SLOVENSKI STANDARD
SIST-TP CEN/TR 17370:2019

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Javni prevoz - Neobdelani operativni podatki in izmenjava statističnih podatkov

Public transport - Operating raw data and statistics exchange

Öffenlicher Verkehr - Betriebliche Rohdaten und Austausch statistischer Daten

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ICS:

03.220.99	Druge oblike transporta	Other forms of transport
35.240.60	Uporabniške rešitve IT v prometu	IT applications in transport

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TECHNICAL REPORT

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English Version

Public transport - Operating raw data and statistics exchange

Transports publics – Échange de données brutes d'exploitation et de données statistiques

Öffenlicher Verkehr - Betriebliche Rohdaten und Austausch statistischer Daten

This Technical Report was approved by CEN on 3 June 2019. It has been drawn up by the Technical Committee CEN/TC 278.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (CEN/TR 17370:2019) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

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 is the Technical Report (TR) of Operating raw data and statistics exchange (OpRa) that contains information needed to define precisely the contents of what could be the scope of the following Technical Specification (TS) or European Norm (EN).

0 Introduction

0.1 General

The Public Transport (PT) sector, particularly for Public Transport Operators (PTO) and Public Transport Authorities (PTA), has identified the necessity to develop a data strategy, based on the cost and value, focusing on the strategic benefits of data. It is crucial that mobility stakeholders are not only able to compete against potential new market entrants, but also need a suitable environment to develop new business models and services. Public transport is becoming a data-enabled or data-driven business and should answer different local conditions.

This led to the need to standardize data analysis in Public Transport to understand formally how information can be created as added value and indicator calculation can facilitate moving from a qualitative analysis of the PT service towards a quantitative one.

In this perspective, OpRa (Operating raw data and statistics exchange) defines a minimum set of Public Transport raw data needed as PT quantitative analysis enabling factor.

This document is an informative document that describes the approach followed to perceive this goal and the results got.

0.2 Transport modes

OpRa takes most public transport modes, except air transport, into account. This specifically includes rail, bus, metro, tramway, trolleybus, ferry, coach, funicular railway, suspension railway, and rack railway.

0.3 OpRa management information

Management information deals with functions analysing production data in order to evaluate the service quality or to take corrective measures in planning and managing operations. In PT, for instance, the study of operational data (e.g. observed run times, passenger load) 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, two main types of data:

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

— data describing the daily actual production (e.g. observed passing times, actual number of passengers, missed interchanges, modifications operated to the plan, etc.).

Advances in technology, in particular as regards data storage, allow the provision of all the necessary underlying data in production databases, against which the desired requests can be made by PT managers. Consistent data structures for management data will make the design of such requests easier, and offer the flexibility required to OpRa exchange PT raw data, in order to enable indicators calculation. Raw data is identified according to specific use cases and, where applicable, defined and described in Transmodel format. In this perspective, the exchange will be performed using similar NeTEx modalities, for compatibility reasons.

0.4 OpRa exchanging data modality

Similarly, to NeTEx, the primary software resource from implementing an OpRa interface will be based on XML schema; at this stage, a full schema has not been designed yet.

Two main variants of the schema will be available each providing a different protocol for embedding the same content model subschemas.

a) **Simple OpRa documents exchange:** *(see NeTEx _publication.xsd*). A schema to use with NeTEx documents input or output by a system that are exchanged as files using FTP, email etc.

b) **OpRa document exchange using SIRI HTTP requests**: *(see NeTEx_siri_SG.xsd*). A schema that embeds the OpRa elements in a sequence of HTTP messages that define request/response and publish/subscribe interchanges for exchanging data. Requests use OpRa elements to specify the desired data. Responses wrap in version frames. The messages are specializations of the SIRI framework.

0.5 Motivation

Measured Public Transport data describing the public transport network fulfilment are essential for studies, control, service improvement and contractual relations between stakeholders. It is important that they can be shared among PTO, PTA, engineering and design office, researchers, and other actors in a clear and unambiguous way, in order to provide accurate and intelligible information.

Furthermore, the OpRa covered scope is fully complementary to other existing exchange standards and allows covering one of the small remaining gaps of public transport standardization, with particular references to Transmodel, NeTEx and SIRI.

NeTEx (CEN/TS 16614-1 to 3) is an exchange protocol dedicated to scheduled public transport data, based on the Transmodel (EN 12896) conceptual data model. NeTEx supports the exchange of information relevant to public transport services for passenger information and AVM systems and is divided into three parts:

— Part 1: network topology exchange;

— Part 2: timetables exchange;

— Part 3: fare information exchange.

SIRI (EN 15531-1 to 5) is complementary with NeTEx and provides operators and manufacturers with a standard framework for exchanging data concerning public transport real-time information, along with a set of functional services for specific types of real-time data. As for NeTEx, the underlying conceptual definitions used by SIRI are provided by Transmodel. SIRI and NeTEx share the same communication protocol.

Using these standards, scheduled and real-time information can be made available for passenger information, and for operations and for process review. However, there is still one final aspect missing, just after real-time: to provide information about what has actually been performed, with the same overall view as for scheduled information. Such data allows a feedback loop to improve existing services.

The OpRa work is therefore about operating raw data and statistics, regularly requested by PTA, aims to meet that need.

0.6 CEN Standards context

OpRa work has been developed under the aegis of CEN draws on a number of existing national Public Transport Service scenarios and EU standards.

The keystone is the Transmodel standard, a conceptual model that names and represents PT info concepts for a wide set of functional areas and can be used to compare and understand different models. Transmodel project outputs have been used both to underpin a number of CEN concrete data standards such as NeTEx, SIRI or IFOPT[1]. It underpins many national standards to allow for harmonization and interoperability. Transmodel generic model has been used to develop OpRa and OpRa-specific requirements itself being updated to include OpRa additions provided also some of Transmodel enhancements (present in prEN 12896-8, concerning Management Information and Statistics).

CEN (Comité Européen de Normalization) is Europe's standardization body. It divides its work into committees covering different aspects of industry and technology. OpRa work is formally produced by Technical Committee 278, Work Group 3, Sub-Group 10. Other TC 278 WG 3 sub-groups handle the related standards, in particular, Transmodel (SG4 Reference data model), SIRI (SG5 Service Interface for Real-time Information) and NeTEx (SG9 NEtwork and Timetable EXchange).

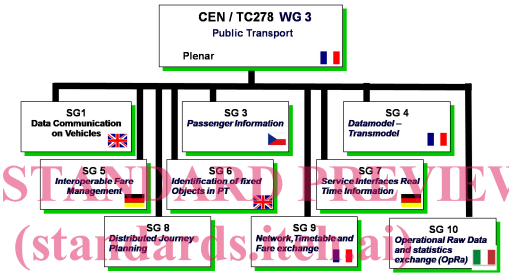

Figure 1 — CEN TC 278 WG 3 Sub-groups

0.7 CEN process and participants

The CEN process requires a working sub-group to develop a candidate specification, which is then sent to national mirror groups for review and comment, with voting stages for approval and adoption. Work on OpRa has involved delegates from France, Hungary, and Italy. Evolution of EU PT standards and OpRa for rail with TAP/TSI compatibility.

The following countries have shown interest for the activation of OpRa work:

1) Austria (ASI);

2) Czech Republic (UNMZ);

3) Denmark (DS);

4) France (AFNOR);

5) Hungary (MSZT);

6) Italy (UNI);

7) Netherlands (NEN);

[1] IFOPT has been included in Transmodel Part 2: Public Transport Network (EN 12896-2) and is no more a standalone standard.

8) Norway (SN);

9) Slovakia (SOSMT);

10) Slovenia (SIST);

11) Spain (UNE);

12) United Kingdom (BSI).

The following map shows the distribution of the stakeholders by country, based on whether they are already active or just interested in the results.

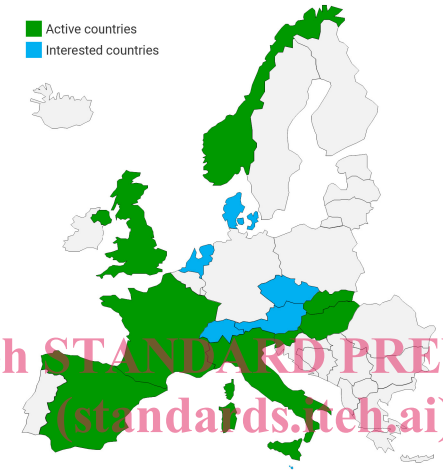

Figure 2 — OpRa stakeholders' involvement

The development of OpRa has drawn on PT national scenarios, in particular to identifies needs and validate the OpRa detailed use cases by establishing mappings with studied national PT scenarios.

The development of OpRa also coincided with an interest by the European Rail Authority (ERA), UITP and other stakeholders in seeking a degree of data interoperability between different modes of Public Transport such as rail, metro and bus, that is, the ability to exchange PT raw data about routes, timetables and fares between systems and to supply external third-party users.

0.8 Evolution of EU PT standards and OpRa

This document describes the results of preliminary analysis phase covering the following main topics:

— national scenarios for Public Transport raw data and statistics exchange (needs and usage);

— Public Transport Quality of Service (QoS) in EU projects;

— use cases definition and classifications;

— compliance with CEN TC 278 WG 3 standards (Transmodel).

The subsequent work consists in the definition of a Technical Specification (TS) for OpRa data exchange format and associated services. In this perspective, it has been proposed to insert this standardization activity among those included in the *EU ICT Rolling Plan 2019*.

0.9 Further information

In the case of long-distance train, OpRa work takes into account the requirements formulated by the ERA (European Rail Agency) — TAP/TSI (Telematics Applications for Passenger / Technical Specification for Interoperability), entered into force on 13 May 2011 as the Commission Regulation (EU No 454/2011), and based on UIC directives.

1 Scope

1.1 Introduction

The OpRa work scope is the definition of a minimum set of Public Transport raw data needed as PT quantitative analysis enabling factor. To obtain this considering all the several aspects involved in this complex domain, the work has been conducted through the following phases:

1) assessment;

2) use cases definition and classification;

3) indicators definition;

4) raw data identification.

OpRa work does not go into the field of service quality measurement and reporting: service quality analysis will of course use data provided by OpRa, but quality definition remains a contractual level issue between a Public Transport Authority and a Public Transport Operator or an operator's internal choice for a purely private service. OpRa mainly only reports unbiased actual data (i.e. measured or observed), described and aggregated in a shared and understandable way.

The OpRa work documented in detail in this document is coherent with EU Directive 2010/40. In particular, it relates to the Article 4[2] of the Delegated Regulation EU 2017/1926 [33], as regards the historic data. OpRa proposes to complement NeTEx (dedicated to the static scheduled information), for the historic data based on the underlying conceptual data reference model Transmodel EN 12896, similarly to the requirement of the Delegated Regulation EU 2017/1926 referring to the static scheduled information[3].

1.2 Assessment phase

The **assessment phase** has been conducted studying the following aspects:

- national scenarios for public transport raw data and statistics exchange, to identify indicators needs and usage;
- public transport KPI definition in research projects to consider what has been already done in literature and research;
- relations with public transport EU norms, to be coherent with already existent PT norms.

Moreover, involved actors and stakeholders have been identified like: **Public Transport Authority** (PTA), **Public Transport Agencies**, **Public Transport Operator** (PTO), **system integrators** and

[2] Transport authorities, transport operators, infrastructure managers or transport on demand service providers shall provide the static travel and traffic data and historic traffic data listed in point 1 of the Annex of the different transport modes, by using: (a) for the road transport, the standards defined in Article 4 of Delegated Regulation (EU) 2015/962; (b) for other transport modes, the use of one of the following standards and technical specifications: NeTEx CEN/TS 16614 and subsequent versions, technical documents defined in Regulation (EU) No 454/2011 and subsequent versions, technical documents elaborated by IATA or any machine-readable format fully compatible and interoperable with those standards and technical specifications; (c) for the spatial network the requirements defined in Article 7 of Directive 2007/2/EC.

[3] 16) For what concerns the exchange of static scheduled data (such as public transport, long distance coach and maritime including ferry), the relevant data in the national access point should use the CEN data exchange standard NeTEx CEN/TS 16614 based on the underlying conceptual data reference model Transmodel EN 12896:2006 and subsequent upgraded version.

passengers, analysing public transportation *Planning and Operation process*, that have been divided into five main stages to group all the activates that characterize the Public Transport Service:

- **strategic planning:** definition of network elements (lines, stops), main service parameters (vehicles sizes, operation intervals, service intervals for important time demand types), and guaranteed interchanges are planned;
- **tactical planning:** operators plan their resource usage (vehicles, rolling stock, personnel), with detailed timetables for each resource unit;
- **before travel:** all planned networks and timetables are published. Passengers and other types of clients can plan their use of the offered transportation services via printed and electronic media, and make their reservations as needed;
- **in-travel:** the transportation service is conducted. Real-time information exchange is available while this takes place and can be recorded;
- **study and control:** in this stage, operators and authorities review the history of actual operations, which could lead to improvements through operational changes, or an optimization of strategic and tactical planning.

The PTA and PTO are interested in all the defined stages, meanwhile from the passenger point of view; only the last three stages are relevant (all the preparation work being hidden).

Figure 3 — Public Transport Service phases

During the assessment the most relevant research projects results have been considered and a deep analysis of the roles and usage of Public Transport Standards have been completed to guarantee a coherent approach of OpRa.

The first four stages are under the scope of NeTEx (Network Timetable Exchange) and SIRI (Service Interface for Real Time Information) and the last stage is the additional scope to be covered by OpRa. All these standards are compliant with the European Public Transport Reference Data Model (Transmodel).

NeTEx supports data exchange for the **Strategic Planning** and **Tactical Planning** stages, with data more than 24 h before validity date. In the **Before Travel** stage, NeTEx can be used to publish all planned data to client systems. Meanwhile SIRI supports "**in-travel / in-operation**" data exchange.

The **OpRa** scope is mainly concentrated to support data exchange for the **Study and Control** stage and it mainly focus on actual and measured information, i.e. information that cannot be changed anymore in the future. The OpRa covered concepts are based on following Transmodel domains:

— operations monitoring and control (Part 4);

— management information and statistics (Part 8).

1.3 Use cases definition and classification phase

To identify the set of raw data, a clear definition of use cases that, based on the assessment phase results, describes the indicators definition and usage to satisfy the Public Transport Study and Control phase is needed.

In this complex and articulate scenario, the work bring to a definition of several use cases this led to the needs to aggregate them and classify accordingly.

1.4 Indicators definition phase

For each defined use case an indicator has been formally defined, including its formulae. It has been advised that some indicators could have particular importance in for the Quantitative Analysis and in this perspective they could be considered Key Process indicators (KPI), for the purpose of this OpRa work, indicators and KPI are used as synonyms.

1.5 Raw data identification phase

After use cases and indicators have been defined, the work enter in the phase of raw data identification for the calculation of the indicators included all use cases. Due to the high level of complexity of the results, a traceability matrix has been identified.

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 12896-8:2018 [4], *Public Transport — Reference Data Model — Part 8: Management Information and Statistics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 12896-8 and the following 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
attribute
property of an entity

3.2
conceptual data model
description of a real-world domain in terms of entities, relationships, and attributes, in an implementation independent manner and providing a structure on which the rest of the development of an application system can be based

[4] Under preparation. Stage at the time of publication: prEN 12896-8:2018.

3.3
conceptual level
conceptual data model in the context of data modelling

3.4
database
collection of data; often used in the sense of the physical implementation of a data model

3.5
data model
real-world domain in terms of data and relationships

3.6
entity
object (data) that has its own existence (as opposed to an attribute)

3.7
function
a sub-activity of a functional area

3.8
functional area
arbitrarily defined set of activities used to define the objectives and limits of the data model

3.9
interoperability
ability of (sub) systems to interact with other (sub) systems according to a set of predefined rules (interface)

3.10
logical data model
data design that takes into account the type of database to be used but does not consider the means of utilization of space or access

3.11
logical denormalized model
relational data model that is not fully normalized, i.e. does not completely follow the normalization rules and thus could be redundant

3.12
logical level
logical data model in the context of data modelling