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BSI Standards Publication

Electronic fee collection - Charging performance

Part 2: Examination Framework

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National foreword

This Published Document is the UK implementation of CEN ISO/TS 17444-2:2017. It is identical to ISO/TS 17444-2:2017. It supersedes PD CEN ISO/TS 17444-2:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (CEN ISO/TS 17444-2:2017) has been prepared by Technical Committee ISO/TC 204 “Intelligent transport systems” in collaboration with 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.

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Endorsement notice

The text of ISO/TS 17444-2:2017 has been approved by CEN as CEN ISO/TS 17444-2:2017 without any modification.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This second edition cancels and replaces the first edition (ISO/TS 17444-2:2013), which has been revised with the following changes:

— editorial and formal corrections, as well as changes, to improve readability;

— updated terminology.

A list of all parts in the ISO/TS 17444 series can be found on the ISO website.

Introduction

Electronic tolling systems are complex distributed systems involving critical technology such as dedicated short-range communication (DSRC) and global navigation satellite systems (GNSS), both subject to a certain random behaviour that may affect the computation of the charges. Thus, in order to protect the interests of the different involved stakeholders, in particular Service Users and Toll Chargers, it is essential to define metrics that measure the performance of the system as far as computation of charges is concerned and ensure that the potential resulting errors in terms of size and probability are acceptable. These metrics will be an essential tool when establishing requirements for the systems and also for examination of the system capabilities both during acceptance and during the operational life of the system.

In addition, in order to ensure the interoperability of different systems, it will be necessary to agree on common metrics to be used and on the actual values that define the required acceptable performances although this is not covered in this document.

This document is defined as a toolbox standard of examination tests plus a method for defining and documenting Specific Examination Frameworks to meet specific needs. The detailed choice of the set of examination tests within an Examination Framework depends on the application and the respective context. Compliance with this specification is understood as using the definitions and prescriptions laid out in this document whenever the respective system aspects are subjected to performance measurements, rather than using other definitions and examination methods than the ones specified in this document.

ISO/TS 17444-1 defines a set of charging performance metrics with appropriate definitions, principles and formulations, which together make up a reference framework for the establishment of requirements for EFC systems and their later examination of the charging performance.

These charging performance metrics are intended for use with any toll scheme, regardless of its technical underpinnings, system architecture, tariff structure, geographical coverage, or organizational model. They are defined to treat technical details that may be different among technologies as a “black box”. They focus solely on the outcome of the charging process, i.e. the amount charged in relation to a pre-measured or theoretically correct amount, rather than intermediate variables from various components as sensors, such as positioning accuracy, signal range, or optical resolution. This approach ensures comparable results for each metric in all relevant situations.

The metrics are designed to cover the information exchanged on the front-end interface and the interoperability interfaces between Toll Service Providers and Toll Chargers, as well as information on the end-to-end level.

Metrics for the following information exchanges are defined:

— Charge Reports;

— Toll Declarations;

— Billing Details and associated event data;

— Payment Claims on the level of user accounts;

— End-to-End Metrics which assess the overall performance of the charging process.

The proposed metrics are specifically addressed to protect the interests of the actors in a toll system, such as Toll Service Providers, Toll Chargers and Service Users. The metrics can be used to define requirements (e.g. for requests for proposals) and for performance assessment.

Toll schemes take on various forms as identified in the ISO 17575 series and ISO 14906. In order to create a uniform performance metric specification, toll schemes are grouped into two classes based on the character of their primary charging variable:

— charging based on discrete events (charges associated to the fact that a vehicle is crossing or standing within a certain zone);

— those based on a continuous measurement (duration or distance).

In all these toll schemes, tolls may additionally vary as a function of vehicle class characteristics such as trailer presence, number of axles, taxation class, operating function, and depending on time of day or day of week, such that, for example, tariffs are higher in rush hour and lower on the weekends.

With this degree of complexity, it is not surprising to find that the attempts to evaluate and compare technical solutions for Service User charging have been made uniquely each time a procurement or study is initiated, and with only limited ability to reuse prior comparisons made by other testing entities.

Examination Framework

The Examination Framework that is defined in this document is designed for measuring the metrics defined in ISO/TS 17444-1. The general aim is to achieve a maximum comparability and reproducibility of the results without restricting the technological choices in system design. Specific Examination Frameworks may be defined for the Evaluation and Monitoring Phases of a project due to the differences in the availability of equipped vehicles.

Evaluation Phase

This phase encompasses system evaluation and selection, as well as commissioning and ramp up during implementation. Important aspects of this phase are

— relatively small sample sizes, and

— well controlled behaviour of test vehicles.

Monitoring Phase

After the system has gone into operation, its behaviour needs to be monitored for several reasons, such as fine-tuning of the system performance, monitoring of SLAs between contractual partners (supplier, Toll Charger, Toll Service Provider, etc.). In this phase, the following system aspects can be expected:

— very large sample sizes possible, but with unknown behaviour of the vehicles;

— in principle all measurements from implementation phase possible, too.

Readers Guide

To understand the content of this document, the reader should be aware of the methodology and assumptions used to develop the Examination Framework and associated examination tests; therefore, a suggested reading order is given below.

a) Annex B provides details of the underlying considerations for developing the Examination Framework.

b) Annex C provides background statistical information which will enable the reader to determine sample sizes and confidence limits based on the defined performance requirements.

c) Clause 5 provides the definition of the Examination Framework for the evaluation of Charging Performance.

d) Clause 6 contains the toolbox of Examination Tests for the evaluation of charging performance for the identified scheme types.

e) Annex D contains methods which can be used to reduce the required sample sizes for metrics with high/low probabilities during the evaluation phase.

f) Annex E provides examples of Specific Examination Frameworks which have been developed in accordance with the methodology in 5.2.

TECHNICAL SPECIFICATION **ISO/TS 17444-2:2017(E)**

Electronic fee collection — Charging performance —

Part 2: Examination framework

1 Scope

This document defines the Examination Framework for the measurement of charging performance metrics defined in ISO/TS 17444-1 to be used during Evaluation and/or on-going Monitoring.

It specifies a method for the specification and documentation of a Specific Examination Framework which can be used by the responsible entity to evaluate charging performance for a particular information exchange interface or for overall charging performance within a Toll Scheme.

It provides a toolbox of Examination Tests for the roles of Toll Charger and Toll Service Provider for the following Scheme types:

a) DSRC Discrete;

b) Autonomous Discrete;

c) Autonomous Continuous.

The detailed choice of the set of examination tests to be used depends on the application and the respective context. Compliance with this specification is understood as using the definitions and prescriptions laid out in this document whenever the respective system aspects are subjected to performance measurements, rather than using other definitions and examination methods than the ones specified in this document.

The following aspects are outside the scope of this document.

— This document does not propose specific numeric performance bounds, or average or worst-case error bounds in percentage or monetary units. Those decisions are left to the Toll Charger (or to agreements between Toll Charger and Service Provider).This document does not consider the evaluation of the expected performance of a system based on modelling and measured data from trial at another place.

— This document does not consider the specification of a common reference system which would be required for comparison of performance between systems.

— This document defines measurements only on standardized interfaces. Proprietary interfaces are excluded, because it is not possible to define standardized metrics on such system properties. These excluded interfaces are among others the link between Toll Charger RSE and central systems in DSRC systems, and the additional sensor input of GNSS modules (inertial sensors, CAN-bus for wheel ticks, etc.).

2 Normative references

There are no normative references in this document.