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Javni prevoz - Referenčni podatkovni model - 8. del: Informacije o upravljanju in statistika

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

Öffentlicher Verkehr - Referenzdatenmodell - Teil 8: Managementinformationen und Statistiken

Transports publics - Modèle de données de référence - Partie 8 : tableaux de bord et statistiques

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

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Öffentlicher Verkehr - Referenzdatenmodell - Teil 8: Managementinformationen und Statistiken

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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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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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 12896-8:2026) 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.

This document will supersede EN 12896-8:2019.

Annex C provides details of the significant technical changes between this document and EN 12896-8:2019.

This document is part of the European standard series EN 12896, known as “Transmodel”. This is a series of documents that comprises the following parts:

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

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

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

— EN 12896-4, Public transport - Reference data model - Part 4: Operations monitoring and control

— EN 12896-5, Public transport - Reference data model - Part 5: Fare management

— EN 12896-6, Public transport - Reference data model - Part 6: Passenger information

— EN 12896-7, Public transport - Reference data model - Part 7: Driver management

— EN 12896-8, Public transport - Reference data model - Part 8: Management information and statistics

— EN 12896-10, Public transport - Reference data model - Part 10: Alternative Modes

Together these documents create Transmodel version 6.2 and thus replace Transmodel V6.0.

In addition to the nine normative parts of this series, a Technical Report (Public Transport – Reference Data Model – Informative Documentation) was published in 2016 under the reference CEN/TR 12896-9. It provides 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 soon as all the normative parts are revised.

For information on the conventions, methodology, and notations for conceptual modelling and the core principles of Transmodel, refer to EN 12896-1.

1 Scope

The present document is composed of the following data packages:

— Indicators;

— Reusable components;

— Explicit frames for statistics

— Query.

This document itself is composed of the following parts:

— main document representing the conceptual foundations and corresponding data model (normative);

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

— Annex B presenting the model evolution (informative);

— Annex C, providing details of the significant technical changes between this document and EN 12896-8:2019 (informative)

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
aggregation frame
data structure within which the data values are grouped and used for a formula to provide an indicator

3.1.2
indicator
set of data (calculated or measured) which may be either qualitative or quantitative that is used to provide information on the status (may be a measure, a functional state, etc.) or the quality of a service or a function

3.1.3
indicator type
category of a given indicator, e.g. time, length, passenger count, price, vehicle, etc.

3.1.4
indicator unit
measurement unit (e.g. metres, seconds, passengers, etc.) in which a specific indicator is measured

3.1.5
formula
method to calculate indicators that are based on other indicators or on a set of raw data

3.1.6
granularity
input for calculation processes representing the smallest unit(s) to generate output indicator(s)

3.1.7
O/D matrix
tabular structure describing data by origin/destination parameters (e.g. daily traffic volume between zones)

3.1.8
indicator parameter type
category of a given indicator parameter, e.g. time, length, passenger count, price, vehicle, etc.

3.1.9
indicator parameter unit
measurement unit (e.g. meters, seconds, passengers, etc.) in which a specific indicator parameter is measured

3.2 Abbreviations

API	Application Programming Interface
AVM	Automatic Vehicle Monitoring
AVMS	Automatic Vehicle Monitoring System
GIS	Geographical Information System
GPS	Global Positioning System
HTTP	Hypertext Transfer Protocol
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
OJP	Open API for Distributed Journey Planning
OpRa	Operating Raw Data and statistics exchange
SIRI	Service Interface for Real-time Information
TM	Transmodel
UML	Unified Modelling Language
URI	Uniform Resource Identifier
URL	Universal Resource Locator
VDV	Verband Deutscher Verkehrsunternehmen (Germany)

WGS World Geodetic Standard

3.3 General information

The following standards are based on the Transmodel conceptual data model for public transport domain to provide a harmonized, interoperable, and consistent approach for public transport data, service interfaces, and journey planning across Europe:

— EN 15531 (series) [10] to [16] – Service interfaces for real-time public transport operations.

— CEN/TS 16614 (series) (NeTEx) [17] to [22] – Network and timetable data exchange, including passenger information and accessibility.

— CEN/TS 17118 [23] – Open API for distributed journey planning.

4 Management Information and Statistics Domain

4.1 Introduction

Management information deals with functions analysing production data to evaluate the service quality or to take corrective measures in planning and managing operations. In public transport, for instance, the study of operational data (e.g. observed passing times, passenger load, delays and cancellations) collected during service operations is an input for strategic planning (e.g. how and when to amend the schedules), tactical planning (e.g. when to undertake a certain control action), quality follow-up, etc.

Management information uses therefore three main types of data:

— data resulting from the planning stages, i.e. theoretical data on the production orders (e.g. timetables, target passing times, driver rosters, etc.);

— data describing the daily actual production (e.g. observed passing times, actual number of passengers, number of late or cancelled journeys, etc.);

— data aggregations and calculated statistics (late journey duration intervals, number and percentage of late and cancelled journey occurrences)

Advances in technology for data capture, exchange, storage and analysis make it possible to make these data available in operational and management information systems for use by a broad range of stakeholders, such as PT operators, authorities, system suppliers, and analysts. Consistent data structures make it easier to define interoperable queries and data exchanges for specific tasks such as performance monitoring, service quality assessment, delay and cancellation analysis, capacity and passenger-demand evaluation, operational control, reporting to authorities, and service planning and optimisation.

4.2 Data Preparedness Levels

Many use cases in OpRa use data sources that can have various levels of reliability. Informing the consumer of a dataset about the reliability of the raw data and other indicators being exchanged an important block of metadata. For example, if an onboard data aggregator device, acting as a producer, states that the data has been fully processed and cleaned, the consumer side is not required to develop and maintain data cleansing functionality.

To be able to calculate the metrics transferred, using OpRa will require, depending on the data about a metric being transferred, access to the raw unprocessed data for both planned and unplanned service operations as well as processed clean data.

For example, in the scenario where data is being exchanged between a PTO unit and a PTO server there are three stages of preparedness of the data:

— Raw;

— Cleansed;

— Processed.

To illustrate the differences between the preparedness states, the following table (Table 1) sums the roles of a producer and a consumer system, and lists some consequences which would trigger some architecture planning considerations in an OpRa-using environment.

Table 1 — Data preparedness Concepts

	Preparedness: Raw	**Preparedness: Cleansed**	**Preparedness: Processed**
Producer / Consumer roles	Producer states that the data contains the whole measurement, but it may contain erroneous data. It is up to the Consumer to get rid of measurement errors if needed	Producer states that erroneous data was removed from the measurement. Consumer may further investigate errors if required, but that's not mandatory	Producer states that validating the data had been finished and shall not be modified. Consumer can use the data without further examination of quality
Consequences	Consumer needs to develop data cleansing methods Consumer may not be aware of measurement characteristics (error probabilities) of Producer's equipment Consumer is responsible for calculating statistics	Producer can hide measurement equipment's characteristics (error probabilities) Producer has larger responsibilities depending on regulatory environment Quality of the Producer system might affect overall performance, since it filters out data Consumer software can be simpler, focusing more on higher-level tasks Consumer is responsible for calculating statistics	

A sample data flow diagram (Figure 1) shows how the level of preparedness may change as data moves between IT systems and organisations:

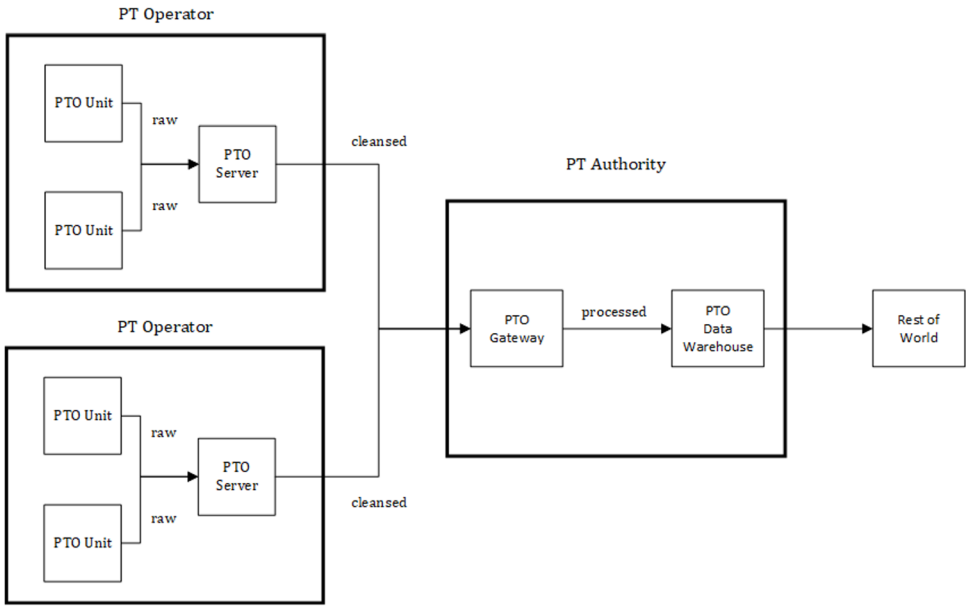

Figure 1 — Data preparedness stages for a PTO – PTA environment

4.2.1 Preparedness level raw

In the scenario where data is being exchanged between a PTO unit and PTO server data for the use case Number of cancelled journeys, the following data may be needed:

- Planned service;
- Requires actual service: control actions (PARTIAL / JOURNEY CANCELLATION);
- DATED VEHICLE JOURNEY reference;
- Cancellation type (PARTIAL / full);
- Control action metadata.

This data may contain partial or unchecked data which originates from a given person on duty at a given place.

No checking or processing of data has occurred. This data can be referred to as raw.

4.2.2 Preparedness level cleansed

Where data goes through some cross-checking before transferring, for example it may go through some integration process combining from multiple sources (e.g. workstations).

Where there is an obvious error, or the data value is outside of expected and or allowed values this data element may have been removed.

This data is the same as the raw data values except false data has been removed. This data can be referred to as cleansed.

4.2.3 Preparedness level processed

Once data has been received in the PTA data warehouse by aggregating data from multiple PTOs it may undergo processing. This processing may have corrected a value where there is an obvious error or the data value is outside of expected and or allowed values.

This data is the same as the raw data except where false data has been corrected. This data can be referred to as processed.

4.3 Recording Service and Vehicle Performance Events

4.3.1 Introduction

The record of events related to the performance of vehicle journeys, in particular service journeys, on each day of their operation is an important source of information for management information. The main information to record is the following:

— actual passing times at points along the route;

— the number of passengers boarding and alighting and the time taken to do so;

— the occurrence of impeded time;

— interchange realisation;

— the occurrence of disturbances.

The diagram below shows such recorded information that exist in Transmodel. Several use cases use the data from the diagram.

The Recorded Object MODEL (figure 2) for vehicle monitoring demonstrates how Transmodel supports the capture, storage, and association of operational data related to VEHICLE MONITORING. Key functionality of the model:

— Vehicle monitoring events**:** the model can record monitored vehicle journeys, including their operational context (e.g., operating day, service journey, and vehicle journey references). Each monitored journey can be broken down into monitored legs and monitored trips, which are linked to trip patterns and stops.

— Temporal and spatial data**:** the model can handle observed passing times, recorded stops, and interchange statuses, ensuring accurate timestamps and location references (e.g., places, zones).

— Logging and traceability**:** all monitored activities can be logged through vehicle monitoring log entries and trip monitoring log entries, providing traceability for auditing and performance analysis.

— Granularity and composition**:** the model allows hierarchical decomposition of journeys into legs and trips, supporting detailed monitoring at different levels of granularity.

— Integration with service data**:** recorded objects should reference planned data such as service journeys, vehicle journeys, and stop points, enabling comparison between planned and actual operations.

— Flexibility for operational adjustments**:** the model should accommodate real-time updates, such as boarding and alighting events, and interchange adjustments, to reflect actual passenger and vehicle behaviour.