



BSI Standards Publication

Intelligent transport systems — Public transport user information

Part 2: Public transport data and interface standards catalogue and cross references

National foreword

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TECHNICAL REPORT

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Intelligent transport systems — Public transport user information —

Part 2: Public transport data and interface standards catalogue and cross references

*Systèmes intelligents de transport — Informations destinées aux
utilisateurs des transports publics —*

*Partie 2: Données sur les transports publics, et catalogue des normes
relatives aux interfaces et références croisées*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

ISO 17185 consists of the following parts, under the general title *Intelligent transport systems — Public transport user information*:

- *Part 1: Standards framework for public information*
- *Part 2: Public transport data and interface standards catalogue and cross references*
- *Part 3: Use cases for journey planning systems and their inter-operation*

Introduction

With the multiple standards that are deployed around the world to provide passenger information, ISO/TC 204 sees a need to identify the range of information provision available to the public. Some of the standards comprise messages and/or services that cover the full scope of the public transport planning and operations enterprise, while others address a narrow scope of passenger information, such as schedule information or bus arrival time prediction.

ISO/TC 204 saw a need to create a catalogue that shows the range and extent of the collection of standards and specifications available. Furthermore, the group identified a need to show the similarities and differences among these standards and specifications for several reasons, for example:

- to match like concepts and messages,
- to understand the overlaps, differences and missing requirements,
- to extend narrow-based standards using the concepts and interfaces developed by the enterprise-based standards.

This Technical Report will be beneficial for all ISO/CEN member countries, as well as non-member countries. It will be a valuable catalogue to help understand the content of the currently available national and regional standards (identified in ISO 17185 Part 1), such as Transmodel, TCIP, Korean ATIS and Japanese ATIS. The intention is that, by deploying these existing national and regional standards from other countries or regions, duplication of cost and time in developing new standards and specifications can be avoided. For those countries that do not have surface public transport information standards, this approach allows the mix and match of standards from different regions, as well as rapid development and deployment that can enhance the usability and convenience of public transport anywhere in the world.

This Technical Report is intended to be fully consistent with those currently available national and regional standards which may be related to international surface public transport. It is designed to serve as a look-up table for developers for the terminology used in different regions for the same concept. For example, the term “trip” in TCIP and GTFS is called “service journey” in Transmodel. This catalogue will expose the differences in language for developers who need to translate data from one standard to another. Principally, this Technical Report, and its scope and approach, will help lower the barriers for developers who need to mix standards; for countries that need to choose the best approach to deploy public transport systems; and, ultimately, for the public wanting a seamless public transport experience wherever they travel.

As Andrew S. Tanenbaum said, “The nice thing about standards is that you have so many to choose from”.¹⁾ This report fully endorses that principle.

1) *Computer Networks*, 2nd ed., p. 254

Intelligent transport systems — Public transport user information —

Part 2: Public transport data and interface standards catalogue and cross references

1 Scope

This Technical Report compares and contrasts public transport standards that were developed by different regions and countries. It uses the CEN Transmodel classes as a reference to compare standard data concept descriptions of public transport user information. The purpose of this Technical Report is to understand the concepts described by existing standards and specifications that cover public transport passenger information.

2 Terms and definitions

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

NOTE Equivalent TCIP or Transmodel term is identified for reference.

2.1

attribute

property of an entity

[SOURCE: CEN EN12896; p. 16 (ref [1](#)), modified — Note 1 has been added.]

Note 1 to entry: Equivalent terms in TCIP / Transmodel: data element (TCIP).

2.2

class

concept within [a] system being modelled

[SOURCE: The Unified Modeling Language Reference Manual; p. 185 (ref [3](#)), modified — Notes 1 and 2 have been added.]

Note 1 to entry: Equivalent terms in TCIP / Transmodel: data concept [US TCIP].

Note 2 to entry: Similar to entity, represents a set of objects with similar behaviour and properties.

2.3

data concept

any of a group of data dictionary structures (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 behavior [sic] all follow the same rules

[SOURCE: ISO 14817, p. 3 (ref [4](#)), modified — Note 1 has been added.]

Note 1 to entry: Equivalent terms in TCIP / Transmodel: object, class, entity (Transmodel); data element, data frame (TCIP).

2.4

data element

atomic piece of information related to a person, place, thing, or concept (for example, CPT-PersonFirstName and CPT-Footnote)

[SOURCE: APTA-TCIP-S-01 3.0.3; p. 32 (ref [2](#)), modified — Note 1 has been added.]

Note 1 to entry: Equivalent Terms in TCIP / Transmodel: attribute (Transmodel).

2.5

data frame

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

[SOURCE: APTA-TCIP-S-01 3.0.3; p. 32 (ref [2](#)), modified — Notes 1 and 2 have been added.]

Note 1 to entry: Equivalent Terms in TCIP / Transmodel: Sub model (as in a “diagram”) in Transmodel [CEN-Transmodel].

Note 2 to entry: This data concept type may also be used to specify groups of data elements for other purposes as well. A data frame may contain other data frames as well as data elements.

2.6

dialog

ordered sequence of message exchanges between two or more entities

[SOURCE: APTA-TCIP-S-01 3.0.3; p. 33 (ref [2](#)), modified — Notes 1 and 2 have been added.]

Note 1 to entry: Equivalent Terms in TCIP / Transmodel: no equivalent in Transmodel.

Note 2 to entry: The rules of the exchange are defined by a dialog pattern. Messages specific to the type of exchange are specified by the dialog.

2.7

entity

object (data) that has its own existence (as opposed to an attribute)

[SOURCE: The Unified Modeling Language Reference Manual; p. 16 (ref [3](#)), modified — Notes 1 and 2 have been added.]

Note 1 to entry: Equivalent Terms in TCIP / Transmodel: data concept (TCIP).

Note 2 to entry: Similar to object and class.

2.8

message

grouping of data elements and/or data frames intended to be transmitted as a complete package of information in one direction

[SOURCE: APTA-TCIP-S-01 3.0.3; p. 39 (ref [2](#)), modified — Note 1 has been added.]

Note 1 to entry: Equivalent Terms in TCIP / Transmodel: no equivalent in Transmodel.

2.9

object

discrete entity with a well-defined boundary and identity that encapsulates state and behavior; an instance of a class

[SOURCE: The Unified Modeling Language Reference Manual; p. 360 (ref [3](#)), modified — Notes 1 and 2 have been added.]

Note 1 to entry: Equivalent Terms in TCIP / Transmodel: data concept (TCIP).

Note 2 to entry: Similar to class and equivalent to an entity.

3 Abbreviated terms

ADPU	Application Protocol Data Unit (in the context of smart cards)
APTA	American Public Transportation Association
ATIS	Advanced Traveller Information System
CEN	Comité Européen de Normalization
CFMS	Contactless Fare Media System
csv	Comma separated values
EU	European Union
GTFS	General Transit Feed Specification (formally known as the Google Transit Feed Specification)
ID	Identification or identifier
IEC	International Electrotechnical Commission
IFOPT	Identification of Fixed Objects in Public Transport, a preliminary CEN Technical Specification, CEN standard, EN 28701:2009, that provides a Reference Data Model for describing the main fixed objects required for public access to Public transport.
ISO	International Organization for Standardization
ISO/TC 204	ISO Technical Committee 204 on Intelligent transport systems
N/I	Not included
NeTEx	NeTwork and Timetable Exchange. (CEN/TS 16614-, -2, -3). A CEN Technical Specification in XML, based on Transmodel v6 and IFOPT, providing exchange messages for space- and fare-, time-related data.
NTCIP	National Transportation Communications for Intelligent Transportation System Protocol (US Intelligent Transportation System standards body)
Pi	Passenger information
PICC	Proximity Integrated Circuit Card
PICS	Profile Implementation Conformance Statement
PRL	Profile Requirements List
PT	Public Transport
PTV	Public Transport Vehicle
SIRI	Service Interface for Real Time Information (EN 15531-1 to 3 and TS15531-4 and 5). A CEN protocol in XML, based on Transmodel that specifies services about public transport real-time services and vehicles, such as vehicle monitoring, stop monitoring, and more.
SQL	Sequential Query Language
TBT	Technical Barriers to Trade

TCIP	Transit Cooperative Interface Profiles
UML	Unified Modelling Language
UTC	Coordinated Universal Time
UTFS	Universal Transit Fare System
WSDL	Web Services Descriptive Language
XML	Extensible Markup Language

4 Objectives from a data catalogue and cross reference document

The objectives of this catalogue are to:

- Facilitate and promote international cooperation in the area of world-wide public transport (PT) standard activities.
- Encourage the PT industry to adopt a coherent and consistent reference data model standard for PT where PT operators will benefit from a larger market base, lowering costs and enhancing interoperability among the systems they procure.
- Enhance economic trade by enabling standards to apply across country boundaries.
- Support PT to build interoperable applications that will work across country boundaries.

In addition, there are many countries that do not have national standards for traveller information. It is hoped that this catalogue will define the scope of functions that are currently defined, and the areas needing further work to support PT passengers.

5 Methodology

5.1 Business plan and survey

This Technical Report was conceived in 2006 as part of a business plan and an initial survey (see [Annex A](#)). The business plan included the following:

- Purpose of developing a data catalogue of worldwide standards on public transportation information.
- Benefits to national standards bodies.
- Justification for the data catalogue.
- Project work plan.
- Resources needed.

In addition, a survey for collecting information was attached to the business plan. The survey results are described in this Technical Report.

5.2 Public transport standards typology

As part of earlier discussions between CEN TC 278 WG 3 and ISO TC 204 (from 2000 to 2002), a set of criteria was defined to compare the TCIP and Transmodel standards. Three measures were defined:

- Equivalence: implies the elements are the same.
- Similarity: elements are similar, that is they overlap in some areas and differ in others.
- Difference: elements are different and are not reconcilable.

In this context, an element was described as a “data element or attribute, or data concept or entity”. However, the purpose of the two standards is fundamentally different and, over the ensuing years, they have moved further apart in terms of their use and application.

In partitioning standards, ISO and other standards bodies are developing “abstract” versus “implementation” standards. Furthermore, wide adoption of internet standards and information technology best practices has helped modularize standards into different classes.

Table 1 — Information service standards’ typology

	Service invocation (method)	Information transfer
Implementation specifications [how]	Interface: TCIP Protocol Interface Compliance Specification (Protocol Requirements List) (Volume IV) / NTCIP 2306 Center to Center Web Services SIRI NeTEx Korean ATIS	Encoding: TCIP XML Schema (Volume III) SIRI XML Schema NeTEx GTFS
Abstract model [what]	Behaviour: TCIP Building Blocks (patterns) (Volume I) SIRI NeTEx	Content: Transmodel SIRI NeTEx TCIP Data Dictionary/ Data Frames/ Data Messages / Dialogs (Annexes A – D)

Generally, the difference between an abstract model and implementation specification is “*what* is the domain?” versus “*how* is it designed and implemented?” The abstract model describes the content (semantics), logical relationships and completeness of the business domain, while the implementation specification documents describe the design for a specific technology based on how a part of the domain will be implemented. For example, there are several ways of invoking an exchange to acquire data (such as, SQL, web services and messaging services) and there are several encoding formats to access the data, including comma separated value file format (csv), XML or protocol buffer.

The reason to segment the standards space into the various categories is to illustrate the differences between the content, behaviour and implementation approaches of these standards. Transmodel, which is used as the reference model, is not a standard that can be implemented out of the box. It is an abstract data model whose data concepts (and the relationships between the data concepts) help users understand the business rules that apply to implementable standards. Transmodel captures the domain rules in a logical, consistent manner.

Given this classification framework, Transmodel is positioned as an abstract model that describes the semantics and business rules. Other standards, like TCIP, are implementation standards that include syntax (data formats) and some semantics. TCIP also includes behavioural specifications, that is, how information is exchanged in a business to business messaging environment. Most implementation standards, like TCIP, do not explicitly define a data model which describes entities/objects, logical relationships and business rules consistent with data modelling methodology. By mapping the implementation standards to an abstract standard, the implementation standard achieves the benefits of the semantic inter-operability of the data model.

The detailed mapping creates a catalogue on several levels of resolution. These include the following:

- typology (abstract/implementation; semantic/behaviour);

- business area;
- data concept;
- data concept attribute.

In addition, some responses of the survey included conformance and testing approaches, approaches to handling data versioning and measuring data quality. In many cases, conformance statements and tests are similar since the base standards upon which the public transport standard is based are the same, for example, XML. For that reason, conformance approaches show the similarities and collaborative methods that an implementer may use to integrate multiple message standards.

6 Public transport standard description results

6.1 Public transport standard overview

The survey included 10 sections. The sections requested three types of information: general information on the standards and its lineage; detailed information on the content of the standard with respect to a reference standard; and conformance and quality/versioning requirements associated with implementation of the standard. Specifically, the 10 topics addressed were as follows:

1. Name.
2. Standard type (see [Table 1](#)).
3. Scope.
4. History and ongoing maintenance schedule.
5. Methodology and approach to development.
6. Business areas covered (mapping to Transmodel and TCIP business areas).
7. Conformance and interoperability with other standards (e.g. XML, IEEE 1512).
8. Conformance provisions.
9. Handling of data version (temporal aspects of data).
10. Handling of data quality (metadata aspects).

The reference standard that was used as the cross reference was Transmodel because it provides a comprehensive abstract model of the PT data across most business areas, including data semantics and business rules. Some standards go beyond Transmodel (such as TCIP), however, only in a few areas.

6.2 Mapping of Transmodel artefacts to regional standards

6.2.1 Areas mapped to Transmodel

Although the detailed data concept and attribute mapping only covers PT passenger information, some standards include many more business areas. This clause includes four areas where elements of Transmodel are mapped to regional standards:

- General information (no mapping);
- Business areas (includes all business areas beyond the scope of this Technical Report);
- Data concepts and attributes;
- Conformance.

6.2.2 General standard information

The general information related to each standard incorporated in the catalogue included the following questions.

1. What is the standard name?
2. What type is the standard? Semantics/message/abstract/implementation?
3. What is the scope of the standard?
4. What year was the standard published?
5. Has the standard been implemented?
6. Who published the standard?
7. What was the methodology used to develop the standard?
8. Please list a short history of the development process:
9. Please describe the ongoing maintenance:

China	
What is the standard name?	Data Bus Interface Communication Specification of Intelligent Service Terminal for City Bus and Trolley-Bus Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center
What type is the standard? Semantics/message/abstract/implementation?	Data format, data frame, message frame, public transport information gathering/ publishing/ exchanging between intelligent service terminal and expansion of peripheral as well as control centre.
What is the scope of the standard?	Data Bus Interface Communication Specification of Intelligent Service Terminal for City Bus and Trolley-Bus defines the system construction, interface specification between intelligent service terminal and expansion of peripheral for city bus and trolley-Bus. Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center defines the communication protocol, communication connection, message handling, data format, information gathering/ publishing/ exchanging between intelligent service terminal on the city/trolley-Bus and control centre.
What year was the standard published?	Data Bus Interface Communication Specification of Intelligent Service Terminal for City Bus and Trolley-Bus: cd Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center: 2012/11/05
Has the standard been implemented?	Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center: implemented since 2013/04/01 Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center: will be implemented in 37 transit cities this year.
Who published the standard?	Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center: implemented since 2013/04/01 Data Communication Protocol between Intelligent Service Terminal for City Bus and Trolley-Bus and Control Center: will be implemented in 37 transit cities this year.
What was the methodology used to develop the standard?	Defining the public transport information communication and interface specification between intelligent service terminal and expansion of peripheral as well as control centre for city bus and trolley-Bus.
Please list a short history of the development process:	Proposed in February 2013, started on November 2013, form the draft in 2014 and now collecting advices.

China	
Please describe the ongoing maintenance:	Collect advice from the industry to update the standard.

Japan	
What is the standard name?	Standards for Public Transport Information
What type is the standard? Semantics/message/abstract/implementation?	Data format for gathering/publishing/exchanging public transport information
What is the scope of the standard?	Defining the elements and attributes of data format for gathering/publishing/exchanging public transport information
What year was the standard published?	XML1.1ver. 2006
Has the standard been implemented?	Approx. 150 high way bus operators have adopted since 2006
Who published the standard?	Ministry of Land, Infrastructure and Transport
What was the methodology used to develop the standard?	Defining the elements and attributes of data format for static and real-time public transport information
Please list a short history of the development process:	Start study data format in 1997 First field trials to provide bus static information in Yokohama (1997) and Okinawa (2000) Field trials to provide static and real-time information in Sapporo (2000), Gifu/Hiroshima (2002), Nagoya (2004), Kyoto (2005) and Fukuoka/Ooita (2006) Large scale field trials have been carried out in 150 high way bus operators since 2006
Please describe the ongoing maintenance:	Reviewing field trial results and planning for improvements of data format

Korea	
What is the standard name?	Technical Regulation of Bus Information Exchanges (C2C)
What type is the standard? Semantics/message/abstract/implementation?	Messages for exchanging between bus information centers
What is the scope of the standard?	Defining the messages and protocols of information for exchanging bus manage centers (local governments)
What year was the standard published?	"Enacted by MLTM in November 2005
Has the standard been implemented?	Revised in March 2010"
Who published the standard?	Yes. Approx. 60 bus operators have adopted since 2004
What was the methodology used to develop the standard?	Ministry of Land, Transport and Maritime Affairs
Please list a short history of the development process:	Consensus
Please describe the ongoing maintenance:	"MLTM & standardization organization have been studied interfaces and data format since 2000.

US – Transit Communications Interface Profiles	
What is the standard name?	APTA TCIP-S-001 3.0.0, APTA Standard for Transit Communications Interface Profiles
What type is the standard? Semantics/message/abstract/implementation?	Semantics and Message
What is the scope of the standard?	
What year was the standard published?	2006
Has the standard been implemented?	
Who published the standard?	American Public Transportation Association
What was the methodology used to develop the standard?	Consensus
Please list a short history of the development process:	Initially developed by NTCIP (1400 Series), Later replaced by APTA version which incorporated additional material.

US – Transit Communications Interface Profiles	
Please describe the ongoing maintenance:	

NEPTUNE –AFNOR French Ticketing Codification	
What is the standard name?	Profil d'échange NEPTUNE – AFNOR French Ticketing Codification reference NF P 99–506
What type is the standard? Semantics/message/abstract/implementation?	data and message format linked to a data model (Transmodel 4.1 and IFOPT)
What is the scope of the standard?	This data exchange profile has the objective to describe precisely all the data elements necessary for a thorough description of the public transport offer (space and time-related data) in order to be able to present this information to the users in a homogeneous way, independently from the media (internet, paper) and also to exchange this information between multimodal information systems.
What year was the standard published?	2009
Has the standard been implemented?	yes, around 50 (reference implementation together with the software CHOUETTE www.chouette.mobi)
Who published the standard?	AFNOR
What was the methodology used to develop the standard?	standard based on an UML data model and XSD/XML for the data exchange structure and protocol
Please list a short history of the development process:	This standard is based on the European specification TRIDENT (2002), based on Transmodel V4.1. The current version incorporates several features of the IFOPT standard (EN 28701) such as equipment, accessibility and stop typology.
Please describe the ongoing maintenance:	maintenance is ensured by the working group in charge of this particular topic (gt7 of AFNOR CN03)

Service Interface for Realtime Information (SIRI CEN)	
What is the standard name?	Service Interface for Realtime Information (SIRI) EN 15531-1 — Business case EN 15531-2 — Communication EN 15531-3 — Services TS 15531-4 - Facility monitoring service TS 15531-5 - Situation exchange service
What type is the standard? Semantics/message/abstract/implementation?	Data and message format linked to a data model (Transmodel 5.1)
What is the scope of the standard?	SIRI is an exchange format for real-time information about PT services, vehicles, events and facilities. SIRI defines very broadly the concept of real time as being any changes to the information introduced after the timetable publication (SIRI's information scope being limited to one single day). The most widely known SIRI service provides the estimated passing time at a specific stop (Stop Monitoring Service. But SIRI offers many other services: General Messaging Service, Vehicle Monitoring Service, Situation Exchange, Facility Monitoring, Production Timetable Service, Estimated Timetable Service, Stop Timetable Service, Connection Timetable Service and Connection Monitoring Service.
What year was the standard published?	2006
Has the standard been implemented?	Yes, all over Europe, and also worldwide (US, Israel...)
Who published the standard?	CEN TC278/WG3/SG7
What was the methodology used to develop the standard?	Conceptual model relying on Transmodel. SIRI offers a set of Web services (SOAP) for accessing the information. Initially targeted exchanges are mainly inter-system communication (AVMS to passenger information system for example), and SIRI 2 (2014) has completed it with the ability to communicate with end user's devices (mainly mobile phones and web browsers).

Service Interface for Realtime Information (SIRI CEN)	
Please list a short history of the development process:	To provide operators and manufacturers a standard framework to exchange data concerning public transport real time information, CEN TC278/WG3/SG7 decided to launch the SIRI project (Service Interface for Real-time Information) in 2004. It now replaces national standard like RTIG, VDV453, etc.
Please describe the ongoing maintenance:	Maintenance is ensured by CEN TC278/WG3/SG7

Network and Timetable Exchange (NeTEx CEN)	
What is the standard name?	Network and Timetable Exchange CEN/TS 16614-1 Network description CEN/TS 16614-2 Timing information CEN/TS 16614-3 Fare description
What type is the standard? Semantics/message/abstract/implementation?	Data and message format linked to a data model (Transmodel 6)
What is the scope of the standard?	NeTEx is an XML based exchange format and a set of services dedicated to scheduled public transport data. It is based on Transmodel and IFOPT and designed for most public transport business needs, covering passenger information systems, planning systems, AVMS (Automated Vehicle Monitoring Systems) and fare management systems. NeTEx is divided into three parts: • Part 1: network topology (networks, lines, routes, stops, connections and geographic element, etc.). NeTEx Part 1 also provides a framework and reusable objects used by all the other parts. • Part 2: timing information (vehicle journeys passing times, day types, calendars, etc.). • Part 3: Description of the tariff offer (fare product, access rights, usage parameters, prices, etc.).
What year was the standard published?	2014
Has the standard been implemented?	Fast starting implementation (France, Italy, Germany, Netherlands, etc.)
Who published the standard?	CEN TC278/WG3/SG9
What was the methodology used to develop the standard?	Conceptual mode relying on Transmodel. NeTEx shares its communication protocol with SIRI and offers a set of Web services (SOAP) for accessing the information and also a REST based lite access.
Please list a short history of the development process:	To provide operators and manufacturers a European wide standard framework to exchange data concerning public transport scheduled information, CEN TC278/WG3/SG7 decided to launch the NeTEx project in 2009.
Please describe the ongoing maintenance:	Maintenance is ensured by CEN TC278/WG3/SG9

6.2.3 Mapping of business areas

The survey included comparison of each regional standard's business processes relative to Transmodel. The Transmodel business processes include the following:

- network description;
- versions, validity and layers;
- tactical planning;
- schedules and versions;
- vehicle scheduling;
- driver scheduling;

- personnel disposition;
- rostering;
- passenger information;
- operations monitoring and control;
- fare collection;
- management information;
- multimodal operation in public transport;
- multimodal operators' environment.

The business area definitions are described in Transmodel [CEN-Transmodel, pp., 18-204].

Most of the standards are narrowly scoped or segmented into many sets of standards. Similar to Transmodel, TCIP is broadly scoped and provides similar if not of slightly broader scope. [Table 2](#) shows the relationship of the standards included in this catalogue compared to Transmodel's business areas. A more detailed comparison between Transmodel and TCIP detailed business processes is included in [Annex C](#).

Table 2 — Business areas compared to Transmodel

Transmodel business package	US-TCIP	Japan	US-CFMS	AFNOR	Korea	GTFS	SIRI	NeTex
network description	Spatial Data Management Processes	Not Included (N/I)	N/I	X	N/I	N/I	N/I	X
versions, validity and layers	(Limited) Data Configuration	N/I	N/I	X	N/I	N/I	X	X
tactical planning	Scheduling Process	N/I	N/I	X	N/I	N/I	N/I	X
schedules and versions	Scheduling Process	N/I	N/I	X	N/I	N/I	X	X
vehicle scheduling	Scheduling Process	N/I	N/I	N/I	N/I	N/I	N/I	X
driver scheduling	Personnel and Work Assignment Process	N/I	N/I	N/I	N/I	N/I	N/I	N/I
personnel disposition	Personnel and Work Assignment Process	N/I	N/I	N/I	N/I	N/I	N/I	N/I
Rostering	Personnel and Work Assignment Process	N/I	N/I	N/I	N/I	N/I	N/I	N/I
passenger information	Customer Information Process	YES	N/I	X	X	X	X	X
operations monitoring and control	PTV Operations Process	YES	N/I	N/I	X	X	X	N/I
fare collection	Fare Collection (this portion not balloted)	N/I	yes - limited	X	N/I	N/I	N/I	X
management information	Data Repository Operations Process (limited)	YES	N/I	N/I	N/I	N/I	N/I	N/I
multimodal operation in public transport	Limited (covered in related business areas)	N/I	N/I	X	N/I	N/I	X	X
multimodal operators' environment	Limited (covered in related business areas)	N/I	N/I	X	N/I	N/I	X	X
operations management ^a	Security and Incident Management Process	N/I	N/I	N/I	N/I	N/I	X	N/I
	Onboard Vehicle Systems Interactions	N/I	N/I	N/I	N/I	N/I	N/I	N/I
	Transit Signal Priority	N/I	N/I	N/I	N/I	N/I	N/I	N/I

^a Incident management is partly included in operations management

6.2.4 Mapping of data concepts and attributes

Data concepts or “classes” are clearly described by Transmodel. They are more difficult to extract from messaging standards. Topological concepts like STOP POINT are defined by messaging standards in a manner similar to Transmodel. For example, a stop point is described by Transmodel as “A POINT where passengers can board or alight from vehicles” [CEN-Transmodel, 247]. Messaging standards use almost the same description of the topological point. However, there are messages such as Bus Location Information (BusLocationInfo, Korea TR Message) where the definition is a reflection of attributes rather than a conceptual description. More specifically, a one to one data concept mapping is difficult and needs to be defined as a Transmodel Class and Attribute correlation in most cases. To that end, the mapping between specific Transmodel classes and data concepts are not included in this Technical Report, but defined as a detailed Class-Attribute mapping.

The attribute mappings are listed in [Annex B](#).

Mapping of each regional standard is included in a separate Annex as follows:

- [Annex C](#): Korean ATIS;
- [Annex D](#): TCIP;
- [Annex E](#): Japanese ATIS;
- [Annex F](#): GTFS;
- [Annex G](#): NeTEx. (Note that NeTEx is entirely based on Transmodel/IFOPT.);
- [Annex H](#): SIRI.

Additionally, [Annex I](#) contains definitions of Transmodel classes that are related to the provision of public transport information. Although many of the concepts are not used by other international standards, they augment the vocabulary of entities available to describe public transport services.

6.2.5 Description of conformance

Standards conformance testing shows how a system or implementation meets the requirements of the standard. As illustrated in [Table 1](#), a standard may be based on or constrain another standard, and may in turn also be constrained. Similarly, many data messaging standards use multiple standards to describe the semantics, behaviour, coding structure and syntax defined by other standards. Description of conformance includes the conformance statement which details the requirements for implementation, and one or more base standards upon which the conformance rests. For example, many data messaging standards now use web services which are based on XML (XML schema) and Web Services Descriptive Language (WSDL). For each standard in the catalogue, [Table 3](#) includes the conformance statement (if available), and the base standard(s) used to specify the data/message.

Table 3 — Conformance

Standard name	Conformance statement	Base standard
GTFS	Meets the requirements in the GTFS files as described by “File Requirements” https://developers.google.com/transit/gtfs/reference	ObjectType for GTFS-realtime CSV for GTFS
Japan	Specification for standard data format for public transport information.	XML
Korea	Technical Regulation of BUS Information Exchanges (C2C)	ASN.1
NEPTUNE -AFNOR	http://www.chouette.mobi/wp-content/uploads/CHOUETTE_Validation_resume-glossaire-1.pdf http://www.chouette.mobi/neptune-validation/v20/fr/	XML Schema

Table 3 (continued)

Standard name	Conformance statement	Base standard
NeTEx	Conformance requirements are specified for France (not available online for now). Tools will be soon available within CHOUETTE: http://www.chouette.mobi/	XML/XSD SOAP (with WSDL) REST and JSON
SIRI	"Conformance requirements are specified (for France): http://www.normes-donnees-tc.org/wp-content/uploads/2014/05/Profil_Siri_IDF_V2-4-STIF-20130712.pdf Reference implementation is available: http://www.chouette.mobi/ "	XML/XSD SOAP (with WSDL) REST and JSON
US- CFMS	Part 5 of the Standard, Compliance Certification and Testing.	XML for messages between an Agency Central System or sub system and a Regional Central System (clearinghouse). — ISO/IEC 14443 for PICC to card reader communications. — ISO 7816 for PICC ADPU commands. — ISO 3166 for country codes.
US-TCIP	Provide Profile Requirements List (PRL) or Profile Implementation Conformance Statement (PICS) describing tailoring performed (within allowed parameters). Provide all mandatory parameters in messages, and optional parameters as specified in the PICS/PRL. Messages must conform to the TCIP XML Schema, and those of other related standards (e.g. XML). Messages must be sent and received according to the requirements in the pattern definitions for the specified dialog patterns, or according to specified requirements for file transfers. Specified message attributes must be provided.	XML Schema

A range of European standards are based on Transmodel: VDV 452 (Germany), NOPTIS (Sweden), NEPTUNE (France), TransXchange (UK). The mapping may be found in the NeTEx documentation.

7 Assessment

Since this analysis reviewed PT standards of which all or part dealt with the passenger information business area, this review shows only a small slice of their common elements. The areas of greatest commonality included topological concepts such as STOP POINT, ROUTE, LINE, and BLOCK, their physical coordinates (POINT), and the scheduled and estimated time (arrival/departure) associated with the stop point (DATE PASSING TIMES and ESTIMATED PASSING TIME). Additionally, the agency (AUTHORITY or OPERATOR) and the vehicle tracked (VEHICLE and VEHICLE DETECTING) are critical elements to assign to the physical, topological and service concepts.

The concepts mapped to the Transmodel classes and associated attributes that are listed in [Table 4](#). (Note: since NeTEx is an implementation of Transmodel, only the data concept mappings to the other standards are included in the table.)

Table 4 — Mapping to Transmodel classes and attributes

Transmodel class	Transmodel attributes	Standard mapping
ACTUAL VEHICLE EQUIPMENT		SIRI, NeTEx
AUTHORITY or OPERATOR	AuthorityID, authorityName, authorityRef	GTFS, TCIP, SIRI, NeTEx
alightingActivity		GTFS, NeTEx
BEACON POINT, ACTIVATION POINT		Korea ATIS, NeTEx
BLOCK	identifier reference blockRef	GTFS, TCIP, SIRI, NeTEx
boardingActivity		GTFS, NeTEx, NeTEx
CONNECTION LINK	from stop fromStopRef, duration (several types)	GTFS, SIRI, NeTEx
COURSE OF JOURNEYS	id	SIRI, NeTEx

Table 4 (continued)

Transmodel class	Transmodel attributes	Standard mapping
DATA SYSTEM		SIRI, NeTEx
DATED BLOCK		SIRI, NeTEx
DATED PASSING TIMES		TCIP, KOREA ATIS, SIRI, NeTEx
DATED VEHICLE JOURNEY		SIRI, NeTEx
DESTINATION DISPLAY		SIRI, NeTEx
DAY OF WEEK		GTFS, NeTEx
DAY TYPE		GTFS, TCIP, NeTEx
DETECTED DIRECTION		TCIP, NeTEx
DETECTED OPERATION		TCIP, NeTEx, NeTEx
DIRECTION		GTFS, SIRI, NeTEx
ESTIMATED PASSING TIME	ESTIMATED ARRIVAL TIME, ESTIMATED DEPARTURE TIME, EXPECTED WAIT TIME	KOREA ATIS, TCIP, SIRI, NeTEx
FOOTNOTE		TCIP, SIRI, NeTEx
JOURNEY PATTERN	POINT IN JOURNEY PATTERN(:POINT(Id)):TIMETABLED PASSING TIME (timetabled departure time, timetabled arrival time, timetabled waiting time) FOOTNOTE:FOOTNOTE ASSIGNMENT JOURNEY PATTERN:SERVICE PATTERN:STOP POINT IN JOURNEY PATTERN:STOP POINT JOURNEY PATTERN:SERVICE PATTERN:STOP POINT IN JOURNEY PATTERN:STOP POINT JOURNEY PATTERN:VEHICLE JOURNEY:DAY TYPE	TCIP, SIRI, NeTEx
LINE id	lineId, lineRef, lineLongName, lineShortName, description	JAPAN ATIS, GTFS, SIRI, NeTEx
LINK DISTANCE	routeLinkDistance	GTFS, NeTEx
LINK SEQUENCE	sequence	GTFS, NeTEx
LOCATION	coordinate	GTFS, SIRI, NeTEx
MEAN PASSENGER WAIT TIME	duration	GTFS, NeTEx
MODE		GTFS, NeTEx
MONITORED VEHICLE JOURNEY		TCIP, SIRI, NeTEx
NETWORK VERSION	Name	GTFS, TCIP, NeTEx
ROUTE		TCIP, NeTEx
OBSERVED PASSING TIME		SIRI, NeTEx
PASSENGER QUERY	(id)	TCIP, NeTEx
PASSING TIME TIMETABLED ARRIVAL TIME	arrivalTime, departureTime	GTFS, TCIP, NeTEx
PASSING TIME	id, alight, reboard	TCIP, SIRI, NeTEx
PERIOD	endTime, startTime, startDate, endDate	GTFS, NeTEx
PLACE	Start of, End of	TCIP, NeTEx
POINT	ID, name, Coordinates, location attribute coordinates	GTFS, JAPAN ATIS KOREA ATIS, TCIP, SIRI, NeTEx
POINT IN JOURNEY PATTERN		TCIP, NeTEx
PT TRIP		TCIP, NeTEx
RIDEs IN PT TRIP		TCIP, NeTEx
ROUTE	Id, DIRECTION, NAME	TCIP, GTFS, KOREA ATIS, JAPAN ATIS, SIRI, NeTEx
ROUTE LINK	DISTANCE linkDistance	GTFS, NeTEx
ROUTE PROJECTION	identifier reference routeRef	GTFS, NeTEx

Table 4 (continued)

Transmodel class	Transmodel attributes	Standard mapping
SEQUENCE	stopSequence	GTFS, NeTEx
SERVICE JOURNEY		SIRI, NeTEx
SERVICE JOURNEY INTERCHANGE	Duration minimumTransferTime, advertised	GTFS, SIRI, NeTEx
SERVICE PATTERN	(Id)	KOREA ATIS, NeTEx
STOP PLACE ELEMENT	(Identifier of) (will be Assigned to a SCHEDULED STOP POINT) stopPlaceId	GTFS, NeTEx
STOP PLACE	StopPointCode, Description, name	GTFS, NeTEx
STOP POINT	ID, NAME, for alighting, for boarding	GTFS, KOREA ATIS, TCIP, JAPAN ATIS, SIRI, NeTEx
STOP POINT IN JOURNEY PATTERN	NAME	TCIP, SIRI, NeTEx
TARGET PASSING TIME		SIRI, NeTEx
TIMETABLE VERSION		SIRI, NeTEx
TRANSPORT MODE		TCIP, SIRI, NeTEx
TRIP OPTIMIZATION QUERY	OPTIMIZATION MODE, PASSENGER QUERY (PLACE-destination, origin)	TCIP, NeTEx
TRIP PATTERN	Id, (Ordered list of PT TRIPs)	TCIP, NeTEx
TYPE OF EVENT	Description, id	JAPAN ATIS, KOREA ATIS, NeTEx
TYPE OF SERVICE		SIRI, NeTEx
VALIDITY CONDITION	conditionId, conditionRef	GTFS, SIRI, NeTEx
VEHICLE DETECTING	Id, time stamp, type,	JAPAN ATIS, KOREA ATIS, SIRI, NeTEx
VEHICLE JOURNEY	identifier vehicleJourneyId, vehicleJourneyRef	GTFS, SIRI, NeTEx
VEHICLE	Id, vehicle registration number	JAPAN ATIS, KOREA ATIS, NeTEx
VERSION		SIRI, NeTEx
VERSION FRAMES:	NETWORK VERSION FRAME, TIMETABLE VERSION FRAME	TCIP, SIRI, NeTEx

Annex A (informative)

Business plan and survey: Detailed mapping of Transmodel and regional standards

A.1 Purpose and need for a catalogue of worldwide standards on public transport information

The purpose of this business plan is to justify the need for and develop program elements for developing a catalogue of worldwide standard on public transport information. The catalogue will not only list the standards that address public transport information concepts and exchange, but will also compare these standards with respect to a reference data model, list of attributes, conformance, extensibility, and maintenance. In particular, this project will enable ISO/TC 204, as well as the worldwide public transport industry, to assess the consistency and coherence of existing public transport information standards with a high level conceptual view. A significant obstacle to promulgating standards in the international arena is the absence of a reference that ensures that regionally deployed standards may be exchanged among systems of different national “flavours”. This effort will provide a baseline that describes the similarities, differences, sameness and inconsistencies between existing regional and national public transport standards and a reference standard. In developing the catalogue, the worldwide public transport industry will adopt a model from which future regional and international standards may be deployed.

The selection of the standard reference model is an important consideration. To date, there are few national or regional models that have been widely adopted with the breadth and scope to meet the needs of ISO/TC 204. Transmodel (Transmodel), developed by the European Union (CEN TC 278 WG 3), is the most comprehensive and widely accepted model throughout Europe and, as such, should be used as the baseline by which other regional and national standards efforts are compared. While it has been validated for a large number of public transport operators in Europe, this effort will show Transmodel's strengths and weaknesses with respect to its global applicability. In showing its relevance to PT practice, Transmodel may be promulgated as an ISO standard.

A.2 Benefits by region

The benefits to each of the participating national standard bodies are significant. Since a project such as this effort requires commitment and resources from each participant, each participant was asked about the benefits that they expect to derive from such an effort. This section includes benefit statements from many major national stakeholders. Among the delegations included are:

- Canada;
- France;
- Ireland;
- Japan;
- Korea;
- Norway;
- South Africa;
- United Kingdom;

- United States.

A.2.1 Canada benefits statement

This project would be an important source of input for a project now getting underway in Canada. In Quebec, some studies and experiments have been undertaken to define interoperability in the exchange of information amongst various public transit authorities in different regions. However, for now, this work cannot be characterized as standards development work. A new project with this as a goal is now under development. A detailed description of the similarities and differences between TCIP and Transmodel would be a significant benefit for this project. It would also be beneficial to establish some comparisons with road network information systems that already exist and to review the lessons learned from their implementation.

A.2.2 France benefits statement

- (1) Follow-up of the worldwide acceptance of Transmodel (or parts of it) in order to preserve to the extent possible the investment already made:
 - The investment made by the French Ministry of Transport, over a decade to develop the Reference Data Model for Public Transport, now brings recognized benefits for the French Public Transport community with several information systems based on this norm; this investment shall be preserved and any new data model extensions shouldn't be contradictory to the current reference;
 - The French Standardisation Mirror Group recognizes the importance of technical exchanges at the ISO level, particularly before the revision of the current version in year 2011, in order to be aware of / to collect the needs of other countries and to disseminate the norm worldwide.
- (2) Partition of Transmodel into submodels / profiles: the existence of a User's Guide presenting profiles for particular Use Cases may be useful for Transmodel users, provided this work is generic.

The following Use Cases have been cited as being of interest:

- Tactical planning of operations (elaboration of driver / vehicle schedules),
- Operations follow-up (follow up of drivers' work / vehicle performance),
- Passenger information (provision of planned and actual timetables),
- Passenger information (trip planning and passenger guidance – in particular guidance of Visually Impaired Persons),
- Passenger information /safety and security aspects – guidance for passengers and various emergency management and first responders (police, assistance, help, etc.) through complex stops,
- Fare collection (sales of fare products, follow-up of sales and consumption of fare products).

Several Use Cases will rely not only on Transmodel, but also on the technical specification IFOPT (Identification of Fixed Objects in Public Transport) developed within CEN TC278 WG3, in particular on the Stop Place Model.

Potential Use Cases that extend Transmodel have been identified as being of interest to France:

- Demand responsive systems,
- Vehicle fleet management.

A.2.3 Ireland benefits statement

The work of creating the catalogue is of great importance in facilitating inter-operability of many transport-related systems and the secure sharing of data.

A.2.4 Japan benefits statement

The standard public transport information data format has been developed in Japan by the Ministry of Land, Infrastructure and Transport. The major purpose is efficient information provision to the public transport users. The real-time information and fixed information become easily available to the public transport users by using this standard data format. Currently, it is mainly used in bus operators to exchange data efficiently between bus operators and information providers, in addition to the information provision to the bus users. There are several bus operators who even provide real time transfer information between other transport modes.

A main purpose of the standardization of the information data format is efficiency improvement of the information exchange among bus operators and information providers.

The enhancement of information contents, such as access information for the physically handicapped person, real-time transfer information, the route guide, etc. is being planned.

Without having standard basic reference model, developing the standards is time consuming and the confirmation of the optimal solution could not easily be examined.

If the reference basic models based on the Transmodel (Transmodel) are defined and become available, the efficiency of the standardization work will be improved.

Moreover, with referring to those similar existing standards in other nations and regions, the standard development work can be simplified and work load can be decreased, and the standards can be developed in shorter time frame.

A.2.5 Korea benefits statement

We (Korea) have developed and are developing various Public Transport (PT) standards for obtaining interoperability in the PT domain. But due to the lack of a basic reference model for these standards, we have perpetrated inconsistency and conflicts among our standards as well as our standardization activities. In this situation, we need a reference framework standard or specification that provides a foundation for coordinating and understanding of our ongoing standardization efforts. PT objects are the representations of real world actors in the domain of public transit, if we make a general reference standard that includes PT actors (objects/classes), their attributes and relationships in the ISO level, the anticipated benefits are as follows:

- enable an understanding of the contents and meaning of the data across domains and thus promote the sharing of data among different applications;
- promote the efficient, effective and economic use of PT information and associated hardware and software systems;
- contribute to a unified approach to addressing world-wide PT problems.

A.2.6 Norway benefits statement

Norway supports a standards catalogue on Public Transport (PT) information. PT is already, and will also in the future, be a very important part of the worldwide effort to reduce the emissions from individual road transport. To increase the use of PT, the availability, reliability and the quality of PT services has to be improved. New Information and Communication Technologies (ICT) as well as information exchange between PT systems will build the basis for such improvements.

Lots of resources have already been spent to achieve interoperability in regional PT systems. This also includes the Norwegian interoperable electronic ticketing systems now being implemented as well as a national and multi-modal travel planner for public transport. Information exchange is a key word here and a standards catalogue on information exchange will be used as valuable input to the continuous work on developing and improving PT ICT services.

A.2.7 South Africa benefits statement

This project will assist South Africa who is in the stage of adopting a number of ITS standards. There are a number of large ITS projects not only in Public Transport but in traffic management and traffic control as well that are currently being planned and implemented.

A catalogue of nature will assist the country with very stretched resources to quickly identify and access appropriate standards for adoption and implementation.

A.2.8 United Kingdom benefits statement

The UK view is that Transmodel is a universally applicable data reference model, and the proposed catalogue is expected to endorse that view and to provide indications of where other local data models (where they exist in any formal sense) might be mapped to Transmodel. It will also provide a basis for the many information systems that have no data model to recognize the modelling structure which is implicit in those systems, mapping them to the concepts in Transmodel. In so doing the work to create the catalogue will help to provide an extended international validation of Transmodel (and an indication of any areas which require further development to meet needs and approaches not previously identified elsewhere) - and it is expected to secure a worldwide commitment to the adoption and maintenance and enhancement of Transmodel as a universal data reference model for public transport - thereby capitalizing on the considerable European investment that has already been made in it over the past 15-years.

A.2.9 United States benefits statement

A standards catalogue will enable the US transit industry to measure the scope and details of TCIP with respect to standards being developed world-wide. A significant outcome would be a detailed description of the similarities and differences between TCIP and Transmodel. A preliminary analysis has shown that Transmodel is richer in describing the semantics (meaning) and relationships among data concepts, while TCIP is richer in describing the attributes of the data concepts and more formal in describing syntax (format and organization) of messages and dialogs. Interoperability requires both formal semantic, syntactic message descriptions, and a defined sequence for exchanging messages. The US transit industry will benefit from a conceptual view of transit data as described by Transmodel, a conceptual view that defines referential integrity rules and validity checks that are associated with a semantic model.

A.3 Justification for ISO work

This effort will result in significant benefits for international standards development. The effort will:

- Facilitate and promote international cooperation in the area of worldwide public transport standard activities.
- Encourage the PT industry to adopt a coherent and consistent Reference Data Model standard for PT where operators will benefit from a larger market base, lowering costs and enhancing interoperability among the systems they procure.
- Enhance economic trade by enabling standards to apply across country boundaries.
- Support PT to build interoperable applications that will work across country boundaries.

A.4 Project work plan

The Project work plan (hereafter referred to as the Plan) addresses the tasks required to develop a catalogue of worldwide standards on public transport information. The Plan consists of education, outreach and technical analysis. The education and outreach effort will focus on articulating the objectives and benefits of the effort for the PT industry and soliciting input from national delegations. The technical analysis effort will focus on comparing the various national information exchange

standards with Transmodel, as well as summarizing information related to other categories of standard development practice.

- Task 1: Outreach/Education:
 - Develop materials that explain the purpose, objectives and benefits of the project to recruit participation by national delegations.
 - Identify contact persons in national delegations who will assume responsibility for participating in the effort.
 - Invite and offer one or more workshops on Transmodel and method for comparing it with a public transport information exchange standard. (This activity should be paired with the output from Task 2).
 - Provide technical assistance from Transmodel experts.
- Task 2: Scope of mapping:
 - For the purpose of prioritizing resources, identify target business areas for analysis.
 - Develop and approve criteria and methods for analysis.
 - Select validation and analysis teams.
 - Update survey (see [Annex B](#) for preliminary survey).
- Task 3: Mapping regional standards:
 - Acquire survey results from national / regional standard experts. (Note: each national body should complete survey on their national / regional standard.)
 - Support delegations in completing surveys, particularly in comparing data concepts and attributes from their standard to Transmodel.
 - Collect and compile surveys.
 - Analyze and validate findings.
 - Discuss and approve analysis in working group.
- Task 4: Impacts on Transmodel and regional standards:
 - Document findings in draft Technical Report (see [Annex A](#) for catalogue outline).
 - Submit new project (working draft).
 - Review comments on new project.
 - Submit committee draft.
 - Review comments on committee draft.
 - Prepare presentation(s).
 - Present to ISO/TC 204 and other national standard bodies as needed.
- Task 5: Alternatives to harmonize Transmodel and regional standards:
 - Describe alternative approaches for harmonizing worldwide standards.
 - Develop a report on the alternative approaches and a plan for moving forward.
 - Working group considers Plan for moving forward.

A.5 Deliverables

- Task 1
 - outreach flyer (benefits and objectives)
 - workshop materials
- Task 2
 - survey and instructions
 - criteria and methods paper
- Task 3
 - survey submittals (and compiled surveys)
 - survey analysis (presentation / paper)
- Task 4
 - executive presentation on Technical Report
 - draft Technical Report catalogue (new project)
 - respond to new project comments
 - draft Technical Report catalogue (committee draft)
 - respond to committee draft comments
 - publish final Technical Report catalogue
- Task 5
 - harmonization options report
 - plan for moving forward

A.6 Schedule

	4/08	7/08	10/08	1/09	4/09	7/09	10/09	1/10	1/10	4/10	7/10	10/10	1/11
Task\Month	0	3	6	9	12	15	18	21	24	27	30	33	36
Task 1 workshops	x		x		x								
Task 1 Tech Asst													
Task 2 Criteria													
Task 3 Complete Survey													
Task 3 Analysis													
Task 4 TR draft													
Task 4 NP													
Task 4 CD													
Task 4 TR final													x
Task 5 Options Report													
Task 5 Plan													

A.7 Resources needed

This section describes the types of contributions requested of national and regional delegations as well as the skills of individuals allocated to the effort. The resources needed to achieve this effort may be substantial depending on the number of standards that are submitted for inclusion in the catalogue.

A.7.1 Contributions from national delegations

Contributions from the delegations include:

- Identify applicable standards that meet the criteria for inclusion in the catalogue.
- Assign individual responsibility for participation in meetings and discussions.
- Assign individual responsibility for completing survey (see experience and expertise of volunteers for skill set requirements).
- Complete survey (see [Annex B](#)).
- Review ISO/TC 204 validation and analysis.
- Review Technical Report.
- Participate in alternatives report and plan for moving forward discussions.

This list does not preclude a delegation from offering additional services and contributions. Some delegations may not have resources for fully completing the survey. However, it is worthwhile to

identify related national standards that fall within the scope of catalogue (sections 1 through 3 of the survey) even if resources are not available to complete survey sections 4 and 5.

In applying ISO policy, the descriptions and analysis will be documented in English.

A.7.2 Experience and expertise of participants

The persons assigned to the two major roles should represent their national delegations. The individual assigned responsibility for completing the survey should understand their national information standards and be familiar with Transmodel functional requirements, data concepts and attributes. In addition, it would be helpful if they are familiar with how to transform a conceptual data model to an implementation representation. Transmodel and ISO/TC 204 experts will be available to provide technical support as needed.

A.8 Survey for catalogue data collection

1. Contact information

Contact Name
Contact Address
Country (Developed Standard)
Contact Email

2. Development process information

What is the standard name?
What type is the standard? [semantics/message/abstract/implementation]
What is the scope of the standard?
What year was the standard published?
Has the standard been implemented?
Who published the standard?
What was the methodology used to develop the standard?
Please list a short history of the development process.
Please describe the ongoing maintenance.

3. Business area comparison

Please associate and compare your standard's business processes to the Transmodel. list all that apply. Add new cells to your standard business processes that are not covered by Transmodel.

Transmodel Business Package
Network Description
Versions, Validity And Layers
Tactical Planning
Schedules and Versions
Vehicle Scheduling
Driver Scheduling
Personnel Disposition
Rostering
Passenger Information
Operations Monitoring And Control
Fare Collection
Management Information
Multimodal Operation in Public Transport
Multimodal Operators' Environment

4. Data concept comparison

Please associate and compare your standard's data concepts/entities/classes to the Transmodel. List all that apply. Add new cells to your standard data concepts that are not covered by Transmodel.

(See data concept list in database/spreadsheet.)

5. Attribute comparison

Please associate and compare your standard's attributes to the Transmodel. list all that apply. Add new cells to your standard attributes that are not covered by Transmodel.

(See attribute list in database/spreadsheet.)

6. Conformance requirements

Please list Conformance Requirements for the standard
Please list base standards used (e.g., XML)

Annex B (informative)

US transit communications interface profiles comparison to Transmodel high level business areas

The high level business area comparison shows the similarities between Transmodel and TCIP across all business areas. The detailed topics are grouped into different categories. [Table B.1](#) shows the detailed subprocesses that are mapped from TCIP to Transmodel. In the first two columns the bolded lettering signifies the high level process while the subprocesses are included below the process names. For example, the TCIP Spatial Data Management Process contains four subprocesses: Data Creation or Collection; Maintenance and Management of Spatial Data; Geoprocessing; and Data Output and Distribution. Transmodel's similar or equivalent Network Description subprocesses include:

- Elements of Topology;
- Infrastructure Description;
- Restrictions;
- Combined Diagram on Topology;
- Additional Aspects to Point;
- Generic Network Concepts;
- Combined Diagram on Generic Network Concepts;
- Network Linear Features;
- Combined Diagram on Network Linear Features;
- Projection;
- GDF Interface.

The last column describes the differences between the two standards.

Table B.1 — TCIP and Transmodel high level business area comparison

TCIP Business Processes	Transmodel Requirements and Business Packages	Comparison between TCIP/Transmodel
Spatial Data Management Process Data Creation or Collection Maintenance and Management of Spatial Data Geoprocessing Data Output and Distribution (based on geographic standards such as ISO 19100-series and OGC/GML, including the Location Referencing Message Specification and GML's GeoSpatial One-Stop specifications)	Network description Elements of Topology Infrastructure Description Restrictions Combined Diagram on Topology Additional Aspects to Point Generic Network Concepts Combined Diagram on Generic Network Concepts Network Linear Features Combined Diagram on Network Linear Features Projection GDF Interface	TCIP based on ISO 19100-series abstract and implementation standards. Transmodel interfaces with GDF and defines a similar spatial abstract model (although not as complete) as the ISO 19100-series standards. CEN IFOPT contains information on geo-spatial information related to public transport domain-specific locations.
(The Data Configuration Management includes similar procedures related to managing version "tables" such as metadata associated with "rows".	Versions, validity and layers Version Frames Versions Other Aspects Combined Diagram on Versions Explicit Versions	Transmodel and TCIP both enable versioning of artefacts or entities.

Table B.1 (continued)

TCIP Business Processes	Transmodel Requirements and Business Packages	Comparison between TCIP/Transmodel
Scheduling Process Data Gathering for Schedule Writing Developing Scheduling Products Distributing Scheduling Products	Tactical planning components Days Journeys Standard Times Journey Times Driver Trips Interchanges Timing Computation of a Journey Schedules and versions Main Types of Schedules and Versions Combined Schedules and Versions Vehicle scheduling Tactical Resource Planning Resources for Tactical Planning Vehicle Planning Vehicle Requirements	The relevant content of TCIP is similar, which does not support the route groupings.
Personnel and Work Assignment Management Process Operator Assignment Definition Pick Process Distribution of Bound Assignments Changes to Operator Assignments	Driver scheduling Duties Other Aspects of Duties Personnel disposition Driver Assignments Driver Accounting Rostering Roster Matrices Roster Cycles Roster Designs Roster Assignments	Similar in scope

Table B.1 (continued)

TCIP Business Processes	Transmodel Requirements and Business Packages	Comparison between TCIP/Transmodel
Asset Management Process PTV Pull In to Garage Fuelling/Service Cleaning Scheduled Service and Inspections Unscheduled Maintenance Overhaul/Contact/Manufacturer Maintenance Garage Parking Management & Vehicle Assignment Pull Out Subprocess En Route Failures Synchronization/Calibration		Not included in Transmodel
Customer Information Process Customer Information Subprocesses Customer Pretrip Planning Itinerary Generation Other Planning Data Printed Planning Material Customer Information-Station/Stop Subprocess Inform Passengers Subprocess Customer Information – Ongoing Subprocess Customer Complaints Inform Customers Ongoing Subprocess – Lost and Found Customer Information Ongoing Subprocess – Customer Subscriptions and Profiles	Passenger information Provision of Information Spatial Information Timetable Information Passenger Trip Planning Estimation of Trip Duration Other Information	TCIP supports distribution of marketing materials and lost/found processes.

Table B.1 (continued)

TCIP Business Processes	Transmodel Requirements and Business Packages	Comparison between TCIP/Transmodel
PTV Operations Process Preparation for Vehicle Operations Normal PTV Operations Exceptions to Normal Operations Close Out of Normal Operations Non PTV Closeouts Security and Incident Management Process Management Planning Management Process Preparation Stage Management Process Incident Detection, Classification, and Verification Stage Notification Stage Response Stage Recovery Stage Follow Up Stage	Operations monitoring and control Dated Operational Plans Resource Detection and Monitoring Vehicle Assignments Monitored Operations Control Actions Events Messages	Although TCIP covers a broader scope in its process description, it covers the same scope as Transmodel with respect to data concepts.
Revenue and Fare Collection Process Data Repository Operations Process Data Storage Data Validation Data Integration Reporting and Archiving Data Distribution	Fare collection Management information Service Journey Performance Recorded Use of Services Multi-modal Operation in Public Transport Domain Definition and Limits Network Description Resource Management Vehicle Coupling Operations Other Aspects	Not reviewed TCIP covers the requirements of the data repository, not the content, whereas Transmodel covers the performance data and its representation. TCIP covers many of the Transmodel concepts in other business processes although not as conceptual models.
Transit Signal Priority Process		Not covered by Transmodel

Table B.1 *(continued)*

TCIP Business Processes	Transmodel Requirements and Business Packages	Comparison between TCIP/Transmodel
	Multi-modal operation in public transport Network Description Resource Management Vehicle Coupling Operations Other Aspects	TCIP covers many of these elements in other business processes.
	Multiple operators' environment Owners and Users of Resources and Network Information from Different Sources Interchanges Fare Collection Functions	TCIP covers some of these elements in other areas such as owners/users of resources within the data frames and messages.

Annex C (informative)

Korea ATIS Class-Attribute comparison to Transmodel

This Annex provides a mapping of Transmodel to the Korean ATIS standard.

Table C.1

TM Class Name	TM Definition	TM Sub-type of	TM Key	TM Attribute	TM Opt	Korea Standard Name	Korea Standard Class	Korea Standard Attribute	Compare
BEACON POINT	A POINT where a beacon or similar device to support the automatic detection of vehicles passing by is located.	ACTIVATION POINT				NodeZoneID		ID	
ESTIMATED PASSING TIME	Time data, calculated from the latest available input, about when a public transport vehicle will pass a particular POINT IN JOURNEY PATTERN on a specified MONITORED VEHICLE JOURNEY. These are mainly used to inform passengers about expected times of arrival	DATED PASSING TIME	.	EXPECTED ARRIVAL TIME	Y	AccesspointArrivalTime		seconds	
POINT	A 0-dimensional node of the network used for the spatial description of the network. POINTs may be located by a LOCATION in a given LOCATING SYSTEM.		#	ID	N	LastBITIdentify		ID	
ROUTE	An ordered list of located POINTs defining one single path through the road (or rail) network. A ROUTE may pass through the same POINT more than once.		#	ID	N	SubRouteIdentity RouteGuide		ID	
ROUTE			.	NAME	Y	SubRouteName		NAME(OPTION)	
STOP POINT	A POINT where passengers can board or alight from vehicles.		.	FOR ALIGHTING	Y	BITIdentify		ID	
STOP POINT			.	FORBOARDING	Y	BITIdentify		ID	
TYPE OF EVENT	A classification of EVENTS (e.g. ALARMS, INCIDENTS) according to their cause of effect.		#	ID	N	IncidentType		code	Break down, Accident, emergency, incident in vehicle, control, permit
VEHICLE	A public transport vehicle used for carrying passengers.		#	ID	N	PTVehicleID		ID	
VEHICLE DETECTING	An activity consisting in the identification of a vehicle at a certain time by a detection device and of collecting crude data such as an absolute location of the vehicle.		#	ID	N	PTVehicleCoordinate		GPS Data(OPTION)	
VEHICLE DETECTING			.	TIMESTAMP	N	PTVehicleCollectedTime		TIME(OPTION)	

Annex D (informative)

TCIP Class-Attribute comparison to Transmodel

This Annex provides a mapping of Transmodel classes to TCIP messages/frames and data elements. Descriptions of each column are:

- Transmodel Class: the name of the concept or a derived concept from the data model.
- Transmodel diagram number: Data model that shows the relationships among Transmodel entities.
- TCIP Message or Frame: The message that conveys a concept or service.
- TCIP Data Element: A TCIP attribute that is part of a message.
- Comparison / Comment: Describes how Transmodel maps to the TCIP concept.

Six TCIP Messages and Frames were used to compare TCIP Passenger Information concepts to Transmodel. They include:

- ATIS:BoardingInstructions (message).
- PIItineraryFareSub (frame).
- PIScheduleAdherenceCountdown (message).
- PiTextTimetable (message).
- PiTripItineraryListSub (frame).
- SubRoute (frame).
- PiTripItineraryList (message).

Each TCIP attribute of a message or frame is mapped to a Transmodel class. Since TCIP is rich in attributes and Transmodel in entities, Transmodel concepts are captured within its data model. A *derived* relationship implies that the Transmodel concept may be understood through the relationship between entities rather than a single entity.

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Table D.1 (continued)

Transmodel Class	Transmodel diagram number	TCIP Message or Frame	TCIP Data Element	Comparison / Comment
JOURNEY PATTERN:POINT IN JOURNEY PATTERN:TIMETABLED PASSING TIME (timetabled departure time, timetabled arrival time, timetabled waiting time)	D47	ATIS:BoardingInstructions	Timing information (boardingTime, departureTime, arrivalTime)	
JOURNEY PATTERN:SERVICE PATTERN:STOP POINT IN JOURNEY PATTERN:STOP POINT	IFOPT - Stop Point Assignment	ATIS:BoardingInstructions	Stoppoint information (platformNumber, gateNumber, stoppoint)	(which is equal to the POINT IN JOURNEY PATTERN)
JOURNEY PATTERN:VEHICLE JOURNEY:DAY TYPE	D25-26	PiTextTimetable	Service Day Information (day-types, day-type-description)	(refer to D.26-D.27)
MONITORED VEHICLE JOURNEY	D41	PIScheduleAdherenceCountdown	vehicle	Assigned to a vehicle (see assignment diagram, see Figure 42 on right hand side)
n/a	IFOPT - Stop Point Assignment	PIScheduleAdherenceCountdown	gate-bay	BOARDING POSITION (in IFOPT) connected to a STOP POINT
n/a	D.48 PASSING TIMES	PIScheduleAdherenceCountdown	comment	
n/a	D.48 PASSENGER TRIPS	PiTriptineraryListSub	maps	
n/a	D.48 PASSING TIMES	PiTextTimetable	Other data (map, other-info)	
NETWORK VERSION:ROUTE	D40	PiTextTimetable	Schedule Version information (schedule-identifier)	may be also TIMETABLE VERSION (id) (if timetable for OPERATING DAY — the PRODUCTION PLAN (id))
PASSENGER QUERY (id): FARE QUERY	D.45 PASSENGER QUERY	PiTriptineraryFareSub	Result of a trip itinerary request (piTriptinerarySub)	
PLACE (end of)	D.48 PASSENGER TRIPS	SubRoute	destination	
PLACE (start of)	D.48 PASSENGER TRIPS	SubRoute	origin	
PT TRIP	D.48 PASSENGER TRIPS	TCIP PiTriptineraryList	TCIP PiTriptineraryList	
PT TRIP	D.48 PASSENGER TRIPS	PiTriptineraryListSub	estimatedTravelTime	Derived from the PT TRIP, first STOP POINT and the PASSING TIME (TIMETABLED or TARGET) at this point with the time constraint given by the user
PT TRIP	D.48 PASSENGER TRIPS	PiTriptineraryListSub	startTime, endTime	This is derived from the PT TRIP, the SERVICE JOURNEYS, and the PASSING TIMES (TIMETABLED or TARGET or even ESTIMATED if available)
PT TRIP	D.48 PASSENGER TRIPS	PiTriptineraryListSub	distance	This is derived from the global length of the PT TRIP (lengths of the different RIDES and CONNECTION LINKS)

Table D.1 (continued)

Transmodel Class	Transmodel diagram number	TCIP Message or Frame	TCIP Data Element	Comparison / Comment
RIDES IN PT TRIP	D49	SubRoute	estimatedTravelTime	Can be computed from PT TRIP segments and origin and destination ACCESS LINKS
ROUTE	D14	PIScheduleAdherenceCountdown	Route	(connected to JOURNEY PATTERN: SERVICE PATTERN: STOP POINT IN JOURNEY PATTERN: STOP POINT)
ROUTE(ID) OR LINE(name)	D.48 PASSENGER TRIPS; D.49 Mean Trip Duration	ATIS:BoardingInstructions	Route information (routeName)	
ROUTE(id):DIRECTION	D14	PiTextTimetable	Route Information (route, direction)	which is equivalent to a JOURNEY PATTERN:SERVICE PATTERN:STOP POINT IN JOURNEY PATTERN (refer to D.14 Routes and D.15 Journey Patterns)
SERVICE PATTERN(id)	D47	PIScheduleAdherenceCountdown	trip	
STOP POINT	D2	PIScheduleAdherenceCountdown	Stoppoint	(or RECORDED STOP, connected to OBSERVED PASSING TIME: ESTIMATED PASSING TIME)
STOP POINT IN JOURNEY PATTERN	D47	PIScheduleAdherenceCountdown	nextArrivalCurrentLocationName	
STOP POINT IN JOURNEY PATTERN(name)	D15, D47	PIScheduleAdherenceCountdown	destination	
TRANSPORT MODE	D57	PiTextTimetable	mode	
TRANSPORT MODE	D.48 PASSENGER TRIPS	PiTriptineraryListSub	mode	
TRIP OPTIMIZATION QUERY: OPTIMIZATION MODE	D.45 PASSENGER QUERY	PiTriptineraryListSub	preference (TriptPreferences);selectionCriteria --	
TRIP OPTIMIZATION QUERY: OPTIMIZATION MODE	D.45 PASSENGER QUERY	PiTriptineraryListSub	preferredRoadType	
TRIP OPTIMIZATION QUERY: OPTIMIZATION MODE	D.45 PASSENGER QUERY	PiTriptineraryListSub	specialAbilities	
TRIP OPTIMIZATION QUERY: OPTIMIZATION MODE	D.45 PASSENGER QUERY	PiTriptineraryListSub	amenities: [at stops or on vehicle]	
TRIP OPTIMIZATION QUERY: OPTIMIZATION MODE	D.45 PASSENGER QUERY	PiTriptineraryListSub	constraints (TriptConstraints): modes; needs; vehicleRestrictions; otherNeeds; vehicleNeeds	
TRIP OPTIMIZATION QUERY: PASSENGER QUERY	D.48 PASSENGER TRIPS	PiTriptineraryListSub	TriptRequest	A solution is one or more TRIP PATTERNS from/to PLACES. There are isomorphic issues with the model because the TRIP PATTERN may be from PLACE to PLACE, or served by one or more PT TRIPS.
TRIP OPTIMIZATION QUERY: PASSENGER QUERY: PLACE (destination)	D.48 PASSENGER TRIPS	PiTriptineraryListSub	destination	

Table D.1 (continued)

Transmodel Class	Transmodel diagram number	TCIP Message or Frame	TCIP Data Element	Comparison / Comment
TRIP OPTIMIZATION QUERY: PASSENGER QUERY: PLACE (origin = STOP POINTS)	D.48 PASSENGER TRIPS	PiTripItineraryListSub	origin	
TRIP PATTERN (Ordered list of PT TRIPS)	D.48 PASSENGER TRIPS	SubRoute	ordered set of segments	
TRIP PATTERN:Id	D.48 PASSENGER TRIPS	SubRoute	Name	
USER PROFILE	D52	PiTripItineraryListSub	Profile (customer profile) How many travellers; Rider characteristics; Where to respond to request; Fare Constraints; What type of fare media; Location of fare transaction (pre-pay vs. on-board)	User profile, commercial profiles. See in Fare Collection D.52 Usage Parameters.
VERSION FRAMES: NETWORK VERSION FRAME, TIMETABLE VERSION FRAME	D21	PlScheduleAdherenceCountdown	metadata	VERSION FRAMES describe groupings of versioned objects originating from the same DATA SYSTEM and belonging to the same TYPE OF FRAME (Examples of VERSION FRAMES: NETWORK VERSION FRAME, TIMETABLE VERSION FRAME, etc.) Explicit frames modelling is enhanced in NETEx.

Annex E (informative)

Japanese ATIS Class-Attribute comparison to Transmodel

This Annex provides a mapping of Transmodel classes to Japanese ATIS class-attributes.

Table E.1

TM Class	TM Definition	TM Attribute	Japanese Standard Class Name	Japanese Standard Attribute
LINE	A group of ROUTEs which is generally known to the public by similar name or number.	ID NAME	Service line/route	ID Name Pronunciation Type Average waiting time One way Code Destination ID
LOCATION	The position of a POINT with a reference to a given LOCATING SYSTEM.	COORDINATE_1 COORDINATE_2 COORDINATE_3	Section line coordinates	Coordinate#1 Coordinate#2 Coordinate#3
MEAN PASSENGER WAIT TIME	An estimated mean waiting time for a passenger at a SSTOP POINT, used to calculate the approximate duration of a trip. This value is estimated from the mean interval between vehicles on a JOURNEY PATTERN or a COMMON SECTION.	DURATION	Average waiting time	Unit in minute It is half of an average interval of train/bus services.
NETWORK VERSION	A set of network data (and other data logically related to these) to which the same VALIDITY CONDITIONS have been assigned.	NAME	Last updated date	YYYY-MM-DD YYYY: Year MM: Month (1 through 12: add 0 on top of it if it is one digit) DD: Day (1 through 31: add 0 on top of it if it is one digit)
PASSING TIME	Time data concerning public transport vehicle passing a particular POINT; e.g. arrival time, departure time, waiting time.	ID ALIGHT AND REBOARD	Bus stop arrival/ departure/ passing time	hh:mm:ss:sss hh: hour mm: minute ss: second , can be omitted sss: mili second , can be omitted
POINT	A 0-dimensional node of the network used for the spatial description of the network. POINTs may be located by a LOCATION in a given LOCATING SYSTEM.	ID NAME	Section physical route station/stop#1	Station/Stop ID