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# **Standard Specification for File Format of Intelligent Construction Data**

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**AASHTO Designation: MP 39-19<sup>1</sup>**

**Technical Subcommittee: 5c, Quality Assurance  
and Environmental**

**Release: Group 1 (April)**



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## 1. SCOPE

- 1.1. This specification describes a tagged file storage format used for geo-referenced intelligent construction data. The type of data includes, but is not limited to, intelligent compaction data and paver-mounted thermal profiling data.
- 1.2. This specification is designed to be independent of hardware platforms, computer languages, and operating system (OS).

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## 2. REFERENCED STANDARDS

- 2.1. *AASHTO Standards:*
  - PP 80, Continuous Thermal Profile of Asphalt Mixture Construction
  - PP 81, Intelligent Compaction Technology for Embankment and Asphalt Pavement Applications
- 2.2. *IEEE Standard:*
  - IEEE 754–2008, Floating-Point Arithmetic
- 2.3. *Websites:*
  - EPSG Geodetic Parameter Dataset: <http://www.epsg.org>
  - ESRI projected coordinate systems:  
<http://desktop.arcgis.com/en/arcmap/latest/map/projections/what-are-map-projections.htm>
  - Example time resolution for programming languages and applications on the Wikipedia website:  
[https://en.wikipedia.org/wiki/System\\_time#Programming\\_languages\\_and\\_applications](https://en.wikipedia.org/wiki/System_time#Programming_languages_and_applications)
  - International Intelligent Construction Technologies Group website: [www.IICTG.org](http://www.IICTG.org)
  - Intelligent compaction website: [www.IntelligentCompaction.com](http://www.IntelligentCompaction.com)
  - PROJ.4 projection parameters: <http://proj4.org/usage/projections.html>
  - The Unified Code for Units of Measure - UCUM: <http://unitsofmeasure.org/trac>

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## 3. TERMINOLOGY

- 3.1. *Definitions:*

- 3.1.1. *array (numeric data type)*—Sequence of data of the specified numeric data type.
- 3.1.2. *array (string)*—Each element is stored as UTF-8 text and is preceded by length stored as an Int16.
- 3.1.3. *ASCII*—Method of encoding basic English printable characters and symbols.
- 3.1.4. *byte*—Data type for an 8-bit, unsigned integer.
- 3.1.5. *double*—Data type for a 64-bit, signed real number, e.g. double precision IEEE floating point.
- 3.1.6. *Int16*—Data type for a 16-bit, signed integer.
- 3.1.7. *Int32*—Data type for a 32-bit, signed integer.
- 3.1.8. *Int64*—Data type for a 64-bit, signed integer.
- 3.1.9. *lookup table (LUT)*—Array of numeric items, where each item is associated with a number or string value. A lookup table is typically used to conserve space or reduce computation time.
- 3.1.10. *signed*—Capable of representing negative and non-negative values.
- 3.1.11. *single*—Data type for a 32-bit, signed real number, e.g. single precision IEEE floating point.
- 3.1.12. *string*—Data type for variable-length text. The string is not terminated and must be preceded by the number of bytes used to represent the string, stored as an Int16. All strings are encoded using ASCII, except for data values, which are encoded using UTF-8.
- 3.1.13. *Unicode*—A set of characters capable of representing almost any writable character.
- 3.1.14. *unsigned*—Capable of representing only non-negative values.
- 3.1.15. *UTF-8*—Method of encoding Unicode. The first 128 characters encoded the same as ASCII.
- 3.1.16. *Veta*—A standardized intelligent construction data management (ICDM) software that stores, maps, and analyzes intelligent compaction and associated geospatial data (e.g., thermal profile data, spot test data). This software can perform standardized data processing, analysis, and reporting to provide project summary results quickly in the field from various IC manufacturers. The software can provide statistics, histograms, correlations for the IC measurements (e.g., speed, temperature, pass count, Intelligent Compaction Measurement Value (ICMV)), and document coverage area; and it can evaluate the uniformity of compaction as part of the project quality control operations. Veta can be downloaded from the [www.IntelligentCompaction.com](http://www.IntelligentCompaction.com) website to validate data files written based on this standard.

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## 4. DATA SPECIFICATION

- 4.1. Data value are stored in binary format for maximum performance, minimum file size, and protection against casual modification. The metadata or data descriptions are stored in text format for ease of parsing and understanding.
- 4.2. *Byte Order:*
  - 4.2.1. All values that require more than one byte must be stored in Little Endian format with the least significant byte (LSB) first and the most significant byte (MSB) last.