

MICHIGAN  
STATE HIGHWAY DEPARTMENT  
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State Highway Commissioner

EXPERIMENTAL CAPPING STUDY  
CONSTRUCTION PROJECT F 33-54, C4 on US-127  
PROGRESS REPORT NO. 1

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Research Project 53 F-29

Research Laboratory  
Testing and Research Division  
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## EXPERIMENTAL CAPPING STUDY

### CONSTRUCTION PROJECT F 33-54, C4 ON US-127

In April, 1953, C. H. Cash, Road Engineer, and C. E. Laird, Construction Engineer, Michigan State Highway Department, requested the Research Laboratory to set up a research project to determine the effect of slab length and method of breaking bond on the crack experience of a concrete capping project.

The south bound roadway of construction Project F 33-54, C2 on US-127 south of Helt, was chosen as the test site. This project was designed as a four lane divided highway with the northbound traffic lane being a new concrete slab constructed east of the existing roadway. It was originally intended to cap portions of the existing concrete pavement with a bituminous concrete surfacing and to remove and replace other sections of the existing concrete pavement with new 9-inch uniform reinforced concrete. The existing concrete pavement, Project 33-27, C3, was constructed in 1926. The pavement was of uniform thickness seven inches thick unreinforced and without load transfer at expansion joints. Because of bad materials in the subgrade and a high water table, several stretches of this original pavement had been repaired previously by having new sections of concrete placed where the worst break-ups had occurred. When it came to constructing the project it was decided to remove more of the existing surface and correct grade conditions. Also the bituminous concrete resurfacing was replaced by concrete capping where the existing surface was left in place. Standard nine-inch uniform reinforced concrete was placed where the existing pavement was removed. This authorized change was to be made under Project F 33-54, C4, and was entirely in the southbound or west roadway.

The location and description of the variables under test in this project are described below:

1. New 9" uniform concrete pavement.

A. Standard Mesh Reinforced Concrete Pavement, 99' slabs, load transfer.

Station 327+00 to 334+71  
 Station 381+91 to 435+19  
 Station 443+40 to 462+59  
 Station 469+98 to 472+00

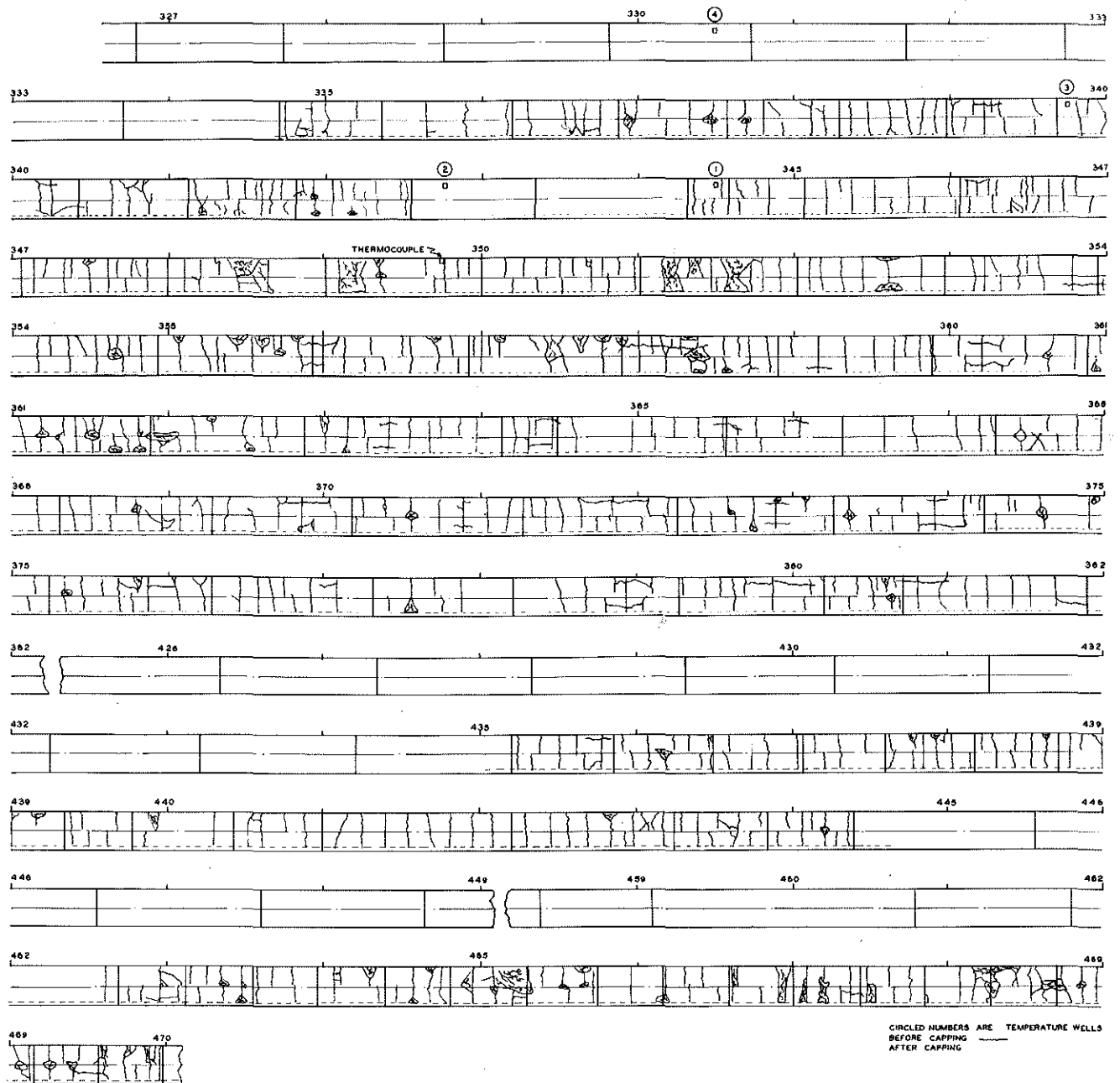
B. With Double Reinforcement in 9" Concrete Pavement, 99' slabs, load transfer.

Station 342+48 to 344+32

In the above sections where the existing subgrade material was faulty, the poor material was removed and replaced with new sand subbase under density control, and the necessary drainage systems to control water table elevation were constructed.

2. Recapped Sections.

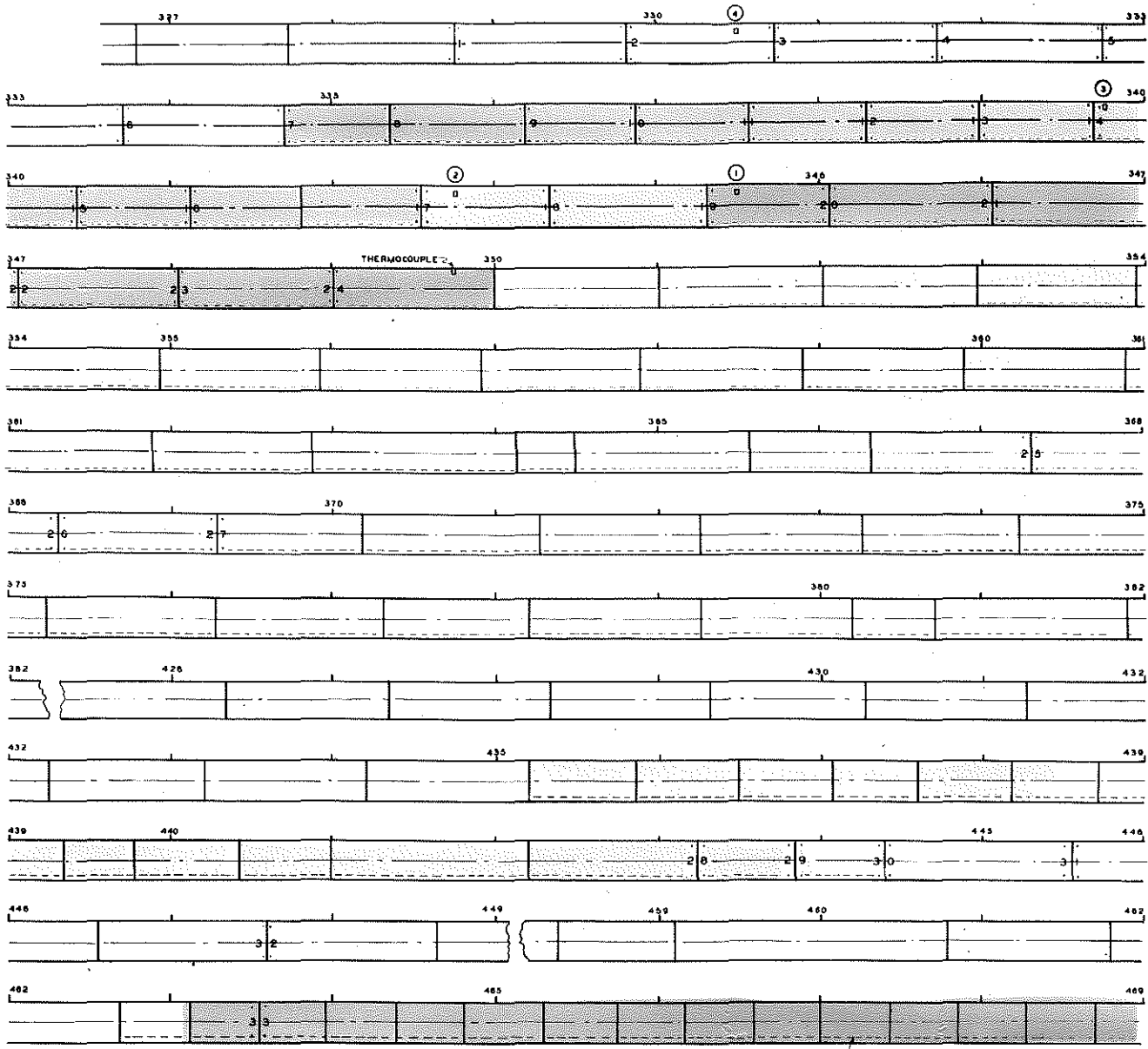
Stationing	Features	Breaker Strip - per Sq. Yd.
A. 462+59 to 469+98	43' slab length, mesh reinforced. No load transfer.	1st layer 0.25 gals AE 3 & 25 lbs. sand. 2nd layer 0.15 gals AE 3 & 25 lbs. sand.
B. 435+19 to 443+40	57' slab length, mesh reinforced. No load transfer.	Same as above
C. 334+71 to 342+48	70' slab length, mesh reinforced. No load transfer.	Same as above
D. 344+32 to 350+00	99' slab length, mesh reinforced. No load transfer.	1 layer of 0.25 gals AE 3 & 25 lbs. sand.
E. 350+00 to 381+91	99' slab length, mesh reinforced. No load transfer.	1 layer of 0.25 gals AE 3 & 25 lbs. sand 2nd layer of 0.25 gals AE 3 & 25 lbs. sand.



CONDITION SURVEY OF PAVEMENT  
BEFORE AND AFTER EXPERIMENTAL CONCRETE CAPPING

CONSTRUCTION PROJECT F 33-54.C4

FIGURE 1



NUMBERS AT CENTER LINES  
INDICATE TEST INSTALLATIONS

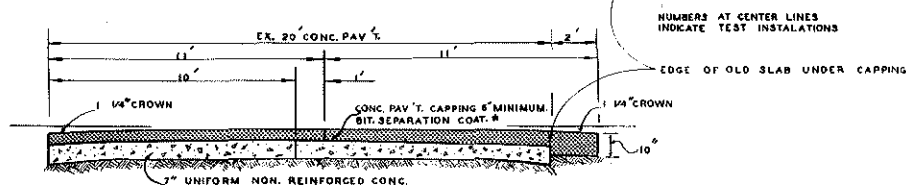
**LEGEND:**

Section No.

- 1-A 99' Slabs - New 9' - Mesh & Dowels
- 1-B 99' Slabs - New 9' - Double Mesh
- 2-A 43' Slabs
- 2-B 57' Slabs
- 2-C 70' Slabs
- 2-D 99' slabs
- 2-E 99' Slabs

**Breaker Strips:**  
One layer 0.25 gallons of AE-3-25 lbs. sand - 2NS  
One layer 0.25 gallons of AE-3-15 lbs. sand - 2NS

**Breaker Strips:**  
One layer 0.25 gallons of AE-3-25 lbs. sand 2NS  
**Breaker Strip:**  
One layer 0.25 gallons of AE-3-25 lbs. sand - 2NS  
One layer 0.25 gallons of AE-3-25 lbs. sand - 2NS



\* DETAILS VARY AS SHOWN IN REPORT.

SECTION SHOWING  
CONCRETE PAVEMENT CAPPING 6" MIN.  
TO APPLY AS CALLED FOR ON PLANS

**EXPERIMENTAL CONCRETE CAPPING  
LAY OUT OF TEST AREAS**

CONSTRUCTION PROJECT F 33-04,C4

FIGURE 2

Prior to construction of the test sections, a complete condition survey was made of the existing concrete surface. Figure 1 shows the cracked condition of the pavement. The concrete capping has been super imposed on the condition survey map to show the location of the joints with respect to the cracks underneath.

Figure 2 is a schematic showing the location of the various test sections as identified by color.

Pins were installed at certain joints in each test section to study the changes in slab length. The location of these joints is shown in Figure 2. Temperature wells (for thermometer readings) were installed at locations also shown in Figure 2, to obtain the pavement temperature. In addition, a thermocouple installation was made at Station 349+75 in the concrete capping area to study the temperature gradient through the existing pavement and the capping.

As of August 26, 1954, only two slabs of these capped had developed a visible crack. This first crack showed up in the traffic lane of the southbound pavement at Station 346+50 when the December, 1953 condition survey was made. In the August 26th condition survey, a crack had developed across the passing lane of the southbound pavement at Station 346+48 approximately 2 feet back of the crack in the traffic lane. This cracking is shown in Figure 1 by a red line and also by pictures identified as Figures 3 and 4. These cracks developed over a very badly cracked section of the existing pavement which was capped with a concrete slab with a 33 foot joint spacing and with a separating or breaker strip between the old and new concrete which consisted of one layer of 0.25 gallons of AE-3 and 25 pounds of 2 NS sand. A picture showing a typical view of the existing pavement before reconstruction is shown in Figure 5.

Observations have so far failed to reveal any definite relationship between cracking of the new surface and the length of slab, or between cracking and the different methods used to break bond between the capping and the original pavement. It is apparent that the pavement in this research project will have to be watched for several years before the effects of the design variables will develop to the point where conclusions can be drawn.



Figure 3. First crack appeared in southbound traffic lane of capped portion, F 33-54, C 4 Station 346+50 during fall 1953.



Figure 4. Second crack appeared in southbound passing lane of capped portion, F 33-54, C 4 Station 346+48, noticed in summer 1954.





Figure 5. Example of type of old surfacing that was capped as F-88-54-C4.