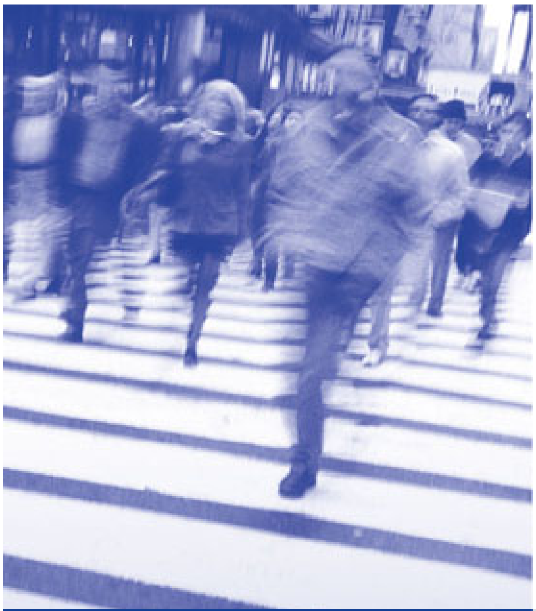

CIVITAS
Cleaner and better transport in cities

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Implementation status report on the equipment of 210 buses and 15 intersections with Zigbee (DSRC)

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				WP4 Influencing travel behaviour		WP10 Project management
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CONTENT

1. SUMMARY

CIVITAS ELAN measure 8.1-LJU “Public Transport Priority at Intersections” is implemented by Telargo as Measure Leader in cooperation with partners Javno podjetje Ljubljanski potniški promet d.d. (LPP) and the City of Ljubljana (COL).

The starting point of the measure was that Ljubljana’s streets are getting more congested as the population grows and more cars enter the transportation system; thus transport is an ever increasingly important issue especially in urban centres. There are many ways of dealing with the problem, depending on the available resources and other local specifics. The prevailing trend in Europe is to promote and support public transit so that more travellers will utilize transit freeing up space on the streets, diminishing the dependence on fossil fuels, and improving air quality. There are many ways how to do it (introducing new vehicles, lines, transport modes, etc.). Another important factor is travel time and accuracy of the timetables. Traffic light priority can be very helpful at optimizing the latter.

Public Transport Priority at intersections is a tool that can be used to help make transit services more reliable, faster, and more cost effective.

Telargo has developed a solution which enables traffic light operators to adjust the traffic light regime when a bus is in the proximity of a traffic light. To assist bus through the junction and to ensure that the traffic light interval is extended or shortened for the most appropriate time period traffic lights and buses should be equipped with DSRC communicators – Zigbee. This solution enables very precise traffic light triggering and the traffic light can turn to red immediately after a bus leaves the junction.

Hence, the main objectives of the respective measures are:

- On the direct communication basis modify traffic light intervals to increase average speed of buses and decrease idling
- Equip corridor with technology that will enable direct communication between the public transit fleet and the infrastructure (traffic lights)

This report presents the implementation of 15 intersections in the city of Ljubljana by which the following milestones where achieved:

- New traffic programmes development
- Equipment of 210 buses with dedicated short range communication modems (Zigbee)
- The equipment of 15 intersections with dedicated short range communication modems (Zigbee)
- Control and testing of the reliability of new traffic programme and traffic light triggering punctuality

2. INTRODUCTION TO THE PROJECT

2.1. Main objectives

Currently, the city centre of Ljubljana is often affected by traffic congestions. Also on large parts of the CIVITAS corridor there are no lanes dedicated to buses, thus public transport has to share lanes with private vehicles. Consequently, the average speed is pretty low and ranges between 10 and 18 km/h.

The main objective of this measure at the local level is to provide a bus network as an effective (in the sense of travel time and speed) and energy-efficient possibility of transport within the city.

At the national and European level, research in the field of prioritization of PT and the implementation of adequate technology will have the main impacts on the field of traffic flow improvement as well as ecology.

Traffic light priority has already been successfully implemented in several cities where average saving time per bus is around 20% for junctions equipped with the mentioned system.

The main objectives of this measure are:

- To increase the average speed of the bus fleet along the CIVITAS ELAN corridor by 10% and reduce idling (waiting time at junctions) in the City of Ljubljana, especially during traffic peaks/ rush hours
- To provide a more passenger friendly, more effective and less time consuming service for everyday movements and commuting
- To implement services based on GPS positioning
- To equip the CIVITAS ELAN corridor mentioned in measure 2.1-LJU with technology that will enable direct communication between the PT fleet and the infrastructure (traffic lights)
- On a direct communication basis modify traffic light intervals to increase the average speed of buses

3. DESCRIPTION OF THE SYSTEM

The existing AVL (Automatic Vehicle Location) system utilized by LPP Ljubljana Public Transport represents the basis for traffic light priority system as it has been planned and designed by Telargo.

The Public Transport Company in Ljubljana (LPP – Javno podjetje Ljubljanski potniški promet, d.o.o.) has been successfully using Telargo's fleet management (AVL) system, specifically tailored to the needs of public transport operators. Positioning is achieved through a GPS module, communication with the main managing and monitoring centre (Control Centre) through GPRS communication. The AVL Unit is designed in a way that enables the connection to a 3rd party device (including dedicated short range communication devices).

Each bus is assigned to a specific route. The description of this route, possibly together with timetables and other relevant data, is downloaded to the AVL unit from the Control Centre. The GPS position and the location on the bus route are currently sent to the Control Centre every 30 seconds. However, location on the route is calculated within the AVL Unit each second. Sophisticated techniques enable to achieve on-route location accuracy of up to 2 metres, even in conditions where GPS is not accurate due to bad signal reception.

A lot of data is collected in the database in the Control Centre. They can be used to compute the statistics of the bus runs. Such statistics are then used for real-time estimates of times of arrivals to certain points (e.g. stations). This information will be also used to determine whether a bus is on time, ahead of schedule or running late compared to the schedule.

The idea of implementing traffic light priority is the following: the AVL Unit will communicate the predicted time of arrival and arrival event to the traffic light controller directly through DSRC (Zigbee) communication. Such direct communication will increase accuracy and improve response times of the traffic lights.

The AVL Units on buses know whether they are on schedule or not. Thus, the buses which are behind schedule will request for priority. If the priority can be given, the green phase will be prolonged in that direction. In the next cycle, the green phase is shortened in order to provide the same average ratios between phases of red and green.

The changes will be introduced gradually in order not to deteriorate the current traffic situation. At the beginning only the buses which are substantially behind schedule are granted priority. The delay threshold will gradually be decreased, thus increasing the number of buses which will request priority. Eventually, all buses could request priority. However, we will investigate the traffic situation, depending on the amount of priority requests. We will be able to find an optimal point, which determines the best amount of priority requests, minimizing average travel times.

4. PLANNING

The planning phase of the project included the following activities:

- Study and analysis of existing systems
  - R&D of theoretical models and proof of concept (8.1-WD1)
  - Definition of main objectives (8.1-WD2)
- Preparation for the development of new traffic programmes, including developing the programme to help conduct simulation analysis
- Planning of the installation of equipment (dedicated short range communication modems – DSRC) (8.1-WD3)
- Selection of the applicable intersections for implementation

4.1. System design analysis – traffic light priority system architecture – design characteristics

4.1.1. Various Traffic Light Controlling Systems

Traffic lights may be controlled in many different ways. Some might be completely static, predefined, while others are dynamic, taking the current traffic situation into account.

Traffic lights can operate on a predefined schedule. This can be fixed or changing according to the time of the day. One of the best known tools for computing optimal schedules is TRANSYT (Traffic Network Study Tool). However, in order to deliver good results, accurate measurements of traffic flow across the studied road network are needed in advance. Furthermore, traffic conditions change over the years. Regular remaking of the schedules helps keeping the schedules close to optimal.

If the traffic lights do not act according to the current traffic situation, this might lead to driver disobedience, breaking traffic rules. It can be especially frustrating in isolated junctions. This is where a vehicle actuated strategy is very helpful. This strategy requires detection of approaching vehicles. The detectors can be underground (inductive loops) or above ground (radars, cameras). As soon as approaching vehicles are detected, the request for green light in that direction is triggered. The controller of the traffic light processes all the requests and assigns optimal times for individual phases. An example is the MOVA system.

Controlling of a junction (and perhaps a few adjacent junctions) is done locally, within a nearby junction controller. This can be useful in areas, where the road network is functionally and logically well separated into smaller regions.

Much better results can be achieved if the traffic lights are connected to a central computer. With this connection positive effects at one junction will not be cancelled at another. One of the best known applications is SCOOT.

Various systems, mentioned before, may provide traffic light priority for some vehicles. These may be emergency vehicles (ambulance, police, and fire-fighters) or public transit vehicles (buses, trams). Emergency vehicles in the USA use strobe lights to signal their arrival. Public transit vehicles may use different systems to signal their approach – inductive loops on exclusive lanes, RFID tags, DSRC communication or even visual detectors. However, the most popular approach lately is to use various AVL systems, used by public transport operators.

Previous implementations in various cities have shown that it is possible to reduce waiting times at junctions by up to 20%.

If the buses, which are behind schedule, have higher priority, it will likely contribute to better traffic flow in that direction, since bus delays are probably correlated with general traffic congestions.

The solution implemented in Ljubljana is innovative as it introduces direct vehicle to infrastructure communication. Within the planning phase (system design analysis) we have also tried to identify possible problems.

4.1.1.1. Identified problems

Clearly, experiences from other cities, which have implemented traffic light priority for public transit, show that substantial benefits can be gained. However, the level of success depends on the accuracy of the predictions of arrivals of buses to the junctions. We have identified two potential problems:

- Prediction inaccuracy
- Communication delay

4.1.1.2. Sources of inaccuracy

The first source of inaccuracy may be GPS inaccuracy. However, our testing has showed that our error correction techniques are able to minimize the influence of GPS errors. The position of the bus on the route is generally calculated with the accuracy of about 2 meters. This error will therefore not cause problems.

The major source of arrival prediction inaccuracy are 'random' events, like stopping at a traffic light or at a bus station. The duration of these two types of events is difficult to predict accurately.

We expect that the impact of traffic lights will be decreased as we implement the traffic lights priority.

However, the duration of stop at a bus station is still difficult to model accurately. To make things worse, the majority of bus stops in Ljubljana are located just before a traffic light. This is good for the passengers, since they can cross the street in the vicinity of the station. But from the traffic light priority point of view, it would be advantageous to place the station right after the traffic light.

4.1.1.3. Source of delay

At first it has been anticipated that communication will be established between the Bus Control Centre and the traffic lights Control Centre. However, this type of communication could cause a delay in data transfer. Namely, the first source is the communication delay between the vehicle and the Bus Control Centre. Our testing showed that the majority of messages have been transmitted within 3 seconds. This may be due to bad GSM (GPRS) signal at some locations (we have noticed this in the vicinity of the Metalka building in Ljubljana centre) or other causes. Furthermore, in such solution design the priority request messages must be forwarded from the Bus Control Centre to the traffic lights Control Centre. This is a communication between servers and should be executed within a few seconds. Also, the communication between the traffic lights Control Centre and the traffic light controller is performed within 1 second. We estimate that the majority of messages should arrive to their destination within 10 seconds.

However, when it has been decided that direct communication will be introduced (Zigbee communication), these delays became irrelevant.

4.2. Ljubljana Traffic Lights System prior to CIVITAS ELAN

The public company LPT (Javno podjetje Ljubljanska parkirišča in tržnice, d.o.o.) is managing the traffic lights system (set up by Iskra sistemi) in Ljubljana. The majority of the traffic lights are controlled locally with an adjacent controller, but they are also connected to the Control Centre with a copper wire, optical fibre, or wirelessly (GPRS). These traffic light controllers have different sets of predefined programmes installed. The switching between the programmes may be actuated by current time or other inputs. The majority of the junctions are also equipped with inductive loops which gather information about the traffic flow. Such information can be used for real-time programme changing at some isolated junctions or for data mining and occasional updating of the programmes for the junctions.

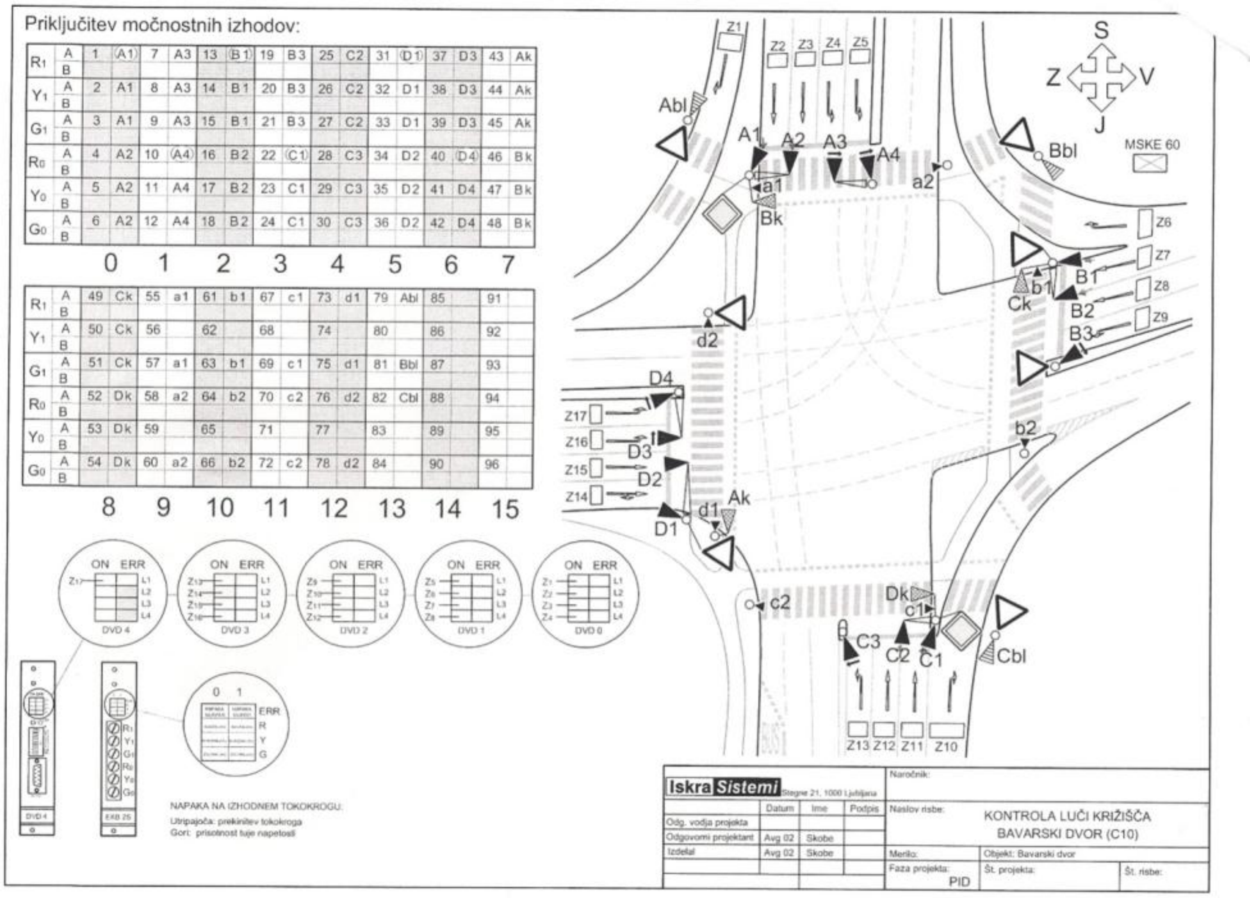


Figure 1: An example of a junction and control programme – Bavarski dvor

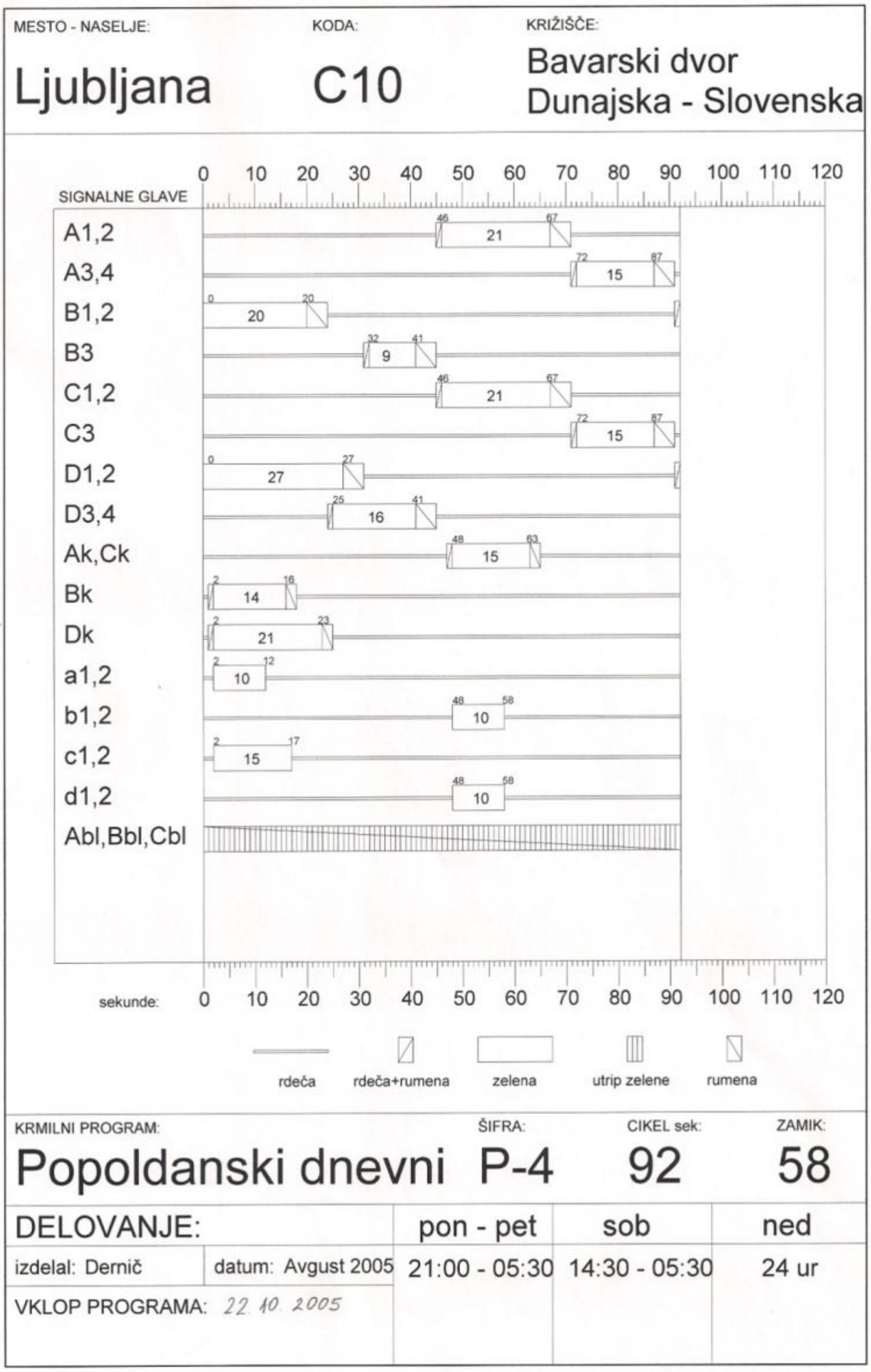


Figure 2: Example of one of the predefined programmes, executed at the Dunajska – Slovenska junction

4.2.1. Selected intersection for the traffic light priority implementation

A decision was made mainly between companies LPT, Iskra Sistemi and Telargo which intersections on the corridor are applicable for the implementation of the traffic light priority system. The most important factor was the technical specifications of traffic light controllers and their communication interface capabilities which allowed for integration with dedicated short range communication and reprogramming of their existing traffic programmes to support traffic light priority.

List of intersections selected for the implementation on the corridor:

Nr.	Intersection
1	Riharjeva – Cesta v Mestni log
2	Riharjeva - Ziherlova
3	Barjanska - Finžgarjeva
4	Aškerčeva – Slovenska
5	Slovenska - Gregorčičeva
6	Slovenska – Erjavčeva
7	Dunajska – Livarska
8	Dunajska – Dimičeva
9	Dunajska – Tolstojeva
10	Aškerčeva - Snežniška
11	Tržaška – Langusova
12	Tržaška – Jadranska
13	Tržaška – Gregorinova
14	Tržaška - Viška
15	Tržaška – Tbilisijska

4.3. Simulations

As part of the planning phase Telargo has developed a dedicated programme/ application – simulation model – specifically designed for the laboratory evaluation and simulation of different traffic priority scenarios. The simulator application is comprised of a user interface where one can enter applicable traffic related data and run simulations for different scenarios.

The entered data enables different parameters to be checked:

- speed
- acceleration
- traffic density (on corridor, on modified corridor)
- driver behaviour
- bus routes/ detours

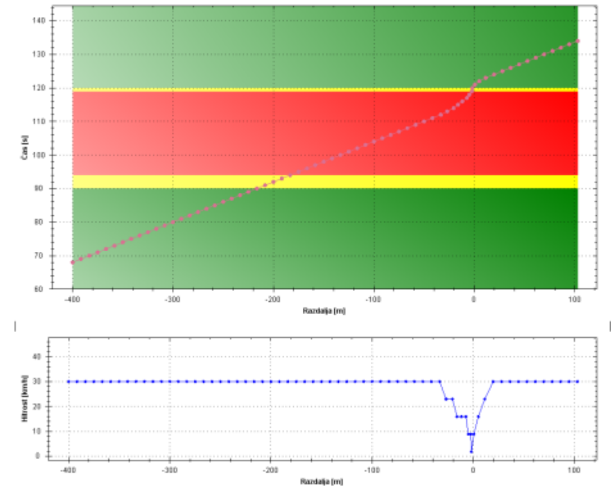
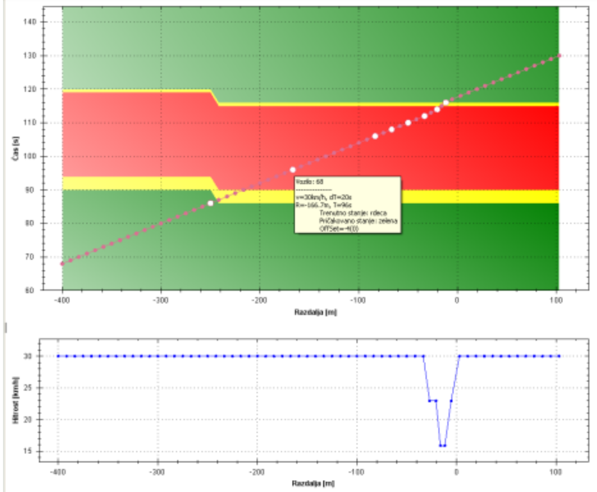
The simulations tool enables simulations of vehicle-to-infrastructure communication on particular intersections:

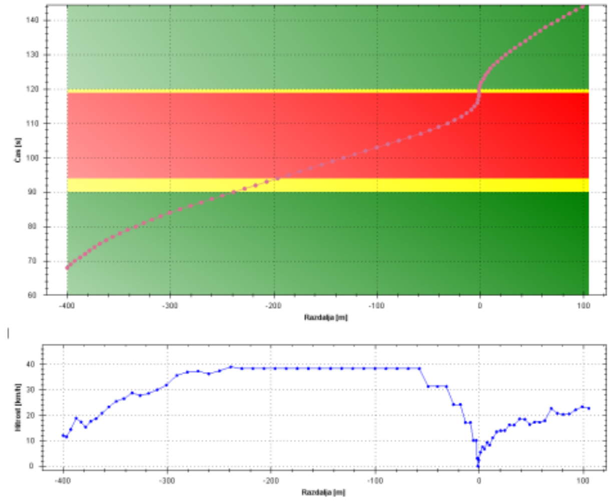
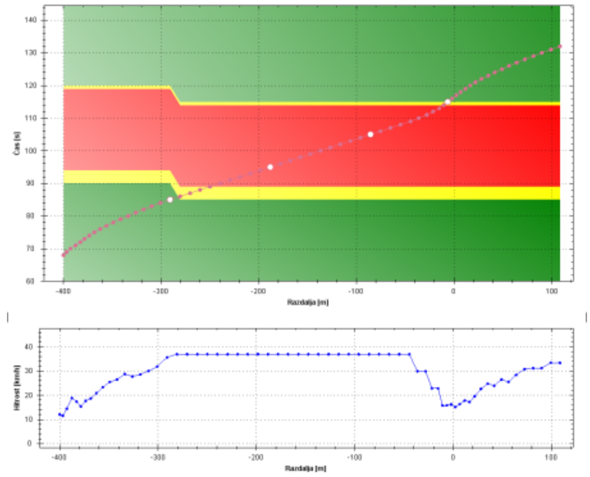
a) without taking into account traffic factors and without traffic light priority,

b) without taking into account traffic factors and with traffic light priority (traffic light arrival predictions),

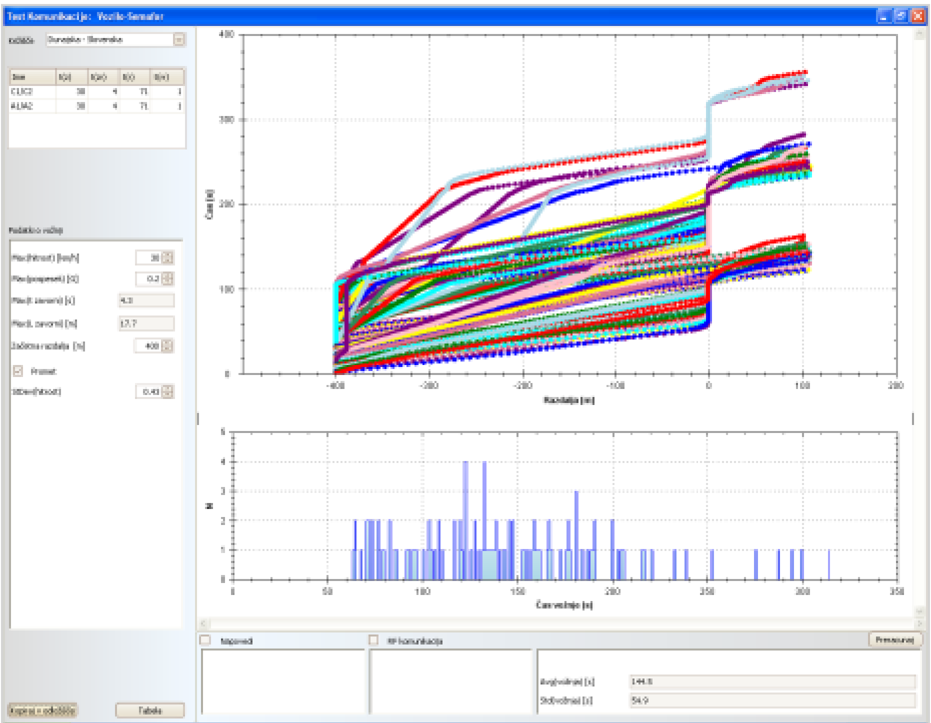
c) taking into account traffic factors and without traffic light priority,

d) taking into account traffic factors and traffic light priority (arrival predictions and short range communication).

	
Single drive without taking into account other traffic factors and without the traffic light priority (intersection Dunajska – Slovenska) (the above scheme shows the distance from the intersection and the driving time; the below scheme shows the vehicle speed in relation to the distance from the intersection) (the vehicle reaches the intersection when there is a red light).	Single drive without taking into account other traffic factors and with traffic light priority: Due to short range communication the green light is shortened by 4 seconds; consequently in the next circle the green light is prolonged for 4 seconds (bus arrival to intersection; distance = 0).

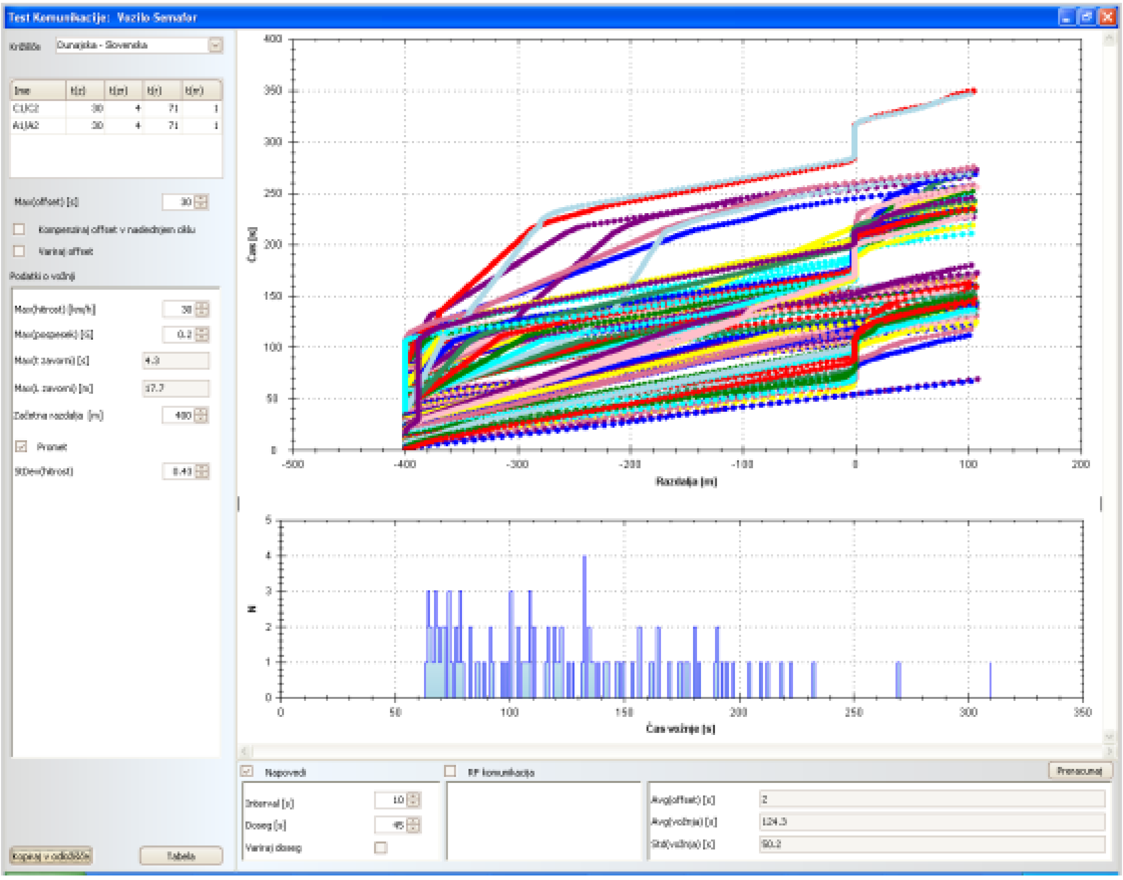
 Single drive taking into account traffic factors without traffic light priority – this scenario shows more real situation on bus speed.	 Single drive taking into account traffic factors with traffic light priority.

Furthermore, the following analyses have been prepared: simulations of single drive with taking into account traffic factors and without traffic light priority:



Due to traffic factors the average time needed for vehicle is 144.5 seconds to travel the observed distance (400 meters before intersection Dunajska-Slovenska), standard deviation is 54.9 seconds, which makes a conclusion that 95% of vehicles (buses) drive the observed distance in 254.3 seconds.

Simulations of single drive with taking into account traffic factors and with traffic light priority:



When traffic as well as traffic light priority are included into the simulation, the average time to drive the observed distance increases to 124.3 seconds and the standard deviation increases to 50.2 seconds. 95% of buses drive the respective distance in 224.7 seconds; thus the drive is 30 seconds shorter (faster) compared to the traffic light priority not being implemented.

4.4. Analysis and planning of the installation of DSRC in buses and at the intersections

DSRC (Dedicated short range communication) module supports wireless communication technology based on the protocol IEEE 802.15.4 and is working in 2,4GHz frequency. The purpose of the module is to enable direct communication between the bus and the intersection, both equipped with DSRC module.

The analysis and planning the installation of DSRC in buses required the following tasks:

- analyse Automatic Vehicle Location device installed in vehicles:
  - preparing all the necessary code for Zigbee module to be able to connect and communicate with 1.9 unit
  - programming API functions for easier implementation of the application code that is still to be done
- analysis of the best location for the installation of Zigbee module

The analysis and planning of the installation of DSRC at intersections required the following tasks:

- analyse the specifications of traffic light controllers; in particularly in terms of communication interfaces and protocols, also most applicable micro location for DSRC module installation
- analyse Automatic vehicle location unit (AVL Unit)
  - programming the logic for 1.9 unit to communicate with traffic light system and programming the applicable code
  - Testing the communication between the AVL unit and traffic light system on a test junction
  - testing with static Zigbee modules in laboratory conditions
  - testing with mobile Zigbee modules connected to the AVL unit in vehicle
- set up the Zigbee modules to enable direct wireless communication
- measuring, calculating and defining trigger distances for traffic lights in every intersection with implemented traffic light priority system

5. REALIZATION

Traffic light priority has been implemented at 15 intersections along the Ljubljana corridor. The system gives priority to LPP's bus fleet (210 vehicles equipped with DSCR – Zigbee modules) in case the bus is running late.

Figure 3: Implemented system gives priority to public transport along the corridor

As already described above the basis of the system presents a direct communication between the buses and the intersections (traffic light controllers) both equipped with DSRC – Zigbee modules.

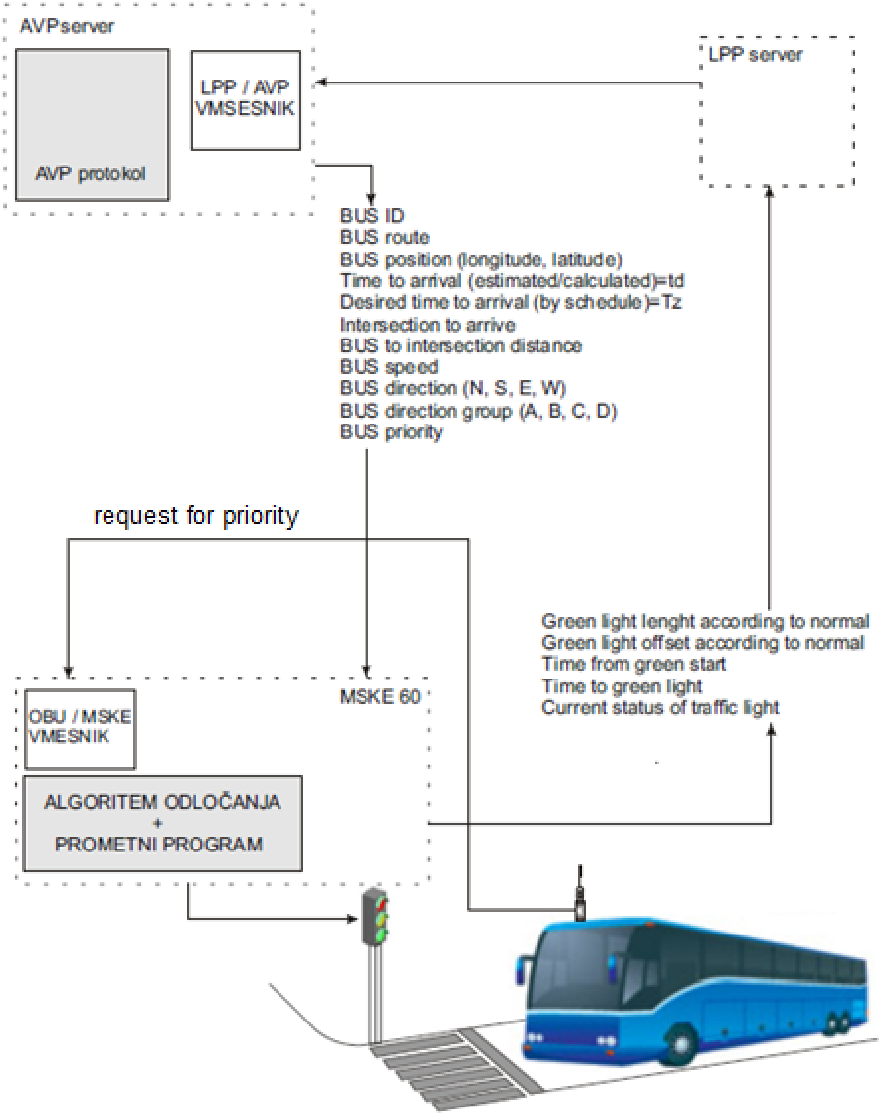


Figure 4: Data flow in the implemented traffic light priority system

Communication between the Zigbee interface at the intersection and the AVL unit begins on the side of the latter. At the triggering of the arrival at the intersection event applicable data is sent; followed by the acknowledgment of the successful data reception (ACK – acknowledge package). The unit triggers an “arrival at intersection event” based on the route distance the bus is running (it is mandatory for the bus to have snap-on-route established in order for the event to be triggered properly). The Zigbee module connected to the AVL unit changes the address of the recipient (preliminary destination address) based on the unique intersection ID for which the information is intended. While the Zigbee module connected to the traffic light controllers at the intersection has the recipient’s address set to 1 and therefore sends acknowledgement packages to all Zigbee modules attached to the bus’ AVL units the AVL unit checks if the package was designated to it (with the help of the unique vehicle’s ID).

When vehicle leaves the intersection (this is defined as distance on the route), the Zigbee module connected to the AVL unit in the bus, sends a “departure from intersection event”. As soon as the acknowledgement (ACK) of the successfully received departure package is received from the Zigbee connected to the traffic light controller at the intersection, the departure event is no longer triggered.

Based on the data received the traffic light priority system regulates the programmes and consequently changes the traffic light programme interval (i.e. prolongs the green light interval).

5.1. Installation of DSRC into buses

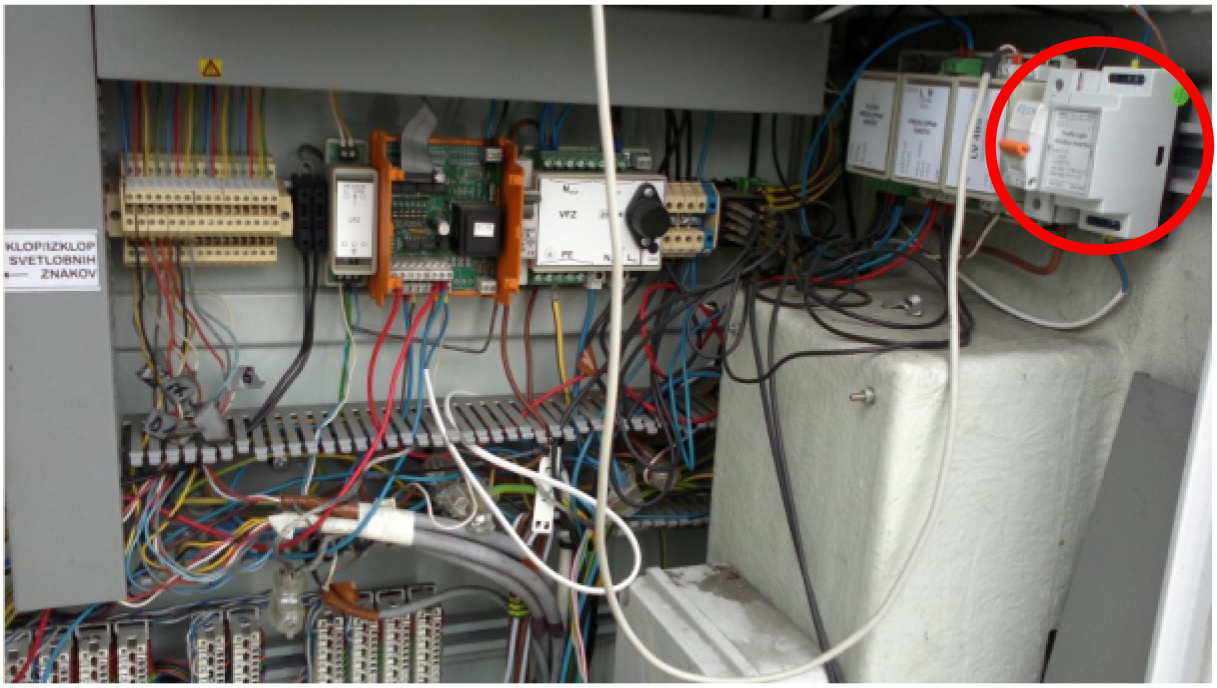
During the ELAN project 210 buses of Ljubljana Public Transport (LPP) were equipped with DSRC (dedicated short range communication) modules.

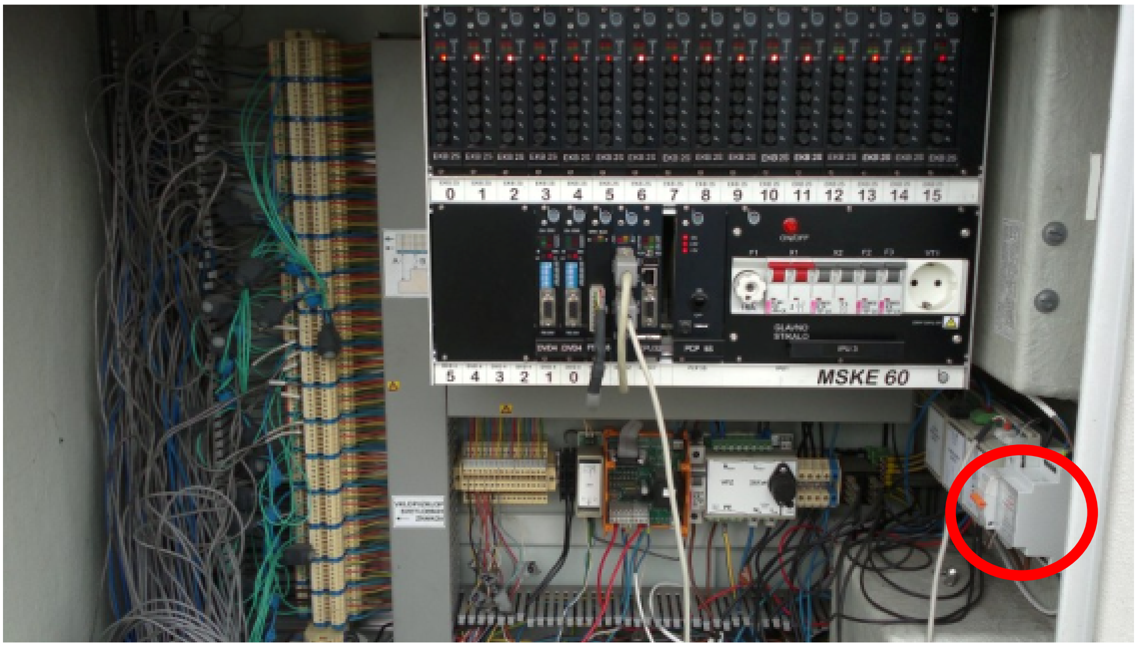
Figure 5: Zigbee module ready for in-bus installation

Figure 6: Location of Zigbee module in bus

5.2. Installation of DSRC into traffic controller

During the ELAN project 15 intersections were equipped with the traffic light priority system.





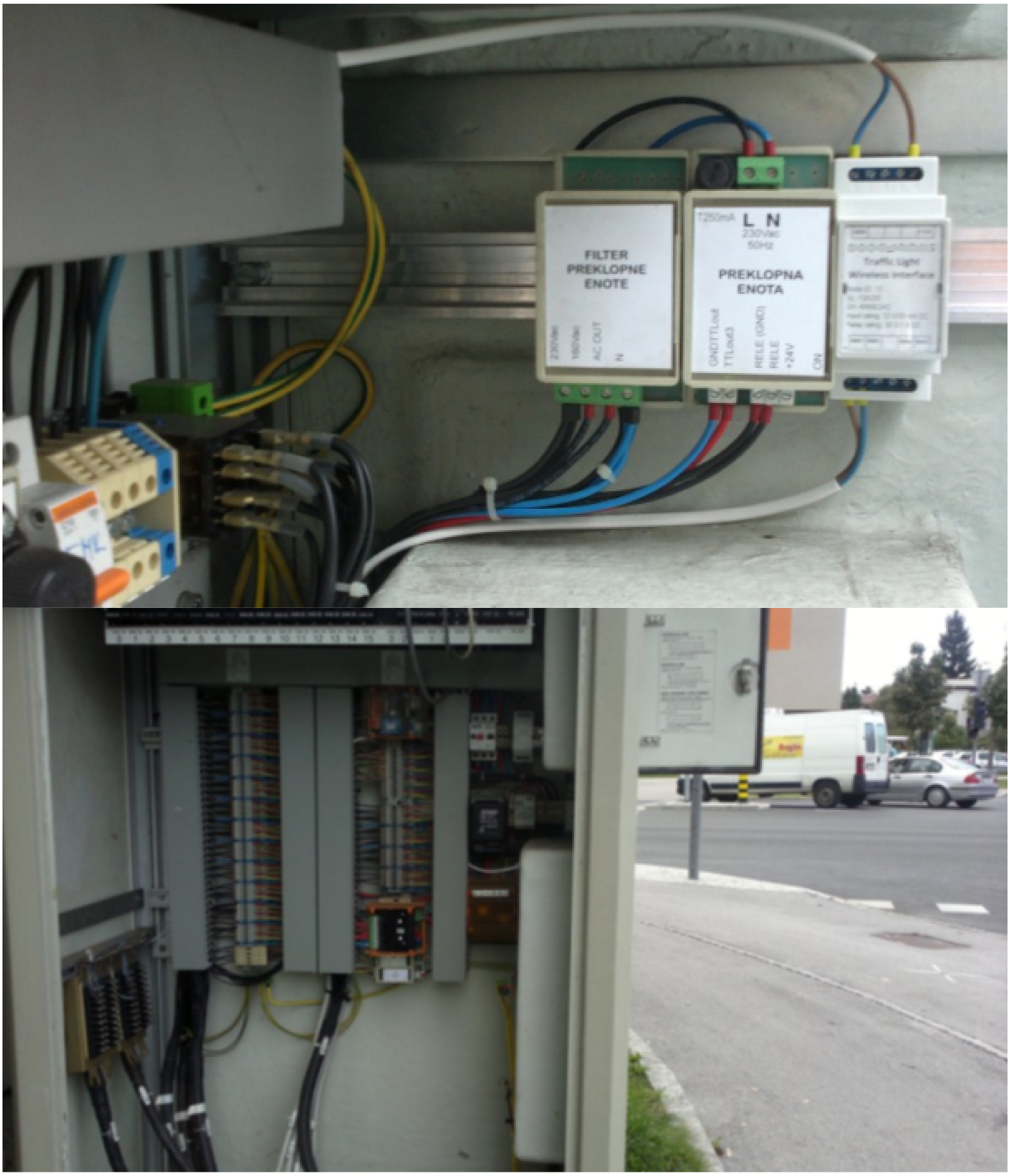


Figure 7: Zigbee module installed in traffic light controller

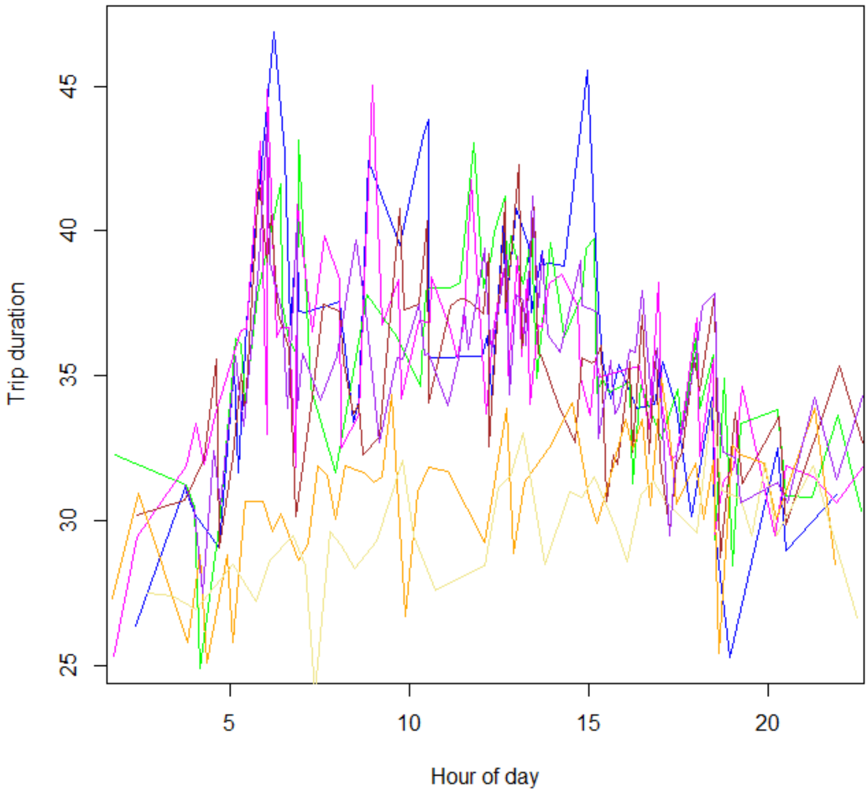
6. MEASUREMENTS AND EVALUATION

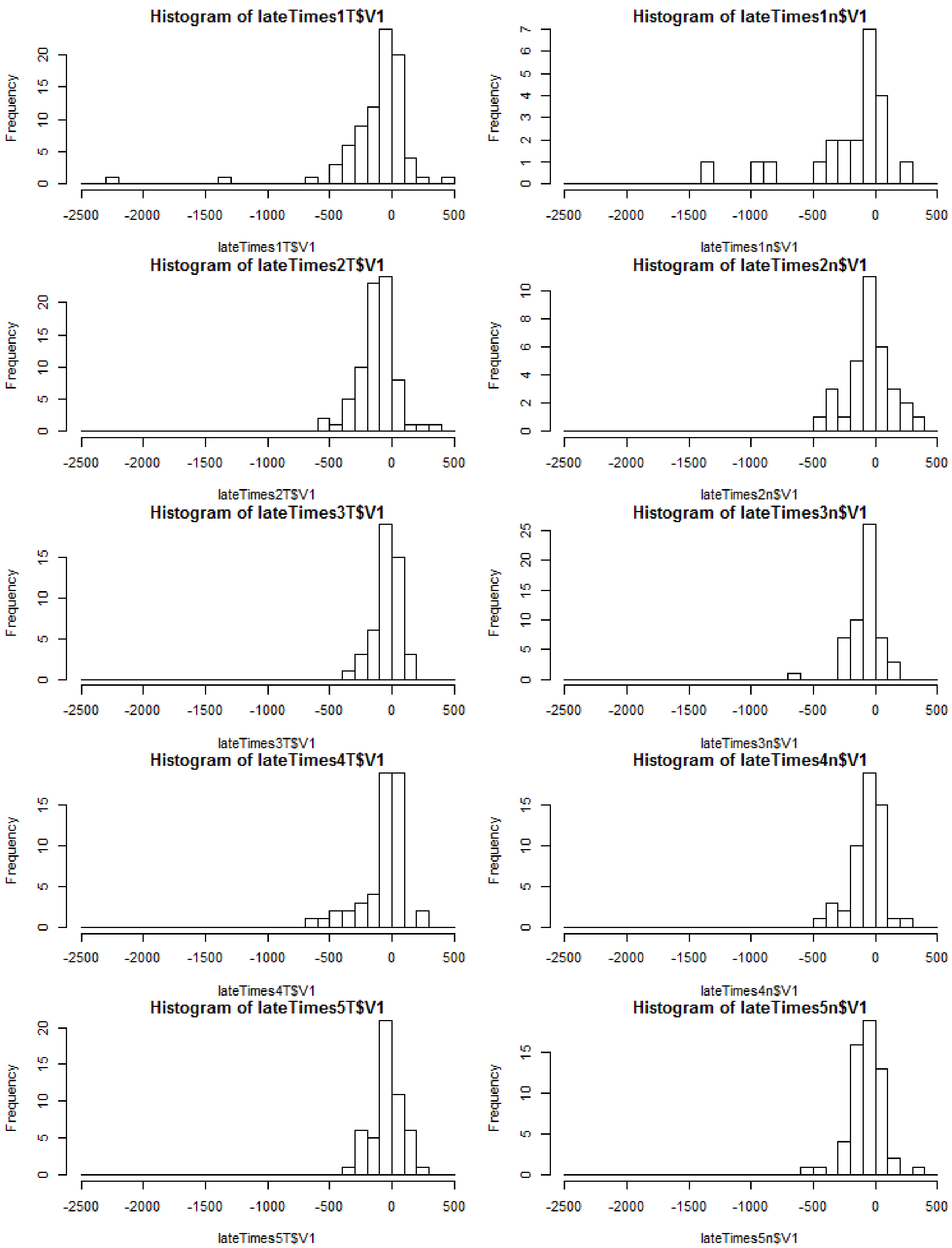
Data was collected on the corridor in both directions where route 6 is running for the period when traffic light priority was not implemented as well as for the period when traffic light priority was activated. The main focus in the evaluation was on the results related to public transport travel time and speed as enhanced speeds in public transport deliver obvious benefits to the passenger as well as the transport operator as they permit savings in operating costs. Namely, the assessment was made for the following parameters:

- Bus travel time
- Bus travel speed
- Number and percentage of buses arriving/ departing on time
- Punctuality of traffic light triggering

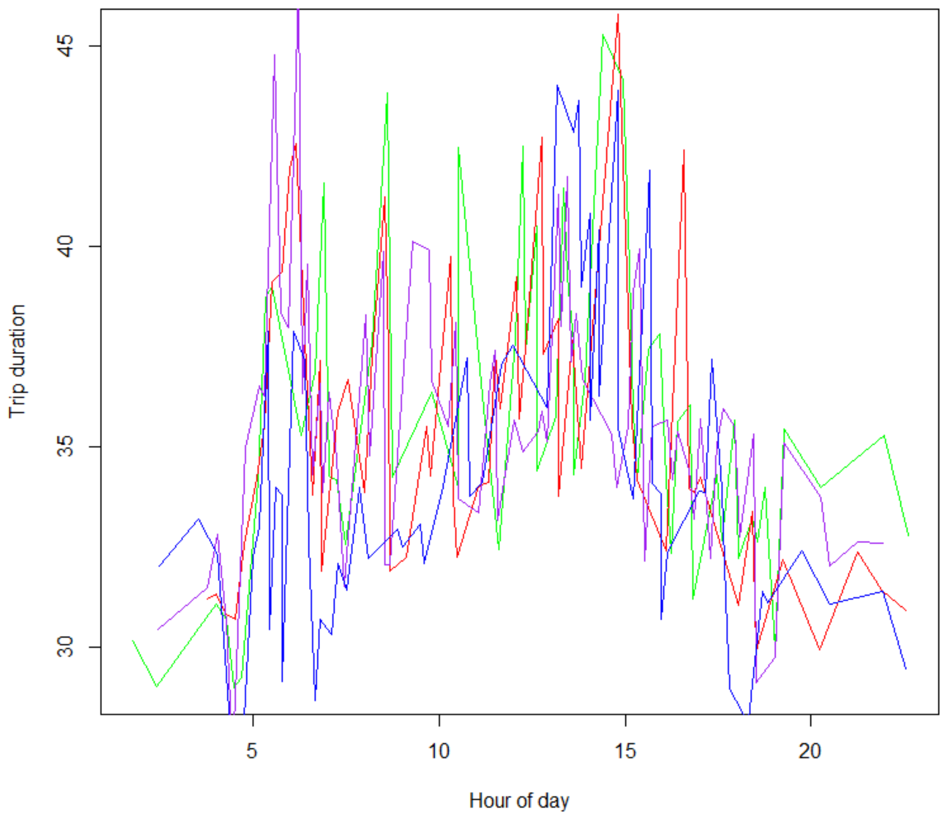
6.1. Bus travel time & speed

This diagramme depicts trip times for various days – 1-7 October 2012. Travel time is longer during working hours at working days, while on weekends (orange and yellow lines) the trip time remains similar throughout the day.

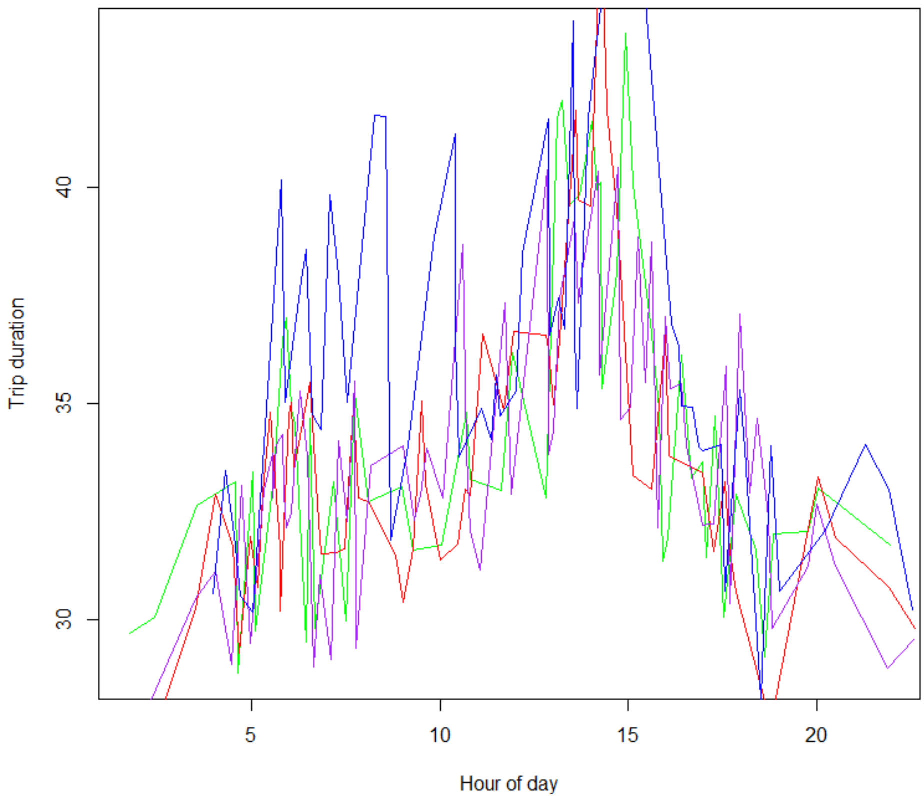




These histograms depict the average delays of bus runs. Buses with traffic light priority (TLP) turned on are on the left side, while buses without TLP are on the right side. The shown data is from 1-5 October 2012.



This diagramme depicts trip (direction Črnuče – Dolgi most) times from 8-11 October 2012; red is 8.10. purple 9.10. green 10.10. and blue 11.10.



The same as above, just in the opposite direction (Dolgi most - Črnuče). It is obvious that the last day (11.10. - blue) had longer trips (and bigger variations) than previous in the first half of the working day.

Črnuče-Dolgi most	8.10.2012	9.10.2012	10.10.2012	11.10.2012
Mean duration [min]	35,3	35,47	35,53	34,05
Standard deviation	3,6	3,4	3,9	4,1

Dolgi most -Črnuče	8.10.2012	9.10.2012	10.10.2012	11.10.2012
Mean duration [min]	33,63	33.7	34,22	36,41
Standard deviation	3,5	3,0	3,7	4,9

The two tables above show that the average trip time has lower on 11 October in one direction, while it has increased in the other direction on both days with the TLP turned on. However, these differences may arise because of daily variations, which are normal and common. The tables below show an example from the week before:

Črnuče-Dolgi most	1.10.2012	2.10.2012	3.10.2012	4.10.2012
Mean duration [min]	35,95	35,58	35,37	35,39
Standard deviation	4,7	3,7	3	3,6

Dolgi most -Črnuče	1.10.2012	2.10.2012	3.10.2012	4.10.2012
Mean duration [min]	36,82	37,04	34,29	34,58
Standard deviation	5,6	6,6	3,5	4,5

There are big variations in trip times in the same direction as above (Dolgi most - Črnuče), however in this case the longer trips occurred on the first two working days.

We may conclude that the variations between different days are quite big and/ or there are not enough data to draw statistically significant conclusions.

We may take a look at the gathered data from another perspective, too. In the first week (1-5 October 2012) TLP has been enabled on some buses, and disabled on the others. These data show that buses with TLP had shorter trips on average, however statistical significance can be argued.

Črnuče-Dolgi most	1st week
TLP	34:02
No TLP	34:35

Dolgi most -Črnuče	1st week
TLP	33:49
No TLP	33:52

Again, we notice that the trip time in the direction Črnuče-Dolgi most was approximately half a minute shorter on average, while in the "problematic" direction Dolgi most – Črnuče the difference is negligible.

The results on the average bus speed are the following:

Direction 06 – Crnuce – Dolgi most:

Date	Average speed (km/h) – TLP active	Average speed (km/h) – TLP not active
1st week of October 2012	20,48	20,14
8 October 2012	-	19,67
9 October 2012	-	19,55
10 October 2012	19,48	-
11 October 2012	20,33	-

The results on the average bus speed are the following:

Direction 06 – Dolgi most – Crnuce:

Date	Average speed (km/h) – TLP active	Average speed (km/h) – TLP not active
1st week of October 2012	20,38	20,48
8 October 2012	-	19,67
9 October 2012	-	20,21
10 October 2012	19,95	-
11 October 2012	18,5	-

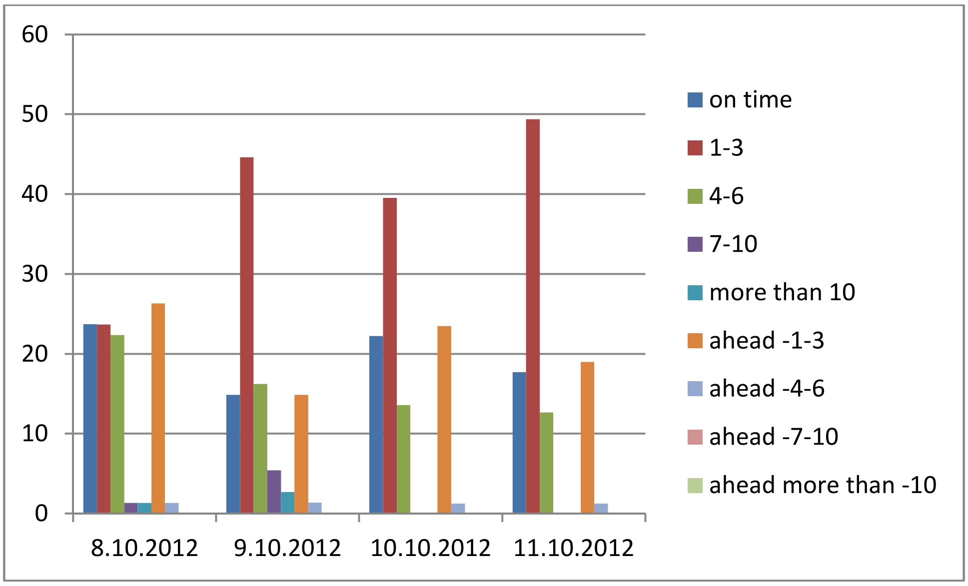
6.2. Number and percentage of buses arriving on time

The report was generated to establish the number of buses arriving on time as well as number of those behind or ahead of schedule. The results show Traffic Light Priority improves public transit schedule adherence; in particular the number of buses on time increases while on the other hand it decreases the number of buses being ahead or behind the schedule for more than 3 minutes.

1.) Schedule adherence – route 06 Črnuce – Dolgi most

	TLP izklopljen		**TLP izklopljen**	
število voženj	**8.10.2012**	**9.10.2012**	**10.10.2012**	**11.10.2012**
on time	19	16	22	27
1-3	36	44	35	35
4-6	3	6	5	5
7-10	1	6	0	2
more than 10	0	1	0	0
ahead -1-3	24	12	23	16
ahead -4-6	0	0	0	0
ahead -7-10	0	0	0	0
ahead more than -10	0	0	0	0

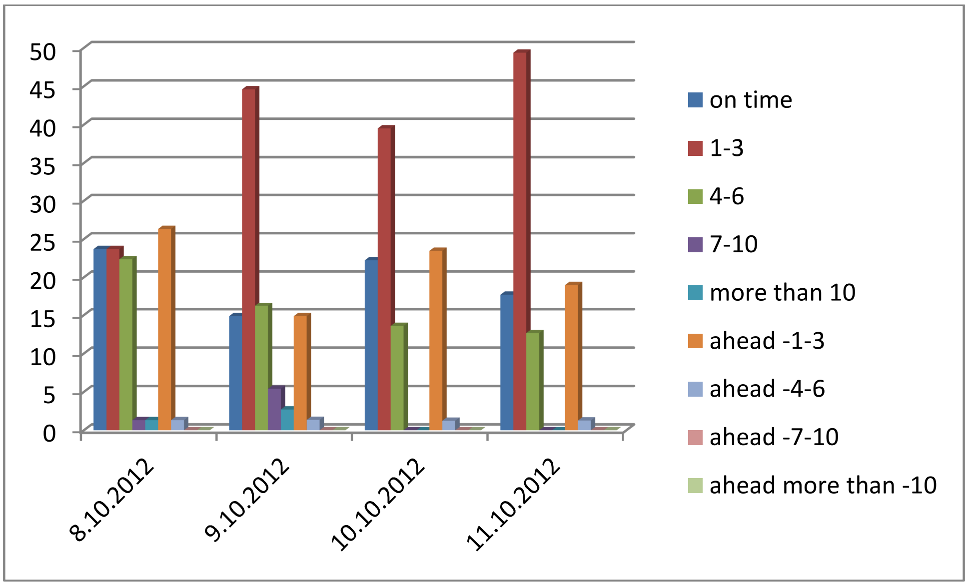
(%)	8.10.2012	9.10.2012	10.10.2012	11.10.2012
on time	22,89	18,82352941	25,88235294	31,764706
1-3	43,37349	51,76470588	41,17647059	41,176471
4-6	3,614458	7,058823529	5,882352941	5,8823529
7-10	1,204819	7,058823529	0	2,3529412
more than 10	0	1,176470588	0	0
ahead -1-3	28,91566	14,11764706	27,05882353	18,823529
ahead -4-6	0	0	0	0
ahead -7-10	0	0	0	0
ahead more than -10	0	0	0	0



2.) Schedule adherence – route 06 Dolgi most – Crnuce

	TLP not implemented		TLP imple-mented	
število voženj	8.10.2012	9.10.2012	10.10.2012	11.10.2012
on time	18	11	18	14
1-3	18	33	32	39
4-6	17	12	11	10
7-10	1	4	0	0
more than 10	1	2	0	0
ahead -1-3	20	11	19	15
ahead -4-6	1	1	1	1
ahead -7-10	0	0	0	0
ahead more than -10	0	0	0	0

(%)	8.10.2012	9.10.2012	10.10.2012	11.10.2012
on time	23,69	14,86486486	22,22222222	17,72151899
1-3	23,68421053	44,59459459	39,50617284	49,36708861
4-6	22,36842105	16,21621622	13,58024691	12,65822785
7-10	1,315789474	5,405405405	0	0
more than 10	1,315789474	2,702702703	0	0
ahead -1-3	26,31578947	14,86486486	23,45679012	18,98734177
ahead -4-6	1,315789474	1,351351351	1,234567901	1,265822785
ahead -7-10	0	0	0	0
ahead more than -10	0	0	0	0



6.3. Punctuality of traffic light triggering

For the purpose of establishing punctuality of traffic light triggering we have logged the information on dedicated short range communication modules communication with the traffic light controllers – arrival & departure events packages sent and arrival & departure acknowledges.

Traffic light triggering implemented – 10 October 2012:

Intersection	Arrival sent (# of packages)	Arrival ack (# of packages)	Departure sent (# of packages)	Departure ack (#number of packages)
Aškerčeva - Snežniška	131	130	131	115
Dunajska – Dimičeva	133	132	133	133
Dunajska – Livarska	129	103	128	127
Dunajska – Tolstojeva	103	101	103	103

7. DISSEMINATION

The following activities related to dissemination of the measure and cooperation activities with other international projects and programmes took place:

- TELARGO had a meeting with Project Automation S.p.A. from Italy in February 2009 who are involved in a similar measure within CIVITAS ARCHIMEDES to exchange experiences and concepts on how to best give priority to public transit vehicles.
- Presentation and discussion about the measure at the meeting of Ljubljana's Transport Policy Project Group in February 2009.
- At an ELAN workshop in Bled TELARGO met with Prof. Gold, University of Zagreb, Faculty of Transport and Traffic Sciences, ML of 8.2-ZAG Public Transport Priority and traveller information. The concepts of the respective measures were briefly introduced.
- The CATCH_MR project (Cooperative approaches to transport challenges in metropolitan regions) will include the measure activities to present examples of good practice in COL (in particular measures that are closely linked to the corridor).
- Measure partners have met with Cektra, a partner of the EU project City Network. The emphasis was on real-time information for passengers, and Cektra was informed about measure 8.1-LJU and the ELAN project.
- In October 2010 TELARGO hosted a study visit from ACTT Treviso, partner in the CIVITAS-CATALIST project. At this occasion, measure 8.1-LJU was presented.
- TELARGO gave a presentation on ELAN achievements in Ljubljana with an emphasis on telematics at an ITS event in Treviso in May 2011 organised by CIVINET Italy.
- The public transport priority measure was presented in various media channels: newspapers, radio, conferences, etc.

COMUNE DI GENOVA

NETWORK ITALIANO CIVINET

Mobilitiamoci:
Innovazioni per la mobilità

CiViNET CIVITAS City Networks Network italiano

Treviso, 18 maggio 2011

Palazzo Rinaldi - Piazza Rinaldi - Treviso

ORARIO	DESCRIZIONE ATTIVITA'	PARTECIPANTI
9:30 – 10:00	Registrazione	
10:00 - 10:20	Apertura lavori Saluti	Comune di Treviso - Vittorio Zanini ACTT - Erich Zanata
10:20 -10:50	Mobilità e ITS a Treviso	Comune di Treviso – Michela Mingardo ACTT - Marco Dall'Agnol
10:50 -11:10	Il quadro programmatico europeo	ISIS - Maurizio Tomassini
11:10 – 11:30	Le misure ITS innovative promosse dall'iniziativa CIVITAS nelle città europee	TRT Trasporti e territorio – Tito Stefanelli
11:30 – 11:50	Coffee Break	
11:50 – 12:10	Public Transport priority at intersections and Real time information for staff and passengers	Telargo company - Alenka Pavlic
12:10 – 12:30	civitas Miracles	City of Barcelona

Figure 8: ITS event (Civinet Italy) agenda where Public Transport Priority measure was presented

8. NEXT STEPS AFTER CIVITAS ELAN

Within the CIVITAS ELAN project a public transport priority solution based on direct communication between the entire Ljubljana Public Transport fleet and 15 intersections on the corridor equipped with short range communication modules (Zigbee) along with applicable reprogramming of traffic light programmes has been developed, implemented and evaluated.

Basically, the solution could be implemented on the entire public transport network in Ljubljana. Also, the same concept could be adopted in other cities.

However, to extend the proposed priority solutions to the entire public transport network in Ljubljana, it is mainly subject to:

- technical compatibility of traffic light controllers in terms of ability to interface with the Zigbee module and support the traffic programme reprogramming,
- associated costs for the necessary traffic light controller upgrades, reprogramming, additional equipment and related costs of installation (rough estimation is 8.000 EUR per intersection).