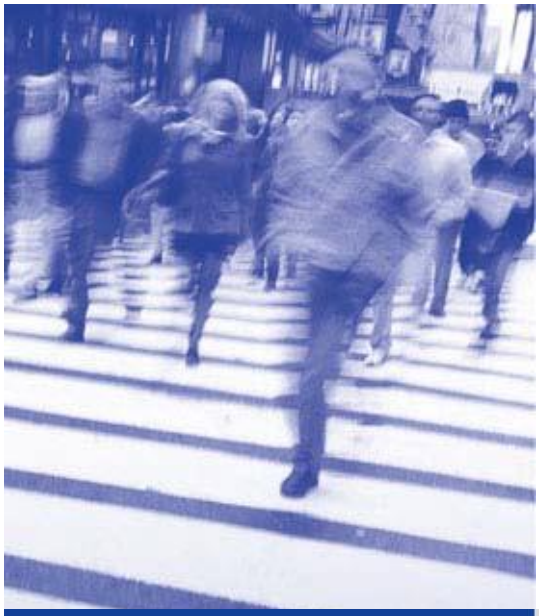

CiViTAS
Cleaner and better transport in cities

MIMOSA
BOLOGNA • FUNCHAL • GDAŃSK • TALLINN • UTRECHT

Measure Evaluation Results Template

Focused Measure TAL 8.1 Bus Lane and Red Light Cameras

Authors:

Marek Rannala, LEM TAL, Tallinn University of Technology

Tiit Metsvahi, Tallinn University of Technology

Version:

MRT – F level

Date: January 2013

Revised version April 2013

THE CIVITAS INITIATIVE
IS CO-FINANCED BY THE
EUROPEAN UNION

Executive Summary

The measure 'Bus Lane and Red Light Cameras' consisted of the installation of surveillance cameras at strategic intersections with traffic lights and along bus lanes in order to enforce the traffic regulations such as compliance with traffic signals, speed limitations and priority bus lanes. The main objectives of the measure were to improve the quality of public transportation systems and increase road safety at the intersections.

The measure was implemented in the following stages:

Stage 1: Preparation phase (2009 - 2011) During the earliest preparation phases, strategic locations to install the cameras were defined: six intersections and 17 bus lanes were selected. The technical and legal issues for the implementation of the system were investigated and the procurement process was elaborated and conducted to select a subcontractor for the installation and maintenance of the cameras.

Stage 2: Installation and testing (2012) The surveillance cameras were installed by the subcontractors (for each intersection two cameras were installed in both directions) and the first tests to detect road traffic infringements were conducted. The tests showed technically high accuracy and infringement detection reliability of the system.

Stage 3: Dissemination campaign (2012) A city-wide campaign was organised to inform citizens on the surveillance camera system through press releases, interviews for newspapers, radio stations and TV channels. After the dissemination, change in awareness and acceptance of the general public were evaluated with the general MIMOSA survey.

Stage 4: Impact Evaluation of the fully functional system - When the system will be officially fully operational in 2013, the impact of the measure will be assessed and analysed.

Since road safety is one of the main issues of the city policy on public transport quality improvement, the measure was selected as **focused measure**. Both, impact and process evaluations were conducted for this measure. The evaluation was based on traffic monitoring indicators, measuring the change in traffic signal, bus lane priority and speed limitation infringements as well as on surveys, measuring public awareness and acceptance of the implemented system.

Although the system could not be fully operative during the MIMOSA period, some intermediate results came out from the impact evaluation. The **key results** revealed that the traffic signals infringements decreased significantly: the number of registered drivers going through the red light dropped to 11,9 times less between October 2011 (0,90% of registered infringements) and April 2012 (0,08% of registered infringements). Infringements on bus lanes declined considerably: the number of bus lane infringements dropped to 4,0 times less between October 2011 (8,20%) and April 2012 (2,06%). Even if no before measurements were available, it can be stated that the number of infringements regarding speed limitation at intersections is low: only 0,25% of drivers passing the two cross-sections were exceeding the speed limit in April 2012. The infringement levels were all increased during one year after installation of the cameras but remained still well below the initial levels. The positive impact of the campaign was measured by the level of awareness on the installation of surveillance cameras which increased from 50% to 62% between November 2009 and September 2012.

Nevertheless, a decrease of the level of acceptance has been observed from 82% to 77% between November 2009 and September 2012.

The most important barrier encountered during the measure was the high restrictive legal regulations which prevented the enforcement of the system as initially planned. This made the preparation of the system and the procurement very complicated and time-consuming.

The most important driver encountered during the measure was the common understanding and agreement between all involved partners on the relevance and the need to implement the measure. This contributed to focus the on-going discussions on the technical and legal details and expected results of the measure rather than on the usefulness of the measure itself. A special effort was made in the organisation of several meetings to include all partners involved in the implementation of the measure.

The MIMOSA team **learnt from this experience** that it is crucial to keep the same team constellation with defined responsibilities during the entire process: do not change horses during a complicated race. The team should have appropriate competences and knowledge in technical issues and in national legislation issues to ensure the feasibility of the measure. It has proven that simple and soft activities should be favoured in the frame of a limited time project such as MIMOSA.

Some recommendations for measure replication can be made. The measure is appropriated for cities which intend to capture the three implemented types of traffic infringements by the same enforcement camera. The main advantage of the system is its high reliability: The fines for traffic infringements are issued automatically but in the case of an appeal by drivers there is always strong evidence available for each infringement in the form of pictures. Concerning the planning process, the initiators of such measure should be aware that a large amount of partners are involved and that the system requires legal change. These two aspects increase the complexity of the planning and decision-making process. It is therefore recommended to give special attention to the compliance of the measure agenda. In the context of Tallinn it would have been better to start the measure in the earliest phases of MIMOSA project (the measure was launched at the end of 2009). Moreover the implementation of an enforcement system such as this requires specific knowledge about the legislative and technical requirements.

A Introduction

A1 Objectives

The measure objectives were:

(A) High level / longer term:

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

(B) Strategic level:

- Promotion of PT usage;
- Reduction in the use of private cars in target areas;
- Reduction in pollution and congestion in target areas;
- Changed travel behaviour and traffic culture.

(C) Measure level:

(1) Define the location for enforcement cameras and installing the necessary equipment;

(2) Promote an attractive and high quality public transport service;

(3) Reduce the number of violations by drivers;

(4) Raise the acceptance of citizens with PT service and improve the overall image of public transport in urban areas.

(D) The expected results were:

(1) Average connection speed of public transport increased by 5 %;

(2) Reduction in the number of violations on intersections by 75 %;

(3) Reduction in the misuse of PT lanes by 70%;

(4) Reduction in the number accidents on intersections by 60 %

A2 Description

The measure was aimed at improving traffic safety and PT speed through the installation of enforcement cameras at intersections in Tallinn with following functions:

- Red light enforcement;
- PT lane (PT lane) usage enforcement;
- Speed limit enforcement.

Two multi-functional cameras (Figure 1) were installed on one of the busiest intersections in Tallinn (Endla-Sõpruse-Tulika), covering two directions of the 5-leg intersection (see Figure 2). Both cross-sections had 3 lanes and the PT lane was the first lane (Figure 2). The intersection was also covered by a traffic monitoring camera system implemented within the scope of the MIMOSA measure 8.2.

Figure 1 Multi-functional enforcement cameras in Tallinn

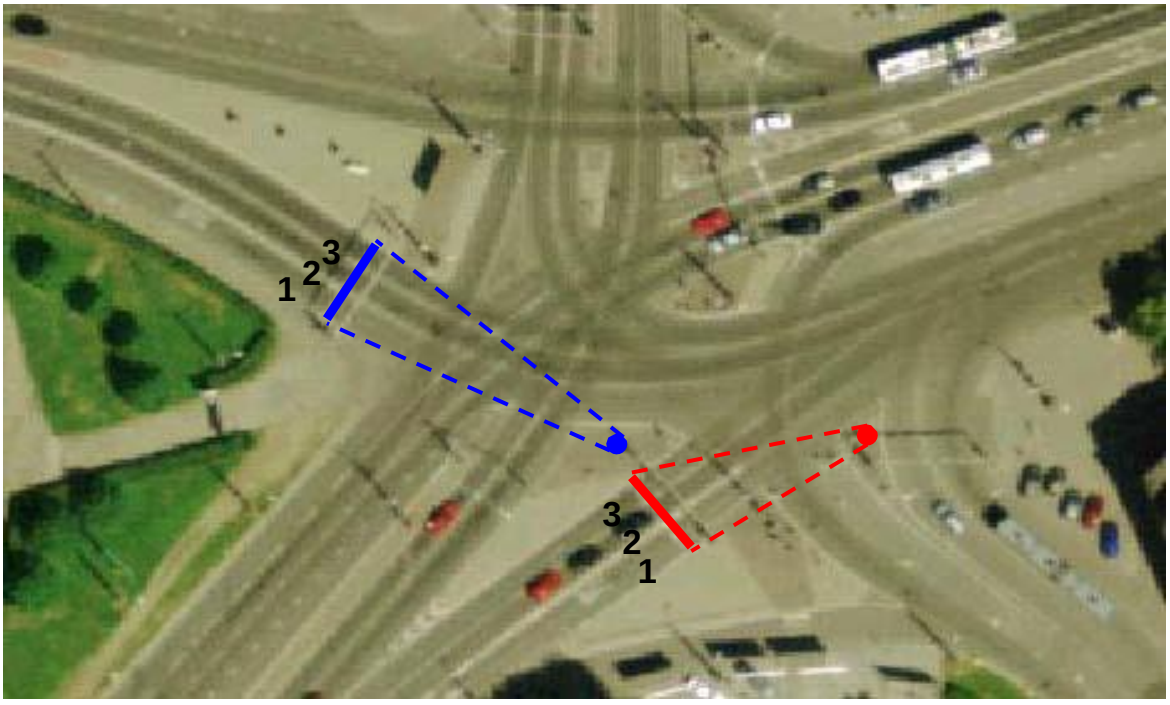

Figure 2 Locations of the enforcement cameras and cross-sections covered with the cameras

The purpose of a **red light enforcement camera** was to reduce the number of severe accidents by reducing the number of side collisions at intersections. A red light camera also served the purpose of improving traffic safety by encouraging drivers to form the habit of following traffic regulations.

Studies on red light cameras throughout the world have controversial results, some even indicating an increase in the number of accidents, mainly caused by the increased number of rear-end collisions. Therefore it is important to carefully study the effects of this pilot project prior to making conclusions or taking decisions about up-scaling the measure.

The working principles of the red light camera had to be more complicated than that in most other countries due to the specific demands of Estonian legislation. The aim being the camera needs to be fully automatic with negligible possibility for appeals. For that reason the infringement had to be fixed with pictures from the front (drivers face) and from the rear of the vehicle, the rear view picture proving the vehicle was on the interchange while the red light was on.

The **PT lane enforcement camera** was used to reduce the misuse of the PT priority system. The main idea of PT priority lanes was to improve the speed and punctuality of mass transport, thus increasing street capacity (measured in persons, not vehicles), reducing PT running costs and through all that increasing modal share of PT. Usage of PT lanes was especially important at intersections where there was a priority traffic light for PT to aid PT vehicles punctuality. The system was usually based on sensors requiring PT vehicles to be close to the intersection for the priority system to work. If the lanes were misused and the lanes occupied, the system was not able to give priority to the PT vehicle.

In Estonia, apart from PT vehicles only taxis with passengers in the vehicle were allowed to use PT lanes. This made the PT lane camera working principles more complicated so a simplification was used, as checking the number of people in the vehicle was not possible with the camera.

The cameras also included a **speed enforcement camera** in the same housing. Enforcing the speed limit at intersections was especially important as intersections were the main locations where pedestrians were crossing streets and side collisions, with severe consequences, occurred between vehicles. Also drivers often increase speed to get across an intersection with a green light. When a red light camera was in use on an intersection, the temptation to increase speed to avoid a red light infringement was even higher.

The cameras were planned to be connected to the existing national highway network speed camera database and fines to be applied automatically to the drivers. By the end of the evaluation period (October 2012) the cameras were technically fully functional and functioning but fines were not being issued for infringements. This situation arose due to the incompatibility with the current Estonian legislation, problems with connecting the system to the speed camera database (managed by the National Road Administration) and uncertainties in covering the running costs of the system. The problems are explained in detail under the chapter D.2.1 “Barriers”.

There was a press release in January 2013 by the measure leader and the National Road Administration that the database issues will be solved and Estonian legislation will be amended in the near future and the traffic cameras will start issuing fines for infringements. No specific dates were mentioned.

B Measure implementation

B1 Innovative aspects

The innovative aspects of the measure were:

- **New physical infrastructure solutions -** Red light and PT lane enforcement cameras had not been used in Estonia before, speed cameras had also not been used in Estonian cities before;
- **Use of new technologies** – Determining the right of a vehicle to use a PT lane required new solutions compared to existing enforcement cameras. Also, a new 3-in-1 solution was used: one camera captured three kinds of infringements.
- **Targeting specific user groups** – PT lane cameras were implemented for improving PT connection speed and punctuality, thus affecting users of PT.

B2 Research and Technology Development

As part of the preparation phase research was carried out on PT lanes and red light infringements on intersections in Tallinn. 6 intersections were selected for red light cameras and 17 intersections/street sections for PT lane cameras, the locations were originally considered along with the MIMOSA measure 8.2 traffic monitoring cameras.

B3 Situation before CIVITAS

According to the annual study of traffic behaviour (organized by Estonian Road Administration) the level of red light infringements in Tallinn had been around 1% of traffic volume for years. The Police Department was working on red light enforcement only occasionally and the effect of the action was thus limited.

According to another study carried out in 2009 on the usage of PT lanes in Tallinn it was found that 17-44% of lane users were not PT vehicles. The study did not separate taxis which had the right to use the lane if they had passengers so the result was only indicative. Also, as in the case of red light, enforcement by the Police Department it was irregular and thus it's effect was limited. However, a study from 2010 shows that the misuse of PT lanes was reduced by more than 50% compared to the study from 2009. No apparent reason for this change was found, it was most likely connected to the enforcement work of the Police. This however cannot be considered as the main reason behind reduction of the PT lane infringement between before- and after-studies. The reduction of other infringements (while the police have not been actively enforcing the other functions on the interchange) show that presence of the camera has considerable effect on the number of all infringements.

This measure was partly an up-scaling of the CIVITAS SMILE project, where public transport priority system elements were introduced as one measure. The CIVITAS SMILE could not give maximum effect, as the situation with illegal use of PT lanes by private cars was rather high. As a result, there was a need to develop this measure in order to use more efficient enforcement methods, including PT lane usage and red light infringements on signalized intersections.

Studies in the scope of MIMOSA measure 5.1 "Improvement of visibility and safety of crosswalks and bicycle tracks" from 3 different crosswalks showed that 40-80% of drivers (depending on location) were exceeding the speed limit while approaching the crosswalks.

B4 Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Preparation phase (2009 - December 2011) – Preparation consisted of research on possible locations of the cameras, technical and legal details of the system, preparing and carrying out the procurement process.

Stage 2: Installation and testing (January 2012 – May 2012) – The cameras were installed and tested for detecting infringements.

Stage 3: Dissemination campaign (spring-summer 2012) – press releases, interviews for newspapers, radio stations and TV channels.

Stage 4: Monitoring of the working system ("In near future" according to press release in January 2013) – Once the system is declared to be in full working order, the interchange is being monitored to determining the effect of the measure.

B5 Inter-relationships with other measures

The measure was related to other measures as follows:

- **CIVITAS SMILE** - This measure was closely related to the previous CIVITAS SMILE project, where one of the measures was the development of a public transport priority system in Tallinn consisting of PT priority lanes and traffic light priority systems.
- **Speed cameras on the national highway network** - This measure was also related to speed cameras introduced in Estonia in 2009 on the national highway network. The current measure was connectable to the system of existing motorway speed cameras.

In addition, the measure was related to other CIVITAS MIMOSA measures:

2.1 Developing P&R and School Bus – increased connection speeds and punctuality was supportive for measures like P&R and school bus.

4.1 Mobility Management and marketing activities - increased connection speeds and punctuality was supportive for marketing public transport.

8.3 Real time information system – predicting accuracy of time of arrival of public transport was directly dependent on public transport priority systems. Keeping the effectiveness of priority systems on high level by keeping personal vehicles away from PT lanes was therefore a direct influence.

8.2 Traffic Monitoring – the measures were originally planned together and the research on the possible implementation at intersections was carried out for both measures together. However, the organisational developments separated the measures later.

C Impact Evaluation Findings

C1 Measurement methodology

C1.1 Impacts and Indicators

Expected impacts of the measure were changes in the drivers' behaviour on the interchange, namely reduction of red light, PT lane and speed infringements. When considering the possible impacts, one has to take into account that the cameras did not become fully functional (the automatic fining function was not implemented, only detection of infringements without issuing fines) by the end of the MIMOSA project, general public was well aware of the fact and thus the impact was limited.

With the red light camera one could expect reduction of accidents but as different studies have shown, occurrence of some types of accidents (for example rear collisions) can even raise. Also, lifetime of the MIMOSA project was too short for accident statistics.

A PT lane camera should reduce misuse of PT lanes and therefore increase speed and reliability of PT. As the camera was installed only on two directions of one interchange and there are several other and more important factors contributing to the speed and reliability, the impact was not evaluated. Three months after installation of the cameras (July 2012) additional PT lanes were introduced in large scale in the centre of Tallinn. The impact of such measure would have made impossible to separate it from the influence of partly functional PT lane camera on one interchange.

With a speed camera one could expect reduction of speed infringements. It is simple and measurable impact and was evaluated with according indicator.

It was also important to monitor awareness and acceptance of general public of the implemented cameras. There were no expectations to what the result would be both before and after the measure implementation.

Table C1.1: Indicators

NO.	EVALUATION	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
15	Society	Acceptance	Awareness	Awareness level	Degree to which the awareness has changed	Index, qualitative, collected, survey
16	Society	Acceptance	Acceptance	Acceptance level	Attitude survey of current acceptance	Index, qualitative, collected, survey
TAL 8.1-1	Transport	Traffic behaviour	No of infringements	Number of red light, PT lane and speed infringements.	Traffic behaviour monitoring	Index, quantitative, collected, study

Detailed description of the indicator methodologies:

- **Indicators 15 and 16, awareness and acceptance** – the evaluation of change in awareness and acceptance on the traffic enforcement cameras was based on the general MIMOSA before-phone survey in November 2009 and a separate combined source after-survey in September 2012.

The **general MIMOSA survey** was planned and carried out by a professional market research company OÜ Klaster. Sufficient sample for different MIMOSA measures purposes was calculated to be between 600-800 persons.

The **general MIMOSA before-survey** was carried out in November 2009 and had a random sample of 1014 people between the ages 14 to 75. The survey was based on landline phone interviews and was carried out in Estonian (mother tongue for 53% of the population in Tallinn) and Russian (42%) languages. 25% of the sample was questioned by mobile phones to retain representability, as the usage of land line phones had decreased rapidly during the past decade. The sample was based on the population registry data and was gathered from all of the 8 city districts of Tallinn. The quotas for age and gender were calculated within districts. The quotas for 2 of the smaller of the 8 districts were above proportion as a minimum of 100 respondents were planned for every district. This was compensated by using different weights for different districts when calculating overall city results. The questionnaire was programmed to CATI (Computer Assisted Telephone Interviewing) and all interviews were performed using the system. The gathered data was checked in three stages: structural control – the CATI directed the interview to right blocks with the help of filter questions; formal control – after the survey the errors in open text answers and numerical answers were corrected; cleaning the data – incomplete answers and interrupted interviews were removed in the process of interviewing.

The social profile of a respondent was based on gender, age, nationality, district of residence, car ownership and transportation mode use.

The before survey had 4 questions about traffic enforcement cameras:

1. Are you aware of the planning of traffic enforcement cameras in Tallinn for detecting and penalizing drivers who are driving in PT lanes and ignoring red lights?
2. How necessary you think it is to implement the previously mentioned traffic enforcement cameras?
3. To what extent do you believe that installation of the traffic enforcement cameras results in safer traffic?
4. To what extent do you believe that installation of the traffic enforcement cameras results in smoother traffic?

Question 1 was used to evaluate the awareness of the planned traffic enforcement cameras and Question 2 was used to evaluate the acceptance of the planned traffic enforcement cameras.

The after-survey was carried out in September 2012 and it had a random sample of 1000 people selected according to the same principles as outlined above. There were changes to the questions in the after survey:

- The phrase “the planning of “ was removed from Question1, as the system was already implemented;
- Question 2 was divided into three separate questions, according to the three functions of the enforcement cameras: red light, PT lane and speed. The reason for dividing the functions was that by the time of before survey the different camera functions were not known but it is useful to know the difference in awareness and acceptance of the different camera functions.

- **TAL 8.1-1 Drivers’ traffic behaviour** – The traffic behaviour was evaluated with city specific indicators, infringements of red light, PT lanes and speed. The measurements were based on video surveillance cameras and were done for the time period 6:00 to 3:00 (21 hours), as the traffic lights were on yellow blinking mode outside that period.

The before-measurements were made on 14th of September 2011 and on 9th of November 2011. The days were all selected to middle of the week (all Wednesdays) that have the most common traffic volume patterns. The after-measurements were made on 9th of May 2012 (2 weeks after installation of the cameras) and 14th of April 2013. In total 79 516 vehicles were counted on the Endla Street and Sõpruse Avenue cross-sections during all measurements. Results from the two cross-sections were summarised as they did not differ considerably.

Four days might seem to be a rather short period for impact evaluation. However, the question is always in measuring an optimal sample with reasonable resources. According to over 30 years experience in traffic studies in TUT Institute of Transportation there is only little variance in traffic volumes and traffic behaviour on normal working days in the middle of a week. Normal means there are no large scale abnormalities in the whole city network during that day – extreme weather, special events, road construction, etc. This was checked after measurements from traffic volume statistics. Also, the used sample sizes have proven to be sufficient in other studies (TUT own traffic studies and Estonian Road Administration annual Traffic Behaviour Monitoring studies) throughout years.

As the speed function of the enforcement cameras was introduced with the procurement results in January 2012, there were no before-measurements on speed infringements.

Table C1.2: Indicators that were not used.

Impacts category	Indicator	How does it impact	Why it was not accessed
2	Economy, capital costs	The system has investment costs for implementation.	No cost benefit analysis was carried out, therefore there was no need for the costs.
3	Economy, maintenance costs	The system has maintenance costs.	No cost benefit analysis was carried out, therefore there was no need for the costs.
21	Transport, safety, no of injuries and deaths	The red light and speed cameras have effect on safety and thus on no of injuries and deaths	The system did not become fully functional by the end of the evaluation period, it was not issuing fines for infringements and the public was aware of it. The period for after evaluation was only 5 months, which is not sufficient for accident statistics.
24	Transport, Congestion levels, average vehicle speed-peak over total network	Change in driver habits not to block intersections at peak hours should have an impact on average speeds.	As only one intersection was equipped with the system, it cannot have measurable impact over total network. Even if it was the intended maximum number of 5 red light cameras, the impact on average speeds in network would be hard to prove to be as a consequence of the system. The system did not become fully functional by the end of the evaluation period, it was not issuing fines for infringements and the public was aware of it.
25	Transport, Congestion levels, average vehicle speed- off peak over total network	The off-peak average speed data would be necessary for comparing in case peak hour averages speed is evaluated.	As only one intersection was equipped with the system, it cannot have measurable impact over the total network. The system did not become fully functional by the end of the evaluation period, it was not issuing fines for infringements and the public was aware of it.

C1.2 Establishing a Baseline

The baseline was set differently for different indicators. The baseline for awareness and acceptance was set to November of 2009 with a before survey. The baseline for the traffic behaviour indicators was set to autumn 2011, when the before-measurements took place.

C1.3 Building the Business-as-Usual scenario

The BAU scenario was for all indicators based on the assumption that without the measure they would have remained constant.

The first Estonian national highway network speed enforcement cameras had already been implemented by the time of the before-survey in 2009. They were in testing phase by the time of the before-survey and there had been a fair amount of news and public discussions on them. Consequently, it is possible that the highway enforcement cameras had impacted on the awareness and acceptance of the MIMOSA measure enforcement cameras but it was not possible to estimate the impact.

There was previous data available for red light and PT lane infringements. The percentage of red light infringements had remained constant over the last 9 years (Figure 4). The statistics on PT lane infringements was varied. There were statistics from several locations in Tallinn since 2009, the results were very different from other locations and there was also a considerable drop (over 50%) in PT lane infringements in 2010, virtually making the planning of the PT lane enforcement cameras pointless. The number of infringements were (unfortunately) increased again in 2011. The conclusion from the unreliable results was that there were no clear previous trends in PT lane infringements that could be used for the BAU scenario.

C2 Measure results

C2.4 Transport

The impact of the enforcement cameras on transport was evaluated with changes in percentages of red light, PT lane and speed infringements (Figure 3).. For the red light and speed infringements the percentage was calculated from the total number of vehicles that passed the cross-sections. For the PT lane infringement the percentage was calculated from the total number of vehicles passing the PT lanes. This describes better the situation of PT lane usage.

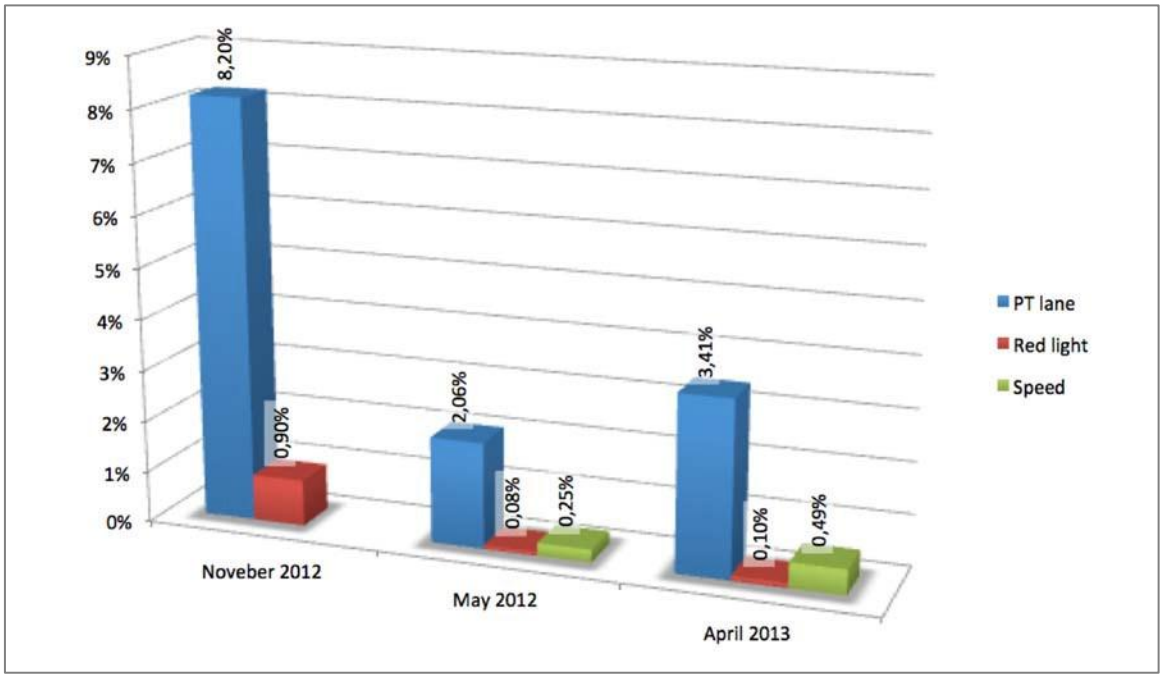

Figure 3 Change in infringement percentages

The red light infringement statistics had been part of the annual Traffic Behaviour Monitoring study organized by the Estonian Road Administration since 2003. For the BAU scenario the results from different years are presented on the Figure 4.

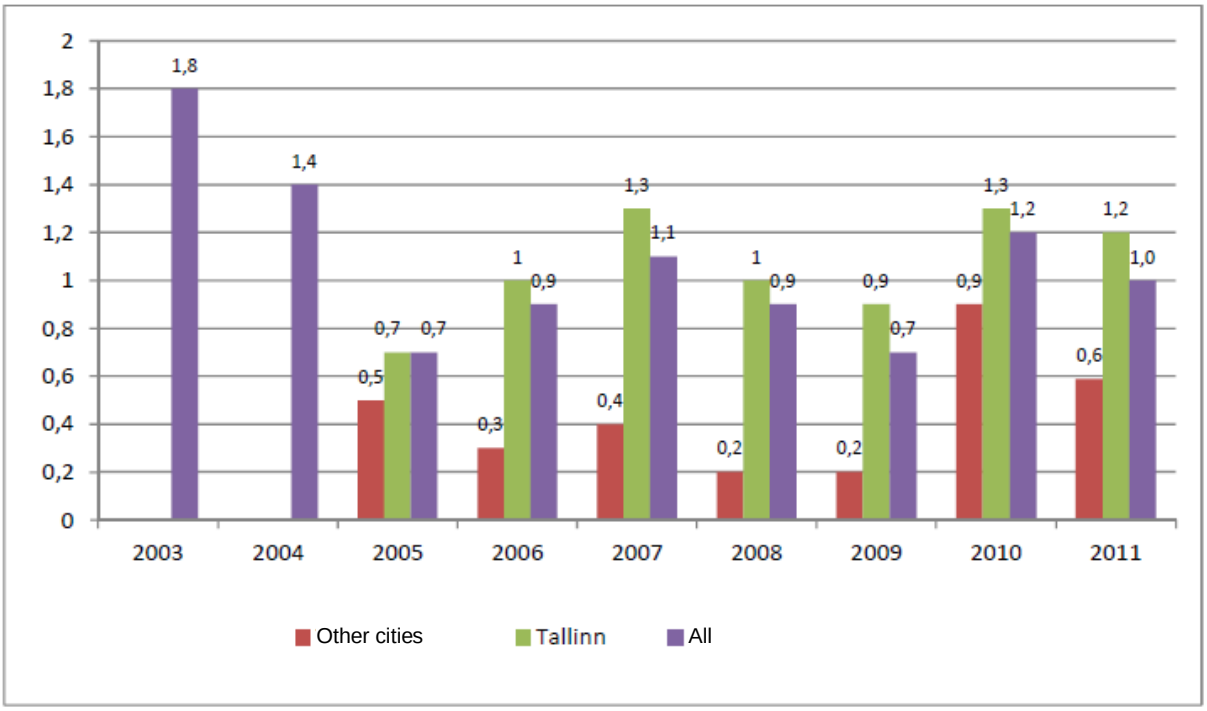

Figure 4 Red light infringement statistics in Estonia

The conclusion from the statistics (Figure 4) is that the red light infringement behaviour had been stable in Tallinn over the years and therefore the BAU scenario was based on assumption, that the behaviour was not changed during the half year between before- and after-measurements.

The results were:

- A large 11,9 times decline in red light infringements as a result of installation of the enforcement cameras, after this during 11 months the percentage increased again 28%;
- A large 4 times decline in PT lane infringements as a result of installation of the enforcement cameras, after this during 11 months the percentage increased again 66%;
- Only 0,25% (of the total traffic flow) of speed infringements right after installation of the enforcement camera, after this during 11 months the percentage increased 2,0 times.

The small share of speed infringements was remarkable when compared to the results from the MIMOSA measure 5.1 "Improvement of visibility and safety of crosswalks and bicycle tracks" studies (carried out in Spring and Autumn 2011) from 3 different crosswalks that showed that 40-80% of drivers (depending on location) were exceeding the speed limit while approaching the crosswalks. However, the crosswalks were situated on wide and straight street sections while the current interchange legs have considerably small radiuses (Figure 2) and limited visibility which both limit the speed of vehicles. Also, traffic lights and dense traffic at the interchange limit the approaching speed as well.

Even though it was known publicly (but not emphasized by the press) that the cameras were not issuing fines for the infringements, the new effective-looking camera housings and warning signs before them had clear, large and positive effect on drivers' behaviour. The main reason behind the change is most probably psychological – one can never be certain to remember whether the cameras

have been fully activated and thus it is better to be careful in the particular interchange. This is partly proven by the fact that one year after installation the percentge of all three types of infringements has increased from 28% to 98%.

The changes between the situation before and right after installation of the enforcement camera are presented in the Table C2.4.1.

Table C2.4.1: Changes in traffic behaviour

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
Red light infringements	0,90% 09-11.2011	0,90% 05.2012	0,08% 05.2012	-0,82%	-0,82%
PT lane infringements	8,20% 09-11.2011	8,20% 05.2012	2,06% 05.2012	-6,14%	-6,14%
Speed infringements	-	-	0,25% 05.2012	-	-

C2.5 Society

The awareness and acceptance of the general public was evaluated before and after the implementation of the measure with surveys. The **awareness** evaluation was based on the question: "Are you aware of the planning of traffic enforcement cameras in Tallinn for detecting and penalising drivers who are driving on PT lanes and ignoring red lights?" The question was formulated differently in the after survey by removing "planning of". The implementation of the speed enforcement function was not known at the time of the before-survey. The results from the surveys are presented on the Figure 6.

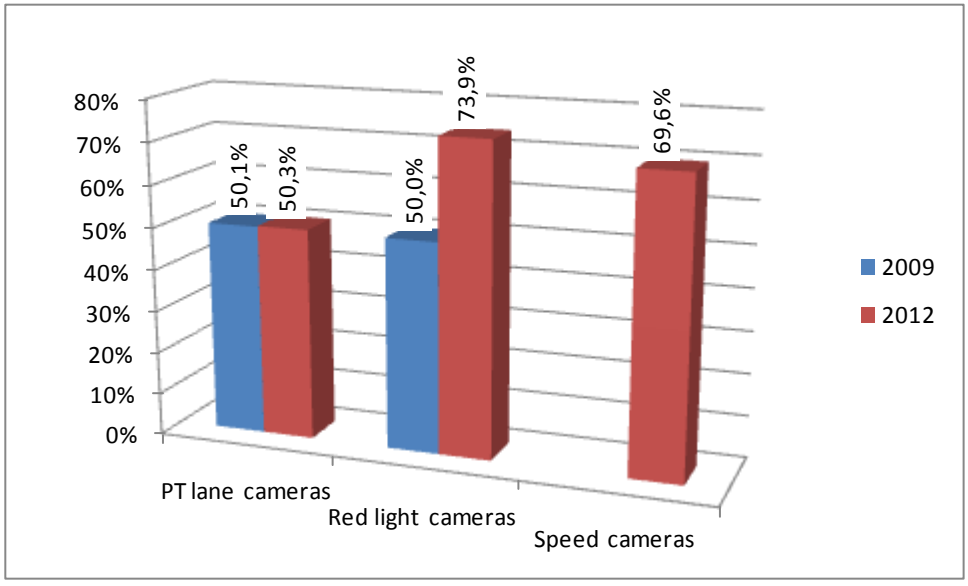

Figure 5 Awareness of the plans to introduce traffic enforcement cameras, before and after implementation.

While the awareness of the PT lane enforcement cameras did not change, there was a considerable increase in the awareness of the red light enforcement cameras. The change reflected the discussions

in the media at the beginning of 2012, which concentrated mainly on the red light and speed enforcement functions.

The **acceptance** of the general public was evaluated with the same surveys using the following questions:

- How necessary you think it is to implement the previously mentioned traffic enforcement cameras? (the awareness question was asked just before)
- To what extent do you believe that installation of the traffic enforcement cameras results in safer traffic?
- To what extent do you believe that installation of the traffic enforcement cameras results in smoother traffic?

In the after survey the general term "traffic enforcement cameras" was substituted with the different camera functions in order to get detailed information on the acceptance. Results from answers to these questions are presented on the Figure 7 to Figure 10.

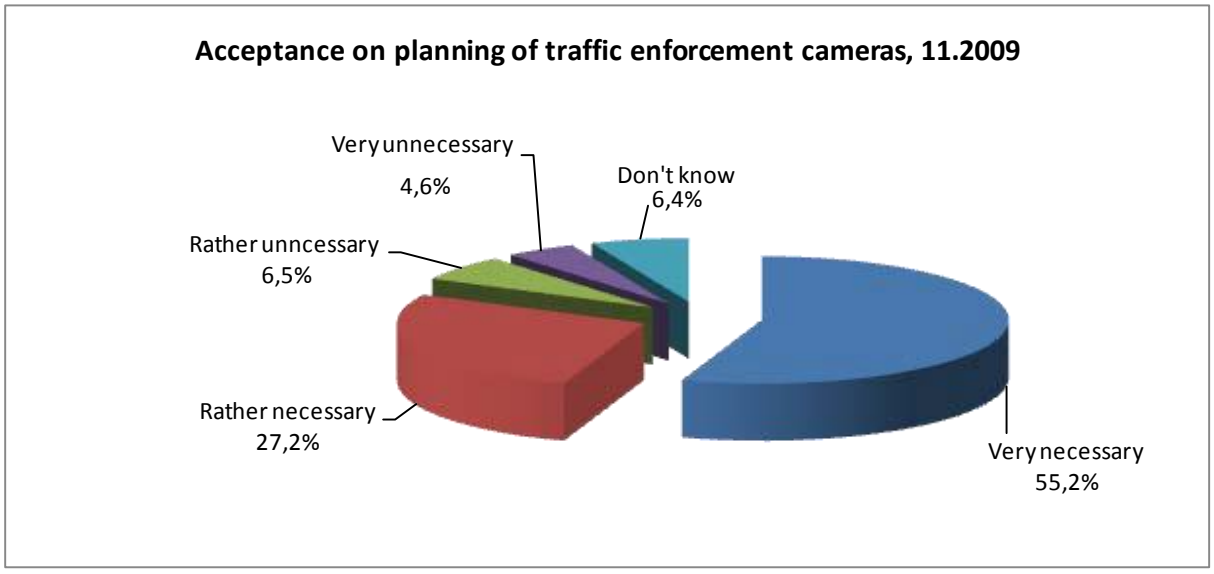

Figure 6 Acceptance of planning of traffic enforcement cameras in Tallinn, before implementation.

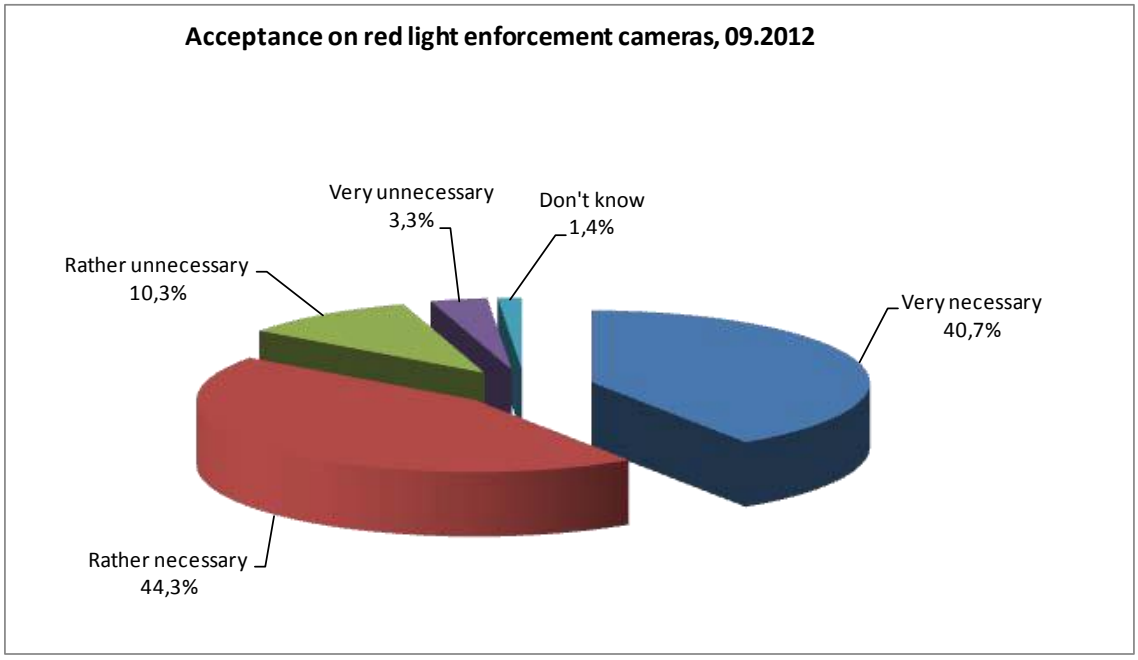

Figure 7 Acceptance of red light enforcement cameras in Tallinn, after implementation.

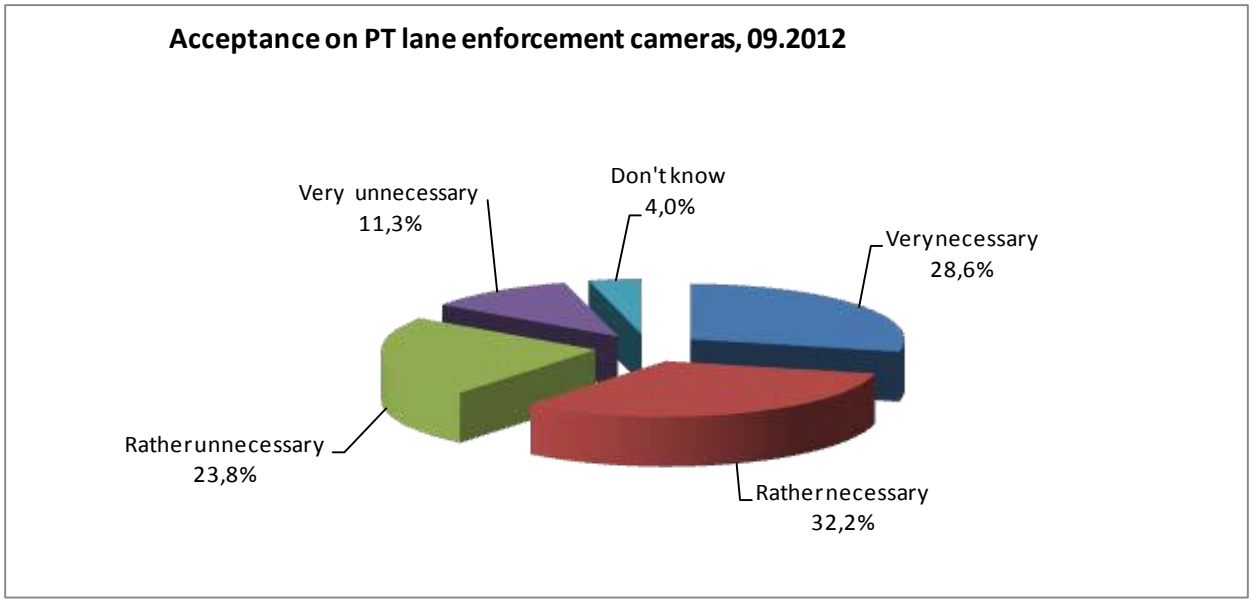

Figure 8 Acceptance on PT lane enforcement cameras in Tallinn, after implementation.

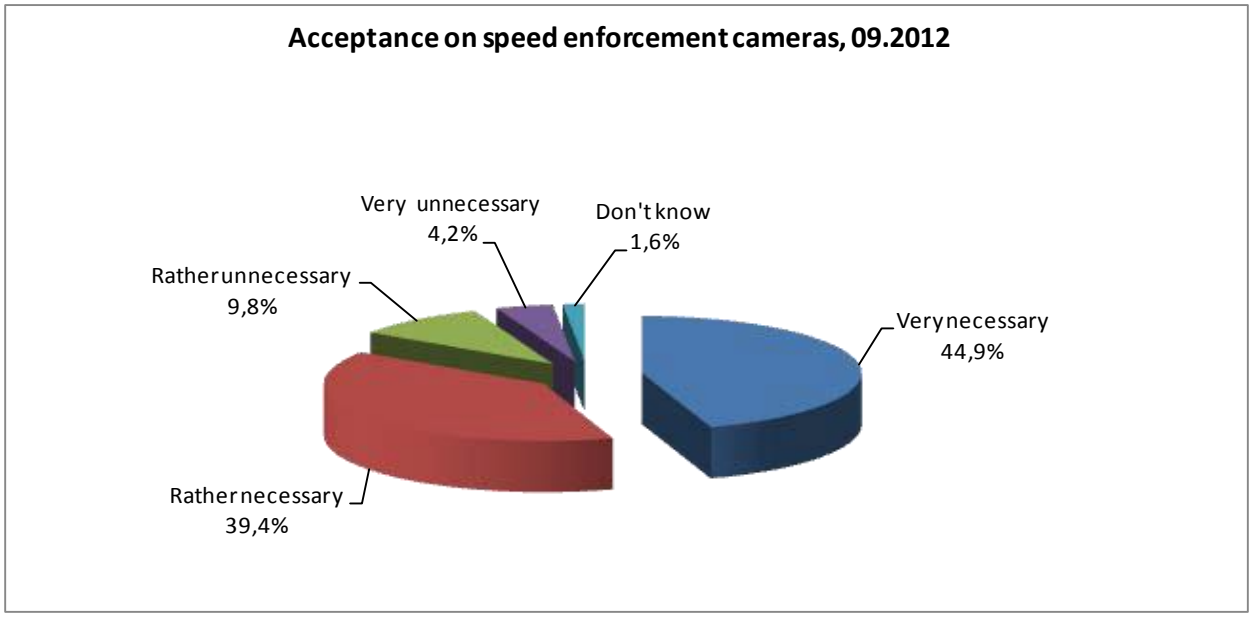

Figure 9 Acceptance of speed enforcement cameras in Tallinn, after implementation.

The results from the surveys show a considerable drop in very high acceptance (very necessary) from 55,2% to an average 38,1% and a slight drop in positive acceptance (very necessary + rather necessary), from 82,4% to 76,7%. The acceptance on PT lane enforcement is clearly the lowest among the functions. Since the system was installed, it has had considerable publicity in the media, this was partly operational and the results of the reduction of infringements had been disseminated to public, the number of answers “don’t know” dropped 2,8 times - from 6,5% to an average 2,4%.

There are several potential reasons behind the drop in acceptance. The newly formulated question dividing camera functions is possibly the largest factor. Initially the camera functions were not known and therefore the acceptance question in the before survey was rather general (asked about traffic enforcement camera). At the same time (2008-2009) speed cameras were implemented on Estonian motorways and despite not mentioning the speed function in the question (it is important to consider that this was a telephone survey, not written) many respondents might have confused the cameras with speed cameras. When we look now at the acceptance of speed function in the after survey, the overall acceptance has not dropped.

The second potential reason for the result and relatively low acceptance of the PT lane camera is the large-scale introduction of new PT lanes in the centre of Tallinn in July 2012 (2 months before the after survey). The new PT lanes were marked down overnight without informing general public or even PT companies and there were no studies carried out on the impact of the project. Therefore the project received negative media reception and this affected possibly also the acceptance of PT lane camera function.

Apart from general acceptance, those interviewed were also asked about their position on the potential impact of the enforcement cameras on traffic smoothness and safety. The answers are presented on the Figure 11 to Figure 14.

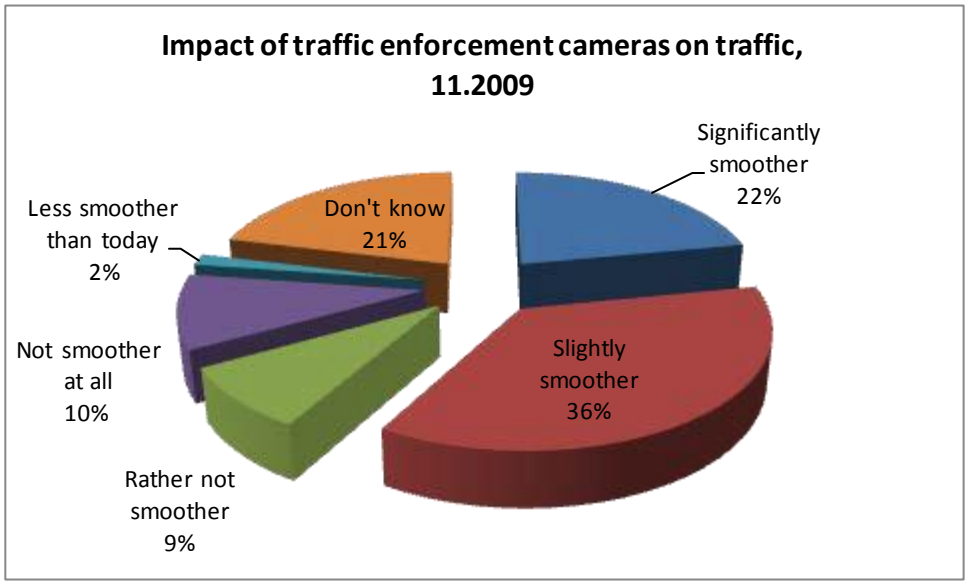

Figure 10 Position on how does introduction of enforcement cameras influence smoothness of traffic, before implementation.

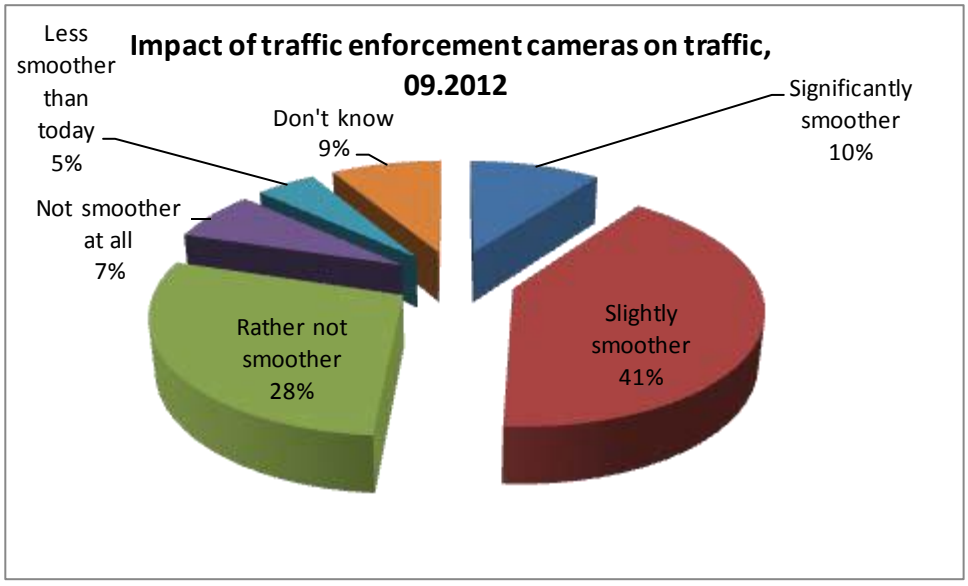

Figure 11 Position on how does introduction of enforcement cameras influence smoothness of traffic, after implementation.

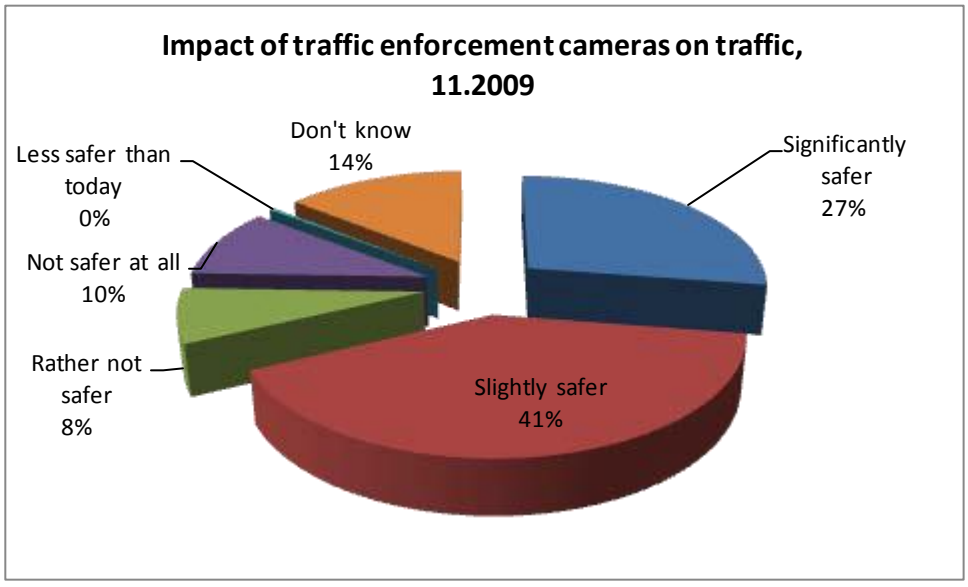

Figure 12 Position on how does introduction of enforcement cameras influence traffic safety, before implementation.

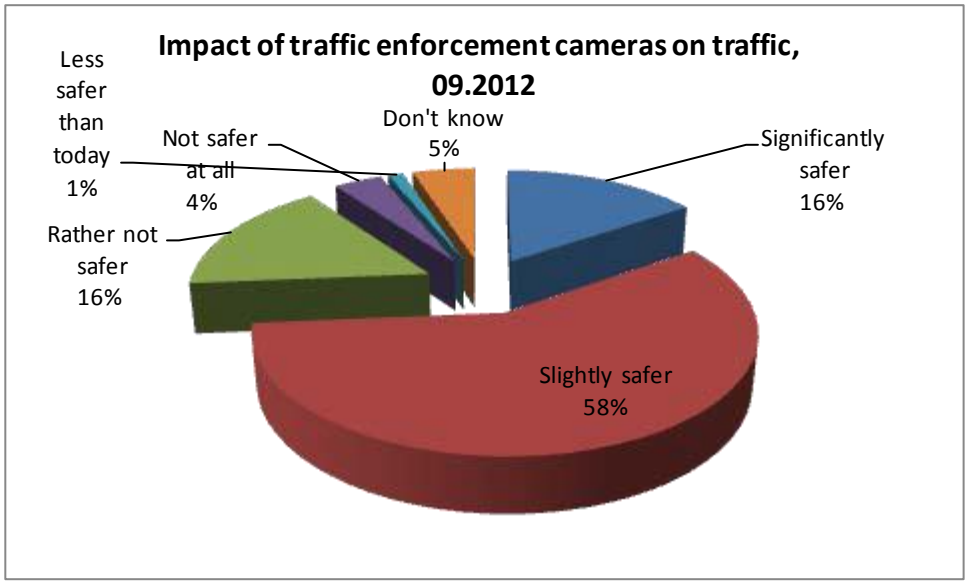

Figure 13 Position on how does introduction of enforcement cameras influence traffic safety, after implementation.

The results show that a positive position (significantly smoother + slightly smoother) on impact of the enforcement cameras to traffic smoothness was reduced from 58% to 51% and the slightly negative (rather not smoother) position increased from 9% to 28%. The number of respondents with no position was reduced from 21% to 9%.

The results on a position on traffic safety was different: the positive position (significantly safer + slightly safer) of respondents on impact of the enforcement cameras to traffic safety was increased, from 68% to 74%, on

For both - traffic smoothness and safety - the very positive (significantly smoother or safer) position was reduced similarly to a general acceptance.

Changes in the awareness and acceptance are presented in the Table C2.5.1.

Table C2.5.1: Changes in the awareness and acceptance

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
15 Awareness	50% 11.2009	62% 09.2012	62% 09.2012	12%	12%
16 Acceptance	82% 11.2009	77% 09.2012	77% 09.2012	-5%	-5%

C2.6 Cost-benefit Analysis

Although originally planned, no cost-benefit analysis was carried out for the measure after consultations with the MIMOSA project evaluation coordination team. The short project period and delays in the implementation did not make it possible to evaluate the possible benefits of the project – mainly from the change of traffic accident statistics. Also, the measure was not fully operational by the end of the MIMOSA project.

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	Average connection speed of public transport increased by 5 %	NA
2	Reduce the number of violations (red light) on intersections by 75 %	★★★
3	Reduce misuse of PT lanes by 70%;	★★★
4	Reduce the number accidents on intersections by 60 %	NA
NA = Not Assessed O = Not Achieved ★ = Substantially achieved (at least 50%) ★★ = Achieved in full ★★★ = Exceeded		

The measurable results from the measure were very impressive. Two of the quantifiable targets were exceeded.

The average connection speed was not a possible target to reach when only two directions of one interchange were equipped with the enforcement cameras. The number of accidents was the most important target, as it was also intended as the main source of benefit in the cost-benefit analysis. However, as the measure did not become fully functional by the end of the project and the time for half-functional time was too short for accident statistics evaluations, the results are not available

C4 Up-scaling of results

It is difficult to give recommendations for up-scaling for several reasons. Firstly, the problems with implementing automated issuing of fines are still not resolved (as of October 2012), requiring change of Estonian legislation and most likely the change of responsibility and of financing the enforcement camera databases. These are difficult obstacles and have to be resolved before the measure can be up-scaled in Tallinn or Estonia. Secondly, since the specific legislation and arrangements are very

different in other countries, it is difficult to give recommendations for wider up-scaling of the measure. The Estonian specific legislation turned out to be very demanding for proving infringements and as a result made solutions complicated and costly. Other countries may have alternatives for the installation of simpler and more cost effective enforcement cameras.

C5 Appraisal of evaluation approach

The selected evaluation approach was capable of bringing out the effects from the measure, although the measure did not become fully operational before the end of evaluation period. The drop in number of infringements as a result of installation of the cameras was drastic even when the cameras were not issuing fines and yet public were aware of that fact. Change in awareness and acceptance by the public was also evaluated.

The change in accident statistics and PT average speed was not evaluated. The evaluation period was too short for accident statistics (5 months) and the system was not fully functional. The PT average speed in the network could not have had detectable impact from PT lane enforcement cameras on only 2 directions at only one interchange. Despite that the original evaluation approach was correct, because up to 17 PT lane enforcement camera locations were planned at the beginning of the measure.

Although originally planned, no cost-benefit analysis was carried out for the measure after consultations with the MIMOSA project evaluation coordination team. The short project period and delays in implementation did not make it possible to evaluate the benefits of the project – mainly from the change of traffic accident statistics. The measure did not become fully operational by the end of the MIMOSA project.

C6 Summary of evaluation results

The key results were as follows:

- **Red light infringements decreased significantly** – The percentage of red light infringements dropped 11,9 times, from 0,90% to 0,08%;
- **PT lane infringements decreased significantly** – The percentage of PT lane infringements dropped 4,4 times, from 8,20% to 2,06%;
- **The level of speed infringements after the implementation was low** – only 0,25% of the drivers passing the two cross-sections were exceeding the speed limit;
- **The percentage of infringements has remained low after one year –** The percentage of all infringements has increased after one year but remains still considerably below the before-percentages.
- **The awareness was increased** – the awareness on the enforcement cameras was increased from 50% to 62%;
- **The acceptance was decreased** – the acceptance on the enforcement cameras was decreased from 82% to 77%.

C7 Future activities relating to the measure

There are clear and necessary future activities related to the measure. The main task is to get the system connected to the speed camera database and fully functional, e.g. issuing fines for infringements automatically. This requires changing of Estonian legislation, resolving issues

regarding management and costs of the system and the database. A workgroup has been formed for this purpose, consisting of officials from Tallinn Transportation Department, the Police Department, Estonian Road Administration, Tallinn University of Technology, Ministry of Economic Affairs and Communications and Ministry of the Interior. As of May 2013 the future of the enforcement cameras is still unclear.

D Process Evaluation Findings

D.1 Focused measure

The reasons for selecting this measure as a focused measure were as follows (listed according to importance):

- The possibility of carrying out a good Cost Benefit Analysis;
- The measure is typical for a group of measures or a specific context;
- The high level of innovativeness of the measure with respect to technique, consortium, process, learning etc.

D.2 Deviations from the original plan

The deviations from the original plan comprised:

- **Number of the enforcement cameras reduced** – After the preliminary study there were 6 positions (intersections) selected for the red light cameras and 17 positions (intersections and sections of streets) for PT lane cameras. It was planned to use low cameras which provide automatic recognition of vehicles licence plates and their search in various police and government databases. After recognition the enforcement system sends a penalty notice to the car owner (analogue to the enforcement systems in UK and Italy).

  During the preparation of the "Concept of enforcement system" it became clear that by revised law the Police Department can send penalty notices to car owners, but in the case of an appeal they have to prove who was the driver at the time of the infringement. For this measure it meant that expensive surveillance cameras had to be purchased for taking pictures of both the face of the driver and the licence plate at the same time. An additional request by the Police Department was that in the case of a red light infringement, the system had to take an extra coloured picture from behind which identified both the rear licence plate and the red traffic light.

- **Addition of speed enforcement function** - After conducting market studies it was identified that these kinds of cameras are expensive but they also have a speed enforcement function. The final decision of the working group was to purchase two sets of cameras with installation and special software for the enforcement system, which has to capture three kinds of traffic infringements.

D.3 Barriers and drivers

D.2.1 Barriers

<u>Overall barriers</u>

- **Problem related barrier** – High legal demands on the enforcement system. This made the preparation of the system and the procurement very complicated and time-consuming.
- **Institutional barrier** – Dependence of the preparation on the state ministries and departments made the City Transport Department more or less a bystander in the

preparation process. Most of the important decisions had to be made outside the municipal level.

- **Political / strategic** – General confrontation between the city and the state governments (and consequently its ministries and departments) made it difficult to get agreement on the system's operation and maintenance solution for the future.

Preparation phase

- **Financial barrier** – Due to financial crisis no funds were available from the budget of Tallinn for covering the share of city in the procurement for the enforcement cameras. The procurement was postponed to 2011, and as a result delayed the implementation of the measure.

- **Organizational barrier** – In February 2010 the unexpected departure (arrested) of the measure leader from his position. This person was most competent with expertise in the measure. This impacted negatively on the leadership of the measure.

Implementation phase

- **Organizational barrier** – Delay in 2 years of public procurement procedure due to barriers in preparation phase.

- **Technological barrier** – Installation of a new and never before tested enforcement system (functional enforcement camera), which required development of new software by the provider of the equipment. This needed more time than had been planned for the limited time scale of the measure.

Operation phase

- **Technological barrier** – Need for special software for enforcement system to be managed by the Police Department for automatic issuing of fines.

D.2.2 Drivers

Overall Drivers

- **Problem related driver** – General understanding between all measure's partners on the needs of the system.

Preparation phase

- **Financial driver** – Availability of public funds (especially CIVITAS funding).

- **Problem related driver** – Common understanding on importance and need for the measure between all involved partners of the measure. All discussions were focused on the details and results of the measure, not the usefulness of the measure.

Implementation phase

- **Planning driver** – Due to accurate technical planning and detailed terms of reference for procurement, installation of the system was carried out on time.

- **Problem related driver** – Measure's partners had recent experience with creating a whole speed camera system on national highways in 2009.

Operation phase

- **Technological driver** – New technologies and new solutions have created more powerful system with possibility to register and process 3 different infringements with just one enforcement camera.
- **Other driver** – High acceptance from the general public on the enforcement system due to the high number of traffic infringements on the intersection.

D.2.3 Activities

Overall activities

- **Involvement and communication related activity** – The main action for every barrier was to discuss the barrier with the measure's partners at meetings, by e-mailing or by telephone.
- **Involvement and communication related activity** – Due to the general understanding of the need for the system, many meetings were organised and a partial success was achieved: the Tallinn Transportation Department was in agreement with the Ministry of Ministry of Economic Affairs and Communications, that Estonian Road Administration would host infringement database in their server.

Preparation phase

- **Organizational activity** – After the of the original measure leader left the position, the local site manager took over the measure leader responsibilities.
- **Organizational activity** – Due to the departure of the original measure leader a joint working group was created to achieve the best solutions for the preparation process of the terms of reference and for launching of the public tender.

Operation phase

- **Problem related action** – Due to the need for special software Tallinn city had supported the Police Department with the financial resources to develop the automatic infringement processing system.

D.3 Participation

D.3.1. Measure Partners

- **City of Tallinn –** Leading role in the measure carried out by the Transport Department, responsible for the traffic management in the city and dissemination activities.
- **Tallinn University of Technology** – A principal partner, responsible for preliminary studies and evaluation of the measure.
- **Ministry of Interior** – A principal partner
- **Ministry of Economic Affairs and Communications** – A principal partner
- **Ministry of Justice** – A principal partner

- **Estonian Road Administration** – A principal partner, responsible for hosting the database of infringements and operating the speed cameras on national highways.

- **Police and Border Guard Board** – A principal partner, responsible for processing traffic infringements.

- **IT and Development Centre by Ministry of the Interior** – A principal partner, responsible for creating software for processing traffic infringements.

- **Alarmtec AS -** A principal partner, responsible for the production of software, installation of surveillance cameras for the enforcement system and maintenance of the system.

D.3.2 Stakeholders

- **Public transport users** – the users benefit from less private cars on PT lanes and therefore higher speed of PT vehicles.

- **Car drivers/ motorists** – number of severe traffic accidents will probably be reduced.

- **Cycle/ walking groups** – improved traffic safety on the intersection.

D.4 Recommendations

D.4.1 Recommendations: measure replication

- **Traffic enforcement system 3 in 1 –** The measure is replicable for cities that need to capture 3 different types of traffic infringements by the same enforcement camera;

- **System with high juridical reliability** – the fines for traffic infringements are issued automatically but in the case of an appeal by drivers there is always strong evidence available for every infringement in the form of pictures.

D.4.2 Recommendations: process

- **Need for specific competence:** implementation of the enforcement system needs specific knowledge about legislation and technical specifications. In Tallinn the preparation for implementation was started by the measure leader who left the workplace unexpectedly and the new measure leader had to resolve many complicated issues in a limited time without the knowledge and the expertise of the previous measure leader;

- **Planning of amortization:** The equipment for the enforcement system was planned to be purchased in the first year of the measure as the normal amortization period for these kind of devices is 36 months by finance regulations of Tallinn. The budget for the measure was prepared in principle that the full cost of the devices would be amortized during the project as 100% eligible cost. Due to delays in the implementation the amortization period during the project was only 9,5 months and as a result could only receive 26,4% of the planned EC support. The city of Tallinn had to find additional budget for the implementation of the measure.

- **Too many different partners for a pilot project:** measures in the CIVITAS initiative have limited time for implementation (4 years). When many partners are involved in the preparation and operation phase, this may present a risk for the implementation timetable.

Negotiations and decision making requires a high amount of resources and time. Currently (October 2012) there is still no final decision, which department of which ministry will be operating the enforcement cameras after the end of procurement contract (January 2013).

- **Early start is crucial:** this measure should have been the first to begin at the start of the MIMOSA project, at least at the end of 2009. With so many important partners involved and complicated legislative process the arrangement of the procurement takes years.

RTD Fact Sheet Template

Bus Lane and Red Light Cameras	
Reference Measure	TAL 8.1. Bus Lane and Red Light Cameras
Date of Submission	05/2012
Date of Review (ISIS)	07/2012
Date of Approval	08/2012
Author(s)	Marek Rannala
Editor(s)	Loredana Marmora (by ISIS)

Context and Purpose

To motivate users of private transport to change to public transport it is necessary to ensure a higher or equal average speed and punctuality of public transport. A public transport priority system has been developed in Tallinn by CIVITAS SMILE. It has helped to improve average speed and punctuality of buses and trolleys and therefore also increased satisfaction levels with public transport. The problem is that car users tend to use bus lanes which reduces the effect of priority system. The measure is aimed at reducing the misuse of bus lanes by installing bus lane cameras, which fix bus lane usage violations by identifying vehicles and drivers using bus lanes and applying fines automatically to violators with help of databases of Estonian Road Administration. Violators are identified by automatic recognition system from photographs taken by the bus lane camera.

Installing of red light cameras serves the purpose of improving traffic safety by creating habits of following traffic regulations to drivers. Studys on red light cameras throught the world have controversial results so far, some indicating even increase of number of accidents, mainly caused by increased number of rear-end collisions. Therefore it is important to carefully study the effects of this pilot project to be able to make right conclusions before making decision about upscaling the measure. The cameras will be connected to Estonian Road Administration database and fines are applied automatically to the drivers.

Description of RTD Activity

A study was performed on violation of red light and bus lane rules in different locations, technical requirements for the cameras and suitable locations for installing the cameras. Legislation and traffic regulations were also analyzed for implementing the systems. A trip to Kiel, Germany was organised to get overview of a working and suitable system.

Outputs and Results

The study gave overview of bus lane usage statistics, recommendations for installing locations of the cameras and technical recommendations for procurement processes of red light and bus lane cameras separately. However the trip to Kiel introduced a system where the cameras are together in one device plus additional speed camera. The system turned out to be the only and therefore winning bid in the procurement. As the system turned out to be expensive, only one multifunctional camera could be installed in the scope of the measure.

Resulting Decision-making

The decisions made were partly based on the outcome of the study. As technical requirements remained the same it was possible to decide over compatibility of the multifunctional system to the needs of Tallinn city and the Police Department and accept the bid for multifunctional camera.

Lessons Learnt

With this kind of measure it is of utmost importance of having representatives of the Police and the Ministry of Economic Affairs and Communications in meetings while discussing details of the planned system. Requirements for verifying infringements seem to be similar from country to country but specific details can totally exclude some systems from consideration.

The number of options for finding fully compatible and certified systems are very limited, there is no other identical system in use in the world. Conditions in nordic climate (+30 to -30C° in Estonia in one year) are specific and all equipment available is not certified for working in such conditions.

Cost-effectiveness

The study gave detailed recommendations for procurement process and can therefore be considered effective. The recommendations turned out to be valid from the results of procurement process. The physical implementation is to be completed in April 2012.

Dissemination and Exploitation

Installation of the cameras started a public debate in January 2012 after the results of procurement were confirmed. The debate raised awareness on people on traffic safety and importance to deal with particular types violations. The results from impact evaluation will be available for all interested parties.