

## TransTech Systems' Pavement Quality Indicator™ (PQI)

Density of hot mix asphalt is the most important construction variable in the durability of asphalt pavement surfaces. All current methods of measuring asphalt pavement density have major limitations. Destructive core samples and laboratory measurement are time consuming and costly. Useful information does not reach the paving crew in time to make any corrections to the paving process. The alternative, nuclear densitometers, currently the "gold standard" in the industry, are cumbersome to use, require strict licensing and usage procedures, take several minutes to get data, and have limitations in their accuracy. Further, the time required by nuclear devices to obtain useful density data limits their in-process, Quality Control (QC) effectiveness during pavement construction.

**TransTech Systems' important innovation** is the development of an alternative, electrical-impedance based Pavement Quality Indicator (PQI) for use as a QC tool during the paving process. For their efforts, TransTech has recently been issued a second patent on the device. The **reason this device is innovative** is that through the use of its constant voltage, low frequency, electrical impedance approach, the PQI is able to make instantaneous, in-situ measurements of pavement density. This approach is based on a novel toroidal electrical sensing field that is established in the material to be measured via a flat sensing plate. This density, or compaction level, is measured by the response of the PQI's electrical sensing field to changes in electrical impedance of the material matrix, which in turn is a function of the composite dielectric constant of the paving material and the air trapped in the voids of the material. Since the dielectric constant of air is much lower than that of the paving material, as compaction increases, the combined dielectric constant increases because the percentage of air in the mix decreases. The embedded computer allows the PQI to perform sophisticated calibration and correction functions and enables the device to store a number of readings for later retrieval and analysis.

The **importance of this innovation** is that relative density measurements can now be taken instantly, allowing necessary changes to the rolling pattern may be made immediately. It also makes it possible to take many more readings per hour on the job site, both of which help ensure the best possible pavement quality. Recent improvements provided the ability to compensate for surface water. The device is light-weight, easy to use and requires no special licensing. Thus, almost any member of the paving crew can operate it successfully.

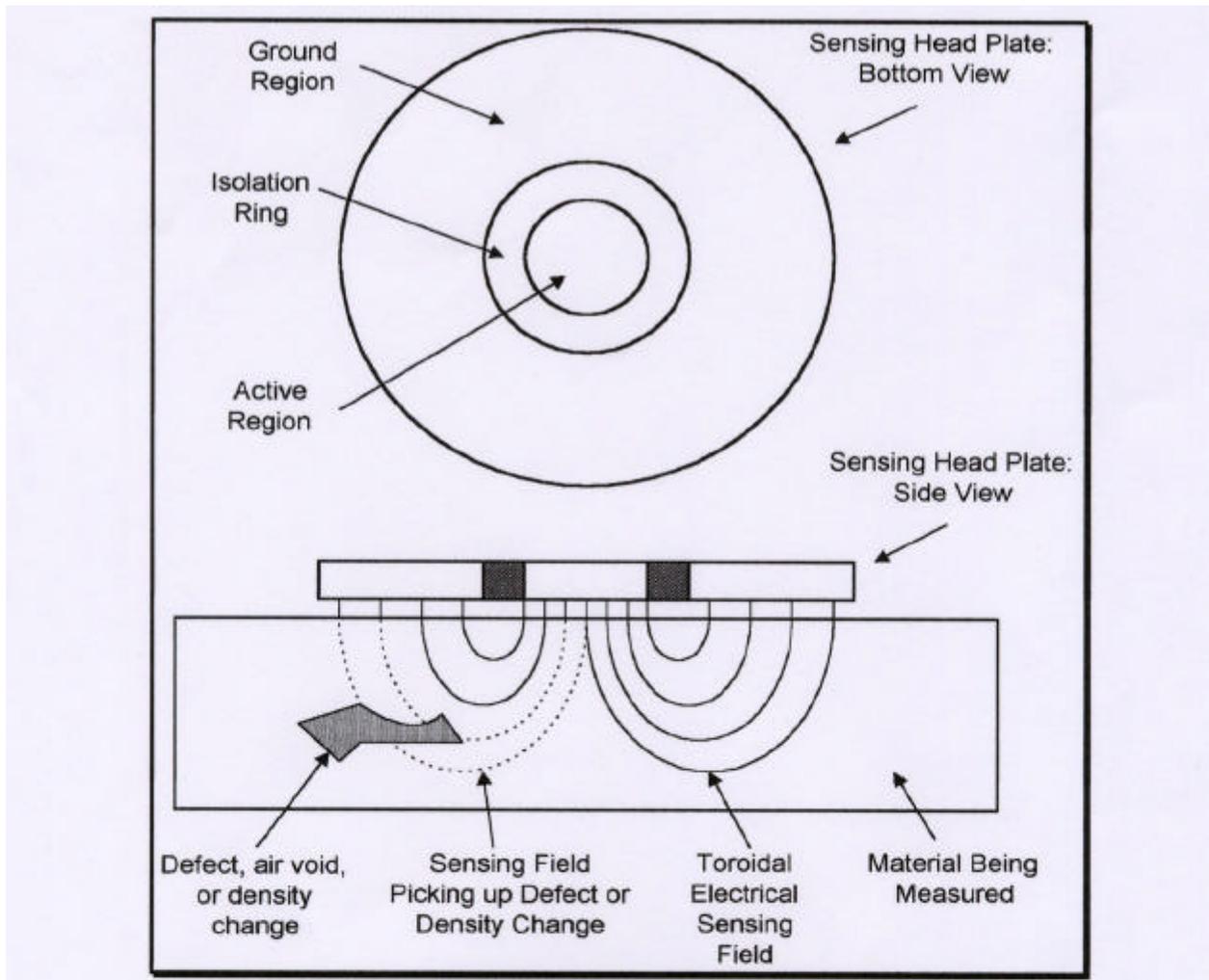
A highly successful FHWA Five State Pooled Fund Study concluded that the use of the PQI for providing QC during paving is a perfectly acceptable method and provides results at least as good as the nuclear devices in widespread use today. This has positioned the PQI as the ideal rapid measurement, non-destructive device for determining asphalt pavement density on the market today.

TransTech Systems, Inc. began the **initial phase of work on the PQI** in 1995 at its original Latham, NY facility, under the New York State Energy Research and Development Authority Agreement 4354ERTER-TR96. TransTech achieved outstanding results during the six-year project, and has benefited from support from the FHWA and AASHTO, delivered through the NCHRP under the IDEA Program administered by the TRB, under the auspices of the National Academy of Sciences. In addition, the USACE, through WES, was a key supporter and has provided funding as well as critical technical guidance. The Rensselaer Polytechnic Institute faculty provided substantial technical in areas such as statistics, software development, materials studies and mathematical algorithms.

Currently, the PQI is a commercial product with approximately 400 units sold. It has been accepted internationally as well as domestically, and is now being used in more than 10 countries worldwide.

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### TransTech Systems' Pavement Quality Indicator™ (PQI)



**Pavement Quality Indicator™ Operational Theory Schematic**



**The PQI Model 301**



**The PQI Model 301 in Use**