

Intelligent Asphalt Compaction Analyzer (IACA)

Highways for LIFE Technology Partnerships 2008 Award \$200,000



U.S. Department of Transportation
Federal Highway Administration

HIGHWAYS FOR LIFE
Accelerating Innovation for the American Driving Experience

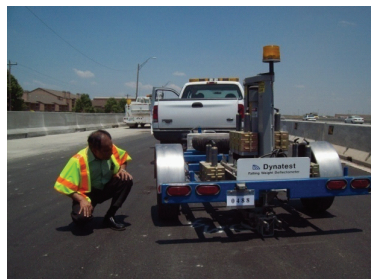
Project Status

Ten prototype units were developed for installation on vibratory compactors, and the technology was validated during the construction of both full-depth and overlays of asphalt pavements. The performance of the IACA during the construction of the HMA pavement was evaluated by independent users at sites across the country during 2009-2010.

FWD Testing

Test Site : I-35 Norman, Oklahoma

- Subgrade: 200 mm @ 10% cement kiln dust (CKD)
- Aggregate Base: 200 mm
- Asphalt Layers: Two 100-mm asphalt layers
- S3 PG 64- 22 OK and 3rd lift of 75-mm S3 PG 76-28 OK



Verifying the seating and location of the test site.

Contact Information

FHWA, Highways for Life
Technology Partnerships Program
Julie Zirlin, 202-366-9105
www.fhwa.dot.gov/hfl

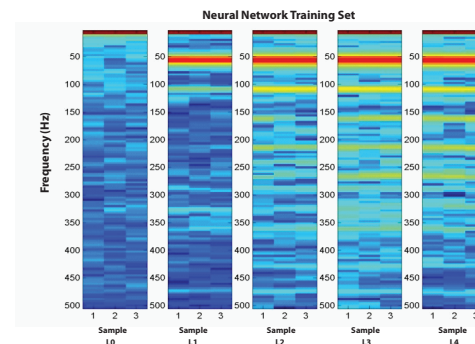
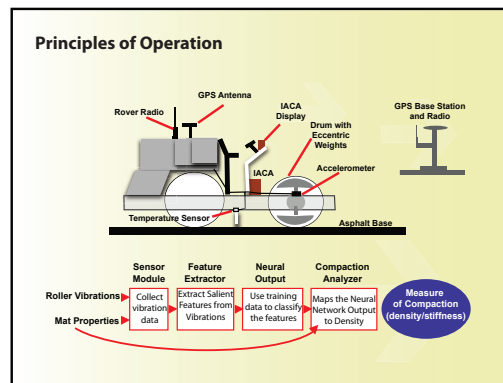
Haskell Lemon Construction Company
www.haskelllemon.com
Technical Contact: Sesh Commuri,
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Need for Innovation

Proper compaction of newly applied asphalt helps ensure a crack-free paved surface and longer lasting roadway. But if compaction levels do not meet the design requirements it can result in early degradation of the pavement. Currently, compaction is verified by testing core samples extracted from the hardened asphalt. Low compaction will result in either reduced payment or no payment for the sections. The Intelligent Asphalt Compaction Analyzer (IACA) is a device mounted to vibratory compactors to provide real-time data so compaction inconsistencies can be remedied while asphalt is still pliable. Replacing the time-consuming manual process will reduce construction time and make pavements last longer.

Project Overview

The IACA is a device based on an artificial neural network technology that can estimate the density of an asphalt pavement continuously in real-time during its construction. Early field trials demonstrated that, after calibration, the accuracy of the IACA is comparable to a nuclear density gauge or a non-nuclear density gauge. Haskell Lemon Construction Company and the University of Oklahoma refined the technology, developed commercial prototypes, and conducted extensive field testing. Recent enhancements extend the ability of the IACA to estimate the stiffness of the pavement layer during its construction.



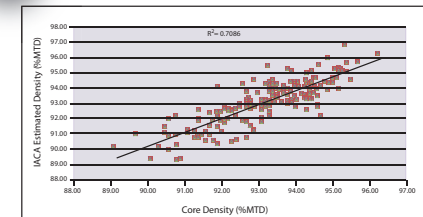
Changes in the compaction are displayed left to right based on the number of passes.



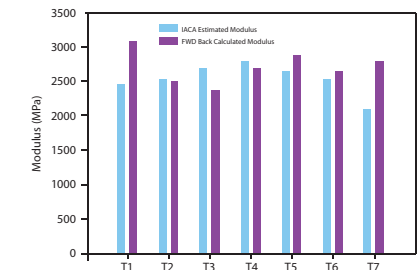
The IACA estimates the density of asphalt pavement in real time so workers can detect and fix compaction problems during the paving process, saving time and money. The components consist of a GPS receiver (not shown, but mounted on the roof of the compactor) and an embedded computer/display which mounts on the vibratory compactor.



Results



Comparison of IACA estimated Density with Density of roadway cores at 180 test locations (MTD - Maximum Theoretical Density)



Comparison of IACA estimated modulus with the modulus back calculated from FWD test measurements at 7 random test locations on I-35

Conclusions

The results obtained during field compaction agree with FWD measurements from the completed pavement. Empirical calculations of the modulus in the laboratory provide significantly higher values of the modulus and are not suited for quality control during compaction. On the other hand, the IACA can estimate the modulus in real-time during the compaction process and can be used to ensure uniform compaction of the asphalt pavement.

The final report and a video is available at <http://www.fhwa.dot.gov/hfl/partnerships/haskell.cfm>.

Project Team

Haskell Lemon Construction Company
University of Oklahoma
Volvo Construction Equipment