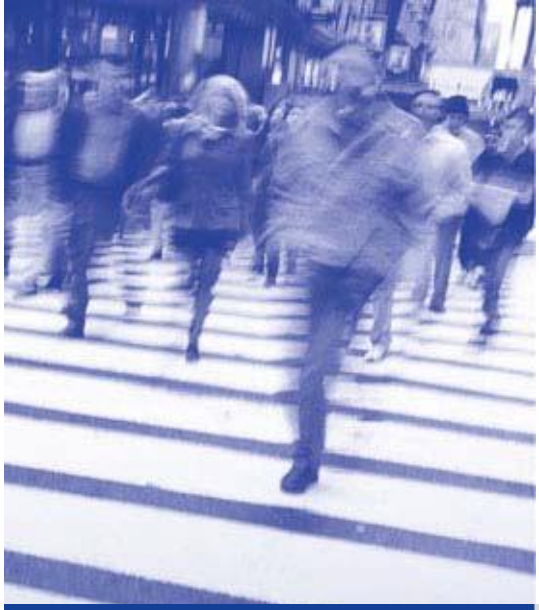

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Measure Evaluation Results

TAL 8.2 Traffic Monitoring

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Executive Summary

The measure 'Traffic Monitoring' aimed at creating a traffic counting network for real time monitoring of vehicle traffic on the main street network of Tallinn. Therefore monitoring cameras were installed at strategic locations of the city to collect data on the traffic flow in real time with which the traffic planners can work in a more efficient way. Thus the measure contributed to create an innovative automated data collection system for traffic planners and to build a traffic data-base with a long term perspective. Solutions for end users were implemented: online real-time supply of traffic related information (internet and smart phone application) and a real time information map have been created.

The measure was implemented in the following stages:

Stage 1: Preliminary study on possible locations of the monitoring cameras (November 2009 – March 2010) A preliminary study was carried out to identify strategic implementing locations for the monitoring cameras. The results of the study enabled the selection of 56 locations.

Stage 2: Preparation and carrying out of the public procurement (March 2011 – November 2011) The public procurement process was elaborated and conducted to select a subcontractor for the installation, operation monitoring and maintenance of the system.

Stage 3: Installation of the monitoring cameras (November 2011 – April 2012) Despite the obstructive winter conditions, the monitoring cameras were installed in the 11 selected locations in Tallinn. The mobile application and the internet site were also implemented during this stage.

Stage 4: Testing of the monitoring cameras (April 2012 – August 2012) Tests for automatic reporting and real time information maps for public users were conducted.

Stage 5: System operational (July 2012 -) System operational with some correction left to do with automatic reports.

Both, **impact and process evaluation** were conducted. The impact evaluation was based on interviewing users about their acceptance of the monitoring system automatic reports and the usage of public services. Traffic planners and consultants were asked about their acceptance on the reporting system and usage of public services was measured by the numbers of visits to the web page and of the mobile application downloads.

The impact evaluation enabled the extraction of **three key results**. The first key-result showed that the traffic experts gave very high appraisal to the counting system, varying from 4,5 - 5,0 on a scale of 1 (min) to 5 (max).The second key-result demonstrated that the use of the public traffic monitoring web page remained stable: the average of visits of the web site was around 2000 visits per month in the period from July-September 2012. The third key-result showed the low usage of public traffic monitoring mobile applications: 152 downloads of the free applications were counted in the period from February-September 2012.

From the process evaluation, barriers and drivers could be identified. **Two main barriers** were encountered. Firstly, the sudden resignation of the MIMOSA local evaluation manager (expert in the topic) during the preparation phase generated difficulties in the elaboration of the measure. Its tasks were taken over by the MIMOSA site manager. Secondly, there was lack of independent (free of commercial interest) expertise on the topic in Tallinn and in Estonia. Therefore it was difficult to plan and implement the measure. To overcome this latter barrier, an organisational activity was conducted: several companies were invited to introduce their equipment and technology in order to plan the measure implementation. **The most important driver** encountered during the measure was the clear understanding of the

measure scope after the analysis of locations and technical requirements for monitoring cameras and the corresponding expected outputs.

From Tallinn´s experience, **several recommendations for a measure replication** could be formulated. First it is recommended to plan the measure embedded in a long-term and comprehensive vision: even if the resources for implementing the monitoring system are not sufficient for creating a full scale network covering the whole city, the full network should be planned before implementing the first parts of the system. Secondly, successful replications are possible but should be implemented with a city context oriented approach: the needs of traffic planners and car users might be very different from one city to another.

Future integration of the system into the Tallinn traffic management centre is envisaged.

A Introduction

A1 Objectives

The measure objectives are:

(A) High level / longer term:

- Reduction of transport related pollution;
- Increase of modal split towards sustainable modes.

(B) Strategic level:

- Efficient traffic management, improve traffic flow planning;
- Reduce congestion and pollution in the city centre.
- Optimise PT network;
- Increase speed of public transport;

(C) Measure level:

(1) Monitor traffic in real time (traffic congestion, detours, average speeds etc), collecting traffic data throughout year;

(2) Create an innovative automated data collection system for traffic planners and solution for end users (mobile phones and internet);

(3) Obtain the data with better cost effectiveness;

(4) Create clear overview about the current situation in real-time for planners and travellers;

A2 Description

The measure was aimed at creating a fully automatic traffic counting network for counting and real time monitoring vehicle traffic on the main street network of Tallinn. The counting cameras monitor automatically traffic flows, speeds and classifications on all lanes and turns of the intersections in real time and also create automatic traffic reports for traffic planners and consultants for later analysis. The aim of the measure was getting counting results without any manual input or intervention.

The detailed monitoring system is important for traffic planners, because besides helping to optimise vehicle traffic (and thus probably supporting car usage) it helps also to monitor and evaluate changes created by sustainable transportation actions and measures.

While the measure was initially intended for traffic experts only, a secondary features were added to the measure by the contractor who installed the systems: the real time traffic flow is also available for the public in a form of an overall Tallinn map (figure 3) and detailed views of the monitored intersections (figure 4) on the Tallinn website on the webpage: http://seire.tallinn.ee/en. The webpage is also easily accessible from smartphones. The usefulness to the public of real time information on intersection capacity is that it makes it possible for car users to alter their route if some intersections are more congested than others.

Besides the web solution, mobile applications were created for smartphones with iOS (iPhone) and Android operation systems. The applications are named “mTraffic” for both operating systems and are available for free. Screenshots from the application are presented on the figure 5. The mobile application was mainly developed for system developers and city

officials to give possibility to check the system status from phone but was also made available for the public. Therefore no marketing was done for the application.

The system is based on video cameras and special software, detecting vehicle movement, classification and speed from the video picture automatically. The counting information (not video) is submitted to a central server in real time and the cameras are constantly active. The automatically created data for traffic planners and consultants can be obtained from the system in a variety of reports and for any time periods, containing classification by vehicle categories.

The system was installed on 10 intersections in Tallinn and 1 straight road section on the western border of Tallinn (see

Table 1 and figure 3). The selection of locations was done from a list of 56 possible locations (figure 1) listed in a preliminary study. The implemented number of intersections was defined by the amount of resources available for installation and running of the cameras, the final number of locations was fixed with a procurement result. The long list of possible locations was created in order to define the possible needs for expanding the monitoring network in future, it was not meant to be implemented at all locations.

Figure 1 Originally listed locations of possible counting points

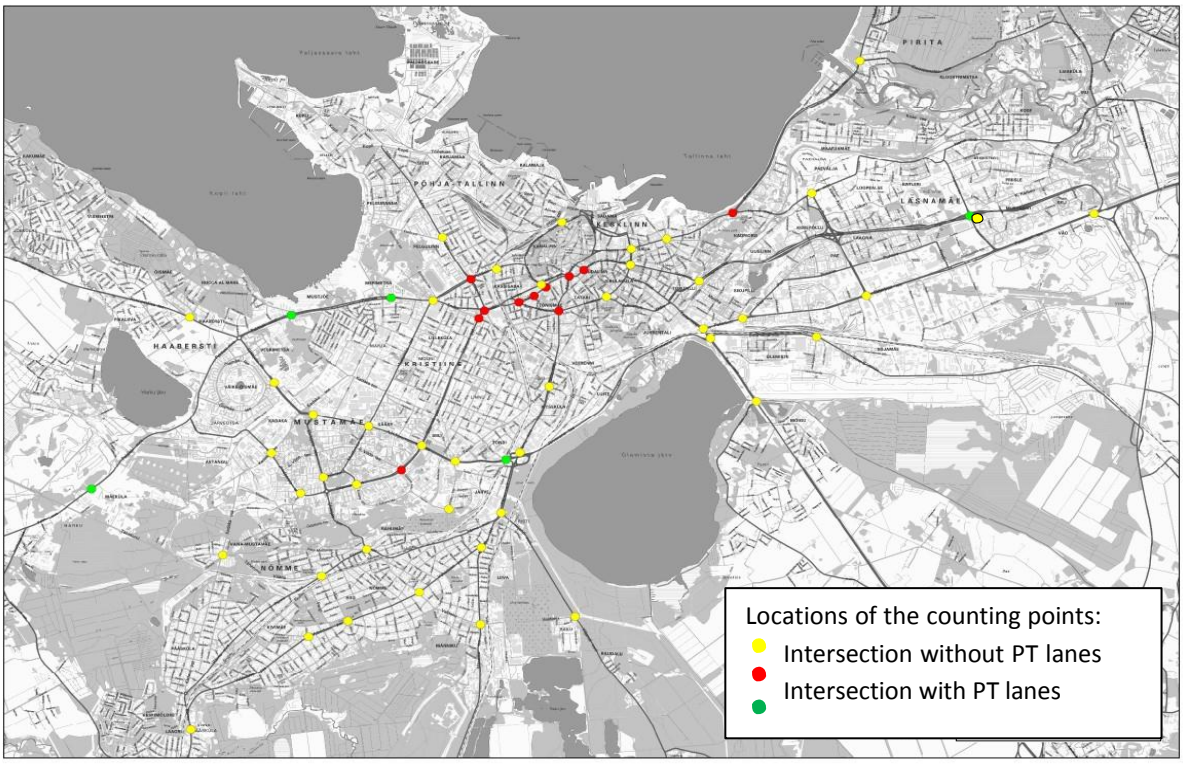


Table 1 List of intersections equipped with the monitoring system

Intersection no.	Name of intersection or cross-section	No of arms	No of directions	No of cameras
1	Endla - Sõpruse pst. - Tulika	5	11	22
2	Paldiski mnt. - Endla - Mustamäe tee	4	10	19
3	Paldiski mnt. - Sõle - Tulika	4	9	18
4	Gonsiori - Laikmaa	4	11	14
5	Endla - Suur-Ameerika	4	5	8
6	Narva - Pronksi - Jõe	4	8	14
7	Paldiski mnt. - Tehnika	4	6	9
8	Sõpruse pst. - Tammsaare tee	4	11	18
9	Tammsaare tee - Ehitajate tee	3	6	10
10	Pärnu mnt. - Järvevana tee	4	14	22
11	Paldiski mnt. city border (Ilmajaam)	2	2	2
	Sum	**42**	**93**	**156**

Figure 2 Monitoring cameras installed on the intersection no. 4

Figure 3 Real time monitoring points on http://seire.tallinn.ee

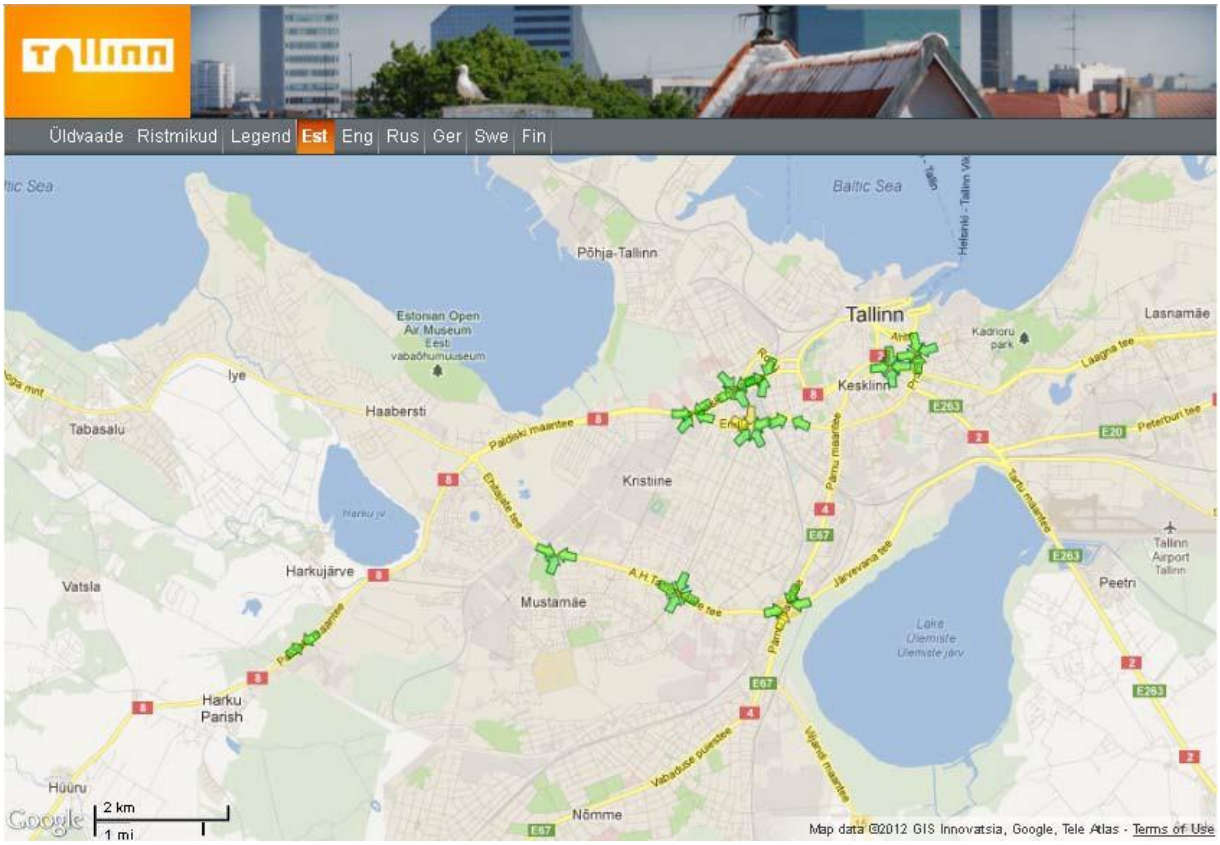
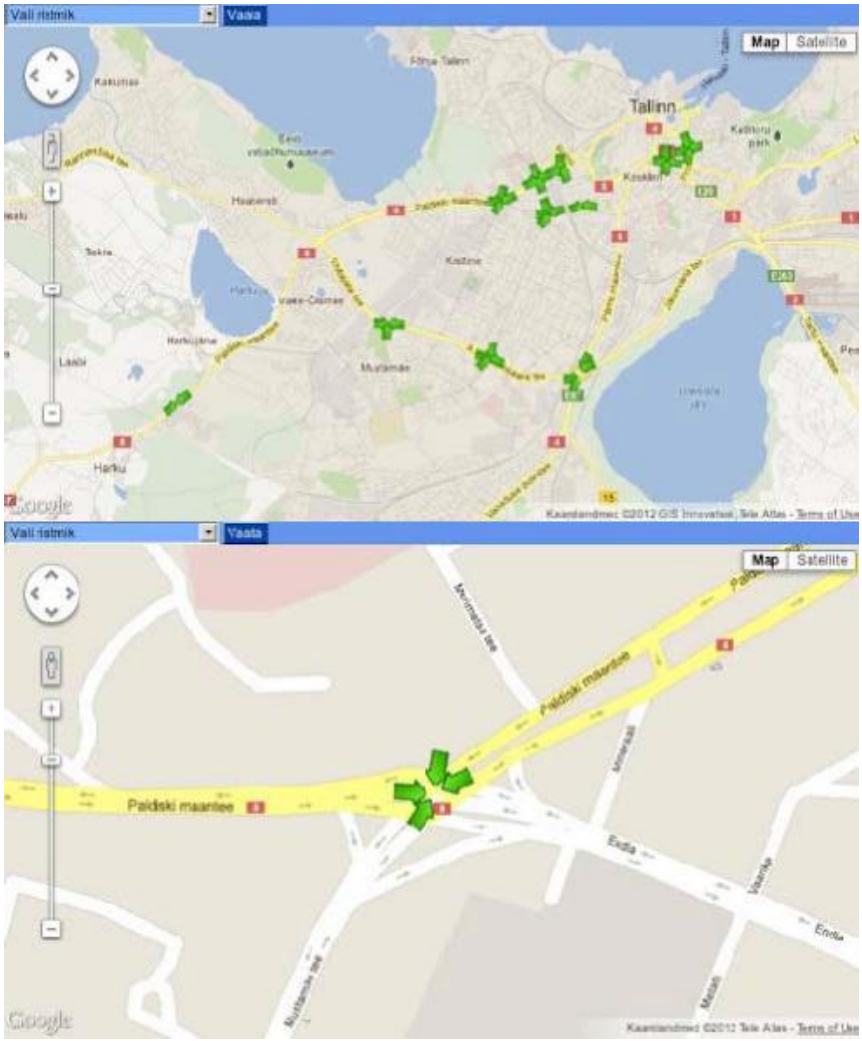


Figure 4 Example of a detailed real time view of a intersection traffic status on http://seire.tallinn.ee

Figure 5 Screenshots from the smartphone application "mTraffic"



The final cost of the monitoring system (11 locations) was following:

No	Equipment and services	Unit	Quantity	Cost of unit	Total cost, €
1	Monitoring devices (traffic counters)	pc	154	1900	292 600
2	Installation of devices	pc	154	100	15 400
3	Operating cost of system	year	1	12 000	12 000
4	Other costs (software etc.)	pc	1	85 000	85 000
	Total cost €				405 000

B Measure Implementation

B1 Innovative Aspects

The innovative aspects of the measure are:

- **Use of new technology -** Central monitoring system with such wide automatic counting and classification possibilities and automatic operative information transfer has not been used in Tallinn and Estonia before.

B2 Research and Technology Development

A study was carried out by Tallinn University of Technology (TUT) from January to March 2010 for finding an optimal solution for the number of cameras and their locations. As a result of the study a list of 56 locations were pointed out as suitable and useful for installing traffic monitoring cameras.

Other possible counting systems had been considered and studied by TUT already before the MIMOSA project and the knowledge was used for making the final selection. The selected system has the best possibilities for categorizing vehicles, is most accurate compared to hand count and has long lifetime between

Both induction loop and piezo electric system have their sensors installed in pavement and have both several disadvantages. First, sensors lifetime tends to be short (up to few years in Estonian climate with frequent freezing and melting during winter time) in pavement and changing pavement sensors means closing vehicle traffic on the particular lane for changing the sensor. Second, there are considerably fewer vehicle classification possibilities with the pavement sensors. On the plus side is possibility for axle and vehicle weight detection with piezo electric sensors but this is not primary function on city streets and was not planned for the measure. Induction loop sensors have been used for adaptive traffic light control in Tallinn since 1980-ies.

There are several other competing video camera based systems available and several of them have been tested in Tallinn. One of the competing systems was installed and tested in the scope of CIVITAS SMILE project in 2008. Closer studies show that the system has several disadvantages compared to the chosen system:

- There was no possibility for vehicle classification;
- There was no possibility for automatic reports;
- There were significant differences (also significantly matching data) from manual count data that is considered to be most accurate;
- The cameras were sensitive to wind and vibration, giving data errors. It was not possible to find out all error sources after years of testing;
- Problems with power supply resulted in data gaps.

Detailed comparison results between different systems are available from the TUT Department of Road Engineering.

B3 Situation before CIVITAS

The need for traffic monitoring was based on the fact that mainly due to increasing number of vehicles and urban sprawl the amount of traffic congestion had increased in Tallinn especially during the past 10 years. Traffic congestion limited also the use of public transport infrastructure; it increased the time used for travelling, fuel consumption and air pollution.

Before implementation of the measure the main sources of traffic information were an annual traffic count and some automatic counting points (without classification of vehicles). The annual traffic count has been carried out for decades in every October during one week and it was based on limited counting hours on street sections (the new system counts turns on intersections, thus including also street sections). It was a manual count requiring therefore considerable amount of skilled manpower and was relatively costly in comparison with the amount of information obtained. Also, it gave no information on monthly and seasonal variations in traffic and the data analysis was also very time-consuming.

There were also many induction loop based pavement sensors for traffic light control that were occasionally used for obtaining traffic data. Problems with using this type of sensors are explained in the chapter B2.

Additionally there were 4 video camera based counting points installed in the scope of the CIVITAS SMILE project from 2008 as described in the chapter B2.

The information outside the annual traffic count was very limited, lacking sufficient number of locations, sufficient number of lanes and turns and suitable classification of vehicles. The combined system of annual count and automatic counting points did not provide sufficient information on anomalies and special occasions which are of interest to traffic analysts.

Besides data collection, the city traffic planners did not have access or possibilities to monitor the detailed traffic situation on important intersections. The information on the state of motorized traffic was also not available to the public.

B4 Actual Implementation of the Measure

The measure was implemented in the following stages:

Stage 1: Preliminary study on possible locations of the monitoring cameras (11.2009 – 03.2010) – A preliminary study on possible implementing locations was carried out by TUT together with measure 8.1 Bus Lane and Red Light Cameras.

Stage 2: Preparation and carrying out of the public procurement (03.2011 – 11.2011) – The public procurement process was initially started together with measure 8.1, later they were separated.

Stage 3: Installation of the monitoring cameras (11.2011 – 04.2012) – The installation was carried out despite winter conditions.

Stage 4: Testing of the monitoring cameras (04.2012 – 07.2012) – Testing period for automatic reporting and real time information map for public users.

Stage 5: System operational (07.2012 -) – System operational with some corrections left to do with automatic reports.

B5 Inter-Relationships with Other Measures

The measure is related to other measures as follows:

- **8.1 Bus Lane and Red Light Cameras –** the preliminary studies on red light cameras and monitoring cameras were carried out together, one red light and bus lane camera (with counting capabilities) is installed on an intersection where there is also a monitoring system, thus enabling the possibility of cross-checking the obtained traffic data from different sources.
- **7.1 Marking routes for smooth freight and city logistics** – The monitoring system is not yet covering the new freight route but information on heavy transport volumes can be obtained with the monitoring system

C Impact Evaluation Findings

C1 Measurement Methodology

C1.1 Impacts and Indicators

No direct measurable impacts could be expected from a measure that was planned to provide information to traffic planners. Secondary effects are most likely expected if the obtained traffic information is used for traffic planning but this is far beyond the time frame of MIMOSA project. The only measurable effect could be savings per amount of information obtained but the new automatic counting system (described in chapter A2) is not comparable to the previous manual traffic counts (described in chapter B3).

Considering the limited possibilities for evaluation it was decided to ask for educated acceptance of the new monitoring system from traffic experts. In addition it was decided to evaluate also usage of the secondary features that were added to the measure later: web service and mobile applications.

Table C1.1: Indicators.

NO.	EVALU-ATION	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
TAL 8.2-1	Society	Acceptance	Acceptance level	Acceptance on the monitoring system	Acceptance on the monitoring system among traffic experts	Index, qualitative, collected, survey
TAL 8.2-2	Transport	Usage of the traffic monitoring webpage and mobile applications	-	Visits to the traffic monitoring webpage	Number of visits made to the traffic monitoring webpage	Index, quantitative, collected, web page statistics

Detailed description of the indicator methodologies:

- **TAL 8.2-1** – The acceptance of the already functional monitoring system was evaluated with a survey among traffic experts in September 2012. The majority of all traffic experts all over Estonia were contacted and from the 14 persons 8 gave feedback to the questionnaire. The experts were selected excluding persons directly connected to Tallinn Transportation Department, Tallinn Technical University or the contractor Signaal AS.

  The experts were interviewed with 5 general questions on the monitoring system:

  1. How necessary do you think it is to start to develop such monitoring system?
  2. How necessary do you think it is to widen the system?
  3. Is the vehicle classification sufficient in the system?
  4. How necessary do you think it is to continue with the same classification when widening the system?

5. How likely shall you use information from the monitoring system in future?

The experts were also asked about 9 different forms that are produced by the monitoring system automatically:

1. Annual report of an intersection
2. Weekly report of an intersection
3. Annual report of an intersection by vehicle classification and weeks
4. Annual report of an intersection by weeks and weekdays
5. Weekly report of an intersection by days and hours
6. One hour counting results of an intersection by manoeuvres
7. One week traffic volumes of an intersection by 15 minutes periods
8. Daily counting report of an intersection by vehicle classification with 15 minutes interval
9. Daily counting report of an intersection by vehicle classification with 1 hour interval

The following criterions were asked on the 9 forms in a matrix form:

1. Clearness of the selection
2. Sufficiency of the selection
3. Necessity of the report
4. Comprehensiveness of the data
5. Potential usage of the form by you

The answers in the matrix were given in a scale of 1 to 5 for every report and parameter. The answers to the questions on the particular reports were used for future development of the system but are not presented in this report.

- **TAL 8.2-1** – The awareness of the traffic monitoring web page was evaluated with statistics from the system provider (based on Webalizer web statistics service) and statistics of mobile applications downloads obtained in October 2012.

Table C1.2: List of potential effects that were not assessed

Impacts category	Indicator	How does it impact	Why it was not accessed
Economy	Costs	The new system makes a difference to how much it costs to have detailed traffic information.	The situation before and after is not directly comparable. Before implementation of the measure there was only a few hours of daytime information from large network of street cross-sections, after there is detailed 24/7/365 information from 11 intersections by all turns. Of course, the cost of obtaining such detailed and large amount of data is considerably higher so the comparison by costs does not give any useful information.
Transport	Transport safety	If the system affects traffic flows and congestions, it has impact also on traffic safety	It is difficult to prove to what extent the monitoring system impacts on traffic flows. The relation between traffic flows and traffic safety is far more complicated than a simple 1:1 linear dependence, thus it is pointless to draw relationships between the monitoring system and traffic safety. Also, the effects can be only secondary and are therefore outside of the MIMOSA project time frame.
Transport	Traffic Flow Levels, Vkm by vehicle type – peak and off-peak	The system can affect traffic flows through informing car drivers on traffic situation.	It is difficult to prove to what extent the monitoring system has impact on traffic flows. The system covers only 11 intersections and it is not always possible for users to find another route. Also, the system was available to the public only since 5.2012 and 5 months is not statistically sufficient time to register any changes in traffic flows if there is no similarly detailed information available from previous years.
Society	Awareness and acceptance of general public on the traffic monitoring web page.	Awareness of general public on the traffic monitoring web page.	The general public-oriented web page and mobile application were not planned to the scope of the measure and were included in a later phase. Thus there was no possibility to evaluate the before-situation. Combined with quite modest numbers of users of the system it would have not given any statistically useful data from large scale random sample. Instead, the usage of the web page was used for showing awareness of the measure.

C1.2 Establishing a Baseline

No baseline was created for any of the evaluation indicators since no change in acceptance or system usage could be measured. The acceptance could not be measured before, because until the procurement results the extent and details of the system were not known and before implementation there could not be any use of non-existent web service.

C1.3 Building the Business-As-Usual Scenario

No BAU scenario was created for any of the evaluation indicators for the same reasons as explained under the chapter “C1.2 Establishing a Baseline”.

C2 Measure Results

C2.1 Economy

Not applicable

C2.2 Energy

Not applicable

C2.3 Environment

Not applicable

C2.4 Transport

The potential impact of the measure on transport was measured with web page visits and mobile application downloads (figure 6 and figure 7).

Figure 6 Web page visit statistics for http://seire.tallinn.ee

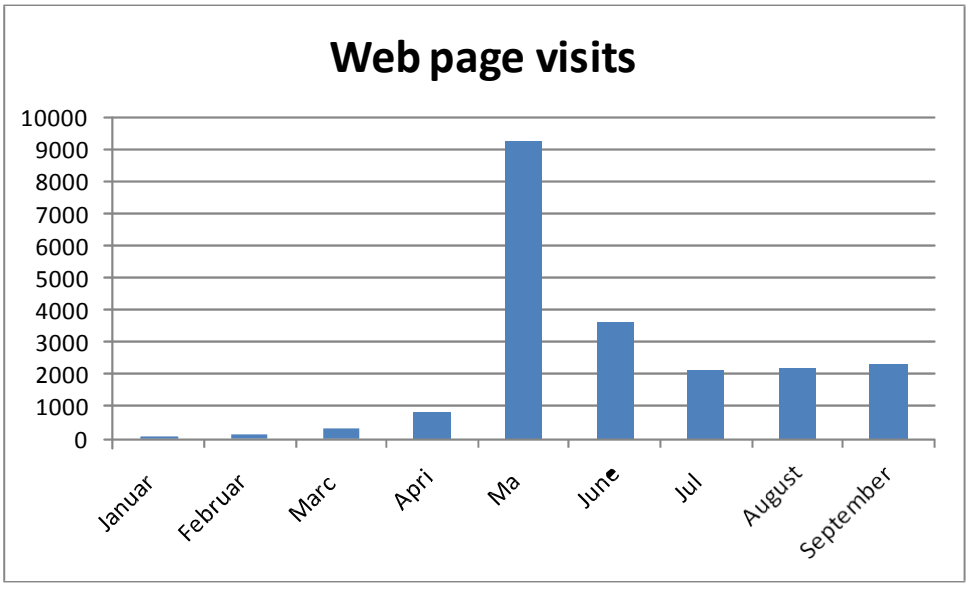
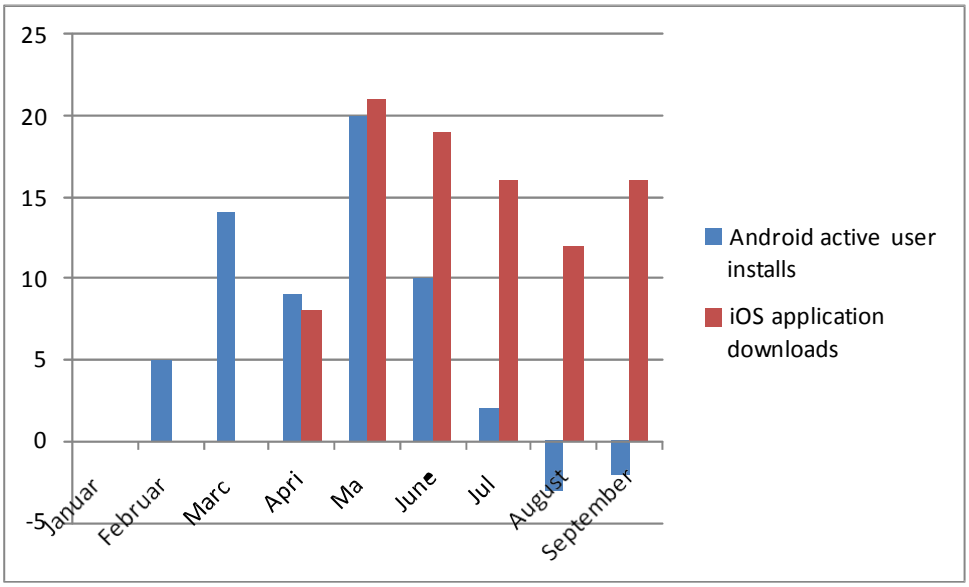


Figure 7 Mobile application installations (Android OS) and application downloads (iOS)



The results show that there was a leap in usage of the web page in May although there were visits already as early as February (figure 6). The reason is that all visits were counted, including the ones by developers of the page and persons involved in the MIMOSA project. The sudden leap in visit statistics was caused by articles in the local municipal monthly newspaper and national newspaper on last days of April and beginning of May.

While the number of visits to the web page was quite considerable and stabilized since June 2012, the number of installations and downloads was very modest (figure 7). The reason was that there had not been any marketing for the applications (and there was no need for it) and that the information on the web page was as easily accessible (although takes more time) from mobile phone browsers as it was through the applications.

The quite low usage statistics was also the reason for not including the questions on awareness and acceptance in the general MIMOSA survey in September 2012. The share of web page or mobile application users among respondents would have been too small for making any statistically valid conclusions.

C2.5 Society

The acceptance of the newly developed monitoring system (not the web page or mobile applications) was measured among traffic experts. This was the only way to bring out the potential impact of the measure since the real impacts are outside of scope and timeframe of the MIMOSA project. The results from the survey are presented in the **Table 2**.

Table 2 Acceptance of traffic experts on the monitoring system

No	Question	Rating
1	How necessary do you think it is to start to develop such monitoring system?	5,0
2	How necessary do you think it is to widen the system?	5,0
3	Is the vehicle classification sufficient in the system?	4,5
4	How necessary do you think it is to continue with the same classification when widening the system?	4,8
5	How likely shall you use information from the monitoring system in future?	4,5

The survey resulted in very high acceptance from traffic experts on the monitoring system, varying from 4,5-5,0 in a scale of 1-5.

The result means that most of Estonian traffic experts have high appraisal to the system implemented in the scope of the measure and they have high expectations to the data that becomes available with it. The result does not mean that from implementation of the cameras something in traffic system is going to change automatically before something is done using the obtained data.

C3 Achievement of Quantifiable Targets and Objectives

There were no quantifiable targets and objectives set in the measure. Although it was considered to evaluate the difference in costs and data quality of the previous traffic information monitoring the arrangements were diametrically different and could not be compared directly.

C4 Up-Scaling of Results

The system was already developed having in mind its future extension and development. As described in paragraph A2 of this report, 56 intersections were identified by a preliminary study to be a possible part of the traffic monitoring system. Thus it was most logical to cover the most important interchanges of Tallinn with traffic counting and monitoring possibilities.

If the system proves to be valuable and efficient in future, it might be worth considering to implement it in other cities of Estonia also to be able to monitor changes towards sustainable transportation.

The public part of the system could be widened from the current web page and mobile application to GPS car navigation systems so that users would be guided optimally according to real time flows in traffic. There is a range of vehicle navigation systems that use traffic monitoring data in other cities and this capability could be widened to Tallinn as well.

C5 Appraisal of Evaluation Approach

The original evaluation approach in the form of evaluating costs of the measure, changes in traffic flows and accident statistics was not suitable for evaluating the measure. The measure cannot have any impact on traffic flows or accidents unless something is changed in the transportation system based on the information received from the system. Also, the cost of

the system is not really comparable to the scope and function of the previous practice of short term manual counts and some not very suitable sensors. Thus more suitable approach was taken by interviewing the only possible persons to give appraisal to the system - traffic experts.

For the new but relatively unimportant public part of the system – web page and mobile applications - it was decided to measure usage by number of visits to the web page and downloads and installations for the mobile applications. This showed that the new additions have only modest use.

C6 Summary of Evaluation Results

The key results are as follows:

- **High appraisal to the counting system from traffic experts** – The traffic experts gave very high appraisal to the system, varying from 4,5-5,0 in a scale of 1-5;
- **Modest use of the public traffic monitoring web page –** The use of the page has stabilized to around 2000 page visits per month for last three months (July-September 2012).
- **Low usage of public traffic monitoring mobile applications** – The total number of downloads of the free applications has been 152 times for the period of February-September 2012.

C7 Future Activities Relating to the Measure

The counting system for experts is still being tested (January 2013) with some problems related to automatic reporting still needing to be solved. There is a general conclusion from the Transportation Department that when additional resources will be available for widening the monitoring system, it will be considered seriously.

D Process Evaluation Findings

D1 Deviations from the Original Plan

The deviations from the original plan comprised:

- **Adding web page and mobile application for public users** – The solutions were decided to be added in negotiations with the provider of the traffic monitoring system;
- **The original evaluation concept dropped** – The whole evaluation concept was changed, because the original one was not in accordance with the actual measure. No impact could be evaluated from the traffic monitoring only and the impact from public solutions is too limited to be detected.

D2 Barriers and Drivers

D2.1 Barriers

Overall barriers

- **Problem related barrier** – There was lack of independent expertise (free of commercial interest) on the topic in Tallinn and in Estonia. Therefore it was difficult to plan and implement the measure;

Preparation phase

- **Organizational barrier** – The initial measure leader (expert in the topic) left the Transportation Department suddenly in 2009 and was substituted with Tallinn site manager who besides this position was already measure leader for 2 other measures and was not expert in this particular topic. This made the implementation of the measure difficult.
- **Financial barrier** – Tallinn city government decided to postpone procurement of the measure from 2010 to 2011 due to financial problems. This delayed implementation of the measure, because 2010 was the appropriate time for procurement.
- **Planning barrier** - Preparations of procurements for measures 8.1 and 8.2 were handled together from the beginning because of their similarity and several interested parties involved. This started to impede and slow down the process.
- **Planning barrier -** Wide interest from companies (12 originally) required additional time and energy for explaining and negotiating all details of procurement. Finally only one submitted

D2.2 Drivers

Overall Drivers

- **Technological driver** – New potentials offered by technology. The technology has made traffic monitoring possible in a way that was not possible before.

Implementation phase

- **Planning driver** – Clear understanding of the measure after analysis of locations and technical demands for monitoring cameras and their outputs. This has enabled concentration on the procurement process instead of putting resources to finding locations and solutions.

D2.3 Activities

Preparation phase

- **Organizational activity** – Several companies were invited to introduce their equipment and technology in order to plan the measure implementation. This was activity caused by the lack of independent expertise in Tallinn and Estonia.
- **Planning activity** – Measure commission was actively involved in determining the requirements of measure implementation.
- **Problem related activity** - Discussions/meetings with other representatives of local measure leaders were held to discuss possible overlapping/discrepancies between similar technical measures. This action caused delays in preparing the measures 8.1 and 8.2 together.
- **Institutional activity -** Procurement of the measure 8.2 was separated from the measure 8.1 after treating the measures together was found to be impeding the process.

D3 Participation

D3.1 Measure Partners

- **City of Tallinn –** Leading role in the measure, organized by Transportation Department
- **Tallinn University of Technology** – Principal partner – responsible for preliminary studies and evaluation
- **AS Signaal** – Principal partner – responsible for installation and running of the whole system, from hardware to software

D3.2 Stakeholders

- **Traffic planners and consultants –** The measure is aimed directly to professionals who are capable of using the data in their work
- **Car drivers** – The later addition to the measure is also aimed at car drivers so that they are informed about traffic situation in Tallinn.

D4 Recommendations

D4.1 Recommendations: Measure Replication

- **The measure is replicable but with reservations –** The possibility of successfully replicating the measure to a large extent depends on the city where it is planned. Technically there are no obstacles for using the system elsewhere but the needs of traffic planners and car users might be very different.
- **Is it the best way for supporting sustainable transport**? – While the objectives of the measure are clearly stated to be supporting sustainable transport, is counting motorized traffic the best way of doing it? Yes, if information on all other transportation modes is already available. This would be good to take into account when considering replicating the measure.

D4.2 Recommendations: Process (Related to Barrier-, Driver- and Action Fields)

- **Planning the whole network –** Even if the resources for implementing the monitoring system are not sufficient for creating a full scale network covering the whole city, the full network should be planned before implementing the first parts of the system. This gives an overview of the final result, its scale and cost and makes it possible also to arrange procurement with fixed costs and an open number of intersections to be implemented.

RTD Fact Sheet Template

Traffic Monitoring	
Reference Measure	TAL 8.2 Traffic Monitoring
Date of Submission	05/2012
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Author(s)	Marek Rannala
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Context and Purpose

Need for the measure is based on the fact that due to increasing number of vehicles and urban sprawl the number of traffic congestions has increased in Tallinn. Traffic congestions limit usage of public transport infrastructure; it increases time used for travelling, fuel consumption and air pollution. For improving the situation and planning solutions information is needed on traffic, volumes and speeds, their daily, weekly and seasonal variations, behaviour in extreme cases etc. Also, road users could benefit from real time traffic information by planning their routes according to volumes and speeds of different locations.

At the moment there is relatively little information available on traffic, it is mostly based on annual traffic counts. There is only limited number of automatic counting locations, the systems are not compatible and therefore the information is not comparable from location to location. There is no central real-time monitoring and data gathering system, only cameras with video picture are available on Tallinn website for public.

As the requirements for the monitoring road network are very specific, a study was performed to find suitable locations for monitoring points and develop technical requirements for procurement process

Description of RTD Activity

The first stage of the study concentrated on finding locations for the monitoring cameras so that the network would enable continuity of decades of annual traffic count. The locations had to be in important traffic flows and coincide with previous counting points.

The second part was to decide on the counted directions and lanes on every location. It is important on junctions, because there are 6 possible directions to 3-sided junction and 12 possible directions to 4-sided junction.

The third part concentrated on the output from the system: output raw and summarized format, automatic reporting and sanctions in case of interruption in data.

The output and technical principles were discussed in series meetings with additional experts and possible tenderers.

Outputs and Results

As a result from the study 61 possible locations were recommended for installation of cameras with different functions. It was considered, that the real number will most probably be smaller because of fixed amount of resources for procurement but it is important that the future procurements on additional equipment would follow the maximum network principles. Recommendations for

technical requirements for procurement were made as the second most important output.

Resulting Decision-making

The procurement for monitoring system was based on recommendations given in the study. Also it was decided to follow the principles given in the study in future development of monitoring system.

Lessons Learnt

The bidders had to propose the number and functionality of monitoring cameras for fixed sum. As a result of the procurement there was only one bidder and the proposal was for 5 cameras. This was far less than expected and the result has been discussed afterwards. The reason turned out to be quite strict rules (and sanctions) for timeouts in the system and the big number of monitored directions on every junction.

Cost-effectiveness

The principles and technical requirements for the monitoring system given in the study are approved and still valid for present and future. For that the amount of analyzes made was justified. The procurement result however has to be also analyzed for future so that result of future procurements would be more in line with expectations.

Dissemination and Exploitation

The results from the system will be partly available for public and partly for specialists only. The results from impact evaluation will be available for all interested parties.