EFFECT OF GROOVED CONCRETE ON CURING EFFICIENCY

Introduction

The textured concrete surface on all PCC primary paving projects (and when specified on secondary projects) is required to be grooved in a specified manner. The laboratory test for determining the efficiency index of concrete curing compounds is made on slabs that are not grooved. This short investigation was undertaken to determine any changes in the curing efficiency index when using various rates of application of curing compound on grooved concrete. Currently a 95 percent curing efficiency index is specified at an application rate of 15 square yards per gallon. Can this efficiency be achieved, and if so at what application rate, on grooved concrete? Grooving the concrete greatly increases the surface area and also causes the liquid curing compound to run off the high spots and collect in the grooves.

Materials

The curing compound used in this investigation was a combination (mixture) of surplus 1982 test samples. The samples had all been tested and approved. They were all manufactured by W.R. Meadows Co. except the curing material used for laboratory numbers ADE 3 16-18 was manufactured by Dayton Superior.

The sand and cement used for the mortar slabs were from the current laboratory stock used for testing curing compounds.

Procedure

Curing slab specimens were proportioned, mixed, and molded as outlined in Test Method No. Iowa 901-B. Some experimenting was done to determine the optimum time for grooving the concrete slabs. Also the

method of applying the grooves, so that they would comply with the specifications, was determined by experimentation.

The final procedure that evolved was:

1. Standard slabs were made in ASTM curing pans.
2. The slab specimens were cured in room conditions until the surface water was gone.
3. The surface was then brushed lightly to remove the laitance and grooved with a tool used in the field to groove pavement surfaces.
4. Surface water returned after grooving. The slabs were cured in room conditions until this surface water was also gone.
5. The slabs were then sealed and coated per Iowa 901-B.

This procedure differs from Test Method No. Iowa 901-B which requires that the slabs be covered with a moisture proof cover, and a sheet of plastic film, and cured in the moist room for 5 hours. After the five (5) hour initial cure the surface water is removed with a soft cloth or towel, and the surface of the slab is brushed lightly to remove any laitance. Then the specimens are sealed and coated.

All other testing procedures and calculations were performed in the standard manner as explained in Test Method No. Iowa 901-B.

A total of 54 slabs were made and tested for efficiency index using various application rates of curing compound. The first 24 slabs were coated at 15, 12½ and 10 square yards per gallon. The final 30 slabs were coated at 15, 10 and 7½ square yards per gallon.

Results

Early in the investigation it was apparent that when the curing compound was applied to the grooved concrete, at the standard rate of 15 square yards per gallon, then the specified efficiency index of 95 percent

could not be achieved. However, the increased rates of application also failed to meet this requirement. Even at twice the standard application rate, no efficiency index reached the required 95 percent.

Copies of the test reports (attached) show that not a single one of the grooved concrete slabs could come up with the specified 95 percent efficiency index, regardless of the application rate. In some cases the heavier application rates resulted in even lower efficiencies than the lighter applications.

Conclusions

1. A curing efficiency index of 95 percent on grooved concrete could not be reached in the Laboratory. It would seem reasonable to expect that we are not achieving this curing efficiency in the field either.
2. A heavier application rate to compensate for the increased surface area of the specimens did little to help the curing efficiency index.
3. Variations in test results on duplicate specimens would indicate that the degree of surface roughness, caused by the grooving of the individual specimens, has a bearing on curing efficiency.
4. The standard test procedure (on smooth concrete surfaces) is so sensitive that a few pin holes in the curing material will cause the material to fail. On the rough surface of a grooved slab, the test results would indicate that the liquid curing compound runs off the higher areas and concentrates in the grooves, perhaps leaving areas insufficiently covered to effect a thorough cure.
5. Increasing the viscosity of the curing material to prevent the run-off condition would undoubtedly cause spraying problems.

6. It has been suggested that a second application to follow the first by 30-60 minutes, forming a layered system, might be more effective. This has not been tried in the Laboratory, but it will be at the first opportunity.
7. If no curing problems are experienced in the field, then perhaps a curing efficiency less than 95 percent is acceptable. However, hairline shrinkage cracks, generally associated with inadequate curing, are difficult to detect on the roughened surface of grooved concrete.
8. Test Method No Iowa 901-B continues to be an excellent procedure for determining the relative merits of different brands or lots of curing compounds. The efficiency index is also a measure of the cure that can be expected in the field. Efforts should continue to achieve the best possible curing of grooved concrete paving.