# Directive 2010/40/EU
# Progress Report 2017
## *Finland*

# Contents

# 1   Introduction

## 1.1   General overview of the national activities and projects

### 1.1.1   Digitalisation and automatization as drivers for user-centric services

Global mega trends, particularly digitalisation, intelligent automation together with the growing role of data and services are fundamentally challenging traditional ways of thought and models of operation across all sectors of the modern society. Amongst this development the transport sector stands at the beginning of a period of significant disruption with new technologies, products and services profoundly shifting the sector as well as customer expectations and opportunities. Recent years have already seen an increasing variety of new transport automation solutions in all transport modes. These first steps have given us just a mere first flavor of all the vast opportunities that are entailed in increasing intelligent automation in transport with respect to, for example, improving the safety, efficiency and smooth operation of traffic and transport and reducing harmful environmental impacts across all transport modes.

Against this background Finland aims to be a world leader in transport automation and ensure a regulatory and operating environment that fosters the development of automation in the best possible way. Finland is determined to realize the full potential, which is attainable through connected and automated transport and intelligent transport systems, and thus seeks to promote actions that include exerting influence on the international regulation of different transport modes, enabling experimentations, developing an interoperable infrastructure and devices for transport automation, introducing 5G network technology, increasing the amount, quality and usage of transport data and improving the quality of satellite positioning. Finland is well positioned to push forward in the first wave of transport automation, because Finland has a high level of versatile expertise and technology required for harnessing automation. The spectrum of activities is extensive reaching across the whole transport sector, ranging from the introduction of autonomous maritime ecosystem to automated vehicle trials on public roads and to the new liberal regulation governing the use of unmanned aircrafts and flying models, among other actions. The speed of change that we are currently witnessing is staggering, however, never have we lived in more exciting times or have we had so many possibilities to make transport more user-centric, more sustainable, safer, efficient and affordable in the benefit of all.

### 1.1.2   Legislation and public sector initiatives accelerate development

Finland aims to be one of most advanced countries in Europe in automated driving, application of new technologies and development of new mobility services. The Ministry of Transport and Communications has published a plan for promoting intelligent automation covering all transport modes: road, rail, air and maritime transport. The Ministry's aim is to create an environment in Finland that is attractive for the development of automated driving, both in terms of legislation and the variety of road and winter conditions. The Ministry's initiative has been followed by numerous testing and piloting projects around automated driving.

The Ministry of Transport and Communications has prepared a new act, Act on Transport Services, which aims to speed up digitalization of the transport sector, enable servicization of mobility and to streamline various regulations. The Act contains deregulation of e.g. taxi services, which is an important part for the development of affordable and efficient mobility services. In addition, the act

forces key stakeholders to open their information and ticketing interfaces which in turn enables aggregation of various mobility services into comprehensive, attractive and cost-efficient offerings brought to the customers by Mobility as a Service operators (MaaS operators). The first phase of the Act has already been approved by the Finnish Parliament and the second phase is close to accomplishment.

As highlighted in the Act on Transport Services, open data is one of the key enablers in the Finnish ITS strategy. The Finnish Transport Agency already publishes most of its static and dynamic data on road, rail and maritime transport as open data free of charge for all interested service developers. The data delivery is organized in the common National Access Point. Many cities are active in sharing their traffic-related data from open interfaces, including for example static and real-time public transport information. The Finnish Transport Agency is cooperating with the biggest cities in building common data platforms and routing services for public transport. These initiatives have gained a lot of interest among developers and numerous mobile applications nowadays make use of these data resources. In addition, many public transport operators have already opened also their ticketing interfaces, which means that they allow third parties to sell their tickets to customers via different mobile applications. As a result, public transport is becoming more accessible and easy-to-use for all passengers.

Mobility as a Service is a concept that originates from Finland, and like the GSM standard in the 90s, is now spreading all around the world. In the concept of MaaS, operators combine different travel options from the market and serve them to the end users via easy-to-use mobile applications or other interfaces. There are several MaaS operators on the market and business models vary from pay-as-you-go to fixed-price monthly packages. As the MaaS operators act as service integrators, their ability to collect a wide variety of services in their ecosystem depends on the availability of open interfaces. From the society's point of view, the new innovative mobility services will enable a situation where a private car is an absolute necessity for less and less people, as there are more convenient alternatives at hand. In the future, different transport modes and services will be widely interoperable. The transport sector is seen as an ecosystem based on different actors' close cooperation and on information utilisation. It consists of transport infrastructure, transportation services and transport information, ICT and payment services.

In this report, the most important national projects and initiatives are discussed, followed by an introduction to some interesting projects from the biggest cities, research organizations and the private sector players.

## 1.2   General progress since 2014

### 1.2.1   Implementation projects of the ITS Directive

The Finnish Transport Agency and the Finnish Transport Safety Agency have actively participated in numerous European projects targeting at harmonious implementation of the actions required by the ITS Directive. The NEXT-ITS, NEXT-ITS2 and NordicWay corridor projects contained numerous deployment projects and coordination activities in the Northern Europe. The European ITS Platform (EIP) project and its successors EIP+ and EU EIP focussed in the harmonised approach towards e.g. service quality criteria, quality requirements and measurement practises as well as harmonisation of the data delivery services i.e. National Access Points in Member States. The projects cover all the traffic information services defined in the ITS Directive. The learnings from these joint European activities have been brought into practise already in the national real-time information procurement

activities. Finnish authorities have also participated in HeERO, HeERO2 and iHeERO projects that focus in the harmonised deployment of the eCall service in the Member States.

### 1.2.2 National development initiatives

#### 1.2.2.1 Digitalization project of the Finnish Transport Agency

The Finnish Transport Agency has started a three-year digitalization project (2016–2018), which paves the way for new transport services, modern road management and automated driving in Finland. The estimated cost of the project is EUR 35 million. The digitalization project has six activities and approximately 70 projects. Some of these projects are presented in this report.



Figure 1. The six activities of the digitalisation programme.

The digitalization project will streamline the production, maintenance and distribution of traffic information. In addition, it will remove obstacles from introduction of new services and automated driving. Technology enables the Finnish Transport Agency to obtain more up-to-date information on the condition, availability and use of the routes. Information is collected over the entire lifecycle of the roads and rails. For example, using Building Information Modelling (BIM) in the construction provides in the early phase comprehensive information on asset management.

Customers and stakeholders can simultaneously produce and utilize information. Most of the information produced is provided as open data for various operators through modern interfaces. Customers and stakeholders can also benefit from traffic information through the services maintained by the Finnish Transport Agency.

The collected data will be utilized in the development activities of the Finnish Transport Agency. With more accurate and up-to-date information, it is easier to target and schedule repair and maintenance actions. The quality and quantity of the information concerning infrastructure assets improves, allowing the use of analysis and simulation of traffic management and maintenance.

The project also aims to improve customer service. The customer service process creates better tools for the processing and interaction.

#### 1.2.2.2 Traffic Lab

The goal of the Traffic Lab is to enable the creation of an ecosystem of digital mobility services. In other words, to use Finland as a test field for digital and innovative services of traffic and logistics – Finland is a traffic lab. The Traffic Lab combines promotion of digital mobility solutions, culture of

experiments and close cooperation between the public and the private sectors. Traffic Lab is co-ordinated by the Finnish Transport Safety Agency (Trafi) since 2016.

The Traffic Lab's priorities include new service concepts for mobility, traffic automation, the Internet of Things, as well as pilots that are strategically significant to trade and industry, companies and regions. Traffic Lab test areas and surroundings (for example Growth Corridor Finland, ITS Factory and NordicWay) are presented in this report (chapters 2.4–2.5) in more detail.

In addition to holding a coordinators role in the Traffic Lab The Finnish Transport Safety Agency has developed its licence policies for the testing of automated vehicles. Parties interested in or planning trials of automated vehicles are invited to contact Trafi. In practice, Trafi will facilitate the implementation of trials through means such as proposing solutions for driver specification and helping with the technical approval and registration of the test vehicles.

### 1.2.2.3  Aurora

The Aurora test ecosystem is designed for verifying and validating new ITS solutions and innovations in real extreme weather conditions. Situated above the Arctic circle, Aurora offers a unique test location for validation, marketing and assessment of impacts and performances of intelligent transport automation. The Finnish Transport Agency and The Finnish Transport Safety Agency (Trafi) have identified a range of research topics that will be implemented jointly with companies in 2017–2019. At the moment the Aurora network covers over 50 members from public and private sector including also foreign players. The Aurora network is led by the Finnish Transport Agency.

Aurora project contains four sub-projects:

 1) Arctic testing for intelligent transport automation: two-step testing ecosystem in harsh winter conditions and with various services (see chapter 2.5.1.5)

2) Digital transport infrastructure (DTI) and connected cars: DTI and connected cars allow transport-related message delivery between the road users, the service providers and the authorities in a standard telecom network. In the first stage safety-related information services are tested in the region (see chapter 2.1.1.8.).

3) Intelligent infrastructure asset management: new opportunities and challenges for infrastructure asset management. The Aurora test ecosystem is open for testing new and innovative technologies and solutions for road maintenance and asset management.

4) Mobility as a Service: flexible and cost-effective mobility services to tourists and locals, without a need for a private car (see chapter 2.5.1.1).

## 1.3  Contact information

The Ministry of Transport and Communications
Eteläesplanadi 16, Helsinki
PO Box 31, FI-00023 Government

Senior Adviser
Mr. Seppo Öörni
tel. +358 295 34 2545, mobile +358 40 577 1179
seppo.oorni@mintc.fi

Senior Adviser for International Affairs
Mr. Antti Paasilehto
tel. +358 295 34 2310, mobile +358 40 532 5657
antti.paasilehto@mintc.fi

Senior Adviser
Ms. Seija Miettinen
tel. +358 295 34 2563, mobile +358 40 724 5010
seija.miettinen@mintc.fi

# 2 Projects, activities and initiatives

## 2.1 Priority area I. *Optimal use of road, traffic and travel data*

### 2.1.1 Description of the national activities and projects

#### 2.1.1.1 Digitraffic

Digitraffic is a service operated by the Finnish Transport Agency offering real time traffic information. Currently the service covers road, rail and maritime traffic. Service is constantly updated. The service has been operational since 2008, already before the adoption of the ITS Directive.

Road Digitraffic provides real time data from the Finnish roads. Most of the data is gathered from Finnish Transport Agency's data sources, which include travel time system, loop detectors, road weather stations and road weather & surface cameras. It also provides history data, road weather forecasts and information about traffic incidents disorders. Road Digitraffic offers several APIs for developers.

Finnish Transport Agency started the development of real time open railway data during the autumn of 2014. In the spring of 2015 the Digitraffic service was updated with a new railway API, which provides data about train traffic. The open API provides data on train compositions and schedules including real-time traffic information, future schedules and history data.

Maritime fairway network data was opened in the beginning of 2016. These datasets include detailed information about fairways, aids to navigation and lights among others.

#### 2.1.1.2 Digiroad

Digiroad is a national database that contains the geometry of the Finnish road and street network featured with the most important road attribute data. Digiroad data covers the entire country. The data enables and supports the development and commercialization of services and applications for e.g route planning, navigation, tourism, and intelligent transportation systems.

Digiroad data consists of the centre line geometry of the transport network, traffic-related attribute data and other transport system objects. The centre line geometry covers the vehicle-accessible roads, ferry and cable ferry connections, railways and separate pedestrian and cycle routes. Traffic-related attribute data include data of traffic elements as well as the restrictions, limits and other features of the road and street network.

Digiroad has been available for users since 2004. The Finnish Transport Agency administrates the service and it is constantly updated. Digiroad data is open for everyone to use and the material can be downloaded from the Finnish Transport Agency's service. The maintenance organizations are the National Land Survey of Finland, the Finnish Transport Agency, and the Finnish municipalities. The Digiroad Operator is responsible for adding and updating the Digiroad data in the database thereby ensuring high quality of the data. More information can be found at http://www.liikennevirasto.fi/web/en/open-data/digiroad

### 2.1.1.3    The target state for traffic information (LIIKETTA)

The project was initiated in 2016 by studying the user needs for traffic information from various stakeholders' point of view. The needs for travel time information, cross-section traffic information as well as information for bicyclists and pedestrians were studied. A field pilot was organised to study the accuracy of two promising travel time monitoring systems. Also two separate sub-studies were prepared; one on the use of video image recognition in the collection of traffic information and another one on the future of bicycle and pedestrian information. One outcome of the study phase was the initial quality requirement and draft specification for the national travel time monitoring system.

The project continued in January 2017 by the preparation of the procurement of national travel time information service covering 1,200 km of national main highways and urban arterials for a period of 5 years. In the procurement the service content and data quality requirements are clearly set, but the selection of the measurement technology is left to the service providers to decide. The Finnish Transport Agency has seen evidence of great interest towards this type of procurement, where the market will provide the most cost-efficient solution to fulfil the client's needs. The tendering process started in May 2017 and the service is expected to be operational by the end of 2017.

### 2.1.1.4    Traffic situation service

Traffic situation service presents map-based graphic traffic information from all modes (road, maritime, rail) collected by the Finnish Transport Agency.  It covers all railway stations, ports and public roads. The service provides information about road traffic incidents, traffic volumes, congestion in the Helsinki region, roadworks, weight limitations on main roads caused by frost breaking, road conditions and weather (including forecast), road camera pictures and iceroads. Information on rail traffic includes arrival and departure times of commuter and long-distance trains and their punctuality. The service also provides information of the maritime traffic (navigational warnings published by the Finnish Transport Agency and the vessels in port and arriving vessels).

The service is constantly updated on the basis of feedback received from the users. Road and winter maintenance information will be added in 2017. The service is available in the internet at http://liikennetilanne.liikennevirasto.fi/.

### 2.1.1.5    Collection and analysis of mobility data

The Finnish Transport Agency implemented a pilot to collect information on people's travel habits using a mobile phone application. A prototype of an application, which collects and analyses mobility data, was developed during the project by a private company. The aim of the project was to study, if the collected data is reliable enough for an extended utilisation of the data to support Finnish Transport Agency's various activities.

The mobile phone-based data collection method developed in the pilot is interesting, because earlier it has not been possible to collect users' mobility data with this level of accuracy. The solution resulting from the project collects and processes data on where, how and when people travel, and this data is received on individual level. Therefore, the aim has been to make the technical solution as open and transparent as possible, in order to offer users reliable information on how their personal information is being processed. The process of collecting and saving the application data is based on open source software, and it follows MyData principles.

The project was executed in the autumn of 2016, and part of it resulted in a mobile phone application, which can be used for collecting mobility data. The application was tested in a closed user group during two one-week trial periods. The results of these trial periods were used to study the reliability and usability of the application in order to reach the project goals.

### 2.1.1.6   Multimodal public transport information services

### Digitransit

Digitransit is an easy-to-access service platform provided by Helsinki Regional Transport and the Finnish Transport Agency. Digitransit is a new real-time journey planning and passenger information platform which has been developed together with the Finnish Transport Agency's matka.fi (journey.fi) service. The Digitransit project ensures that route and timetable data gathered from various sources are comprehensive and of high quality.

The coverage of the service is nationwide and takes into account real-time data where available. The service can combine all modes of transport including public transport, airlines, private car, walking, cycling as well as city bikes. In addition to the open data and APIs, the source code is also open at Github. All interested parties can participate in the development of the open-source service. This is likely to decrease errors, improve security and increase the provision of data that is always up-to-date.

Once the project is complete, travellers will have a modern timetable and route planner covering all forms of public transport and providing a number of new features. The data and application code are open, enabling service providers to develop new services for travellers.

### Nationwide journey planner

Nationwide journey planner (https://opas.matka.fi/) is a multimodal door-to-door route planning service for public transport. Based on the user's location, the journey planner will suggest the best route. If there are disturbances on the route, the journey planner redirects the user to a new route.

The journey planner covers commuter and long distance rail traffic, national air traffic and bus traffic between cities and countryside. The journey planner will offer comprehensive services for those travelling from city to city and locally. It also includes the route information in the cities of Helsinki region, Tampere, Turku, Joensuu, Jyväskylä, Kotka region, Kouvola, Kuopio, Lahti, Lappeenranta, Hämeenlinna, Mikkeli, Oulu, Seinäjoki and Vaasa, and price information in the Helsinki region. The project's goal is to cover all municipalities and cities in Finland, making all public transport timetables available at a single site.

The Finnish Transport Agency provides access to journey planner data and API when the application or service supports public transport use and public transport information provision. Development and testing as well as commercial use of interfaces are free of charge. The Finnish Transport Agency published a beta version of the nationwide service in June 2016. The service design is now under development; the new journey planner service will be made available to the public during 2017. The pilot is part of the Digitalization programme of Finnish Transport Agency (Automated collection of traffic and mobility data).

### Real-time information pilot and services

The Finnish Transport Agency launched a public transport pilot in 2016 to test the delivery and distribution of the real-time information of national bus and train traffic. The aim of the pilot is to find out the requirements for real-time data, how this information can be produced and how it can be linked to static scheduling information. In addition, the pilot will determine what kind of requirements should be set for systems producing real-time data and what kind of real-time scan tools are needed.

In addition, the purpose of the pilot is to define preconditions for the tendering of real-time public transport systems as well as guidelines for the development of real-time data processes. Companies in the market benefit from the pilot's results, based on accumulated knowledge, in developing and offering compatible solutions to their customers.

The pilot was implemented in the cities of Jyväskylä, Lahti, Oulu, Lappeenranta and Joensuu. The pilot was implemented in close co-operation with Digitransit and nationwide journey planner. The pilot is part of the Digitalization programme of Finnish Transport Agency (Automated collection of traffic and mobility data).

In addition, the regional public transport organizations in the four biggest conurbations of Helsinki, Turku, Tampere and Oulu have already invested in their own real-time information and ticketing systems. These systems enable the collection and distribution of real-time location data of each vehicle as well as information on the punctuality of the services.

#### 2.1.1.7    Route and schedule editor

The route and scheduling editor (RAE) of the Finnish Transport Agency can be used for storing public transport stops and stop-specific timetables. The RAE tool has two roles; editor (traffic operator) and administration (road authority).

The RAE tool can be used to store routes in gtfs format files. For example, the traffic operator may provide their application for operating of a certain route to the authority in an electronic form (including route and timetable information). Routes accepted by the authority will automatically pass through to the Finnish Transport Agency's public transport database and, for example, the matka.fi service. The information of the Digiroad stops is used by RAE.

#### 2.1.1.8    Proactive approach to maintenance required in the road network

There are several ongoing pilots and initiatives in the field of digitalizing the road maintenance processes. In Lapland, the Centre for Economic Development, Transport and Environment is testing a solution where buses are equipped with video cameras that collect video stream of the driving conditions along the long-distance bus routes. The video streams are sent to a cloud service via Android smartphone. The personnel responsible for controlling the quality of maintenance operations can access the video streams and check the status without driving long distances themselves.

In addition to everyday road maintenance activities, digitalization is also used also in the collection of data of the structural condition of the road surface. Laser scanning technology and other methods have been tested by the Finnish Transport Agency in the context of producing an accurate picture of the road surfaces condition e.g. formation of tracks and other damages in the pavement. As the

technology gets cheaper a large fleet of commercial vehicles such as milk trucks and taxis can be harnessed to produce data with high coverage of the national road network.

Video recognition technology has been tested in the roadside flora inventories. The information could be used in the planning and procurement of the roadside maintenance works.

## 2.1.2   Progress since 2014

Description of the progress in the area since 2014:

Since 2014 there have been many advances made in the field of optimal use of road, traffic and travel data. In data collection, a procurement of national travel time information has been prepared searching for the most cost-efficient solution for collecting real-time travel time information from the national highways and the four biggest cities. In addition, the use of mobile application in the collection of travel and traffic data has been piloted successfully. A lot of effort has been put to effectively collect continuous data on the driving conditions and road's structural condition, using e.g. laser scanning and video recognition technologies combined with modern data processing solutions.

The Digitraffic service has been established to work as the key platform for storing and distributing all types of traffic related real-time data, including information from rail and maritime traffic. The Traffic Situation service, which is the publicly funded end-user internet service for such data, has also been widened towards other modes of transport.

Another significant development has been the nationwide public transport database Digitransit that already covers the long-distance services and several conurbations. The aim is to soon cover most of the city level services as well. There is also a nationwide end-user routing service in place, utilizing the Digitransit platform and covering all public transport modes as well as real-time public transport data.

### 2.1.3 Reporting obligation under Delegated Regulation (EU) 2015/962 on the provision of EU-wide real-time traffic information services (priority action b)

Measures undertaken, if any, to set up a national access point and on the modalities of its functioning:

In compliance with Article 3 of the Delegated Regulation (EU) 2015/962 a national Single Point of Access through which data is accessible has been set up as follows:

- Static road data is available for exchange and re-use in compliance with Article 4 of the Delegated regulation via the Digiroad service (www.digiroad.fi).
- Dynamic road status and traffic data is available for exchange and re-use in compliance with Articles 5 and 6 of the Delegated regulation via the Digitraffic service (www.digitraffic.fi).

All data in the afore-mentioned services is shared according to the principles of open data under a Creative Commons Attribution 4.0 International License.

Where relevant, the list of motorways not included in the comprehensive trans-European road network and identified priority zones:

The real-time traffic information service covers the comprehensive trans-European road network (TEN-T) in Finland. All Finnish motorways are in this network. There are no specific priority zones identified.

Additional information:

The static road data is available at the access point in Esri Shape -format for download and in WMS/WFS interface service as defined in the INSPIRE Directive. Few data types are available at external services in format defined in the service in question.

The dynamic road status data is available at the access point in DATEX2-format. The traffic data is available in JSON-format.

### 2.1.4 Reporting obligation under Delegated Regulation (EU) No 886/2013 on data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users (priority action c)

Progress made in implementing the information service, including the criteria used to define its level of quality and the means used to monitor its quality:

The implementation activities for priority action c are defined in the national implementation plan prepared by the Finnish Transport Agency. The targeted quality levels have been studied in the EIP- and EIP+ -projects in cooperation with other Member States.

The Finnish Transport Agency operates the Traffic Management Centre which provides traffic reports on safety related traffic events as specified in the Delegated Regulation. The safety related traffic reports are distributed through the Finnish Transport Agency's web pages (http://liikennetilanne.liikennevirasto.fi/) and via social media e.g. Facebook and Twitter. The Traffic Management Centre also delivers information directly to existing distribution channels, including variable message signs as well as RDS-TA, public and private media broadcasters and external service providers. The information is provided free of charge.

In addition to the set-up of the message distribution, the Finnish Transport Agency has invested in the monitoring and early observation of the safety-related events. The roadside monitoring station network has been expanded and new ways of collecting and disseminating safety-related information has been piloted in the NordicWay project together with the other Nordic countries. NordicWay Coop piloted a solution to relaying safety-related traffic information from a vehicle to other vehicles using cellular network and cloud infrastructure. The project is further discussed in chapter 2.4.1.

Also the reindeer warning service produces safety-relevant event messages in the northern areas of Finland. The reindeer warning service was opened for the public in August 2017.

Results of the assessment of compliance with the requirements set out in Articles 3 to 8 of Delegated Regulation (EU) No 886/2013:

The Finnish Transport Agency is currently the only provider of road safety-related minimum universal traffic information in Finland. In accordance with the Commission Delegated Regulation (EU) No 886/2016 the Finnish Transport Agency has given a formal declaration stating that the Agency's service provision is in compliance with the requirements and specifications of the Delegated Regulation.

The Ministry of Transport and Communications has designated the Finnish Transport Safety Agency as the national body to assess whether the requirements set out in the Delegated Regulation are fulfilled by the service providers dedicated to traffic information. So far the Finnish Transport Safety Agency has not perceived any deviations or irregularities in the service provision in Finland.

Where relevant, a description of changes to the national access point:

The safety-related traffic information is provided from the National Access Point Digitraffic along with real-time traffic information as discussed in chapter 2.1.3.

Additional information:


## 2.2 Priority area II. *Continuity of traffic and freight management ITS services*

### 2.2.1 Description of the national activities and projects

#### 2.2.1.1 *Renewal of traffic management systems*
The national activities have been focused in the renewal of existing, independent traffic management systems under the new system architecture as well as utilisation of several data sources and data analytics to improve the quality of traffic management systems. Automatisation and operational efficiency are in the target of project initiatives.

The renewal of traffic management systems for road, rail and maritime traffic started in 2013 when the Finnish Government granted 90 million euros for the so called LOU project. The share of road traffic management systems was 30 million euros, which have also been granted CEF funding support via the NEXT-ITS and NEXT-ITS2 projects.

The objective is to increase automation, cost-efficiency and reliability of the traffic management systems and to deliver better services to road users. The real-time situational picture and efficient analytical tools are in the centre of the new joint operational user interface called T-LOIK. The base version of the common user interface was deployed for pilot use incorporating also the integration layer deployment at the end of December 2014. The first version of the base system was taken into operational use during the summer of 2015 containing also incident information functionalities, while maintaining the old separate systems functioning in parallel. By October 2015, the full deployment of the base system with 100% integration was completed. System integrations have continued in 2016 and 2017 by bringing e.g. tunnel management systems into the T-LOIK environment.

The major technical solutions are based on off the shelf software components, using as much of open source as possible. The integration of the existing legacy systems to T-LOIK has been carried out by developing as generic interfaces to services as possible. A major effort has been put into developing a uniform system and data architecture, which enables transport system and traffic information integration. This modular architecture developed supports the later integration of traffic systems and traffic data. Thus the base system allows the gradual implementation and quality control of new sources of traffic data, data fusion, data analysis, alerts and automation. These are crucial for the deployment of ITS Directive's priority actions.

The development of the base system was carried out iteratively by three agile software development teams lead by Finnish Transport Agency's project management and integrator team. The software development teams and parts of the management and integrator teams were procured.

### 2.2.1.2   Border Queue Management Service at Vaalimaa truck parking area

The new lorry park and waiting area in Vaalimaa offers 410 parking spaces when entering Russia and 51 when entering Finland. It was opened for traffic in January 2017. The service provider of this PPP project is Tieyhtiö Vaalimaa Oy, and the procuring authority is Finnish Transport Agency.

General objective of the Border Queue Management service is to minimize the queues at the border of Finland and Russia.  The aim of the pilot project is to test the border queue management service, to determine the impacts of the border queue management service and to gather feedback and develop the service. Truck drivers are obliged to book a place in the queue in advance or enroll in the live queue. Booking can be made in the internet, by phone or in separate reservation points for a certain day and hour.

The preliminary study of the border queue management service was finished in the spring 2013. The service was piloted from December 2014 to December 2016. The system was installed to the new lorry park in June 2017. The service contract will continue for three years until June 2020. Weather information and real-time photos will be added to the service to make border crossing easier.

### 2.2.1.3   Secure truck parking of Vaarala

A new truck parking area (150 truck parking spaces) will be constructed in Vaarala. The Vaarala truck parking area is located in the Metropolitan Region of Helsinki, in the node of Vuosaari Harbour, Helsinki West Harbour, Helsinki Airport, Ring Road III (motorway E18) and Motorway E75. The truck park is designed according to the principles as set out in the Commission's Delegated Regulation 885/2013.

The Vaarala truck parking area will be the first high-standard and secure truck parking area in Finland. Area is fenced and guarded, and there will be an access control system. Area provides digital solutions and intelligent systems e.g. a system showing vacant parking spaces, parking space booking system and queue management system of harbours and logistics centres. There is a possibility to connect the Vaalimaa truck parking area and the Vaarala truck parking area on a system level, and, in the future, possibly also to the Tallinn truck parking area. Area will be open for 24/7 and it has various services for truck drivers and heavy vehicles (e.g. a restaurant, rest rooms, a gas station, truck repair and maintenance services).

Total cost of the project is 10.2 M€ + Intelligent systems/digital solutions about 2 M€. The Finnish Transport Agency and the ELY Centre for Uusimaa (building of truck parking spaces) are responsible for the project. The partners are Speed Group Ltd and the City of Vantaa.

### 2.2.1.4  *Smart guidance for heavy good vehicles at port*

The ferry connection between Helsinki and Tallinn has over 8 million annual passengers. The traffic to the ferry terminals creates substantial congestion, noise and other negative externalities at both ports and cities. FinEstSmartMobility project provides more fluent integration of different transport modes of this inter-city and cross-border traffic with piloting and planning ICT-driven solutions. The project is funded through Interreg Central Baltic programme. The project partners are: the City of Helsinki, the City of Tallinn, ICT Demo Center, the City of Vantaa, the Estonian Road Administration, Forum Virium Helsinki LTD and Helsinki Region Transport. There are two planned pilots for smart guidance for heavy goods vehicles at port, which will begin in 2018.

PILOT A. Just-in-time logistics for heavy goods vehicles, based on truck parking at the ring-roads and mobile application that directs them: More than 200 000 trucks / year are travelling through centers of Helsinki and Tallinn city to and out the Old Harbor/Tallinn and West Harbor/Helsinki. Both harbors are located in the city centers and lack sufficient parking spaces. In order to ease the pressure on harbors, trucks should arrive at the port area just-in-time when they are loaded to the ferries – not hours or days before the loading. In pilot A, such solutions will be developed. An important part of this is to better use the truck parking lots located along the ring roads.

PILOT B. Smart management for outgoing traffic, with dynamic mobility management: Where pilot A focuses on the incoming traffic, pilot B focuses on outgoing traffic, as it is the outgoing traffic from ports that is causing congestion. The final solution can be for example a mobile app or street side applications for guidance. It is desirable that both cities can use the same solutions.

### 2.2.2  Progress since 2014

Significant resources have been put into the renewal of the traffic management systems in all traffic modes i.e. road, rail and maritime traffic. Automatisation and operational efficiency are in the target of the so called LOU project. The new integrated traffic management system for road traffic (T-LOIK) was taken into operative use already in the end of 2014 and after that, more sub-systems and intelligent, automated features have been introduced to increase the reactiveness, effectiveness and efficiency of the operations of the national traffic management centres.

The importance of intelligent ICT solutions and data in planning and providing logistics services and in the services provided by the authorities that support these will continue to grow. The aim is that in

Finland, traffic services and control systems will be based on excellent real-time view of the traffic situation.

The aim in logistics is to use digital documents throughout the entire supply chain and to see that the different parties in the chain are united by a shared system of electronic transactions. In Finland this requires the introduction of electronic documents and operating models that enable their use. As nodes for sea and land transport, ports are in a key position regarding the use of electronic systems in logistics.

In freight management the greatest progressing step since 2014 is the implementation of the queue management system for the Vaalimaa border crossing station. The truck drivers are now allowed the possibility to book their turn in the station, and are not obliged to queue in the highway. This will greatly reduce the waiting times and decrease the problems caused to other drivers by the queueing truck traffic. The next planned steps include smart and secure truck parks and truck traffic management systems in the Helsinki Region and the ports of Helsinki and Tallinn.

## 2.3 Priority area III. *ITS road safety and security applications*

### 2.3.1 Description of the national activities and projects

#### 2.3.1.1 *Reindeer warning systems*

Finland's designated reindeer herding area covers 36 % of the country's total land area and sees as many as 4000 reindeer accidents occurring on Finland's roads and railways per year. The idea of the pilot is that reindeer warnings made by professional drivers are shared in real time with private road users through various car navigation systems and mobile applications. The professional drivers are provided with a reindeer warning device and with the help of that they are able to notify other drivers that there are reindeer on or near the road. After receiving the warning through the car's navigation system or reindeer warning application, the driver can prepare for a possible encounter with reindeer. The warning system relies on GPS location and mobile technology, enabling accurate warnings for road travelers. The service aims to reduce reindeer accidents by half by 2020.

The system was first piloted on two road sections with 25 drivers in 2013–2015. The pilot continued in 2016–2017 with 1000 drivers in the area of Fell Lapland. A mobile application for Android phones will be launched in the autumn of 2017, when the service will also be opened for the public.

The project is part of the Aurora test ecosystem and it's implemented in cooperation with the Centre for Economic Development, Transport and the Environment of Lapland, the Finnish Transport Agency, the Reindeer Herders' Association, Paikkatieto Online Oy, HERE and V-Traffic Mediamobile.

#### 2.3.1.2 *eCall*

During 2011 – 2014 Finland participated in the HeERO (Harmonised eCall European Pilot) project which validated the standards of pan-European eCall and prepared the deployment of eCall in Europe. This work has been continued in the I_HeERO project which will be finalised by the end of 2017. Finnish participation in the I_HeERO project includes implementation of eCall in Public Safety Answering Points (PSAP) and mobile networks, conformance assessment of PSAPs, eCall end-to-end tests and contribution to the development of Heavy goods vehicle (HGV) eCall.

The work carried out so far in the I_HeERO has included development of eCall in the information system of Finnish PSAPs. This work is still going on. The eCall flag has been successfully tested in laboratory environment with all MNOs operating in continental Finland.

The eCall implementation part of the Finnish I_HeERO project includes both mandatory conformance tests for the PSAP as well as end-to-end test covering the whole eCall service chain from In-Vehicle System (IVS) to PSAP. The aim is to have eCall implemented in Finnish PSAPs by the end of September 2017.

Finland has also contributed to the development of the specifications of the HGV eCall and a prototype of the HGV eCall PSAP, and studied the user needs of the system.

### 2.3.2    Progress since 2014

A lot of effort has been put into building the readiness for the introduction of the eCall system in Finland in conformance with the specification of the ITS Directive. The readiness will be reached by the end of September 2017.

Another important project has been the implementation of a reindeer warning system in the northern part of the country. Reindeer accidents are very common in the reindeer herding areas and with the help of the new service, based on mobile applications and crowdsourced data collection, it is possible to reduce the accident risk significantly.

There are more initiatives that could also fall into the priority area III but are reported elsewhere, such as the Nordicway project (reported under priority area IV). In addition it should be mentioned, that the Finnish Emergency Response Centre has introduced a free mobile phone application, which automatically provides the 112 operator an accurate gps position of the user that makes an emergency call through the application. This greatly serves the need to send help directly to the right location in the case of emergency, including traffic accidents. The application has been loaded over 900 000 times so the penetration rate in Finland is very high.

### 2.3.3    112 eCall (priority action d)

National eCall PSAPs Infrastructure ready by 1<sup>st</sup> October 2017: YES

Authorities that are competent for assessing the conformity of the operations of the eCall PSAPs:

Chief Adviser Anna Schirokoff / Finnish Transport Safety Agency, P.O. Box 320, 00520 Helsinki, anna.schirokoff@trafi.fi, tel. +358 29 534 5268

Director Jukka Aaltonen / Hätäkeskuslaitos, P.O. Box 112, 28131 PORI, jukka.aaltonen@112.fi, tel. +358 295 480 112

Additional information:

### 2.3.4 Reporting obligation under Delegated Regulation (EU) No 885/2013 on the provision of information services for safe and secure parking places for trucks and commercial vehicles (priority action e)

Number of different parking places and parking spaces on their territory and percentage of parking places registered in the information service and providing dynamic information on the availability of parking spaces and the priority zones

There are 5 229 traffic rest areas on main roads in Finland, of which 576 are commercial, 1 403 refueling points and 3 250 owned by the Government. The development needs of the service areas have been studied (amount, locations, services). Crime is not a major problem in the rest areas (mainly fuel thefts), although some foreign transport customers have begun to demand guarded rest areas.

The Vaalimaa truck parking area (410 parking spaces) at the Russian border is provided with the Border Queue Management service. The Vaarala truck parking area (150 truck parking spaces), which is currently under construction, will be the first high-standard and secure truck parking area in Finland. There is a possibility to connect the Vaalimaa truck parking area and the Vaarala truck parking area on a system level, and, in the future, possibly also to the Tallinn truck parking area.

TRANSPark is a portal maintained by the International Transport Forum (IRU). It offers detailed information of over 4 000 parking areas in 41 countries with regard to services, number of parking slots and security level. In Finland, 300 refueling points and two ports (Hanko and Vuosaari) offering parking areas are listed in the service.

Additional information: (e.g. has a national access point been set up to provide truck parking data? Does it include dynamic data? What is the source of data (public / private)? Is data published on the European Access Point for Truck Parking hosted by DG MOVE?)

At the moment the National Access Point (Digitraffic) does not offer any truck parking data. However, the solution is now under planning. In the first phase the plan is to bring the static information about the rest areas on the national highway network into the common European information portal. In addition, the organisation model is being discussed.

## 2.4 Priority area IV. *Linking the vehicle with the transport infrastructure*

### 2.4.1 Description of the national activities and projects

#### 2.4.1.1 *NordicWay*

NordicWay is a pre-deployment pilot project of Cooperative ITS (C-ITS) services in four countries (Finland, Sweden, Norway and Denmark). The project goal is to pilot and facilitate specific C-ITS functionalities through a common architecture (see figure 2). The end goal of the project is to lay the foundation for automated cloud service using hybrid communication (mainly cellular network) with data generated by vehicle on-board sensors and the surrounding infrastructure.

NordicWay has the potential to improve safety, efficiency and comfort of mobility and connect road transport with other modes. NordicWay is the first large-scale pilot using hybrid communication (3G, LTE/4G and ITS-G5) for C-ITS. Its aim is to offer continuous interoperable services to the users with roaming between different mobile networks also across country borders.

The project is a collaboration between public and private partners in the four countries, and is co-financed by the European Union within the Connecting Europe Facility programme 2015-2017.

As part of NordicWay, the NordicWay Coop pilot project started in Finland in June 2015 as a cooperation between the Finnish Transport Agency, the Finnish Transport Safety Agency and HERE. The pilot tested relaying of information relating to the traffic situation between vehicles and infrastructure. The exchange took place in the mobile network without the need for special infrastructure for data exchange. The piloted service included Day 1 information services of road works, obstacles on the road, extreme weather conditions, reduced visibility, slipperiness of the road and accidents. Over 1300 voluntary participants used a mobile application to share information with other vehicles on the road, the traffic management centre and the surrounding infrastructure in a C-ITS network.

In the first stage of the project the technical readiness of the system was verified. The second stage including a one-year pilot on road E18 between Helsinki and Turku started in the spring of 2016. The piloting phase ended a year later and the evaluation results are presented in November 2017.

The Nordicway Coop approach has a key role in the collection of safety-related traffic information that is described under the Priority Area I.
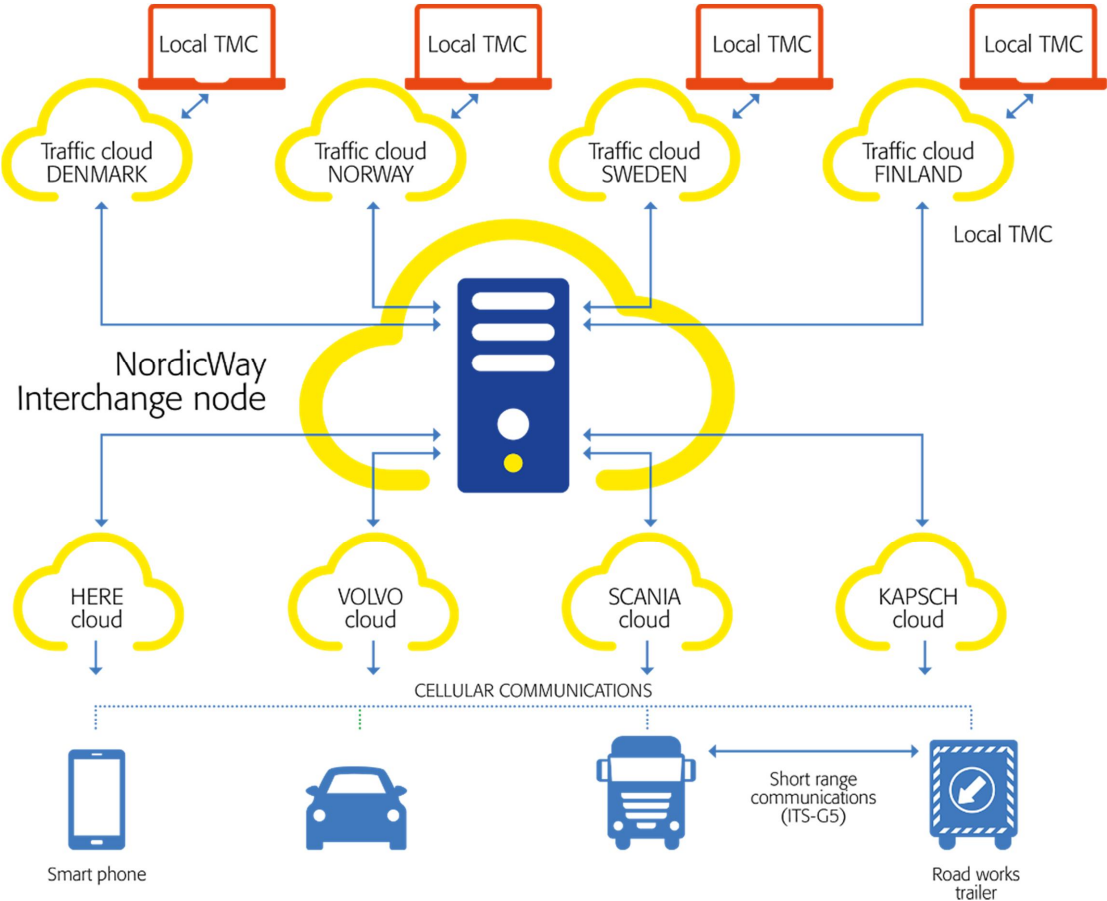


Figure 2 Nordicway architecture and interoperability

### 2.4.1.2 NordicWay2

NordicWay2 is an EU CEF project funded by Denmark, Finland, Norway and Sweden. It involves testing and demonstrating the interoperability of C-ITS services, both for passenger and freight transport. NordicWay2 real life deployment pilots will have a strong impact on improving safety and efficiency of the European Core and Comprehensive road transport network, including parts of urban networks and urban-interurban transport connections along the northern part of the Scandinavian-Mediterranean Core Network Corridor. The project will use hybrid communication and assess, among others, the capability of connected and automated vehicles to monitor road infrastructure. The Finnish pilots in the NordicWay2 project include the deployment of C-ITS day 1 and 1.5 services as well as automation in icy and snowy road conditions.

## 2.4.2 Progress since 2014

Description of the progress in the area since 2014:

The activities within the Priority Area IV have been focused in the European project Nordicway. In the pilot project, the technical readiness was verified following a field test with hundreds of drivers using a mobile application to send warnings for safety-relevant events via mobile network and cloud server to other drivers approaching the same highway stretch. The evaluation results will be available in the autumn of 2017. Wider deployment of the service as well as more pilots are already planned under the Nordicway2 project.

## 2.5 Other initiatives / highlights

### 2.5.1 Description of other national initiatives / highlights and projects not covered in priority areas 1-4:

#### 2.5.1.1 Road traffic automation trials

Arctic testing for intelligent transport automation
The Aurora test ecosystem is designed for verifying and validating new ITS solutions and innovations in real extreme weather conditions. Situated above the Arctic Circle, Aurora offers a unique test location for validation, marketing and assessment of impacts and performances of intelligent transport automation. One of the domains Aurora focuses on is Arctic testing for intelligent transport automation. The Aurora network pools operators who are interested in testing and developing automated driving and intelligent transport systems in extreme weather conditions, and offers them an opportunity to participate in testing and development.

The Aurora test ecosystem offers two-level testing facilities. On the first level it is possible to test drive on safe and secured tracks closed from traffic and suitable even for early phase prototype testing. In the second stage, tests can be carried out also among other traffic on public roads. The E8 highway (nationally highway 21) from Kolari to Kilpisjärvi (280 km) is dedicated for the open road testing of automatic driving, with a specially instrumented section of 10 km. A total amount of 5 million euros public funding will be used for the additional intelligent features and R&D-activities.

One of the Aurora R&D activities is the Arctic Challenge project that studies automation in snowy and icy conditions. Arctic Challenge is also part of the EU CEF funded NordicWay 2 project. In addition, the Infra Challenge project studies intelligent infrastructure in Arctic conditions.

The Norwegian and Finnish road transport authorities have signed a partnership agreement. Their aim is to develop the safety and efficiency of cross-border traffic on E8 by means of connected and automated driving as well as other intelligent transport systems in northern Finland and Norway.

## CityMobil2

The City of Vantaa participated in the CityMobil2 project co-funded by the EU's Seventh Framework Programme. CityMobil2 set up a pilot platform for automated public transport systems, which will be implemented in several urban environments across Europe. As part of the project, the city of Vantaa carried out an experimental pilot project for automated minibuses in 2015.

Minibuses operating without a driver transported passengers from the Kivistö station to the Vantaa Housing Fair area during the summer 2015. The test trail was 1 km long. The participants in the pilot were the city of Vantaa, Helsinki Regional Transport, the Finnish Transport Safety Agency, the Finnish Transport Agency and Helsinki-Uusimaa Regional Council.

## Automated bus trials in traffic- SOHJOA project

Self-driving last-mile electric buses were launched on the streets in Finland at three locations, in an effort to solve urban mobility challenges. Buses can transport up to nine persons. Operation started in July 2016 in the Helsinki Hernesaari area. After that the buses started to operate in Espoo for August-September and finally in Tampere, ending operation in November. In 2017 the piloting continues in Tampere, Espoo and Helsinki, with a revision of mobility requirements from the previous piloting stage. In addition to piloting, the project will create an open innovation platform that companies can utilize to develop new products and service ideas.

SOHJOA-6Aika is part of Finnish cities' collaborative 6Aika project family funded by the European Structural Fund. The partners are Aalto University, Forum Virium Helsinki, Finnish Geographical Institute and Tampere University of Technology. Sohjoa is tested as part of the Traffic Lab and NordicWay – a project funded by the Finnish Transport Safety Agency and the Finnish Transport Agency.

## ROBUSTA

The ROBUSTA project develops novel approaches for transport automation. The project will test and study technologies that enable to remove the human operator from the bus and to put him in the control room responsible of multiple buses. The key objective is to create a remote drive system that allows the use of semi-automated buses, and later highly automated vehicles in urban traffic conditions.

Specific research and development themes include software platform for remote control of robot buses, 5G network as an enabling technology, real-time sensor data, human-machine communication assisted with artificial intelligence, development of remote control room, in addition to exploring how automated vehicles could be fitted to existing mobility ecosystem, what the future business potentials are and assessing the user experience of both passengers and remote operators.

Specific attention will be put on the development of remote operation systems and interfaces that are easy and intuitive for humans to operate, and yet reliable and robust enough to provide the necessary functionality and safety.

## Oulu Zone

OuluZone is a 5G enabled research and training center. Oulu Zone offers a closed area of 850+ hectares with test tracks to develop a highly automated vehicle in arctic conditions (over 160 winter days per year). OuluZone can offer for example an environment to test automated vehicle handling in snowstorm or slippery surfaces for tyre testing.

## UrbanAutoTest

VTT Technical Research Centre of Finland and a consortium of industrial partners (Tieto, TTS Oy, Taipale Telematics, HERE), supported by local and national authorities (the City of Tampere and the Finnish Transport Safety Agency), have set up the UrbanAutoTest project, of which main objective is to facilitate companies to develop and test connected and automated driving functionalities.

The project has generated a test environment located in the City of Tampere, consisting of closed and public route test track with test equipment, portfolio of verification and validation, technology research and consultancy services and growing portfolio of test vehicles and tools. The weather conditions in Tampere are challenging in winter times due to snow, ice and slush conditions, which can change rapidly. The project runs from January 2016 until the end of 2017.

## Living Lab Bus - Open innovation and test environment

The Living Lab Bus enables development, testing and demonstration of various services and technologies in a real use environment. A fleet of innovative electric buses in normal operation in the Helsinki Region are used as a concrete test environment. The environment is implemented in co-operation with private companies and research organisations together with the support of the public sector. In addition to those involved from the beginning, third parties are welcome to get in contact to participate and use the platform to test their own solutions.

The Living Lab Bus environment can be used for collecting data, validating solutions and as an interface for involving end users in the innovation and feedback process. It thereby supports service and technology providers' business development, innovation, co-development and co-operation activities as well as product marketing.

Consortium:  Ajeco Ltd., EEE Innovations Ltd., Foreca Ltd., iQ Payments Inc., Linkker Ltd., HSL, City of Helsinki, City of Tampere, VTT Technical Research Centre of Finland Ltd., Aalto University, University of Tampere, Tampere University of Technology. More information: www.vtt.fi/sites/livinglabbus/

## 5G-SAFE

5G-SAFE is a two-year research and development project (2017-2018), which is funded via Tekes (the Finnish Funding Agency for Innovation) Challenge Finland competition. The main objectives of the project are to improve road safety, to optimise logistics and road maintenance, and to contribute to the future of automated driving by delivering novel focused and time-critical services to vehicles, road users, and 3rd party organizations in a reliable and scalable manner. The work is conducted in collaboration with the key Finnish research and industry players in the field.

Localised road weather services play a key role in the 5G-SAFE solution together with direct event and control information. The advanced services utilise sensor and video data, collected from the vehicles, and generate focused alerts and information to drivers, road users, and automated vehicle control systems.

So far, the lack of sufficient communication media has hindered the wide-scale adoption of advanced vehicular services with high reliability and low latency demands. The upcoming 5th generation (5G) mobile network technology is expected to bring a solution to this. 5G-SAFE will analyse the impact of 5G on the services, while ensuring a smooth transition via current and emerging communication and cloud technologies.

5G-SAFE is envisioned to have a significant societal, business and scientific impact through its automotive and 5G solutions that have a global demand and market.

### 2.5.1.2    Mobility as a Service (MaaS)

Mobility as a Service is a concept that originates from Finland and is currently spreading all around the world. Within the last few years there have been many interesting pilots organized in cooperation with the public sector and private sector players. Also, several promising start-up companies have been founded in Finland that are now opening their MaaS offerings in many other countries. This chapter provides a quick look in the most significant initiatives.

### Commercial MaaS-services

Several commercial companies have emerged from Finland to the MaaS market, the biggest ones of them being Tuup, MaaS Global and Sito's MaaS unit. Tuup's mobile application offers information on prices, routes and timetables of public transportation, taxis, rental cars and bicycles. Tuup offers also an on-demand shared taxi service Kyyti, where customers can lower the price if they can be flexible in travel and waiting times. MaaS Global's mobile application Whim offers travel options for public transport, taxis and car hire and in addition to pay-as-you-ride type of pricing, they offer mobility packages with a monthly fare. Whim was launched in the late 2016 and is currently pilot testing in Helsinki.

Both Tuup and Maas Global have announced that they have closed contracts with cities in Europe and North America. As a proof for the competiveness of the Finnish companies MaaS Global also announced in June 2017 that they have received 14 million euros funding from large international companies.

### European Research on MaaS

Mobility as a Service for Linking Europe (MAASiFiE) was a two-year project that investigated the prerequisites for organizing user-oriented and ecological mobility services in order to provide consumers with flexible, efficient and user-friendly services covering multiple modes of transport on a one-stop-shop principle. The main scope of MAASiFiE was to identify and analyse MaaS models and create a Roadmap 2025 for MaaS in Europe. One of the important results of the project was a common view of the roles of the public sector players, which is quoted below.

When considering the integration of transport modes and how to blur existing boundaries, enabling and agile legislation and regulation is essential. The national public sector, including government, ministries, transport agencies, and national road infrastructure operators, has a major role as an enabler of service pilots, open data availability and a builder of the legislative framework that affects the potential of different modes and services. These actors are also responsible for setting incentives and disincentives, which should be focused effectively. The focus of regulation should be in ensuring transparent market conditions and fair market performance and securing the legal position of consumers and travelers. The national public sector actors have their own roles and responsibilities,

which should be coordinated among actors and in order to support and push towards a common vision.

While national authorities are setting regulation on the national level, local authorities are needed to integrate the needs of the business sector and consumers to the policy framework on regional and municipal levels. Local authorities play a significant role in public transport planning and organization but also in planning and developing of efficient and attractive land use. In the future, local authorities might also be among the key stakeholders in MaaS business, because of their strategic positioning in the public-private partnership ecosystem.

MAASifie was financed by the CEDR Transnational Road Research Programme 2014 on Mobility & ITS. Project coordinator was VTT Technical Research Centre of Finland Ltd. (Finland) and project partners AustriaTech (Austria) and Chalmers University of Technology (Sweden).

## Some examples of publicly funded MaaS pilots

One of the focus areas in the Aurora test ecosystem is MaaS. A pilot was organised in Ylläs ski resort to test MaaS services in the area and between Ylläs and the main local transport hubs, Kittilä airport and Kolari railway station. The piloted YlläsAround service included multimodal transport services, which were all available for the end users through a mobile application. The application also provided payment and ticketing features. The pilot project was organised in 2016-17. The pilot was implemented in cooperation with the Finnish Transport Agency, the Municipality of Kolari, the Ylläs Travel Association, Sonera and Semel.

In Hämeenlinna a pilot was organized together with Sonera and the local authorities and transport operators. A new application "Sonera Reissu" offered transport services in the city of Hämeenlinna for rail/bus and (shared) taxi. The idea in the Reissu service was that end users could pay their trip on a one-stop-shop basis via mobile application. The Reissu application used mobile payment and ticketing and it combined both taxi and train/bus trips on the same ticket. Sonera Reissu used fixed prices with taxi companies and took a minor commission fee on re-sold train tickets.

In Seinäjoki a pilot was organized for packaging several transport services into a fixed price monthly travel package. Packages contained local buses, taxis and a demand-responsive service. The pilot was organized in 2016-17 for a limited test group. The participants that include MaaS operator Sito, local authorities and operators and TEKES are now considering the future solution.

Kutsuplus (2012-2015) was an intermediate form of public transport and taxi complementing other Helsinki Region Transport Authority services (bus, local train, tram, metro) in the metropolitan area of Helsinki. Kutsuplus used a network of nine-seat minibuses. The service was an alternative to multiple transfer trips and private car drives. The key features of Kutsuplus service included an online or SMS order for the ride 45min in advance, ride from (virtual) bus stop to (virtual) bus stop, different service classes, ridesharing as well as payment in advance. The large-scale pilot organized by the Helsinki Region Transport and their private partners ended in 2015.

Fölix was a pilot performed in the City of Raisio close to Turku in the fall of 2016, and it is an extension of Turku Region Traffic, Föli, which covers the public transportation of the cities Turku, Kaarina, Raisio, Naantali and Lieto, and is known for being one of the first Finnish regional public transports that started to use mobile ticketing and payment. Fölix provides on-demand shared taxi

rides from two separate bus stops located in Raisio city centre within the specified service area. The service is mostly targeted to customers living in areas outside the public transport service area. To enable merging the taxi rides, they have to be booked two hours prior. By merging the rides, the service and rides are expected to be profitable for the taxi operators as well.

### 2.5.1.3 ITS projects of Finnish cities

#### Helsinki

The city of Helsinki wants to develop the traffic system mainly based on rail traffic, by increasing the service level of public transport and by increasing opportunities for walking and cycling. Improving traffic safety is a central aim of traffic planning. Real-time data on the transport system status is one of the key goals for the city's ITS strategy. It also places emphasis on new solutions and experimentations, favoring crowdsourcing methods and open approaches, better utilisation of infrastructure capacity, development of innovative procurement, implementation of IoT based services and solutions as well as enabling new mobility as a service pilots and businesses.

Helsinki together with relevant local authorities has over 20 projects focusing on smart mobility. These can be categorized with main focus areas of new digital services (such as MaaS), mobility information (linking to IoT), automated systems, behavior change, urban logistics and supporting measures like innovative procurement, parking, electrification and sustainability. The main focus areas have seen good progress with e.g. several MaaS developers bringing products to the market, and automated busses been trialled among normal traffic. In coming years the focus will shift to transition from pilots to viable commercial services utilising public-private cooperation models.

Additionally a number of these projects utilize a model of 'agile piloting', in which the project supports rapid development and uptake of new mobility innovation. This is carried out via quick pace, themed open calls, which result per round in 4-6 pilots being funded by 5-50 k€ each. Primary target is to shift public funding and resources from research and public sector -driven pilots towards creating a market. Most pilots will result in new commercial products already during or within short time period after the pilot. Notably a special focus of the projects lies in "twin-city" co-operation of Helsinki and Tallinn, Estonia. Four projects are joint projects focused on enabling smooth travel of persons and goods, with further 3-5 projects having separate elements with this scope.

#### Tampere

ITS Factory, operating in the City of Tampere, is an innovation and piloting environment for intelligent traffic originating from 2006. ITS Factory has initiated tens of ITS projects, opened up transport related data, and implemented a site for disseminating transport data to all: http://wiki.itsfactory.fi/index.php/ITS_Factory_Developer_Wiki. Six pilots for the real time traffic status information have been set up via innovative procurement, preparations for MaaS are ongoing, and the urban test bed for automated driving has been set up. The novel travel planner game, where bus journeys entitle to points and thereby awards, is being trialled as well. The ITS Factory Roadmap is available at http://bit.ly/itsfactoryroadmap. Together with the city council, the members of ITS Factory – companies that offer intelligent traffic products and services as well as colleges and research institutes invest in the creation of new transport services. ITS Factory is part of the Traffic Lab.

### Turku

Turku has been one of the first cities adopting new technologies especially in public transport. The regional ticketing and information system Föli e.g. offers open data on the location of the busses, includes full mobile ticketing and even includes open ticketing interfaces that allow third parties such as MaaS operators to sell Föli tickets to their customers via mobile applications.

The next planned steps in Turku include among others an automated ferry across river Aura (Älyföri project), trial for automated buses as well as so called "floating" intelligent citybike system allowing offerings for many different types of light vehicles.

### Oulu

Oulu is a northern technology hub of Finland. The city and the state have implemented multiple state of the art systems and services that bring benefits to mobility. The ITS core is a modern metro Ethernet network which uses high speed optical fiber to connect all the traffic light controllers to the central system. There is a strong focus on traffic control and so most of the traffic signal devices and programs have been renewed within the last decade. Traffic is being monitored in a joint management center for the Finnish Transport Agency, city and the police. Data and live camera streams cover most of the traffic network. The information is being shared with citizens and developers through a multimodal traffic information service called Oulunliikenne.fi (www.oulunliikenne.fi). Public transport has new information systems too with many information channels to the passengers and traffic signal priorities in every intersection.

Many of the methods first developed in Oulu have started to expand elsewhere. The best example of sharing a public sector innovation is the emergency vehicle pre-emption system called HALI, which has the potential to become a national system and an open product for authorities as well as an open business ecosystem. Right now the focus is in networking the companies, researchers and authorities with the ITS Oulu project, which includes 6-8 pilot projects that will be focused in solving some real life problems related to mobility. ITS Oulu is a 0,6 MEUR project for the years 2017-2018 and is being planned to continue as a strong network after the project. The state and the city are planning to enhance the already quite comprehensive network for walking and cycling. One of the newer ideas is a super-crossing where walking and cycling will be served in the best possible way and prioritized over vehicle traffic in some cases. There is also a traffic management system going to be built by the Finnish Transport Agency on highway 4 including variable message signs, road weather stations and traffic monitoring systems.

### 2.5.2   Progress since 2014

Description of the progress in the area since 2014

Automated driving and new transport services covering the whole travel chains are in the core of the Ministry's transport strategy and have therefore deserved a lot of attention and resources in the development of the transport sector in Finland since 2014. Several cities and organisations have built closed instrumented test circuits for initial testing of automated driving, but in addition to that, many test areas have been designated from open highway and street environment to attract car manufacturers and technology developers to join the Finnish ecosystem for automated driving. Finnish specialty is naturally the harsh winter conditions, since the automated driving solutions must function in all possible road and weather conditions before a wider market penetration can be expected.

In addition to the building of test sites, many organisations are already testing automated buses in real service operation of limited scale. Also a rising industry branch in Finland is the hardware and software needed in the operation of automated vehicles, including e.g. software platforms for remote control of robot buses, 5G network as an enabling technology, real-time sensor data, AI assisted human-machine communication and development of remote control room functionalities. Numerous companies are currently investing heavily into the new emerging businesses together with the public sector players and funding organisations.

Mobility as a Service is a concept that originates from Finland and is now spreading fast all around the world. It is expected to change the whole transport system and make private car ownership much less common than today. There are several MaaS operators in the market and business models vary from pay-as-you-go to fixed-price monthly packages. The national public sector, including government, ministries, transport agencies, and national road infrastructure operators, has a major role as an enabler of service pilots, open data availability and a builder of the legislative framework that affects the potential of different modes and services. In the last couple of years numerous pilots have been organized in Finland in cooperation with the national and local public organisations, cities and the private companies to develop and test new services in action. Many fully commercial MaaS services have already emerged to the market and are currently expanding from Finland to the bigger markets in Europe and elsewhere.

# 3 Key Performance Indicators (KPIs)

*Note: The EC document on "ITS KPIs for the EU" is to be used for comprehensive definitions of the KPIs and further guidance. The EU EIP Activity 5 report on "ITS Deployment and Benefit KPIs definitions" is a complementary document providing in particular estimation methods.*

The deployment KPIs are calculated for the TEN-T road network with the length of 5207 km. [3]

The values used and their sources are described in the table below.

As the benefits of the services cannot be directly measured they have to be estimated. The benefits calculations for road transport regarding change of travel time, injury accidents and emissions are based on estimates by Risto Kulmala made for the projects NEXT-ITS and NEXT-ITS2. The travel time benefit calculations for public transport are based on a national travel survey[1] and a report[2] on a journey planner for the region of Helsinki.

| | Length (km) | Vehicle km travelled | Veh. hours driven (million/year) | injury accidents (average 2010–2014) | $CO_2$ emissions (million tonnes/year) |
|---|---|---|---|---|---|
| TEN-T network | 5207[3] | 15070[3] | 188.375[3] | 712[3] | 3833.808[4] |
| Information gathering: road weather and traffic volume | 5207[5] | | | | |
| Information gathering: travel time | 767[6] | | | | |
| Traffic management and control measures | 608[7] | | | | |
| Cooperative ITS services and applications | 1498[8] | | | | |
| Real time traffic information | 5207[5] | | | | |
| Dynamic travel information | 5207[9] | | | | |

---

[1] National Travel Survey 2010–2011. Finnish Transport Agency, Transport Planning. Helsinki 2012.
[2] Laine, T., Pesonen, H., Moilanen, P. (2003). An assessment of the effects and cost-effectiveness of a public transport journey planner. FITS publications 22/2003, Ministry of Transport and Communications.
[3] Rajamäki, R. (2016). TEN-tieverkon turvallisuustilanne Suomessa [Safety of TEN road network in Finland]. Trafi publications 15/2016.
[4] On average 254.4 g/km in 2015 (NEXT-ITS2)
[5] The traffic situation service covers all main roads
[6] Estimation of Liiketta network
[7] Tomi Ristola 2017
[8] Includes NordicWay and Reindeer Warning Services
[9] The journey.fi service covers the whole country

## 3.1 Deployment KPIs

### 3.1.1 Information gathering infrastructures / equipment (road KPI)

- <u>Length of road network type / road sections (in km) equipped with information gathering infrastructures & Total length of this same road network type (in km)</u>:

- <u>KPI</u> = (kilometres of road network type equipped with information gathering infrastructures / total kilometres of same road network type) x 100

For road weather and traffic volume services: KPI = 100

For travel time services: KPI = 767/5207 = 15

### 3.1.2 Incident detection (road KPI)

- <u>Length of road network type / road sections (in km) equipped with ITS to detect incident & Total length of this same road network type (in km)</u>:

- <u>KPI</u> = (kilometres of road network type equipped with ITS to detect incident / total kilometres of same road network type) x 100

For manual incident detection: KPI = 100

On all TEN roads expect for critical sections such as tunnels, the EasyWay service quality requirement is to detect incidents within either 15 (sections of safety or flow concerns) or 30 minutes of their occurrence. This is implemented manually via road users or manually/automatically by police/rescue authority reports.

Automated incident detection has only been deployed in tunnels in Finland, complying with the service level objectives agreed by EasyWay for Europe. It is deployed on 8.3 km of tunnels (the total length of road tunnels in Finland is about 13 km).

### 3.1.3 Traffic management and traffic control measures (road KPI)

- <u>Length of road network type / road sections (in km) covered by traffic management and traffic control measures & Total length of this same road network type (in km)</u>:

- <u>KPI</u> = (kilometres of road network type covered by traffic management and traffic control measures / total kilometres of same road network type) x 100

    KPI = 608/5207*100 = 12

### 3.1.4 Cooperative-ITS services and applications (road KPI)

- <u>Length of road network type / road sections (in km) covered by C-ITS services or applications & Total length of this same road network type (in km)</u>:

- KPI = (kilometres of road network type covered by C-ITS services or applications / total kilometres of same road network type) x 100

KPI = (1498/5207)*100 = 29

### 3.1.5 Real-time traffic information (road KPI)

- Length of road network type / road sections (in km) with provision of real-time traffic information services & Total length of this same road network type (in km):

- KPI = (kilometres of road network type with provision of real-time traffic information services / total kilometres of same road network type) x 100

KPI = 5207/5207*100 = 100

### 3.1.6 Dynamic travel information (multimodal KPI)

- Length of transport network type (in km) with provision of dynamic travel information services & Total length of this same transport network type (in km):

- KPI = (kilometres of transport network type with provision of dynamic travel information services / total kilometres of same transport network type) x 100

KPI = 5207/5207*100 = 100

### 3.1.7 Freight information (multimodal if possible or road KPI)

- Length of road network type / road sections (in km) with provision of freight information services & Total length of this same road network type (in km):

- Number of freight nodes (e.g. ports, logistics platforms) covered by freight information services & Total number of the same freight nodes:

- KPI1 = (kilometres of road network type with provision of freight information services / total kilometres of same road network type) x 100

- KPI2 = (number of freight nodes with provision of freight information services / total number of same freight nodes) x 100

See chapter 2.2.1 national activities and projects in the field of freight information services.

### 3.1.8   112 eCalls (road KPI)

N.a. – will be provided through the COCOM 112 questionnaire

## 3.2   Benefits KPIs

### 3.2.1   Change in travel time (road KPI)

This KPI is calculated separately for road traffic (KPI 1) and public transport (KPI2).

KPI 1= ((travel time before ITS implementation or improvement – travel time after ITS implementation or improvement) / travel time before ITS implementation or improvement) x 100

KPI 1 = ((188.4-186.4)/188.4)*100 = 1.1

KPI 2= ((travel time before ITS implementation or improvement – travel time after ITS implementation or improvement) / travel time before ITS implementation or improvement) x 100

KPI 2 = ((65.5-55.5)/65.5)*100 = 15.3

KPI 2 is calculated as the full potential assuming that all public transport users use the services.

### 3.2.2   Change in road accident resulting in death or injuries numbers (road KPI)

- Number of road accident resulting in death or injuries before ITS implementation or improvement:

- Number of road accident resulting in death or injuries after ITS implementation or improvement:

KPI = ((number of road accident resulting in death or injuries before ITS implementation or improvement – number of road accident resulting in death or injuries after ITS implementation or improvement) / number of road accident resulting in death or injuries before ITS implementation or improvement) x 100

KPI = ((712-611)/712*100 = 14.2

The KPI is calculated as the total potential benefit compared to a situation without services and assuming that all road users receive the information.

### 3.2.3   Change in traffic-CO2 emissions (road KPI)

KPI = ((traffic $CO_2$ emissions  before ITS implementation or improvement – traffic $CO_2$ emissions after implementation or improvement) / traffic $CO_2$ emissions before ITS implementation or improvement) x 100

KPI = ((3834-3788)/3834*100 = 1.2

## 3.3 Financial KPIs

Annual investment in road ITS (as a % of total transport infrastructure investments):

The annual investment into renewal and development of road management systems is approximately 7 million euros.

The amount of road investments on the TEN-T road network was 107 million euros (2016), hence the KPI is 6,5 %.

Annual operating & maintenance costs of road ITS (in euros per kilometre of network covered):

The annual maintenance costs of road ITS systems is approximately 9 million euros. In addition, the life-cycle management costs of roadside equipment is 3-5 million euros annually.

The costs for the development and maintenance of ITS services is 0,5-2 million euros annually.

The costs for the TMC operations are 5,6 million euros annually.

The KPI calculated for the TEN-T road network (5 207 km) is hence 3 760 euros/km.

The above mentioned costs exclude the costs for HVAC-systems, tunnel safety systems, electricity, tunnel lightning and traffic lights.