

OFFICE MEMORANDUM



MICHIGAN
STATE HIGHWAY DEPARTMENT

October 10, 1966

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To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: Investigation of Retarder in Bridge Deck Concrete, B04 of 82053A, C39
(US 24 over Upper Branch of Rouge River, Detroit)
Research Project 66 B-80. Research Report No. R-604.

In accordance with your request of July 19, 1966, a laboratory study of three cores taken from Pour C, Stage 2, of the northbound deck of this US 24 structure has been performed by M. G. Brown and W. L. Frederick.

Details of the pouring and finishing problems relating to this pour on June 29, 1966, were given in a letter from P. A. Nordgren to you dated July 18, 1966. Pouring was reported to have begun at 10 a. m. on June 29 with subsequent air temperatures exceeding 90 F. Between 2 and 6 oz of Pozzolith 100R water reducer-retarder per sack of cement were used during the day's pour. The worst finishing problems apparently were encountered in an area about 9-ft wide down the middle of the pour where 6 oz of 100R retarder per sack of cement reportedly were used, plus two smaller areas in the west half. A possible cold joint at variable depths was indicated in this region, caused by rapid stiffening or drying out of the concrete. Some of these areas required patching or final finishing with up to 1 in. of a more fluid mix.

A quantitative determination of Pozzolith 100R was requested on the three cores submitted to the Research Laboratory, and compressive strengths were obtained in the process of crushing and grinding these specimens. The cores were 22 days old when broken and gave the following corrected compressive strengths:

Core No.	Location in Pour C	Compressive Strength, psi
1	8.4 ft from north end, 38.8 ft east of construction centerline.	3500
5	8.8 ft from south end, 13.0 ft east of construction centerline.	3550
6	38.2 ft from north end, 35.6 ft east of construction centerline.	2690

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Portions of these finely ground cores were analyzed by the Spectro-Chemistry Unit and a new technique was devised for quantitative determination of the amount of Pozzolith 100R. It was estimated that the degree of accuracy of this method would be approximately ± 1 oz of 100R per sack of cement. The same mix proportions as on June 29 were used in these control mixes. Chemical analysis of these control cylinders and the three cores submitted indicates that all three cores (Nos. 1, 5, 6), contained about 6 oz of Pozzolith 100R per sack of cement. This would agree with P. A. Nordgren's letter of July 18.

In making the laboratory mixes, three mortar mixes were prepared to determine the setting properties, using the Proctor needle method (ASTM C403). The times for initial set as measured by the Proctor needle were 4-1/4, 8-1/2, and about 11-1/2 hr for mortar mixes containing 0, 3, and 6 oz of Pozzolith 100R per sack of cement, respectively. These tests were run in the laboratory at 76 F and about 40-percent relative humidity. The mix with 6 oz of 100R was difficult to measure, since a firm crust gradually formed which produced erratic Proctor needle readings.

This crusting or surface stiffening effect prior to initial set at the higher retarder concentration possibly contributed to the finishing problems of June 29. This effect most certainly would be accentuated by the high temperatures and drying conditions of that date. The laboratory analyses, as mentioned before, also confirmed that the areas represented by Cores 1, 5, and 6 did contain about 6 oz of Pozzolith 100R per sack of cement. It may be of interest to note that Master Builders' recommended dosage for Pozzolith 100R is 3 to 5 oz per sack of cement.

OFFICE OF TESTING AND RESEARCH



E. A. Finney, Director
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EAF:MGB:jcb

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