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

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

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 278.

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

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European foreword

This document (prEN 12896-7:2018) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

The EN 12896 series, *Public transport — Reference data model*, is composed with the following documents:

— *Part 1: Common concepts*;

— *Part 2: Public transport network*;

— *Part 3: Timing information and vehicle scheduling*;

— *Part 4: Operations monitoring and control* [currently at Enquiry stage];

— *Part 5: Fare management* [currently at Enquiry stage];

— *Part 6: Passenger information* [currently at Enquiry stage];

— *Part 7: Driver management* [currently at Enquiry stage];

— *Part 8 : Management information & statistics* [currently at Enquiry stage]; and

— *Part 9: Informative documentation* [CEN/TR].

Together these create version 6 of the European Standard EN 12896, known as “Transmodel”, and thus replace EN 12896:2006, known as “Transmodel v5.1”.

In comparison with the previous edition, the technical modifications made are presented in the Technical Report CEN/TR 12896-9, *Public transport — Reference data model — Part 9: Informative documentation*.

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.

Part 2 of this standard presents space-related data structures.

Part 3 presents time-related data structures and replaces the sections of EN 12896:2006 referring to the time-related Tactical Planning Components and to Vehicle Scheduling.

Part 4 presents data referring to daily operations (i.e. to operational days), different from those planned for day types (space-related data structures and tactical planning components) and including operational raw data referring to operations follow-up.

Part 5 presents fares structures including sales, validation and control.

Part 6 presents Passenger Information (planned and real-time).

Part 7 (this part) presents Driver Management including Driver Scheduling (day-type related driver schedules), Rostering (ordering of driver duties into sequences according to some chosen methods) and Driving Personnel Disposition (assignment of logical drivers to physical drivers and recording of driver performance).

Part 8 presents Management Information and Statistics.

1 Scope

1.1 General Scope of the Standard

The main objective of the present standard is to present the Reference Data Model for Public Transport, based on:

— the Reference Data Model, EN 12896, known as Transmodel V5.1;

— EN 28701:2012, *Intelligent transport systems — Public transport — Identification of Fixed Objects in Public Transport (IFOPT)*, although note that this particular standard has been withdrawn as it is now included within Parts 1 and 2 of this European Standard (EN 12896-1:2016 and EN 12896-2:2016) following their successful publication.

incorporating the requirements of:

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

— CEN/TS 16614-1 and -2: *Public transport — 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 the understanding and the use of the model;

— the data model is entirely described in UML.

The following functional domains are considered:

— Network Description: routes, lines, journey patterns, timing patterns, service patterns, scheduled stop points and stop places;

— Timing Information and Vehicle Scheduling (runtimes, vehicle journeys, day type-related vehicle schedules);

— Passenger Information (planned and real-time);

— Fare Management (fare structure, sales, validation, control);

— Operations Monitoring and Control: operating day-related data, vehicle follow-up, control actions;

— 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);

— Management Information and Statistics (including data dedicated to service performance indicators).

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 (enumerated above) taken into account in the present standard, and of which the data have been represented as the reference model, are described in EN 12896-1, *Public transport — Reference data model — Part 1: Common concepts*.

1.3 Particular Scope of this Document

The present document entitled *Public transport — Reference data model — Part 7: Driver management* incorporates the following data packages:

— Driver Scheduling;

— Rostering;

— Personnel Disposition;

— Driver Control Actions.

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 (normative), providing a complement to EN 12896-1:2016, particularly useful for Parts 4 to 8 of the Public Transport Reference Data Model; and

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 12896-2:2016, *Public transport — Reference data model — Part 2: Public transport network*

EN 12896-3:2016, *Public transport — Reference data model — Part 3: Timing information and vehicle scheduling*

EN 12896-4:–[1], *Public transport — Reference data model — Part 4: Operations monitoring and control*

EN 12896-5:–[2], *Public transport — Reference data model — Part 5: Fare management*

EN 15531-1, *Public transport — Service interface for real-time information relating to public transport operations — Part 1: Context and framework*

EN 15531-2, *Public transport — Service interface for real-time information relating to public transport operations — Part 2: Communications*

EN 15531-3, *Public transport — Service interface for real-time information relating to public transport operations — Part 3: Functional service interfaces*

CEN/TS 15531-4, *Public transport — Service interface for real-time information relating to public transport operations — Part 4: Functional service interfaces: Facility Monitoring*

CEN/TS 15531-5, *Public transport — Service interface for real-time information relating to public transport operations — Part 5: Functional service interfaces - Situation Exchange*

CEN/TS 16614-1, *Public transport — Network and Timetable Exchange (NeTEx) — Part 1: Public transport network topology exchange format*

CEN/TS 16614-2, *Public transport — Network and Timetable Exchange (NeTEx) — Part 2: Public transport scheduled timetables exchange format*

CEN/TS 16614-3, *Public transport — Network and Timetable Exchange (NeTEx) — Part 3: Public transport fares exchange format*

EN 28701:2012, *Intelligent transport systems — Public transport — Identification of Fixed Objects in Public Transport (IFOPT)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General Terms and Definitions

The following generic terms are used.

[1] Under preparation.

[2] Under preparation.

3.1.1
attribute
property of an entity

3.1.2
conceptual data model
description of a real-world domain in terms of entities, relationships and attributes in an implementation independent manner in order to provide a structure on which the rest of the development of an application system can be based

3.1.3
conceptual level
<data modelling> conceptual data model

3.1.4
database
collection of data

Note 1 to entry: Often used in the sense of the physical implementation of a data model.

3.1.5
data domain
data structure (which is, in this European Standard, a part of the Reference Data Model for Public Transport) made up of data related to each other, through the fact that there is a functional area or group of functions using this data set as a whole

3.1.6
data model
description of a real-world domain in terms of data and relationships

3.1.7
entity
object (data) that has its own existence (as opposed to an attribute)

3.1.8
fare management
all activities related to the collection of money from passengers

3.1.9
function
activity; in this European Standard, sub-activity of a functional area

3.1.10
functional area
arbitrarily defined set of activities, used, in this European Standard, to define the objectives and limits of the data model

3.1.11
interoperability
ability of (sub)systems to interact with other (sub)systems according to a set of predefined rules (interface)

3.1.12
logical data model
data design that takes into account the type of database to be used but which does not consider means of utilization of space or access

3.1.13
logical denormalized model
relational data model that is not fully normalized, i.e. does not completely follow the normalization rules and thus may be redundant

3.1.14
logical level
<data modelling> logical data model

3.1.15
management information
all activities allowing the company management to collect the information necessary to meet problem-solving needs

3.1.16
object-oriented data model
data structure expressed according to principles that allow for a direct implementation as an object-oriented database, where information is represented in form of objects, i.e. respecting the principle of encapsulation meaning in particular that each data is accessed or modified through operations (methods) belonging to it

3.1.17
operations monitoring and control
all activities related to the transportation process, i.e. real-time functions related to the driving and transportation of passengers according to given instructions, including the monitoring of the driving process and its control in case of deviations, as well as all activities that support the driving process such as traffic light priority, track switching, bay selection, advance/delay advice, etc.

3.1.18
passenger information
all activities related to informing the users either on the planned or on the actual transportation services

3.1.19
personnel disposition
all activities related to the mid-term and short-term management of drivers

3.1.20
real-time control
see Operations monitoring and control

3.1.21
relational data model
type of logical data model giving the information as series of tables (relations) and attributes, and possessing the following characteristics: a) all attribute values are atomic; b) all "tuples" (rows/occurrences) are distinct; c) no part of the primary key may be null; and d) foreign key values must correspond to an existing primary key in another relation or be null

3.1.22
scheduling
see Tactical Planning

3.1.23
tactical planning
all activities related to the tactical planning of transportation, splitting into vehicle scheduling, driver scheduling, rostering

3.2 Domain-Specific Terms and Definitions

The following terms specific to the driver management domain are used. Terms which are also data entity names are defined in the data dictionary in Annex A and are not repeated here.

3.2.1
relief
person taking the place of another person as responsible for a certain task (such as driving a bus)

3.2.2
roster
plan showing turns of duty or leave for individuals in an organization

4 Symbols and Abbreviations

IFOPT	Identification of Fixed Objects in Public Transport (EN 28701:2012)
ISO	International Organization for Standardization
IT	Information Technology
NeTEx	Network and Timetable Exchange (CEN/TS 16614 series)
PT	Public Transport
PTO	Public Transport Operator
SIRI	Service Interface for Real-time Information (EN 15531 (all parts) and CEN/TS 15531 (all parts))
SIRI-FM	Service Interface for Real-time Information Facility Monitoring (CEN/TS 15531-4)
SIRI-SX	Service Interface for Real-time Information Situation Exchange (CEN/TS 15531-5)
UML	Unified Modelling Language
URI	Uniform Resource Identifier
URL	Universal Resource Locator

5 Driver Management

5.1 Introduction

The description of driver management is divided into three main parts. The first major part concerns *driver scheduling*, in essence creating the day-type related driver schedules where the required work is divided into duties that represents a set of work to be performed by one driver on one day.

The next major part concerns *rostering*, describing how the driver duties are ordered into sequences, according to some chosen method, to obtain a starting point for a balanced work share among the personnel over the planning period.

The final major part is the *personnel disposition*, describing how physical drivers are assigned to do the work of a logical driver. This part also covers the recording of driver performance.

Additionally, there are clauses concerning *driver*, *driver trip* and *driver control actions.*

5.2 Driver

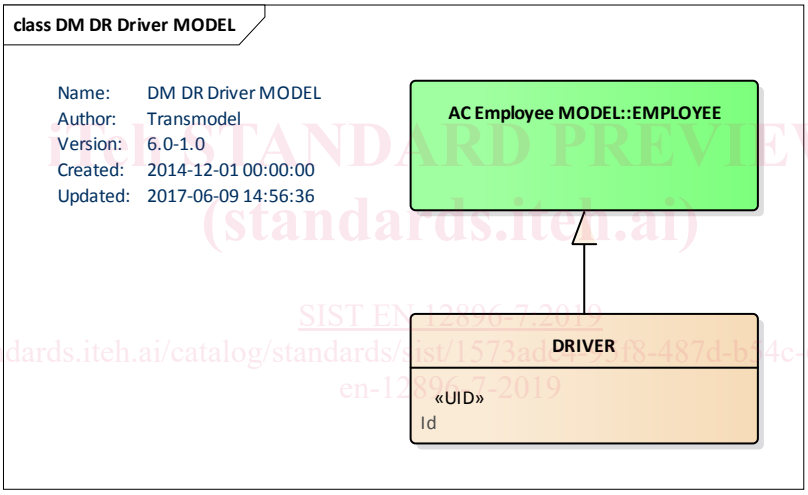

Figure 1 — Driver MODEL

The DRIVER entity describes a physical driver, who is an EMPLOYEE (see EN 12896-1) of the public transport company.

Note that in the first stages of the planning process there are no direct references to the DRIVER (i.e. the physical driver). Instead a theoretical LOGICAL DRIVER is used during planning, and later on there will be a separate assignment of which DRIVER (physical driver) that shall perform the duties specified for a certain LOGICAL DRIVER.

5.3 Driver Scheduling

5.3.1 General Remarks

Driver scheduling involves the construction of driver DUTies to cover the scheduled SERVICE JOURNEYs (see EN 12896-3) at minimum cost. This process shall also give DRIVERs fair workloads, which comply with the law and with the agreements made between the company and, for example, driver unions. There are numerous parameters, such as maximum length of driving time allowed without a break, which will be essential input for the driver scheduling algorithm. These are not

included in the reference model, because they do not have a complex structure or relationships to the data model entities but are simple values.

In many cases, BLOCKs (see EN 12896-3) will have already been compiled before the start of the driver scheduling process and will be used as input. However, schedulers do not always want to work in that order; the model allows DUTies to be entered into the system before pieces of vehicle work have been assigned to them.

5.3.2 Duties

5.3.2.1 Duty Components

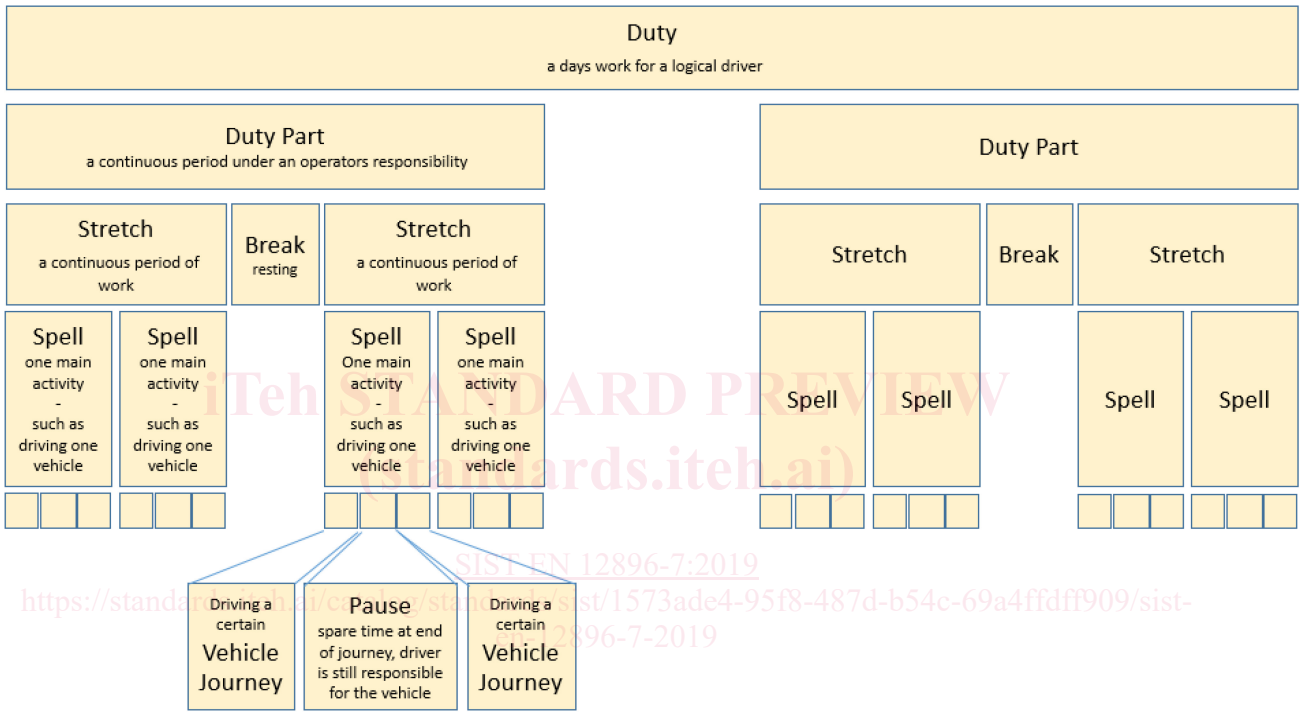

Figure 2 — Simplified overview of the main concepts in a duty in relation to a driver

A DUTY describes a day's work for a LOGICAL DRIVER on one DAY TYPE. A DUTY may be a SPARE DUTY, in which case no specific work has yet been assigned to it, or an ASSIGNED DUTY, which is composed of a hierarchy of components.

Operators and applications use various DUTY component levels. The reference model includes more levels than any one company is likely to want, in order to support these existing ways of structuring the data. Some of these levels may only be used within the driver scheduling package and will not be needed in a company database. They are included in the model because they explain the relationships between entities that will be in such a company database.