

Australian Standard™

**Transport information and control  
systems—Requirements for an ITS/TICS  
central Data Registry and ITS/TICS Data  
Dictionaries**



This Australian Standard was prepared by Committee IT-023, Transport Information and Control Systems. It was approved on behalf of the Council of Standards Australia on 14 May 2004.  
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Australian Standard™

**Transport information and control  
systems—Requirements for an ITS/TICS  
central Data Registry and ITS/TICS Data  
Dictionaries**

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## PREFACE

This Standard was prepared by the Standards Australia Committee IT-023, Transport Information and Control Systems.

This Standard is identical with, and has been reproduced from ISO 14817:2002, *Transport information and control systems—Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries*.

The objective of this Standard is to specify the framework, formats, and procedures used to define information exchanges within the Intelligent Transport System/Transport Information and Control Systems (ITS/TICS) sector. It defines the content of the ITS/TICS central Data Registry and Data Dictionaries, the registration process to enter data concepts into the Data Registry.

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| <i>Reference to International Standard</i> |                                                                                          | <i>Australian Standard</i> |                                                                                          |
|--------------------------------------------|------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------|
| ISO/IEC                                    |                                                                                          | AS/NZS                     |                                                                                          |
| 9834                                       | Information technology—Open Systems Interconnection                                      | 4153                       | Information technology—Open Systems Interconnection                                      |
| 9834-1                                     | Part 1: Procedures for the operation of OSI Registration Authorities: General procedures | 4153.1                     | Part 1: Procedures for the operation of OSI Registration Authorities: General procedures |
| ISO                                        |                                                                                          | AS ISO                     |                                                                                          |
| 1000                                       | SI Units and recommendations for use of their multiples and of certain other units       | 1000                       | The international systems of units (SI) and its application                              |

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## INTRODUCTION

### 0.1 Background

This International Standard has been developed by ISO/TC 204/WG 1, *Architecture*, in order to provide a framework for the documentation and registration of data that passes through system interfaces within the Intelligent Transport System / Transport Information and Control Systems (ITS/TICS) domain.

The International Standard is designed to maximize interoperability and facilitate information reuse.

This International Standard defines the registration process for ITS/TICS. It further defines the Data Dictionary and the Data Registry content and Data Registry management procedures.

#### Vision statement

This International Standard envisions common use and maximum interoperability of data within the ITS/TICS sector by the creation and maintenance of an ITS/TICS Data Registry, supported by interface and application specific ITS/TICS Data Dictionaries, created and maintained in a common and interoperable form, and to ensure the minimization of duplication by clear rules for data concept definition and Data Registry management.

#### Mission statement

The mission is to develop a standard to define the principles and concepts; scope; field of application; rules and procedures; definition and concept of operation for a central ITS/TICS Data Registry and ITS/TICS functional Data Dictionaries; and to make provision for the migration of data from ITS/TICS functional Data Dictionaries to the central Registry so as to maximize interoperability and minimize proliferation of similar (but inconsistently defined) data entries.

This International Standard defines the framework, formats, and procedures used to define information and information exchanges within the ITS/TICS sector. The standard is designed to be used by the ITS/TICS community at large, but should be of special interest to application developers, equipment providers, and Data Registry managers.

This International Standard specifies a set of meta attributes for ITS/TICS Data Dictionaries, as well as associated conventions and schemes, that enables the description, standardization and management of all exchanged ITS/TICS data. Through consistent use of these common structures and associated conventions and schemes, interchange of data and information among the various ITS/TICS functional subsystems via their specific application systems can be maximized. This International Standard also supports reuse of data elements and other data concepts across various ITS/TICS functional subsystems and their specific application systems

The Data Registry process defined within this International Standard is consistent with implementation(s) of the ISO ITS/TICS System Architecture defined in the ISO 14813 Standardization deliverables, particularly ISO 14813 Parts 2 and 3. This does not preclude the application of the Data Registry using alternative International, Regional or National System Architecture methodologies or techniques, indeed, a common Data Registry will ease migration and interoperability between such approaches.

The ITS/TICS data concepts that populate the ITS/TICS Data Registry may originate from a Computer-Aided Software Engineering (CASE) tool implementation of the ISO 14813 TICS Reference Architecture, from International Standards for ITS, from National implementations for ITS, or from the submission by relevant users. Data Dictionary entries are not limited to those generated by object oriented methodologies.

## 0.2 Document overview

This clause provides an overview of this International Standard. Clause 1 identifies the scope of this International Standard. Clause 2 identifies requirements for conformance to this International Standard. Clause 3 identifies references required for proper implementation of this International Standard. Clause 4 defines terms used in this International Standard and Clause 5 lists the abbreviations.

The requirements for the ITS/TICS central Data Registry and ITS/TICS Data Dictionaries begin in Clause 6 with an overview of the concept of operations for the ITS/TICS Data Registry and ITS/TICS Data Dictionaries. A framework describing the registration of different types of data concepts in the ITS/TICS Data Registry and the registration status levels are presented.

Clause 7 identifies the fundamental ITS/TICS data concepts while Clause 8 identifies the basic and administrative meta attributes used to document them. Clause 9 describes the naming conventions and name abbreviation conventions used. Clause 10 states the requirements for the data concepts and the meta attributes contained in the ITS/TICS Data Registry and ITS/TICS Data Dictionaries.

Clause 11 provides a reference model for national, regional and international relationships and summarizes internationalization aspects associated with national and regional requirements for the ITS/TICS Data Registry and Data Dictionary environment.

The annexes to this International Standard describe the specific details for implementing the requirements introduced in Clauses 6 through 11. Annex A details ITS/TICS functional operating procedures for registration and harmonization of data concepts. Annex B prescribes the detailed definitions and descriptions of the ITS/TICS Data Registry and Data Dictionary meta attributes. Annex C prescribes the meta attribute requirements for data concepts contained in the ITS/TICS Data Registry and ITS/TICS Data Dictionaries. Annex D specifies the naming and name abbreviation conventions and the process for converting ITS/TICS descriptive names to ASN.1 names. Annex E contains the rules for data representation in an information model, along with examples. Annex F describes the ASN.1 information object specification for an ITS/TICS data concept with examples.

The bibliography includes a list of documents related to this International Standard.

## AUSTRALIAN STANDARD

# Transport information and control systems — Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries

## 1 Scope

This International Standard specifies the framework, formats, and procedures used to define information exchanges within the Intelligent Transport System/Transport Information and Control Systems (ITS/TICS) sector. It defines the content of the ITS/TICS central Data Registry and Data Dictionaries, the registration process to enter data concepts into the Data Registry. Throughout the text, the Data Registry should be taken to mean the ITS/TICS central Data Registry.

Specifically, this International Standard specifies:

- framework used to identify and define all information exchanges;
- framework used to extend standardized information exchanges to support local customizations and combinations;
- information modelling method for defining ITS/TICS data concepts, when used;
- meta attributes used to describe, standardize and manage each of the data concepts defined within this framework;
- requirements used to record these definitions; and
- formal procedures used to register these definitions within the Data Registry.

The Data Registry described herein supports, and is designed to include, data concepts using alternative International, Regional or National System Architecture methodologies or techniques. A common Data Registry will ease migration and interoperability between such approaches.

## 2 Conformance

### 2.1 Conformance considerations

This International Standard prescribes a conceptual model, but not a physical implementation. Therefore, the meta model need not be physically implemented exactly as specified. However, it should be possible to map unambiguously to and from the implementation and the meta model.

Regional and National Data Registries/Dictionaries have the option of adopting data concept definitions from the ITS/TICS Data Registry/Dictionaries, but are not required to do so. However, in the case of exchanging information internationally in application programs, claiming conformance with this or other international Standards in ITS/TICS sector, it *is* a requirement to use only data concepts that have already been registered in the ITS/TICS Data Registry.

## 2.2 Strictly conforming implementations

A strictly conforming implementation shall be a strictly conforming metadata set.

A strictly conforming implementation:

- a) shall support all mandatory, optional and conditional data concept attributes (see Annex C);
- b) shall not use, test, access, or probe for any extensions to data concept attributes;
- c) shall not exceed limits nor minimum-maximum values specified by this International Standard; and
- d) shall not interpret nor allow the production of data concept attributes that are dependent on any unspecified, undefined, or implementation-defined behaviour.

## 2.3 Conforming implementations

A conforming implementation shall be a conforming metadata set.

A conforming implementation:

- a) shall support all mandatory, optional and conditional data concept attributes (see Annex C);
- b) as permitted by the implementation, may exceed use, test, access, or probe for extensions to data concept attributes;
- c) as permitted by the implementation, may exceed limits or minimum-maximum values specified by this International Standard; and
- d) may interpret or allow the production of data concept attributes that are dependent on implementation-defined behaviour.

## 3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8824-1:1998, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 8824-2:1998, *Information technology — Abstract Syntax Notation One (ASN.1): Information object specification*

ISO/IEC 9834-1:1993, *Information technology — Open Systems Interconnection — Procedures for the operation of OSI Registration Authorities: General procedures*

ISO 1000:1992, *SI Units and recommendations for use of their multiples and of certain other units*

ISO/IEC Directives, Part 1, 4<sup>th</sup> Edition, 2001

## 4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Definitions of Data Registry and Data Dictionary meta attributes are given in Annex B.

**4.1****association**

data concept; structural relationship

**4.2****classification scheme**

scheme for the arrangement or division of objects into groups by functional area

**4.3****data**

representations of static or dynamic objects in a formalized manner suitable for communication, interpretation, or processing by humans or by machines

**4.4****data concept**

any of a group of Data Dictionary structures defined in this International Standard (i.e. object class, property, value domain, data element concept, data element, data frame, message, interface dialogue, association) referring to abstractions or things in the natural world that can be identified with explicit boundaries and meaning and whose properties and behaviour all follow the same rules

**4.5****data concept instance**

individual occurrence of a data concept

**4.6****Data Dictionary****DD**

organized and constructed (electronic data base) compilation of descriptions of data concepts that provides a consistent means for documenting, storing and retrieving the syntactical form (i.e. representational form) and the meaning and connotation of each data concept

**4.7****data element**

data concept; some single unit of information of interest (such as a fact, proposition, observation, etc.) about some (entity) class of interest (e.g. a person, place, process, property, concept, association, state, event) considered to be indivisible in a particular context

**NOTE** A data element is represented by an object class, a property of the represented object class and a value domain.

**4.8****data element concept**

data concept; an expression of the inherent concept embodied in a data element without regard to the value domain(s) by which it can be physically represented

**NOTE** A data element concept is represented by an object class and a property of that object class.

**4.9****data frame**

data concept; grouping of data elements primarily for the purpose of referring to the group with a single name, and thereby efficiently reusing groups of data elements that commonly appear together (e.g. ASN.1 SEQUENCE, SEQUENCE OF, SET, SET OF or CHOICE) in a message specification

**NOTE** This data concept type may be used to specify groups of data elements for other purposes as well.

**4.10****data model**

description of the organization of data in a manner that reflects an information structure

**NOTE** See also information model.

**4.11****Data Registry****DR**

store of data, characterized in a consistent manner, as determined according to the provisions of this International Standard, used for a specific purpose (in this case ITS/TICS)

**NOTE** The data registration process provides a determination of the ITS Data Dictionary items accepted into the ITS/TICS Data Registry. The Data Registry contains not only data about data concepts in terms of their names and representational forms but also substantial data about the semantics or meaning associated with the data concepts. A Data Registry may contain data that assists information interchange and reuse, both from the perspective of human users and for machine-interpretation of data concepts. The Data Registry is comprised of items only from ITS/TICS Data Dictionaries, showing their source; however, not all ITS/TICS Data Dictionary items shall necessarily be submitted for inclusion, or accepted, into the Data Registry.

**4.12****data registrar**

organizational element or an individual appointed by ISO/TC 204 to undertake the day-to-day management of the Data Registry process

**4.13****data registration process**

process by which data is formally described and provided to an approved location in the Data Registry

**NOTE** This process is effected under the control of the ITS/TICS data registrar, in accordance with the requirements of this International Standard.

**4.14****data type**

classification of the collection of letters, digits, and/or symbols used to encode values of a data element based upon the operations that can be performed on the data element

**4.15****identifier**

means of designating or referring to a specific data concept instance

**4.16****generalization**

specialization/generalization relationship in which an object class of a specialized element (child) is substituted for a generalized element (parent)

**4.17****information model**

graphical representation that logically organizes various data concepts by depicting key relationships among the data concepts

**EXAMPLE** An information model might specify that a Vehicle may be described by a variety of properties, such as: Make, Model, Year, and Vehicle Identification Number. Likewise a Collision might be described by properties such as Time of Occurrence, Severity, and Number of Vehicles Involved. Finally, the model might depict that a Collision has a many-to-many relationship to a Vehicle.

**NOTE 1** Within the scope of this International Standard, information models are depicted using UML Class Diagrams.

**NOTE 2** This International Standard uses the term information model in order to reflect the fact that relationships give the data a context and thereby transforms data into information. Some groups use the term data model. See also data model.

**4.18****interface dialogue**

data concept; collection of all the temporal sequences of messages, including variants such as multiple responses, that are used to accomplish the services that the interface dialogue provides

**4.19****message**

data concept; grouping of data elements and/or data frames, as well as associated message metadata, that is used to convey a complete unit of information

**NOTE** For the purposes of this International Standard, a message is an abstract description; it is not a specific instance.

**4.20****message instance**

occurrence of a message containing the actual values for the data elements and, in some cases, data about the message

**4.21****meta**

word denoting a description that is one level of abstraction above the concept being described

**4.22****meta attribute**

any documenting characteristic of a data concept

**4.23****metadata**

data that defines and describes other data

**4.24****name**

indexical term used by humans as a means of identifying data elements and other data concepts

**4.25****object class**

data concept; construct used to represent any kind of object (also referred to as an entity) within a ITS/TICS information environment

**4.26****property**

data concept; documenting characteristic of an object class used to group and differentiate individual objects

**4.27****semantics**

meaning, including concept(s), associated with a given data concept

**4.28****syntax**

structure of expressions in a language and the rules governing the structure of a language

**4.29****value domain**

data concept; expression of a specific and explicit representation of some information about something of interest within the ITS/TICS domain

## 5 Symbols and abbreviated terms

|       |                                                   |
|-------|---------------------------------------------------|
| ASN.1 | Abstract Syntax Notation One                      |
| ANSI  | American National Standards Institute             |
| CASE  | Computer-Aided Software Engineering               |
| CCC   | (ITS/TICS Data Registry) Change Control Committee |

|       |                                                |
|-------|------------------------------------------------|
| DCI   | Data Concept Identifier                        |
| DD    | Data Dictionary                                |
| DR    | Data Registry                                  |
| ExCom | (ITS/TICS Data Registry) Executive Committee   |
| ID    | identification                                 |
| IEC   | International Electrotechnical Commission      |
| IOS   | Information Object Specification               |
| ISO   | International Organization for Standardization |
| ITS   | Intelligent Transport System(s)                |
| N/A   | not applicable                                 |
| OID   | object identifier                              |
| OSI   | Open System Interconnection                    |
| TC    | Technical Committee                            |
| TICS  | Transport Information and Control System(s)    |
| UML   | Unified Modeling Language                      |
| URL   | Uniform Resource Locator                       |

## 6 Concept of operation

### 6.1 Summary

The scope of ITS/TICS applications covers numerous ISO/TC 204 functional areas as well as national and regional ITS/TICS organizations, each having an established group of stakeholders. The international integration of ITS/TICS applications is one of the major development issues, so that data defined and gathered in one of these functional areas (e.g. traffic management, traveller information) can be applied in another. For this type of interoperability the definition of data that can persist across different functional areas must be standardized. The ITS/TICS Data Registry and ITS/TICS Data Dictionaries meet this requirement.

The ITS/TICS Data Registry/Data Dictionary system supports the harmonization of data concepts (e.g. data elements) from different stakeholder groups. The ITS/TICS stakeholder community is large and diverse as evidenced by the number of working groups within ISO/TC 204 and the number of national or regional ITS bodies participating. The definition of key data elements will arise from numerous sources. Moreover, different groups will have an interest in the definition of the same data concept, which could lead to the prospect of duplicate or similar definitions being developed.

The architecture of the ITS/TICS Data Registry and ITS/TICS Data Dictionaries is based on the specification of ISO/TC 204 working group (functional area) Data Dictionaries that support the data definition process of ISO/TC 204 working groups, as well as national or regional ITS Data Dictionaries that document their data definitions. In addition, the central ITS/TICS Data Registry supports standardization and harmonization processes that facilitate the different working groups and national or regional authorities to share data element definitions and avoid duplication.

The complete ITS/TICS distributed system will be very large, both in geographic extent and in the number and diversity of the application areas, inevitably leading to the independent development of sub-systems. In this context, a second major purpose of the ITS/TICS Data Dictionaries and the ITS/TICS Data Registry is to document and register information at interfaces. This process provides the main foundation for interoperability, by also focusing on those data elements which cross an interface, but which are not necessarily harmonized throughout ITS/TICS. The semantics of data elements may be documented by recording the associations of the information models in which they participate.

The operational concept of the data registration is described in the following subclauses. See Annex A for specific procedural details.

NOTE There may be regional and national variations of this concept of operations.

## 6.2 Framework

The overall framework for the ITS/TICS Data Registry and ITS/TICS Data Dictionaries is presented in Figure 1. It illustrates the relationships among the:

- ITS/TICS architectures (and information models),
- ITS/TICS Data Dictionaries (that are intended to include all data concepts),
- The ITS/TICS Data Registry, and
- ITS/TICS Applications.

For each of these physical elements, the diagram also lists their key functions. For Data Dictionaries, the Data Registry and the applications it further identifies the key stakeholders or stakeholder groups that participate in or manage their operations. Finally, the diagram illustrates the information exchanged between these operational elements.

The ITS/TICS Data Dictionaries shall contain data concepts based on information flows documented in an ITS/TICS Architecture. (Note that there may be multiple architectures, each with multiple versions that are referenced.) Each data concept in a Data Dictionary should reference one or more flows of information between specific objects documented in a specific version of an ITS/TICS Architecture, the primary architecture being as defined in ISO/TR 14813-2:2000<sup>[7]</sup>. Regional and National architectures are also accommodated. This includes the application of the registry using data concepts from alternative International, Regional or National system architecture methodologies or techniques. This will ease migration and interoperability between such approaches.

Each referenced flow should be characterized by a source entity, information exchanged and destination entity. The referenced architecture defines the information exchange requirements and the relevant Data Dictionary further defines the syntax and semantics of the data representation of that architecture information exchange requirement.

The Data Dictionaries in Figure 1 may be developed, for example, by ISO/TC 204 or regional or National Standards Development Organizations (SDOs), public agencies, or private companies. These Data Dictionaries are the responsibility of their respective SDOs, regional or National bodies. Each Data Dictionary shall be associated with a data steward and/or data submitter, using the process defined in this International Standard, to submit data concepts from their respective Data Dictionaries to the ITS/TICS Data Registry. Furthermore, these Data Dictionaries should use registered data concepts from the ITS/TICS Data Registry rather than invent new data concepts. The use of such registered data concepts will help to avoid redundancy in data concepts.

The ITS/TICS Data Registry shall be the repository for submitted data concepts. Through the efforts of the data stewards, the registrar and the Data Registry change control committee (CCC) support identification of harmonization opportunities, recommendations for harmonization, and promotion of data concepts to higher quality levels where warranted. Finally, the Data Registry can provide data concepts to developers and other users for use in ITS/TICS applications.

Developers and other users should use data concepts from the Data Registry at the highest (*Preferred*) quality level. The data concepts at this level are described unambiguously, harmonized across ITS/TICS sectors, and are considered representative of published data standards.

Table 1 presents a summary of the distinguishing characteristics between Data Dictionary and a Data Registry within the ITS/TICS sector.

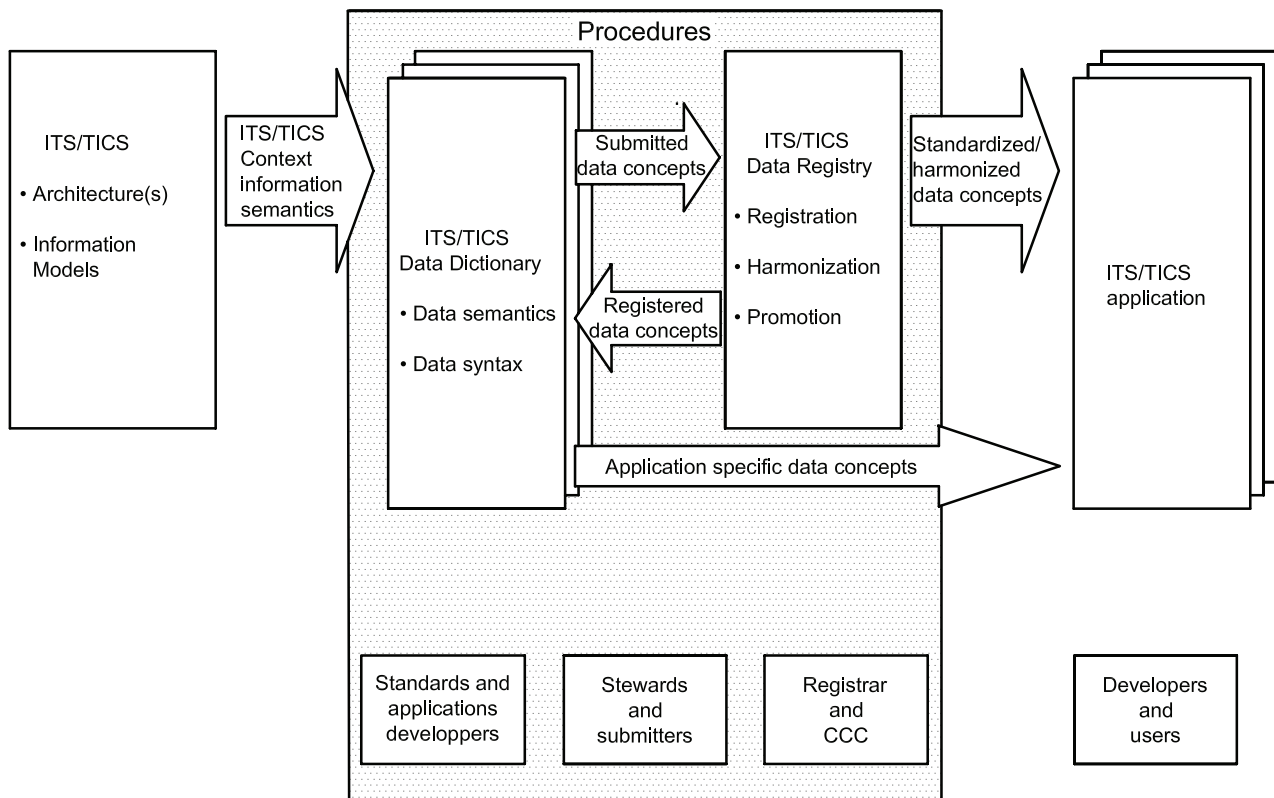


**Figure 1 — ITS/TICS Data Registry operational framework**

**Table 1 — Data Dictionary/Data Registry distinguishing characteristics**

| ITS/TICS Data Dictionary              | ITS/TICS Data Registry                |
|---------------------------------------|---------------------------------------|
| Multiple Data Dictionaries            | One (International) Data Registry     |
| Covers single functional area         | Covers multiple functional areas      |
| Managed by a functional area steward  | Managed by the CCC                    |
| Harmonized within the functional area | Harmonized across the ITS/TICS sector |
| Unique ID within functional area      | Unique ID across the ITS/TICS sector  |

## 6.3 Organizational roles

### 6.3.1 Overview

Organizational roles associated with the ITS/TICS data registration process shall be established. The organizational roles shall include the ITS/TICS DR Executive Committee (ExCom), the ITS/TICS Change Control Committee (CCC), the ITS/TICS Registrar, ITS/TICS Stewards and ITS/TICS Submitters. A summary of each role is provided in this clause. Annex A provides a description of the purpose, specific responsibilities, and membership or selection criteria for each role.

Figure 2 provides a high level view of how these organizational roles are related within the context of the ITS/TICS Data Registry.

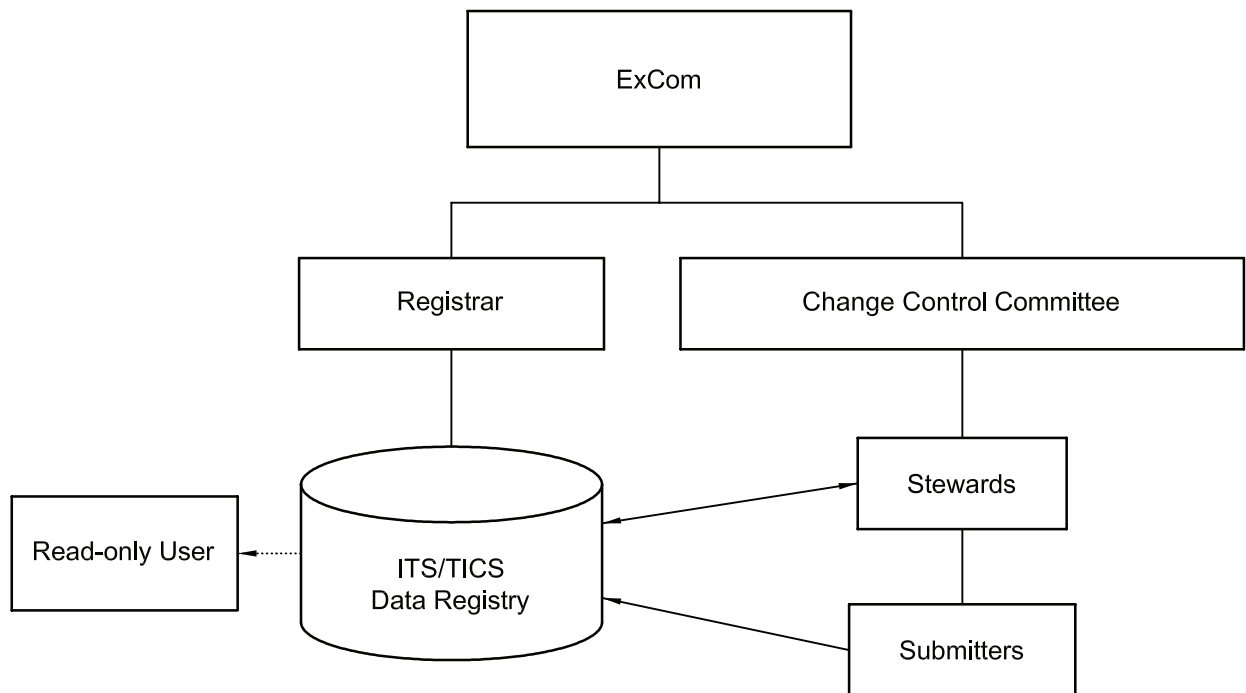


**Figure 2 — Organizational roles to the ITS/TICS Data Registry and their relationships**

### 6.3.2 Registration Authority

The ITS/TICS Registration Authority shall be in accordance with the ISO/IEC Directives, Part 1 (2001), Annex H.

### 6.3.3 Registrar

The ITS/TICS Registrar shall be an organizational element, expert in data registration processes, responsible for facilitating the registration of ITS/TICS data concepts and making those data concepts widely accessible and available to the ITS/TICS community. The ITS/TICS registration authority shall appoint the Registrar.

### 6.3.4 Steward

An ITS/TICS Steward shall be an organizational element of the ITS/TICS community such as a WG Convenor or his designated representative. Stewards are responsible for the accuracy, reliability, and currency of descriptive metadata for data concepts at a registration status level of Qualified or above within an assigned functional, regional or national area. Stewards are approved by a process defined by the registration authority. Stewards are responsible for data within ITS/TICS sectors and may have responsibilities that cut across multiple ITS/TICS functions (e.g. value domains such as date, time, location, codes of the countries of the world).

### 6.3.5 Submitter

An ITS/TICS Submitter shall be an organizational element recommended by an ITS/TICS Steward and approved by a process defined by the ITS/TICS registration authority. A submitter is authorized to identify and report data concepts suitable for registration. Such Submitters may be Stewards or National Bodies.

### 6.3.6 Read-only user

An ITS/TICS Read-only User shall be an organizational element or individual that is approved to review the contents of the ITS/TICS Data Registry. A read-only user submits a request for access. Access is approved by the CCC or organizational element designated by the ExCom. A read-only user has access to all the ITS/TICS sector contents in the Registry, but is not permitted to submit, alter, or delete contents.

### 6.3.7 ITS/TICS change control committee

The ITS/TICS Change Control Committee (CCC) shall be the organizational element that is constituted to provide technical direction and harmonization of data contents for the ITS/TICS Data Registry. The structure, staffing, procedures, and membership of the CCC are determined by the ITS/TICS ExCom. The membership of the CCC should include the ITS/TICS Stewards.

### 6.3.8 ITS/TICS executive committee

The ITS/TICS Executive Committee (ExCom) shall be an organizational element established by ISO/TC 204. It shall be responsible for administering responsibilities and authority delegated by the ISO/TC 204. Responsibilities of the ExCom shall include overall metadata registration policies and business direction of the ITS/TICS Data Registry. Reporting responsibilities to TC 204 shall be specified. Approval of ExCom procedures and practices shall be subject to review and approval by TC 204 or its designated organizational component.

## 6.4 Registration status levels

### 6.4.1 Summary of registration status levels

Registration status levels shall apply to individual data concepts that have been entered into the ITS/TICS Data Registry. Data concept registration status levels shall be of five levels: Card, Draft, Recorded, Qualified, and Preferred. The relationships among these status levels, along with the requirements for a data concept to achieve a particular registration status level, are presented in Table 2.

**Table 2 — ITS/TICS registration status levels and criteria**

| Data concept status level | Status criteria                                                                                                        |
|---------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Preferred</b>          | Change Control Committee confirmation that a data concept is preferred for use in the ITS/TICS community.              |
| <b>Qualified</b>          | Change Control Committee confirmation that all mandatory attributes are completed and conform to quality requirements. |
| <b>Recorded</b>           | All mandatory meta attributes for the data concept have been input.                                                    |
| <b>Draft</b>              | At least the meta attributes Descriptive Name and Submitter Organization have been completed.                          |
| <b>Card</b>               | At least the meta attributes of Descriptive Name, Submitter Organization, Submitter Phone Number have been completed.  |

While the general intent is to progress as many data concepts as possible from Draft to the Preferred registration status, progression to a status higher than Recorded or Qualified may not be appropriate. That is, necessary meta attribute documentation for a data concept may not be available to establish required documentation for the Recorded status, may not be of the quality necessary for the Qualified status, or identification as Preferred data concept may not be appropriate. Such data concepts shall be held at their current status level in the Registry to facilitate understanding of and access to these data concepts by the ITS/TICS community.

### 6.4.2 Description of registration status levels

The status level of a data concept entry shall be based upon the completeness of the data entered, its accuracy, and its conformance to the established format and syntax. The registration status levels shall be as listed below.

- a) Card - A data concept in the Card status shall indicate that the Submitter wishes to make the ITS/TICS community aware of the existence of a data concept in their local domain. A data concept in the status of Card in the ITS/TICS Data Registry shall be maintained under version control within the submitters Data Dictionary. The Submitter may remove a data concept in the status of Card from the Registry at any time. The minimum meta attribute documentation for the Card status in the ITS/TICS Registry shall be: Descriptive Name, Submitter Organization Name, Submitter Phone Number, and Submitter Email Address.
- b) Draft - A data concept in the Draft status shall indicate that the submitter wishes to propose it for progression up the ITS/TICS Data Registry registration levels. Data concepts in the Draft status are not maintained under version control, which means that updates will completely replace the original entry without retaining a record of the original. The Submitter may request the retirement of a data concept in the Draft status at any time, which will completely remove the data concept from the active Registry. The minimum meta attribute documentation for the Draft status is Descriptive Name and Submitter Organization Name.
- c) Recorded - A data concept in the Recorded status shall indicate that the Submitter has completed entries in all mandatory meta attributes. A data concept in the Recorded status implies that the data concept may be shared across ITS domains. The contents of the mandatory meta attributes may not conform to quality requirements. The Submitter may retire a data concept in the registration status of Recorded at any time. Data concepts in Recorded registration status or higher are maintained under version control.
- d) Qualified - A data concept in the Qualified status shall indicate that the CCC has confirmed that the mandatory meta attributes are complete and conform to applicable quality requirements. In the event that a data concept is not approved by the CCC for the Qualified registration status level, it shall remain at the Recorded registration status level.
- e) Preferred - A data concept in the Preferred status indicates that the CCC confirms that the data concept is preferred for use in the ITS/TICS community. The descriptive name and ASN.1 name shall both conform to the ITS/TICS requirements.

### 6.5 Procedures

The ITS/TICS Registration Authority shall establish the necessary procedures to accomplish the following functional activities:

- a) Submission of data concepts for registration — Submitters shall submit data concepts for entry into the ITS/TICS Data Registry. These data concepts may be recorded as Card or Draft registration status, as the Submitter deems appropriate. A registration status of Card implies usage restricted to the Submitter's domain while being posted for informational purposes. The Draft status implies that the submitter intends to progress the data concept to higher ITS/TICS registration status levels. Submitters or Stewards may progress data concepts in the Draft status to the Recorded registration status by completing all mandatory meta attributes required of that data concept.
- b) Progression of data concepts — Submitters shall progress data concepts to Recorded status. Progression of data concept to registration status of Qualified or higher shall require the sponsorship of a Steward and approval of the Change Control Committee.
- c) Harmonization of data concepts — The objective of harmonization is to resolve any potential duplicate or overlapping of data concepts. Procedures shall be established to facilitate data concept harmonization and reuse.
- d) Modification of data concepts — Procedures shall be established to change data concepts.

- e) Retirement of data concepts - Procedures shall be established to retire data concepts.
- f) Administrative processing - The ITS/TICS Data Registrar may assign administrative registration statuses in order to track an interim state of a data concept.

**NOTE** This clause introduces the requirements for procedures associated with the ITS/TICS Data Registry and ITS/TICS Data Dictionaries. These procedures require organizational participation of certain roles, as specified in 6.3, in dealing with data concepts to be registered in the ITS/TICS Data Registry, as identified in Clause 7. Annex A provides representative procedures to address these functional requirements. Annex F provides guidance on the documentation of data concepts in preparation for submission to the Data Registry for registration.

## 6.6 Version control

### 6.6.1 Version maintenance

This subclause presents the requirements for synchronization of the meta attribute structures of the ITS/TICS Data Dictionaries and ITS/TICS Data Registry.

Configuration versions of the ITS/TICS Data Registry shall be maintained for meta attributes.

A “Current Version” and a “Development Version” shall be established and maintained for attributes of the ITS/TICS Data Registry. If TC204 working groups, regional and National bodies want to maintain consistency of their Data Dictionary meta attributes with those of the ITS/TICS Data Registry, the versioning procedures below shall apply.

### 6.6.2 Current version

The current version shall consist of those attributes approved by the CCC for current use in ITS/TICS Data Dictionaries and the ITS/TICS Data Registry.

### 6.6.3 Development version

The development version shall consist of those meta attributes under development, together with pertinent current version meta attributes, for use in ITS/TICS Data Dictionaries and the ITS/TICS Data Registry as the next current version. The CCC controls the release of each development version as the new current version. If TC204 Working Groups or regional or national bodies elect to keep their Data Dictionaries synchronized with the ITS/TICS Data Registry, they shall convert to the next version of the ITS/TICS Data Registry.

## 7 Data concepts

**NOTE** The term “data concept(s)” is used throughout the document to mean “types of data concept(s)”.

### 7.1 Summary of data concepts

This clause defines and explains the nine data concepts applicable to this International Standard. Data concepts refer to abstractions and things in the natural world that can be identified with explicit boundaries and meaning. The properties and behavior of these fundamental constructs all follow the same set of rules. Within ITS/TICS, there may be data concepts to represent, for example, a Bus Route and relevant information about it.

Data concepts include interface dialogue, message, data frame, object class, association, property, data element concept, value domain, and data element. See F.4 for an ASN.1 Information Object Specification (IOS) for an ITS/TICS data concept. Figure 3 presents a framework for data concepts and how they relate to one another. For illustration purposes, the braces, i.e. “{” and “}”, portray the particular relationships among the data concepts. The numeric annotation associated with each brace indicates the number of each data concept that may be realized. For example, there may be from 2 to n messages within an interface dialog, where n is any integer number. As another example, a message may consist of 0 to n data elements and 0 to n data frames.

Figure 4 presents interface data concepts and their relationships. Information interchange between two ITS/TICS system components shall be characterized from the top down as an interface dialogue or a set thereof. Interface dialogues shall be a set of messages whose order and timing for transmission is predicated upon a defined operational concept or scenario containing timing information. Messages shall be a collection of data elements and/or data frames which contain the substantial data to be exchanged.

Figure 5 presents model data concepts and their relationships. In support of the information interchange data concepts, additional data concepts for modeling are provided. These modelling concepts support the realization of the organization of the various data concepts by characterizing key relationships among the data concepts. See Annex E.

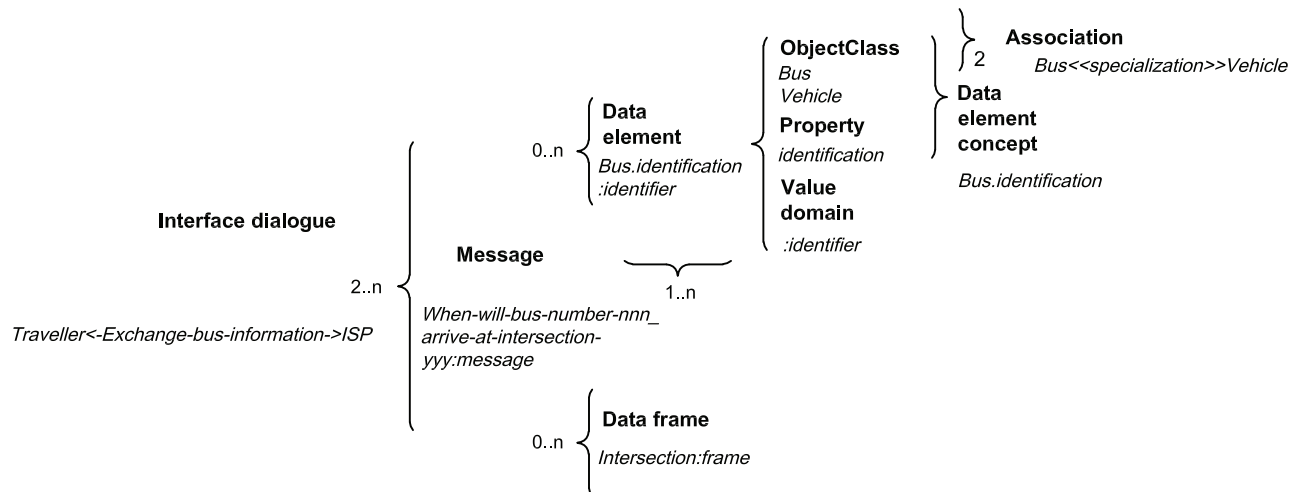


Figure 3 — ITS/TICS data concepts framework

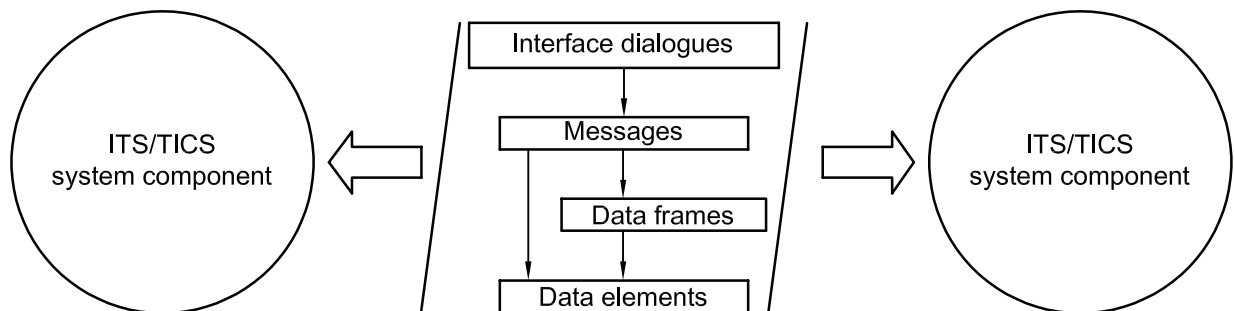


Figure 4 — ITS/TICS interface data concepts

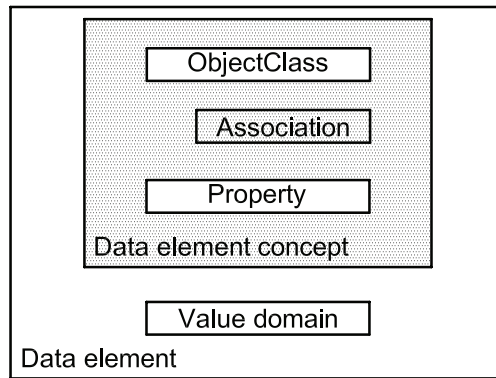


**Figure 5 — ITS/TICS model data concepts**

## 7.2 Interface dialogue

An interface dialogue shall be a temporal sequence of messages, including variants, among two or more system components that are used to accomplish a service/observable result. In Figure 3 the interface dialogue example is “Traveller<-Exchange-bus-information->ISP”

## 7.3 Message

A message shall be a structured grouping of data elements and/or data frames. In Figure 3 the message example is “When-will-bus-number-nnn-arrive-at-intersection-yyy:message.” See F.7 for an example ASN.1 Information Object Specification of a message.

## 7.4 Data frame

A data frame shall be a structured grouping of data elements primarily for the purpose of referring to a group with a single name to efficiently reuse such groups of data elements that commonly appear together in a message specification. In Figure 3 the data frame example is “Intersection:frame.” See F.6 for an example ASN.1 Information Object Specification of a data frame.

## 7.5 Object class

An object class shall be a description of a set of objects that share the same properties, relationships and semantics within a given domain of discourse about which there is a need to represent some information. Modifiers that qualify or further specialize the object class may be used. An object class is one of three data concepts used to characterize a data element. In Figure 3, the object classes illustrated are “Bus” and “Vehicle”.

## 7.6 Association

An association shall be a structured relationship between two object classes. A particular type of association is called a composition in which an object of the “whole” class is in a “whole/part” relationship with objects of the “parts” class. Modifiers may be used to show a composition. In Figure 3, the association example is “Bus<<specialization>>Vehicle.”

When an object class participates in an association, it has a specific role that it plays in that relationship. See Annex E for information modeling considerations.

## 7.7 Property

A property shall indicate information of interest that applies to one or more object classes. The information of interest might be a fact, proposition, or observation about each object of the class. A property is one of three data concepts used to characterize a data element. In Figure 3, the property example is “identification”.

## 7.8 Data element concept

A data element concept shall consist of a object class and a property. While in a form similar to a data element, a data element concept is devoid of a value domain or representation. In Figure 3, the data element concept example is “Bus.identification”.

## 7.9 Value domain

A value domain shall be a term that indicates, precisely and unambiguously, the format and syntactic form for data concept instance values. A value domain is one of three data concepts used to characterize a data element. In Figure 3, the value domain example is “:identifier”.

## 7.10 Data element

A data element shall be a formalized representation of some information (i.e., a property; e.g., a fact, proposition, or an observation) about an object class (e.g. a person, place, process, concept, association, state, or event), with an explicit value domain. A data element (a data concept) shall be characterized by three data concepts (see Figure 3): object class, property, and an explicit value domain descriptive name (and value domain reference, where applicable, describing the physical form of the information). In Figure 3, the data element example is “Bus.identification:identifier”. See F.5 for an example ASN.1 Information Object Specification of a data element.

# 8 Data concept meta attributes

## 8.1 Basic meta attributes of data concepts

### 8.1.1 Meta attribute categories

The basic meta attribute categories of identification, definitional, relational and representational shall be used in the ITS/TICS Data Registry and ITS/TICS Data Dictionaries. The definition of each meta attribute is provided in Annex B. See Annex C for meta attribute applicability to various data concepts.

**NOTE** These basic meta attributes may be represented in one or more (meta) data models to reflect more completely the relationships among the data. While selected meta attributes are based upon ASN.1 syntax for data representation, alternative (meta) data models may result in alternative syntax. Consequently, additional meta attributes to support other syntaxes (e.g. CORBA IDL, EDIFACT Graphical Syntax, XML Schema) may be added in future revisions and some existing mandatory attributes may become optional.

### 8.1.2 Identification meta attributes

Identification attributes shall differentiate one data concept from another. For example, the Data Concept Identifier together with Data Concept Version is a unique identification “tag” for a data concept within the ITS/TICS Data Registry. The ASN.1 Object identifier is also a unique identifier for each data concept. Other identification meta attributes may be used, e.g. Descriptive name and Synonymous Descriptive Name, for identification purposes but may be less precise. See B.2.

The identification meta attributes shall be as identified below.

- Data concept identifier
- Data concept version

- Descriptive name
- Synonymous descriptive names
- Symbolic names
- ASN.1 name
- ASN.1 object identifier
- Uniform resource locator

### 8.1.3 Definitional meta attributes

Definitional meta attributes shall describe the semantic aspects of a data concept. These meta attributes may directly address semantic meanings (e.g. Definition, Remarks) or indirectly provide insights into the semantic aspects of a data concept (e.g. Descriptive Name Context, Source, Data Concept Type). See B.3.

The definitional meta attributes shall be as identified below.

- Definition
- Descriptive name context
- Symbolic name usage
- Source
- Architecture reference
- Architecture name
- Architecture version
- Data concept type
- Remarks
- Context
- Standard
- Metadata source
- Priority
- Frequency/message mode
- Delivery verification
- Data quality

### 8.1.4 Relational meta attributes

Relational meta attributes shall document associations among or between data concepts. See B.4.

The relational attributes shall be as identified below.

- Precursor
- Successor

- Synonym
- Abstract
- Roles
- Multiplicity
- Association constraints
- Aggregate
- Role key
- Referenced messages
- Referenced data frames
- Referenced data elements
- Referenced object classes
- Referenced associations

#### **8.1.5 Representational meta attributes**

Representational meta attributes shall describe requirements for physical representation of data elements and value domains. These meta attributes shall define how data elements or value domains appear in databases or user interfaces, and constrain allowable processing activities. See B.5.

The representational meta attributes shall be as identified below.

- Data type
- Format
- Unit of measure
- Valid value rule

#### **8.2 Administrative meta attributes**

Administrative meta attributes shall describe management and control aspects associated with a data concept. For example, Last Change User identifies the user that last changed a data concept. Registration Status identifies the status level of a data concept

The administrative meta attributes identified below shall be used in the ITS/TICS Data Registry to facilitate administrative management of ITS/TICS data concepts. These administrative meta attributes are optional for the ITS/TICS Data Dictionaries. See B.6 for definitions of these administrative meta attributes.

- Registration status
- Date registered
- Last change date
- Last change user
- Registrar organization name
- Registrar phone number

- Steward organization name
- Steward phone number
- Submitter organization name
- Submitter phone number
- User
- View
- Related groups
- Security class

## 9 Data concept names

### 9.1 Descriptive names

Descriptive names shall be formulated when developing data concepts. Requirements for developing descriptive names for data concepts, their component parts, and their abbreviations are described in Annex D. These requirements shall apply to the entire ITS/TICS data environment.

The descriptive name shall be a name that represents the meaning of a data concept. The descriptive name often serves as a synopsis of the data concept's definition. Abbreviated names are used primarily as physical names, and are also referred to as symbolic names, internal names, or access names in application database environments and application program interfaces or messages. When names are formulated by combining multiple terms that provide a more complete characterization of the data concept being named, then separators shall be used in various combinations to enhance readability. Use of these separators: period, colon, left caret, right caret, and dash is defined in Annex D.

The descriptive name shall be unique.

### 9.2 Data concept descriptive name formats

Descriptive names shall be constructed by combining the relevant component descriptive names with specific separators. The formats are shown Table 3.

**Table 3 — Descriptive name formats for ITS/TICS data concepts**

| Data concept         | Descriptive name format                                      |
|----------------------|--------------------------------------------------------------|
| Object class         | ObjectClassTerm                                              |
| Property             | propertyTerm                                                 |
| Value domain         | value-domain-term                                            |
| Data element concept | ObjectClassTerm.propertyTerm                                 |
| Data element         | ObjectClassTerm.propertyTerm:value-domain-term               |
| Data frame           | DataFrameTerm:frame                                          |
| Message              | MessageTerm:message                                          |
| Interface dialogue   | SourceName<-InterfaceDialog->DestinationName                 |
| Association          | RoleAObjectClassTerm <<associationtype>>RoleBObjectClassTerm |

## 10 Meta attribute requirements for ITS/TICS data concepts

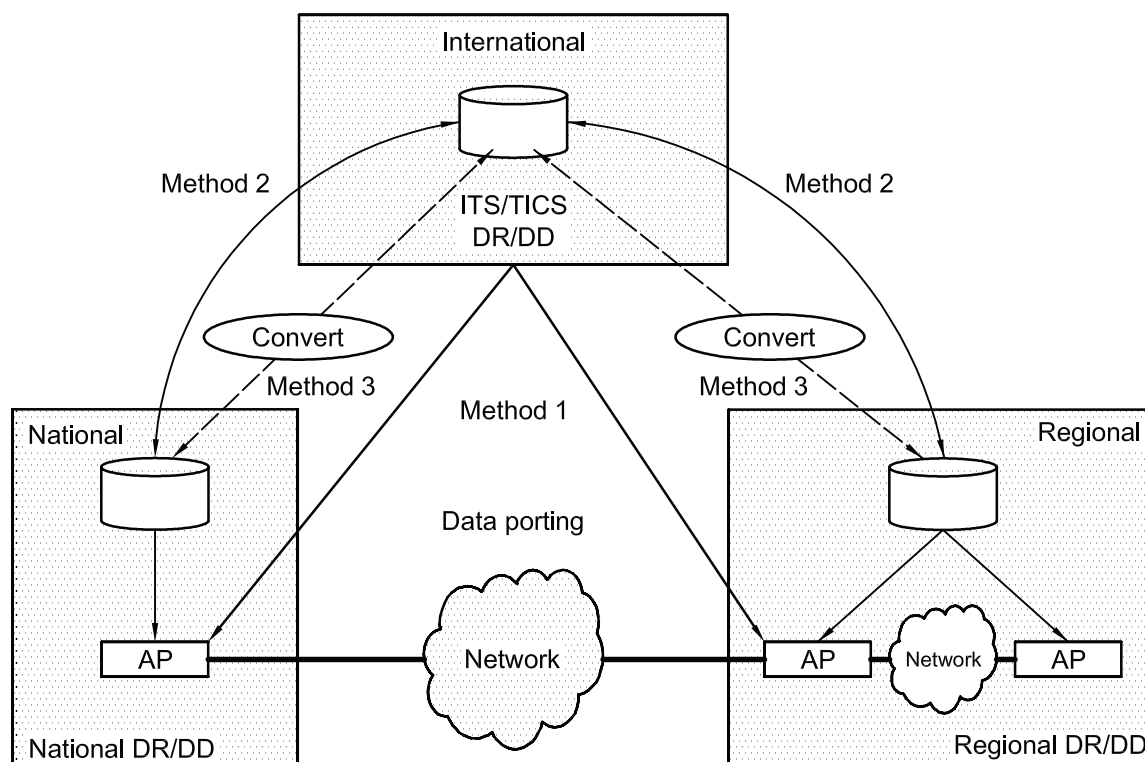
The ITS/TICS Data Registry and ITS/TICS Data Dictionaries shall consist of meta attributes for each data concept as delineated in Annex B. Annex C specifies the applicability of the meta-attribute to each data concept. C.2 provides specific requirements for the ITS/TICS Data Registry. C.3 provides specific requirements for an ITS/TICS Data Dictionary.

**NOTE** The meta attributes specified for the ITS/TICS Data Registry and ITS/TICS Data Dictionaries are not required for use in ITS/TICS application Data Dictionaries, although such use is encouraged.

## 11 International relationships

This International Standard recognizes that while the ITS/TICS sector is global in scope, National and regional Data Dictionaries and data registries are developed according to individual National and/or regional requirements as well as National and regional conditions. These National and regional Data Dictionaries and data registries take into consideration the cultural conventions relevant to the community of interest. For example, the Data Dictionary may contain data in the local language and may employ the local conventions for date, time, currency, etc. However, the global economy within a multimodal transport environment requires data portability. In order to maximize data portability and minimize data conversion to achieve international ITS/TICS information interchange, explicit relationships shall be established between the ITS/TICS (International) Data Registry/Data Dictionaries and the National and regional data registries and Data Dictionaries.

Figure 6 presents a top level view of that relationship. One of three methods shall be employed in exchanging data between the International ITS/TICS DR/DD and the National and/or Regional environment. Method 1 shall provide for a National application's direct access to the ITS/TICS DR/DD to acquire data concepts that have been internationally harmonized. Method 2 shall provide for a direct exchange of data concepts between the International DR/DD and the National/Regional DD/DR. Method 3 shall provide for an exchange of data concepts through a conversion process that recognizes established cultural conventions.



DR Data Registry  
 DD Data Dictionary  
 AP Application Program

**Figure 6 — Reference model for national, regional and international relationships**

## Annex A (informative)

### ITS/TICS functional operating procedures

#### A.1 Introduction

This annex defines the overall concept of operations for the ITS/TICS Data Registry. It identifies specific ITS/TICS roles and responsibilities and provides specific functional operating procedures for the use of the Data Registry and interactions with the ITS/TICS DR functional or national Data Dictionaries. These procedures support standardization and harmonization processes that facilitate the different working groups and national or regional authorities sharing data concepts. See 6.3 for organizational roles and responsibilities (and their relationships), and 6.4 for registration status levels definitions.

#### A.2 Roles and responsibilities associated with the ITS/TICS Data Registry

##### A.2.1 Registrar

The Registrar provides a single individual point-of-contact responsible for managing and maintaining information about ITS/TICS data in the Registry, under the authority of the ITS/TICS Registration Authority. The Registrar is responsible for:

- a) Monitoring and managing the Registry contents.

NOTE The Registry is established, operated, and maintained by the ITS/TICS Registration Authority.

- b) Enforcing policies, procedures, and formats for populating and using the Registry.
- c) Proposing procedures and standard formats for the Registry to the ITS/TICS DR CCC for consideration.
- d) Recording current registration status for data concepts in the Registry.
- e) Ensuring access for authorized users to contents in the Registry.
- f) Assisting in the progression of data concepts through the registration status levels.
- g) Assisting in the identification and resolution of duplicate or overlapping data concepts in the Registry.
- h) Acting on direction from the ITS/TICS Registration Authority.
- i) Effecting registration of ITS/TICS data concepts in external data registries or Data Dictionaries.
- j) Enforcing data registration procedures for submitting data concepts to the Registry, e.g.
  - How to prepare, submit, and process submissions of data concepts.
  - How the Registry is used to avoid duplicate data concept submissions to the Registry.
  - How the Registry is used to effect harmonization of data across Data Dictionaries of participating organizations.
  - How external registries are used as a source of data concepts for reuse in the Registry.

- k) Maintaining a separate document recording the appropriate contact information for all members of the CCC and the ExCom.
- l) Adding new users or organizational entities that may become authorized to access the ITS/TICS Data Registry.
- m) Maintaining other controlled word lists of the ITS/TICS Data Registry.

### **A.2.2 Stewards**

Stewards provide specific expert points of contact responsible for coordinating the identification, organization, and establishment of registered data for use throughout the ITS/TICS enterprise within an assigned area.

Stewards are responsible for:

- a) Co-ordinating the identification and documentation of data concepts within their assigned area.
- b) Ensuring that appropriate data concepts in their assigned area are properly registered.
- c) Co-ordinating with other Stewards to attempt to prevent or resolve duplicated efforts in defining data concepts.
- d) Reviewing all data concepts once they are in the Recorded status to identify and attempt to resolve conflicts among data concepts with other Stewards' responsible areas.
- e) Ensuring the quality of meta attributes for data concepts they propose for the Qualified registration status level, reusing standardized data from external data registries where applicable.
- f) Proposing Preferred registration status level data concepts in their assigned area.
- g) Ensuring that data registration procedures and formats are followed within their assigned functional area.
- h) Recommending Submitters to the Registration Authority.

### **A.2.3 Submitters**

Submitters are organization elements that are familiar with or engaged in development and operational environments. Submitters maintain current data concepts and are engaged to describe and submit new data concepts following the ITS/TICS data registration requirements.

A Submitter is responsible for:

- a) Identifying himself to the Registrar in writing.
- b) Identifying and documenting data concepts appropriate for registration in the Registry.
- c) Submitting data concepts to the Registry.
- d) Ensuring the completeness of mandatory meta attributes for ITS/TICS data concepts proposed for the Recorded registration status level.

### **A.2.4 Read-only users**

A Read-only User is an organizational element approved by the Registrar to review the contents of the Registry. Read-only Users may not add to, delete from, or otherwise modify the contents of the Registry.

### A.2.5 Change control committee

The ITS/TICS DR CCC provides overall technical direction of, and resolution of technical issues associated with, the Registry, its contents and its technical operations.

The ITS/TICS DR CCC is responsible for:

- a) Overall conduct of ITS/TICS registration operations.
- b) Promoting the reuse and sharing of data in the ITS/TICS Registry within and across ITS/TICS functional-areas, and among external interested parties to the ITS/TICS enterprise.
- c) Progressing data concepts through Registry registration Qualified and Preferred status levels.
- d) Identifying data concepts to be registered in external data registries or Data Dictionaries.
- e) Resolving technical issues associated with registered data concepts, e.g., overlap, duplication, etc.
- f) Approving updates to data concepts previously placed in the Registry in the Qualified or Preferred registration status levels.
- g) Proposing Registry policies to the ExCom for approval.
- h) Approving authorized Submitters, Read-only Users, and types of users, of the Registry.
- i) Approving Registry content, procedures, and formats.
- j) Submitting management-related recommendations and issues to the ExCom.
- k) Acting on directions from the ExCom.
- l) Meeting periodically in face-to-face meetings, with additional meetings and teleconferences held as needed.

The CCC will normally fulfil its responsibilities via consensus building in accordance with an established procedure. Intransigent issues may be resolved by an established procedure.

### A.2.6 Executive Committee (ExCom)

The ITS/TICS ExCom is responsible for overall policy and business direction for the ITS/TICS Registry, to include:

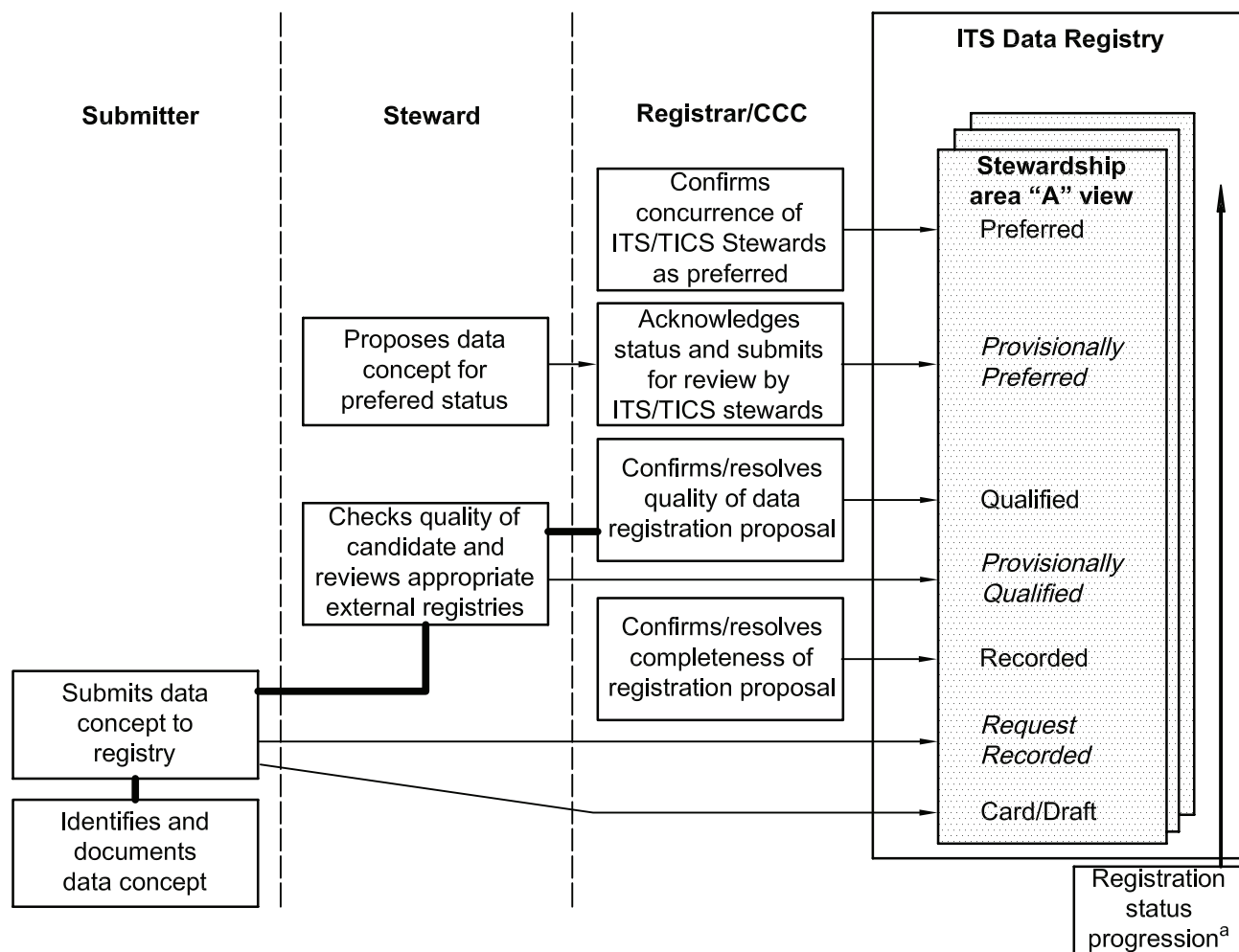
- a) Establishing overall Registry policies.
- b) Resolution of all business management issues pertaining to the Registry, e.g. copyrights, stewardship, funding, ExCom membership, etc.
- c) Ensuring the long-term success and performance of the Registry.
- d) Establishing and updating the Registry charter and strategic plans.
- e) Meeting at least semi-annually in face-to-face meetings, with additional meetings and/or teleconferences held as needed.

The ExCom will normally fulfil its responsibilities via consensus building. Intransigent issues may be resolved by simple majority vote, one vote per member organization.

## A.3 Registration concept of operations

### A.3.1 Overview

The operational procedures for the ITS/TICS DR is summarized in this subclause. These procedures describe registration and harmonization practices for the ITS/TICS Data Registry. See 6.3 for organizational roles and responsibilities (and their relationships), and 6.4 for registration status levels definitions. This clause describes the registration activities associated with Submitters, Stewards, and the registrar and CCC roles. Figure A.1 summarizes these functional activities.



<sup>a</sup> Timing of registration status progression is entirely dependent upon the data Submitter/Steward. Card is not subject to progression.

**Figure A.1 — Registration functional activities**

### A.3.2 Registration initiation

All Submitters accomplish the Submitter registration activities in the same way in accordance with these functional operation procedures so that data concepts are consistently and accurately registered. The responsibility of the Submitter is to propose and document data concepts for registration in the registration status of Draft; and, if desired, propose data concepts for the registration status of Recorded. A Submitter acquires an understanding of ITS/TICS data concepts, their context and sources, and their significance in the course of accomplishing normal operational, design, development, or management activities.