

District Of Columbia Department of Transportation (DDOT)

**SPECIAL PROVISIONS
FOR
INTELLIGENT COMPACTION-HMA**

**Effective Date
Sep. 10, 2014**

THE STANDARD SPECIFICATIONS, SERIES 2013, ARE AMENDED BY THE FOLLOWING ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SUPPLEMENT THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

In addition to the requirements of the Specifications for HMA, the following shall apply:

DESCRIPTION.

- A.** 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 an intelligent compaction measurement value (ICMV). High Precision Positioning System (HPPS) with assistance of base station for corrections shall be used for determining the position of the roller. Results from the IC shall be displayed to the roller operator as color-coded maps on an onboard computer screen in real-time during roller operations and the data submitted to the Engineer in a required format and information under ARTICLE C (data requirements).
- B.** Quality acceptance for IC-HMA will be per the Special Provisions for Plant Aging of Flexible Paving Mixture.
- C.** Submit to the Engineer an IC Work Plan at least 4 weeks prior to the Preconstruction Conference. Describe in the work plan the following:
 - 1.** Compaction equipment to be used including:
 - Vendor
 - Roller model,
 - Roller dimensions and weights,
 - Description of IC measurement system,
 - HPPS system to be used with the device accuracy,
 - Documentation system,
 - Measures to be taken in the field to avoid loss positioning signal,

- Temperature measurement system
 - Software.
2. Roller data collection methods including sampling rates and intervals and data file types.
 3. 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.
 4. Training plan and schedule for roller operators, Engineer's personnel, and DDOT QA/QC and Asset Management personnel, including both classroom and field training.
 5. Communication protocol for informing DDOT team point of contact concerning construction progress and schedule to facilitate research field testing and data collection.

EQUIPMENT.

A. IC Roller - The IC roller(s) shall meet the following specific requirements:

1. IC rollers shall be self-propelled double-drum vibratory rollers equipped with accelerometers mounted in or about the drum to measure the interactions between the rollers and compacted materials in order to evaluate the applied compaction effort. IC rollers shall also be equipped with non-contact temperature sensors for measuring pavement surface temperatures.
2. The output from the roller is designated as the Intelligent Compaction Measurement Value (IC-MV) which represents the stiffness of the materials based on the vibration of the roller drums and the resulting response from the underlying materials.
3. When using GPS as the HPPS system the radio and receiver units shall be mounted on each IC roller to monitor the drum locations and track the number of passes of the rollers.
4. The IC rollers shall include an integrated on-board documentation system that is capable of displaying real-time color-coded maps of IC measurement values including the stiffness response values, location of the roller, number of roller passes, pavement surface temperatures, roller speeds, vibration frequencies and amplitudes of roller drums.
5. The display unit shall be capable of transferring the data by means of a USB port.
6. An on-board printer capable of printing the identity of the roller, the date of measurements, construction area being mapped, percentage of the construction area mapped, target IC-MV, and areas not meeting the IC-MV target values. (Printer option to be selected by the DOT)

B. High Precision Positioning System (HPPS).

The Contractor shall provide a HPPS that meets the following requirements. The goal of HPPS requirements is to achieve accurate and consistent measurements among all devices on the same project. When using GPS, conversions of GPS data need to be minimized to avoid errors introduced during the process.

C. Data Requirements.

Provide IC data in a Veda-compatible format. As a minimum, the following Essential IC Data Information and IC Data Elements shall be available for post processing.

- Essential IC Data Header Information for Each Data File or Section:

Item No.	Description
1	Section Title
2	Machine Manufacture
3	Machine Type
4	Machine Model
5	Drum Width (m)
6	Drum Diameter (m)
7	Machine Weight (metric ton)
8	Name index of intelligent compaction measurement values (IC-MV)
9	Unit index for IC-MV
10	Reporting resolution for independent IC-MVs – 90 degrees to the roller moving direction (mm)
11	Reporting resolution for independent IC-MVs – in the roller moving direction (mm)
12	UTM Zone
13	Offset to UTC (hrs)
14	Number of IC data points

- Essential IC Data Elements for Each Data Point:

Item No.	Date Field Name	Example of Data
1	Date Stamp (YYYYMMDD)	e.g. 20080701
2	Time Stamp (HHMMSS.SS -military format)	e.g. 090504.00 (9 hr 5 min. 4.00 s.)
3	Longitude (decimal degrees)	e.g. 94.85920403
4	Latitude (decimal degrees)	e.g. 45.22777335
5	Easting (m)	e.g. 354048.300
6	Northing (m)	e.g. 5009934.900
7	Height (m)	e.g. 339.9450
8	Roller pass number	e.g. 2
9	Direction index	e.g., 1 forward, 2 reverse
10	Roller speed (kph)	e.g. 4.0
11	Vibration on	e.g., 1 for yes, 2 for no
12	Frequency (vpm)	e.g. 3500.0
13	Amplitude (mm)	e.g. 0.6
14	Surface temperature (°C) -	e.g. 120
15	Intelligent compaction measurement values	e.g. 20.0

Items 3 and 4 can be exclusive with items 5 and 6, and vice versa. Item 14 is only required for asphalt application. The size of data mesh after post-processing shall be less than 18 inches (450 mm) by 18 inches (450 mm) in the X and Y directions.

D. Local GPS Base Station when using RTK-GPS.

Provide a real time kinematic global positioning system (RTK-GPS) to acquire position measurements in longitude/latitude and/or northing/easting 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 correction data to the rollers.

An acceptable alternative to the RTK-GPS will be a GPS system with Correction Service Subscription (CSS). CSS is a service that can be subscribed to receive VRS signals in order to achieve higher accuracy GPS positioning normally via cellular wireless data services; i.e., without the need for a ground-based base station. Examples of GPS Correction Service subscriptions are: Trimble VRSTM, Trimble VRS NOWTM, and Omni STAR.

For any of the above options, GPS validation shall be performed prior to the construction. The tolerance for GPS validation between the IC roller measurement and hand-held rover shall be with less than ±12 inches in the northing and easting directions.

CONSTRUCTION REQUIREMENTS

1. Install and operate equipment in accordance with the manufacturer's specifications.
2. Verify the temperature sensor(s) and HPPS is working within the requirements of this Special Provision when requested by the Engineer.
3. Contact the Department immediately when system failure occurs. Daily percent coverage will be considered zero when the repairs are not completed within two (2) working days of System Failure. The start of this two (2) working day period begins the next working day after System Failure.
4. All locations reading non-ambient temperatures will be used in the analysis.

Technical Assistance. The Contractor shall coordinate for on-site technical assistance from the IC roller representatives during the initial seven (7) days of production and then as needed during the remaining operations. As a minimum, the roller representative shall be present during the initial setup and verification testing of the IC roller(s). The roller representative shall also assist the Contractor with data management using the data analysis software including IC data input and processing.

On-Site Training

The Contractor shall coordinate and provide for on-site training for Contractors and Agency project personnel related to operation of the IC technology. Contractor's personnel shall include the paving superintendent, QC technician(s), and roller operator(s). Agency's personnel shall include the project engineer and field inspector(s). *(This can be expanded based on agency needs)* Arrangements shall be provided that includes an enclosed facility with electrical availability and a projector for presentations and should be 4-8 hours in duration.

Minimum training topics shall include:

1. Background information for the specific IC system(s) to be used
2. Setup and checks for IC system(s), HPPA system, including base-station and hand held rovers, if used
3. Operation of the IC system(s) on the roller; i.e., setup data collection, start/stop of data recording, and on-board display options
4. Transferring raw IC data from the rollers(s); i.e., via USB connections
5. Operation of vendor's software to open and view raw IC data files and exporting all-passes and proofing data files in Veda-compatible format
6. Coverage and uniformity requirements

A. Equipment Breakdowns.

Contact the Department immediately when System Failure occurs. Daily Percent Coverage will be considered zero when the repairs are not completed before the next paving operation starts.

B. Data submittal.

Furnish to the Engineer an electronic file in the format with information listed under Article C (data requirements). 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.

METHOD OF MEASUREMENT.

A. BASIS OF PAYMENT

The Contract lump sum prices for the Instrumented Roller(s) include all costs related to providing the IC

roller(s) including the fuel, roller operator, GPS system, or any other equipment required for the IC process. All quality control procedures including IC rollers and GPS systems representatives support, on-site training and testing facility shall be included in the contract lump sum price in this Special Provision.

Interruptions of satellite reception of signals to operate this system will not result in any adjustment to the "Basis of Payment" for any construction items or to Contract time. The Department will pay for the Instrumented Roller(s) on the basis of the following schedule:

PARTIAL PAYMENTS

The lump sum will be paid in partial payment amounts for completion of the work per the following table

Payment Schedule		
Item	Criteria	% of Lump Sum Paid
A	Certification of the IC Supervisor(s), Onsite IC Support and Operators of the Instrumented Rollers	10% payment
B	Instrumented Roller(s) Approved for Use	10% payment
C	Measurement Pass Completion	
	Project Percent Coverage (PPC) ≥ 80%	80% payment
	Project Percent Coverage (PPC) < 80%	% Payment = 0.8xPPC+24

Project Percent Coverage (PPC) — the percent of required daily compaction area, for the project, where the minimum required cumulative measurement pass count is achieved. (AASHTO PP 81-14)