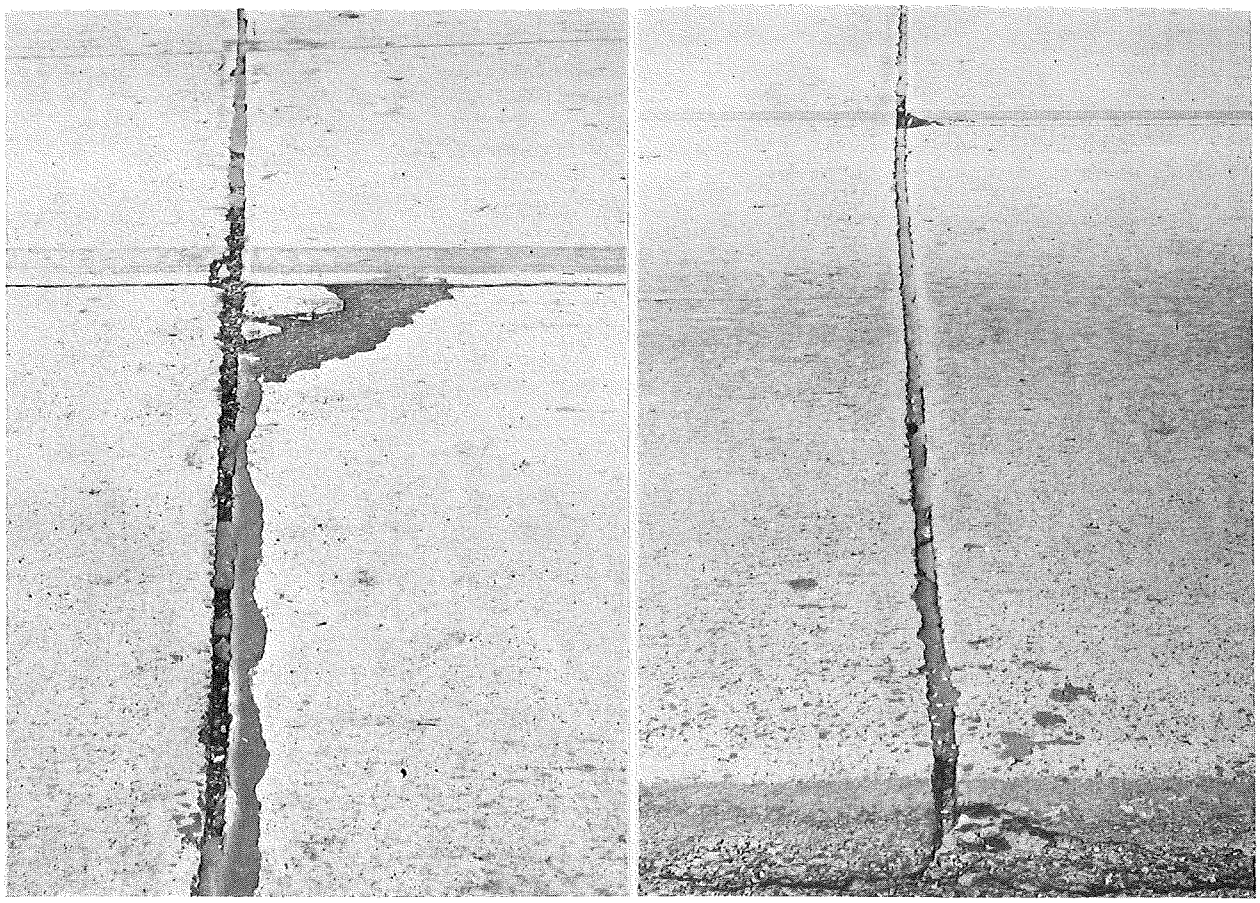


Figure 2. Transverse joints adjacent to blowup, at end of 150-ft slab south of blowup (left: Sta. 56+85), and north of blowup (right: Sta. 59+34).

Figure 3. Dowel bars as removed from blown up joint.

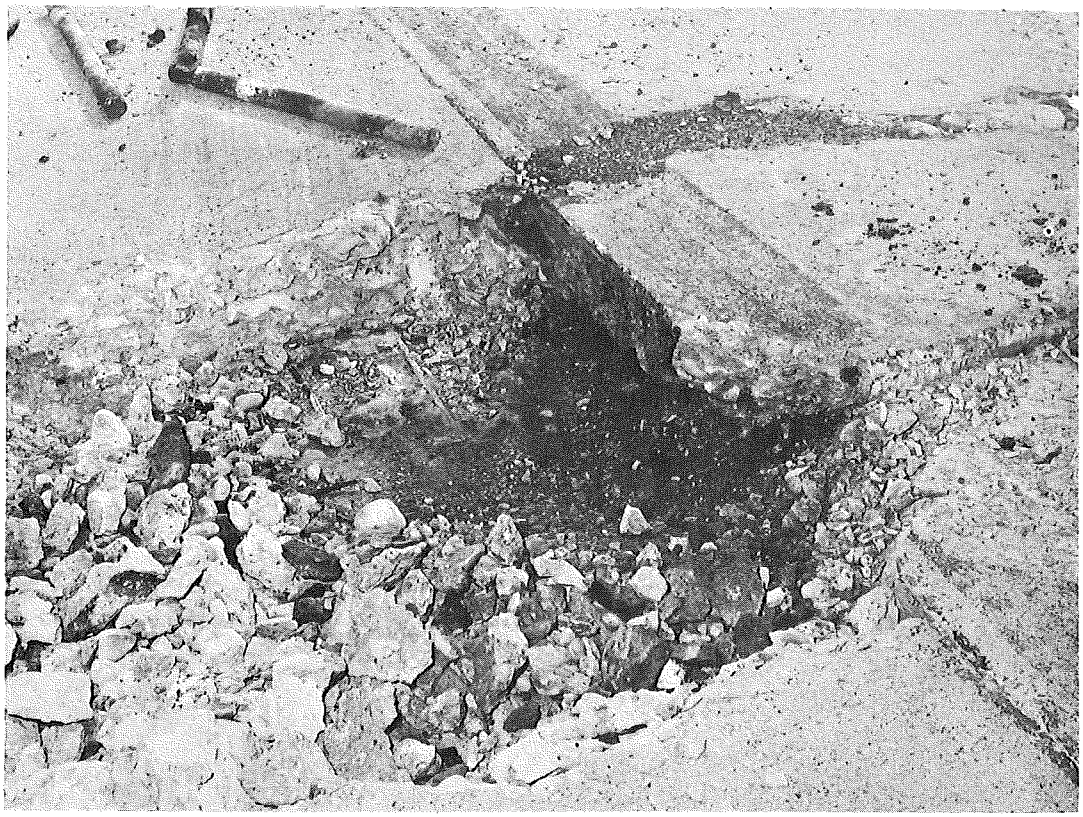
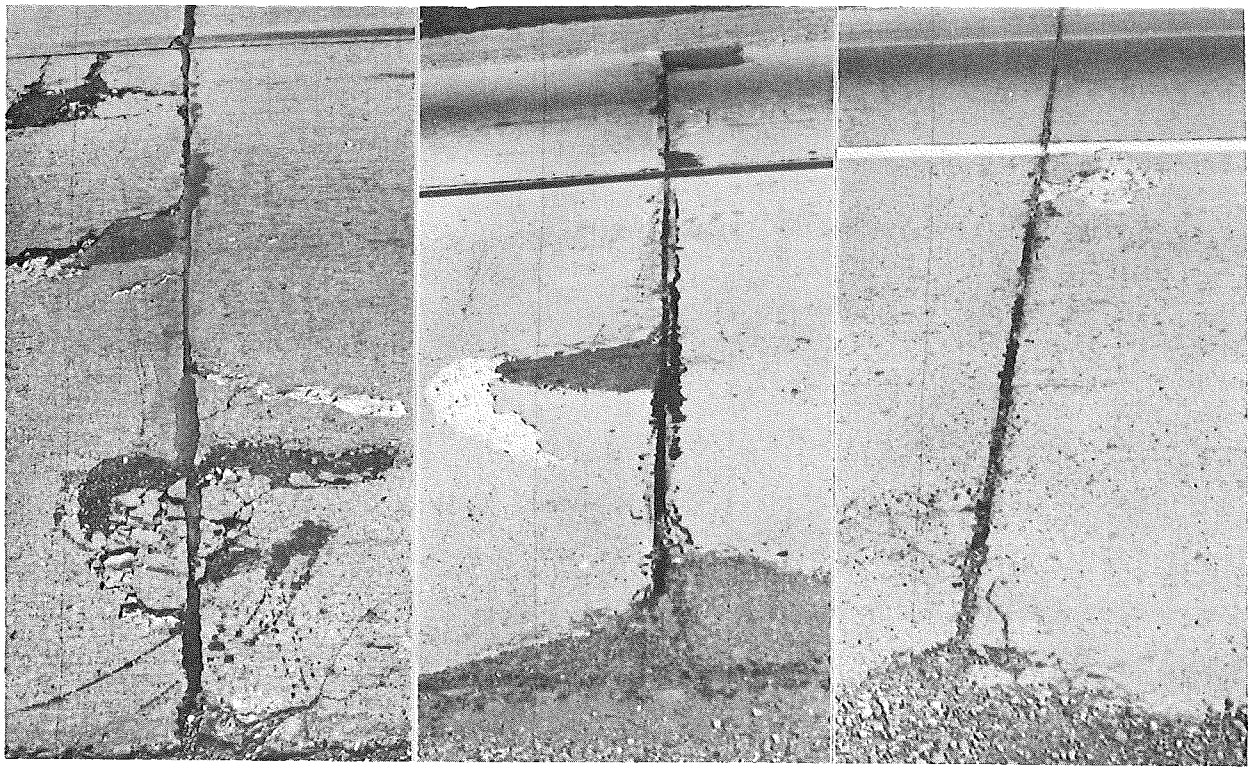
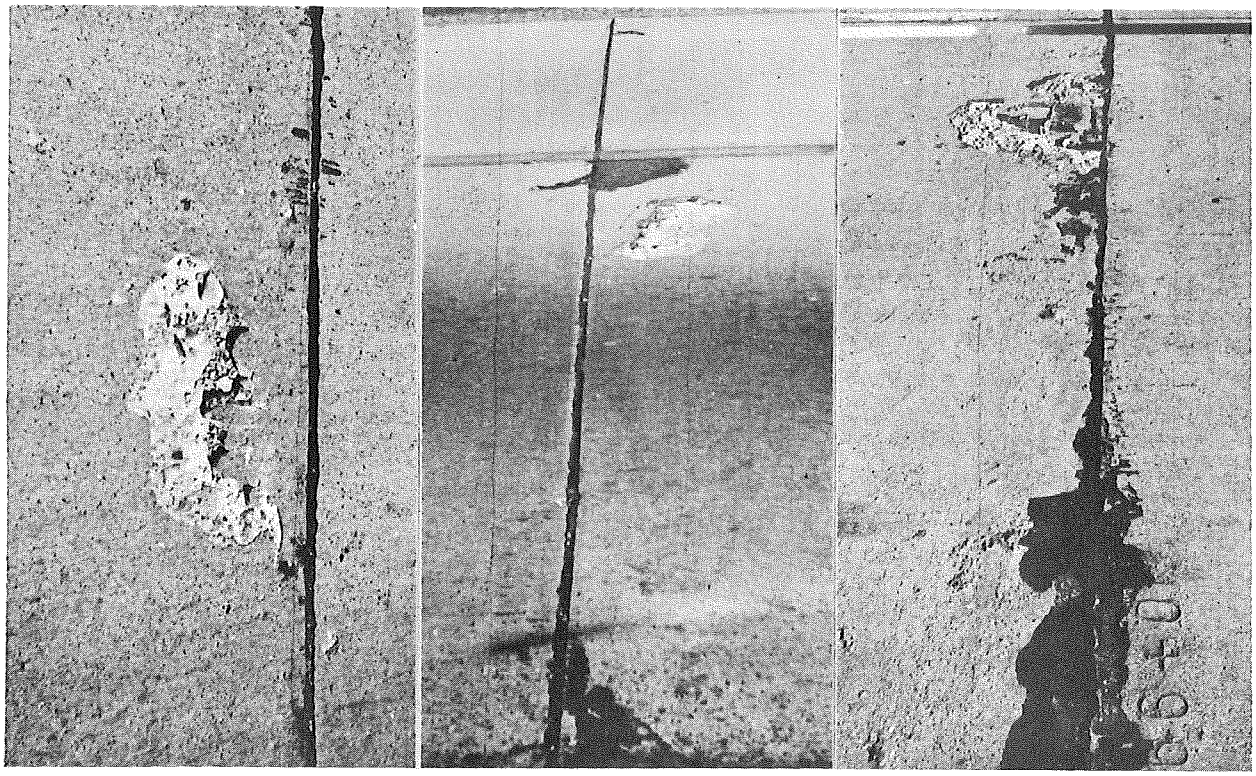


Figure 4. Intersection of transverse and longitudinal joint exposed during repair. Note decomposed concrete in lower portion of slab.



144+70 NB | 143+70 NB | 114+44 NB



132+80 SB | 75+15 NB | 40+99 SB

Figure 5. Varying degrees of failure were apparent for other joints in this project; joint at upper left is a construction joint, and all others shown are contraction joints.