ITS STANDARDS: A BRIEF STROLL THROUGH THE DIFFERENT DOCUMENT TYPES

ITS standards are developed and published by standards development organizations (SDOs) that use different terms to describe and delineate their standards documents. The purpose of this paper is to describe the document types that are collectively known as "Intelligent Transportation Systems (ITS) Standards." The source of information for this document includes individual SDO manuals or Internet homepages.

Some standards documents are of the type that includes mandatory requirements while others are less restrictive and include recommended or optional specifications. The different types of documents and terminologies may, for those who are not familiar with standards and the standards development process, imply that some ITS standards are not "true" standards. Nevertheless, all of the ITS standards documents in some way determine the characteristics of ITS products and services. In this sense, and in the sense that these are approved consensus documents, they are all "standards."

Importance to State and Local Personnel

It is important to understand that different standards organizations use different terminology for their standards-related products. This report describes the differences among the various document types that all fall within the general category of "ITS Standards."

The information contained in this report is intended to clarify the usage and meaning of the different terminology used by standards developing organizations. This information should help those who either use or specify the use of ITS standards to differentiate among the types of standards and to specify the correct standard when procuring ITS equipment.

Importance to Manufacturers and Vendors

There are many types of standards for various types of ITS systems and applications. These systems and applications may include transportation management centers, traveler information systems, and electronic payment systems, to name a few. The many types of standards may seem disconcerting to those who are trying to suit their products to the specifications and requirements in ITS procurement proposals. Therefore, it is helpful to understand and distinguish among the many types of ITS standards documents.

Description of Document Types

To accelerate the development of ITS standards, the U.S. DOT ITS Standards Program supports the following SDOs in their various roles and responsibilities:

- American Association of State Highway and Transportation Officials (AASHTO)
- American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12
- American Society for Testing & Materials (ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)

- Institute of Transportation Engineers (ITE)
- National Electrical Manufacturers Association (NEMA)
- Society of Automotive Engineers (SAE)

Each SDO has its own categories or classifications of standards documents. The following are descriptions of the documents being developed as ITS standards. A summary list of the SDO document types is presented in the following table:

SDO Standards Document Types

SDO	***Standard Document Names***
AASHTO (NTCIP)	Protocol and Profile Standards Protocols Class Profiles Application Profiles Transport Profiles Subnet Profiles Data Standards Object Definitions Data Dictionaries Management Documents
ASTM	Standards Provisional Standards Classifications Guides Practices Specifications Terminology Test Methods
ANSI ASC X12	Draft Standards Draft Standards for Trial Use Technical Reports and Guidelines American National Standards
IEEE	Standards Recommended Practices Guides Trial-Use Documents
ITE	Informational Reports Recommended Practices Equipment Standards Software/Protocol Standards Proposed Standards Interim Standards
NEMA	Standards Suggested Standard for Future Development Authorized Engineering Information
SAE	Standards Recommended Practices Information Reports Draft Technical Standards

AASHTO

AASHTO is the lead SDO in the AASHTO/ITE/National Electrical Manufacturers Association (NEMA) partnership for the development and enhancement of the National Transportation Communications for ITS Protocol (NTCIP). The NTCIP family of standards is copyrighted and published by the three SDOs jointly. Each NTCIP joint standard publication should thus be considered a NEMA standard, an ITE software/protocol standard, and an AASHTO standard.

NTCIP standards documents can be categorized as follows:

- *Protocol and Profile Standards* documents define the data exchange mechanisms and procedures for NTCIP systems. There are two subcategories:

  Protocols: These documents form the basic requirements for NTCIP systems.

  Class Profiles: These are the early NTCIP documents that defined all seven layers of the International Organization for Standardization (ISO) open systems interconnection (OSI) communications stack. Experience indicated that these documents were too restrictive for the breadth of deployment situations in the industry; therefore, current efforts are focused on the development of the following profile documents:

  Application Profiles: Define how to apply various standards dealing with sessions, encoding, and general procedures for dealing with data. This includes combining simple network management protocol (SNMP) used for configuration and monitoring of network devices and simple transportation management framework (STMF).

  Transport Profiles: Define how to transport an application message from source to destination [e.g., transmission control protocol/ internet protocol (TCP/IP)].

  Subnet Profiles: Define how to set up a communications circuit (e.g., dial-up services).

- *Data Standards* documents define the data to be exchanged in NTCIP systems. There are two types:

  Object Definitions: Define those SNMP objects required to monitor and control a device.

  Data Dictionaries: Provide definitions for data entities, including metadata (descriptive information about data).

- *Management Documents* address management issues such as how to create standards and how to assign document numbers.

ANSI (ASC X12)

ANSI, although it does not itself develop standards, coordinates national standards for the United States. In 1979 an ANSI committee was chartered to develop standards to facilitate electronic data interchange (EDI) for business transactions. This committee, the Accredited Standards Committee (ASC) X12 is in the process of developing three or more ITS-related standards involving Commercial Vehicle Operations (CVO). Adopted ASC X12 standards are published once a year as an entire set of standards called a "release." Each release includes the following classes or types of standards documents:

- *Draft Standards:* Standards that have not been subjected to public review, but have been approved by the Committee;

- *Draft Standards for Trial Use:* Standards that are in the process of review but are implementable in their current form;

- *ASC X12 Technical Reports and Guidelines:* Documents that assist in the use and understanding of ASC X12 standards;

- *American National Standards:* Final versions of standards that have survived public review and have been elevated to this status by ANSI.

It should also be noted that revisions to standards documents are generated on a regular basis and are published as either "versions" or "releases." These documents include revisions and new draft standards that have been recently approved by the Committee.

ASTM

The definitions for ASTM standards are:

- *Standards:* Documents that have been developed and established within the consensus principles of the Society and that meet the approval requirements of ASTM procedures and regulations. The term "standard" serves in ASTM as a nominative adjective in the title of documents, such as test methods or specifications, to connote consensus and approval. The various types of standard documents are based on the need and usage as prescribed by the technical committees.

- *Provisional Standards:* Documents published for a limited time to meet a demand for more rapid issuance of specific documents, such as an emergency situation, regulatory requirements, or other special circumstances. They are not full consensus documents because they require subcommittee consensus only.

- *Classifications:* Systematic arrangements or divisions of materials, products, systems, or services into groups based on similar characteristics such as origin, composition, properties, or use.

- *Guides:* Compendiums of information or series of options that do not recommend a specific course of action. A guide increases the awareness of information and approaches in a given subject area.

- *Practices:* Definitive sets of instructions for performing one or more specific operations that does not produce a test result. Examples include, but are not limited to, application, assessment, cleaning, collection, decontamination, inspection, installation, preparation, sampling, screening, and training.

- *Specifications:* Precise statements of a set of requirements to be satisfied by a material, product, system or service that indicates the procedures for determining whether each of the requirements is satisfied.

- *Terminology:* Documents composed of terms, definitions of terms, descriptions of terms, nomenclature, and explanations of abbreviations, acronyms, and symbols.

- *Test Methods:* Definitive procedures that produce test results.

IEEE

IEEE standards are classified as:

- *Standards:* Documents with mandatory requirements. Mandatory requirements are generally characterized by use of the verb "shall."

- *Recommended practices:* Documents in which procedures and positions preferred by the IEEE are presented. Recommended practices normally use the word "should."

- *Guides:* Documents in which alternative approaches to good practice are suggested but no clear-cut recommendations are made.

- *Trial-Use documents:* Publications that are effective for not more than two years. They can be any of the categories of standards publications listed above.

IEEE standards include, but are not limited to the following:

- Lists of terms, definitions, or symbols, applicable to any field of science or technology within the scope of the IEEE.

- Expositions of scientific methods of measurement or tests of the parameters or performance of any device, apparatus, system, or phenomenon associated with the art, science, or technology of any field within the scope of the IEEE.

- Characteristics, performance, and safety requirements associated with devices, equipment, and systems, with engineering installations.

- Recommendations reflecting the current state-of-the-art in the application of engineering principles to any field of technology within the scope of the IEEE.

ITE

ITE reports and standards may take the following forms:

- *Informational Reports:* Publications containing information and data on actions or options for use relevant to particular transportation engineering procedures or equipment applications. The content of informational reports is based on the experiences of practicing transportation professionals and on research. Such reports are prepared for information purposes only and do not include ITE recommendations on the course of action or the preferred application of the data they contain.

- *Recommended Practices:* Publications which include recommendations for rules, conditions, methods, or requirements concerning procedures, performance, design, operations, systems, services, practices, or courses of actions for application to transportation engineering activities and functions. Recommended practices include appropriate information and data to support the recommendations. Recommended practices do not include canons of ethics or other rules of professional conduct.

- *Equipment Standards:* Equipment standards describe design, material, processing, safety aspects, or performance characteristics of equipment used for controlling, directing, or informing users of transportation facilities. They may include what is important about the equipment, testing procedures, and how to evaluate the test results in light of the equipment's intended use. The particular utility of an equipment standard is that it provides this complex information in a form useful to persons who may not be experts in the subject area.

- *Software/Protocol Standards:* These standards define software or communications protocols used in transportation facilities, systems, communications or equipment. They are usually applicable to advanced technologies, including intelligent transportation systems. These standards may include message sets, object definitions, data dictionaries, and other components of application software, operating systems, and communications protocols.

- *Proposed Standards:* These are published for the purpose of receiving comment on any or all portions of the proposed standard. A proposed standard does not replace an existing ITE standard or become a new ITE standard until it has been formally adopted.

- *Interim Standards:* ITE standards may be adopted as final or interim standards. An interim standard is a standard which will be reconsidered in less than five years, pending

completion of planned or ongoing research or testing, but for which there are compelling reasons to adopt with an interim designation at this time.

NEMA

While NEMA is not independently developing ITS Standards, it is an integral part of the development team for the NTCIP family of ITS Standards. In addition, all NTCIP standards will ultimately be published as NEMA standards, so it may be helpful to illustrate the three forms in which NEMA standard documents can exist:

- *Standards:* Define a product, process, or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operation, characteristics, performance, rating, testing and services.

- *Suggested Standards for Future Development:* Describes a standard which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to a future development.

- *Authorized Engineering Information:* Explanatory data and other engineering information of an informative character not falling within the classification of a NEMA *Standard* or *Suggested Standard for Future Development.*

SAE

All SAE standards documents are termed "technical reports" and are of the following types:

- *Standards:* These technical reports are documentation of broadly accepted engineering practices or specifications for a material, product, process, procedure, or test method.

- *Recommended Practices:* These reports are documentation of practice, procedure, and technology that are intended as guides to standard engineering practice. Their content may be of a more general nature, or they may present data that have not yet gained broad acceptance. Recommended practices emphasize the capabilities and limitations of the information they contain.

- *Information Reports:* These reports are compilations of engineering reference data or education material useful to the technical community. Information reports require only one level of consensus for approval and publication.

- *Draft Technical Standards:* A draft technical standards report is similar to other SAE technical reports except that consensus approval was not reached by the sponsoring council or division. The draft technical report may be superseded at any time by a technical report, which has consensus approval, or a revised draft technical report. Draft technical reports may be developed by a technical committee, which may adopt reports from an existing company, government, or international standard.