1. SCOPE

1.1 This test method covers the determination of international roughness index (IRI) using an inertial profiler. Procedures are also included for locating individual bumps or depressions in the pavement surface.

1.2 This method does not address any of the safety concerns regarding operating an inertial profiler, working in a construction area, or working near live traffic. The user of this method is responsible for knowing and following all applicable regulatory limitations, as well as developing appropriate safety and health procedures prior to use.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standard:
PP 43 Quantifying Roadway Roughness Using an Inertial Road Profiler with Laser Height Sensors

2.2 ASTM Standards:
E 867 Terminology Relating to Vehicle-Pavement Systems
E 950 Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference
E 1364 Measuring Road Roughness by Static Level Method
E 1926 Computing International Roughness Index of Roads from Longitudinal Profile Measurements

2.3 NCHRP Report:
228 Calibration of Response-type Road Roughness Measuring Systems, 1980

2.4 NYSDOT Materials Method:
24.1 Inertial Profiler Calibration and Verification

3. DEFINITIONS

3.1 International Roughness Index (IRI) - An index computed from a longitudinal profile measurement reported in m/km. IRI is a mathematical calculation of the vertical movement of a car’s cabin as the car travels over a specific path. All vertical movement is accumulated and divided by the distance traveled. For this test method IRI is computed according to the quarter-car model.

3.2 Measurement - A single determination of IRI along the reference line for the entire length of a single PRQ lot in the direction of traffic.

3.3 Quarter-car Model - A mathematical model of one wheel (one quarter) of a car of a standard weight with a standard tire, standard spring rate and standard damping.
3.4 Reference Line - The imaginary line that the noncontact height sensor traces along the pavement surface. The closer repeat tests are taken to the same reference line, the less variability will occur between the results.

4. SIGNIFICANCE AND USE

4.1 This test method allows for the measuring of relative elevations at known distances along a path of travel with a self powered vehicle for the purpose of calculating the pavement’s profile and calculating the IRI of that profile.
4.2 This test method is primarily intended for collecting quality control or quality assurance data during pavement construction.
4.3 This test method may be used for collecting data for pavement management purposes or to aid in the design of pavement rehabilitation treatments.

5. EQUIPMENT

5.1 Inertial Profilers must meet the equipment requirements given in the specification for which the data is being collected.
5.1.1 If there is no applicable specification requirements the following apply:
5.1.1 A self-powered test vehicle conforming to ASTM E950 Class I and AASHTO PP43 containing an automated recording system capable of providing the following information to the on-board display, onboard data storage device, and on-board printer.
• The date, time, contract number, route, location, test direction, lane and operator for each test.
• The equipment parameters related to calibration.
• A general profile, using a scale of 1:300 horizontal and 1:1 vertical.
• The average IRI and range for the specified wheelpath for each PRQ lot.
• Location and height of any defects exceeding the specified limit. If no limit is specified, report the location and height of any defect exceeding 6 mm over a length of 5 m.
• A simulated profile for each PRQ lot that contains a defect requiring repair.
5.2 Set the high-pass filter to 90 m for all measurements.
5.3 Set the low-pass filter to 0.15 m for all measurements.

6. WEATHER LIMITATIONS

6.1 Collect data only when the temperature and weather conditions are within the operating range recommended by the equipment manufacturer.
6.2 Data collection is not permitted during precipitation.
6.3 Data collection is not permitted when standing water is present on the pavement.
6.4 Care should be taken when collecting data under windy conditions. Variances in the reference line between repeat measurements can reduce test repeatability.

7. PROCEDURE

7.1 Startup
7.1.1 Perform all startup procedures required by the equipment manufacturer.
7.1.2 Perform all required calibration procedures according to Materials Method 24.1.
7.1.3 Enter all applicable location information and direction of measurement.
7.1.4 Verify that date and time displayed by equipment are correct.
7.1.5 Clear the reference line of loose material and debris.

Note: At least 45.75 m of data must be collected ahead of the area under test to minimize error through data filtering.
7.1.6 Position the data collection initiation indicator at least 45.75 m before the start of the test location, and record the distance from the indicator to the start of the test location to the nearest 0.01 m.

7.2 Data Collection
7.2.1 Start the data collection system.
7.2.2 After the data collection system indicates testing can begin, accelerate toward the test location at a constant rate of acceleration such that testing speed is reached prior to initiating data collection.
7.2.3 Initiate data collection when the profiler reaches the data collection initiation indicator (manually or automatically).
7.2.4 Maintain a constant speed throughout data collection.
7.2.5 During data collection keep the height measurement sensor as close as possible to directly over the intended line of reference.
7.2.6 Terminate the data collection at the end of the test section (manually or automatically).

7.3 Data Processing.
7.3.1 Review the data for reasonableness and make any necessary notations.
7.3.2 Calculate the IRI for the measurement. If multiple consecutive measurements were made in the same pass, calculate the IRI for each measurement.

8. REPORTING RESULTS

8.1 Printout directly from the inertial profiler of IRI for each measurement
8.2 Soft copy of all profile data in .ERD format.

NOTE: Information on .ERD files is available through the Materials Bureau.

8.3 A list that indicates which location and measurement(s) is represented by each .ERD file.

NOTE: Multiple sequential measurements (adjacent PRQ lots) may be included in a single .ERD file so long as sufficient information is provided to identify which measurements are included in the file.

9. Precision and Bias

9.1 Precision and Bias are determined during equipment verification according to Materials Method 24.1.
9.2 ASTM E950 contains an extensive discussion of precision and bias.