



U.S. Department  
of Transportation

**Federal Highway  
Administration**

Transportation Pooled Fund Program

# Intelligent Compaction Field Demonstration

## Introduction



The intelligent compaction (IC) field demonstration is a major part of the FHWA pooled fund research project effort, "Accelerated Implementation of Intelligent Compaction Technology for Embankment Subgrade Soils, Aggregate Base, and Asphalt Pavement Materials." This project is part of the blueprint for the FHWA IC strategic plan, and was initiated under Transportation Pooled Fund (TPF) Solicitation No. 954. The pooled fund includes 12 participating state departments of transportation (DOTs), including: Georgia, Indiana, Kansas, Maryland, Minnesota, Mississippi, North Dakota, New York, Pennsylvania, Texas, Virginia and Wisconsin (additional States may be included upon approval by the FHWA). The goals of this project are to:

- Accelerate the development of IC QC/QA specifications for subgrade soils, aggregate bases, and HMA pavement materials. The focus of the technology will be to provide a reliable method to capture the maximum potential value added from current IC technology and currently used/available QC/QA field-testing equipment (dynamic cone, FWD, plate load tests, nuclear density, moisture, temperature, cores, etc.).
- Develop an experienced and knowledgeable IC expertise base within the participating state DOTs.
- Identify and prioritize needed improvements and research for IC equipment and QC/QA field-testing equipment. Prioritization will be based on the potential for: simplifying IC usage, achieving greater IC value (cost benefit), and improved accuracy.

## What are the IC roller requirements?

The rollers included in these demonstrations need to be equipped with an in-situ measurement system and feedback control, global position system (GPS) based mapping, and software that automates documentation of the results. However, consideration of alternatives may be allowed on a case-by case basis.



## TechBrief

The Transportation Pooled Fund (TPF) Program allows federal, state, and local agencies and other organizations to combine resources to support transportation research studies.

See the following website for details:

[http:// www.pooledfund.org](http://www.pooledfund.org)

This study, "Accelerated Implementation of Intelligent Compaction Technology for Embankment Subgrade Soils, Aggregate Base and Asphalt Pavement Material" is being conducted under TPF-5(128). It is a three year study beginning September 2007 and ending September 2010.

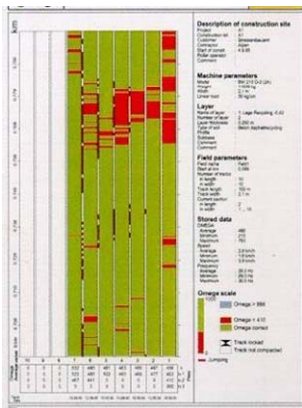
See the following website for details:

[http://  
www.pooledfund.org/  
projectdetails.asp?  
id=954&status=1](http://www.pooledfund.org/projectdetails.asp?id=954&status=1)

of IC technology objectively.



*Courtesy of Bomag*



*Bomag system*

## What are the test site requirements?

Depending on the needs of participating DOTs, the IC field demonstrations will cover one or more of the following material types:

- Type I—Granular, non-cohesive subgrade soils
- Type II—Fine grain, cohesive subgrade soils
- Type III—Aggregate base material
- Type IV—Asphalt pavement material
- Type V—Stabilized base material

Each IC demonstration project will conform to the following:

- Compaction of selected pavement materials (Type I through Type V), accomplished with an IC roller on a portion of a construction project;
- Compaction of a minimum of two test sections between 500 and 1,000 ft in length and two traffic lanes in width, using IC rollers; and
- Incorporation of a quality control (QC) program at the IC test sections which includes both traditional compaction specification testing and any additional testing outlined in the testing protocol for IC.

There will be two IC test sections with two adjacent control sections (compacted using conventional rollers) for some of the field sites in order to evaluate the benefits

## How many test sites are planned?

One field demonstration is planned for each TPF participating state DOT. Additional sites may be included upon approval from FHWA. This will result in a minimum of 13 demonstration sites spread throughout the project period (September 2007 to September 2010). Ideally, these field demonstrations will include 6 sites for soil/aggregate compaction and 6 to 7 sites for asphalt compaction.

## What data will be collected?

There are two types of data to be collected:

- **IC roller measurement values (MV):** Depending on the roller type and model, spatial roller MVs and associated GPS data will be collected along with detailed data such as

in-situ calibration, operating speed, operating frequency/amplitude, reporting resolution, etc.

- **Other independent data:** This will include detailed description of the compacted material,

layer thickness, laboratory test data, and other in-situ measurements of properties of compacted materials, such as density, modulus, moisture, temperature, etc.

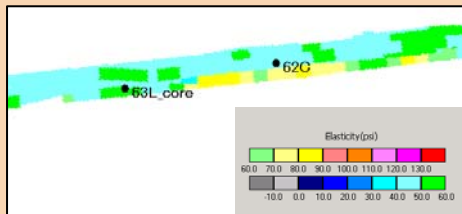
## What elements will be included in the reports?

Data analysis from the field demonstrations will seek to answer the following questions:

- Is the density (or modulus) and/or the variability of density (or modulus) improved when IC technology is used as compared to conventional compaction technology (average density/modulus and its variability)?
- Is the efficiency of the compaction operation improved when IC technology is used as compared to conventional compaction technology (fewer roller passes, decreased time of compaction, etc.)?
- Do the IC equipment response parameters that are measured or calculated from the roller instrumentation compare to measurements of the same properties using stand-alone pavement testing equipment?

Standardized reports will be produced for all IC demonstration projects. The elements of a standardized report will include test date, site location, material types, demonstration objectives, testing protocols, summary of data collected, discussion of findings, comments (including answers to the above three questions), follow-up actions, conclusions, and recommendations.

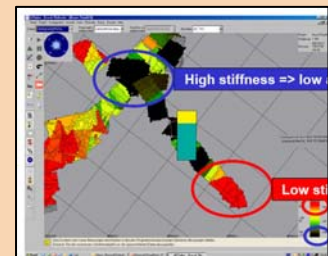
The purpose of these IC field demonstrations and related supplemental testing is to gather the data necessary to gain the knowledge needed to develop viable and productive IC specifications for future projects.



*Sakai system*



*Caterpillar system*



*Ammann/Case system*

## What are the procedures for field demonstrations?

The following are primary steps required for a field demonstration project:

1. Site selection (location, dates, materials to be compacted, review by the project team),
2. Invitation for roller vendors participation,
3. Change order for the construction contract (if necessary),
4. Field demonstration (pre-demo briefing, DOT staff training, field compaction and data collection),
5. Data analysis and reporting, and
6. Follow-up activities (e.g., performance data collected in the future).

The project team will work closely with TPF participant states and roller vendors throughout each of these steps. A separate document is provided for a detailed experimental plan.

## Who benefits from this study?

- \* **Pavement Designers** who can use the knowledge gained from this project to improve pavement designs to minimize both initial and life-cycle costs,
- \* **QC/QA Personnel** who will be able to use IC data to increase the amount of available information related to the quality of construction and possibly reduce the amount of conventional testing,
- \* **Contractors** who can optimize their construction operations to better achieve the compaction specifications,
- \* **Materials Suppliers** who can integrate the results from this study into their materials selection and proportioning procedures, and
- \* **Specification Developers** who determine what variables should be controlled to optimize construction quality and long-term performance, thus minimizing life-cycle costs.

## Benefits of Intelligent Compaction

- \* **Improve density...**  
**better performance**
- \* **Improve efficiency...**  
**cost savings**
- \* **Increase information...**  
**better QC/QA**



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Key Words — compaction, intelligent compaction, roller, soils, subgrade, aggregate, embankment, stabilized base, asphalt, HMA, pavement performance, quality control, quality assurance.

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