

New Technologies

Measuring Pavement Deflection at 55 MPH: The Rolling Wheel Deflectometer

Prioritizing needs and targeting scarce highway funds are critical issues for highway officials. Highway engineers have many valuable tools to assess surface deterioration and overall condition of pavements in their transportation network. One of the newest tools is the Rolling Wheel Deflectometer (RWD). It is primarily designed to measure the structural capacity and stiffness of asphalt pavements at the network level.

After years of testing, the Federal Highway Administration has developed the first prototype device for measuring pavement deflection data continuously *at speeds matching the pace of traffic*. The new device, called the Rolling Wheel Deflectometer (RWD), can measure deflections over hundreds of miles in a given day and provide a “structural map” of an entire highway network quickly and accurately. The RWD is designed to be a network-level screening device.

“Technology is finally catching up with what our highway engineers need to know about the structural integrity of the whole network,” says Associate Administrator King W. Gee, head of FHWA’s Office of Infrastructure. “The information we gain from the rolling wheel deflectometer will enable users to determine the remaining life of our highway pavements. It is hoped that it will then translate into proactive programming and strategic management of one of our Nation’s greatest investments, our highway transportation infrastructure.”

How the RWD works....

The RWD consists of four laser measuring devices mounted on a specially designed aluminum beam on a custom semitrailer chassis. Using sophisticated computer technology, the lasers accurately measure pavement elevations before and during loading. The semitrailer is designed to apply an 18,000 pound static load over the rear axle. Typical operation of the RWD provides a reading every one-half inch at 55 mph. These readings are then averaged to provide a mean deflection for a section of roadway, typically 100 feet or longer.

As with all deflection testing on asphalt pavement, the best results are obtained when the road surface is dry and warm, and the subgrade is not frozen. The presence of rainwater on the road adversely affects the accuracy of the readings and operation on wet pavement is not recommended.

Test results from the RWD corresponds well with the non-destructive techniques developed in recent years for determining asphalt pavement strength, known as the “deflection response” of a pavement as it is loaded by a heavy truck wheel. The current method to model this behavior uses a Falling Weight Deflectometer (FWD) that drops a heavy weight on the pavement from a stationary position and measures the resulting deflections. In contrast, the RWD *is a heavy moving truck* and collects deflection response data on a real-time basis.

The Rolling Wheel Deflectometer is one of the most significant innovations for managing highway pavements by measuring structural capacity at highways speeds.





Testing and Verification...

Extensive "Proof of Concept" testing of the RWD was successfully completed in Illinois during 2002. The first network level testing of the RWD prototype was completed in July, 2003 on a variety of highways in Texas. The device easily collected deflection data on over 300 miles of roadway at speeds up to 55 mph in just a few days. By comparison, testing with stationary devices on these same routes would have required several weeks of testing and could only provide test data at discrete points, usually at 50 to 500 foot intervals.

Both tests incorporated carefully controlled comparisons with stationary devices. These included industry-standard FWD tests, electronic deflection-measuring instruments mounted in the pavement, and a slow-speed measuring device developed by the University of Texas. Data was collected from the RWD on multiple passes over the instrumented test sections at selected speeds between 30 and 60 mph. Detailed analysis of the data is ongoing but the preliminary results show promising comparisons between the devices.



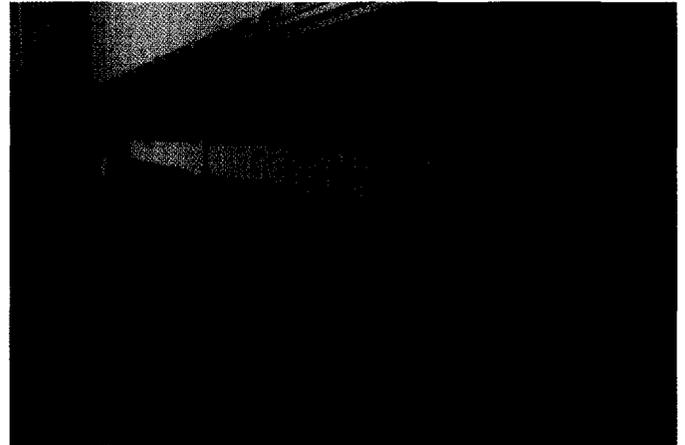
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What's Next?

"Our transportation community must continue to research and develop better solutions that will lessen congestion and enhance mobility and safety on the Nation's surface transportation system", says FHWA Administrator Mary E. Peters. "We support technologies and tools that use public investments wisely".

The RWD has great potential to help transportation agencies make more informed decisions about pavement rehabilitation and replacement. For the first time, agencies can assemble reliable structural information about pavements over a whole highway network at a reasonable cost and target projects to those segments that need structural improvement and rehabilitation.

FHWA plans to conduct a series of Test and Evaluations (T&E) of this technology around the United States in the following months. These T&E will provide State Highway Agencies opportunities to examine the equipment and data as well as evaluate the usefulness of network level pavement deflection data.



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