Project Summary

Texas Department of Transportation

5-4385-01: Pilot Implementation of Bump Detection Profilers for CRCP Construction

Background

During project 0-4385, a sliding profiler device was developed that, when attached to a concrete paver, could be used by the finishers for aid in determining the location of bumps on fresh concrete. Contractors could then fix the defects while the concrete is still fresh and pliable. The results of the device on this project for estimating profile and bump detection on wet concrete appeared promising. Consequently, it was recommended that a pilot implementation of the device be conducted. The primary purpose of project 5-4385-01 was to construct three easy-to-operate production units which did not require the use of an external PC or other remote operations and to use these units on several construction projects.

What the Researchers Did

In this project, the sliding profiler concept developed in project 0-4385 was implemented. In the summer of 2005 work began on building a unit from findings and recommendations of project 0-4385. In addition to the hardware, real-time software with a bump detection procedure was developed.

The sliding profiler was first taken to a construction project in December of 2005, on SH 360, northwest of the Dallas/Fort Worth airport. During the tests, the marker mechanism for detecting bumps was found to be too heavy for the wet pavement. The unit was redesigned and used on paving projects on Loop 375 in El Paso in February and along US 380 in Decatur in March of 2006. The unit was attached to a work bridge and pulled along on fresh concrete. Bumps were noted and recorded at both sites. Researchers later ran the walking profiler on the target sections, obtaining reference data to compare with the sliding profiler test results. In both cases measurements identified bumps in the dry concrete detected by the sliding profiler. At both sites, however, it was noted that several false bumps, caused by jerking of the manually pushed work bridge, occurred. Additionally, during the tests in El Paso it was noted that when the device was used after the finishers, slight markings were left on the pavement that were not covered by the tinning and curing process. As a result, a snowboard version was constructed and tested both at Decatur and on a project in Austin. This version had reduced path markings and was used on the next project in Grand Prairie.

The last tests were made on a construction project on SH 161 in Grand Prairie in August of 2006 using the new snowboard version. For these runs, the sliding profiler was attached to a motorized work bridge in hopes there would be less jerking action. Fewer false bumps were noted because of jerking of the work bridge.

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Additionally, there was less marking left from the profiler. For this run, a bump was detected by the sliding profiler, and the finishers went back to rework the area of the bump. However, the bump was still detected when rerun. Later during the month, the walking profiler was brought to the site and the same bump was noted.

Three sliding profiler devices including hardware for attachments and an instruction manual were delivered to the Texas Department of Transportation (TxDOT) for more testing and use.

After the project ended, following a wrap-up meeting, a procedure for minimizing jerk was developed and was shown to reduce the number of false bumps due to jerking when pulled by the work bridge.

What They Found

During this project, researchers found that the sliding profiler located bumps in the wet concrete. It was necessary to make a number of improvements to the profiler carriage in order for the unit to float on the wet concrete with minimal markings. The device was easy to use and indicated bumps detected by a flashing light as the device was pulled along the wet pavement behind the paver. The system had problems with false bump detection, caused by jerking of the sliding profiler device when used with a work bridge and manually pushed. A procedure for minimizing jerk has been developed but was not implemented in the three versions delivered to TxDOT. False bumps were not noticed when processing data when the device was attached directly to the paver.

What This Means

With proper implementation of research results, the sliding profiler device when attached to a concrete paver could be used by the finishers for aid in determining the location of bumps on fresh concrete. Contractors could then fix the defects while the concrete is still fresh and pliable. This device could thus potentially eliminate the need to use grinding operations in many cases to improve ride quality of CRCP pavements, thereby reducing contractor cost.

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