

R-206

MICHIGAN  
STATE HIGHWAY DEPARTMENT  
Charles M. Ziegler  
State Highway Commissioner

Experimental Concrete Capping on Groesbeck Highway,

Project F 50-7, C5-F-421(1)

Joint Investigation between Construction Division  
and Testing and Research Division with Approval  
of Bureau of Public Roads

Research Project 52F-25

Progress Report No. 2

Research Laboratory  
Testing and Research Division  
Report No. 206  
April 16, 1954

LAST COPY  
DO NOT REMOVE FROM LIBRARY

## EXPERIMENTAL CONCRETE CAPPING ON GROESBECK HIGHWAY

Project F 50-7, C5 - Supplemental to Report No. 194

In the summer of 1952 observations were made on the construction operations during the capping of Groesbeck Highway. Previous to this a complete condition survey was made of the original pavement, and subsequent to the concrete capping, another survey was made at the end of the curing period to determine the cracking in the concrete cap. This last survey was made between June 18 and July 29, 1952, and the results were reported in Research Report No. 194, dated August 20, 1953. This report presents a summary of the cracking observed at that time and in addition gives the cracking observed in a survey made in October, 1953.

The experimental section of recapped pavement was divided into four sections according to the method of bonding the cap to the original surface.

- Method 1. From station 2/68 to 30/32, the concrete capping was bonded directly to the existing pavement.
- Method 2. From station 319/33 to 371/88, the capping was again bonded directly to the old pavement. In this last mentioned section the steel reinforcement was originally carried through the contraction joints by error. As soon as this condition was discovered, an authorization was issued to the contractor to saw the contraction joints to a depth sufficient to cut the steel reinforcing.
- Method 3. From 30/32 to 249/46, a breaker strip consisting of a single application of asphalt emulsion AE-3 and sand, composed of .25 gallons of emulsion to 40 lbs. of sand per sq. yd., was used.
- Method 4. From 249/46 to 319/33, a 3/4 inch bituminous concrete leveling course as a breaker strip was used.

The thickness of capping used varies within each of the above sections. The first has thicknesses of 5, 5 1/2, and 6 inches; the second and third have thicknesses of 5, 5 1/2, 6, 6 1/2, and 7 inches; while the fourth has all the above thicknesses plus one stretch of 7 1/2 inch capping.

Table 1 presents the average number of cracks per slab for various thicknesses and methods of bonding the cap to the original pavement. Values are shown for the 1952 and 1953 survey and the increased cracking per slab per mile observed on the second survey. This same data is presented graphically in Figure 1. Table II presents the ratio of cracking for Methods 1 and 4 compared to the standard method, Method 3, for capping thicknesses of 5, 5 1/2, and 6 inches. A study of this table shows that cracking is more than twice as prevalent for Method 1 while Method 3 and 4, where separating courses are used, are about equally effective. If the comparison of Method 3 and 4 is extended over the entire range of capping thicknesses then the average number of cracks per slab would be 2.2 for each method which illustrates that at present the performance of the two methods are almost identical.

Photographs of cracking in the concrete cap are shown to illustrate the progressive deterioration at some cracks and to show typical examples of new cracking which has formed since the first survey. Figures 2 and 3 show the development of two cracks which were illustrated in Report No. 194, while Figures 4 through 7 illustrate closely spaced cracking which is quite prevalent now, but which did not appear at the time of the first survey. In Figure 4 the most prominent crack was noticed in the first survey but the second crack has formed since that. The cracks illustrated in Figures 5, 6 and 7, have occurred in the area where the cap was bonded to the old pavement and where the reinforcing steel was carried through the joints. The most prominent cracks as well as the greatest number of cracks have occurred in this area.

TABLE I

## COMPARATIVE RESULTS OF DIFFERENT METHODS OF BONDING CAPPING TO OLD PAVEMENT

CAPPING METHOD			Length Section - feet	Average Number of Cracks per Slab with Capping Thicknesses of:																		
				5"			5 1/2"			6"			6 1/2"			7"			7 1/2"			
				'52	'53	Inc.	'52	'53	Inc.	'52	'53	Inc.	'52	'53	Inc.	'52	'53	Inc.	'52	'53	Inc.	
Bonded Direct to Old Pav't	Reinforced	Not carried thru the joints	1300	4.5	7.5	3.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
			1200	---	---	---	3.3	5.2	1.9	---	---	---	---	---	---	---	---	---	---	---	---	---
			300	---	---	---	---	---	---	5.3	7.5	2.2	---	---	---	---	---	---	---	---	---	---
		Carried Continuous thru joints	500	8.7	10.8	2.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
			2000	---	---	---	7.0	9.0	2.0	---	---	---	---	---	---	---	---	---	---	---	---	---
	1300		---	---	---	---	---	---	6.5	7.7	1.2	---	---	---	---	---	---	---	---	---	---	
			900	---	---	---	---	---	---	---	---	---	6.3	8.5	2.2	---	---	---	---	---	---	
			600	---	---	---	---	---	---	---	---	---	---	---	---	6.4	7.5	1.1	---	---	---	
	With A. E. 3 and Sand as Breaker (Standard Method)		1500	1.3	2.5	1.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
			8000	---	---	---	2.5	3.8	1.3	---	---	---	---	---	---	---	---	---	---	---	---	
		4700	---	---	---	---	---	---	2.0	2.7	0.7	---	---	---	---	---	---	---	---	---		
		2400	---	---	---	---	---	---	---	---	---	0.7	1.1	0.4	---	---	---	---	---	---		
		5400	---	---	---	---	---	---	---	---	---	---	---	---	0.5	1.0	0.5	---	---	---		
With 3/4" Bituminous Concrete Breaker Strip On Old Pavement		400	2.3	3.4	1.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
		1100	---	---	---	3.1	3.9	0.8	---	---	---	---	---	---	---	---	---	---	---	---		
		3100	---	---	---	---	---	---	1.1	1.8	0.7	---	---	---	---	---	---	---	---	---		
		300	---	---	---	---	---	---	---	---	---	0.7	1.2	0.5	---	---	---	---	---	---		
		900	---	---	---	---	---	---	---	---	---	---	---	---	0.0	0.4	0.4	---	---	---		
		1200	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.1	2.6	0.5		

TABLE II

CRACKING RATIO FOR VARIOUS METHODS OF BONDING CAPPING  
TO OLD PAVEMENT

(Ratio based on Standard Method -  
A. E. 3 and Sand as Breaker Strip.) - 1953 Survey.

CAPPING METHOD	Capping Thickness			Average
	5"	5 1/2"	6"	
Method 1 Bonded direct to Old Pavement - Without Reinforcement Carried Thru Joints	3.0	1.4	2.8	2.2
Method 3 With A. E. 3 and Sand as Breaker Strip (Standard Method)	1.0	1.0	1.0	1.0
Method 4 With 3/4 Bituminous Concrete Breaker Strip on Old Pavement.	1.4	1.0	0.7	1.0