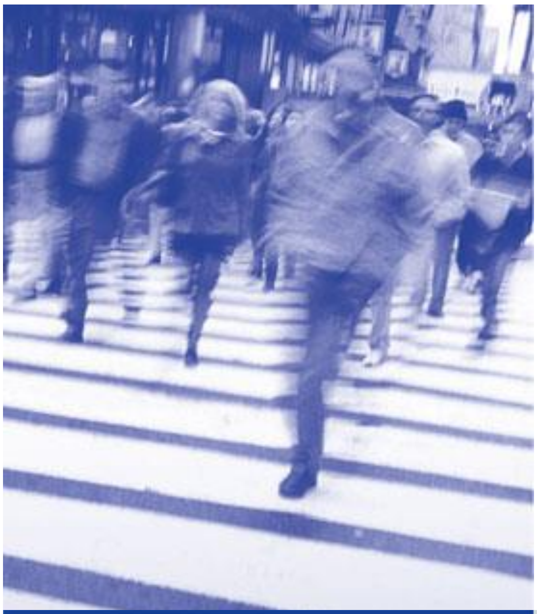

CIVITAS
Cleaner and better transport in cities

POINTER

Cluster Report 6: Traffic Management and Control

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Written by	**Pengjun Zheng, Mike McDonald, Jinan Piao** Transportation Research Group, University of Southampton, UK **Martin van de Lindt, Sophie Emmert, Janiek de Kruijff, Guus Mulder** TNO Behavioural and Social Sciences (Strategy and Policy Group, Mobility and Logistics Group), Netherlands	
Verified by	Mike McDonald	
Approved by	Tariq van Rooijen	
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Contents

1. INTRODUCTION

Traffic management and control plays an essential role in urban transport system, the purpose of which is to maximize road network potential and improve safety to meet current and future mobility needs in cities. 38 ambitious and innovative transport measures were introduced and developed by participants to demonstrate the contributions to sustainable urban mobility goals in CIVITAS.

The 38 measures within this cluster were grouped into 3 sub-groups:
(a) Monitoring and Control （20 measures）
(b) Public Transport Priority (5 measures)
(c) Safety Improvements (13 measures)

A new sub-cluster “Safety improvements” with 13 measures has been introduced, compared to 25 measures in 2 sub-clusters in CIVITAS II (Table 1.1)

Table 1.1: Comparison of sub-clusters between CIVITAS II and CIVITAS Plus

	CIVITAS II	CIVITAS Plus
Monitoring and Control	16	20
Public Transport priority	9	5
Safety Improvements	0	13
Total	25	38

This report is a part of work of Pointer Workpackage 2, ‘Evaluation’. The main objectives of the report are to provide a technical cross site summary and comparison of impact evaluation results, and identify key drivers and barriers for measure implementation at cluster/sub-cluster levels. For more detailed results, the individual Measure Evaluation Result Templates should be consulted. Separate reports on both Process and Economic Evaluation have been produced by POINTER.

2. IMPLEMENTATION

2.1 MONITORING AND CONTROL

Measures in this sub-group consist of:

- The development of signal control systems to optimize traffic flow (Aalborg, Monza, Ústí nad Labem, Funchal, Bologna, Tallinn, Utrecht, Gdańsk, Vitoria-Gasteiz)
- The installation of observatory or display devices to improve safety (Tallinn, Bologna, Brescia, Skopje, Szczecinek)
- The implementation of real time passenger information services (Bath, Coimbra)

Generally, the following implementation stages can be identified:

1) Identification of the experimental area and corridors. Due to the limitation of the resources, an area and corridors need to be determined to perform the monitoring and control actions to maximize the benefits from traffic management. It is possible to identify the corridor or intersections by analyzing the condition of traffic flow, or evaluating the performance of traffic lights plan. An example is shown in Figure 1, where a corridor in Monza was identified based on the route with high traffic volume.

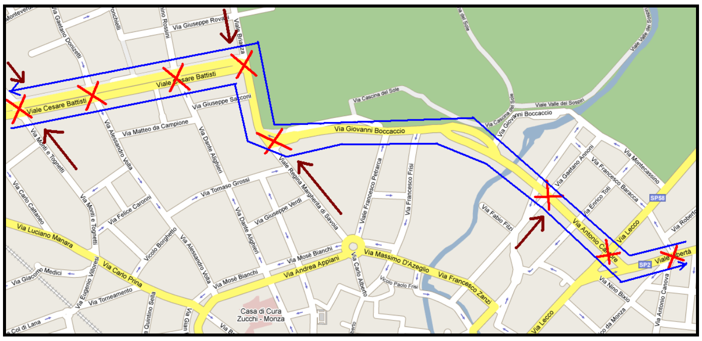


Figure 1 Determination of the experimental corridor (Monza, Measure 81)

2) Establishment of an information collection system. The purpose of traffic monitoring and control is to improve the safety and provide efficient solutions to traffic congestions which are valuated based on the data from various agencies and on-site devices. The most direct approach is to use the devices that have already been installed. If the existing detectors cannot meet the requirement, new installations will be needed. For example, multi-functional enforcement cameras were set up to monitor the usage of a bus lane, speed limits and red lights in Tallinn (Figure 2). Sometimes, relevant information can be obtained directly from other bodies including airport, environment agencies, transport companies, public transport operators, shopping centres, local authorities, and hospitals. The cooperation with large companies whose navigation units have been widely distributed among users is another option (e.g. Aalborg purchased congestion data from TomTom). Some of the data from public agencies may be not up-to-date, such as accident data. One solution to this problem is to distribute mobile platforms with GPS function to related agencies such as police department to collect the latest data.

Figure 2. The installation of multi-functional cameras (Tallinn, No.8.1)

3) Control system for traffic management. The best option to optimize the performance of the installed devices is to establish a traffic control/management system. For example, RoadManager®, a system designed and implemented by Project Automation to maximize the flow of traffic and is already in use in several Italian cities(Monza, Measure 81), or the CISIUM system, Bologna’s traffic control centre which controls the majority of the traffic signals and influences traffic communications in the area (Bologna, Measure 8.3). A central traffic control facility which connects all the detectors and central systems, or an adaptive traffic signal control system (SPOT system) can be used to optimize the traffic flow in a network.

4) Interaction between users and administrators. The interaction between users and administrators can be realized by setting up information panels such as the real-time public information panels in Szczecinek (Figure 3)

Figure 3. Dialogue display-showing two messages-“Slow down” and “Thank you”(Szczecinek, No. 8.6)

5) Stakeholder meetings and dissemination campaign. Meetings with local residents and stakeholders is helpful to understand user needs and generate support. Also, the involvement of newspapers, radio stations and TV channels are very useful in promoting the progress of implementation.
6) Legislation issue. During the implementation, compliance with current legislation is important. One example is the control of a reserved bus lane by mobile gates (Measure 8.4 at Bologna). The project was stopped because the implementation was not compliant with existing legislation.

An outline of the individual measures which belong to the category of “Monitoring and Control“ is given in Table 2.1.

Table 2.1 Implementation of monitoring and control

City	Measure #	Outlines of measure implemented	General Comments
Aalborg	70	-Data evaluation found that FCD from navigation units to be the best data resource for setting up a congestion monitoring system. A contract was placed with TomTom to buy the FCD data. -An Adaptive Signal Control System (SPOT system) was implemented to dynamically control the signals at intersections.	-Due to an extra-ordinary severe winters in 2010 and partly 2011, the implementation of the Adaptive Traffic Signal Control System was delayed. -A significant additional traffic flow was added from the Synergivej intersection in the spring 2011, which required additional work with the Adaptive Traffic Signal Control System. Therefore, the last parts off the implementation were carried out in the first half of 2011.
Monza	81	- An experimental city corridor was identified, by analyzing the performance of current traffic light plans, the traffic flow and design new plans for the targeted intersections. - The UTC system was made operational, and the performance measured and improved. - Measurements were made for impact evaluation.	-There was a significant improvement in the performances of the corridor, especially through the regularization of the behaviour in the peak hour. -The benefits, obtained estimating the Value of (saved) Time through the standard reference table are greater than the incurred costs. -The level of service of the bottleneck part of the corridor was good ranking,
Ústí nad Labem	26	-Detailed description of road infrastructure in the city was described, including pedestrian routes and significant civil engineering works. Specific risks resulting from the local natural and climatic conditions were identified. -Current management and organization of road traffic in the city was described and analyzed. Based on the analysis of current conditions, a proposal for optimal traffic management scheme was developed. -Application of transport telematics was	-The optimization of traffic management in the city and establishment of the central traffic control station results in improvements of traffic flow, elimination of congestions, decrease of time consumption and reduction of negative impacts on the environment. -The measure was delayed by time-consuming gathering and processing of data about modern methods of traffic management, technologies and trends for each sub-system of the city traffic management system.

		proposed and a central traffic control station was designed and applied in SUTP.	
Funchal	8.3	-Design of a mobility observatory was undertaken and information sources to support the observatory, and creation of mechanisms for collection and validation were identified -Purchase of equipment and training modules.	-Some administrative difficulties were found in launching the tender process to contract an external team to develop the Observatory. -There were some delays in the development of the mathematical models because it was difficult to obtain some data. -The negotiating process that culminated with the signing of mobility pacts was delayed because it was a pioneering activity and no previous experience existed.
Bologna	8.3	-A new mathematical algorithm for congestion detection was implemented in CISIUM; new software and devices were developed to detect accidents. - On road and desktop was compared, and statistical analysis were carried out. A new public website with real time information on traffic conditions and traffic events was launched.	-In developing the software, an unexpected increase in software problems was encountered. -Two indicators were removed so the evaluation of the average speed was not significant considering the available data. -Political changes slowed down the deployment of the communication module for real time traffic information.
Tallinn	8.2	-A preliminary study was carried out to identify strategic implementing locations for the monitoring cameras. -The monitoring cameras, mobile application and internet site were installed in the 11 selected locations at Tallinn. -Tests for automatic reporting and real time information maps for public users were conducted. Both impact and evaluation were conducted.	-After negotiation with the provider of the traffic monitoring system, a web page and mobile application was added. -The evaluation concept was changed because the original one no longer related to the actual measure. -The implementations revealed that the use of traffic monitoring web page stabilized to around 2000 page visits per month and mobile application was very low.
Utrecht	8.1	-Implementation of a temporary traffic control centre. During this stage the development of collection strategies, scenarios and procedures mainly focused on the expected traffic situations related to major road constructions. -Working toward the establishment of the permanent traffic centre.	-The establishment of the permanent traffic control centre was as foreseen. functioning from February 2012. -The involvement of several stakeholders from diverse fields of expertise and different levels raised the complexity of the coordination process and was identified as a barrier during the implementation process.

Gdańsk	8.1	-A conceptual framework was defined and reviewed; the stakeholders affected or involved were identified. -The ITS system proposed in the feasibility study is based on the implementation of several modules: video surveillance, alternative routes guidance, traffic information and media information, parking management, Public Transport vehicles and privileged vehicle priority.	-Because Gdansk developed its own its concept, there was a need to revise the measure description. -Delay was caused by the modification of original measure.
Vitoria-Gasteiz	M03. 04	-The city council of Vitoria-Gasteiz analyzed the current problems of traffic signal regulation and operation across the city. -A new software adapted to the new regulation and traffic lights priority is developed. -New traffic regulation plan, including a progressive implementation by regulation subareas (zones) with strict control procedures and contingency plans was implemented. -An assessment was performed to evaluate the impact of this measure and compare the results of the simulation model with the real situation.	-The original plan included the modification of some traffic lights in some intersection in order to improve the capacity of these crosses, but this was not carried out due to lack of budget. -An additional method of bus priority was introduced.
Tallinn	8.1	-Preparation consisted of research into possible locations of the cameras, the technical and legal details of the system, and preparing and carrying out the procurement process. -The cameras were installed and tested for detecting infringements -Dissemination campaign – press releases, interviews for newspapers, radio stations and TV channels. -Monitoring of the working system –the interchange is being monitored to determining the effect of the measure	-Red light, PT lane, and speed infringements decreased significantly. -The law requires the penalty notice with the driver's face, license plate, and the red traffic light(in red light enforcement). Due to the cost of high definition cameras, the number of enforcement cameras was reduced. -The cameras with high definition also had a speed enforcement function, so this function was added.
Bologna	8.5	-Installation of new stations for cameras and transformation of existing stations from analogy to digital. -Monitoring and automatic enforcement systems (STARS) were installed at junctions and a specific office was set up to manage maintenance for all ITS systems in the city.	-Both the accidents and injuries were reduced at all crossings equipped with STARS.
Brescia	M05. 02	-A monitoring centre was designed and implemented which contained both the web and pda versions. -A methodology was elaborated to develop the Urban Road Safety Plan (PSSU).	-Road accident reporting was enhanced by the installation of the monitoring centre. -During the operation, the system implemented by Telecom encountered several problems and was replaced by a new system not only to manage the road accident reporting but also to share information between agencies.

Szczecinek	8.5	-Debates with the local residents were carried out concerning an expansion of the monitoring system including additional crossings. -An analysis of the existing monitoring system was conducted. -Plans of an adaptation of the existing control centre and the connections between the police control centre and the municipal police centre were made.	-Reduction of the average time of police intervention from 16 down to 5 minutes at locations covered by monitoring.
Szczecinek	8.6	-Speed display units were installed at pedestrians crossings located close to schools. -Start of the monitoring system of the traffic speed at the pedestrian crossings exploitation process.	-Measure implementation contributed to increase in school children's security in their way to/from school. -After the installation, the society acceptance for the solution increased; number of drivers exceeding the speed limit dropped. -In terms of economic point of view, the measure is moderately effective. -School children's parents realized that pedestrian crossings close to schools have become safer.
Coimbra	M08.03	- New e-panels that could be powered by solar energy were introduced together with a GPS/ GPRS operation support system, -A "SMTUC Mobile" System was developed to supply timetables on mobile phones. -A feasibility study was also carried out in order to assess the technical, economic and quality impact of implementing an integrated management system of city traffic lights.	-Implementation of a mobile phone application was undertaken instead of the feasibility study. -The financial crisis delayed purchase of e-panels. -Due to the availability of Galileo system, the feasibility study was not performed. -The technical study on traffic light priority for PT was delayed.
Bath	8.2	-Research was carried out to explore available components compatible with Galileo systems. -Suitable hardware with the Galileo chipset integrated into existing hardware for field trials. -On Vehicle Computer Prototypes were developed with Galileo chipset integrated.	-The delay to the wider Galileo programme and the dependency of the project on the availability of the commercial positioning services resulted in a delay to the measure. -Delays resulted in the revision of the original objectives.
Bologna	8.4	-A feasibility and technical analysis were performed. It was found that there were no technical issues but legal issues.	-Due to the legal issue, a portable system was not compliant with the current legislation the possibility of using mobile equipment to control bus lanes is not possible
Per	5.1	Not available	Not available
Per	8.1	-An Urban Traffic Control (UTC) system to controls some of the city intersections was installed - An AVM (Automatic Vehicle Monitoring) system for public transport (PT) priority provisioning and service management was installed.	All activities were successfully completed

		- Tracking devices (AVL system) was installed in the municipality fleet vehicles -AVM/AVL and UTC/AVM integration & testing was carried out	
Sko	8.3	-Relevant literature and technical solutions were reviewed. -A measure was proposed to establish a computer traffic management and control centre that will include 28 city centre intersections. -Great interest from central government of Skopje and Macedonia resulted in a significantly expansion of the project.	-Due to the measure delay, the "before and after" analysis could not be completed. -The complex administrative and institutional procedures for procurements, and the amount and price of the equipment involved, resulted in delay. -The measure was extended to a wider area to over 120 intersections.

There were no significant deviations in implementing the measures except for that in Bologna where the 'Mobile Gates to Control Reserved Bus Lanes', a portable enforcement solution, was not physically implemented because of legal issues.

2.2 PUBLIC TRANSPORT PRIORITY

Measures in this sub-group consist of:

- The development of priority lane for public transportation(Iasi)
- The design of priority signals at intersection for public transportation (Monza, Iasi, Ljubljana, Craiova)
- The implements of traveller information system for public transportation(Zagreb)

Procedures for implementation of these measures are as follows:

1) Identify the locations to implement priority bus lanes. The development of a priority bus lane needs to consider two aspects, the traffic situation of the road segment and the space availability. One road segment contains two intersections. The first aspect can be determined by identifying the busiest intersections in a given corridor. Once the segments are determined, the space availability to develop an exclusive lane for public transport becomes the key factor to be taken into account. An example of identifying road segments to perform the public transport priority development. was in Monza (Figure 4)

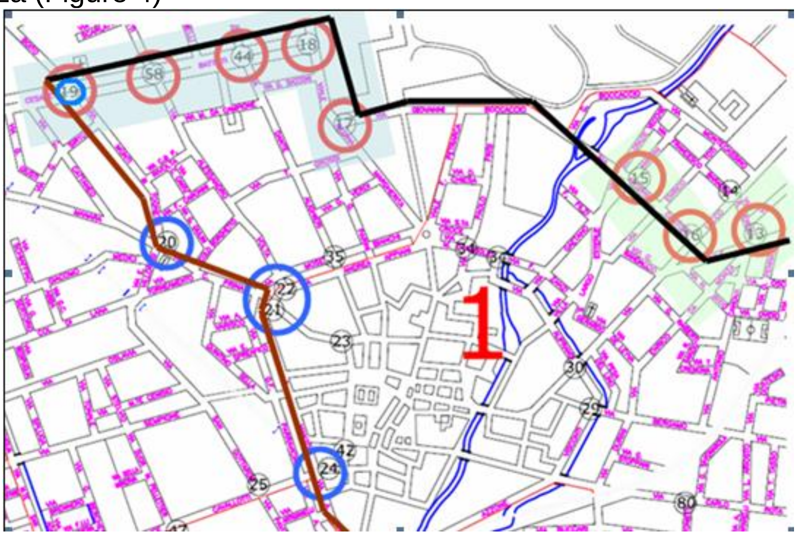


Figure 4. Monza corridors (Monza, No.82)

2) The public procurement tender. The main activities during this stage include the preparing of public procurement documentation and organizing/executing the public procurement procedure.
3) Installation of required equipment. Equipment is necessary for both buses and for the signal control system. The devices installed on the buses enables the central control system to determine the location of each bus in real-time. A signal control system, such as Road Manager®, can provide coordinated and centralized control of signals, which enable signal timings to be adjusted based on real-time bus locations. In addition, the interface between the public transport and the users, such as traveller information system can increase the user satisfaction and attract more people to switch from other modes. This boosts efficiency and the benefits of the public transport priority development.

An outline of the individual measures that fall into the category of "Public Transport Priority" is given in Table 2.2.

Table 2.2 Public Transport Priority

City	Measure #	Outlines of measure implemented	General Comments
Iasi	14	-Identify first 15 busiest intersections on the CIVITAS corridor. By improving the traffic flow at these sections, the entire corridor was improved. -An exclusive bus lane was determined based on the section of road with enough space. -Controls and radar detectors were installed at the trial intersections and the lane reserved for public transport vehicles were marked on the road.	-Due to the delay of another measure (IASI 76), the initial plan in which to interconnect the priority system and management system was changed. -Both of the passenger satisfaction and accuracy of bus timing were increased.
Monza	82	- A data base of bus system was established by collecting actual data from buses. -Signal plans were loaded to the intersections which were affected by the bus lanes to allow the UTC system to respond based on the behaviour of buses. -Measurements were taken to carry out impact evaluation.	-Due to the complexity and the novelty of the research and design stage, some delays were encountered.
Ljubljana	8.1	-The measure was defined to incorporate the priority request concept that at least deteriorates traffic situation. -A connection between ZigBee in vehicle and ZigBee at intersection was established, and data collection was performed. 210 buses were installed the Zigbee communication system.	-Due to the technical issues, the selection of intersections was constantly changing. -Because of the technical issues, the comparison of the fuel consumption parameters was not done for the entire duration of the testing period. -Late implementation resulted in the exclusion of some evaluation activities.
Zagreb	8.2	-A public transport priority system was installed at signalized intersections and a traveller information system at PT stops which includes a network of LED displays and a control centre.	-Due to technical, administrative and financial reasons the original objective was altered and consisted of the introduction of PT system on selected intersections. -The traffic modelling module was introduced which was not included in

			the original plan.
Craiova	M08.06	-A radio module (emitter) connected to the tram onboard computer and a receiver placed on the traffic lights was adopted for priority traffic light regulation. -Drivers of trams were trained and the green light system was installed and tested.	-The overpass construction led to the cancellation of 2 crossroads linked to a priority traffic light system.

2.3 SAFETY IMPROVEMENTS

Measures for safety improvements were:

- Speed reductions (Aalborg, Donostia–San Sebastián, Ljubljana, Utrecht);
- Educational campaign and safety related services for residents(Brighton & Hove, Donostia–San Sebastián, Ljubljana, Bologna, Ústí nad Labem);
- Driver training centres to improve driving skills (Coimbra)
- Evaluate the existing infrastructural and non-infrastructural actions and situations to improve the safety (Donostia–San Sebastián, Ústí nad Labem, Bologna, Perugia)
- Development of an area to enable cars and cyclists to share the space (Aalborg)

The above implementations addressed three essential safety related factors: environment, residents, and drivers. Implementation stages usually involved:

1) Location identification. A first step in improving road safety is to identify locations with particularly high numbers of accidents. The data could be obtained from police statistics, safety audit, speed measurements of traffic flow, and questionnaires about road safety issues (Ústí nad Labem). For example, the participation of the citizen helps decision makers to locate conflicts between modes and its solutions (Donostia–San Sebastián). An expert team from Ústí nad Labem developed a data collection system by installing inspection devices on some vehicles to evaluate safety deficits from the driver's perspective.

2) Implementations of safety improvement actions. The most common action adopted by cities was the development of speed reduction zone. These zones were generally located in residential areas with high densities of population, school zones or road sections with high volumes of pedestrians (Aalborg, Donostia–San Sebastián). To reduce vehicle speed in these areas, both traditional and creative approaches were implemented and tested. Approaches include installing speed limit signages, bumps, flexible bollards. A pillow bump in Aalborg is shown in Figure 5 to selectively limit vehicle speeds. These bumps allow the buses to pass with signed speed but slow down regular car traffic. To monitor vehicle speed, radar system can be introduced. It was shown by the city of Ljubljana that mobile radar system is more effective and user-friendly than the stationary one. The development of a new pedestrian zone is also an alternative option, which is an extreme situation of speed reduction. The city of Perugia optimized road markings to improve road user's safety. Where normal speed reduction measures are not sufficient for safety improvements in special areas such

as school zones, additional implementation was introduced. One example is road safety signs in the surroundings of schools as shown in Figure 6.

Figure 5. Pillow bump (Aalborg, Measure 43)

Figure 6. Example of a school surrounding before and after the implementation (Utrecht, Measure 5.1)

3) Educational campaigns. To encourage public to respect road safety code and raise their awareness of transport mode alternatives, education campaigns and public events can be held. An example was the public safety demonstration in Ústí nad Labem (Figure 7). The targeted group were people at high risk. Based on the analysis of the relationships between socio-economic characteristics and the most "at risk" road user group, tailored campaign plans can be designed. For example, if the audiences of the campaign are children, the following methods could be considered: workshops with contributions from police officers, teachers, parents and students to provide these people a wider knowledge of the dangers of the traffic and enable them to have environmental friendly mobility behaviour (Bologna). A map of safe routes for a particular school district can be a valuable resource for children or their parents during the campaign. The city of Coimbra established a driving centre equipped with a high tech driving simulator (Coimbra).

Figure 7. Public event raising awareness about road safety issues, traffic accidents and their consequences (Ústí nad Labem, Measure 40&49)

Key implementation stages and issues encountered during the implementation for safety improvement measures are summarised in Table 2.3.

Table 2.3 Safety Improvements

City	Measure #	Outlines of measure implemented	General Comments
Aalborg	*43*	-Five speed reduction zones were approved by The North Jutland Police. Signs, narrowing streets, bumps, bollards and different methods were tested and compared. -The after-data collection phase was performed to collect accident data, speed levels, and user perception and acceptance.	-The previous experience helped to solve issues that might exist in cooperation with the police.
Aalborg	42	-Landscape architecture company made a sketch of the area in dialogue with people from the ARCHIMEDES team and from the Project Engineering Department to determine the experimental area. -Removal of traffic lights, road narrowing, 30km/h zone, different kinds of pavements were applied to slow traffic.	-The construction work was delayed due to an unusual severe winter. -The number of accident registered in a year after the construction work was lower than expected. -A high proportion of the respondents considered the shared space was not functioning very well.
Brighton & Hove	44	-"At risk" groups and locations where they are at most risk were identified. -Solutions for each ‘at risk’ location were proposed and a road safety publicity campaign featuring city residents was launched in November 2010.	-Speed and volume counts were carried out at identified ‘at risk’ sites but could not be found for over the total network. -Traffic islands which are supposed to prevent dangerous U turns could not be justified because of the lack of collision records. -Three pure speed control Radars were replaced by a combination of two Radar and one red light camera systems.

Donostia–San Sebastián	46	-According to the density of residential population and locations, areas were selected and 30-kilometer-zones were designed. -After information campaigns, speed reduction zones were implemented and monitoring and evaluation were performed.	-Good results achieved seem not have reached population in all its extent. -Due to delays from mayor works, the implementations of safe districts, 30-km-zones, and information campaign were postponed. -Based on the dissuasive effect proved by Radar systems in other locations, it was decided to use two speed control Radars in combination with five Radar cabinets.
Donostia–San Sebastián	47	-Speed control Radar systems were introduced in selected "safe districts" to help monitor traffic. -A citizen road safety pact meeting was held to design the measures to be implemented.	
Ústí nad Labem	40 + 49	-A website was established with advice and recommendations for safe behaviour of drivers, pedestrians and cyclists. -Workshops, campaign events, traffic education were promoted and held by theCIVITAS team in various ways.	-To launch the campaigns in most attractive and effective way, some adjustments of the schedule were made. -Traffic calming solutions on busy roads in the city were not easy to be implemented.
Ljubljana	5.4	-Identification of danger zones on school routes, traffic signalization, school districts, safe routes. -Updating and maintenance of interactive plans of safe routes on the City of Ljubljana and elementary school websites. -A design for a pedestrian corridor and roundabout in front of elementary school was made and discussed with users. -Various workshops were held with mentors about traffic related training.	- To complement the indicator “No. of speed limit violations in the vicinity of schools“, the indicator “Monitoring the average vehicle speed in the vicinity of elementary schools” was added. -Low number of volunteers and individual motivation level than expected.
Ljubljana	5.5	-A draft version of the redesign for public spaces and streets near the corridor was produced and mobile Radar system was tested. - Pedestrian zones withall motorized traffic prohibited and pedestrian zones where traffic was limited to local traffic only were defined in an Order. -A reconstruction of the streets into pedestrian areas was carried out.	-Due to the compatibility of speed violation data, "Average speed in the reduced speed zones" was added. -During implementation, the reduced speed zones were replaced by pedestrian zones.
Bologna	5.1	-The implementations of IT systems for traffic signal enforcement, optimisation of traffic signal design, technical analyses of Variable Message Signs (VMS) speed display, were conducted. -Intermediate traffic islands were constructed to protect pedestrian crossings.	-Activities related to traffic calming and safety were successful. -The lack of a leading role raised difficulties in the implementation of the measure.

Bolo gna	5.2	-Bologna's Municipal Police Department organized different training courses for different types of schools to improve road safety awareness. -A set of safety initiatives near the schools such as small-scale traffic calming works, redesigning of crossroads and pedestrian crossings, and the installation of traffic signs were implemented.	-Considering that insufficient parents were willing to respond to online questionnaires, hard copy questionnaires were sent to schools. -Difficulty in persuading parents and schools to allow children to go to and from school alone. -Administrative structures, procedures and routine, laws and regulations hindered the progress of the Measure.
Utrec ht	5.1	-Pilot implementations were performed and the results were discussed including the experiences of stakeholders, the satisfaction with the school zones, the average vehicle speed and the costs of new school zones. -Results of the pilot were described in a report and extension was recommended to other participated schools.	-The deadline of school participation was postponed to fit for school year. -The pilot implementation revealed some problems and resulted in the adjustments of layout of the school zones.
Coim bra	M05. 07	-Conception and definition of technical specifications were established for the simulators in the driving centre, and simulators were purchased and installed. -Training was firstly carried out for trainers and technical personnel, and then public transport drivers were trained. -A promotion action was launched for potential users.	-A prolonged administrative and bureaucratic process related to the lack of co-financing from the national government delayed the measure implementation. -Training by simulators reduced the average operating costs, fuel consumption, emissions, as well as accident risk.
Peru gia	5.2	-A state of the art study defined several parameters to be measured and instruments needed. -27 sites were selected of road marking, measurements and test data was collected. -The proposed methodology to evaluate the road pavement markings was validated. -Additional cites participated in the measures.	-The experimental campaign was extended to other sites. -Dissemination/demonstration activities were carried out in other cities and in international level. -Climatic conditions affected the execution of the measurements. -The safety of the operators during measurements was a concern.

3. DRIVERS AND BARRIERS

3.1 INTRODUCTION

Background and methodology[1]

The main goal of the process evaluation procedure of CIVITAS-POINTER has been to develop new findings about factors of success, and strategies to overcome possible barriers during the implementation phase of CIVITAS Plus measures by cross-site analyses of all relevant information. A specific focus lies in the identification of potential barriers, but information on factors of success, such as drivers, is needed as well. Barriers and drivers may differ during the various stages of the measure. Therefore distinction has been made in three different phases:

1. Preparation phase: the measure is developed in detail and design work for the measure is conducted. At the end of this phase all planning details are fixed, including all decisions and permissions that are a pre-condition for starting the implementation phase.

2. Implementation phase: the measure is implemented in real life. At the end of this phase the measure begins operation.

3. Operation phase: the measure is opened to the public, i.e. users are able to increase their utility. The first phase of operation lies within the time-frame of the CIVITAS Plus Initiative and can be analysed and evaluated by CIVITAS POINTER. The long-term running is the outstanding time (beyond the CIVITAS II Initiative) until the measure comes to the end of its life. This could be caused by technical issues, programme termination, end of funding, redesign, or reconstruction.

The process evaluation framework is built upon three information blocks, each of which has his own form. The first block is called measure evaluation and results in the completion of the so called Measure Process Evaluation Form. It should be completed for all non-focused measures. The second building block consists of the subset of focused measures. These measures are selected based upon several criteria. One criteria was the potential to conduct a Cost Benefit Analysis (CBA). The aim of the focussed measures is to get a deeper insight into the selected measures. The forms which provide information for the two blocks above were completed several times during the programme and functioned as a basis for the last building block: the process evaluation part of the Measure Evaluation Report Template (MERT).

[1] A detailed description of the objectives and methodology of the process evaluation is to be found in other POINTER reports

The raw information from the various forms showed that the drivers and barriers are extremely measure and site specific. To analyze and report, they have been grouped into barrier and driver fields. An overview of these fields can be found in Annex 1. Specific and detailed information about the barriers and drivers of the measures is to be found in the individual MERTs.

Aim and structure of this chapter

The starting point of the process evaluation at cluster level is that policy makers and other stakeholders are interested in understanding the barriers and drivers that may be relevant for the measures. The process evaluation data of the MERTs were put in a database and analysed on a aggregated level with SPPS for the various sub clusters. (Specific information should be obtained from the individual MERTs.)

For the cluster Traffic Management and Control, 37 MERTs are available, divided between the three sub clusters as presented in Section one (see Table 3.1 below)

Table 3.1: Sub clusters and number of measures

Subcluster:	**Number of measures**
PT priority	5
Monitoring and Control	20
Traffic safety	12
Total	37

An overview of the cluster is given in Section 3.2 (for background information: see Annex 2). The Sections 3.3, 3.4, and 3.5 are used to describe the barriers and drivers within the sub clusters. Detailed background information on these sections can be found in Annex 3. The conclusions as distilled from the measure information are given in Section 3.6

3.2 CLUSTER OVERVIEW: GENERAL ASPECTS

To put the findings of this cluster in perspective, it is important to appreciate the quality of the process evaluation data gathered. Distinction has been made at three quality levels: (i) low quality means that data are not / hardly useful due to the use of old MERT forms and / or not or hardly understandable answers on the questions; (ii) medium quality means that the data are useful, although not all the crucial questions (barriers, drivers, actions and recommendations) are well completed; (iii) high quality means that the data are very useful because all questions are answered well or on a fairly acceptable level, although variability in the quality of the answers may exist. Some 24% of the process evaluation data are of low quality, 51% of medium and 24% of high quality. As the division over all the CIVITAS Plus measures was 15%, 49% and 36% respectively, it can be concluded that data for this cluster is of a somewhat lower quality compared to the overall data. The division between focussed and non-focussed measures, were respectively 30% and 70% in the cluster and 30% and 70% for all measures.

In 62% of the measures in this cluster, one of the innovative aspects was related to new technology, and is the aspect that differs most from the overall results, which was 46%. This variation is not remarkable given that the aims of the measures in this cluster were mainly to maximize road network potential by adopting traffic management to provide efficient solutions to traffic congestions problems and to improve safety. Targeting specific users was also mentioned more often in this cluster: respectively 43% to 38% overall. New modes of transport, innovative economic instruments and innovative policy instruments were aspects that scored slightly lower in comparison to the overall score. The strategic, tactical and operational goals showed a focus on safety and public transport. At the strategic level, the most frequently mentioned goals were an increase in road safety (35%) and tan increased modal shift towards slow modes or PT (30%). These goals corresponded to the tactical goals that were most mentioned, i.e. increase safety and reduce accidents (27%) and the most mentioned operational goals of improving road safety (24%) and reducing the speeds of private cars and increasing the speed of public transport (24%).

To reach these goals, the measures faced many hampering barriers and drivers during the different stages. An overview of both barriers and drivers is given in Table 3.2 below. A conclusion is that politics played an important role especially in the preparation stage in this cluster. Political barriers have been seen as hampering at the implementation stage as well, with less influence at the operation stage. Political drivers, on the other side, acted as important drivers at all stages, although the effect is greatest at the preparation stage. Technological barriers were mentioned most for all three stages. Financial, institutional and technical factors seemed to act more as barriers than as drivers, especially at the implementation and operation phase of the measures. Organizational issues were mentioned frequently as driver and barrier in the different stages. Organizational issues were identified as drivers at the stages of preparation and implementation.

Table 3.2: Barriers and drivers per measure stage

	Barriers			Drivers		
Fields	**Preparation**	**Implementation**	**Operation**	**Preparation**	**Implementation**	**Operation**
Political	22%	14%	8%	46%	24%	14%
Institutional	24%	14%	14%	5%	11%	3%
Cultural	8%	5%	11%	8%	0%	3%
Problem related	19%	22%	22%	8%	14%	3%
Involvement	14%	14%	5%	22%	19%	11%
Positional	3%	3%	5%	19%	16%	5%
Planning	14%	3%	3%	5%	16%	8%
Organizational	22%	24%	14%	27%	35%	30%
Financial	16%	19%	8%	11%	11%	5%
Technological	30%	32%	22%	16%	19%	22%
Spatial	16%	8%	5%	8%	3%	3%
Other	3%	3%	0%	3%	8%	3%

3.3 SUB CLUSTER: MONITORING AND CONTROL

3.3.1 Barriers

The aims of this sub cluster of optimizing traffic flow, developing signal control systems, improving safety by the installation of observatory or display services and implementing real time passenger information services, were hampered by several barriers at the various measure stages. At the preparation stage, technological aspects were a major problem, and are mentioned as a barrier in 45% of the measures technological aspects, for example, in Coimbra and in Szszecinek (Table 3.3). In Coimbra, the technological barrier had to do with the fact that the Galileo satellite navigation system was not available and the GPS/GPRS needed to be implemented using the standard technology. Therefore, the initial objective of applying the Galileo technology was not achieved. The technological barriers in Szszecinek were due to a lack of space available for monitoring in the Headquarter of the Municipal Police. Political, financial and problem related aspects were also mentioned as important barriers as well at the preparation stage (all 20%). In the case of Perugia an automatically vehicle location system (AVL-system) was designed for taxis, but due to opposition by the taxi drivers, the implementation phase was delayed. Eventually it was decided to prioritize the installation of the AVL system to other Municipal vehicles. The implementation phase showed that barriers related to technological aspects still occurred for 40% of the measures. For example, this barrier was mentioned in Szszecinek where due to the severe winter weather conditions it was impossible to connect the electricity lines which were necessary for traffic surveillance equipment. Bologna encountered a barrier that had to do with the implementation of the technology. The local press criticized by calling the STARS project ‘The traffic light killer’. This was the implementation measures and technology because there were some bad examples in other Italian cities which led to criminal sentences against the operator of the enforcement system. The impact of this barrier, which only occurred in the initial months of the measure, was that it gave people the idea that the Municipality only installed the equipment to earn money ‘illegally’ through fines. This resulted in a high number of disputes over fines. At the operational stage, technological barriers remained important (30%). Organizational barriers, which had been encountered at all stages, occurred for 15% of the measures at the operational stage. Technological barriers were mentioned most at this stage. The two cases that were not implemented successfully (Bologna, Mobile Gates to Control Reserved Bus Lanes**;** Tallin, Traffic Monitoring) faced almost all the above mentioned barriers. Bologna faced juridical problems regarding the use of cameras. The main barriers in Tallin were the unexpected job change of the expert employee and postponed procurement due to financial problems in the city.

Table 3.3: Measures and barriers per measure stage

Measure	Measure Title	Success	Preparation	Implementation	Operation
Aalborg, 70	Congestion Monitoring Using Telematics	2	Spatial		
Bath, 8.2	Innovative telematic systems for traffic management and traveller services – Galileo Applications	2			
Bologna, 8,3	Cisium: New Traffic Control Centre	1	Technological	Technological, Political	Technological
Bologna, 8,4	Mobile Gates to Control Reserved Bus Lanes (STOPPED)	0	Political, Institutional		
Bologna, 8,5	Stars: Automatic Enforcement of Traffic Lights	3	Technological, Other, Financial	Involvement, Technological, Financial	Technological, Financial
Brescia, M05.02	Accident Risk Analysis and Development of a Road Safety Monitoring Centre in Brescia	2			Organizational
Coimbra, M08.03	Infomobility Tools for Traffic Data Management in Coimbra	1	Technological	Financial, Technological	Technological

Funchal, 8,3	Urban Mobility Control and Monitoring Centre	2	Technological, Involvement	Problem related	Positional
Gdansk, 8,1	ITS Deployment	1	Institutional	Institutional	Institutional
Monza, 81	UTC System in Monza	3	Problem related, Technological	Organizational	Organizational
Perugia, 5.1	Road safety and security traffic control/monitoring system	-	Financial, Technological	Financial	Positional, Political
Perugia, 8.1	The set up of a traffic monitoring control centre for public transport	-	Problem related, Political	Problem related, Technological	Technological, Organizational
Skopje, 8.3	Integrated traffic management in the central area of SKO	1	Political, Organizational	Political, Technological	
Szszecinek, 8.5	Traffic surveillance at selected main road intersections	3	Organizational, Technological	Organizational, Technological	
Szszecinek, 8.6	Development of the monitoring system of the traffic speed at the pedestrian crossings close to schools	3	Cultural, Technological	Cultural, Technological	Cultural, Technological
Tallinn, 8,1	Bus Lane and Red Light Cameras	1	Problem related, Institutional, Political, Financial, Organizational	Organizational Technological Problem related Institutional Political	Technological Problem related Institutional Political
Tallinn, 8,2	Traffic Monitoring	0	Problem related, Organizational, Planning, Financial,	Problem related	Problem related
Usti Nad Labem, 26	Strategic Traffic Management	2	Institutional, Positional	Spatial, Financial, Problem related	
Utrecht, 8,1	Traffic Control Centre and Traffic Management	2		Organizational	Institutional
Vitoria-Gastiez, M03.04	Traffic Light Regulation for the New PT Network and Superblocks Model in Vitoria-Gasteiz	1	Technological	Involvement, Problem related	Problem related

3.3.2 Drivers

At the preparation stage of this sub cluster, political aspects were the most frequently mentioned drivers (35% of the measures). In Monza, for example, a strong political commitment by the Mobility Deputy Major helped to implement the measure to improve the capacity of the road network. The same applied in Szszecinek, where a project, that as well as that in Monza, was a very successful implementation. Involvement, Positional and Technological drivers were mentioned frequently at this stage (20% of the measures). The drivers mentioned at the implementation stage were varied and only cultural, spatial, financial and other drivers were of low importance. Organizational aspects were mentioned for 25% of the measures, examples are clear cooperation with partners (Utrecht) and clear and effective leadership (Funchal). At the operation stage, important drivers were mainly related to organizational aspects (30%) and technological aspects (25%).

Table 3.4: Measures and drivers per measure stage

Measure	Measure Title	Success	Preparation	Implementation	Operation
Aalborg, 70	Congestion Monitoring Using Telematics	2	Political, Positional, Financial, Spatial,		Technological
Bath, 8.2	Innovative telematic	2			

	systems for traffic management and traveller services – Galileo Applications				
Bologna, 8,3	Cisium: New Traffic Control Centre	1	Technological	Technological	Technological
Bologna, 8,4	Mobile Gates to Control Reserved Bus Lanes (STOPPED)	0			
Bologna, 8,5	Stars: Automatic Enforcement of Traffic Lights	3	Involvement	Involvement	Involvement
Brescia, M05.02	Accident Risk Analysis and Development of a Road Safety Monitoring Centre in Brescia	2	Positional		Planning, Organizational
Coimbra, M08.03	Infomobility Tools for Traffic Data Management in Coimbra	1	Problem related	Technological	Financial
Funchal, 8,3	Urban Mobility Control and Monitoring Centre	2	Cultural, Political, Positional, Involvement,	Political, Involvement, Positional, Planning, Organizational	Organizational, Political, Planning,
Gdansk, 8,1	ITS Deployment	1	Organizational	Organizational	Organizational
Monza, 81	UTC System in Monza	3	Political, Cultural	Organizational, Problem related	Organizational
Perugia, 5.1	Road safety and security traffic control/monitoring system	-	Involvement	Positional	Organizational
Perugia, 8.1	The set up of a traffic monitoring control centre for public transport	-	Political, Organizational	Political, Organizational	Political, Organizational
Skopje, 8.3	Integrated traffic management in the central area of SKO	1	Political, Technological	Political, Technological, Financial	
Szszecinek, 8.5	Traffic surveillance at selected main road intersections	3	Positional, Political	Positional, Political	
Szszecinek, 8.6	Development of the monitoring system of the traffic speed at the pedestrian crossings close to schools	3	Involvement, Organizational		
Tallinn, 8,1	Bus Lane and Red Light Cameras	1	Problem related, Financial	Planning, Problem related	Technological, Other, Problem related,
Tallinn, 8,2	Traffic Monitoring	0	Technological	Planning, Technological	Technological
Usti Nad Labem, 26	Strategic Traffic Management	2	Technological	Other, Problem related, Institutional	
Utrecht, 8,1	Traffic Control Centre and Traffic Management	2		Technological, Organizational, Institutional, Political,	
Vitoria-Gastiez, M03.04	Traffic Light Regulation for the New PT Network and Superblocks Model in Vitoria-Gasteiz	1	Political, Institutional	Planning	Positional, Technological

3.4 SUB CLUSTER: PT PRIORITY

3.4.1 Barriers

The aims of this sub cluster were to develop priority lanes for public transport, design priority signals at intersections, implement travel information systems for public transport, and develop areas that enable cars and cyclist to share the space. At the preparation phase, the spatial barrier was mentioned for two of the five measures. Both the moderate successfully implemented measures (Iasi and Craiova) faced difficulties fitting priority lanes for public transport. At the implementation stage, technological barriers were mentioned most. In two of the five cases (Ljubljana and Iasi), the measures faced technological difficulties with the punctuality and synchronization of the traffic light system in order to create a green interval for PT buses. At the operational stage, three of the five measures faced barriers that were related to technical difficulties. For example, in Craiova construction work of the overpass led to the cancellation of two crossroads linked to the priority traffic light systems. This situation led to a shortening of the operational period.

Table 3.5: Measures and barriers per measure stage

Measure	Measure Title	Success	Preparation	Implementation	Operation
Craiova, M08.06	Priority Traffic Light Regulation for PT in Craiova	1	Institutional, Planning, Spatial		Problem related
Iasi, 14	Bus Priority Measures in Iasi	1	Spatial, Planning	Positional, Technological	Spatial
Ljubljana, 8,1	Public Transport priority at intersections	1	Organizational, Technological	Financial, Organizational	Problem related
Monza, 82	Public Transport Priority System	2	Problem related	Problem related	Problem related
Zagreb, 8,2	Public transport priority and traveller information	1	Planning, Involvement	Technological, Institutional	

Drivers

Political and organizational drivers were mentioned at two of the five measures in in the preparation stage of this sub cluster. The political driver in the case of Iasi was that the municipality of Iasi was highly committed to improving traffic flow in general and public transport in particular. However, this did result in an only modest successful measure. Ljubljana mentioned that the cooperation activities with other international projects and programs helped the project. This was based on a contract with partners from the CIVITAS Archimedes project (Monza). At the implementation stage, involvement and political aspects were mentioned for two of the five measures. In Zagreb, the presence of a 'local champion' was an important driver. Under the leadership and enthusiasm of the measure leader the measure went forward and new and innovative ideas were developed almost every day. In Ljubljana this involvement was also present, but on a broader scale as the City of Ljubljana was highly interested in the implementation of the system, as the CIVITAS project helped accelerate work in this field. At the operational stage, a small number of drivers were mentioned (political, institutional and technological).

Table 3.6: Measures and drivers per measure stage

Measure	Measure Title	Success	Preparation	Implementation	Operation
Craiova, M08.06	Priority Traffic Light Regulation for PT in Craiova	1	Positional, Involvement	Institutional, Positional	Institutional
Iasi, 14	Bus Priority Measures in Iasi	1	Political, Problem related	Other	Technological

Ljubljana, 8,1	Public Transport priority at intersections	1	Organizational	Planning, Involvement, Problem related, Political,	
Monza, 82	Public Transport Priority System	2	Political	Political	Political
Zagreb, 8,2	Public transport priority and traveller information	1	Organizational	Organizational, Involvement, Technological, Financial,	

3.5 SUB CLUSTER: SAFETY IMPROVEMENTS

3.5.1 Barriers

The wide variety of measures in this sub cluster include speed reductions, educational campaign and safety related services for residents, driver training to improve driving skills and evaluation of the existing infrastructural and non-infrastructural actions and situations to improve the safety. At the preparation stage, technological, planning, positional and other barriers were not important, but political and institutional barriers were faced 33% of all measures. Bologna (Urban Traffic Safety Plan), Donostia – San Sebastian, Usti Nad Labem and Brighton encountered a lack of political will, for example, because of the unpopularity of driver-restricting measures. In Donostia – San Sebastian this was also a cultural barrier. Negative reactions from drivers to car restrictions on use remain strong resulting in a public opposition to this kind of measures. Bologna faced a cultural barrier as well during the project. In order to reduce traffic and pollution around schools, sustainable alternatives were promoted including so called 'Pedi-bus': a walking school bus where groups of children accompanied by a few parents walk along fixed routes. There are several stops along the route where children can join the pedi-bus similar to a regular bus route. However, it became clear that it was very difficult to persuade parents and schools to allow children to go to and from school alone. Also, the Italian school regulations state that children must leave school with an identified/ known adult. The implementation stage showed a decrease in the number of barriers that are mentioned in comparison to the preparation stage. Organizational (33%) and involvement (both 25%) are the first and second most mentioned barrier at this stage. The operational stage shows an increase in cultural barrier, from 8% at the implementation stage to 25% at the operation stage. Institutional, problem related, involvement, organizational, financial and technological barriers were encountered in 17% of the measures.

Table 3.7: Measures and barriers per measure stage

Measure	Measure Title	Success	Preparation	Implementation	Operation
Aalborg, 42	Traffic Speed Reduction Zones in Aal	3	Planning	Planning	
Aalborg, 43	Provision for Soft Modes in Aal	2	Institutional		
Bologna, 5,1	Urban Traffic Safety Plan	3	Institutional, Political, Financial	Institutional, Political, Financial	Institutional, Political, Financial
Bologna, 5,2	Safer Road to School	1	Cultural, Institutional, Spatial	Cultural, Institutional, Spatial	Cultural, Institutional, Spatial
Brighton, 44	Road Safety Campaign in Brighton & Hove	1	Political	Political	

Coimbra, M05.07	Safety Oriented Driving Training in Coimbra	2	Technological, Financial	Technological	Problem related, Technological
Donostia - San Sebastian, 46+47	Safe districts and 30 kilometre zones	1	Political, Involvement, Cultural	Financial, Technological	Cultural
Ljubljana, 5,4	Safe routes to school	3	Involvement, Organizational, Spatial	Involvement, Organizational	Involvement, Planning, Organizational
Ljubljana, 5,5	Reduces speed zones	1	Institutional, Organizational	Spatial	Cultural
Perugia, 5.2	Assessing the options for more efficient road pavement markings	3		Other, Organizational	
Usti Nad Labem, 40 + 49	Drive Safely Campaign and Road Safety	3	Political, Problem related, Spatial	Organizational, Involvement	Technological
Utrecht, 5,1	Utrecht Road Safety Label	2	Involvement, Problem related, Organizational	Involvement, Problem related, Organizational	Financial, Involvement, Problem related, Organizational,

3.5.2 Drivers

For 67% of the measurers political aspects were mentioned as a driver. In Brighton, the measure was part of ‘Brighton & Hove’s Sustainable Urban Mobility Plan and had a stated priority of the city. In Bologna (Safer Road to School) it was mentioned because a constructive and open involvement of stakeholders and institutional partners was created which confirmed their partnership year after year. Their enthusiastic approach supported the implementation of the measure and thus resulted in a very successful implementation. At the implementation stage, organization related aspect were mentioned most as a driver (58%). In the case of Ljubljana (Safe Routes to School) the role of the ‘local champions’ proved to be significant in the organization of the outreach campaign and to establish the portal of safe routes. Organization aspects were mentioned most as a driver at the operation stage (42%). Involvement was mentioned in 25% of the measures. Donostia – San Sebastian, Ljubljana (Reduced speed zones) and Usti nad Labem both had high levels of public acceptance of the measures. This has acted as an important driver for the further development of the measure.

Table 3.8: Measures and drivers per measure stage

Measure	Measure Title	Success	Preparation	Implementation	Operation
Aalborg, 42	Traffic Speed Reduction Zones in Aal	3	Spatial, Political	Organizational	
Aalborg, 43	Provision for Soft Modes in Aal	2	Political, Involvement, Other	Other	
Bologna, 5,1	Urban Traffic Safety Plan	3	Organizational, Technological, Financial	Organizational, Technological, Financial	Organizational, Technological, Financial,
Bologna, 5,2	Safer Road to School	1	Organizational	Organizational	Organizational
Brighton, 44	Road Safety Campaign in Brighton & Hove	1	Political, Cultural	Planning	Planning
Coimbra, M05.07	Safety Oriented Driving Training in Coimbra	2	Technological, Financial	Involvement	Organizational, Technological
Donostia - San Sebastian,	Safe districts and 30 kilometre zones	1	Political, Spatial, Institutional	Financial	Involvement

46+47					
Ljubljana, 5,4	Safe routes to school	3	Positional, Organizational, Involvement	Positional, Organizational	Political, Positional, Organizational,
Ljubljana, 5,5	Reduces speed zones	1	Political, Organizational	Organizational, Spatial, Involvement	Cultural, Spatial
Perugia, 5.2	Assessing the options for more efficient road pavement markings	3	Political, Planning	Political, Institutional	
Usti Nad Labem, 40 + 49	Drive Safely Campaign and Road Safety	3	Political, Planning	Problem related, Organizational	Involvement
Utrecht, 5,1	Utrecht Road Safety Label	2	Organizational, Political, Involvement, Positional,	Organizational, Political, Involvement, Positional,	Organizational, Political, Involvement, Positional & Financial

3.4 OUTCOMES

- The number and frequency of drivers and barriers reduced from the preparation stage to the implementation and operation stages
- Public opinion and involvement may act as a strong barrier as well as a powerful driver. Donostia – San Sebastian stated the importance of providing clear information to the population to overcome negative reactions from drivers to car use restriction measures. Bologna faced public opposition partly caused by the local press that criticism of the STARS project. However, involving the public helped the measures, as in Bologna (Safer Road to School) where stakeholders took the role of 'local champions' and the enthusiastic approach strongly supported the implementation of the measure.
- Political aspects have the same character as public opinion aspects and acte as a strong barrier as well as a powerful driver, especially at the preparation stage.
- Organizational aspects were the main driver for Safety Improvements in traffic. Political aspects were important at the preparation stage, especially as a driver.
- Technological aspects were one of the main barriers to a successful implementation of public transport priority.
- Technological driven measures often faced technological barriers. This may expected because one of the innovative aspects was related to new technology in 62% of the measures in this cluster.

4. IMPACTS

A summary of the outputs and impacts of the Monitoring and Control measures is given in Table 4.1. The impacts are considered together under the main areas of economy, energy and environment, transport and society.

4.1 MONITORING AND CONTROL

Table 4.1: Achieved Impacts for Monitoring and Control Measures

City	No.	Economy Energy Environment	Transport	Society	Outputs	Comments
Aalborg	70	Estimated fuel consumption decreased by 2.45%, or equal to a 33,000 litres reduction per year on the section of the ring road	Travel time decreased by 25 seconds (8.5%) per trip on average in the peak periods; fuel consumption decreased by 2.45%;	Drivers used navigation units actively in more than 18% of the trips and that 15% of the drivers uses the units actively on 50% of the trip or more	A congestion monitoring system (with navigation unit) and an adaptive traffic signal control system were established	-Acceptance & route choice survey conducted among 100 drivers with GPS device installed, 42 answered the questionnaire. -Analysis on GPS data was repeated for 2 years covering 2 peak hours, free flow of a day in 4 seasons
Monza	81	Capital cost 56000€. Operating cost: 1440€ per year. Maintenance: 10 € per year before; 50€*8 intersections after; The benefit comes from the travel time saving. The total expected annual saving is 16000€.	Shorter traffic light cycle time (160” to 150” peak, 160” to 125” off-peak) with reduced waiting time for pedestrians and cyclists Estimated density reduced by 20%	N/A	An Urban Traffic Control (UTC) system was established	-The capital, operational and maintenance costs were calculated yearly. - The air quality measurement was performed once during the project. -Traffic condition data during peak & off-peak periods were collected twice, before and after the project.
Ústí nad Labem	26	No changes on total fuel consumption, CO and NOx emissions.	Significant improvements on congestion level (speed increased by 7.2% and 5.3% peak/offpeak) and per vehicle time consumption	N/A	Optimal traffic management solution was developed. Evaluation was carried out using microscopic simulation	-All the data was obtained from the micro-simulation model.

			(reduced by 55.4% and 51.9% peak/offpeak)		model	
Tallinn	8.1	N/A	Traffic regulation related infringements decreased significantly(Red light from 0.95% to 0.1%, PT lane from 7.95% to 2.2% of traffic);	Awareness level increased from 50% to 62%; Acceptance level decreased from 82% to 77%;	Two multi-function surveillance cameras were installed.	-The awareness & acceptance survey was based on general MIMOSA before-phone survey in Nov.2009 (n=1014) and after-survey in Sep. 2012 (n=1000) -Drivers' traffic behaviour was evaluated by video surveillance cameras on two days before and after the measurements. 53932 vehicles were counted in total.
Funchal	8.3	N/A	N/A The majority of indicators that were considered were removed, since they would not contribute to assess the observatory in a proper way.	Percentage of people that considers the observatory useful slightly decreased from 84.1% to 82.4%.	A Mobility Observatory was established as a tool for monitoring and managing mobility issues.	-An acceptance survey was conducted in 2010 (n=679) and 2011(n=584) by random process and mostly face-to-face pattern. -5 interviews with experts and stakeholders were performed to evaluate acceptance.
Bologna	8.3	The capital cost of 775000€ consists of the expenses on the centralization of traffic lights (175000€) and the establishment of the traffic control centre (600000€). The total amount of operating cost is 143.044€, in which the personnel cost	Improvement in traffic conditions caused by interventions; PT time keeping improved (Advance increased by 3.17%, punctual decreased by 1.06% and delay decreased by 2.64%). Traffic delay at high volume	N/A	Real-time traffic information channels were established;	-An accuracy of timekeeping survey was performed in 2008, 2009, 2010, and 2011. In 2008, 53 bus routes were observed and 45.8% of the 192,698 scheduled journeys were monitored. -Delay time

		and software maintenance cost occupied the largest share 92%.	decreased.			was observed by on road sensors.
Bologna	8.5	N/A	Accidents reduced by 21%; injuries reduced by 28%	Number of fines increased by 89% for all crossings and 343% for Mimosa crossings.	The Automatic Enforcement of Traffic Lights system was enhanced.	-The acceptance and transport safety related data were obtained from municipal police.
Tallinn	8.2	N/A	Potential transport impact was measured indirectly, using web page visits and mobile application downloads. Modest use of the public traffic monitoring web page (about 2000 per month); Low usage of public traffic monitoring mobile applications (about 15 downloads per month)	High acceptance to the counting system from traffic experts (average 4.8 at a scale of 5);	A traffic counting network was established.	-The acceptance of the monitoring system survey was among 14 traffic experts, 8 answered the questionnaire. -The awareness of the traffic monitoring web page was based on Webalizer web statistics service.
Utrecht	8.1	The impact evaluation is not applicable.	N/A	N/A	A permanent regional traffic centre was set up, including the capabilities of data collection, monitoring, traffic management, incident management, etc.	N/A
Gdańsk	8.1	N/A	N/A	N/A	Tow locations were selected and a concept of comprehensive ITS system supporting transport management was elaborated.	N/A
Bologna	8.4	N/A	N/A	N/A	None	The project was stopped due to the legal issue.
Vitoria-Gasteiz	M03. 04	The investment of the measure is 331.200,00 €. Due to the improvements of the traffic conditions, during	Average speed increased by 0.96km/h(2%)	An acceptance level is 5.72(in 0-10 scale),which is relatively low.	It was designed a new traffic light regulation over 230 intersection regulators in Vitoria-Gasteiz.	-The air quality and traffic condition related data were obtained from a simulation

		the year, 817.562 hours are saved by the citizens, that is, 12.180.835.80 € in terms of journey time savings; Besides, in terms of social benefit, 2.423 tonnes of CO_2 and 8 tonnes of NOx are saved in the whole city. In terms of money, it is 438.377,89 € of public benefit after 10 years.				model. -An acceptance survey was performed among 400 randomly selected people by telephone.
Coimbra	M08. 03	Capital cost: 241542€, mainly comes from the installation of operating support system and passenger information system. Average operating cost: decrease from 2.41€ /veh-km(2007) to 2.59€/ veh-km (2008), included vehicle operating cost and the device operating cost. Average operating revenue: Increased from 1.35€/veh-km(2007) to 1.4€/veh-km (2008).	Percentage of lost trips due to traffic problems is about the same; average network speed increased by 0.3km/h (1.4%); number of failures of the GPS / GPRS Operation Support System (PT Service quality) decreased by 23%.	Increase awareness level by 34%.	125 GPS/GPRS Operation Support System were installed on buses and 12 existing real time passenger information panels were renewed, and 6 new generation real time passenger information panels were installed.	- The cost and vehicle speed data was collected from GPS/GPRS Operation Support System.
Brescia	M05. 02	N/A	The enhancement of the road accident reporting activity; the constant updating and mapping of the road accident database was achieved. Death index reduced by 0.85%;	Awareness of Civitas is low at 9.7% only	A road safety monitoring centre and an Urban Plan (PSSU) were established.	-All transport safety data was collected from Local Police and a Regional database. -A road safety perception was performed (600 filled in questionnaires , significance level >90%)
Bath	8.2	The operational costs in this measure comes from the usage of GPRS service of the devices installed on the	The EGNOS augmentation of GPS did not show significant measurable improvements in positional	Acceptance by customer increased from 46% to 54%. Acceptance in terms of operator	The feasibility of utilizing a dual mode GPS and Galileo was tested.	-As a partner of the measure, ACIS was responsible for data collections.

		vehicle to communicate with the control centre. The service fee is £7per calendar month per vehicle.	accuracy.	availability of data is high at 90%.		
Perugia	5.1	No data available	No data available	No data available	No data available	N/A
Perugia	8.1	Fuel consumption after the implementation of the AVM system on the PT fleet and priority system reduced from 1.99 Km/l to 2.17 Km/l (8.7%); .	PT service reliability (average delay of PT -23%) in all AVM measurement points; PT quality of service (+0.2 score in respect of scheduled time); PT mean local travel time decreased by about 4%; Average queue length in intersections reduced up to 35%;	Lack of awareness is obivious, with only awareness less than 25% for all age groups.	An Urban Traffic Control (UTC) system that controls some of the city intersections and an AVM (Automatic Vehicle Monitoring) system that will allowed the implementation of traveller information and public transport (PT) service management were implemented.	-Face-to-face questionnaire and focus groups surveys were performed to collect awareness and service quality data in 2009, 2011, and 2012. -
Skopje	8.3		The measure was delayed and results could not be obtained.		Modernization of traffic signals including the creation of a city Traffic Control Centre and implementation of centralized Traffic Management System to coordinate signalized intersections and pedestrian crossings.	N/A
Szczecinek	8.5	The capital cost for the traffic surveillance system is 64979€. After the installation of the system, the annual operating costs in 2010 and 2011 is 8726.02€ and 13621.11€ respectively. The average annual cost for the year 2010 and 2011 is 11173.57€.	Number of transport accidents for 11 intersections decreased significantly from 27 to 8, average time for a patrol police to arrive decreased from 16 to 5 minutes.	Society acceptance increased by 13.4% to 84.5%; the perception of security at locations covered by monitoring increased by 14.5% t0 46.4%.	11 cameras were installed at hazardous locations; Monitoring Centre was created;	-A face-to-face survey was conducted to collect acceptance and security perception data (350 respondents) -Transport Safety related data was obtained from local police.
Szczecinek	8.6	The development of the two monitoring system for two selected pedestrian	The number of drivers exceeding the speed limit has dropped during peak hours	10% increase in society acceptance to 84.7%;	3 dialogue displays installed at 2 pedestrian crossings close	-A face-to-face survey was conducted to collect acceptance

		crossings cost 17610.05€ (capital cost); The average operating costs is 139.53€/year. The benefits of the measure including increase in society acceptance for pedestrian crossings close to schools; Increase in traffic security close to schools	as well as off-peak hours respectively by 20.5% and 24.5%;		to schools	and security perception data (350 respondents); --Transport Safety related data was obtained from local police.

Most of the traffic management and control measures were designed to improve traffic operations, transport service and safety. Therefore a key aspect in the evaluation was to determine the extent to which traffic management and control measures have changed transport operations, services and safety. A wide range of indicators have been used depending on the type of implementation and measure objectives. In a number of measures, impacts in peak and off-peak periods were assessed separately

The measures in the “Monitoring and Control” section focused on the installation of traffic monitoring devices and implementations of traffic control system to inter-connect those devices to optimize traffic condition. The popular indicators selected by the measures in this category included “Average Vehicle Speed”, “Number of Accidents & Injuries”, “Service Reliability”. Figure 8 depicts Achievements in increases in traffic speed are shown n Figure 8. The development of an optimal traffic management strategy with ITS technologies in “Strategic Traffic Management(26) was seen to the most effective in increasing vehicle speeds. In comparison with the combination of the strategies in measure 26, the transport impact of a single implementation of informobility tools in Coimbra (M08.03) was much more limited.

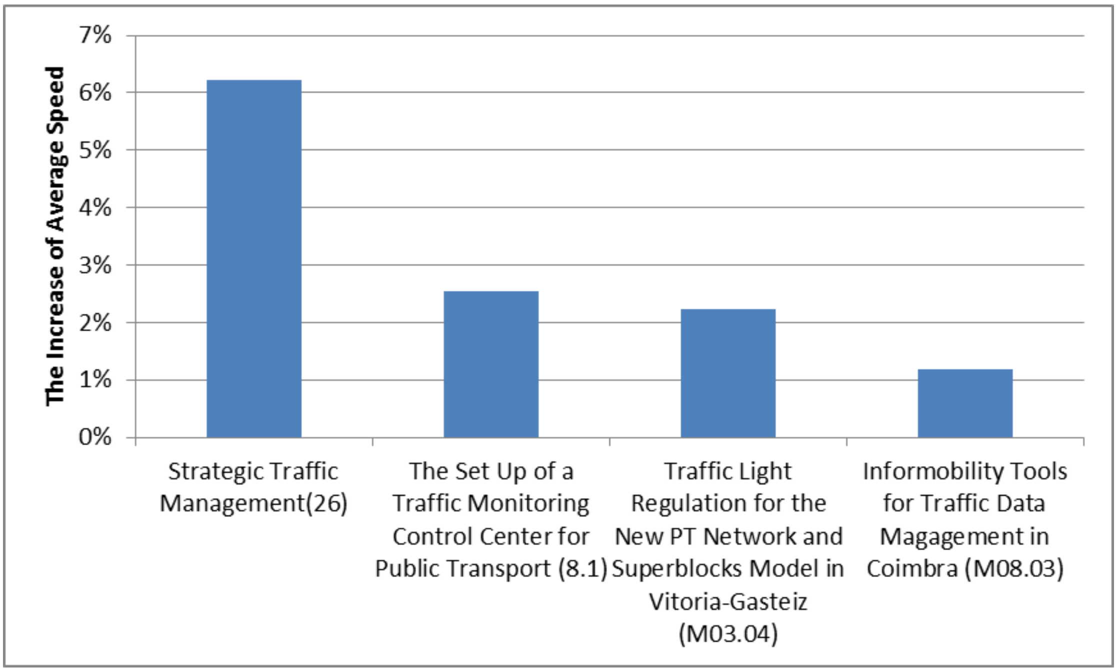


Figure 8. The improvements in Average Vehicle Speed.

Impacts on the transport safety are shown in Figure 9. Different context conditions result in different outputs for similar types of implementation. The surveillance system installed in Szczecinek contributed to the 70% decrease in traffic accidents, while the automatic enforcement of Traffic Lights in Bologna only accidents reduced by 20%. The installation of the monitoring system at the pedestrian crossings close to schools can be identified as another effective way to reduce the traffic accidents.

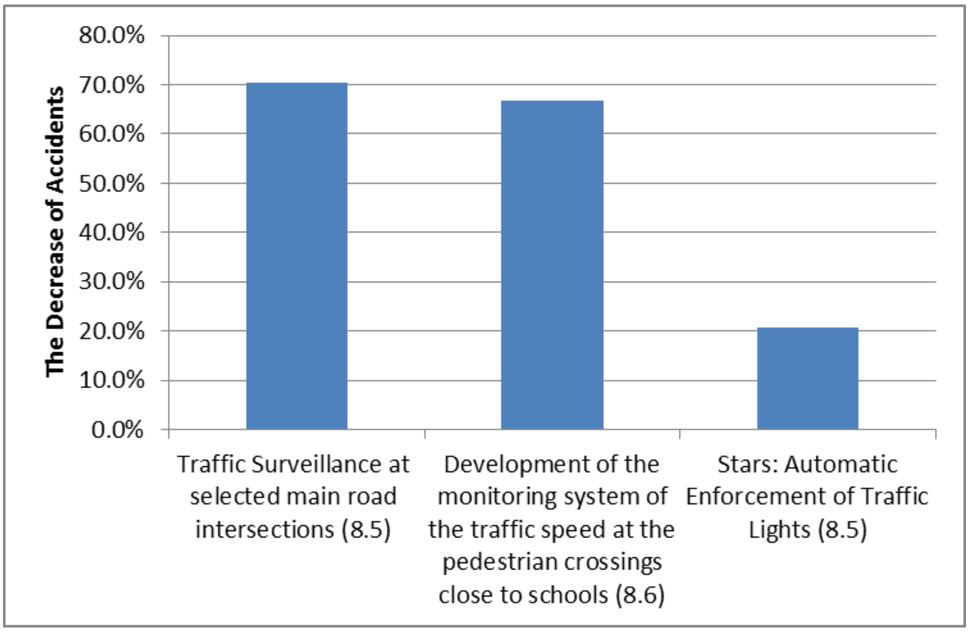


Figure 9. The improvements in transport safety.

4.2 PUBLIC TRANSPORT PRIORITY

A summary of the outputs and impacts of the Public Transport Priority measures is given in Table 4.2.

Table 4.2: Achieved Impacts for Public Transport Priority Measures

City	No.	Economy Energy Environment	Transport	Society	Comments
Iasi	**14**	Capital cost of the measure is 55439€; maintenance cost 1980€ per year	Accuracy of time keeping increased by 10% to 88%. Quality of service in terms of positive feedbacks increased by 9% to 45%; Average vehicle speed increased by almost 6% and 8% in peak and off-peak.	N/A	-Face-to-face interviews were carried on before and after the measurement in 2009, 2010 and 2011. (100 people were interviewed each yr) to evaluate the quality of service.
Monza	**82**	N/A	Due to the congestion, travel time reduction hasn't been	Awareness of PT priority is very low at 6.4%; 69.1%	-Interviews at bus stops were carried out to collect user

			achieved (0%).	think PT priority is very useful	acceptance and service quality data before and after the measurement. (240 people in 2011; 236 people in 2012)
Ljubljana	**8.1**	Due to the inappropriate selection of a sample, the results on fuel consumption are not comparable.	High level of punctuality/success of traffic light triggering, 95% and 96.2% respectively for arrival and departure triggering; increased percentage of buses arriving on time; small reduction of travel times (53 seconds in average) and very minor change in travel speed (-0.2%);	N/A	-15 equipped intersections were selected to test success of traffic light triggering.
Zagreb	**8.2**	N/A	Average vehicle operation time was decreased by 6.46%; Operating speed increased by 6.9%; Cumulative running time is decreased by 7.3%; Cumulative intersection delay in the whole Savska Street is decreased by 7.84%; Delay on Deželićeva intersection was reduced by 84%; Average number of vehicle/h is decreased by 1.86%.	Satisfaction with information increased slightly from 70.5% to 70.9, 'very satisfied' rate increased much more from 6.25% to 11.44%.	-A satisfaction survey was performed. (225 filled out the survey in 2009 and 402 in 2011)
Craiova	**M08.06**	Capitcal cost is 7200€	An increase of tram's speed in peak and off-peak, by 14 % and 13 % respectively; a shortening of travel time for public transport users; Average occupancy increased by 1 % in peak and 7 % in off-peak.	N/A	-The ave. occupancy rate in peak/off-peak hour was collected by 2 people by empirical counting of passengers twice a week.

The measures to improve level of service of public transport, are included in the category of "Public Transport Priority". The major indicators used in this group were "Accuracy of timekeeping", and "Average Vehicle Speed". Improvements in timekeeping accuracy after implementing measures are shown in Figure 10. Although the city of Iasi (14) implemented both an exclusive bus lane and bus priority signals, better results were obtained in Ljubljana

(8.1) with a PT priority system on the buses instead of installing radar detectors at intersections.

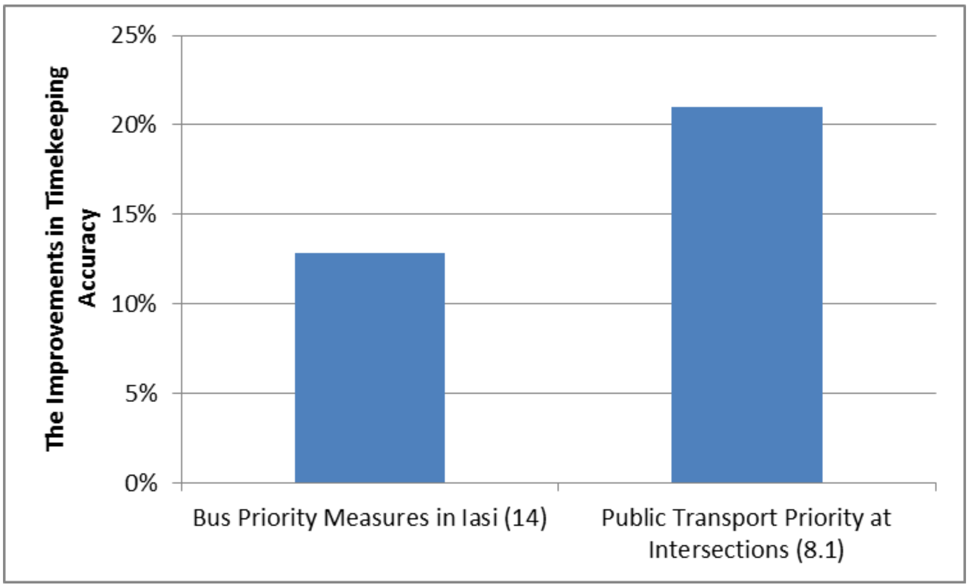


Figure 10. The Improvements in Accuracy of timekeeping.

Improvements in average vehicle speed also varied between the similar implementations (Figure 11). The measure in the city of Craiova (M08.06) achieved the best performance of a 14% increase in speed, although similar applications in Ljubljana resulted in only 2% change.

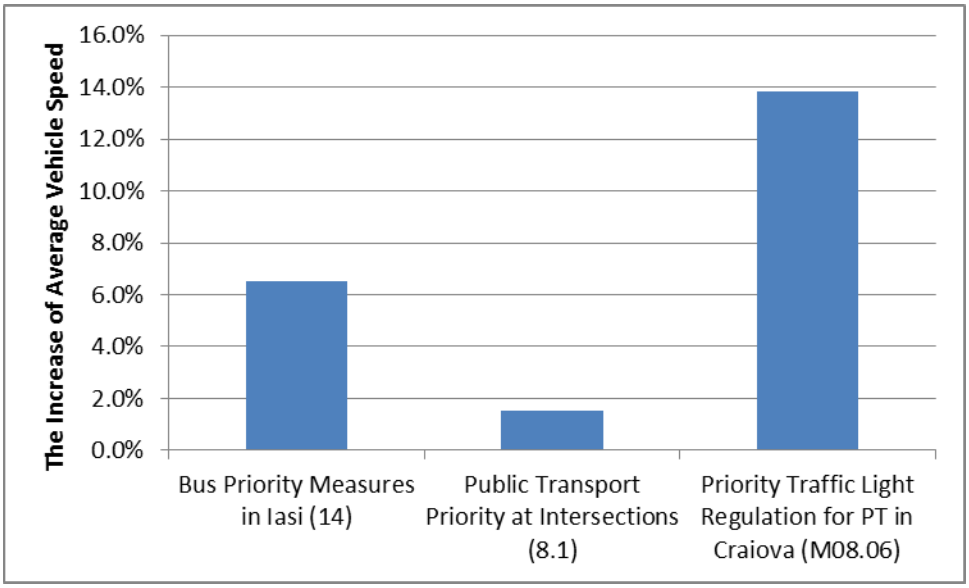


Figure 11. The Improvements in Average Vehicle Speed.

It can be seen from the evaluation results that the establishment of a traffic monitoring control center is effective in improving the service reliability of public transport, as shown in Figure12. The sole application of a vehicle tracking system (8.2) is less effective in comparison to the monitoring control center (8.1).

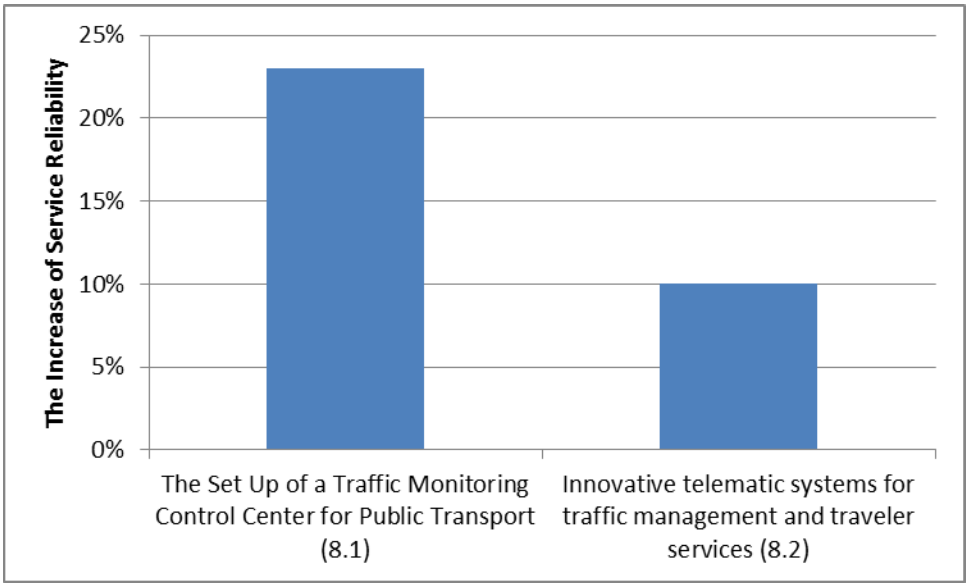


Figure 12. The Improvements in Service Reliability.

4.3 SAFETY IMPROVEMENTS

A summary of the outputs and impacts of the Safety Improvements measures is given in Table 4.3.

Table 4.3: Achieved Impacts for Safety Improvements Measures

City	No.	Economy Energy Environment	Transport	Society	Comments
Aalborg	***43***	N/A	Speed levels lowered in 7 out of 10 measured roads within the five zones. Speed level increased only minimally on 3 roads;	People feeling uncomfortable with letting their children walk alone in the street decreased from 56% to 43%; people who were comfortable with letting their children travel in the traffic increased by 13%;the share of people who felt discomfort with letting their children travel in the local area decreased by 16%. Awareness and acceptance decreased by 3% and 6%; respondents experienced the general road	-For collection of awareness, acceptance and safety perception data, survey letters with survey link were distributed to 3000+ residents with 12%questionnaire response. - Automatic speed measurements through spools and car counts were conducted in 2009 and 2010.

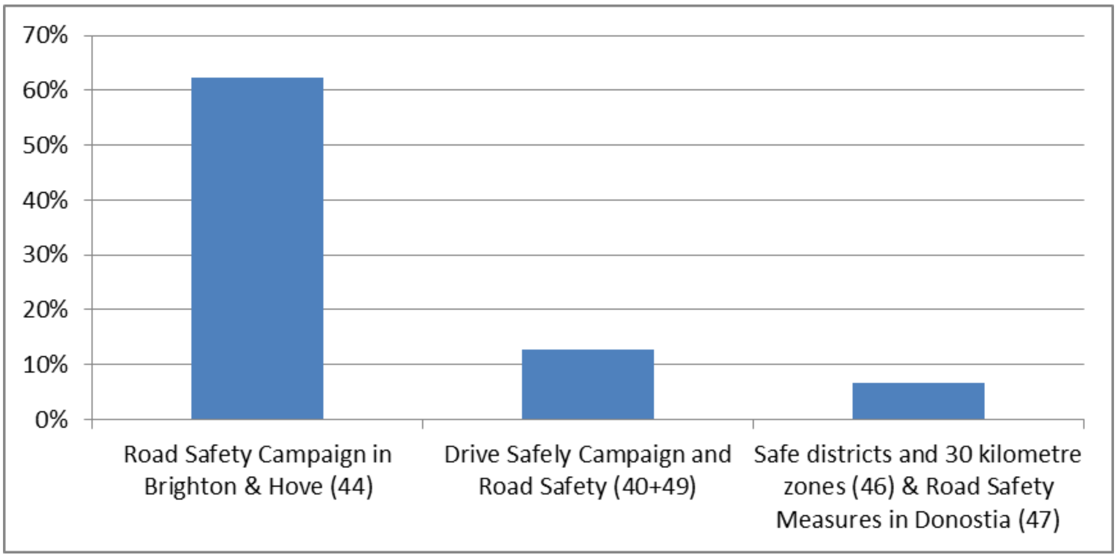
				safety in the local area as unsafe decreased by 7%	
Aalborg	**42**	N/A	The number of accidents decreased and a positive effect on the safety was observed despite the uncertainties related with such a relative short after period; The number of vehicles at the street has increased by 13%; the average speed level in the area has decreased by 3,1 km/h; the number of cyclists decreased by 44%;	82% are satisfied or very satisfied with the area; 80% respondents regarded initiative safe for pedestrians while 44 % regarded it as rather unsafe for cyclists	-An acceptance and safety & accessibility perception survey was performed in 2012, 239 people were interviewed by paper questionnaires. -Automatic traffic counts were implemented to collect peak& off-peak traffic flow data in 2010, 2011, 2012.
Brighton & Hove	**44**	N/A	Accidents decreased significantly from 60 to 15; casualties decreased from 45 to 17;	People's perception of safety decreased from 75% to 63%;	-On-street questionnaire survey to evaluate awareness level(n=50). -Observation monitoring survey to observe the crossing behaviour (n=250).
Donostia–San Sebastián	**46+47**	N/A	56% reduction in the overall number of deaths and severe injured people caused by traffic accidents and the decrease in average traffic speeds by 4.39km/h on average;	Awareness level decrease by 6.36%; Acceptance level(30-km-zones) decrease by 7.24%; Acceptance level(Radar system) increase by18.72%, population's perceived security has increased; the perception of security has also increased;	-On-street personal interviews were carried out to collect awareness and acceptance data before and after the implementation (n=400).
Ústí nad Labem	**40 + 49**	Life time cost (2011 – 2025) is 1888211 € and 571200 € respectively for operating and capital costs	Number of fatalities in 2011 was about 25% higher than in 2009, the number of serious injuries decreased by	Obedience of speed limit increased from 94.74% to 100%; Awareness	-A before-and-after survey on awareness was conducted. (137 respondents in 2010;142 in

			3,57 %, number of light injuries by 14,41 %; Significant potential for improvements of safety level, large amount of safety deficits was identified; campaign activities raised awareness about road safety issues; traffic training of children became regular part of education of all primary children	level increased from 86.2% to 90.2%; acceptance level is 50.3%.	2011). -Safety related data was obtained from official police records.
Ljubljana	**5.4**	N/A	Number of injured/dead pupils increased; A significant decrease in the average speed of 1-20%;	The acceptance of the "hard" safety measures by the parents is ranging from 59-65,6%; Acceptance of the safety measures has increased by 9,4% to 23,4%; the acceptance of the soft measures undertaken by the school/municipality has reduced in a range from 10-31%.	-Acceptance of stakeholders face-to-face interviews were performed after the implementation. (195 responses) -Traffic speed and violations were monitored at 10 selected locations by radar control system in 2009 and 2011.
Ljubljana	**5.5**	N/A	Improved transport safety ; decrease of the average driving speed; increase in effective sanctioning of traffic violations; improved quality of urban space;	N/A	
Bologna	**5.1**	N/A	46% reduction in accidents at crossings with traffic islands and a 34% reduction in accidents at crossings equipped with traffic lights; 21.1% fewer accidents; a 26% reduction in recorded flows.	N/A	-The average speed and flows data was collected over a 3-day period on week days to reduce errors. -Safety related data came from Municipal Police.
Bologna	**5.2**	N/A	28% more students involved in the co-operation process; increase in students who said they would not drink and drive; more than 20% of	Number of schools involved increased by 150%, number of students involved	-The sample of the awareness level of students was not extracted with a scientific method.

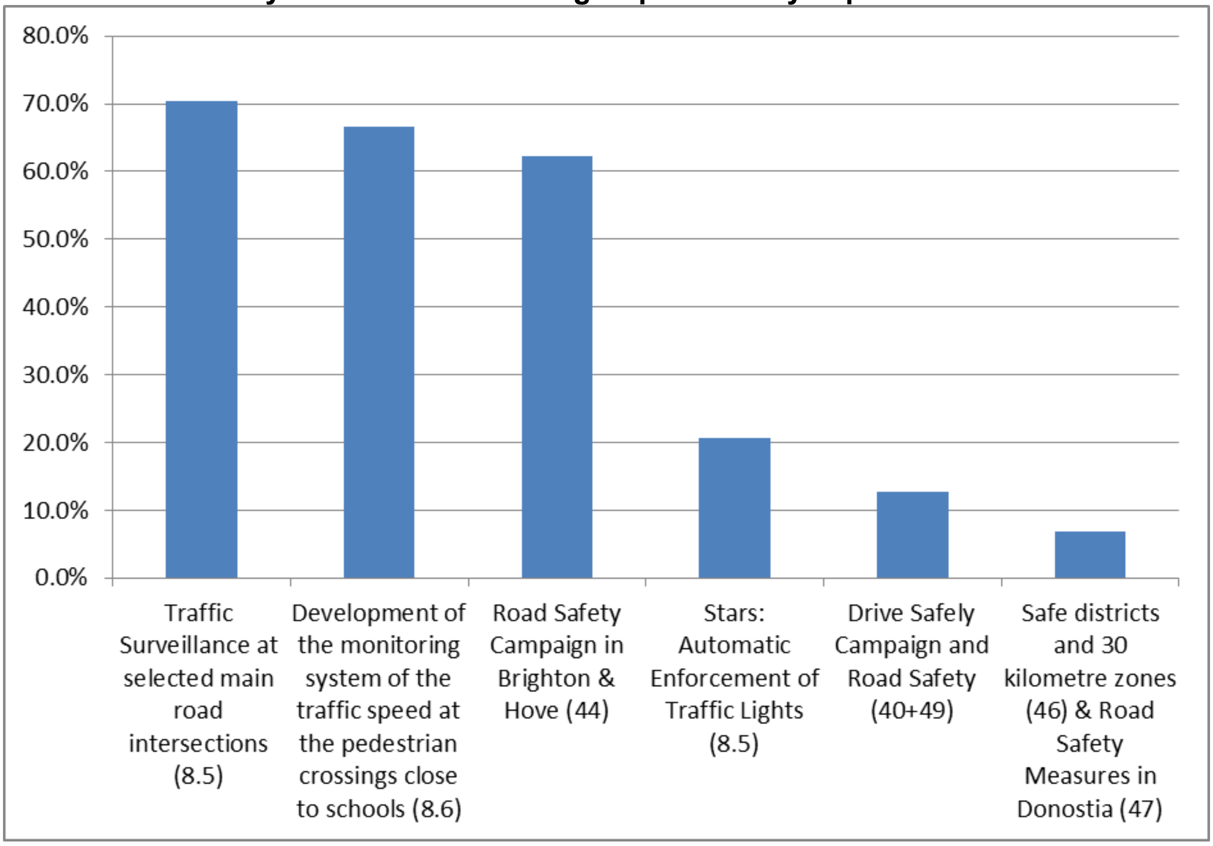
			the total students enrolled in the eight elementary schools participated in the 'Pedi-bus'. 21.1% fewer accidents;	increased by 28%; awareness level in terms of incorrect behaviours of students is reduced generally	-All the surveys were conducted among participated schools and students.
Utrecht	**5.1**	N/A	54 out of 70 primary schools received school zone; car usage on two of the three URSL schools decreased, whereas it increased on the non-URSL school.	By October 2012, 38 primary schools received the label whereas another 32 schools were actively working on meeting the criteria ; satisfaction about the road safety among school children, parents and teachers increased by 7-15%;	-The modal split survey was carried out among 4 schools with the response rate from 8%-36% from parents in 2010 and 12%-66% from parents in 2012. In both surveys, response rates from children are 100%. -The number of respondents from teachers for the two road safety satisfaction surveys is 34 and 28.
Coimbra	**M05.07**	The average operating costs decreased about 15%, from 3,41 €/vkm to 2,90 €/vkm; a substantial improvement of the average fuel efficiency(15% reduction); reductions in the average emissions per vehicle-km between 19% and 93%	Quality of driving maintained the same, accident risk decreased by 33%; reduction of the total	The awareness level of the drivers increased about 8%; acceptance level of the drivers increased about 3%	-The cost, fuel consumption, service quality, transport safety and emission data was obtained from Municipal Public Transportation Services of Coimbra.
Perugia	**5.2**	N/A	CIS-Q (Civitas Indicator for Stripes – Quality), score (from 0 to 10) to the road marking decreased from 6.6 in 2010 to 4.9 in 2012; Some best practices introduced in the management of road marking:	N/A	-A methodology is designed to be a tool for public administrations to monitor the quality of road markings and reduce the costs through an optimized management of road marking maintenance.

Overall, there is a lack of analysis of the on economic, energy and environment impacts of the measures in this sub-cluster. This may be a result of the nature of measures, because in most cases, no direct revenues were generated from safety improvement measures. However, cost and environmental impacts are important for safety measures, especially when physical implementation of bumps, narrowing etc. may have implications for fuel consumption and emission of traffic, and should be considered in the evaluation.

Safety improvements in the category of “Safety Improvements” are summarized in Figure 13A. According to the results, it is clear that in comparison to the development of a safe district, the most effective method of reducing accidents in an area is to carry out a safety campaign. However, if all the measures are taken into account, the traffic surveillance system is more efficient (Figure 13B).



A. Only the measures in the group of "Safety Improvements".



B. All traffic management and control measures.
Figure 13. The Improvements in transport accident reduction

4.4 OUTCOMES

- A wide range of impacts could result from traffic management and control measures. As specific measures may be designed and implemented to address particular problems, evaluation of unique impacts relevant to particular measures could provide insights into the intended effects of such measure implementations

- For almost all measures, positive results have been generally achieved according to a wide range of indicators selected. While a few key indicators such as travel time, and accidents have been used for the majority of measures, some unique indicators relevant to particular measures, such as recorded flow, operating speed, provided insights into the intended effects of such measures.
- A number of transport monitoring and control measures, such as UTC systems, can effectively improve transport performance, including reduced travel time, accidents, and fuel consumption. However, because of the diversity of cities, public transport measures have to be adapted to existing conditions.
- Public Transport Priority measures improve the efficiency of transportation system and the Public Transport is more effective, when its information is given to travellers.
- Safety and performance improvements can be best achieved by a combination of measures to improve the traffic monitoring and public awareness of PT.
- Functional Transport Infrastructure, including road markings, plays an important role, as does effective traffic regulation, in improving safety for the pedestrians, especially school children.
- The impacts of the most measures on all categories of indicators such as transport efficiency, fuel consumption reduction, transport safety and society awareness, measured by observations and/or questionnaires were generally positive.
- Each Traffic Management and Control measure was focused on one or more specific traffic information and control services such as traffic surveillance, traffic light control, public transport priority and public safety awareness. When combined, a comprehensive traffic management and control system can be developed. Therefore, it is important to integrate measure implementations.
- Energy and environment impacts were only evaluated for a small number of measures. The analysis of energy impacts was mostly based on fuel consumption. Fuel savings achieved varied dramatically from 0% to 67%. The application of strategic traffic management in the city of Ústí nad Labem only brought quite small fuel consumption savings (less than 1%), which can be ignored if the uncertainty of the calculation is considered. Driver training achieved very significant energy consumption per vkm, which is a combined result for switching fuel from diesel to electricity and use of eco-driving principals. It should be noted that the PT priority measure in Ljubljana involved a major error in data collection and the results are indicative rather than conclusive. Analysis on the environmental impacts was mostly based on the indicator of emissions. Emission reductions achieved from three traffic management measures varied from 0% to 90% reductions in CO emission. The introduction of simulators for driver training is a very effective way to reduce both the fuel consumption and pollutant emissions (Coimbra).
- Use of Information Technology is effective to support transport monitoring and control, such as adaptive traffic signal control, PT priority control at signalised intersections, and dynamic traffic information displays. The provision of priority to public transport vehicles was effective in reducing journey times and improving reliability.

5. UPSCALING AND TRANSFERABILITY

5.1 INTRODUCTION

Up-scaling refers to the potential for a measure (or group of measures) to be expanded more widely across a city. Several factors need to be considered for up-scaling. For example, there are likely to be geographical/location constraints and perhaps capacity limitations. In addition, a measure considered to be practically possible may well be affected by politically acceptability. In the CIVITAS evaluation, all cities were encouraged to assess upscaling taking the above factors into consideration.

A main objective of the transferability analysis was to assess whether the success of measures in a city were dependent on any particular conditions, and whether the success achieved and the lessons learnt in one city can be transferred to other cities. Successful implementation of a measure or a package of measures in a given city should provide ground for transferring the experience to other cities, if the right conditions are met. Transferability addresses the possibility of transferring/adopting successful measures to a given city.

5.2 UP SCALING

Monitoring and control

Upscaling for traffic monitoring and control measures is not always feasible and necessary. Extensions in area coverage are possible for measures which have been applied at only limited locations

Table 5.1 Upscaling possibilities

City	Measure	Up-scaling
Aalborg	Congestion Monitoring Using Telematics(70)	Due to the uncertainty of effect, extend to the entire city area is not appropriate.
Monza	UTC System in Monza(81)	Can be up-scaled and extended to intersections under the control of the UTC system.
Ústí nad Labem	Strategic Traffic Management(26)	Not required but feasible on utilization of modern technologies.
Tallinn	Bus Lane and Red Light Cameras(8.1)	Not suitable for up-scaling due to the un-solved obstacles.
Funchal	Urban Mobility Control and Monitoring centre(8.3)	No up-scaling considered because of the lack of data and delays.
Bologna	Cisium: New Traffic Control centre(8.3)	More monitoring resources required but with risks of side effects on private traffic.
Bologna	Stars: Automatic Enforcement of Traffic Lights(8.5)	Up-scaling may not necessarily improve safety and may have problems regarding the acceptance.
Tallinn	Traffic Monitoring(8.2)	The up-scaling has been considered.
Utrecht	Traffic Control centre and Traffic Management(8.1)	N/A
Gdańsk	ITS Deployment(8.1)	N/A
Bologna	Mobile Gates to Control Reserved Bus Lanes (STOPPED)(8.4)	N/A

Vitoria-Gasteiz	Traffic Light Regulation for the New PT Network and Superblocks Model in Vitoria-Gasteiz(M03.04)	Has been implemented in the whole city.
Coimbra	Infomobility Tools for Traffic Data Management in Coimbra(M08.03)	Has been implemented in the whole city.
Brescia	Accident Risk Analysis and Development of a Road Safety Monitoring centre in Brescia(M05.02)	Has been implemented in the whole urban area.
Bath	Innovative telematic systems for traffic management and traveller services – Galileo Applications(8.2)	Scalability has been proved and up-scaling has been put in the queue for consideration.
Per	Road safety and security traffic control/monitoring system(5.1)	No results obtained
Per	The set-up of a traffic monitoring control centre for public transport(8.1)	Will be extended to the full urban network and to the full fleet in the future.
Skopje	Integrated traffic management in the central area of SKO(8.3)	N/A
Szczecinek	Traffic surveillance at selected main road intersections(8.5)	The system has been extended.
Szczecinek	Development of the monitoring system of the traffic speed at the pedestrian crossings close to schools(8.6)	High acceptance from residents for up-scaling

Public transport measures

Upscaling for public transport priority measures can be considered and looks promising, However, specific traffic conditions and infrastructure ina proposed extension area, together with other context factors need to be considered. Upscaling is not feasible for tailored solutions.

Table 5.2 Upscaling possibilities

City	Measure	Up-scaling
Iasi	Bus Priority Measures in Iasi(14)	An expansion of the measure has been planned.
Monza	Public Transport Priority System(82)	A better understanding of the impacts of the measure could be obtained with expansion.
Ljubljana	Public Transport priority at intersections(8.1)	The up-scaling of the measure is expected.
Zagreb	Public transport priority and traveller information(8.2)	Simulation results show that considerable improvements could be achieved by up-scaling.
Craiova	Priority Traffic Light Regulation for PT in Craiova(M08.06)	The up-scaling is in consideration.

Safety Improvement measures

Upscaling is possible for safety education measures. However, corridor or area extensions for speed reduction measures need to take existing traffic conditions and other limitations into account

Table 5.3 Upscaling possibilities

City	Measure	Up-scaling
Aalborg	*Traffic Speed Reduction Zones in Aal(43)*	The intrinsic characteristics restrict its up-scaling.
Aalborg	Provision for Soft Modes in Aal(42)	The proposed solution is tailored to the specific problem, not available to be up-scaled.
Brighton & Hove	Road Safety Campaign in Brighton & Hove(44)	A performance evaluation of the measure needs to be finished firstly.
Donostia–San Sebastián	Safe districts and 30 kilometre zones (46)	No specific problems reported
Donostia–San Sebastián	Road Safety Measures in Donostia(47)	No specific problems reported
Ústí nad Labem	Drive Safety Campaign and Road Safety(40 + 49)	Locations where traffic accidents occur are suitable for up-scaling.
Ljubljana	Safe routes to school(5.4)	All schools participated, no up-scaling needed.
Ljubljana	Reduces speed zones(5.5)	Up-scaling has been planned.
Bologna	Urban Traffic Safety Plan(5.1)	Applied in the entire city, up-scaling is not possible.
Bologna	Safer Road to School(5.2)	Re-arranging children's and parents' journeys using a general plan need to be considered in up-scaling.
Utrecht	Utrecht Road Safety Label (5.1)	An up-scale was already accomplished.
Coimbra	Safety Oriented Driving Training in Coimbra(M05.07)	An assessment estimation of the impact of up-scaling is positive.
Perugia	Assessing the options for more efficient road pavement markings(5.2)	Measurements are evaluated in different conditions to guarantee upscaling through the whole city.

5.3 TRANSFERABILITY

One of the goals of the process evaluation was developing specific recommendations on the transferability potential of a measure to other cities and on recommendations to improve the processes around the measures. From the results it has to be concluded that both types of recommendations overlapped. Thus, recommendations are mostly on how the measure process could be better organized in other cities, i.e. the recommendations on transferability became warnings for pitfalls, often related to the barriers and drivers.

A simplified overview of the recommendations as mentioned by the measures is shown in Annex 4. It can be seen that recommendations on transferability and process overlap as well as related factors such as target group approach, raising awareness, involvement of and cooperation with stakeholders.

The above issues are the main prerequisites for transferability of the measures. For the various sub clusters there are specific topics on transferability and / or process improvement:

- **Monitoring and control.** There is a transferability potential of this kind of measures. However, to a large extent it depends on local / national circumstances. One relats to juridical aspects, such as privacy legislation regarding the use of cameras and data. The European legislation has to be taken in account at this point. Secondly, the well-functioning of the technical applications plays an important role and experienced companies have to take part in the work
- **Public Transport Priority.** The transferability potential of the measures is limited as where extra space for lanes is required. For various reasons many cities will lack the space and or there are institutional and planning regulations barriers to create the space. The transferability potential is larger n case of more technical solutions like synchronization of traffic lights. However, again the quality of the technical applications plays an important role and the involvement of experienced companies is essential. Above all, it must be realized that giving priority to public transport is often not a popular measure, so political will and power is essential.
- **Safety improvements.** Measures aimed at improving safety are generally readillywell transferable. However, there may always be a strong opposition to measures with speed restriction goals. Thus, involvement, communication about ‘speed and danger’ and the use of ‘local champions’ are very important. Measures on driving and /or safety courses have a large transferability potential, although they need to be very target group specific.

6. RECOMMENDATIONS

The assessment of the traffic management and control measures vary in both scope of impacts and the effectiveness of the measures based on the selected indicators. This reflects the complex interactions between the measures and the transport context in the CIVITAS city. Therefore, for successful implementation of those traffic management and control measures, integration with existing infrastructure systems, services and policy in the city needs to be properly considered. Based on the implementation results of the 38 measures in this cluster, it is recommended that:

- The real-time information that drivers can receive, such as speed monitoring alerting, public transit message, young pedestrian crossing, etc, could have substantial impacts on their behaviour. Therefore, delivering the dynamic traffic message to the drivers by LED display or other means should be considered at the top of the traffic monitoring and control measures.
- A publicity campaign to raise awareness is key to improving transport performance, public transport usage and safety. Such campaigns should be held on a regular basis for specific target groups, particularly for school children and their parents.
- Public transportation priority measures are effective, and should be considered as a high priority for European cities.
- Some transport management and control measures are implemented at functional levels, such as traffic monitoring and Automatic Enforcement of Traffic Lights, are usually implemented as part of integrated measures and their impacts are difficult to quantify individually. It is recommended that detailed evaluation at functional level should be carried out for such measures so that the effectiveness can be better assessed based on the evaluation and the implementation objectives.
- Overall, there is a lack of analysis on the economic, energy and environment impacts of measures, particularly those for safety improvement. Cost effectiveness and environmental impacts are increasingly important for transportation, and have profound implications for assessment of measures. It is suggested that cost, energy and environment impacts should be considered and evaluated in detail in the future.

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ANNEX 1: OVERVIEW OF BARRIERS & DRIVERS

Overview of barrier fields and examples

NR	Barrier field	Examples of barriers
1	**Political / strategic**	Opposition of key actors based on political and/or strategic motives, lack of sustainable development agenda or vision, impacts of a local election, conflict between key (policy) stakeholders due to diverging believes in directions of solution
2	**Institutional**	Impeding administrative structures, procedures and routines, impeding laws, rules, regulations and their application, hierarchical structure of organizations and programs
3	**Cultural**	Impeding cultural circumstances and life style patterns
4	**Problem related**	Complexity of the problem(s) to be solved, lack of shared sense of urgency among key stakeholders to sustainable mobility
5	**Involvement, communication**	Insufficient involvement or awareness of (policy) key stakeholders, insufficient consultation, involvement or awareness of citizens or users
6	**Positional**	Relative isolation of the measure, lack of exchange with other measures or cities
7	**Planning**	Insufficient technical planning and analysis to determine requirements of measure implementation, insufficient economic planning and market analysis to determine requirements for measure implementation, lack of user needs analysis: limited understanding of user requirements
8	**Organizational**	Failed or insufficient partnership arrangements, lack of leadership, lack of individual motivation or know-how of key measure persons
9	**Financial**	Too much dependency on public funds (including CIVITAS funding) and subsidies, unwillingness of the business community to contribute financially
10	**Technological**	Additional technological requirements, technology not available yet, technological problems
11	**Spatial**	No permission of construction, insufficient space
12	**Other**	?????????

Overview of driver fields and examples

NR	Driver field	Examples of drivers
1	**Political / strategic**	Commitment of key actors based on political and/or strategic motives, presence of sustainable development agenda or vision, positive impacts of a local election, coalition between key (policy) stakeholders due to converging (shared) believes in directions of solution
2	**Institutional**	Facilitating administrative structures, procedures and routines, facilitating laws, rules, regulations and their application, facilitating structure of organizations and programs
3	**Cultural**	Facilitating cultural circumstances and life style patterns
4	**Problem related**	Pressure of the problem(s) causes great priority, shared sense of urgency among key stakeholders to sustainable mobility
5	**Involvement, communication**	Constructive and open involvement of policy key stakeholders, constructive and open consultation and involvement or citizens or users
6	**Positional**	The measure concerned is part of a (city) program and/or a consequence of the implementation of a sustainable vision , exchange of experiences and lessons learned with other measures or cities
7	**Planning**	Accurate technical planning and analysis to determine requirements of measure implementation, accurate economic planning and market analysis to determine requirements for measure implementation, thorough user needs analysis and good understanding of user requirements
8	**Organizational**	Constructive partnership arrangements, strong and clear leadership, highly motivated key measure persons, key measure persons as 'local champions'
9	**Financial**	Availability of public funds (including CIVITAS funding) and subsidies, willingness of the business community to contribute financially
10	**Technological**	New potentials offered by technology, new technology available
11	**Spatial**	Space for physical projects, experimentation zones
12	**Other**	?????????

ANNEX 2: BACKGROUND INFORMATION GENERAL OVERVIEW

Focussed / non focussed measures and quality ratings of process evaluation

Focussed measure * processhooglaag Crosstabulation

			processhooglaag			Total
			laag	gemiddeld	hoog	
Focussed measure	0	Count	8	13	5	26
		% within Focussed measure	30,8%	50,0%	19,2%	100,0%
		% within processhooglaag	88,9%	68,4%	55,6%	70,3%
		% of Total	21,6%	35,1%	13,5%	70,3%
	1	Count	1	6	4	11
		% within Focussed measure	9,1%	54,5%	36,4%	100,0%
		% within processhooglaag	11,1%	31,6%	44,4%	29,7%
		% of Total	2,7%	16,2%	10,8%	29,7%
Total		Count	9	19	9	37
		% within Focussed measure	24,3%	51,4%	24,3%	100,0%
		% within processhooglaag	100,0%	100,0%	100,0%	100,0%
		% of Total	24,3%	51,4%	24,3%	100,0%

Focussed measure * processhooglaag Crosstabulation

			processhooglaag			Total
			laag	gemiddeld	hoog	
Focussed measure	0	Count	35	107	70	212
		% within Focussed measure	16,5%	50,5%	33,0%	100,0%
		% within processhooglaag	77,8%	72,3%	64,2%	70,2%
		% of Total	11,6%	35,4%	23,2%	70,2%
	1	Count	10	41	39	90
		% within Focussed measure	11,1%	45,6%	43,3%	100,0%
		% within processhooglaag	22,2%	27,7%	35,8%	29,8%
		% of Total	3,3%	13,6%	12,9%	29,8%
Total		Count	45	148	109	302
		% within Focussed measure	14,9%	49,0%	36,1%	100,0%
		% within processhooglaag	100,0%	100,0%	100,0%	100,0%
		% of Total	14,9%	49,0%	36,1%	100,0%

Innovative aspects

Innovative aspect	Cluster Yes	Cluster No	Total Yes	Total No
Innovative aspects Conceptual	46%	54%	49%	51%
Innovative aspects New Technonogy	62%	38%	46%	54%
Innovative aspects New mode of transport	5%	95%	14%	86%
Innovative aspects Targeting specific users	43%	57%	38%	62%
Innovative aspects economic instrument	0%	100%	4%	96%
Innovative aspects policy instrument	11%	89%	18%	82%
Innovative aspects organizational	27%	73%	24%	76%
Innovative aspects Physical infrastructure	19%	81%	19%	81%

Innovative aspects other	8%	92%	5%	95%

Targets

Strategic level target	Number	Percentage
Increase road safety	13	35%
Increase modal shift towards slow modes or PT	11	30%
Reduce environmental impact	7	19%
Increase efficiency of transport system	6	16%
Reduce congestion	4	11%
Improve quality of life	4	11%
Reduce number of vehicles in city centre	3	8%
Improve traffic management	3	8%
Raise awareness	1	3%

improve quality travel info

Tactical level target	Number	Percentage
Increase safety and reduce accidents	10	27%
Increase use of traffic management	5	14%
Increase commercial speed PT	4	11%
Achieve more efficient use of transport network	4	11%
Increase efficiency PT	4	11%
Reduce car speed	3	8%
Reduce environmental impact	3	8%
Increase use PT and slow modes	3	8%
Share traffic and travel information and data	3	8%
Awareness for measures	2	5%

Develop innovative transport telematic systems

Implement innovative transport telematic systems

improve quantity and quality of traning heavy duty vehicles

ITS concepts part of future policty, develop local ITS achtitectures, authorities support ITS implementation a interfaces

tool to monitor quality of road markings

Operational (measure level) target	Number	Percentage
Improve road safety	9	24%
Reduce speed private cars, increase speed PT	9	24%
Prioritize PT on intersections	7	19%
Implement travel information systems	7	19%
Raise awareness and acceptance	6	16%
Improve traffic management	5	14%
Reduce congestion	3	8%
Reduce number of private cars	3	8%
Increase safety on crossings by changing traffic light configuration	3	8%

Influence driving behaviour	3	8%
Efficient traffic flow	2	5%
Increase attractiveness PT	2	5%
Reduce violations	2	5%

assess traffic risk, more responsive sustem

develop methodology to verify efficience of road markings and define a protocol to verify

Establish mobility partnerships, manage database, monitor development, use supportive tools, promote integ
sustainable mobility

ANNEX 3: DRIVER AND BARRIER OVERVIEW PER SUB CLUSTER

Sub cluster: Monitoring & Control

Barriers

	Preparation	Implementation	Operation
Political	20%	15%	10%
Institutional	20%	10%	15%
Cultural	5%	5%	5%
Problem related	20%	30%	15%
Involvement	5%	10%	0%
Positional	5%	0%	10%
Planning	5%	0%	0%
Organizational	20%	20%	15%
Financial	20%	20%	5%
Technological	45%	40%	30%
Spatial	5%	5%	0%
Other	5%	0%	0%

Drivers

	Preparation	Implementation	Operation
Political	35%	25%	10%
Institutional	5%	10%	0%
Cultural	10%	0%	0%
Problem related	10%	15%	5%
Involvement	20%	10%	5%
Positional	20%	15%	5%
Planning	0%	20%	10%
Organizational	15%	25%	30%
Financial	10%	5%	5%
Technological	20%	25%	25%
Spatial	5%	0%	0%
Other	0%	5%	5%

Sub cluster: PT Priority

Barriers

	Preparation	Implementation	Operation
Political	0%	0%	0%
Institutional	20%	20%	0%
Cultural	0%	0%	0%
Problem related	20%	20%	60%
Involvement	20%	0%	0%
Positional	0%	20%	0%
Planning	0%	0%	0%
Organizational	20%	20%	0%
Financial	0%	20%	0%
Technological	20%	40%	0%
Spatial	40%	0%	20%
Other	0%	0%	0%

Drivers

	Preparation	Implementation	Operation
Political	40%	40%	20%
Institutional	0%	20%	20%
Cultural	0%	0%	0%
Problem related	20%	20%	0%
Involvement	20%	40%	0%
Positional	20%	20%	0%
Planning	0%	0%	0%
Organizational	40%	20%	0%
Financial	0%	20%	0%
Technological	0%	20%	20%
Spatial	0%	0%	0%
Other	0%	20%	0%

Sub cluster: Traffic safety

Barriers

	Preparation	Implementation	Operation
Political	33%	17%	8%
Institutional	33%	17%	17%
Cultural	17%	8%	25%
Problem related	17%	8%	17%
Involvement	25%	25%	17%
Positional	0%	0%	0%
Planning	0%	0%	0%
Organizational	25%	33%	17%
Financial	17%	17%	17%
Technological	8%	17%	17%
Spatial	25%	17%	8%
Other	0%	8%	0%

Drivers

	Preparation	Implementation	Operation
Political	67%	17%	17%
Institutional	8%	8%	0%
Cultural	8%	0%	8%
Problem related	0%	8%	0%
Involvement	25%	25%	25%
Positional	17%	17%	8%
Planning	0%	0%	0%
Organizational	42%	58%	42%
Financial	17%	17%	8%
Technological	17%	8%	17%
Spatial	17%	8%	8%
Other	8%	8%	0%

ANNEX 4: BACKGROUND INFORMATION RECOMMENDATIONS

Transferability

Transferability	Number	Percentage
Raise awareness and acceptance of target group	6	16%
Good cooperation stakeholders	5	14%
Cooperation with local authorities and legislation is important	4	11%
centralized mobility centre	3	8%
Availability of data	3	8%
Consider local culture	3	8%
Make sure to have enough financial resources	3	8%
Easily transferred and polular	2	5%
Research before start	2	5%
Changes may be necessary when transferred	2	5%
Use a good traffic model	2	5%
Integrate real time information	2	5%
Priority of PT has positive effect and should be transferred	2	5%
Combine with other measures or concepts	2	5%
Traffic light management has positive effects	2	5%

adapt the physical space to specification of simulator
Addres the issues of traffic management as a complex solution for the entire city, not a part of the city
analogical system not recommended in case of implementeation of real time infomobility tools
can be used in other metropolitan areas
complex measure
Consider the difficulty of the evaluation beforehand
encourage a more conscious use of the car
focus on PT network improvements
identify at an early stage and understand the resistance
Implement pedeastrian areas to improve quality of life
increas capacity
increase monitoring locations in city
Invest in a preliminary plan to investigate traffic conditions and safety topics
low investments compared to benefits, but beware of social costs it generates
Make sure to implement the system in a large portion, or all, of the urban network
Measure is tranferable to other cities who want increased road safety
Need for implementation phase
need of good traffic planners
Physical obstructions increases safety to a larger extent than signals only
preparation of divers
Provide alternative routes for unnecessary traffic

Public dialoge should be a priority
quality control is important
Repeat safety audits to develop suitable road safety improvements
road safety engineering measures were small and low cost, but effective
set up efficient monitoring
solving technical barriers
straffic speed monitoring around pedestrian area efficient
System with high juridical reliability
The implemented solution but be easy to understand
Training may be required to ensure every involved actor can manage the system efficient
upgrade operation support system with analogical communication could be a good solution
Use pilot project before full scale project
visits to already implemented driving simulators

Process

Recommendations	Number	Percentage
Use communication and campaigns to raise awareness and acceptance	12	32%
Involvement stakeholders or participants	9	24%
Good planning/action plan	8	22%
Political and legislation support	6	16%
Have a strong project team with the correct skills	5	14%
Make sure to have the correct data avialable	5	14%
Find synergy with other measures or concepts	4	11%
Make sure the evaluation can be done	3	8%
Enough financial resources	3	8%
Best practives	2	5%
Find ways to achieve cultural change	1	3%