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Javni prevoz - Referenčni podatkovni model - 2. del: Omrežje javnega prevoza

Public transport - Reference data model - Part 2: Public transport network

Öffentlicher Verkehr - Datenreferenzmodell - Teil 2: Netzwerk des öffentlichen Verkehrs

Transports publics - Modèle de données de référence - Partie 2: Réseau de transports en commun

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Public transport - Reference data model - Part 2: Public transport network

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This European Standard was approved by CEN on 5 May 2016.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 12896-2:2016) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2017, and conflicting national standards shall be withdrawn at the latest by March 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document together with documents EN 12896-1:2016 and EN 12896-3:2016 supersedes EN 12896:2006.

The series composed of the following documents:

Public transport - Reference data model - Part 1: Common concepts

Public transport - Reference data model - Part 2: Public transport network

Public transport - Reference data model - Part 3: Timing information and vehicle scheduling

Public transport - Reference data model - Part 4: Operations monitoring and control

Public transport - Reference data model - Part 5: Fare management

Public transport - Reference Data model - Part 6: Passenger information

Public transport - Reference data model - Part 7: Driver management

Public transport - Reference data model - Part 8: Management information and statistics

Together these create version 6 of the European Standard EN 12896, known as “Transmodel” and thus replace Transmodel V5.1.

The split into several documents intends to ease the task of users interested in particular functional domains. Modularisation of Transmodel, undertaken within the NeTEx project, has contributed significantly to this new edition of Transmodel.

In addition to the eight Parts of this European Standard an informative Technical Report (Public Transport – Reference Data Model – Informative Documentation) is also being prepared to provide additional information to help those implementing projects involving the use of Transmodel. It is intended that this Technical Report will be extended and republished as all the eight parts are completed.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Part 1 of this standard presents the following items:

— rationale for the Transmodel Standard;

— use of the Transmodel Standard;

— applicability of the Transmodel Standard;

— conformance statement;

— transmodel origins ;

— reference to the previous version and other documents.

The data structures represented in Part 1 are generic patterns that are referenced by different other parts. This particular document (Part 2) represents a new edition of EN 12896:2006 of the chapter “description of the network”. Moreover, it incorporates the major part of the IFOPT standard model of stop places and related concepts as updated and harmonized within the NeTEx project.

1 Scope

1.1 General scope of the Standard

The main objective of the present Standard is to present the public transport reference data model based on:

— the public transport reference data model published 2006 as EN 12896 and known as Transmodel V5.1;

— the model for the Identification of Fixed Objects for Public transport, published 2009 as EN 28701and known as IFOPT;

incorporating the requirements of

— EN 15531-1 to 3 and CEN/TS 15531-4 and CEN/TS 15531-5, *Service interface for real-time information relating to public transport operations (SIRI)*;

— CEN/TS 16614-1 and CEN/TS 16614-2, *Network and Timetable Exchange (NeTEx)*;

in particular the specific needs for long distance train operation.

Particular attention is drawn to the data model structure and methodology:

— the data model is described in a modular form in order to facilitate understanding and use of the model;

— the data model is entirely described in UML.

In particular, a reference data model kernel is described, referring to the data domain:

— network description: routes, lines, journey patterns, timing patterns, service patterns, scheduled stop points and stop places.

— This part corresponds to the network description as in Transmodel V5.1 extended by the relevant parts of IFOPT.

— Furthermore, the following functional domains are considered:

  — timing information and vehicle scheduling (runtimes, vehicle journeys, day type-related vehicle schedules);

  — passenger information (planned and real-time);

  — operations monitoring and control: operating day-related data, vehicle follow-up, control actions;

  — fare management (fare structure and access rights definition, sales, validation, control);

  — management information and statistics (including data dedicated to service performance indicators);

  — driver management:

    — driver scheduling (day-type related driver schedules);

— rostering (ordering of driver duties into sequences according to some chosen methods);

— driving personnel disposition (assignment of logical drivers to physical drivers and recording of driver performance).

The data modules dedicated to cover most functions of the above domains will be specified. Several concepts are shared by the different functional domains. This data domain is called “common concepts”.

1.2 Functional domain description

The different functional domains taken into account in the present Standard and of which the data have been represented as the reference data model are described in “Public transport reference data model - Part 1: Common concepts”.

They are:

— public transport network and stop description;

— timing information and vehicle scheduling;

— passenger information;

— fare management;

— operations monitoring and control;

— management information;

— personnel management: driver scheduling, rostering, personnel disposition.

The aspects of multi-modal operation and multiple operators’ environment are also taken into account.

1.3 Particular Scope of this Document

The present European Standard entitled “Reference data model for Public transport – Part 2: Public transport network” incorporates data structures which form the network topology description of Transmodel V5.1 and the major part of the fixed objects model of IFOPT. It is composed of three data packages:

— network description;

— fixed objects;

— tactical planning components.

The data structures represented in this part form network topology descriptions. They typically reference to structures as described in the “Public transport - Reference data model - Part 1: Common concepts”, such as version frames or generic grouping mechanisms.

This document itself is composed of the following parts:

— Main document (normative) representing the data model for the concepts shared by the different domains covered by Transmodel;

— Annex A (normative), containing the data dictionary, i.e. the list of all the concepts and attribute tables present in the main document together with the definitions;

— Annex B (informative), indicating the data model evolutions.

2 Normative references

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

EN 12896-1:2016, *Public transport - Reference data model - Part 1: Common concepts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12896-1:2016 apply.

4 Symbols and Abbreviations

DRT	Demand responsive transport
FTS	Flexible transport service
GIS	Geographic information system
IFOPT	Identification of fixed objects in public transport
ISO	International standards organization
IT	Information technology
NeTEx	Network and Timetable Exchange
PT	Public transport
PTO	Public transport operator
SIRI	Service Interface for Real-time Information
UML	Unified modelling language
URI	Uniform resource identifier
URL	Universal resource locator
VDV	Verband Deutscher Verkehrsunternehmen (D)
WGS	World geodetic standard

5 The Network Topology Domain

5.1 Introduction

The reference data model includes entity definitions for different types of points and links as the building elements of the topological network. Stop points, timing points and route points, for instance, reflect the different roles one point may have in the network definition: whether it is used for the definition of (topological or geographical) routes, as a point served by vehicles when operating on a line, or as a location against which timing information like departure, passing, or wait times are stored in order to construct the timetables.

The line network is the fundamental infrastructure for the service offer, to be provided in the form of vehicle journeys which passengers may use for their trips. The main entities describing the line network in the reference data model are the line, the route and the journey pattern, which refer to the concepts of an identified service offer to the public, the possible variants of itineraries vehicles would follow when serving the line, and the (possibly different) successions of stop points served by the vehicles when operating on the route.

The model delivers also a detailed geographical representation of stopping locations and related concepts, such as equipment, access and navigation paths taken from the IFOPT standard and harmonized with Transmodel within the NeTEx project., including the description of:

— the stops and stations at which transport is accessed together with accessibility characteristics;

— the points of interest from/to which passengers are travelling;

— the detailed navigation paths between the various locations and associated constraints;

— the equipment and services relevant for public transport actors;

— the parking locations relative to both stops and points of interest.

5.2 Model and document structure

The Network Topology models split into three main sub-models.

a) network description model (ND);

b) fixed object model (FO);

c) tactical planning components model (TP).

Network description model: describes infrastructure elements (different types of points and links) and paths (routes and lines) dedicated to (regular and flexible) public transport operation; this description may be considered as a macroscopic view of the network topological aspects of the network. The model splits into:

— network infrastructure model;

— line network model;

— route model;

— flexible network model;

— activation model;

— vehicle and crew point model.

Fixed object model: describes geographical aspects of fixed elements such as stopping locations, or points of interest. It represents, in particular, a detailed view of the stopping places, and associated elements, such as services or equipment, but also concepts enabling the representation of the navigation through or access to the stops. The model splits into:

— site model;

— stop place model;

— flexible stop place model;

— point of interest model;

— equipment description model;

— path and navigation path model;

— check constraint model;

— parking model;

— vehicle stopping model;

Tactical planning components model: describes basic concepts related to the description of the work patterns of public transport vehicles, such as journey patterns and service patterns, useful for planning transport and some related aspects. This part describes the space-related aspects of the vehicle services, whereas the time-related aspects (vehicle journeys, run times, etc) are described in Part 3 – Timing Information and Vehicle Scheduling. The model splits into:

— journey pattern model;

— timing pattern model;

— service connection model;

— service pattern model;

— common section model;

— routing constraint model;

— time demand type model;

— stop assignment model;

— train stop assignment model;

— path assignment model;

— notice assignment model;

— passenger information display assignment model.

Explicit frames model: specific sets of "explicit" VERSION FRAMES that specify sets of data elements appropriate for a particular use case or set of related use cases.

The present document is structured according to the model structure as shown above with some exceptions due to the necessity to introduce some concepts earlier in the document in order to ease the understanding.

5.3 Network description model

5.3.1 Model overview

The network description model describes the basic physical network for transport and is itself divided into a number of separate sub-models covering different aspects of the network:

— network infrastructure model:

  — infrastructure network;

  — network restriction;

— main tactical planning points and links model (from the journey pattern model);

— activation model;

— vehicle and crew point model;

— line and route model;

— line network model;

  — line network;

  — line schematic map;

— flexible network model;

  — flexible link, point and zone;

  — flexible route;

  — flexible line.

For ease of understanding, the sub-models are presented one at a time, each describing only a small set of related concepts.

The sub-models depend on a number of general framework models (for example, generic point and link model, notice model, etc.) described in the part "Public transport - Reference data model – Part 1: Common concepts".

5.3.2 Infrastructure Network

5.3.2.1 General

The infrastructure network model describes the physical network on which the transport services run; a closely related network restriction model describes the physical restrictions on its use. This part does not concern the service aspects, i.e. vehicle work patterns described separately (e.g. by TIMING PATTERNs, JOURNEY PATTERNs, SERVICE PATTERNs).

5.3.2.2 Infrastructure Network– Conceptual Model

5.3.2.2.1 General

Figure 1 describes the main components of the physical path network (rail, roads, etc.).

This modelling of the infrastructure is, however, very basic and simple and is used here to represent specific operational constraints (restrictions) for public transport operation resulting from the characteristics of the INFRASTRUCTURE POINTs and LINKs and of VEHICLE TYPEs.The spatial detailed organization of the infrastructure itself is described by other models (GDF, Inspire, etc.) and the data are usually provided by GIS data sets.

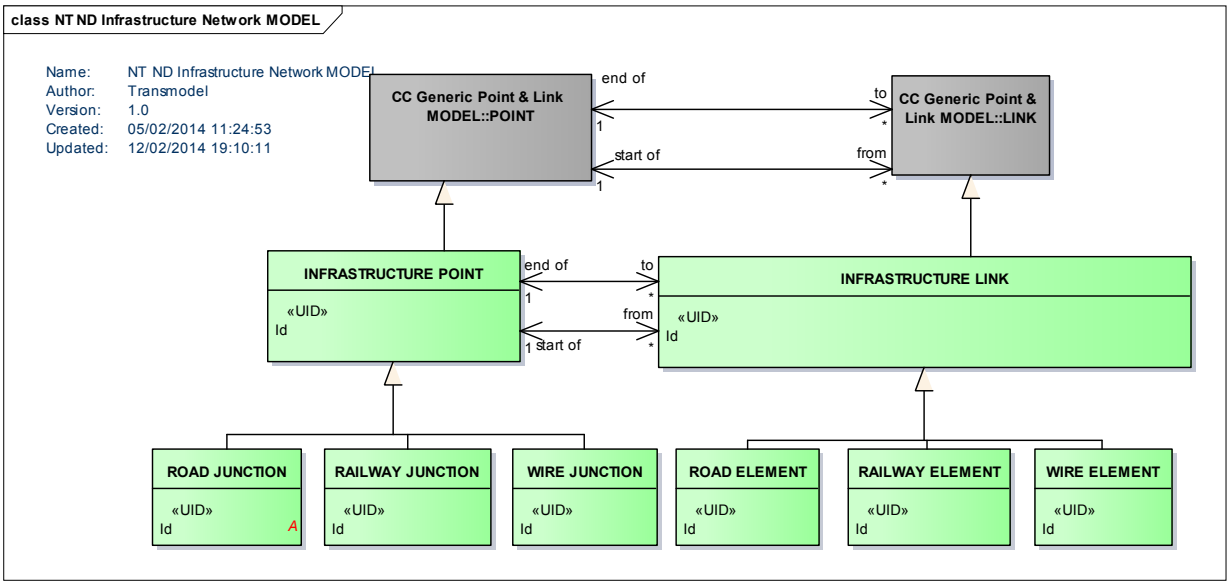

Figure 1 — Infrastructure network – Conceptual model

5.3.2.2.2 Infrastructure points and links

The PT network is described in Transmodel by POINTs and LINKs. This means that separate descriptions of a network either as a set of points or a set of links, or both, are possible and may be kept separately (cf. Generic POINT and LINK – conceptual model from the "Public transport - Reference data model – Part 1: Common concepts".

The approach of representing the network in terms of generic POINTs and/or LINKs and their specializations (here: INFRASTRUCTURE POINT, INFRASTRUCTURE LINK) is used extensively in Transmodel to describe distinct functional layers as separate graphs.

5.3.2.2.3 Infrastructure network and functional aspects of the network

In Transmodel terms, the infrastructure network builds a LAYER (cf. Layer – Conceptual Model from the "Public transport - Reference data model - Part 1: Common concepts"). A LAYER is a user-defined GROUP OF ENTITies, specified for a particular functional purpose, associating data referring to a particular LOCATING SYSTEM.

Examples of LAYERS (described through concepts introduced later in this document) are: timing pattern layer (defined through TIMING POINTs and TIMING LINKs), and service pattern layer (defined through SCHEDULED STOP POINTs and SERVICE LINKs). Transmodel defines a correspondence mechanism between LAYERS, called PROJECTION (cf. section Generic Projection from part "Public transport - Reference data model Part 1: Common concepts"). It should be noted that the uniqueness of a LOCATING SYSTEM within a LAYER is an important parameter, in particular for the coherence of distances.

Each separate LAYER reflects different concerns and is deliberately kept independent of other LAYERs. Thus for example the modelling of the objects necessary to describe the work patterns of vehicles (JOURNEY PATTERNs) is represented separately in the LAYERs describing the operational planning and not in the infrastructure layer.

The different functional LAYERs may be projected (using the Transmodel projection mechanism) onto the the infrastructure layer to represent how they are related to the physical paths represented by sequences of INFRASTRUCTURE LINKs.

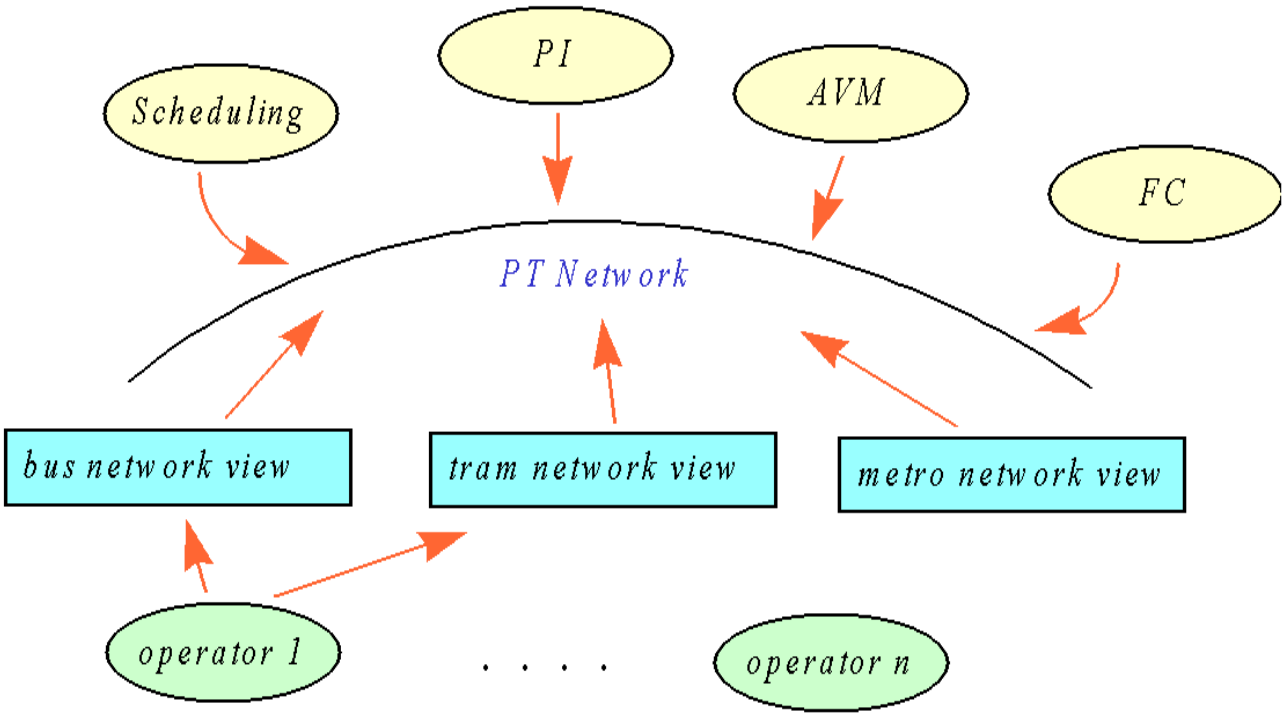

Figure 2 — Examples of layers – Different layers according to the transport mode

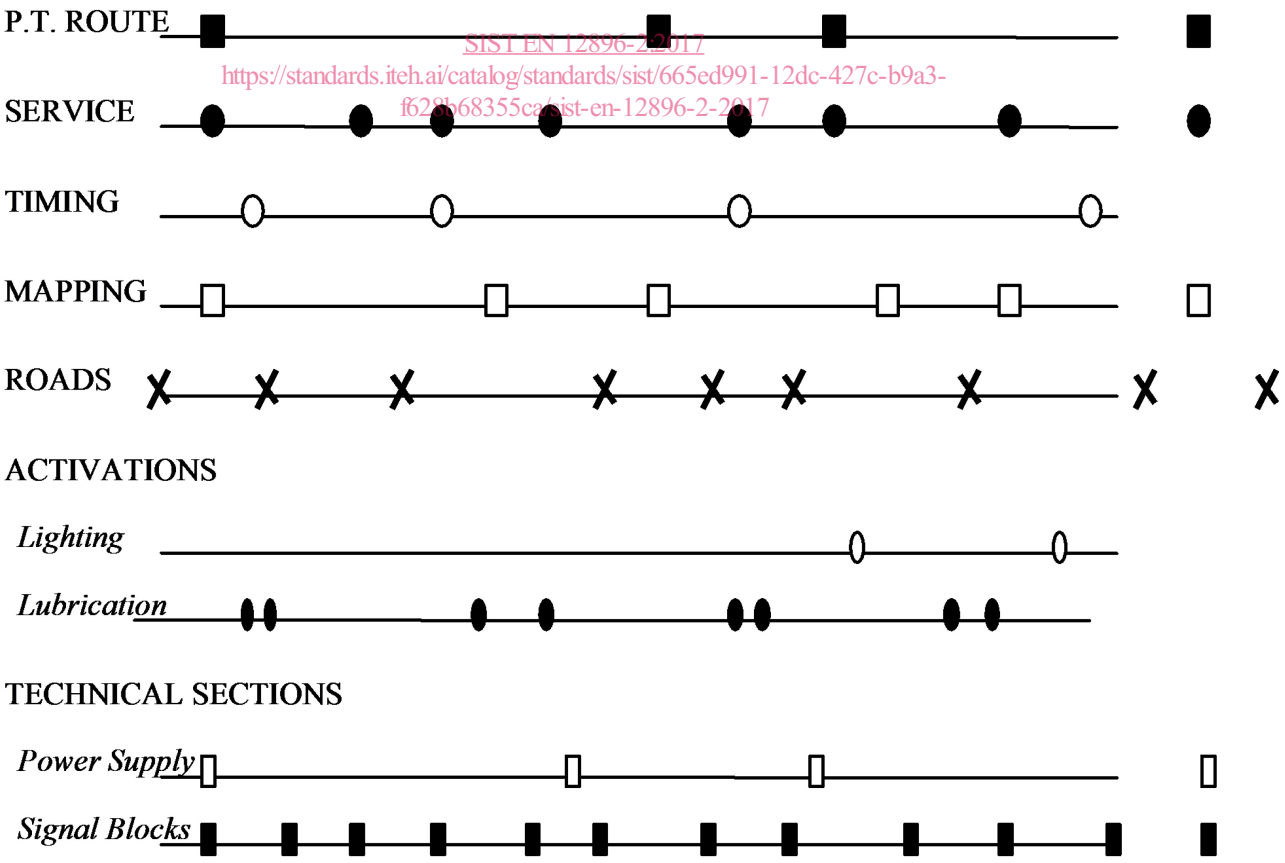

Figure 3 — Examples of layers – Different layers according to an operational need