Liikenne- ja viestintäministeriö

National km-tax for Passenger Cars Cost Estimation

Oikeudenmukainen ja älykäs liikenne -työryhmä

Julkaisuja 39/2013

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Asiasanat
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Yhteyshenkilö	
Tuomo Suvanto LVM	

Muut tiedot

Tiivistelmä

Raportissa käsitellään valtakunnallisen kilometriveromaksujärjestelmän kustannuksia.

Investointi- ja operointikustannukset on laskettu kolmelle eri vaihtoehdolle. Vain verotusta varten tehtävälle järjestelmälle, ns. monipalvelumallille ja ei-paikannukselle perustuvalle mallille.

Investointikustannukset ja operointikustannusten suuruudet riippuvat tarkasteltavasta mallista.

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1. Introduction

The work of the Working Group for “Fair and intelligent transport” is intended to provide an overall picture of how Finland should go about the introduction of road pricing in the long term. The Working Group will look at technology, transport, economic and regulatory issues.

The Working Group is proposing a km-tax for passenger cars (some 2.6 mill. cars in 2013, estimated 3.0 mill. in 2025) to replace fixed car and vehicle taxes. The aim is to secure the tax revenue of the traffic in the trend, that vehicles consume less fuel and the revenue decreases. Another key objective is the positive effects of more sustainable mobility behaviour, which are indicated in the effect analyses. This proposal does not touch the taxation of other vehicle categories for transport policy reasons.

The committee, whose term of office expires at the end of 2013, has not taken a position on the level of taxation. The draft model is therefore tax neutral, i.e. produce as much as the current taxation model.
The present report addresses the costs of collecting the envisaged Km-tax. The study evaluates capital expenditure (CAPEX) and operation expenditure (OPEX) which needs to be taken and covered by the Finnish Government.

A high level description of an entire and workable system (including among other things the institutional setup) is required to enable the cost calculations. This outline of the scenario is the base for the calculation. The described scenarios have been developed according to the state of art and the expected developments over the next decade. However, it is to be understood that the system descriptions and scenarios in this report shall not be interpreted as proposals, they are the base for the calculations only. There are many ways of setting up a km-tax scheme.

The Ministry of Transport and Communications has appointed Kristian Appel at Traficon Ltd for the task. The work has involved Bernhard Oehry and Andrea Felix from RappTrans AG in Switzerland. The Ministry is represented by Tuomo Suvanto.

2. Description of a possible system

2.1 Basis

To enable the cost estimate, a rough description of the system is required, including all statements and information that significantly affect costs (establishment, maintenance and operation costs).

The year 2025 is given as a horizon when the system would be fully operational. The long (but realistic) horizon creates its own challenges to the characterization and assessment of costs. A number of critical factors may change significantly during the period of 10+ years. Today, the predominant solutions may have been joined by new or replaced by completely new solutions. It is possible that the so-called multi-service environment is created, i.e. that the tolls or taxes are just one service among many others in the same system environment. It is also possible that some of the technical devices are integrated in vehicles already by the car manufacturer. The possibilities of smart cellular phones for reliable tax collection are another question mark.

In the following as a basis for the cost calculations is described the main rationale, main assumptions and sub-assemblies and their main solutions. In addition some alternative possibilities are identified.

The main starting points for the envisaged Km-tax system are:

- Km-tax applies to passenger cars only
- Km-tax applies to the entire Finnish road network (including private roads)
- Km-tax can be different at different times
- Km-tax can be different in different regions
- Km-tax is differentiated by the characteristics of the vehicle (registered characteristics)
- Km-tax also applies to foreign cars, which are used in Finland
- in addition to the Km-tax it shall be possible to levy e.g. congestion charges (fluency fee or environmental charge), and road user charges for certain road objects (for financial purposes)

Boundary conditions:

- the Km - tax is to be collected by a Road Tax Authority supported by Service Providers in free competition (EETS Providers or Private Multi-Service Providers); they equip vehicles with the required equipment and are responsible for ensuring that the amount of driving is correctly measured and reported to the Road Tax Authority.
- the Finnish Government establishes a new governmental entity called Road Tax Authority (may be a part of an existing Authority) who is in charge and obliged to equip all vehicles that out of whatever reasons did not manage to establish a contract with one of the EETS Providers or Private Multi-Service Providers.
- The Road Tax Authority is also in charge of the Occasional User Scheme for foreign users and provision and maintenance of the enforcement infrastructure.
- EETS (European Electronic Toll Service) is running and is one way to pay for the tax.
- the tax collection goal is 100% coverage (to be specified in detail by the Finnish Government).
- the Finnish Government has to organize and operate a credible enforcement to discourage fraud.
- the tax is assessed and billed by the Road Tax Authority based on their own collected data or on the data collected and provided by the EETS Providers or Private Multi-Service Providers

Special issues

Abroad registered vehicle´s payment methods (foreign vehicles):
Assuming that one cannot force a foreign vehicle to purchase/borrow the necessary vehicle equipment, there must also be other methods of payment. Some possibilities are:

- The vehicle has already an EETS device, which as such enables payment of the tax
- Foreign vehicles borrow an OBU for a deposit on the border or on a ferry and return it when exiting the country
- A foreign vehicle may, if the stay is short-term (e.g. ≤ 10 days), subscript to an e-vignette , which is linked to the license plate of the vehicles and valid only in a specific area

Multi-Service model:
It should be noted that the so-called multi-service environment may be there in 2025 and that the km - tax is just one service among many others in the same system environment. This can happen if the multi-service environment is able collect all required data to the same or to lower costs without any loss of the collection quality and in privacy conditions. This can be taken into account in the calculations as an optional scenario.

Integration of equipment in the vehicle by the car manufacturer:
Some of the required functionalities and devices may be integrated into the vehicle in the future. However, taking into account the open service market, this is mainly concerned with the hardware and the related cost is not very high. The advantage is more ergonomic – less retrofit equipment required or they are simpler.

Use of Smart phones or other new technologies?
Smart phones are often mentioned as an option for Electronic Fee Collection (EFC). Currently available EFC solutions have the great advantage of being dedicated and fixed to a certain vehicle. On the contrary a smart phone is assigned to a legal or natural person. Using smart phones, which by definition are meant to be flexible in use, it is not easy to reach the same reliability and security. They do not support the compliance checking defined in the standards. To ensure that every vehicle pays the right fee for each number of kilometers driven would be a big challenge, as smart phones tends to circulate between people or are heavily used for many other purposes, easily loose signal or power, can easily be lost or stolen, etc. Smart phones are therefore not considered in this cost calculation, although their coming generations may make them a potential tool.

V2I and I2V solutions (5.9 GHz) is an emerging field of applications for communication between vehicles or with the infrastructure that possibly might support road user charging (RUC). The range of the radio link 5.9 GHz extends over several 100 meters, and therefore as such it does not support the identification of single vehicles in the traffic stream, which is a prerequisite for enforcement. In addition, no profiles or standards for fee collection do exist at the moment for this technology. Hence 5.9 GHz technology will not be considered in this study, not the least because it is not covered by the Interoperability Directive 2004/52.

2.2 Technologies

The EFC technologies are described more in detail in the report of the working group "International Review of RUC, international practices and trends for the future" / Traficon & Rapp in the spring 2013.

In the current situation it must be assumed that the system requires an OBU. In this case, the so called Interoperability Directive applies (EC Directive 2004/52/EC on the interoperability of toll systems in Europe) and it allows only for the following techniques:

- Satellite based positioning;
- GSM-GPRS (reference GSM TS 03.60/23.060);
- 5.8 GHz microwave technology.

Other EFC specific technologies that might be needed for specific purposes are automatic registration plate recognition (ANPR), as well as possibly an electronic vignette (e-Vignette). These do not need to conform to any EFC standards.

2.3 The system

In order to base the calculations on a sound base, a high level system description is required. The described scenarios below represent 3 approaches how a Km-tax could be realised and shall not be understood as result of an in-deep and detailed feasibly study.

The basic concept is based on a GNSS /CN OBU (satellite based positioning and Cellular Network communication)

The travel distance measurement is based on satellite positioning and map matching. The road network is divided into a sufficiently short road sections for which the tariff class is defined. Based on the satellite positioning, map matching of used road sections is done. Each road segment length and the corresponding tax can be obtained from a table valid for the time of usage that can be stored in the vehicle unit, or back-office system.

At this point, one does not need to resolve whether to communicate the precise route information to the back-office systems, and in what form (encrypted, locked, etc.). In any case, it is required that there is an opportunity afterwards to check that the payments were determined correctly.

The EETS Providers and Multi-Service Providers are to provide the agreed information in an agreed format to the Road Tax Authority, which shall specify in detail the required quality of the information.

The main solutions for enforcement are based on CEN DSRC (microwave technology) and (automatic) number plate recognition (ANPR).

Enforcement is very important and required for a credible system to ensure the collection of taxes. Enforcement is deployed to create a sufficiently high risk of being caught cheating.

The OBU allows a road side or portable DSRC device to check the state of the OBU (working correctly/something wrong). In addition, number plates readings from the roadside devices and mobile patrol cars can be used. In doubtful cases data from different sources can be compared with each other and with the information obtained from the service provider's account summaries.

Enforcement is on the responsibility of the Finnish Government. Procurement and maintenance of the enforcement infrastructure and equipment will be in the area of responsibility of the Road Tax Authority. The operation can be conducted by either by the Road Tax Authority or by another governmental entity.

In order to reduce the need for (costly) road-side equipment it recommended that some surveillance and monitoring tasks are integrated into the OBU ("strong OBU" with

dedicated sensors) and corresponding log files can be reported automatically to the back-office (e.g. disruption of power supply, significant gaps of positioning data, etc.).

Treatment of foreign vehicles

The starting point is that foreign vehicles also are required to pay the km-tax. There are some alternative ways to solve the issue. The most convenient situation is if the vehicle has already the EETS - equipment or otherwise an interoperable device. This option should be utilized to the maximum.

Another possibility is to provide the required OBU (with deposit) at border posts and ports or already on-board the ferries (Plug & Play OBU). This is, however, a logistically demanding solution and an effort for the vehicle owner/driver.

A third solution, which one can always fall back on, is an electronic vignette (eVignette) for temporary use. The eVignette is linked to the vehicle number plate. Difficult in this case is the pricing of the vignette, so that it is fair to different groups of users. Pricing may be easier if the vignette is sold only for short periods, as well as region by region. In this case, for example, a vehicle arriving in Helsinki by ferry could buy a vignette, that is valid only in the region of arrival and at maximum for 10 days (it should be possible to buy the licenses of shorter lengths). The same vehicle would not be allowed to buy a succession of permits (more than a week). As OBU's also should be offered at the borders for those who want it, the eVignette cannot be considered discriminating.

Multi-service environment

A multi-service environment can be generated in many ways. Most likely, there will be several parallel competing multi-service environments, if any at all. It may happen that the party providing toll collection himself offers other services or allows others to do it via his platform. It could also be that there are multi-service platform providers offering an environment that satisfies the Road Tax Authority.

When it comes to taxation, the requirements of reliability and accuracy, however, are demanding. Current actors within RUC are reluctant to be exposed to high risks and find it likely, that the public services and commercial/entertainment services for a long time if not forever operate in different environments.

The possible savings of a multi-service environment will be estimated based on certain general assumptions.

Smart phones

The analysis will not take into account the possibility that the smartphone would replace the standard EFC OBU. The requirements of the current EC legislation are so high that cost savings are unlikely to be achieved especially as also the requirements even increase due to the multi-service environment that a phone represents by default. The situation can be compared to a situation where the tolling equipment (OBU) would not only be a secure tolling equipment but also is an entertainment device, a telephone and a netsurfing tool.

eCall

eCall will be mandatory in new cars in EU from October 2015. It is now and then discussed, if the eCall equipment could serve as a platform for other services as well. This is not the case yet, but new activities are currently initiated by ERTICO, whereby the future development of eCall will be examined, how it may be integrated to a wider

telematics platform and if it could take advantage of other in-vehicle technology. It is likely, that some kind of integration is developed by 2025 enabled by more open specifications.

3. Cost model and basic input data

3.1 Principle

The target year 2025 is given, when the system would be fully operational. The long (but realistic) horizon creates its own challenges for assessing costs. A number of critical factors may change substantially during the period of 10+ years. Unit prices fall, the volumes are increased. Today, the predominant solutions may have been joined by new or replaced. It is also possible that the so-called multi-service environment is born, i.e. that the tolls or taxes are just one service among many others in the same system environment.

The following principles are applied for the cost calculations

- the current view on what the system would look like (as described above) is the starting point as well as the current technology, which is supposed to become mature and becoming significantly cheaper by 2020-25
- based on this, a basic cost calculation will be made
- two other scenarios are defined: one regarding the multi- service environment option (Sc. #2) and one based on a flat fee all over the country (Sc. #3 km-declaration).
- finally, there are still some factors that require sensitivity analysis, i.e. the how the total cost depends on the unit price (e.g., the unit price of the OBU or allocation of the OBU costs)

Main costs drivers:

The main costs drivers in the envisage scheme (all roads, all light vehicles, tariff differentiation based on location and/or time) will be

- The costs of the equipment of the (domestic) users
- The remuneration of the EETS and Private Multi-Service Providers
- The enforcement approach and infrastructure
- The Occasional User Scheme in order to avoid equipment of all foreign users and provide a comfortable solution for foreign visitors of Finland

The different approaches regarding equipment and remuneration of service is described in detail in the outline of the scenarios.

The cost for the enforcement scheme is widely dependant of the infrastructure needed, the coverage across the country and the number of mobile enforcement units in operation. Due to the large surface of Finland and the rather huge liable road network it is not possible or recommended to envisage an enforcement density like on the current free-flow motorway tolling schemes. The OBU shall be used as a toll data recorder, but must also include specific sensors supporting a self-monitoring of the OBU. Among others power cut offs or longer periods without GNSS or CN signals must be recorded. To do so, an internal battery is required. As soon as the OBU is on regular working mode (again) these log files are reported to the central system and help to detect fraud or attempts to fraud the data recording. A second mechanism to detect fraud is the plausibility check of the recorded and declared journeys. No car can fly - hence the declared journey needs to be seamless and without significant gaps. A limited number of enforcement infrastructure

and a plausibility matrix are needed to support this kind of monitoring. Special events like piggyback on a trailer, truck or train needs to be reported by the user.

The (necessary) occasional user scheme is for sure a significant cost-component but will be similar for all 3 scenarios; hence it will not have a strong impact between the scenarios. Both an eVignette scheme and a km-performance declaration application can be implemented at similar costs and have comparable requirements in context of vehicle data to be registered or payment options and handling.

The main purpose of the occasional user scheme is to limit and reduce the number of foreign users to be equipped with an OBU as much as possible. At border stations, at ports, but also on ferries the capacity to register users and handout of OBU is limited. The more foreign users can use a WEB-based application such as an eVignette or simple km-performance declaration the smaller the operational issues at entry and exit points to Finland are and the less costly the approach is.

The share of vehicles using it will vary in a small bandwidth, hence the implementation and basic operation costs of the occasional user scheme will be basically the same (working assumption).

Outline of Scenarios:

Scenario 1) Charging scheme with strong GNSS/CN OBU and occasional user scheme (eVignette) for foreign users – Km-Charge with strong OBU

The Finnish Government will establish a Road Tax Authority (may be a part of an existing Authority) which is in charge of setting-up, operate and maintain the entire Electronic Fee Collection (EFC) System. This includes also the set-up and maintenance of the toll context data (mainly the digital map of the liable road network and tariff data). Some specific tasks as the operation of the Mobile Enforcement Units, audit and monitoring of Private Multi-Service Providers can be done by the Road Tax Authority as well or be assigned to another governmental body.

The Road Tax Authority also is in charge of the assessment and determination of the Km-tax based on the road usage data submitted by EETS Providers. Invoicing and clearing of the Km-tax of the EETS Users is assumed to be part of the services provision of the EETS Providers.

All investments and operation costs are covered by the Finnish Government. The EETS Providers will receive a remuneration per user for the services provided to the user such as provision of the OBU, customer relationship management, provision of information and help desk etc.

The main characteristics are:

- GNSS/CN OBU,
  The GNSS/CN OBU is mandatory for all domestic users, voluntary for foreign users.
  The OBU is provided by a Road Tax Authority which is established by the Finnish Government and by EETS Providers. In Scenario 1 there are no (other) Private Multi-Service Providers involved than the internationally operating EETS Providers.
  Foreign vehicles entering and leaving Finland on a regular base (e.g. commuters from the Baltic countries, Russia, Sweden, Norway etc.) can subscribe for a permanent OBU and are handled like domestic users.

The Road Tax Authority is also in charge of Plug & Play OBU provision for voluntary equipped foreign users. The Plug & Play OBU for the foreign users is easy to install and can be picked-up in outlets at or close to the Finnish border and on-board of all ferries.
For the Plug & Play OBU a deposit covering the OBU cost is charged, which is refunded as soon as the OBU is returned. The return of the OBU can be done at the same locations as mentioned above or by shipping it to an assigned service centre.
All OBUs will be equipped with sensors supporting the enforcement of the scheme enabling the self-monitoring of the OBU by detecting and reporting potential attempts of the user to fraud the scheme.

- nationwide enforcement will be based on fixed and portable enforcement infrastructure and mobile enforcement units. The same enforcement equipment will also be used for the surveillance of the occasional user scheme.
  As mentioned above the OBU and its self-monitoring functions are one of the key elements of the enforcement approach which allows reducing road-side equipment to a minimum. The limited number of enforcement stations at strategic useful locations enables plausibly checks of the declared data.

- occasional user scheme based on the license plate (eVignette): The eVignette is for the foreign users an alternative to the OBU. The booking of eVignette will be based on a WEB-application and shall be possible for a limited time period only e.g. up to 10 days maximum. Foreign users spending more time in Finland are asked to be equipped with an OBU.
  The advantage of an eVignette for the user is the comfort; the advantage for the Finnish Government is a reduced challenge to equip all vehicles entering Finland with a Plug & Play OBU.

Scenario 2) Charging scheme embedded in Multi-Service Environment – Km-Charge in Multi-Service Environment

The basic approach of Scenario 2 is the same as in Scenario 1.

The only, but significant difference is the involvement of additional Private Multi-Service Providers next to the EETS Providers. These Private Multi-Service Providers are considered as Service Providers offering in addition to the charging data collection service for the Km-tax some other commercial services to the users which can also be based on the OBU (or an in-vehicle application platform). The business case of the Private Multi-Service Providers is based on the multi-service provision and enables them to operate the road-usage data collection at lower cost due to the alternative sources of income.

The Finnish Government can take advantage of already existing equipment and Customer Relationship Management (CRM) service by avoiding installing equipment in the entire Finnish vehicle fleet at their own cost and thus receiving the data collection service at lower and more attractive service costs.

The Road Tax Authority remains in charge of the service provision to domestic users without subscription with a Private Multi-Service Provider and the voluntary equipped foreign users for both the commuters with installed OBU and the users with Plug & Play OBU. Analogue to Scenario 1 the Road Tax Authority is in charge of the assessment and determination of the Km-tax based on the road usage data submitted by the Private

Multi-Service Providers and EETS Providers. Invoicing and clearing of the Km-Tax is assumed to be done solely by the Road Tax Authority.

Scenario 3) Charging scheme based on Km-recording by OBU or Km-reading declaration at entry and exit of Finland (foreign Users) – Km-Charge based on driven distance in Finland (flat fee)

Scenario 3 is based on the recording or declaration of the distance driven in Finland. The recording can be based on the usage of an OBU or declaration of the odometer reading at entry and exit of Finland. In order to keep the Km-recording smart and simple no tariff differentiation by location or time will be possible.

Analogue Scenario 1 the Road Tax Authority will be in charge of system implementation of the EFC Scheme and namely equipping of domestic users with an OBU. Foreign users can choose to install an OBU like the domestic vehicles or subscribe with an EETS Provider; there will be no Plug & Play OBU. Domestic vehicles never or only seldom leaving Finland can pass on without OBU installation and declare their annual Km-performance in a similar way as foreign users.

The Occasional User Scheme is a WEB-based application for odometer reading declaration. The foreign user simply needs to register (licence-plate, payment mean, etc.) and declare the odometer reading at entry and exit of Finland. The same application can be used in an “inverse” mode by domestic users for declaration the distance driven outside Finland.

- In Scenario 3 a reduced share of domestic users need to be equipped with an OBU, a majority of vehicles can do without an OBU.
  Vehicles never leaving Finland can take advantage of the simplified procedure by declaring on a regular base the Km-reading. Basically the same approach and (WEB-based) application as for the foreign users can be used.
  For occasional cross-border trips by domestic vehicles the same (WEB based) application can be used on “inverse” mode hence by declaration of the Km-performance abroad in order to deduct it from the annual km-performance declaration.
  This dual approach helps to reduce the number of OBU and related operation costs.
  Also in Scenario 3 foreign users entering and leaving Finland on regular base (mainly commuters) can subscribe for the installation of an OBU and are handled like domestic users or they subscribe with an EETS Provider.

- The Occasional User Scheme is based on a rather simple WEB-based application and the users are required to or declare at each entry and exit to Finland the Km-reading. The kilometre declaration is linked to the vehicles licence plate and payment is guaranteed by a link to a credit, debit or fuel card or a prepay amount must be uploaded on an account. Prepay-amounts not used will be refunded after leaving Finland.

- Enforcement will be based on spot-checks at the border and strategic well located enforcement stations enabling plausibility checks that will ensure that the Km-reading is correctly declared. A rather small number of fixed enforcement stations and a plausibility matrix enable an efficient and low cost monitoring of the Km-performance declarations for both domestic and foreign users.

Prerequisites for scenario 3 are:

- in contrary to today, odometer fraud is by 2025 assumed to be no issue anymore; the electronic devices used then are more difficult to manipulate and/or an internal sensor can monitor and record fraud attempts
- nomadic devices (e.g. smart phones) and their applications can guarantee a comfortable declaration of Km-reading and back-up by a secure payment functionality (ePurse functionalities)
- cross-border enforcement for penalty and fines is easier than today

Remuneration of Private Multi-Service Provider:

In order to calculate the effects and impacts of the Service Provision without (Sc. 1 & Sc. 3) and with "Multi-Service Environment" (Sc.2) the remuneration for the service provision is split in to 2 components:

Remuneration of Customer Relationship Management service

- Remuneration for the "basic CRM service" to the User:
  Customer Relationship Management (CRM) costs per User like establishment of account, invoicing, clearing of payments, help desk and call centre service, web-page, up-date of customer data, public relations and marketing, etc..
  This part of the remuneration is considered as fixed and not varying between the scenarios.

  For the Private Multi-Service Provider this remuneration can be considered as a fixed fee per user. Due to the multi-service provision the CRM costs are partly cross-financed and/or supported by the other services.

Remuneration of OBU provision

- Remuneration for the OBU provision to the User (Private Multi-Service Provider only)
  Cost for the equipment of the user (incl. all necessary services around the OBU provision like shipping, replacement of defective OBU etc.) with an OBU. The OBU costs of the Road Tax Authority are covered by the according investment during the ramp-up phase and renewal of the OBU stock during operation.

- In Scenario 1 and Scenario 3 the OBU will be provided by the Road Tax Authority and EETS Providers only, hence there is no involvement of Private Multi-Service Providers.

- In Scenario 2 the majority of OBU will be provided by the Private Multi-Service Providers. This OBU provision service will be remunerated.

- The OBU (or in-vehicle platform) will be used also for other applications, hence the Finnish Government contribution needs to cover only some of the cost due to the cross financing by other "clients" or even the user.
  Annual costs vary dependant of involvement of the Private Multi-Service Provider (example only).
  Scenario 1: no Private Multi-Service Providers (only EETS providers)
  Scenario 2: 6 Euro per user per year
  Scenario 3: no Private Multi-Service Providers (only EETS providers)

- As sensitivity analysis two sets of calculations will be prepared.
  The first set of calculations assumes the OBU will be provided by the Finnish government free of charge to the user.
  The second set of calculations assumes the OBU will be procured by the Finnish government but need to be paid by the users.

Remuneration for payment guarantee
Based on the Finnish constitution the invoicing of a tax cannot be (completely) be outsourced. It's assumed that the Road Tax Authority acting on behalf of the Finnish Government will be in charge of the assessment and invoicing of the Km-charge. The Road Tax Authority will provide this service for all domestic users and will use road-usage and client data provided by the EETS and Private Multi-Service Providers.
Clearing and dunning will be conducted according the existing national regulations; hence the EETS and Private Multi-Service Providers do not have to provide a payment guarantee for their users.

Foreign users will pay for the Km-Tax by using common payment means such as cash, debit, credit and fuel cards. For the service and the payment guarantee the payment means providers offer a commission based on the amount of revenue. . The level of remuneration of this service is fixed as 2% for all scenarios and applies only to the revenue collected from foreign users. The remuneration of the payment means providers is either settled direct by the Finnish Government or via the Road Tax Authority.

Remuneration of EETS Provider:

The remuneration of the EETS Provider needs to be differentiated between domestic and foreign users. For domestic users a (combined) annual remuneration for the CRM service and the OBU provision is foreseen. For the foreign users a (combined) remuneration per border crossing (visit) to Finland applies. The "combined" remuneration covers the CRM service and the OBU provision service.

Regarding the level of the remuneration it is assumed that the EETS Provider will have various Toll Chargers and probably also the user to contribute to the remuneration of his services, hence the annual remuneration for domestic users paid by the Finnish Government to EETS Providers can be rather low but in any case higher than for the Private Multi-Service Provider (Sc.2 only).

The remuneration of foreign users is assumed along the same line. Linking it to the estimated number of visits is a fair and reasonable approach. The remuneration for foreign EETS users will be on a very moderate level.

Summary and overview table

The following table show a high-level overview of tasks and the involved entities in the 3 scenarios, tasks outsourced to Private Multi-Service Providers are highlighted in blue spelling

Item	Scenario 1: GNSS/CN OBU Road Tax Authority approach e-Vignette	Scenario 2: GNSS/CN OBU Private Multi-Service Provider approach e-Vignette	Scenario 3: Km-recording OBU & Km-declaration application
Implementation and basic operation of Km-Tax scheme	Road Tax Authority on behalf of the Finnish Government		

Item	Scenario 1: GNSS/CN OBU Road Tax Authority approach e-Vignette	Scenario 2: GNSS/CN OBU Private Multi-Service Provider approach e-Vignette	Scenario 3: Km-recording OBU & Km-declaration application
Contract mgt. and monitoring of service providers	Finnish Government or Road Tax Authority		
Toll context data provision and maintenance	Road Tax Authority		
Domestic Users OBU provision and customer service	Road Tax Authority EETS Provider	Road Tax Authority EETS Provider Main share with: Private Multi-Service Provider	Road Tax Authority EETS Provider
Plug & Play OBU provision and customer service	Road Tax Authority	Road Tax Authority	Not applicable
Occasional User Scheme	eVignette operated by: Road Tax Authority	eVignette operated by: Road Tax Authority	Km-declaration WEB application operated by: Road Tax Authority *Note: Domestic user will use Km-declaration as well*
Km-tax assessment	Road Tax Authority on behalf of the Finnish Government *Note: EETS and Private Multi-Service Providers provide the required data for the assessment to the Road Tax Authority*		
Invoicing (assumption part of customer service)	Road Tax Authority on behalf of the Finnish Government *Note: EETS and Private Multi-Service Providers provide the required data for the invoicing to the Road Tax Authority*		
Commission for payment means provider (foreign user only)	Finnish Government direct or via Road Tax Authority– The payment guarantee of the payment means provider needs to be remunerated, (state of the are a small percentage of the revenue)		
Road Side Equipment (DSRC & ANPR)	Not applicable	Not applicable	Road Tax Authority
Enforcement equipment provision and maintenance	Road Tax Authority		
Enforcement scheme operation (e.g. imposing of fines)	Road Tax Authority or other Finnish governmental entity		

The estimation of cost will be based on:

- implementation costs - also called capital expenditures (CAPEX),

- operation and maintenance costs - also called operation expenditures (OPEX),
- a linear depreciation over a dedicated period (10 years) for selected CAPEX items (mainly hardware)

3.2 Cost items

The estimation of cost will be based on:

- implementation costs - also called capital expenditures (CAPEX),
- operation and maintenance costs - also called operation expenditures (OPEX),
- a linear depreciation over a dedicated period (10 years) for selected CAPEX items (mainly hardware)

CAPEX

The CAPEX estimation will be structured as follows and includes the following cost items:

- Ramp-up project (admin, public relations, legal & tech. support, IT-licenses, insurances, rents etc.) - [lump sum per ramp-up year]
- Contract establishment with EETS Providers or Private Multi-Service Providers incl. suitability for use testing of OBU - [per Service Provider]
- IT back office infrastructure - [lump sum]
- Toll context data proxy (digital map) - [lump sum]
- (Plug&Play) OBU (ramp-up volumes) for (foreign) users – [dependant of number of users]
- Pre-financing & handling OBU for domestic users (stock-management) - [lump sum]
- Support & service network infrastructure - [lump sum]
- Occasional user system (eVignette or Km-declaration) - [lump sum]
- Enforcement infrastructure - [lump sum]
- Road-side equipment (DSRC & ANPR) - [lump sum] – Scenario #3 only
- Training & ramp-up activities (mainly HR costs) - [lump - sum]
- Others & miscellaneous - [lump sum]

OPEX

The OPEX estimation will be structured as follow and includes following cost items:

- Management & overhead (admin, public relations, legal & tech. support, insurances, rents etc.) - [lump sum per year]
- Contract management with EETS Providers or Private Multi-Service Providers - [lump sum per Service Provider per year]
- IT back office (incl. IT-licenses, etc.) - [lump sum per year]
- Up-date and maintenance of toll context data proxy (digital map) - [lump sum per year]
- New (plug & play) OBU (incl. all OBU "overhead" costs, OBU operated by Road Tax Authority) - [per OBU]
  During the 10 year operation period the OBUs needs to be replaced once. This replacement, OBU for new users, replacement of defective or destroyed OBU, etc. are considered as annual renewal of the OBU stock and are part of the OPEX.
- Management of OBU stock for domestic users [lump sum per year]
- Handling plug & play OBU - foreign Users only - [per OBU per handling]
- Customer Relationship Management (CRM) & OBU Mgt - domestic Users - [per OBU per year]
- Customer Relationship Management (CRM) users without OBU - domestic Users [per user per year]
- Customer relationship management (CRM) & OBU Mgt - foreign Users - [per User or OBU handling]
- Occasional User System (eVignette or Km-declaration)
- Cost for Customer Relationship Management (CRM) - Occasional User Scheme

- Commission for payment means provider - (for revenue by foreigners only; plug &play OBU and OUS)
- Remuneration of EETS Provider - domestic Users - [per active OBU per year]
- Remuneration of EETS Provider - foreign Users - [per active OBU per visit in Finland]
- Remuneration of CRM services of Private Multi-Service Provider - [per active OBU per year]
- Remuneration of OBU provision of Private Multi-Service Provider - [per active OBU per year]
- Support & service network - [lump sum per year]
- Road-side equipment (DSRC & ANPR) - [lump sum per year]
- Enforcement infrastructure - [lump sum per year]
- Enforcement human resources - [lump sum per year]
- Others & miscellaneous - [lump sum per year]

Depreciation
For selected CAPEX items (mainly hardware) a linear depreciation over a dedicated period (10 years) will be taken into account.

Summary per Scenario
The various OPEX are clustered per scenario showing the share per main area of expenses. All these expenses need to be covered by the Finnish Government.

Following clusters have been prepared:

- Annual OPEX - Road Tax Authority (overhead and operation & maintenance of infrastructure)
- Annual OPEX - Users handling by Road Tax Authority (incl. new OBU) - incl. CRM
- Annual OPEX - Occasional User System (eVignette or Km-Declaration) - incl. CRM
- Annual OPEX – Commission for payment means providers (%-age of Revenue, foreign users only)
- Annual OPEX - Remuneration of EETS Providers - OBU & CRM only (domestic and foreign Users)
- Annual OPEX - Remuneration of Private Multi-Service Providers - OBU & CRM only (domestic Users only - no foreign Users)
- Annual Depreciation (of hardware part of CAPEX)

3.3 Calculations conducted

Based on the large number of domestic users the main cost driver will be the equipment of the vehicles and the operational expenditures per user.

From commercial point of view there are two basic approaches for the equipment of the vehicles:

- The OBU is provided free of charge by the Finnish Government
  The Finnish Government procures the OBU and provides the OBU free of charge to the user.
  The User can also subscribe with an EETS Provider or Private Multi-Service Provider; possible rental or service fees to be paid by the user are not subject of our cost calculation.

- The User pays for the OBU
  The Authority procures the OBU, but the user is obliged to buy the OBU from the Finnish Government or as an alternative the user can subscribe with an EETS Provider or Private Multi-Service Provider. Also for this approach possible rental or service fees to be paid by the user are not subject of our cost calculation.
  Other issues which need to be considered, in the case the user has to buy the OBU, are regulations regarding warranties and periods of replacement of the OBU.

For both approaches a calculation for the three scenarios above has been conducted.

3.4 Basic input for the cost estimate

For the preparation of the cost estimate the outline of the following items are of relevance:

- Institutional set-up, what is done by the Finnish Government (Toll Charger) with support of a Road Tax Authority, what can outsourced and will be provided by Private Multi-Service Providers,
- Remuneration approach or model for Private Multi-Service Providers (based on tasks and responsibilities of Private Multi-Service Providers) – see above
- Enforcement approach and allocation of tasks and responsibilities -– see above

The following key figures are subject of interest for the cost estimate:

- Figures on domestic vehicle fleet and annual growth of vehicles fleet,
- Figures on cross-border traffic for foreign and domestic vehicles, e.g. number of foreign vehicles “visiting” Finland, share of domestic vehicles driving abroad (e.g. leaving Finland at least once a year),
- Number of EETS Providers and Private Multi-Service Providers,
- Number of entry / exit points to Finland, like border stations and ferry ports with significant traffic volumes,
- Estimated or envisaged revenue
- Average total HR costs per Full Time Equivalent (FTE; e.g. for enforcement agent)
  (this average value shall include all costs like wages, insurances, social security, etc.)

4. Analysis of the results

4.1 Scenarios where OBU is provided by the Finnish Government

The chosen approach foresees that the OBU will be provided free of charge by the Finnish Government to the users. According the Finnish constitution the tax assessment and in particular tax invoicing cannot be outsourced, hence the Road Tax Authority which fulfils all legal requirements to support the Finnish Government will solely be in charge of these tasks. The EETS Providers and Private Multi-Service Providers are responsible for the Customer Relationship Management (CRM) and the collection of the road usage data of the user. All relevant data will be made available to the Road Tax Authority for assessment of the tax and invoicing. For this service provision the EETS Providers and Private Multi-Service Providers will receive a remuneration per user, but these service providers do not have to provide a payment guarantee for their users. For dunning and prosecution of domestic users not paying their Km-tax the same rules and regulations apply as for any other tax in Finland.

For the OBU provision the EETS Provider and the Private Multi-Service Provider will receive an adequate remuneration.

The following table shows an overview of the summarised results of the cost estimations for the Finnish Km-Tax assuming the OBU is provided by the Finnish Government to the user:

Status:
27Nov13 - V3.0

Summary and overview CAPEX and OPEX
OBU financed by Finnish Government

Sc.	Short description	CAPEX	Average annual OPEX excl. Depreciation	Ratio Average OPEX vs. average revenue	Average annual OPEX incl. Depreciation	Ratio Average OPEX incl. Dep. vs. average revenue	Remarks
		[Mio EUR]	[Mio EUR]		[Mio EUR]		
Sc#1	Sc#1 - GNSS/CN OBU & eVignette - Road Tax Authority approach (plus EETS)	411.0	152.3	6.9%	192.2	8.8%	**Road Tax Authority** and **3 EETS providers** for domestic and foreign users
Sc#2	**Sc#2** - GNSS/CN OBUs & eVignette - Multi-Service Provider approach (incl. EETS)	183.7	144.9	6.6%	161.8	7.4%	Addtional 3 **Private Multi-Service Providers** for domestic users (only)
Sc#3	**Sc#3** - Km-registration by OBU and KM-declaration for foreign users	127.0	100.9	4.7%	112.4	5.2%	Significant reduced number of equipped domestic users, only 500'000 at start of operation

Note: all the costs shown above are to be covered by the Finnish Government

Sc#1 - GNSS/CN OBU & eVignette - Road Tax Authority approach (plus EETS)
Scenario 1 is based on assigning the implementation and most part of operation of the EFC scheme to a governmental body called Road Tax Authority.
Scenario 1 foresees the equipment of the entire Finnish vehicles fleet with a dedicated OBU. Facing the estimated 3.0 Million domestic vehicles it is clear and evident that this comes at a high cost not only for the equipment, but also during operation.
Commuters and regular foreign visitors to Finland can take advantage of the OBU approach as well, but due to the small number this will not have a notable impact on the costs.
Assuming EETS for light vehicles is also running by 2025 a small but growing share of vehicles will take advantage of EETS and the provided equipment. This helps to reduce costs, but also the EETS Provider services needs to be remunerated. Hence EETS

contributes to cost reduction, but due the assumed small share of EETS the positive effects are limited.

The dual services provision for foreign users featuring a Plug & Play OBU for long stay visitors and a simple eVignette for short-term visitors is a relevant cost factor. This combination, however, fulfils the requirement of equal treatment of all users and comes at an affordable cost.

In order to reduce the enforcement costs to a reasonable level the OBU is used as charging data recorder, but must also include specific sensors supporting self-monitoring of the OBU. Nevertheless a minimum density of road-side based enforcement infrastructure is needed in particular also for checking the eVignette scheme. The equipment will also be used for plausibly checks of the equipped users.

Taking on board all scaling factors and in particular significant reduced OBU cost by the 2025 horizon Scenario 1 is still a very costly and challenging approach. The resulting ratio between average operations costs (incl. depreciation) and envisaged revenue of slightly fewer than 10% is promising, but must be quoted as only achievable under optimal conditions.

Sc#2 - GNSS/CN OBUs & eVignette - Multi-Service Provider approach (incl. EETS)

The core idea of scenario 2 is to take advantage of a presumably existing Multi-Service Provider environment helping to reduce the cost for equipment of the vehicles and lowering the operational costs. The Finnish Government can take profit of that the Multi-Service Provider can (re-)finance the costs for his OBU or in-vehicle platform and Customer Relationship Management cost by alternative sources of income maybe even including also some fees from the users. This leads to a win-win situation for the Finnish Government and the Private Multi-Service Providers.

Based on the assumed business case of the Multi-Service Provider the low remuneration for the charging data collection and CRM service leads to significant reduced operation cost for all the users that are willing and able to subscribe with a Multi-Service Provider. The costs for the Occasional User Scheme and Enforcement are not impacted by the Multi-Service Provider environment.

Next to this specific reducing the cost for the majority of the domestic users, the entire EFC scheme set-up and outline is exactly the same as in scenario 1. The established Road Tax Authority will remain in charge handling all the domestic users that did not (manage to) subscribe with a Private Multi-Service Provider and all foreign users.

In Scenario 2 a rather high share of user subscriptions with the Private Multi-Service Providers is assumed (80%), which requires that the Multi-Service environment is there well in time before the year 2025 (around 2020), to be able to achieve such a penetration. A fair but rather low remuneration for their service was taken into account.

Under all these conditions the implementation and operation cost can substantially be reduced and the ratio between operations costs (incl. depreciation) and envisaged revenue drops remarkable under 10%. Compared with Scenario 1 the results are quite promising and show the achievable level of costs under the described circumstances.

Sc#3 - Km-registration by OBU and Km-declaration for foreign users (“Flat Fee”)

The scenario 3 originates from a proposal for a flat km-fee. This enables to reduce the number of equipped (domestic) users and provide a simple and easy to understand

Km-declaration scheme for all users. Based on the fact that a rather high share of vehicles never or only occasionally are leaving Finland a periodic (e.g. annual) declaration of the Km-performance without on-board equipment is a promising and cost saving approach. The massively reduced number of equipped (domestic) users contributes to significantly lower investment and operational costs.
For all domestic vehicles the odometer reading and the plausibility of the declaration can be cross-checked at the (annual) vehicle inspection or during inspections by police or the mobile enforcement units.

Commuters and regular foreign visitors to Finland can take advantage of the OBU approach, but this will not have a notable impact on the costs. For all other foreign users the simple approach of odometer reading declaration at entry and exit of Finland can be realised at low costs and offers a comfortable solution for the foreign visitors to Finland.
Spot-checks at the entry and exit points alongside with a strategically well located enforcement infrastructure can cope with the challenges of enforcement and will contribute to safeguard the revenue from foreign users.

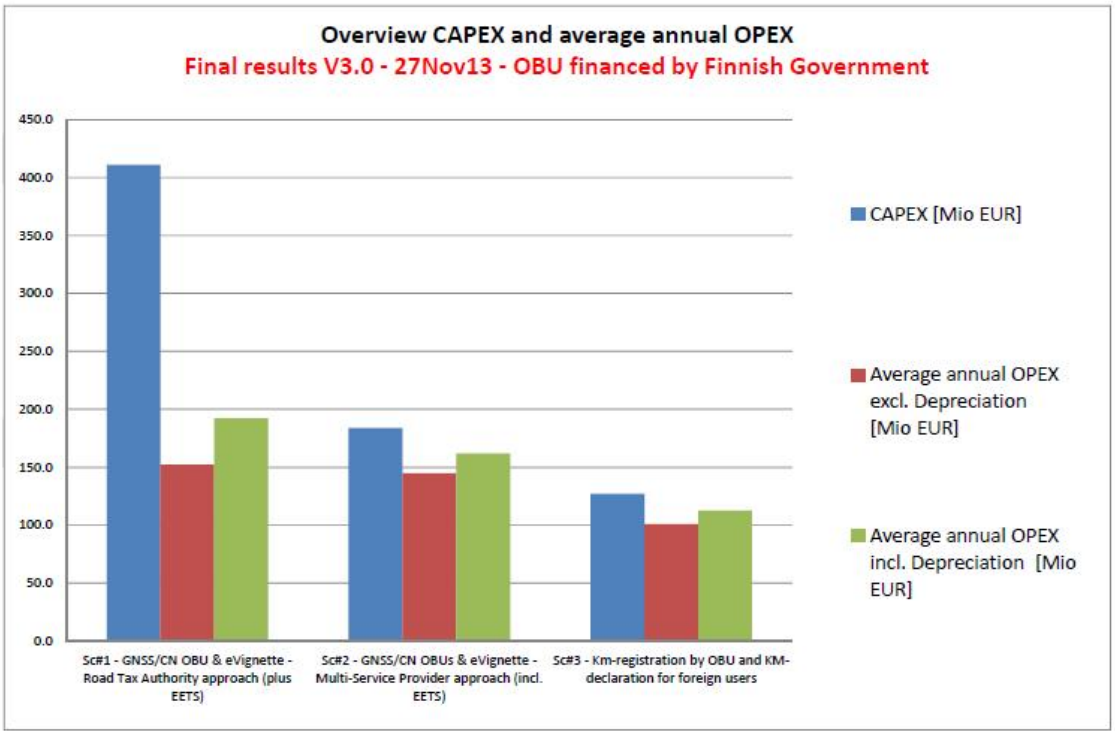
This low key approach results naturally in rather low investment and operational costs. The conducted calculations are based on the 500'000 equipped vehicles at start of operation, what is considered as sufficient high estimate.

Summary
The following overview visualizes the results and shows the quite promising results for Scenario#2 and Scenario#3 in comparison to Scenario#1.

Summary and overview CAPEX and OPEX
OBU financed by Finnish Government

Sc.	Short description	CAPEX	Average annual OPEX excl. Depreciation	Ratio Average OPEX vs. average revenue	Average annual OPEX incl. Depreciation	Ratio Average OPEX incl. Dep. vs. average revenue	Remarks
		[Mio EUR]	[Mio EUR]		[Mio EUR]		
Sc#1	Sc#1 - GNSS/CN OBU & eVignette - Road Tax Authority approach (plus EETS)	411.0	152.3	6.9%	192.2	8.8%	**Road Tax Authority** and **3 EETS providers** for domestic and foreign users
Sc#2	**Sc#2** - GNSS/CN OBUs & eVignette - Multi-Service Provider approach (incl. EETS)	183.7	144.9	6.6%	161.8	7.4%	Addtional 3 **Private Multi-Service Providers** for domestic users (only)
Sc#3	**Sc#3** - Km-registration by OBU and KM-declaration for foreign users	127.0	100.9	4.7%	112.4	5.2%	Significant reduced number of equipped domestic users, only 500'000 at start of operation

Note: all the costs shown above are to be covered by the Finnish Government



The following table shows the investment costs (CAPEX) for the three scenarios. All figures are given in Million Euro and without VAT.

OBU provision by Authority	Sc.1 GNSS/CN – Road Tax Authority approach	Sc.2 GNSS/CN – Multi Service Provider approach	Sc.3 KM-Registration
Ramp-up project (admin, public relations, legal & tech. support, IT-licenses, insurances, rents etc.)	5.0	5.0	5.0
Contract establishment with EETS and Private Multi-Service Providers and suitability for use testing of OBU	3.0	6.0	3.0
IT back office infrastructure	25.0	25.0	25.0
Toll context data proxy (digital map)	5.0	5.0	0.0
(Plug & Play) OBU (ramp-up volumes) for (foreign) users	330.0	100.0	40.0
Pre-financing & handling OBU for domestic users (stock management)	0.5	0.2	0.5
Support & service network infrastructure	3.0	3.0	5.0
Occasional Users system (eVignette or KM-Declaration) - [lump sum]	5.0	5.0	5.0
Enforcement infrastructure	31.0	31.0	35.0
Road-side equipment (DSRC & ANPR)	Not applicable	Not applicable	5.0
Training & ramp-up activities (mainly HR costs) - [lump - sum]	2.5	2.5	2.5
Others & miscellaneous	1.0	1.0	1.0
Total	411.0	183.7	127.0

The following table shows the annual operation costs (OPEX) at start of operation in 2025 for the three scenarios. All figures are given in Million Euro and without VAT.

OBU provision by Authority OPEX 2025	Sc.1 GNSS/CN – Road Tax Authority approach	Sc.2 GNSS/CN – Multi Service Provider approach	Sc.3 KM-Registration
Road Tax Authority (overhead, operation and maintenance infrastructure)	36,6	36,8	34,0
Road Tax Authority for handling of users with OBU (incl. CRM, tax assessment & invoicing and new Plug & Play OBU)	89,4	54,2	42,3
Occasional User System (eVignette or KM-Declaration) incl. CRM	16,3	16,3	17,5
Commission Payment Means of foreign users (%-age of revenue born by foreign users)	1,6	1,6	1,0
Remuneration of EETS Service Providers - OBU & CRM (domestic and foreign users)	2.6	2,6	1,3
Remuneration of Private Multi-Service Providers - OBU & CRM (only domestic Users only - no foreign users)	Not applicable	26,5	Not applicable
Total without deprecition	146.5	138,0	96,1
Annual Depreciation (of CAPEX)	39,9	16,9	11,5
Total incliding depreciation	186.4	154,9	107,6

The following table shows the average annual operation costs (OPEX) for the three scenarios. All figures are given in Million Euro and without VAT.

OBU provision by Authority average OPEX – 10 years	Sc.1 GNSS/CN – Road Tax Authority approach	Sc.2 GNSS/CN – Multi Service Provider approach	Sc.3 KM-Registration
Road Tax Authority (overhead, operation and maintenance infrastructure)	36,6	36,8	34,0
Road Tax Authority for handling of users with OBU (incl. CRM, tax assessment & invoicing and new Plug & Play OBU)	91,6	55,0	44,0
Occasional User System (eVignette or KM-Declaration) incl. CRM	19,0	19,0	20,1
Commission Payment Means of foreign users (%-age of revenue born by foreign users)	1,8	1,8	1,2
Remuneration of EETS Service Providers - OBU & CRM (domestic and foreign users)	3,3	3,3	1,6
Remuneration of Private Multi-Service Providers - OBU & CRM (only domestic Users only - no foreign users)	Not applicable	29,0	Not applicable
Total without deprecition	152,3	144,9	100,9
Annual Depreciation (of CAPEX)	39,9	16,9	11,5
Total incliding depreciation	192,2	161,8	112,4

4.2 Scenarios where OBU is paid by the user

This approach foresees that the OBU will be paid by the user. The Finnish Government is responsible for the procurement, stocking and distribution of the OBU but the user has to cover the costs of the OBU. Regarding warranties and exchange of OBU special regulations need to apply.

Analogue to the approach above and according the Finnish constitution the tax assessment and in particular tax invoicing cannot be outsourced; hence the Road Tax Authority which fulfils all legal requirements to act on behalf of the Finnish Government will solely be in charge of these tasks. The EETS Providers and Private Multi-Service Providers are responsible for the Customer Relationship Management (CRM) and the collection of the road usage data of the user. All relevant data will be made available to the Road Tax Authority for assessment of the tax and invoicing. For this service provision the EETS Providers and Private Multi-Service Providers will receive a remuneration per user, but these service providers do not have to provide a payment guarantee for their users. For dunning and prosecution of domestic users not paying their Km-tax the same rules and regulations apply as for any other tax in Finland.

In this approach the remuneration for the OBU provision of the Private Multi-Service Provider is skipped, only the EETS Providers receive the a small remuneration because they do not have other sources of income in Finland but are considered as an beneficial partner for the Finnish Government in the Km-tax collection.

The following table shows an overview of the summarised results of the cost estimations for the Finnish Km-Tax assuming the OBU is paid by the user.

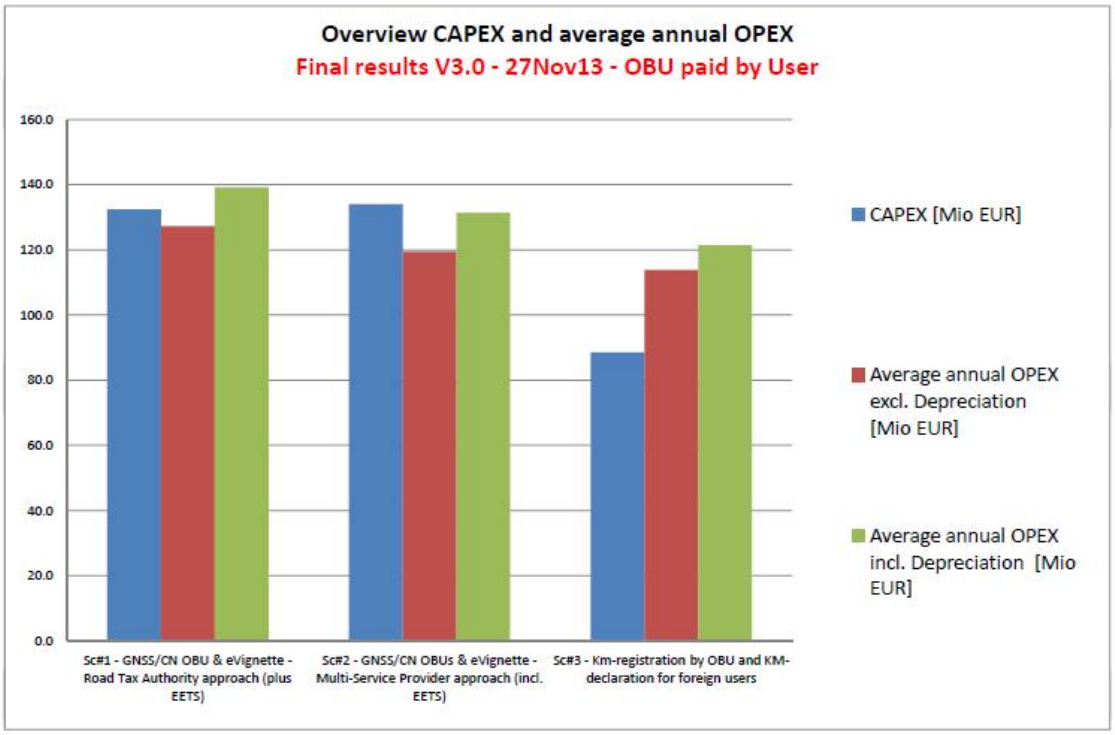
The following table shows an overview of the summarised results of the cost estimations for the Finnish Km-Tax assuming the OBU is paid by the user:

Status:
27Nov13 - V3.0

Summary and overview CAPEX and OPEX
OBU paid by the User

Sc.	Short description	CAPEX	Average annual OPEX excl. Depreciation	Ratio Average OPEX vs. average revenue	Average annual OPEX incl. Depreciation	Ratio Average OPEX incl. Dep. vs. average revenue	Remarks
		[Mio EUR]	[Mio EUR]		[Mio EUR]		
Sc#1	**Sc#1** - GNSS/CN OBU & eVignette - Road Tax Authority approach (plus EETS)	132.5	127.3	5.8%	139.2	6.3%	Road Tax Authority and **3 EETS providers** for domestic and foreign users
Sc#2	**Sc#2** - GNSS/CN OBUs & eVignette - Multi-Service Provider approach (incl. EETS)	134.0	119.5	5.4%	131.4	6.0%	Addtional 3 **Private Multi-Service Providers** for domestic users (only)
Sc#3	**Sc#3** - Km-registration by OBU and KM-declaration for foreign users	88.5	113.9	5.3%	121.4	5.6%	Significant reduced number of equipped domestic users, only 500'000 at start of operation

Note: all the costs shown above are to be covered by the Finnish Government



Based on the fact that all major costs related to the OBU provision have been allocated to the user; hence eliminated from the cost calculation, it is not surprising that both CAPEX and OPEX of Scenarios 1 and 2 are basically the same.

Scenario 3 is still lower in CAPEX and OPEX because of the significant lower costs for handling of the foreign users. Also the handling of the domestic users is lower, but because of the small share of only 500'000 equipped users the impact is not as strong as in Scenario 1 and 2.

The following table shows the investment costs (CAPEX) for the three scenarios. All figures are given in Million Euro and without VAT.

OBU paid by User	Sc.1 GNSS/CN – Road Tax Authority approach	Sc.2 GNSS/CN – Multi Service Provider approach	Sc.3 KM-Registration
Ramp-up project (admin, public relations, legal & tech. support, IT-licenses, insurances, rents etc.)	5.0	5.0	5.0
Contract establishment with EETS and Private Multi-Service Providers and suitability for use testing of OBU	3.0	6.0	3.0
IT back office infrastructure	25.0	25.0	25.0
Toll context data proxy (digital map)	5.0	5.0	Not applicable
(Plug & Play) OBU (ramp-up volumes) for (foreign) users	50.0	50.0	Not applicable
Prefinancing & handling OBU for domestic users (stock management)	2.0	0.5	2.0
Support & service network infrastructure	3.0	3.0	5.0
Occasional Users system (eVignette or KM-Declaration) - [lump sum]	5.0	5.0	5.0
Enforcement infrastructure	31.0	31.0	35.0
Road-side equipment (DSRC & ANPR)	Not applicable	Not applicable	5.0
Training & ramp-up activities (mainly HR costs) - [lump - sum]	2.5	2.5	2.5
Others & miscellaneous	1.0	1.0	1.0
Total	132.5	134.0	88.5

The following table shows the annual operation costs (OPEX) at start of operation in 2025 for the three scenarios. All figures are given in Million Euro and without VAT.

OBU paid by User OPEX 2025	Sc.1 GNSS/CN – Road Tax Authority approach	Sc.2 GNSS/CN – Multi Service Provider approach	Sc.3 KM-Registration
Road Tax Authority (overhead, operation and maintenance infrastructure)	36,6	36,8	34,0
Road Tax Authority for handling of users with OBU (incl. CRM, tax assessment & invoicing and new Plug&Play OBU)	64,5	49,8	53,2
Occasional User System (eVignette or KM-Deklaration) incl. CRM	16,3	16,3	17,5
Commission Payment Means of foreign users (%-age of revenue born by foreign users)	1,6	1,6	1,0
Remuneration of EETS Service Providers - OBU & CRM (domestic and foreign users)	2,6	2,6	2,6
Remuneration of Private Multi-Service Providers - OBU & CRM (only domestic Users only - no foreign users)	Not applicable	7,2	Not applicable
Total without depreciation	121,6	114,3	108,3
Annual Depreciation (of CAPEX)	11,9	11,9	7,5
Total incliding depreciation	133,5	126,2	115,8

The following table shows the average annual operation costs (OPEX) for the three scenarios. All figures are given in Million Euro and without VAT.

OBU paid by User average OPEX – 10 years	Sc.1 GNSS/CN – Road Tax Authority approach	Sc.2 GNSS/CN – Multi Service Provider approach	Sc.3 KM-Registration
Road Tax Authority (overhead, operation and maintenance infrastructure)	36,5	36,9	34,0
Road Tax Authority for handling of users with OBU (incl. CRM, tax assessment & invoicing and new Plug&Play OBU)	66,8	50,8	55,4
Occasional User System (eVignette or KM-Deklaration) incl. CRM	19,0	19,0	20,1
Commission Payment Means of foreign users (%-age of revenue born by foreign users)	1,8	1,8	1,2
Remuneration of EETS Service Providers - OBU & CRM (domestic and foreign users)	3,2	3,2	3,2
Remuneration of Private Multi-Service Providers - OBU & CRM (only domestic Users only - no foreign users)	Not applicable	7,8	Not applicable
Total without depreciation	127,3	119,5	113,9
Annual Depreciation (of CAPEX)	11,9	11,9	7,5
Total incliding depreciation	139,2	131,4	121,4

Annex: Approach cost estimates

Rapp Trans uses an in-house developed Road User Charging (RUC) Cost Model. The RUC Cost Model allows estimating the costs of different RUC scenarios over a defined time period (e.g. 10 year operation period) and does focus on the costs which will occur to the Toll Charger for implementation and operation of a RUC scheme.

The outcomes of the RUC Cost Model are the estimations of the implementation costs (CAPEX; capital expenditure) as well as the yearly and total operating costs (OPEX; operational expenditure; with & without depreciation) for each scenario requested.

It enables to compare the cost effects of different variations of RUC schemes to each other. The overview of the costs allows the decision maker to have a valuable basis for decision making. Especially the graphical presentation of the different scenarios next to each other facilitates the understanding and communication among parties.

Method

The process for the set-up of the cost model includes basically the following steps.

The first step in the RUC Cost Model is to define:

- the system / scheme architecture (see outline above)
- the breakdown of main cost and revenue elements (see outline above
- the number and specifications of the different scenarios which are going to be calculated

Based on the defined data, an estimation of these main costs element is done. In the next step the quantities (e.g. number of OBU requested) are multiplied with the cost factors, or the lump sums are inserted in the detailed calculation for each requested scenario separately.

For each scenario the implementation costs (CAPEX), operation and maintenance costs (OPEX), depreciation and total (average) costs per year including depreciation can be calculated.

Detailed Calculation **Scenario Easy**

Implementation Costs (CAPEX)

Cost Position	Scenario Easy	2014 preparation / ramp-up period	2015 start of operation	2016	2017	2018	2019	Total
Cost element 1	75'000	75'000						75'000
Cost element 2	950'000	950'000						950'000
Cost element n	3'000	3'000						3'000
Total	**1'028'000**	**1'028'000**	**0**	**0**	**0**	**0**	**0**	**1'028'000**

Operation Costs (OPEX)

Cost Position	Scenario Easy	2014 preparation / ramp-up period	2015 start of operation	2016	2017	2018	2019	Total	
Yearly operation (and maintenance) cost element n (lump sum)	324'000		324'000	330'480	337'090	343'831	350'708	1'686'109	Average Costs per Year
Total	**324'000**	**0**	**324'000**	**330'480**	**337'090**	**343'831**	**350'708**	**1'686'109**	**337'222**

Depreciation

Cost Position	Scenario Easy	2014 preparation / ramp-up period	2015 start of operation	2016	2017	2018	2019	Total	
Cost element 1	15'000		15'000	15'000	15'000	15'000	15'000	75'000	
Cost element 2	190'000		190'000	190'000	190'000	190'000	190'000	950'000	
Cost element n	600		600	600	600	600	600	3'000	Average Costs per Year
Total	**205'600**	**0**	**205'600**	**205'600**	**205'600**	**205'600**	**205'600**	**1'028'000**	**205'600**

Total costs per year (incl. Depreciation)

Total	Scenario Easy	2014 preparation / ramp-up period	2015 start of operation	2016	2017	2018	2019	Total	Average Costs per Year
		0	**529'600**	**536'080**	**542'690**	**549'431**	**556'308**	**2'714'109**	**542'822**

Calculation for scenario "Easy" (simplified example)

The information from the different detailed calculations is in a last step summarised and visualized in graphics. This allows the reader to easily compare the costs of different scenarios.

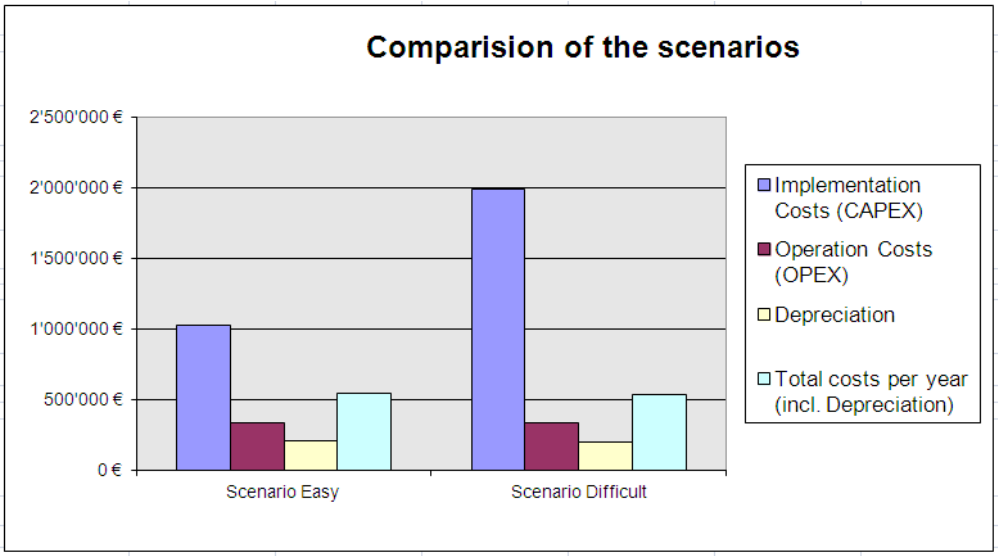
Summary

Implementation Costs (CAPEX)	Scenario Easy	Scenario Difficult
Total	**1'028'000 €**	**1'992'500 €**

Operation Costs (OPEX)	Scenario Easy	Scenario Difficult
Total	**337'222 €**	**337'222 €**

Depreciation	Scenario Easy	Scenario Difficult
Total	**205'600 €**	**199'250 €**

Total costs per year (incl. Depreciation)	Scenario Easy	Scenario Difficult
Total	**542'822 €**	**536'472 €**



Summary and comparison of the scenarios (simplified example)