

**An example of a view
on
(EETS) tariff classes
and
vehicle (use) parameters**

This draft may still contain contentious issues
Please, comment

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Foreword

The aim of the EETS, the European Electronic Toll Service, is to allow the user of a vehicle to conclude one service contract and to use one OBE for circulating a vehicle within all the electronic toll domains in Europe.

Within the EETS a toll charger has to accept vehicles with onboard equipment (OBE) from a third party, the EETS provider, and to utilise toll declarations received from this provider.

This paper discusses problems with the use of vehicle (use) parameters and provides a solution that

- confines these problems to vehicle's registration by the EETS provider and
- makes the deployment of OBE independent of the (fixed) vehicle parameters.

This paper aims to bridge the gap between the layman and the professional. By focussing on the high-level, conceptual issues it should be comprehensible for those with only a common knowledge of the EETS and performance indicators. Technical details that may be of interest only to experts are provided in the footnotes.

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Although the Dutch Ministry of Infrastructure and the Environment pursues the EETS, this paper is a technical paper and does not represent or imply any official position of the ministry.

Summary

In most toll domains, the tariff to be paid for the circulation of a vehicle depends on vehicle (use) characteristics. Over the years the standardisation of the parameters been often debated.

This debate has been cumbersome. Standardisation was trying to confine and to harmonise the many options available to policy makers. Also, the use of technical standards for the exchange of tariff schemes was not supported by legal departments.

In this paper an alternative is presented. During subscription, the static vehicle (use) characteristics are mapped to a tariff scheme dependent tariff class parameter in accordance to rules set by the toll charger. Later on, all communication between the toll service provider and the toll charger may then use the value this tariff class parameter.

With this alternative the vehicle (use) characterisation is confined to the subscription (vehicle registration) phase. The data communication between the toll charger and the toll service provider can become independent of the tariff schemes. Moreover, the responsibility for harmonisation of vehicle (use) characteristics is moved from CEN to the responsible policy actors.

Note that this alternative may be used next to the existing solutions. From a formal point of view, only one new tariff scheme dependent vehicle (use) parameter is added.

Recommendation

Allow that a toll chargers and toll service providers may use tariff scheme dependent tariff class identifiers (in stead of vehicle (use) parameters) in the communication between their equipment.

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1 Introduction

1.1 Overview

This introduction provides a brief description of the EETS and the need for performance metrics with the major terms and concepts.

For the EETS, details can be found in the EETS Directive [1] and the EETS Decision [2]. The overall system architecture is described in the CEN standard ISO 17573 [3].

1.2 The EETS

1.2.1 Toll

A toll is a charge, tax, fee, or duty in connection with using a vehicle within a toll domain. The definition is a generalization of the classic definition of a toll as “a charge, a tax, or a duty for permission to pass a barrier or to proceed along a road, over a bridge, etc.”

A toll domain is an area, a part of a road network, or a structure like a bridge or ferry where a toll regime, i.e. a set of rules governing the collection of the toll, is applied.

A toll domain may contain one or more tolled objects, distinguished parts of the toll domain for which one or more tariff schemes apply.

EXAMPLE An area, all public roads within an area, a bridge, a zone, or a stretch of road (network).

In other words, the toll domain constitutes the area of jurisdiction for a toll charger while the tolled objects are the actual objects for which a toll has to be paid¹.

1.2.2 The organisational model

The organisational model is the so-called CESARE III model as depicted below.

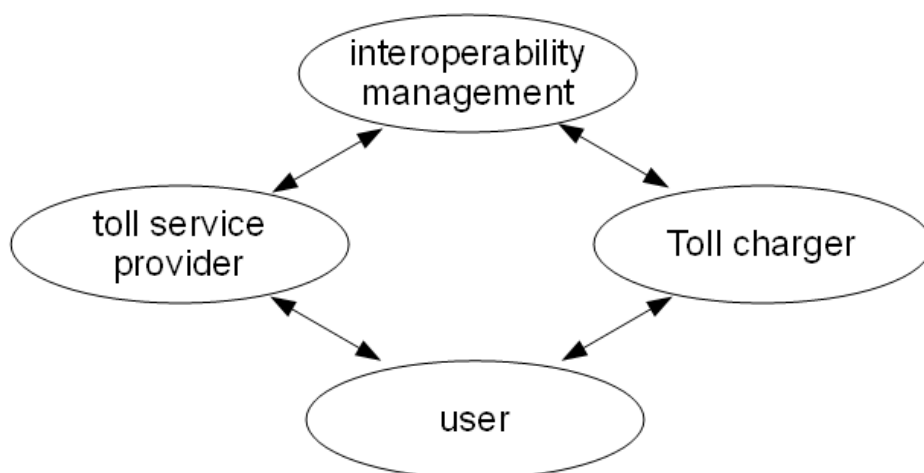


Figure 1-1 The organisational model

The toll charger is the legal entity charging² toll for vehicles in a toll domain.

¹ In case the location of the tolled object coincides with the location of the toll domain (with is often the case), the term toll domain may be used as a synonym for the tolled object.

² Because the actual collection of the toll is not covered in the CEN standards, 'charging and collecting' would be more precise.

The toll service provider is the legal entity providing its customers toll services on one or more toll domains for one or more classes of vehicle. The toll service provider is responsible for the operation (functioning) of the OBE with respect to tolling.

Within the EETS a toll service provider is called an EETS provider.

An EETS provider acts towards a toll charger as the representative of its clients (and the ones liable for toll)³

Note in the CESARE model a toll charger or a toll service provider may delegate / subcontract any task to a third a third party. However, this shall have no impact on its responsibilities / liability towards the other parties.

A user is a customer of a toll service provider, a one liable for toll, the owner of the vehicle, a fleet operator, a driver, etc. depending on the context.

1.2.3 The overall architecture

The overall architecture is depicted below.

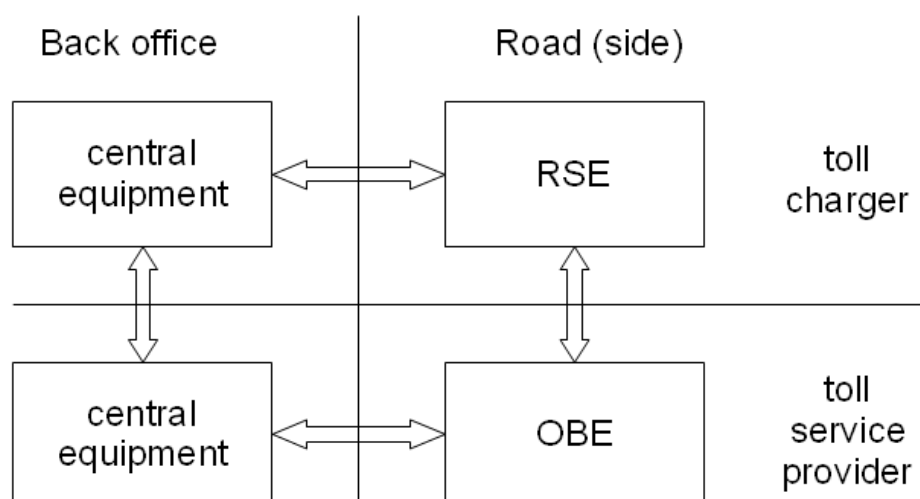


Figure 1-2 Overall system architecture

The toll charger's equipment consists of its central equipment⁴ and his roadside (including mobile) equipment (RSE). The communication between its central equipment and his RSE is considered propriety.

The toll service provider's equipment consists of its central equipment and onboard equipment (OBE). The communication between its central equipment and its OBE is considered propriety.

This paper focuses in the interoperability interfaces between the toll charger and the toll service provider, i.e. between OBE and RSE and between the TC's and TSP's central equipment.

³ In other toll charging environments a toll service provider may merely act as a reseller or as a (non-) transparent agent of the toll charger.

⁴ Also called back office or back office equipment

1.3 Vehicle (use) parameters, tariff classes and tariff schemes

1.3.1 Basic definitions

A tariff class is a set of vehicles treated similarly by a toll charger (see [2])

A tariff class may depend on one or more vehicle (use) parameters.

Example In the Austrian toll systems the set of vehicles with 3 axles and EURO-Emission classes EURO 0 to III constitutes a tariff class.

Both the tariff classes and tariff schemes are defined by the toll charger and the definition of the both shall be part of toll context data, i.e. the data needed by the toll service provider to establish the toll due for circulating a vehicle on a toll domain.

As some tariff schemes are based on variable vehicle (use) data. Some additional definition are needed.

Fixed vehicle parameters are vehicle classification parameters that do not vary from trip to trip. By contrast, variable vehicle (use) parameter are vehicle classification parameters that may vary from trip to trip⁵.

Note A vehicle use parameter is always a variable parameter. If not, it should be a vehicle parameter.

Example Exemptions for disabled persons may be based on vehicle characteristics (e.g. designed to be used by disabled persons) or on vehicle use characteristics (e.g. carrying a disabled person).

Similarly, a distinction can be made between the fixed vehicle class and a fixed vehicle class defined as the set of vehicles that are treated similar in case the variable parameters have the same value.

1.3.2 The legal context

Within the EETS each Member State (toll charger) is free to define its own toll policy and tariff schemes. This is explicitly stated in article 3.2 of the Directive [1].

NOTE Also, the harmonisation European tax legislation is based on another pillar and requires unanimous decision (see article 113 of the treaty on the functioning of the European Union [4])

This is also reflected in Annex VI of the Decision [2] on vehicle classification parameters. Although this Annex limits the use vehicle parameters to those already in use, defined in CEN 15509 [5] or defined in CEN/ISO 24534-3 [6], it contains also provisions for the introduction of new parameters (see Annex VI article 3 and 4).

2 The current situation and problems

2.1 Introduction

Current (draft) CEN standards are based on the use of vehicle (use) parameters. However, the use of the vehicle (use) in these standards is not without problems.

This section provides a brief analyses of the following type of problems:

1. Problems with the definition of these parameters and the determination of their values
2. Problems with the decision-making process

⁵ The terms fixed and variable are used also in the Decision [2]. In earlier papers the terms static and dynamic were used in stead.

3. Problems with the dissemination of tariff schemes

2.2 Problems with vehicle (use) parameters

There are several problems with the support of vehicle parameters currently used in EETS toll domains.

a. Not all parameters currently in use are supported in the draft CEN standards

Example Vehicles equipped as police car, as fire brigade cars, as an (animal) ambulance, as a hearse, or to carry disabled persons, etc.

b. Some tariff schemes are using parameter values that are not supported

Example The tariff scheme for the Severn Bridges in the UK is based on vehicle classes like 'busses with 9 to 17 seats' and 'motor caravan' (see [8]).

c. Some parameter values are toll domain dependent

Example 1 Both the tariff scheme for the German and the Austrian LKW maut are based on an 'emission class' parameters. However no equivalent of the German specification [7] is used in Austria, the definition of these parameters differ.

NOTE In case both toll chargers should accept these difference (i.e. the determination of the Euro class by the other party) each EETS provider could go for the cheapest class in case of any difference⁶.

d. Inconsistencies between legislation and CEN standards for tolling

Example 1 Annex VI of the Decision [2] refers to ISO 24534-3 [6] but other / inconsistent vehicle parameters were since then introduced in the relevant CEN standards.

Example 2 Exemptions for disabled persons vary between toll domains.

Note that with respect to a., b., and c. the problem is not the use of these parameters – a toll charger is free to define its tolling policy – but only a problem that standardisation should cope with.

2.3 Problems with the decision-making process

Currently the Member States / toll chargers are free to define their toll policy and therefore the vehicle (use) parameters for this policy, while, on the other hand, CEN tries to standardise these parameters. This does not work.

In this respect it should be noted that politicians and policy departments are not inclined to feel themselves restricted by technical standards. On the contrary, a policy department will not bother about these kind of issues. They will regard them rightly as technical issues that can be resolved.

Any harmonisation of the use of vehicle (use) parameters for tolling should be dealt with first, bilaterally or multilaterally, by the parties responsible for choosing this parameters, i.e. by the member states and/or the toll chargers and CEN should accept and cope with this situation.

2.4 Problems with the dissemination of tariff schemes

When looking to the details, the use of the (draft) CEN standards for dissemination of tariff schemes to EETS providers may not be likely:

⁶ Note that the EETS Decision [2] precludes any discrimination based on the vehicle's state of registration.

- a. The structure of a tariff scheme, i.e. the definition of the tariff classes, may not change for years. So why should a toll charger invest in an expensive protocol that will be seldom used.

Note It may be much cheaper for both parties if the EETS provider would enter that structure manually in its data base.

- b. The allocation of a new tariff to each tariff class will occur more frequently (e.g. once a year), but the same argument applies.

- c. The determination / definition of the tariff classes may be too complicated to use the (draft) CEN standards for its dissemination.

Example1 See "Leitfaden zur Ermittlung der Schadstoffklassen schwerer Nutzfahrzeuge" for the determination of the environmental class in the tariff scheme for the German LKW maut.

Example 2 Detailed analyse revealed that it was not feasible to translate the definition of the proposed Dutch tariff scheme in 2010 into data structures as currently defined in the draft CEN standards.

- d. In order to avoid any misunderstandings, the legal department may decide to disseminate the copies of official publication instead

Example In 2010 it was already considered a serious legal problem to translate our draft toll law. In order to avoid the liability for translation differences, it was even suggested to ask a third party to publish an unauthorised translation. The use of esoteric data structures (as jurists see them) was completely out of the question.

To conclude, it is quite unlikely that a toll charger will use the CEN standard for the use of its tariff scheme(s). Instead, he will just publish the official documents as part of its EETS domain statement.

3 An alternative: using tariff class identifiers

3.1 Introduction

The proposed alternative is based on the assignment of a tariff class identifier to each of the tariff classes in a toll domain⁷. This will confine the problems to the subscription phase and make the deployment of OBE tariff scheme independent⁸.

This alternative is detailed in the next sections.

3.2 The subscription phase

An EETS provider has to determine the value of all the static vehicle parameters needed before the vehicle may start to circulate in the various toll domains.

NOTE This has to be done anyway and irrespective of any complexity associated with this task (see the problems with vehicle parameters above).

When the value of the involved vehicle parameters are determined, the determination of the tariff class is only a small step.

Example When the Euro class is known the 'rate group' A, B, or C for the Austrian toll can be easily determined.

⁷ Or for each of the tariff schemes in case the toll domain uses more than one tariff scheme (which is currently not the case)

⁸ Except for variable parameters, but see section 3.4.

In order to arrive at a universal solution it is proposed that the toll charger assigns for each tariff scheme he uses a distinct integer value to each of the tariff classes⁹ under that tariff scheme.

If doing so, the communication in the deployment phase may use these tariff class identifiers in stead of the original and possible domain dependent original vehicle (use) characteristics.

3.3 The deployment phase

During the deployment phase, i.e. when the vehicle is circulating in the toll domain, there is no need any more to use the original vehicle parameters. The toll domain dependent vehicle class identifier will be used instead.

Note that this will make the OBE independent of structure of the tariff schemes.

3.4 Coping with variable vehicle (use) parameters

Using vehicle class identifiers simplifies also the use of variable vehicle parameters.

First note that problem of determining or setting variable parameters has to be dealt with anyway and irrespective of the introduction of tariff class identifiers.

So, given known values of variable vehicle parameters, these values have to mapped¹⁰ together with the fixed tariff class identifier to the actual tariff class identifier.

NOTE Alternatively, implementations may use the two parameters: the fixed vehicle class identifier and the variable vehicle class identifier¹¹.

The actual tariff class identifier can then be used in the communication between the EETS provider's (onboard) equipment and the toll charger's (roadside) equipment.

4 Explanation, properties, consequences and advantages

- a. All problems with the assignment of (fixed) vehicle parameters are confined to the subscription, i.e. to a back office process.
- b. The storage and use of vehicle parameters in the OBE may be replaced by a simple and universal toll domain dependent tariff class identifier¹².
- c. The protocol for the communication between a vehicle and the road side has become independent of the actual tariff scheme used for a toll domain

Note In DSRC systems the design of the roadside equipment may even be simplified. The RSE does not have to know anymore which vehicle parameters it has to request from the OBE. And, in case more than one parameter is used, it is (a bit) simpler to map one tariff class identifier to a tariff than a combination of other parameters.

- d. The OBE has to be aware of the toll domain the vehicle is circulating in

⁹ Or for each of the fixed vehicle classes in case variable vehicle (use) parameters are used as well.

¹⁰ It should go without saying that this mapping is toll domain dependent and should be prescribed by the toll charger.

¹¹ The subtle differences between these alternatives are still for further study. E.g. in case the fixed tariff class identifier is already included in a 'toll account certificate' (see below), the separate use of both parameters may be preferred.

¹² Strictly speaking, one tariff class identifier per tariff scheme. But as yet each of the EETS toll domains uses one tariff scheme only and, moreover, the context data definition in ISO 17575 part 3 is based also on single tariff scheme contexts.

Note However, EETS OBE has to be suited for GNSS toll domains as well. And, for a DRSC domain only a very coarse domain description is needed¹³.

e. No loss of information

Note 1 To some extent a tariff class identifier is only a coding trick. A toll charger may assign a tariff class identifier to each unique combination of the vehicle classification parameters.

Example ASFINAG could just assign a number to each combination of the environmental category (or even the Euro class value) and the number of axles category.

Note 2 In case there is no need to determine the original vehicle category parameter(s), a more coarse tariff classification might be possible.

Note 3 As has been checked with legal experts in the Netherlands and Austria, there are no legal obstacles for using an appropriate tariff class identifier in stead of the original vehicle category parameters.

f. Security may be improved and simplified

Checking compliance with respect to a correct assignment of the (fixed) vehicle parameters may be based now on the exchange of a universal domain dependent certificate that is signed by the EETS provider.

Note This 'Toll Account Certificate' as it called in papers on secure monitoring may than contain the static tariff class, the vehicle licence plate number and a (secure element or account number).

g. A new fixed vehicle classification parameter can be introduced in due time.

Note It does not require a new type of OBE and it does not require any adaptation of a CEN standard (the official documents are used for the dissemination of the new tariff scheme).

To summarize, the use of toll domain dependent tariff class identifiers will make the OBE and RSE immune (or at least much more immune) to new tariff schemes and/or tariff scheme changes. Also, it may pave the way to cheaper OBE and RSE¹⁴. Moreover a new fixed vehicle classification parameter does not require adaptation of the requirements for the communication between the toll charger's equipment and toll service provider's equipment. The same CEN standard can still be used.

5 Glossary and abbreviations

5.1 Glossary

context data (17573)

information defined by the responsible toll charger necessary to establish the toll due for circulation a vehicle on a particular toll domain and conclude the toll transaction (see [3])

NOTE The definition is equal to the one for 'toll context data' in the Decision [2].

declaration

toll declaration

EETS Provider

A legal entity providing its customers toll services on the EETS toll domains

¹³ Only the right toll domain for a gantry has to be known and gantries in different DSRC toll domains are usually not located too closely.

¹⁴ Although this may require new investments comparable to the introduction of a new vehicle parameter and although not all parties may profit from cheaper OBE that is also more immune to new tariff scheme definitions.

European Electronic Toll Service (EETS)

A service which allows users to circulate a vehicle in all the toll domains falling under the scope of Directive 2004/52/EC and pay the corresponding tolls with a single contract and a single on-board equipment.

fixed parameter

A vehicle parameter for which the value does not vary from trip to trip

NOTE The opposite of a variable vehicle parameter

onboard equipment (OBE)

A complete set of hardware and software components required for providing EETS which is installed on board of a vehicle in order to collect, store, process and remotely receive/transmit data.

tariff class

The set of vehicles treaded similarly by a toll charger (see [2])

tariff scheme (Decision)

the allocation to tariff classes of the toll to be paid, as defined by the toll charger (see [2])

tariff scheme (17573)

Set of rules to determine the toll due for a vehicle in a toll domain for a tolled object at a certain day and time (see [3])

EXAMPLE A table that shows the toll due for the various vehicle tariff classes.

toll

charge, tax, fee, or duty in connection with using a vehicle within a toll domain

NOTE The definition is a generalization of the classic definition of a toll as “a charge, a tax, or a duty for permission to pass a barrier or to proceed along a road, over a bridge, etc.”.

toll charger

legal entity charging toll for vehicles in a toll domain

NOTE In other documents the terms operator or toll operator can be used.

toll context data

information defined by the responsible toll charger necessary to establish the toll due for circulation a vehicle on a particular toll domain and conclude the toll transaction (see [2])

NOTE The definition is equal to the one for 'context data' in 17573.

toll declaration

statement to a toll charger that confirms the presence of a vehicle in a toll domain in a format agreed between the Toll Service Provider and the Toll Charger

NOTE A valid toll declaration has to fulfil formal requirements, including security requirements, agreed between the Toll Service Provider and the Toll Charger.

toll domain

area, a part of a road network, or a structure such as a tunnel, a bridge or a ferry where a toll regime is applied

toll service provider

legal entity providing its customers toll services on one or more toll domains for one or more classes of vehicle

NOTE 1 The toll service provider can provide the OBE or can provide only a magnetic card or a smart card to be used with the OBE provided by a third party (just as a mobile telephone and a SIM card can be obtained from different parties).

NOTE 2 The toll service provider is responsible for the operation (functioning) of the OBE with respect to tolling.

toll system

off-board equipment and possible other provisions used by a toll charger for the collection of toll for vehicles

NOTE 1 The OBE is excluded from the definition.

NOTE 2 The actual payment (collection of the fee) can take place outside the toll system.

tolled object

distinguished part of a toll domain for which one or more tariff schemes apply

EXAMPLE An area, all public roads within an area, a bridge, a zone, or a stretch of road (network).

user

generic term used for customer of a toll service provider, one liable for toll, the owner of the vehicle, a fleet operator, a driver, etc. depending on the context

variable parameter

A vehicle (use) parameter for which the value may vary from trip to trip

NOTE The opposite of a fixed vehicle parameter.

EXAMPLE The presence of a trailer or the number of axles including trailer axles and/or lifted axles.

vehicle classification parameter

vehicle related information according to which toll are calculated based on the toll context data (see [2])

vehicle usage classification parameter

vehicle usage related data according to which toll are calculated based on the toll context data and that does not depend on the location of the vehicle or on the time at which it is used.

EXAMPLE A vehicle usage parameter may be related to its payload and/or to the driver and/or its being in service.

NOTE A vehicle usage parameter is always a variable classification parameter, i.e. a classification parameter for the value may vary from trip to trip. If not, it should be a vehicle parameter.

vehicle (use) parameter

a vehicle classification parameter and/of a vehicle usage classification parameter.

5.2 Abbreviations

CE Central Equipment
DSRC Dedicated Short Range Communication

EP	EETS Provider
EETS	European Electronic Toll Service
GNSS	Global Navigation Satellite System
OBE	On Board Equipment
RSE	RoadSide Equipment
TC	Toll Charger
TSP	Toll Service Provider

6 References

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