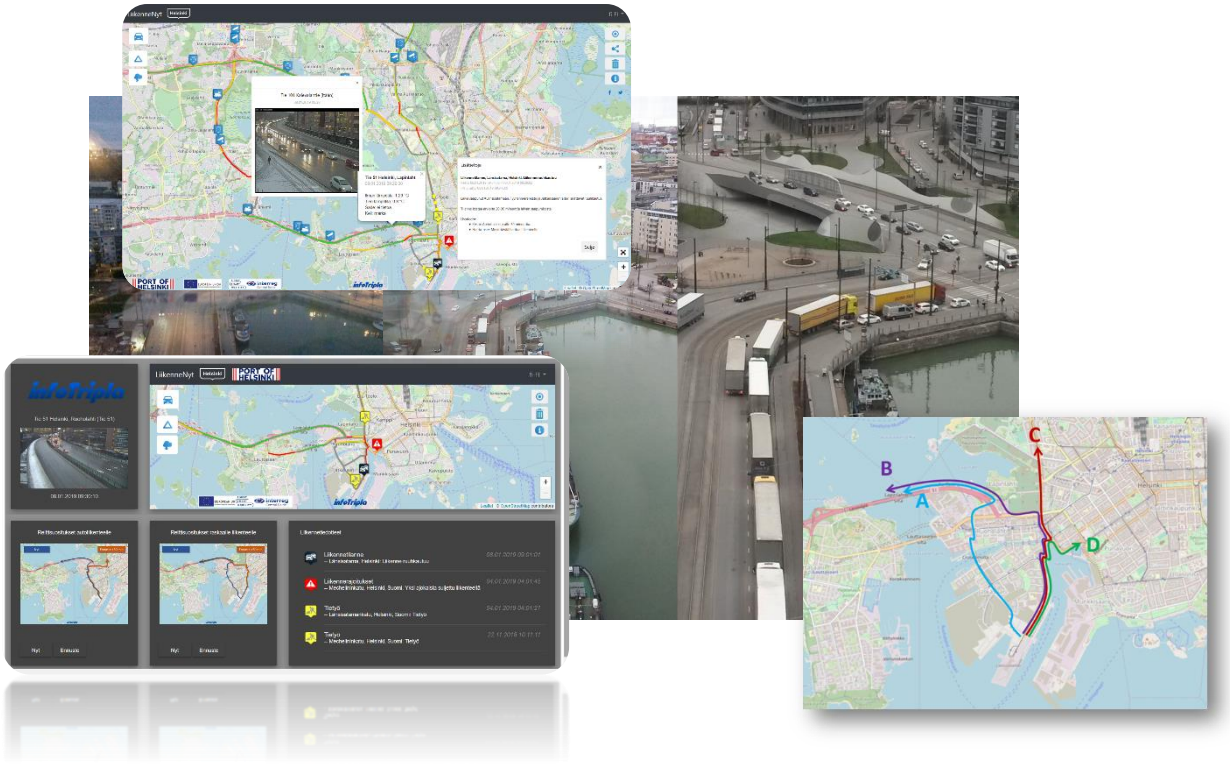

infoTripla

FinEst Smart Mobility
Final Report

Helsinki West Harbour and Tallinn Old City Harbour outbound traffic

1.4.2019

FINEST SMART MOBILITY

Interreg Central Baltic

EUROPEAN UNION
European Regional Development Fund

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Content

1 Project

Infotripla Oy suggested so called "HARBOUR's PSO – Harbour's Predicted and Smooth Outbound Traffic" to be piloted in the Helsinki West Harbour. Project was selected to be carried out as an innovation partnership project in FinEst Smart Mobility project (http://www.finestlink.fi/en/finest-smart-mobility/) and with co-funding from Interreg Central Baltic 2014-2020 Programme.

1.1 Project Summary

The concept – HARBOUR's PSO - targeted to solve the challenge to monitor and predict existing traffic situation around and generated by the harbour. The result from the development of the concept is traffic situation and short-term traffic prediction information of the traffic generated by the harbour and its surroundings.

The concept is based on flexible, cost-effective and customer proven traffic data analytics system provided by Infotripla. The concept aimed at developing and piloting of a new harbour traffic information system. Technically, the idea was to build the concept based on following technologies and solutions on traffic information ecosystem layers.

The overall concept is described below. The priority in this project, also the innovation, was in number 6 (PSO traffic situation "black box") including the analysis and model to provide traffic situation, traffic predictions and traffic incident alerts to be used in information delivery.

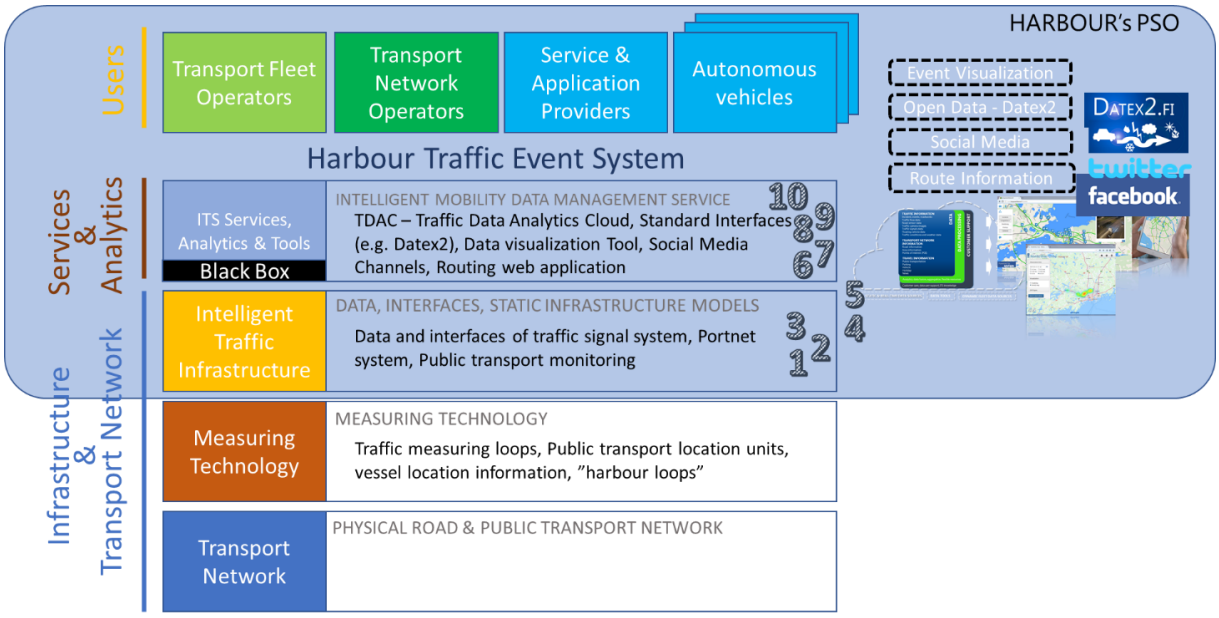


Figure: The pilot service stack

The idea in the concept was to use several data sources of intelligent traffic infrastructure to provide traffic fluency model. These data are aggregated in company's analysis cloud (TDAC – Traffic Data Analysis Cloud). Addition to road related data, the original idea was to use ferry related data provided by so called PortNet system. During the project, another FinEst Smart Mobility pilot project by Fleetrange ltd and their pilot API providing estimate time of arrival (ETA) for ferries was decided to use.

Traffic information provided based on these processes was planned to be delivered via information delivery stack; Event visualization (responsive web), Event delivery interface (standardized Datex2), Incident alerts and routing information via social media channel (Twitter) and Routing suggestions via web application (web based information service or application).

In addition to the technical concept, the traffic management operations were selected and agreed to be the target user group. The concept, however, will also benefit several other user groups. In addition to use these technologies, concept and tools to Helsinki West Harbour, flexibility of the concept enables the concept to be expanded into larger area.

1.2 Background

Ferry connection between Helsinki West Harbour and Tallinn Old City Harbour is one of the busiest in the world. Harbours' location in the heart of the city means lots of challenges in daily traffic conditions in the area. The primary focus of this project was on Helsinki West Harbour.

Challenges are not only limited to ports but also larger areas and functions in these two cities. Situation of the harbour in Helsinki, in the middle of the city in Jätkäsaari island, causes lot of challenges to traffic. There are not many alternative routes available, surrounding area is under construction of new residential area, lots of new residents use same routes and traffic to and from city centre is significant and uses same intersections during peak hours. Additionally, trams are crossing same challenging intersections regularly.

The idea of the concept is based on Infotripla's existing traffic information system background. It uses TDAC – Traffic Data Analytics Cloud, in order to enable fast deployment, to collect, aggregate, analyse and deliver traffic data and information. Addition to TDAC, Infotripla's proven traffic information processes are used to process data available from various sources.

Infotripla's information service environment is proven and secure. The cloud data center complies with the telecommunications security requirements specified by authorities and standards.

2 Development Phase for Prototype

The concept was prototyped with pre-functionalities and concept demonstrations during the development phase. In the development phase tenderers were expected to develop their idea and to create a prototype of the service which proofs that their idea is viable as an actual solution. The prototype of proposed pilot information was made and demonstrated by data analytics and method visualisation. In prototype phase, the elements of the concept were pre-planned for the concept roll-out and technical elements were proven by company's laboratory level tests and expert feasibility analysis.

More detailed concept description was made to ensure and identify available data in more detailed level. Thus, all needed data sources were invented and discussed with relevant parties. Especially data available from vessel organisations and harbours were new and vessel ETA (estimation of arrival) data was identified to be used (from another pilot of Fleetrange Ltd). The availability and/or timing for availability of more familiar data sources like traffic light system, public transport system, public open data etc. were confirmed and planned.

Demonstration of planned real-time traffic information was made by using company's existing traffic data analytics cloud system (TDAC) to provide PSO traffic situation "black box".
Demonstration of planned functionalities and deliveries as a project results (outputs) were given for

a. Traffic situation (traffic situation snapshot)

b. Traffic predictions (near future traffic situation snapshot)

c. Traffic incident alerts (incidents in standardized format, Datex2))

d. Route suggestions (route suggestions for a) trucks, b) other vehicles)

The demonstration concentrated on mock-up level demonstrations in data delivery level. Data delivery of traffic situation, predictions and alerts were provided in mock-up together with preliminary data specification documents.

As a result of the prototype phase, prototype logic for promised outputs was planned.

The challenge faced in the prototype phase was with traffic signal data availability. The lack of the access to the data was identified and communicated with City of Helsinki, responsible for the traffic signals system to be used as a data source. Due to the challenges the City of Helsinki had at the same time with traffic signal system provider (other procurement process with delays), the process to take care of this unprioritized need was pending.

3 Implementation Phase

In the implementation phase, the pilot system was developed from demonstration to real world system including all tools, data and data delivery stack functionalities.

The focus in development was on preparing all planned technical features to be delivered for pilot system. In order to deliver traffic fluency model, as a background for the pilot, technical interfaces and logic was implemented (figure below). Also, connections to external systems were implemented (e.g. Fleetrange's Ferry ETA API).

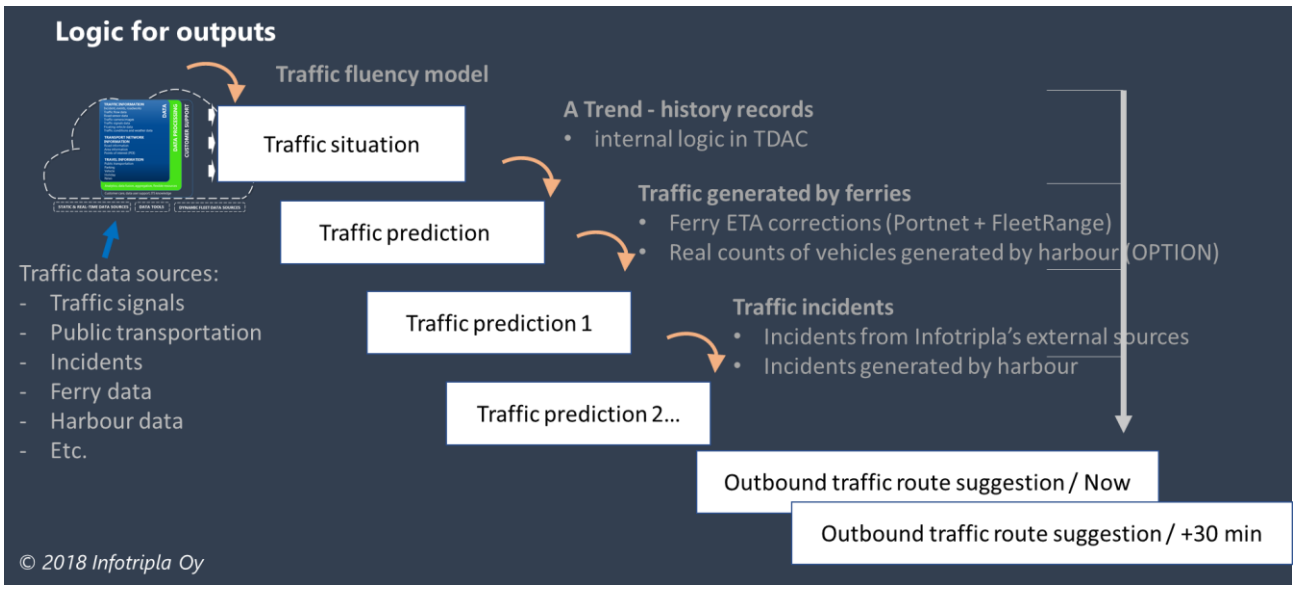


Figure: Traffic fluency model logic for the pilot

The logic uses several data sources, from which data is collected to TDAC system. In TDAC system, Traffic fluency model is built as traffic situation, traffic prediction and routing suggestion information. The process uses also trends, ferries' estimation time or arrivals, external incident information and incident events provided by the harbour incident tool.

The concrete output from implementation phase was

1. Map visualization for traffic situation & other traffic related information
2. Harbour event tool to provide harbour area specific incident information
3. Traffic management alerts via dedicated social media channel
4. Data interfaces for incidents
5. Route suggestion principles & routes for heavy and other traffic leaving the harbour

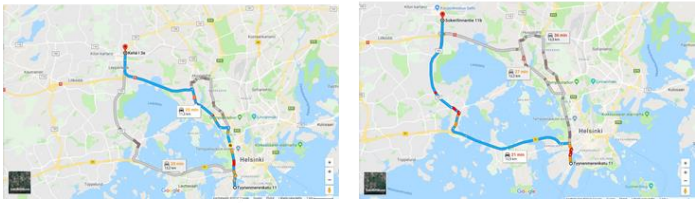
As mentioned earlier, one of the challenges (also in implementation phase) was lack of traffic signal data, which is one of the key elements to build a fully reliable fluency model.

During the implementation phase, co-operation with other project pilots were set. Thus, information provided by the pilot was made available to Kyyti (project pilot: Smart approach to

Helsinki Airport from Estonia) and GoSwift (project pilot: Smart queuing system of trucks approaching the harbour).

Implementation phase also included stakeholder discussions and the start to engage traffic management responsibles to use pilot system features. As development was made in co-operation with relevant stakeholders, pilot system was finetuned and further developed to correspond users' needs. Discussions with traffic management stakeholders were also flavoured with traffic management policy principles, which are - in most cases - influencing final decisions to apply available information in real operations. As an example, even if it would be possible to guide truck drivers to alternative routes in practise, it is not always possible due to wider traffic system policy decisions. Several routes were identified and analysed to find best possible routes to be used for guidance. Also some routes were forbidden to be used due to routing policies.

Trucks



Other vehicles

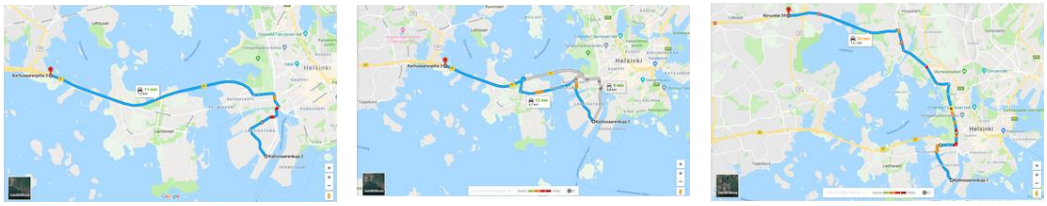


Figure: Target to guide trucks and other cars out from the harbour.

Preparations for piloting included also live laboratory analysis of systems in piloting area to ensure that the systems developed work well. These tests gave also valuable information how these solutions can be used to support various stakeholders, e.g. traffic management.

4 Exploitation Phase

4.1 Exploitation results

As described in the project proposal, exploitation results of the concept and pilot were **traffic situation information and short-term traffic prediction information available on data and web user interfaces.**

Exploitation phase aimed at delivering pilot use of the system. Following the project plan, full stack of delivery channels was made available. As steered by the project, the focus was to deliver decision supporting solutions for traffic management and operations, with less emphasis on the end user functionalities.

The exploitation phase results include following features developed and implemented:

Figure: Pilot set up

West Harbour's Dashboard

All relevant information is collected to West Harbour's Traffic Dashboard – LiikenneNyt (Traffic Now in eng). In the pilot, Dashboard was available for professionals in traffic management. Dashboard is available via web and by any device (laptop, mobile, tablet, screens…). Dashboard includes;

- Traffic Snapshot information
- Traffic events
- Route suggestions
- Relevant traffic camera feeds

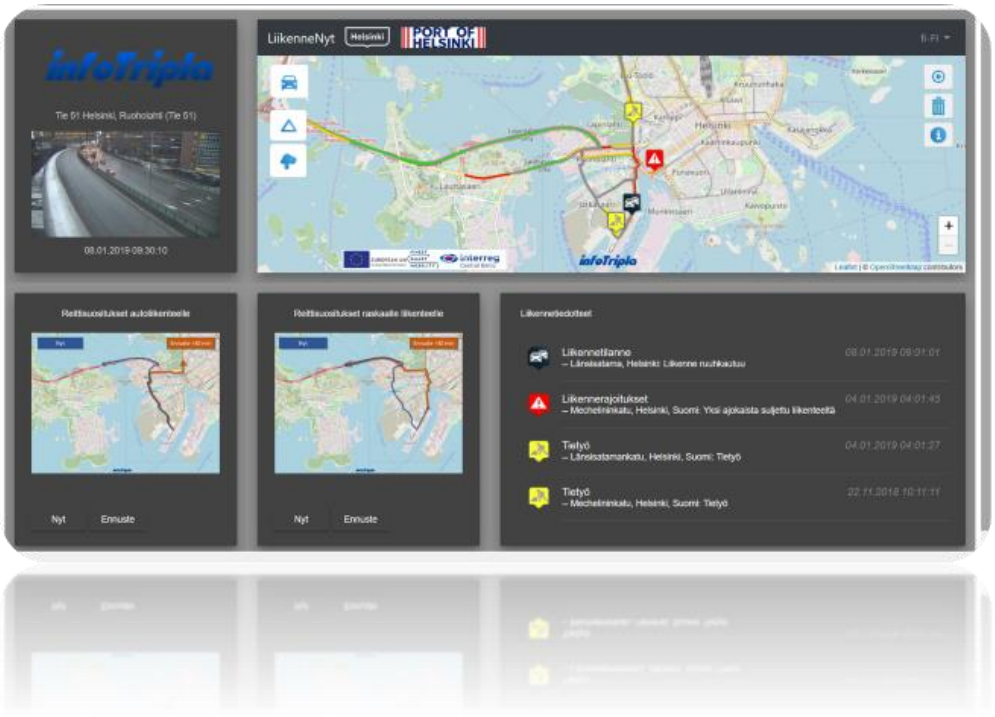


Figure: Helsinki West Harbour Dashboard

Dashboard's address: https://helsinki.dashboard.liikennenyt.fi/ (link availability dependent on the pilot continuation)

Traffic Situation Snapshot

Traffic information portal solution by which all relevant traffic related information is collected to be available for traffic management and later by any user. Overview for the limited pilot area covered: Jätkäsaari – Länsiväylä – Kehä 1 – Turunväylä - Mechelininkatu). Snapshot includes:

- Traffic fluency model information (note: traffic signal data is not yet available from City of Helsinki)
- Traffic events (ferry events, national road network events and harbour's nearby events)
- Route suggestions (real time & predicted) for heavy and other traffic
- Traffic cameras, road weather

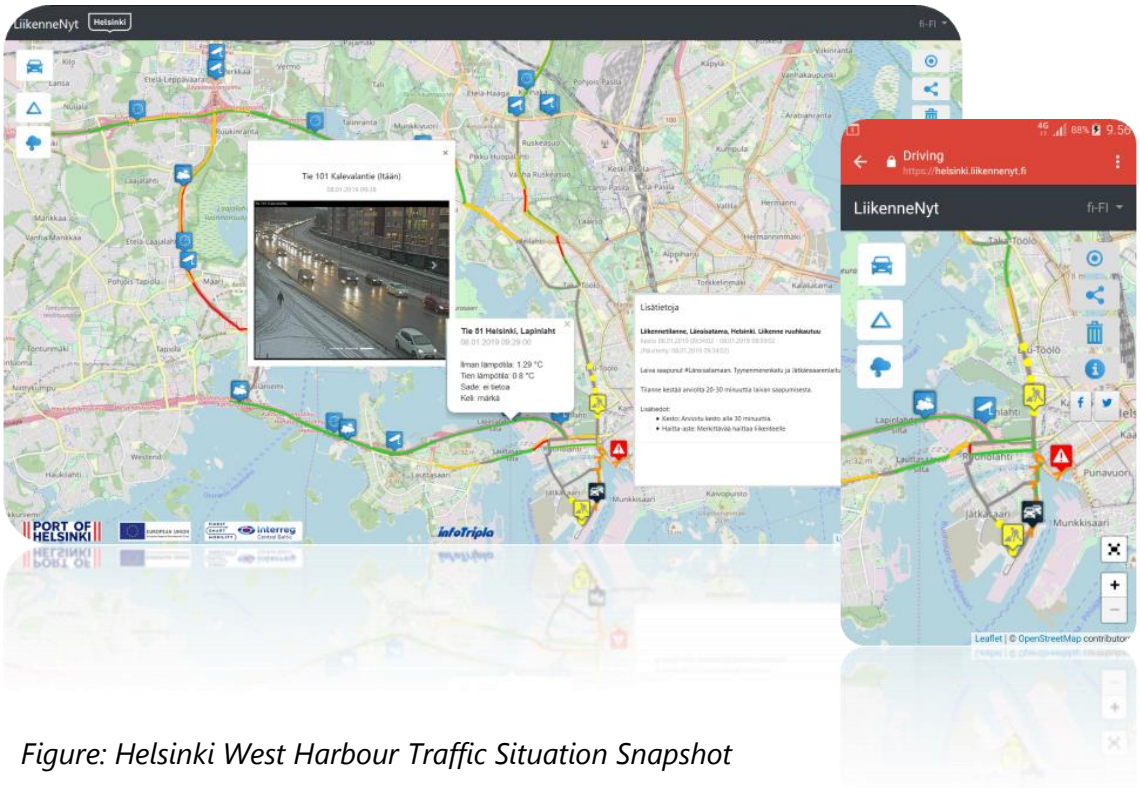


Figure: Helsinki West Harbour Traffic Situation Snapshot

Web address: https://helsinki.liikennenyt.fi/ (link availability dependent on the pilot continuation)

Route Suggestions for Harbour's Outbound Traffic

Real time and estimated route suggestions for traffic generated by harbour. Suggestions are provided for both heavy trucks and other traffic. Suggestions are made based on traffic situation, fluency model and events. Suggestions are used in traffic situation snap shot, dashboard and via interface.

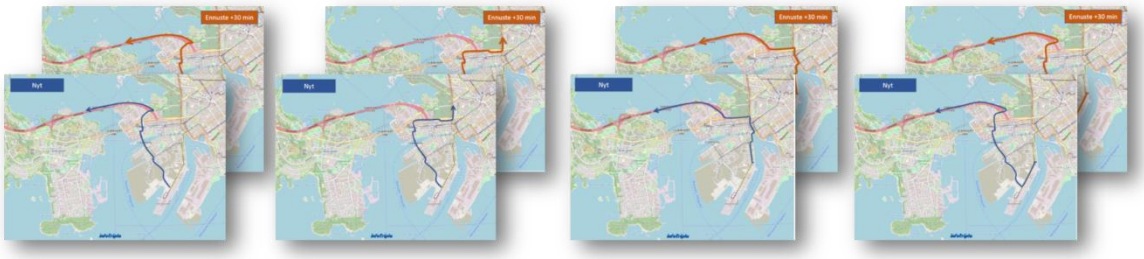


Figure: Helsinki West Harbour Route Suggestions

Route suggestions available in interface documentations: https://helsinki.liikennenyt.fi/opendata/index.html (link availability dependent on the pilot continuation)

Twitter Alerts – Arrival of Ferries and Traffic Pulse

Dedicated Twitter account for traffic management and traffic signal operators. Dedicated feed is not open for public. Twitter messages are generated automatically based on data available about ferries and traffic situations. Twitter messages are sent upon ferry arrival – using available ETA of ferry and confirmed arrival information. Message types are:

1. Estimation Message – including 5 minutes estimation of arrival
2. Arrival Message – including arrival confirmation

Messages and functionalities can be enriched in the future right after more precise data is available e.g. about exact timing of vehicles arriving from harbour to street network.

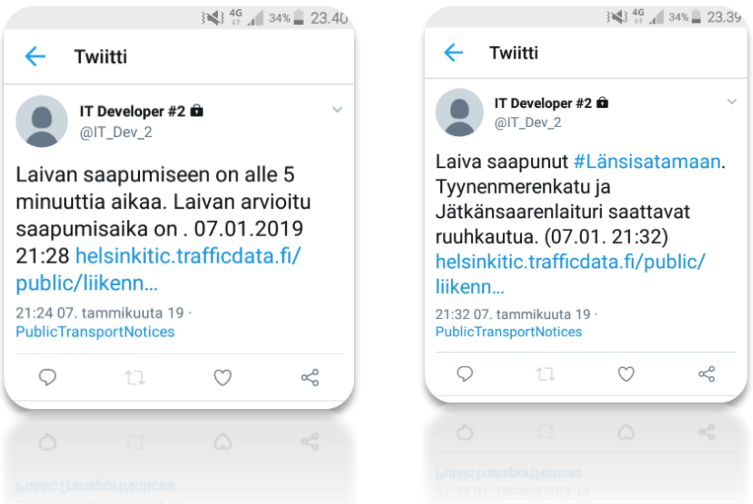


Figure: Helsinki West Harbour Twitter Alerts

Harbour Event Tool

Harbour event tool is developed to provide information about specific traffic specific traffic events in the area surrounding the harbour. These events are also used in fluency model and snap shot information. Additionally, these events are provided to other service providers via Datex2 interface. In this pilot, Infotripla provided these events, but in the future, these events are more likely to be provided by relevant local professionals, such as traffic management operators or city officers.

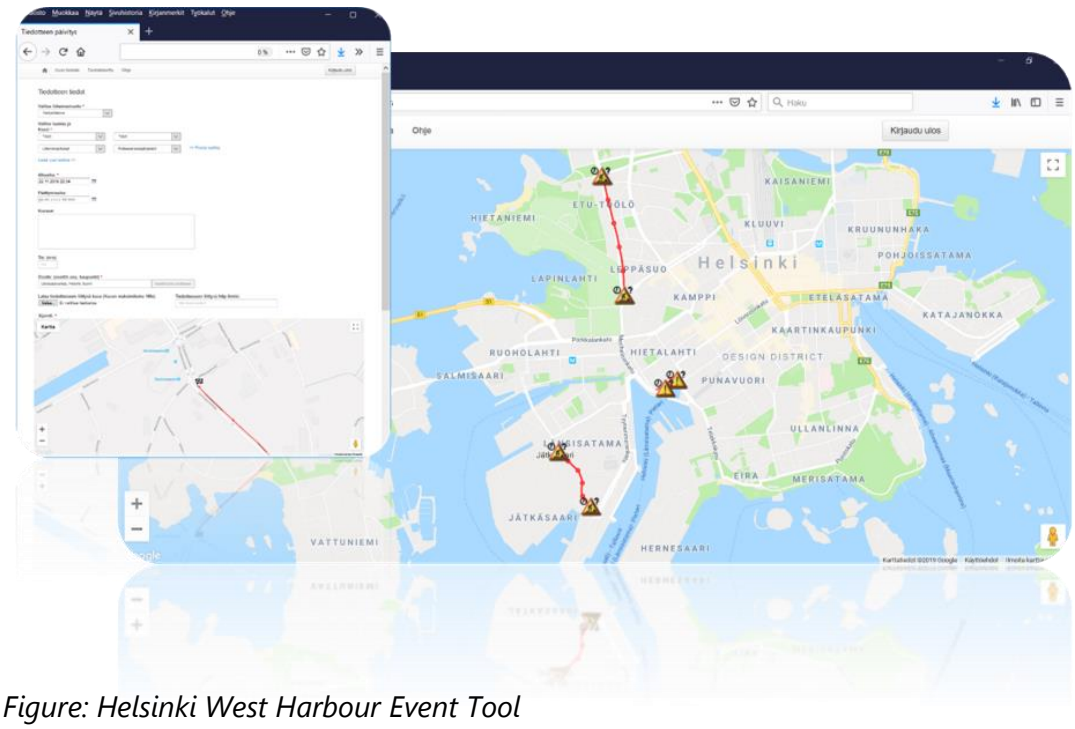


Figure: Helsinki West Harbour Event Tool

Harbour Event Tool address: https://helsinkitic.trafficdata.fi/

(Event tool is used by professionals, link availability dependent on the pilot continuation).

Open Data – for harbour's route suggestions and events

Route suggestions and events provided by the pilot and back end functionalities are published also via Open Data pilot page and technical interfaces. This was made to enable the use of data by 3rd parties in their services. Interfaces provided by the pilot are:

- Event Datex2 –interface
  - Datex2 Light (REST/JSON) and Datex2 Service (SOAP) – events for the pilot area (incl. arriving ferries, harbour's events

- Datex2 Heavy Traffic (SOAP) – heavy traffic events
- Route suggestions
  - Route Suggestion (REST/JSON) – real time and predicted route suggestions for heavy and other traffic

Additionally, Infotripla provides commercial product Datex2 Premium interface including all nationwide and other available cities' events.

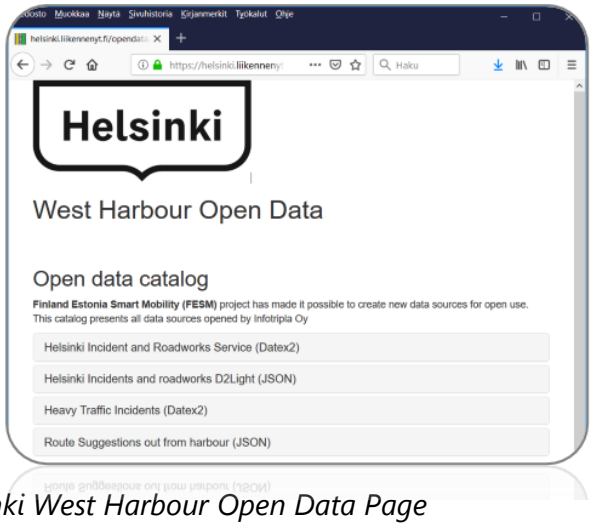


Figure: Helsinki West Harbour Open Data Page

Documentation for project Open Data:
https://helsinki.liikennenyt.fi/opendata/index.html (link availability dependent on the pilot continuation)

These service elements were published in pilot landing page to ease the use and provide access to several services.

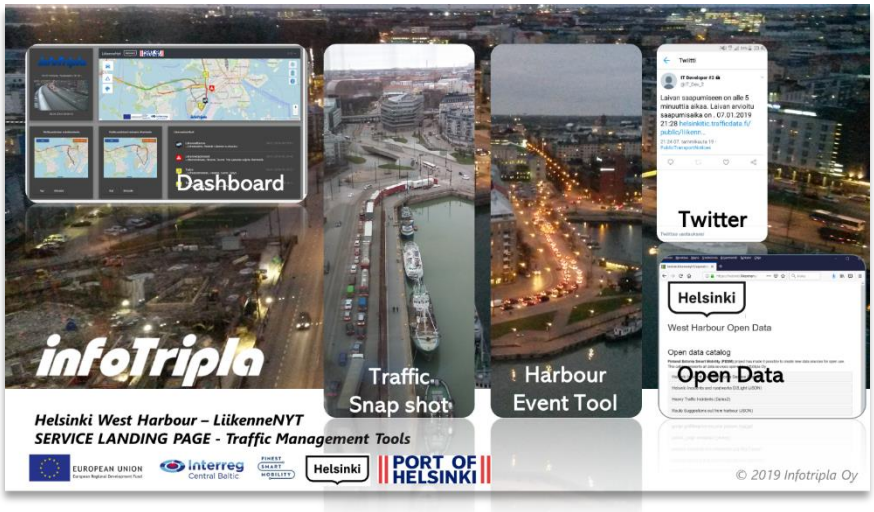


Figure: Pilot service landing page

4.2 Piloting Use Cases

The concept was piloted in two use cases; 1) Traffic management and operations and 2) End users.

Use case 1: Traffic Management and Operations

The main finding from Traffic Management meetings and traffic guidance policy discussions was that not so much can be done with heavy trucks routing (no available re-routing). Thus, crucial issue is timing of operations and optimization of traffic flow in the area. Use case 1 was targeted to support the traffic management operations in West Harbour surroundings and especially to improve the timing of operations (e.g. control of traffic signal programmes) and support operators in their multitasking working environment.

Use case 2: End Users

End user use case was not prioritized but decided to be covered to review future potential for similar service. In addition to not being prioritized as a use case, the challenge with not having traffic signal data available for fluency model (to achieve acceptable quality and reliability level) influenced the decision of not launching the end user service for large scale piloting. Use case was demonstrated and described to drivers to get a feedback for future release. Demonstration interviews and a survey were made to ensure that the developed pilot is something that people need and will utilize. Additionally, this use case was used to identify any finetuning needs of the concept (e.g. information delivery channels used) and future development needs (e.g. in co-operation with ferry operators).

5 Impacts & Lessons Learned

5.1 Impacts

The impacts of pilot were learned during the piloting period. Of course, some challenges described earlier (like lack of source data from traffic signals for fluency model) forced to change the pilot use case a bit. In the beginning of the piloting period, some modifications and finetuning were made based on experiences in real use. Evaluation was then made by measuring effects in outbound traffic fluency and, by demonstration interviews and supported by professional opinions.

Impacts were evaluated against to the use cases described in 4.1.

Use case 1 - Traffic Management and Operations. Use case was tested in real traffic situation where results were compared between the test days prior and after the pilot was in use. Results were measured by counting heavy trucks moving from the harbour through nearby intersections to access roads with free traffic flow. Tests were made first without solution in use and then with pilot in use. The test concentrated particularly on the timing of traffic management operations.

The most important finding of the test was made related to the right timing of operator operations in traffic management on the routes leading away from the harbour. In cases where the extra traffic load from a ferry came to street network and the system was not in use, operations to manage several dozens of trucks leaving harbour were often too late. This caused unnecessary queueing of trucks to first intersections while blocking the harbour exit. With right timing based on alerts of truck load onto the street network, operations were able to handle the situation in a timely manner while maintaining the control of the traffic flows.

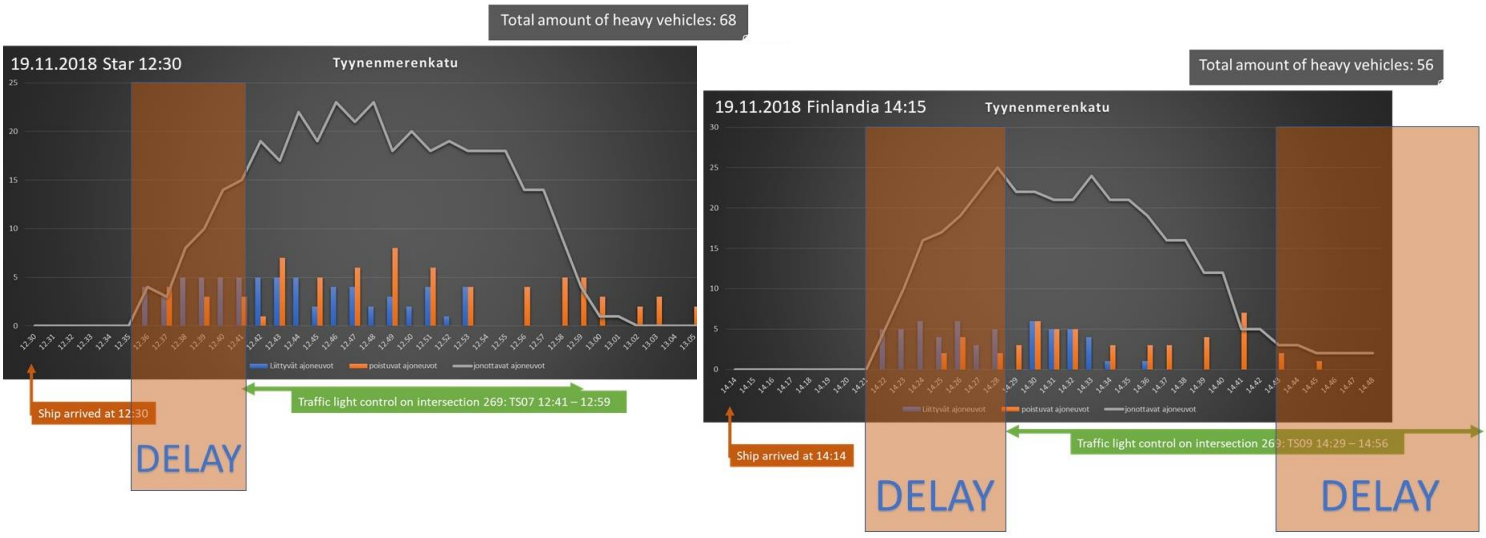


Figure: Example chart illustrating the volume of trucks leaving the harbour and the effects of a timing of the traffic clearance program use

More results are available in the annex "Pilot measurement and demonstration interview results".

To summarise the results,

- The timing of the harbour clearance program was better on reference measurement day.
- The harbour clearance program was running for unnecessarily long periods in some cases.
- Based on the visual observations on the traffic in other directions ensured, that stronger operations for harbour clearance program use in traffic management are possible.
- The amount of heavy vehicles varies between the days of the week.
- The difference was big between the measurement days.
- Tram traffic interferes with the harbour clearance program.
- There is no green wave from Tyynenmerenkatu to Porkkalankatu, which gives an opportunity for future development.
- Ferry arrival prediction data from Fleetrange pilot had some inaccuracies.

Use case 2 - End Users. This use case was not piloted and launched to end users due to the previously mentioned lack of traffic signal data and the decision to focus on analysing the potential of the service. Thus, use case was tested and end users' opinions were surveyed by demonstration interviews with individual Finnish drivers in West Harbour on 4th Feb. In addition to interviews, survey flyers for individual drivers accessing the ferries (TallinkSilja) from Tallinn was distributed on 4th and 5th Feb. This was made to ensure that the pilot concept refers to people's needs and requirements in the future. Additional target was to find out needs for finetuning the concept (e.g. possible information delivery channels to be used) and future development needs (e.g. in co-

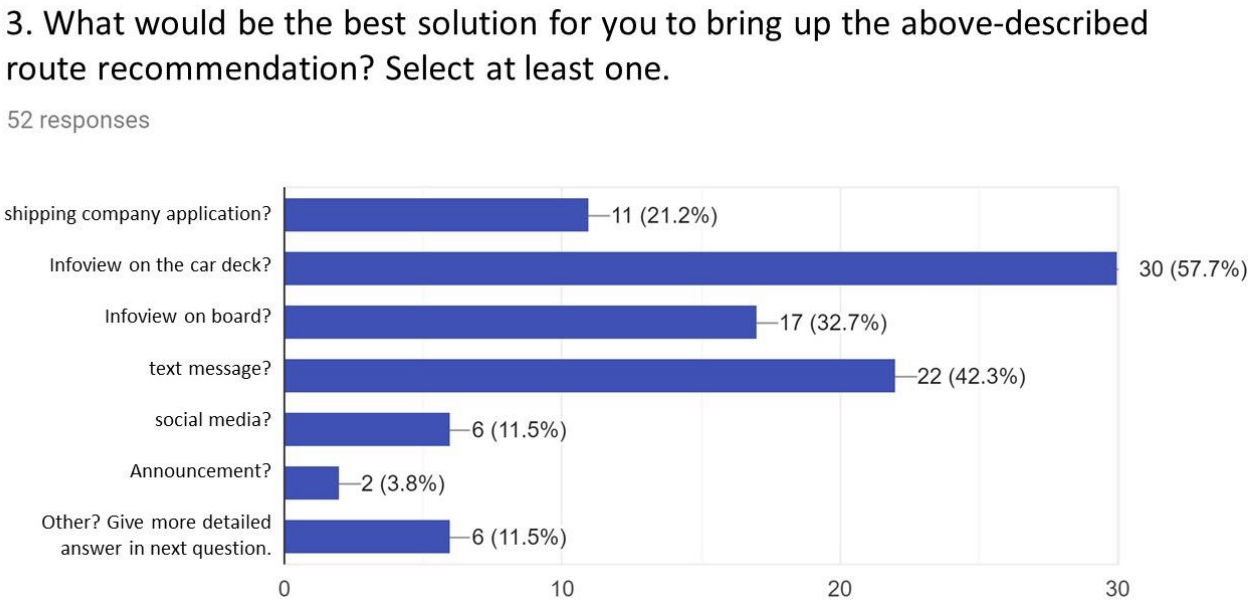


Figure: Demonstration interview results, example of route suggestions delivery to end users

More results available in the annex "Pilot measurement and demonstration interview results".

As a result, 52 answers were received. Based on received answers,

- The concept was approved to answer to real user needs.
- Gave a confirmation that most of the individual drivers are not using the fastest routes. (use same route than heavy trucks which cause queues in intersections of that route).
- The respondents stated to be more than happy if any information would be available to make their route out from the harbour a smoother experience.
- People were willing to receive the information through channels such as information messages, displays on ferry/on the car deck.
- In addition to suggested routes out from the harbour, people were willing to receive other traffic related information (e.g. road works, fluency, incident) on roads they use

As a summary, answers were very promising and ensuring the potential of the solution.

5.2 Impacts vs. award criteria

Project results, outcomes and impacts compared to award criteria template are as follows:

1. Contribution to expected outcomes; By monitoring the real-time situation of vessels and outbound traffic generated by harbour, traffic management processes of cities and national roads (incl. traffic signal system) are supported by predictions and real-time information of traffic. Also, drivers driving out from the harbour are supported by traffic predictions, alerts of incidents nearby etc. to avoid unforeseen traffic jams and to select better routes out from the harbour. Of course, the aforementioned lack of data source prevent the large-scale use of solutions.

2. Value for the end user; Planned information delivery stack is delivered. Value for the end user is measured and approved by interviews. Standardized data interface to 3rd parties enables also value-added services to be exploited by other service providers. Pilot functionalities provide better and valuable end user information for timing and routing. Better and valuable information used to optimize transport network operations improves actions taken by e.g. Traffic management centre. The pilot was also based on the experiences company had already from other traffic information service concepts, in other cities. The future potential of the end user solution was examined by dedicated interviews with selected target group members - to approve the service experience acceptability for potential production phase.

3. Project management and execution; Project was delivered following the concept plan provided. Planned development steps and interim results were followed. Roles were easy to handle because of normal development process and successful co-operation between

company, other stakeholders and the procuring authority. Identified standards were used e.g. in data delivery using Datex2 format.

4. Innovativeness of the solution; The proposed pilot solution consisted of a set of technologies. Planned technologies were mainly used, and flexibility (concerning future scalability and replicability needs) was enabled by selected technical elements (e.g. use of service model to enable cost-effective and modular flexibility). As planned at an early stage of the project, the whole solution was designed and implemented to take care of future needs for ecosystem integration. Thus, developed elements can now be integrated to other eco-systems as well as other external elements can now be integrated to the developed environment.

5. Scalability; Scalability was one of the crucial objectives from the very beginning of the project and it was also crucial for Infotripla to provide scalability in any of the provided solutions. Cross-border elements exist: The link to Tallinn implementation was pre-planned and is still possible to execute but needs still more detailed discussions. The current solution, thanks to its' modularity and flexibility, enables the solution's long-term usage for mobility services. Provided in a modular and scalable way, it is possible to apply the solution to a) other harbours, b) other transport nodes (e.g. bus terminals, airports) and c) other traffic environments from city level to nation-wide implementations.

6 Project Communication

Project communication was mainly based on normal project management processes. In project management level project was managed following Scrum project management framework and steering group meetings. Steering group was represented by main actors of the project.

Project was communicated in project level (project meetings in Finland and in FinEst Smart Mobility project level), in national and international media (ForumVirium, FinEst Smart Mobility, national media channels) and in national eco-system (other projects, stakeholders, networks). Also social media was used to deliver project information.

Unfortunately, publicity was not able to be taken fully in piloting phase because pilot to end users was not able to be made in large-scale (lack of source data and restrictions to pilot). Nevertheless, end users and especially their needs and thoughts were received by interviews. This gives a good opportunity to post-project communication, if large-scale launch is possible.

7 Conclusions

7.1 In general

Project was successful on a general level. Targeted objectives were mostly achieved.

Unfortunately, lack of one key data source (traffic signal data) set limitations for piloting, but it also gave lessons to learn how we can handle the challenges that we are not able to solve by ourselves. This means more co-operation discussions, flexibility in plans and project management. And, challenged by the lack of data, we were forced and managed to proactively change plans to find another data source to be used for traffic fluency model when we took public transportation location data into use.

Project, as a whole, gives a really good opportunity to expand, scale and replicate the developed solutions.

7.2 Scalability

The result can be used in various services by exploiting provided standardized traffic information. Relevant data exchange standards were used to enable scalability and quick launch to market.

European standards (like Commission driven Datex2) are used to provide scalability, usability and cost-effective solutions for the mobility service ecosystem. In general, using standards whenever possible and to launch APIs and well-maintained interfaces to new data enable ecosystem growth. Thus, standards were used already in the pilot.

The solution - even though only pilot – contains already proven technologies which enables the scaling up of the service. Of course, some new elements of the pilot are to be taken to production level through company's productizing procedure. The pilot's modularity and flexibility enable solution's long-term usage for mobility services. Also, modular and scalable solution enables use in a) other harbours, b) other transport nodes (e.g. bus terminals, airports) and c) other traffic environments from city level to nation-wide implementations. Results of the project can also be used in company's other existing traffic information solutions that are already in production.

7.3 From Pilot to Production

The pilot has proved that the implemented elements have a lot of potential in real production in the future. Production launch plans have already been made and discussions are started.

The challenge of traffic signal data source needed for high quality traffic fluency model is crucial for some parts of the pilot solution. Discussions and plans to enable use of that data are already in a road map.

7.4 Potential Overview

The innovation of the concept is to combine harbour traffic related data in order to provide world class solution to be used in harbours concerned in the project, but also enabling the solution to be replicated to similar use cases (here harbour, in the future airports, bus terminals etc.). Company's objective has been to provide market-ready results in the end of the project to gain the most out from the results to ensure maximised use of the service by the project stakeholders and other mobility users.

Using Infotripla's experience of production level deployments of the services – together with an already proven production-ready technical environment – has given an advantage to go ahead to larger production deployment right after the pilot – if decided so.

Next target is production market roll out in other harbours in Finland and abroad.

7.5 Future Plans

The pilot has ended and preparations for the future steps are to be taken. Positive feedback on the pilot and new development ideas are supporting these actions. Ongoing activities to enable future use of the pilot are:

- Negotiations with relevant stakeholders to enable continuation of the pilot and shift to production phase in Helsinki West Harbour. The target is to have pilot-level solutions to be used by traffic management operations. Also, actions to enable the use by end users is most likely to be taken.
- Next negotiation steps with ferry operators are to be taken during the spring to enable traffic related information to their customers. This includes also information in port area, which connects port organisations to the initiative.
- Pilot solution, thanks to its flexibility and scalability, can also be used in other harbours, terminals etc. This opportunity will be examined in detail to find out its business potential through replication.
- Pilot has also future potential in Tallinn and Estonia. The implementation of pilot in Tallinn Old City Harbour was as an option to this project. The Tallinn option is still valid and available. Estonia stakeholders have been involved in steering the Helsinki pilot preparations through the pilot project steering group. Piloted solution, due to its' modularity and flexibility, enables solution's cost-efficient modifications to other harbours, e.g. Tallinn Old City Harbour. Estonian stakeholders have commented that also they see that this solution can work together with city traffic solutions (like intelligent traffic light controls) in order to manage not only the flow from ports but also the regular traffic. This can be solved together with city authorities – planning and rerouting the city traffic in peak hours to ensure smooth outbound traffic from port.

8 Additional Information

Additional information on the pilot and its future potential available from:

CEO Kimmo Ylisiurunen, Infotripla, phone +358 40 738 8902, email first.secondname(a)infotripla.fi.