R-367

AGGREGATE SOURCE AND POPOUT FREQUENCY
I 94 from Marshall to Jackson

O. L. Lindy

Research Laboratory Division
Office of Testing and Research
Research Project 39 F-7(14)
Report No. 367

Michigan State Highway Department
John C. Mackie, Commissioner
Lansing, November 1961

AGGREGATE SOURCE AND POPOUT FREQUENCY
I 94 from Marshall to Jackson

At the request of R. L. Greenman, Assistant Testing and Research Engineer, the Research Laboratory Division has completed a study of popout incidence and coarse aggregate sources on both the eastbound and westbound roadways of I 94 from west of Marshall to east of Jackson. This included condition survey mapping and selective photographing of all contracts on this portion of I 94, comprising 69.1 lin mi of two-lane 24-ft pavement, built between 1949 and 1960.

The individual projects are described in Table 1, which also summarizes the frequency of popouts as classified by a system illustrated in Fig. 1. The seven aggregate sources, singly and in combination, for this construction are given in Table 2, ranked from poorest to best performance in terms of total popout frequency. Material from two of these seven aggregate sources underwent beneficiation by heavy medium separation. Finally, Fig. 2 shows the range of popout sizes encountered on these concrete surfaces.

The survey revealed that popouts in varying degrees and quantities have occurred on all projects included in the study. Of further concern is the fact that the number and size of popouts varied considerably among the projects using beneficiated aggregates.

TABLE 1

POPOUT FREQUENCY AND PROJECT IDENTIFICATION

I 94 from Marshall to Jackson

Project Number	Location	Year Completed	Roadway	Pavement Length, miles	Aggregate Source and Pit Number	Popout Frequency, percent of area*		
						Light	Medium	Heavy
13083, C3	16 Mile Rd east to 17-1/2 Mile Rd	1960	Eastbound	0.945	Pickett (34-26)	14.0	10.0	0.0
			Westbound	0.945	Pickett (34-26)	6.0	8.0	0.0
13083, C2	17-1/2 Mile Rd east to east of Partello Rd	1960	Eastbound	1.610	Pickett (34-26)	10.6	11.8	0.0
			Eastbound	1.610	Pickett (34-26)	23.5	2.4	2.4
13083, C1	East of Partello Rd east to east of 22-1/2 Mile Rd	1960	Eastbound	3.421	Pickett (34-26)	48.2	17.7	0.0
			Westbound	3.421	Pickett (34-26)	83.6	7.8	0.0
13083, C4	East of 22-1/2 Mile Rd east to Jackson-Calhoun County line	1960	Eastbound	1.788	Bundy Hill (30-35)**	4.2	40.3	22.2
			Eastbound	0.871	Bundy Hill (30-35)**	0.0	76.1	19.6
			Eastbound	5.079	Bundy Hill (30-35)** and Muir-Stacey (47-30)	17.5	74.5	3.4
			Westbound	3.776	Bundy Hill (30-35)**	32.6	52.9	9.5
			Westbound	3.961	Bundy Hill (30-35)** and Whittaker & Gooding (38-56)**	12.0	52.1	35.9
38102, C2, C3	Jackson-Calhoun County line east to Ludlow Rd	1960	Eastbound	0.842	Bundy Hill (30-35)**	9.0	55.8	4.5
			Westbound	0.842	Bundy Hill (30-35)**	43.9	27.0	0.0
38102, C1	Ludlow Rd east to old US 12	1959	Eastbound	4.518	Bundy Hill (30-35)**	9.6	75.4	15.8
			Westbound	4.518	Bundy Hill (30-35)**	18.2	57.5	24.1
38101, C9 38101, C13	Old US 12 east to US 127	1953	Eastbound	9.667	Pickett (34-26) and Kuhl (81-8)	0.0	100.0	0.0
		1956	Westbound	9.667	Bundy Hill (30-35)**	9.3	70.8	1.5
38101, C4, C5	US 127 east to M 106	1952	Eastbound	1.292	Klumpp (38-46) and American Aggregate (47-3)	0.0	72.2	27.8
			Westbound	1.292	Klumpp (38-46) and American Aggregate (47-3)	0.0	95.2	4.4
38101, C2 38101, C14	M 106 east to old US 12	1949	Eastbound	4.528	Klumpp (38-46)	0.0	16.5	83.5
		1956	Westbound	4.528	Bundy Hill (30-35)**	15.2	63.6	16.0

* Frequency = total popouts per 100 lin ft of roadway; light = 120 or less, medium = 120 to 200, heavy = over 200.

** Beneficiated by heavy medium separation.

TABLE 2
POPOUT FREQUENCY AND AGGREGATE SOURCE

Aggregate Source and Pit Number	Pavement Length, miles**	Popout Frequency, percent of area***			
		Light	Medium	Heavy	Total
Klumpp (38-46)	4.53	0.0	16.5	83.5	100.0
Bundy Hill (30-35)* and Whittaker & Gooding (38-56)*	3.96	12.0	52.1	35.9	100.0
Pickett (34-26) and Kuhl (81-8)	9.67	0.0	100.0	0.0	100.0
Klumpp (38-46) and American Aggregate (47-3)	2.58	0.0	83.7	16.1	99.8
Bundy Hill (30-35)* and Muir-Stacey (47-30)	5.08	17.5	74.5	3.4	95.4
Bundy Hill (30-35)*	31.25	14.7	63.4	11.6	89.7
Pickett (34-26)	11.95	43.9	10.6	0.3	54.8

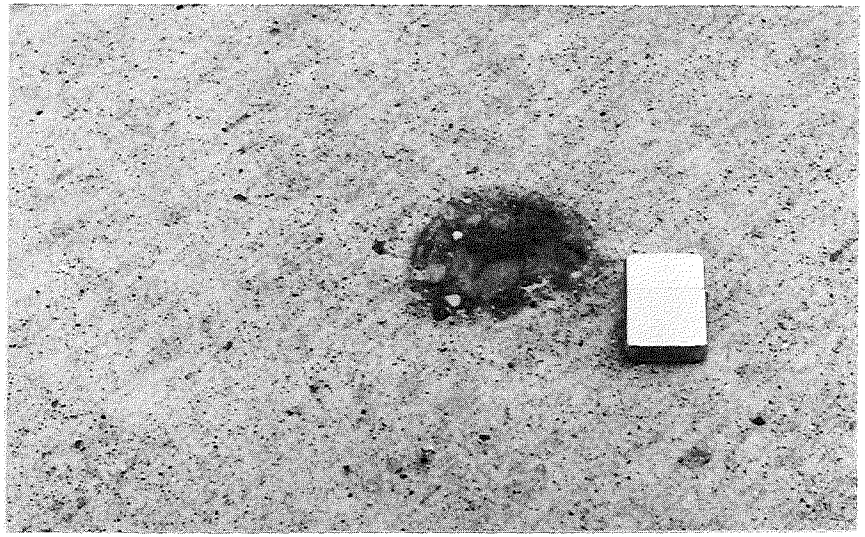
* Beneficiated by heavy medium separation.
** Mileage given for 24-ft wide roadway.
*** Frequency = total popouts per 100 lin ft of roadway; light = 120 or less, medium = 120 to 200, heavy = over 200.

Light frequency = 120 or less per 100 lin ft

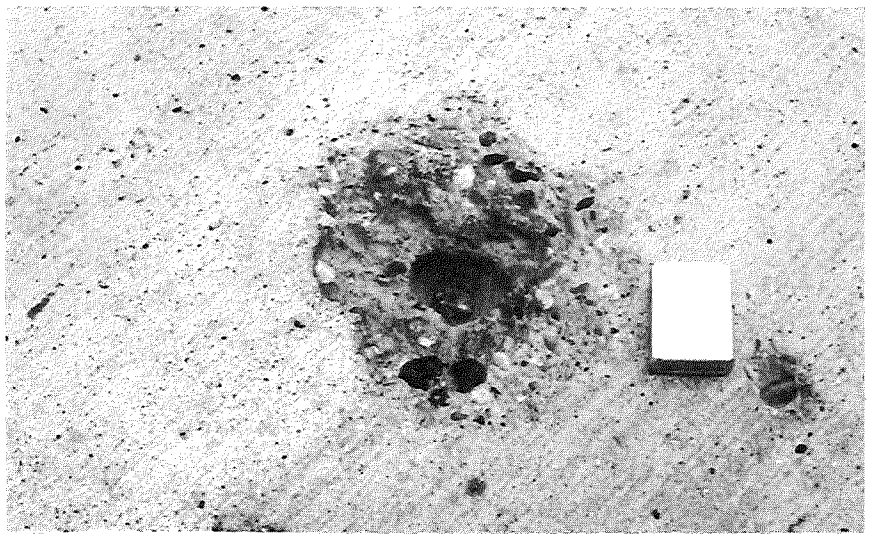
Medium frequency = 120 to 200 per 100 lin ft

Heavy frequency = over 200 per 100 lin ft

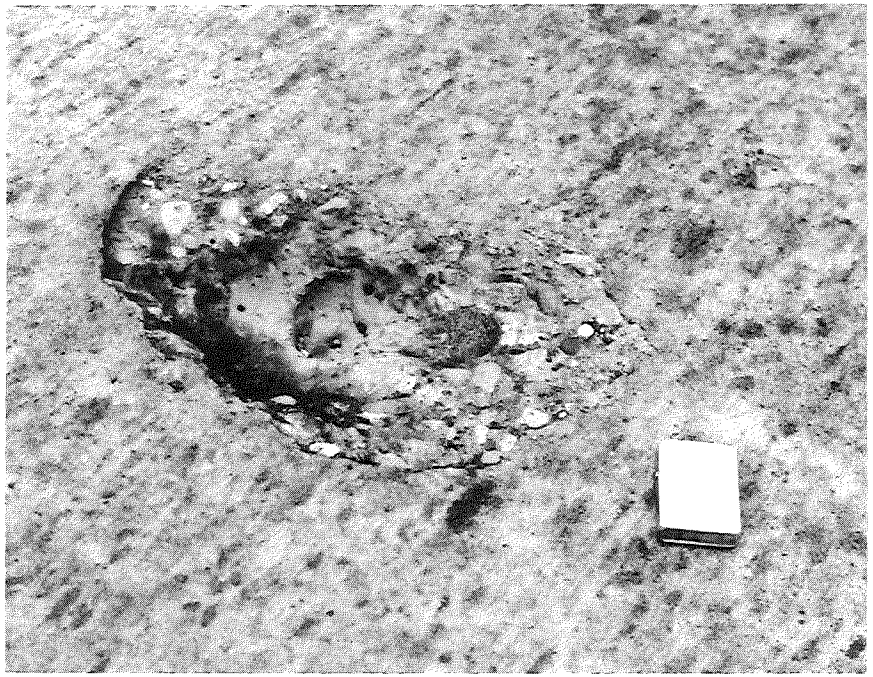
Figure 1.
Popout
frequency
classification



Small: 0- to 3-in. diameter



Medium: 3- to 6-in. diameter



Large: 6 in. or larger

Figure 2. Range in size of popouts.