STUDY OF BONDING SIDEWALK AND PARAPET CONCRETE TO MODIFIED (WATER SOLUBLE) LINSEED OIL CURED BRIDGE DECK POURS

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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John P. Woodford, Director
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INTRODUCTION

This study was initiated by a letter to John P. Woodford, State Highway Director on October 15, 1973, from David A. Merchant, Division Engineer, Federal Highway Administration.

In his letter, Mr. Merchant asked that a possible problem that had been noted on several construction inspection trips be investigated. During the placement of the modified (water soluble) linseed oil intermediate curing on deck pours, some of the material gets placed on the areas that are to receive additional concrete at a later date. Namely, the raised medians, raised shoulders, sidewalks, and parapets. It was not known at that time what effect this material had on the bond between these surfaces. Mr. Merchant also outlined a proposed testing procedure to be considered by the Testing and Research Division.

On October 22, 1973, G. J. McCarthy, Deputy Director of Highways, sent a reply to Mr. Merchant which stated that the Department would perform the requested tests, but would use two types of finishes: a rough textured surface and a smoother surface.

TESTING PROGRAM

The bond strength, which is the subject of this report, was obtained by using 6-in. diameter cylinders instead of beams as suggested in Mr. Merchant's letter. These test specimens consisted of a 4-in. concrete cap cast on the appropriately finished surface of a 6-in. base. The bonding surface for both finishes consisted of three separate surface treatments: a plain surface having been moist cured; a surface having the modified linseed oil cure with the compound still in place; and a linseed oil cured surface with the linseed compound sandblasted off. In testing, the cylinders were clamped on their sides in a testing apparatus and loaded unitl the concrete cap sheared off. These cylinders were all tested when the concrete caps had reached the age of 14 days. No ASTM standard currently covers this shear bond test.

Table 1 shows the proportioning and fresh concrete measurements of the mixes for one cu yd of concrete. The cylinder bases were made from mix No. 1 and the caps from mix No. 2.

Test Specimen Preparation

The test specimens were made by cutting a 6 by 12-in. cylinder mold in half and then cutting a 4-in. ring off the remaining cylinder mold, to be used later when the caps were poured. A standard seven-sack bridge mix was used to cast the twelve 6 by 6-in. cylinders; the air content, slump, and concrete temperature were measured, and the concrete was vibrated into the mold by a 1-in. probe vibrator.

Six of the cylinders were finished with a wood float and six were finished with a broom texture; after finishing two cylinders of each finish were covered with wet rags and polyethylene. The remaining eight cylinders were sprayed with a white linseed oil curing compound that was certified to conform to ASTM Standard C-309 Type II and AASHO M-148. The curing compound was applied at a rate of 200 sq ft/gal. All 12 cylinders were cured for seven days with molds left in place.

After seven days, the linseed oil curing compound was sandblasted off two cylinders for each finish, and all cylinders were left to air dry for three days. The 4-in. ring mold was then taped to the cylinders, the surface moistened with water, and the caps were cast from mix No. 2. The cylinders were all covered with polyethylene and cured seven days with the molds still in place. After seven days the polyethylene was removed to let the cylinders air dry with the molds in place.

After seven days of air drying the cylinders were stripped one at a time and tested in single shear.

The shear strength values from Table 2 show that there was no evidence of any bond between the linseed oil curing compound and the cap that was sheared off. The other values show that an effective bond could be achieved by either removing the curing compound by sandblasting or by using a wet cure of a broomed or troweled finish.

CONCLUSIONS

The best bond strength in shear can be achieved by a wet cured finish. The best bond strength in shear where a linseed oil curing compound is used occurs when it is removed before additional concrete is placed. In practice, it probably would be simpler to cover areas which are to receive later pours with Burlene or polyethylene just prior to spraying the soluble linseed membrane. This would eliminate the need for sandblasting.

TABLE 1
CONCRETE COMPOSITIONS

Mix No.	Pour Date	Slump, in.	Entrained Air, percent	Mix Volume, cu ft	Concrete Temp., F	Mix Components, lb/cu yd						Net Water/ Cement Ratio	Total Water, lb/cu yd	Admixtures, fl oz/cu yd	
						Cement Weight	Fine Aggregate 2NS Sand		Coarse Aggregate		Net Mix Water			A-E MBUR Concrete	WR+R Pozzolith 100xR
							Oven Dry wt	Absorbed Water	Oven Dry wt	Absorbed Water					
1	3/11/74	3	7.7	1.75	71	658	1,030	8.5	1,947	22	240	0.365	270	7	28
2	3/21/74	3-1/2	7.4	1.25	71	658	1,030	8.5	1,947	22	240	0.365	270	7	28

TABLE 2
SHEAR STRENGTH VALUES, psi

Surface Treatment						
	Float Finish			Broom Finish		
Cylinder No.	Linseed Oil Compound	Linseed Oil Compound Sandblasted Off	Plain Moist Cured Surface	Linseed Oil Compound	Linseed Oil Compound Sandblasted Off	Plain Moist Cured Surface
1	0	315	250	0	245	555
2	0	285	290	0	175	465
Average psi	0	300	270	0	210	510