OFFICE MEMORANDUM

DATE: September 20, 1978

TO: L. T. Oehler
Engineer of Research

FROM: M. G. Brown

SUBJECT: Study of Latex Modified Concrete Deterioration on Wiard Rd over US 12 (S04 of 81063), Research Project 78 TI-508, Research Report No. R-1097

The following is a summary of the subject investigation as requested by a letter from E. Rohacz to G. J. Casey dated April 5, 1978. As stated in Mr. Rohacz's letter, the latex concrete overlay was placed by the R. J. Fox Construction Co. in October 1977, to repair surface damage to the deck caused by a tanker fire on July 3, 1976. The southside or inside lane was poured October 7 and the north, or outside lane was poured October 15. The south shoulder area was poured October 10. In March 1978, it was noted that portions of the overlay on spans 4 and 5 at the east end of the structure were showing heavy deterioration along the south curb line and along the transverse joints. This five-span structure is oriented mainly east-west, but the spans are numbered 4 to 8 from east to west. Since this deck carries northbound Wiard Rd on a curve toward the west, the deck superelevation conducts most surface drainage toward the south curb where the deep scaling was concentrated.

An initial set of nine 4-in. cores was drilled April 26, 1978, in both lanes of spans 4, 5, and 6 toward the easterly end. These partial-depth cores were tested for shear bond strength and cube sections were cut from the latex concrete overlay to assess the compressive strength. The results on these first nine cores were transmitted as Report of Test on 78 CC-812 through 820, dated August 7, 1978. These results indicated a substantial difference in compressive strength of the latex overlay in the north and south lanes of spans 4 and 5. This strength difference, however, was not reflected in the shear bond strength which had a fairly acceptable range from 250 to 380 psi. The latex concrete portion of the cores was pulverized and initial tests were run to check the latex and cement contents of cores number 6 and 9. These tests indicated the latex content was about the same but there was a substantial difference in cement.

Subsequent to these findings an inspection of the deck was made on August 11, 1978, by the Project Engineer J. Aerts, E. Swartzel, and myself. The heavy scaling, up to 1-1/4 in. deep, along the south curb area of spans 4 and 5 was noted as well as a small area along the north side of span 6 and toward the west end. It was also found that light scaling was starting in the north side of spans 7 and 8. Some color change could be seen in the latex concrete overlay in both the south and north half which suggested some mix differences, mainly cement content, from the Concretemobiles as both pours were placed from east to west. Project records were checked and it was

determined that three different trucks were used on the October 7th pour and only two of these were used in the October 15th pour. The truck numbers and approximate limits of latex concrete from each are shown in the attached diagram. It became more evident that the latex concrete from truck No. 4 in both the October 7th and 15th pours had resulted in a much lighter color than the latex concrete from trucks No. 1 and 3.

Therefore, nine additional cores were obtained on August 14 and 15 in spans 6, 7, and 8 to complete the sampling of all five spans. The locations of the latter nine cores, numbered 1A to 9A, plus the initial nine cores are also shown in the attached diagram. The results of testing on all 18 cores are given in Table 1. The most significant data in this table are the cement contents of 10 selected cores which include the limits of pours from truck No. 4 and the other two trucks for comparison. It is evident there is a definite deficiency of cement in the latex concrete from truck No. 4. The cement content ranged from 3.9 to 5.1 sack/cu yd in the south half of spans 4 and 5, and 4.8 to 4.7 sack/cu yd in the north half of spans 6, 7, and 8, which were placed with truck No. 4. The 6.1 sack value for core 5A is thought to be in the area of transition from truck No. 4 to No. 3. Due to problems in cutting small cube sections from the overlay part of the cores, and testing in compression, we feel that a number of the compressive strength results are low. In particular, the values from cores 6A through 9A, and also 1A, should be higher to be commensurate with their cement contents.

In summary, we feel the areas poured from truck No. 4 have a significant shortage in cement from the 7 sacks/cu yd called for in Table 7.04-4 of the 1976 Standard Specifications. We believe the only proper corrective measure would be to remove the existing overlay in the south half of spans 4 and 5, and the west 3/4 of span 6, and all of spans 7 and 8, in the north half only. This could then be replaced with acceptable latex modified concrete and the spalled joints at piers 4, 5, and the west abutment could be reformed.

We also believe the manufacturer of the mobile concrete mixers should be contacted to see if a more positive check on the cement flow in the continuous batching could be installed on their trucks. Apparently, the current cement meters will indicate proper cement flow even if it is partially blocked.

TESTING AND RESEARCH DIVISION

M G Brown

Supervisor - Materials Research Unit

MGB:bf

THIS COPY FOR

cc: K. A. Allemeier
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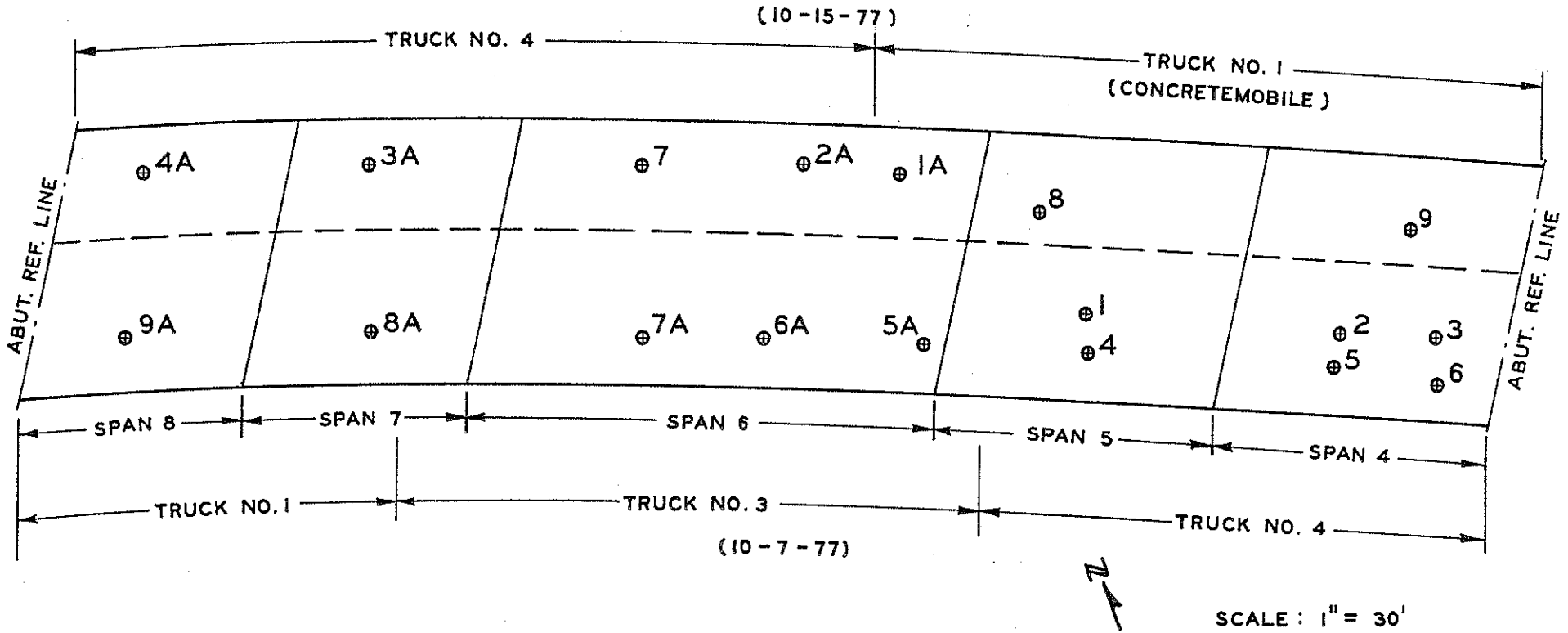
TABLE 1
LATEX OVERLAY CONCRETE TEST DATA
Wiard Rd Over US 12, S04 of 81063

	Core Number		Span No.	Thickness, in.	Shear Strength, psi	24-Hour Absorption, percent	Cement Content, sk/cu yd*	Cube Compressive Strength, psi
	Laboratory	Field						
Inside Lane Overlayed 10-7-77	78 CC-814	3	4	2.1	250	--	---	3,120
	817	6	4	2.4	260	--	3.9	2,370
	813	2	4	2.0	250	--	---	3,530
	816	5	4	2.0	340	--	---	2,810
	78 CC-812	1	5	1.5	380	--	---	2,330
	815	4	5	1.6	330	--	5.1	2,410
	78 CC-1121	5A	6	1.6	490	0.80	6.1	5,320
	1122	6A	6	1.9	330	1.04	6.7	2,610
	1123	7A	6	1.8	520	0.78	---	2,650
	78 CC-1124	8A	7	2.0	490	0.91	---	2,630
	1125	9A	8	2.0	380	0.66	6.8	2,400
Outside Lane Overlayed 10-15-77	78 CC-820	9	4	2.0	250	--	6.8	4,750
	819	8	5	2.0	330	--	7.0	4,690
	1117	1A	6	1.4	340	0.99	7.2	2,330
	78 CC-1118	2A	6	1.5	410	0.92	4.8	1,930
	818	7	6	1.5	340	--	---	2,780
	1119	3A	7	1.8	370	1.54	---	2,180
	78 CC-1120	4A	8	1.9	380	1.57	4.7	1,240

NOTE: Shear tests and cubic compression tests run on air dry specimens.

* Chemically determined



Location diagram for cores in latex concrete overlay and limits of concretemobile discharge areas, Wiard Rd over US 12 (S04 of 81063).