



Iowa Department of Transportation

SPECIAL PROVISIONS FOR INTELLIGENT COMPACTION-HMA

Harrison County
NHSN-030-1(127)--2R-43

Effective Date
January 20, 2010

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

In addition to the requirements of Section 2303 of the Standard Specifications, the following shall apply:

090048.01 Description

This specification describes the Contractor's responsibilities for furnishing Intelligent Compaction (IC) equipped rollers, data acquisition, training, roller verification/repeatability testing, and transmitting data to the Engineer. IC for HMA is defined as the gathering of data from self-propelled vibratory roller systems involved with the measurement and recording of roller position, date/time, speed, vibration frequency, vibration amplitude, surface temperature, pass count, travel direction, and a compaction measurement value (MV). Real Time Kinematic (RTK) based Global Positioning System (GPS) with base station corrections shall be used for determining the position of the roller. Results from the IC shall be displayed to the roller operator on a color coded computer screen in real-time during roller operations and the data saved for transfer and viewing by the Engineer.

Quality acceptance for IC-HMA will be based on cores according to Section 2303 of the Standard Specifications. The IC results will be used as a guide to supplement core sampling for research purposes. Secure a maximum of three additional cores per lot collected concurrently with acceptance cores based on viewing roller pass coverage, surface temperature during compaction operations, and IC compaction MVs. The Engineer will determine the location for the additional cores.

Submit to the Engineer an IC Work Plan at least two weeks prior to the Preconstruction Conference. Describe in the work plan the following:

- Compaction equipment to be used including:
 - Vendor
 - Roller model,
 - Roller dimensions and weights,
 - Description of IC measurement system,

- GPS capabilities,
- Documentation system,
- Temperature measurement system, and
- Software.
- Roller data collection methods including sampling rates and intervals and data file types.
- Transfer of data to the Engineer including method, timing, and personnel responsible. Data transfer shall occur at minimum once per day or as directed by the Engineer.
- Training plan and schedule for roller operators, Engineer's personnel, and Iowa State University's research personnel; including both classroom and field training.
- Communication protocol for informing the Iowa State University research team point of contact concerning construction progress and schedule to facilitate research field testing and data collection.

090048.02 Equipment and Materials

A. Rollers

Comply with Article 2001.05 of the Standard Specifications for self-propelled vibratory rollers. Article 2001.05 applies to all rollers used in the breakdown position. Breakdown roller is defined as the roller(s) making the initial contact with the HMA.

Ensure that IC equipment can measure roller position, date/time, speed, vibration frequency, vibration amplitude, surface temperature, pass count, travel direction, and a compaction measurement value (MV). Provide a computer screen in the roller cab for viewing measured results. Ensure that results are stored for transfer to the Engineer for viewing on a laptop computer. Provide the Engineer and Iowa State University each with a copy of the IC roller vendor software for viewing results. Ensure that results are displayed as color coded spatial maps based on GPS coordinates.

B. Data Collection, Export, and Onboard Display

Provide and export the following data in a comma, colon, or space delimited ASCII file format:

- 1) Machine Model, Type, and Serial/Machine Number
- 2) Roller Drum Dimensions (Width and Diameter)
- 3) Roller and Drum Weights
- 4) File Name
- 5) Date Stamp
- 6) Time Stamp
- 7) RTK based GPS measurements showing Northing, Easting, and Elevation
- 8) Roller Travel Direction (e.g., forward or reverse)
- 9) Roller Speed
- 10) Vibration Setting (i.e., On or Off)
- 11) Vibration Amplitude
- 12) Vibration Frequency
- 13) Surface Temperature
- 14) Compaction Measurement Value

Ensure that the roller's onboard display will furnish color-coded GPS based mapping showing number of roller passes, surface temperature, vibration frequency, vibration amplitude, and the MV on a computer screen in the roller operators cab. Provide displayed results to the Engineer for review upon request.

C. Local GPS Base Station

Provide a real time kinematic global positioning system (RTK GPS) to acquire northing, easting, and elevation data used in mapping of IC measurements. Ensure the system has the capability to collect data in an established project coordinate system. Furnish a local GPS base station used for broadcasting differential correction data to the rollers with a tolerance less than 0.1 ft in the vertical and horizontal.

D. Training**1. Preconstruction (classroom)**

Make available all personnel responsible for roller operations to attend a one-day classroom training on IC. Training will be provided by Iowa State University research personnel and scheduling coordinated by the Engineer. Classroom training will involve both the Contractor's and Engineer's personnel.

2. Field (prior to and during compaction operations)

Provide two working days of field training by the IC equipment manufacturer to roller operators and Engineer's personnel.

E. Geotechnical Mobile Lab Parking

Provide the Engineer an all weather access, parking for the Iowa State University Geotechnical Mobile lab trailer (8 feet by 44 feet), and parking for 3 vehicles at the HMA plant site or agreed upon alternative location. The lab trailer will be furnished and operated by Iowa State University which will be under contract with the Contracting Authority to perform IC-HMA research.

090048.03 Construction**A. Roller Verification/Repeatability Testing**

Construct periodic test strips under controlled roller operations for evaluating IC roller measurement errors. Coordinate with the Engineer and Iowa State University research personnel at least one day in advance of testing for IC roller repeatability evaluation. Test strip construction will require four to six roller passes on a 200 feet long strip of intermediate course by one roller width area under controlled roller operating conditions (i.e., constant speed, vibration amplitude, and frequency). The IC measurements obtained in the same area for several repeated passes will be used to assess the measurements errors. The results will be used for research purposes to validate the manufacturer claims for the IC measurement reliability. It is anticipated that repeatability test strips will be identified during the course of the project. The test strip areas can be designed within the production compaction areas.

B. Roller Operations

Operate the IC roller according to manufacturer's recommendations to provide reliable and repeatable measurements. Keep vibration frequency and amplitude constant during roller operations for comparing successive passes. Changes in frequency and amplitude influence MVs. Permitted variation in vibration frequency is ± 125 vibrations per minute. Maintain rolling speed to provide a minimum of 10 impacts per linear foot and within ± 0.5 miles per hour during measurement passes. Speed fluctuations influence the MVs and are not permitted outside this range during measurement passes. Record IC-HMA roller operations forward and reverse directions. It is anticipated that MVs will be affected by rolling direction and therefore the output data fields shall indicate rolling direction. Check and recalibrate, if necessary, IC equipment at the beginning of each workday.

C. Equipment Breakdowns

In the event of IC roller breakdowns/IC system malfunctions/GPS problems, the Contractor may operate with conventional rolling operations, but IC data shall be collected and provided for a minimum 80% of the project surface and intermediate HMA quantity.

D. Data submittal

Furnish to the Engineer an electronic file in ASCII file format with information listed under Article SP-090048.02, B. As a minimum the file transfer shall occur immediately following the final compaction operations on each working day. The Engineer may request data any time during compaction operations.

090048.04 Method of Measurement

None. Lump sum item.

090048.05 Basis of Payment

- A. Payment for Intelligent Compaction-HMA will be the lump sum contract price.
- B. Payment is full compensation for all work associated with providing IC equipped rollers, transmission of electronic data files, two copies of IC roller manufacturer software, training, and preparing and maintaining work space for Iowa State University's IC trailer and associated parking.
- C. Delays due to GPS satellite reception of signals to operate the IC equipment or IC roller breakdowns will not be considered justification for contract modifications or contract extensions.