For Increased Pavement Durability

Paver Vibrator Monitors

Iowa Department of Transportation

HR – 1068

Evaluation of Paver Vibrator Frequency Monitoring and Concrete Consolidation

DTFH-71-97-PTP-IA-47

Priority Technology Program

Purpose of Monitor

The paver vibrator monitor can display the frequency of each individual vibrator on a paver. These real time readings can be used to accurately adjust or set the frequency of any of the vibrators, instead of using indirect, inaccurate, hydraulic control dial settings. The new models are capable of using a PCMCIA memory card or a serial port connection to a laptop computer to record each of the vibrator frequency readings corresponding to a location on the completed pavement. A monitor alarm can be set to activate if the frequency range deviates from the specified frequency range, eliminating occurrences of over and under vibration.

Improved Performance

The greatest benefit derived from consistently monitored vibration is more durable pavement. The air content and consistency of the mix can be kept more uniform throughout the slab.

Paver Operators:

Vibrator monitors using the direct digital readout allow the paver operator, for the first time, to regulate the frequency of each of the vibrators thus providing consistent vibration across the slab. The old method of controlling the frequency through a bank of numbered dials and hydraulic valves did not assure uniform frequencies across all vibrators and did not provide any visual readout.

Quality Control/Quality Assurance (QC/QA):

These monitors lead directly into the QC/QA concept. The monitors give the contractors quality control, and the highway agencies a way to monitor quality assurance during paving.

Innovations at Work

The vibrator monitors were evaluated through a FHWA Priority Technology Program (PTP) project. The PTP project goal was to test accuracy, reliability, and field durability of the vibrator monitoring system. A companion project, PCA 97-01, "Evaluation of Vibrator Performance vs. Concrete Consolidation and Air Matrix", was conducted on the same pavement sections used for the PTP project. This companion project received funds from the Portland Cement Association (PCA) to study the vibrator impact on concrete consolidation. The final report for the PTP project, HR – 1068 was completed in September 1999 and the final report for the PCA project, 97-01, was completed in July 2000.

Iowa DOT – Working for You

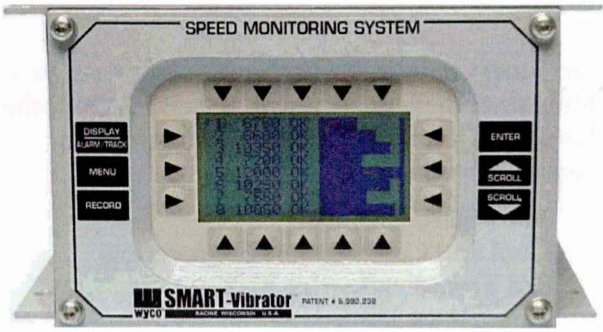
The Iowa DOT has instituted a specification for the use of paver vibrator monitors (available upon request). This specification requires the use of the vibrator monitoring device on paving machines being used for mainline paving projects, over 50,000 yds^2, starting with three projects let in 1999.

Research Results

The paver vibrator monitors are durable, reliable, require little maintenance, and are more accurate and reliable when compared to other manual monitoring devices. The paver vibrator monitors also ensure consistent vibration over the course of the day, identify vibrator wear and other maintenance problems, provide real-time feedback to the contractor, and, in the event of problems with the hardened concrete, provide documentation to verify vibration.

Field Observations:

In the PTP project, it was shown that not only are the paver vibrator monitors easy to read and readily accessible for observation and adjustment, they are also operator friendly and require less than 30 minutes instruction. Less than three hours were required to mount the monitor and substitute six research vibrators.



Partners

Iowa DOT, FHWA, ISU, PCA, ICPA, The WYCO Tool Company, Minnich Manufacturing, Fred Carlson Company, Inc., and Manatt's, Inc.

Future Research Needs?

As a result of the research conducted for the PTP project and its companion project, the need for future research was addressed. The research team has suggested studies be conducted analyzing the relationship between the air matrix of the hardened concrete and the vibrator variables (spacing, depth of vibrator tip, angle of vibrator from the horizontal, and radius of influence of the vibrator). Additional studies that were suggested by the research team include the following: (1) analysis of the relationship between the air matrix and the tamper bar operations (width of tamper bar, depth of movement relative to strikeoff bar, and rate of tamping); (2) as well as the relationship between the grout box operations (depth of grout in box, depth of vibrator vs. depth of grout, disposition of materials at various levels in grout box to the slab depth, and density of the materials at various levels in the box) and the air matrix of the hardened concrete.

For More Information

Dr. James Cable, ISU, was the principal investigator for both of these projects with Robert Steffes as the Iowa DOT contact. For additional information contact either Jim or Bob at:

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