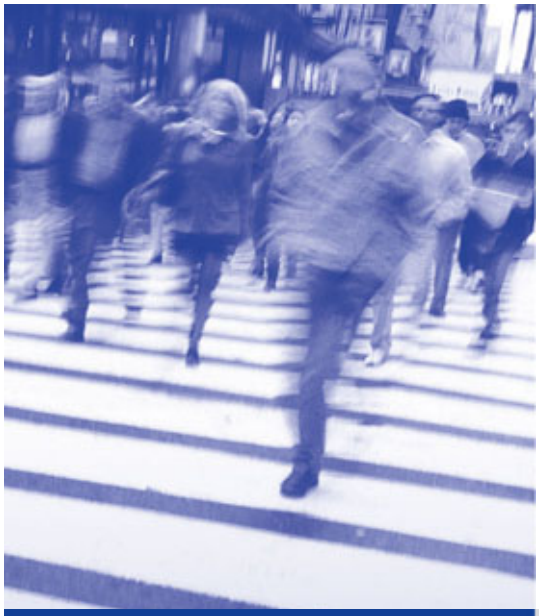

CiViTAS
Cleaner and better transport in cities

ELAN
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Implementation status report on 70 new energy efficient trams

ELAN Deliverable No. 1.3–D1

Project acronym: ELAN
Project full title: Mobilising citizens for vital cities

Grant Agreement No.: ELAN TREN/FP7TR/218954/"ELAN"

Measure: 1.3 - ZAG Energetic recovery system for trams

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Co-authors: Dubravko Baričević, Branko Mikinac

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Keywords

General

x	CIVITAS		
x	ELAN Project		

Work package links

x	WP1 Alternative fuels & clean vehicles		WP7 Energy-efficient freight logistics
	WP2 Collective transport & intermodal integration		WP8 Transport telematics
	WP3 Demand management		WP9 Project coordination
	WP4 Influencing travel behaviour		WP10 Project management
	WP5 Safety, security & health		WP11 Research and Technological Development
	WP6 Innovative mobility services		WP12 Impact and process evaluation
		x	WP13 Dissemination, citizens' engagement, training and knowledge transfer

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04/11/2010	L. Pavić-Rogošić	Preparation of the proposal of final draft	Draft	ML,SDM
08/11/2010	Srećko Krznarić	Preparation of the final draft	Final	ML, SDM, SC

CONTENT

1. Summary

Measure 1.3-ZAG *Energetic recovery systems for trams* aims at the increased use of energy efficient trams in Zagreb's public transportation (PT) fleet. Its main purpose, to introduce 70 innovative tramway vehicles into the public transport fleet, was achieved. After the introduction of the first new tram on 15 January 2008, on 30 June 2010 the last of the new 70 trams was introduced. The introduction of new trams contributed to decreasing electricity consumption (feeding back electricity into the network) and decreasing noise level by using innovative technology. It has also increased accessibility of public transport, made transportation by tram more attractive to the citizens of the city and has improved security standards for passengers, vehicles and staff through use of CCTV in vehicles.

Besides achieving a modernization of the PT fleet and increasing security, the innovative aspect is the application of energy efficient technologies to return power into the electrical supply network while using brakes in tramways.

The gradual substitution of the existing fleet by state-of-the-art vehicles made travel by PT more attractive to the public.

A survey done by ODRAZ among more than 400 citizens has shown their almost unanimous judgment that the new low-floor trams are the major recent PT improvement. New technology improvements, like displays in the vehicles were also highly praised.

The new tram in the centre of Zagreb

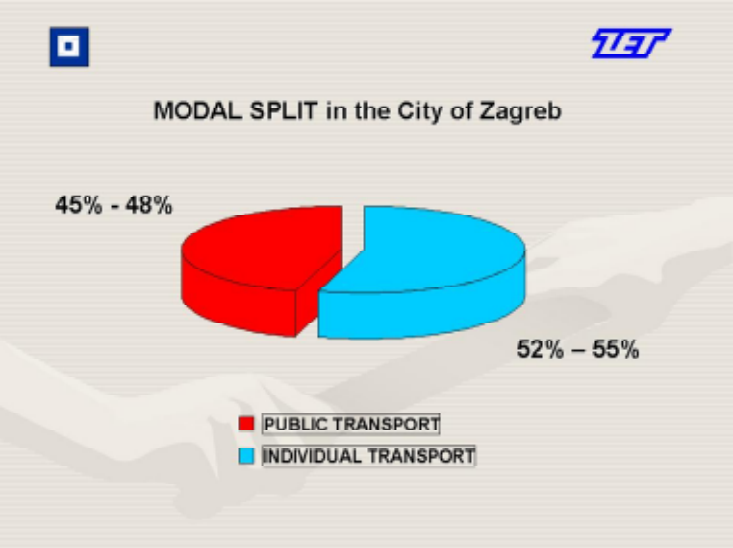
2. Introduction

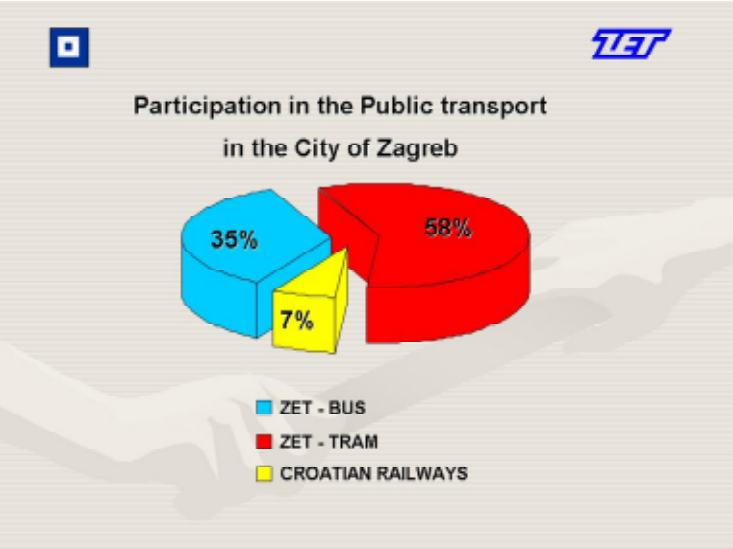
2.1. City of Zagreb

Zagreb is the capital city of Croatia, with nearly 780,000 people living within the city boundaries, while the metropolitan area has more than 1 million inhabitants.

The city's historic street grid was largely defined in the 19th century which today causes traffic problems as the centre houses main administrative, cultural, commercial and social institutions. The grid could hardly support traffic until 1990, but with the number of vehicles having almost doubled since then, the situation becomes dramatic, so there was an urgent need to act.

The modal split in Zagreb, according to ZET's latest data, is slightly in favour of individual transport (52-55%). Public transport is organized through bus, tram and rail services. The modal split is visible in the graphs below:





2.2. About ZET

The Zagreb Municipal Transit System or ZET (Zagrebački električni tramvaj) is a branch of the Zagreb Holding, specialized for passenger transportation in the city of Zagreb and one part of Zagreb County. It is exclusively owned by the City of Zagreb and it is mainly financed through the City budget. ZET provides transport to citizens through bus, tram and funicular services, but also provides special transportation to people with disabilities.

It was founded in 1891 as Horse Tram Association, which turned into Zagreb Tram in 1892. Zagreb Electric Tram – ZET was established in 1909. Since July 2006 ZET is a branch of the Zagreb Holding.

ZET, aside from its primary function, passenger transportation, in more than one century of its existence, greatly influenced the development of Zagreb, and this influence continues to grow by covering important daily transport routes in Zagreb and suburban areas with its extensive tram and bus system. ZET follows the city development and connects many newly built districts, and together with the City District Councils adapts the routes and stations to address the needs of citizens.

In the last few years ZET has started new projects for upgrading its public transit system. Before CIVITAS-ELAN 70 new, modern, low-floor trams were purchased. CIVITAS-ELAN has contributed to the delivery of a second series which includes an additional 70 low-floor trams.

ZET also acquired 214 low-floor buses. Following environmental standards, ZET started to use biodiesel in public transportation vehicles and compressed natural gas (CNG).

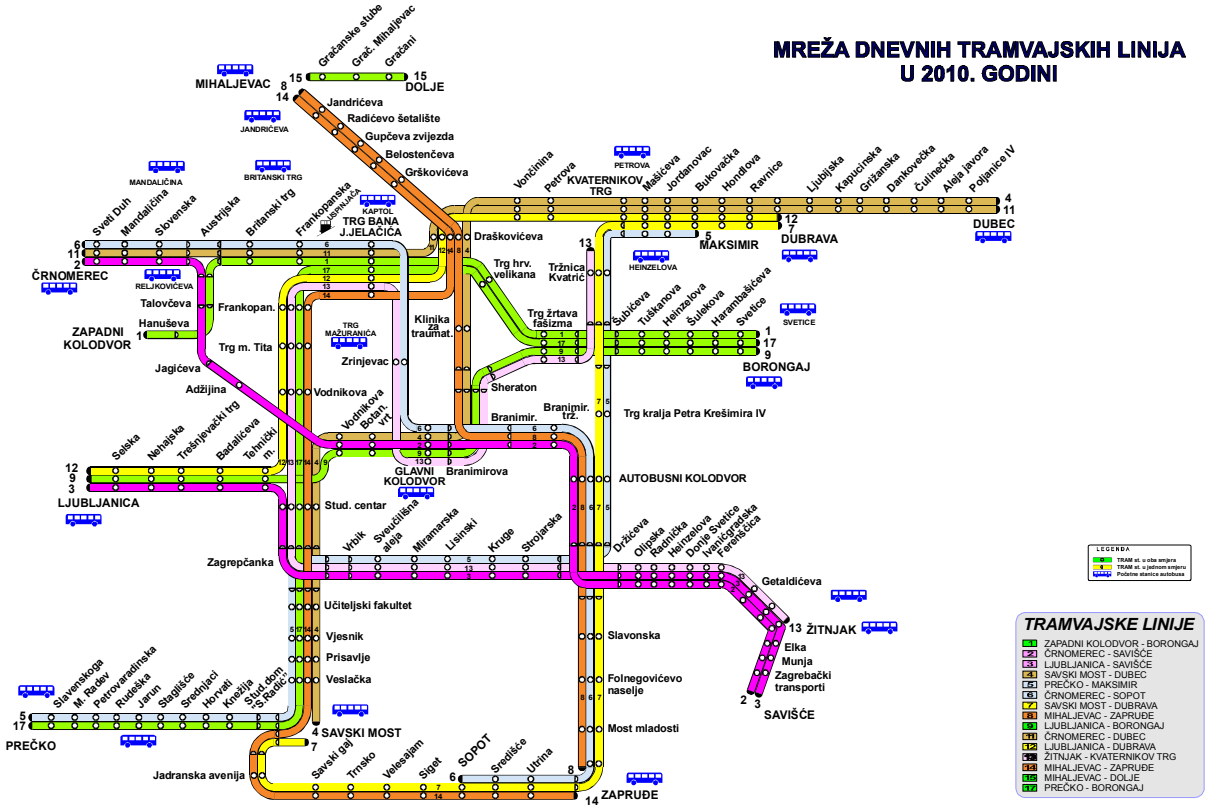
The radio connection system is modernized and traffic monitoring and control are also computerized by introducing a vehicle location system. Setting up the infrastructure for 147 displays on tram and bus stops, on which passengers should be able to receive real-time arrival information, is in progress.

Since July 2007, service users can buy a ticket by using mobile services and sending an SMS. The activities of introducing digital and automatic public transport charge, so called smart cards, is part of the CIVITAS-ELAN activities.

With the realization of all planned activities, ZET and the City of Zagreb, when it comes to quality of public transportation service, will meet European standards.

2.2.1. Tram service

Tram service is the basic type of public transport in Zagreb. Regular tram transport includes 116.843 meter long tracks, 193 lead (motor) cars and 41 trailers. 15 day lines run during the day on 148 km long tracks and four night lines on 57 km long tracks. The city has 256 tram stops. 204.000.000 passengers are transported in Zagreb by trams per year. (Data for 2008).



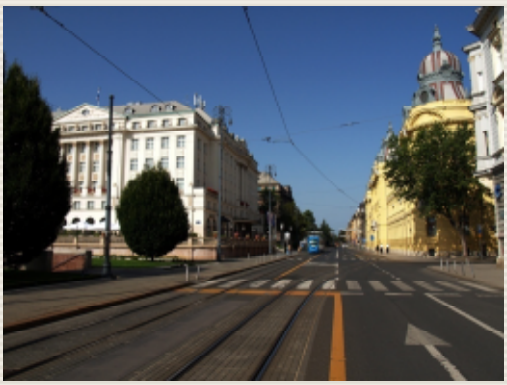
Linija broj 3 ne prometuje subotom, nedjeljom i blagdanom

Slika 1

The fleet consists of several tram types produced by different manufacturers. Croatian manufacturers are Končar and TŽV Gredelj from Zagreb, which built 16 articulated TMK 2100 trams, and Crotram consortium, also from Zagreb, who produced 140 modern, low-floor TMK 2200 trams and two low-floor TMK 2300-K trams. Đuro Đaković factory from Slavonski Brod produced 18 four-axle TMK 201 and also 19 trailers type 701. 51 vehicles TMK 301 i 351 (KT4) were produced by ČKD Prague. The same manufacturer produced 78 units of TMK 401 (T4) matching 73 trailers 801 (B4). There are 16 TMK 901 (GT6) trams produced by Düwag. There are two so called grinding machines as well as two work trams. There are five ploughs and seven cargo trailers.

Two tram depots exist in Zagreb. The depot in Trešnjevka consists of 9.213,11 m long gauges, 28 of which are used for parking. Six vehicles on daily basis are being prepared for traffic, one type of trailer, work and cargo trams. The depot in Dubrava has 8.500 m long tracks with 30 gauges. This depot puts in service three types of trams and one type of trailers.

TRAM TODAY



TRAM VEHICLES

Producers: HR companies (Đuro Đaković, Končar, Gredelj)
ČKD TATRA, Düwag

NUMBER OF TRAM VEHICLES

Motor cars	303
Trailers	85
TOTAL	**388**

TRAM GAUGE	1 000 mm
LENGTH OF TRACKS (in m)	
on separate body	62,534
on roadways	54,309
subtotal	**116,843**
Depot Trešnjevka	6,164
Depot Dubrava	9,312
Subtotal depots	15,476
TOTAL	132,319

The tram fleet through history

New trams

2.3. Situation before CIVITAS

Tramways are the backbone of public transport in Zagreb. They are operating in short intervals and often beyond capacity. ZET operates 15 tram lines with 267 motor cars and 129 trailers over 117 km tracks with 1.000 mm gauge. Due to the prevalence of energy consuming, not accessible, uncomfortable, overcrowded and noisy vehicles, transport by tram was not sufficiently attractive to public. Therefore, a shift towards individual motorized transport was observed.

Being aware that a large proportion of trams that operated in Zagreb did not offer the level of service required, and because most of these vehicles were well past their lifetime the procurement of new vehicles was planned. A financing plan for procurement was prepared.

ZET started a large scale fleet renewal in 2005, introducing 70 new low-floor tramways in the period 2005 - 2007. Apart from being more accessible and attractive, these vehicles produce less noise than the old ones. A particular interesting feature is the energy recovery system that allows generating electrical power when braking and feeding it back to the electrical

network. Using this feature and lighter construction materials, energy efficiency can be increased. The first low-floor tram introduced in Zagreb in 2005 was built by Croatian manufacturers, the CROTRAM consortium (Končar and Gredelj). The level of domestic production is more than 60%. Altogether, 70 trams were introduced within the first round.

3. Measure 1.3 – ZAG – Energetic recovery systems for trams

This measure is part of **WP1 Alternative fuels & clean vehicles**, which is addressing alternative fuels and clean vehicles in a comprehensive and integrative approach: Such vehicles should, among others, be low-polluting, energy efficient, using renewable fuels produced in the region and silent.

One of the ways how CIVITAS-ELAN achieves this is by increasing energy efficiency through comprehensive energy management and innovative energy recovery/ saving techniques.

The measure to increase energy efficiency in Zagreb is 1.3-ZAG Energetic recovery system for trams, by introducing new energy efficient and energy saving trams and feeding back electricity.

3.1. Newly introduced trams

As already mentioned 70 new trams were produced by Crotram consortium and put in traffic between 2005-2007.

Within the second round, partly co-financed through CIVITAS ELAN, an additional 70 trams were introduced to PT in Zagreb. The last, the 70th tram of the second series (NT 2200), was delivered by Crotram on 30 June 2010. On that day the intensive modernisation of Zagreb's tram fleet was officially completed. Since then, the quality of PT as well as the drivers' working conditions have significantly improved.

The basic characteristic of the tram is its low floor without stairs by which is entirely adapted to people with difficulties in walking. Also, circulation of passengers is quicker.

The tram consists of five parts, with two hanging parts and three with operative base. Its construction is made of steel, with polyester parts. It is 32 meters long, with air-conditioned space for passengers and the driver. The highest speed is 70 km/h. The tram can accommodate 202 passengers, out of which 48 have the possibility to sit.

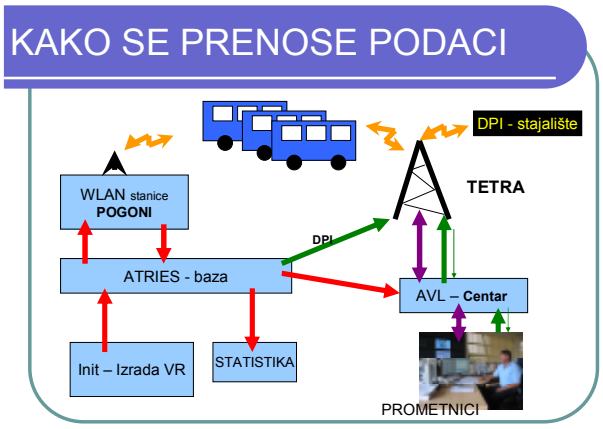
One of the main characteristics of those new trams is the ability to feed back electricity into the network when braking. In case that one or several trams in driving mode are within the same energy sector, the energy recovery supplements their need for energy from electric pull of gravitating rectifier stations, thus they are less burdened. In case that there are no other vehicles, the part of energy recovery stays in breaking resistors and is gone to the air, while a part is returned to bus in rectifier stations.

The gradual substitution of the existing fleet by state-of-the-art air-conditioned low-floor trams that return braking power into electrical supply network remarkably increased the level of service to patrons, and thus patronage of trams, which will eventually lead towards less pollution by private motor vehicles within the city.

All of the 70 new trams are labelled with stickers "CiViTAS ZAGREB-co-financed by the EU".

3.2. Training of drivers and maintenance personnel

The education of drivers on how to drive the new tram which is long and heavy, with specific characteristics of acceleration and deceleration, is a key for safety and comfort of passengers. The goal of the training on how to drive and manage during driving was not only to increase the safety of passengers in the tram, but also to decrease the risk of unexpected situations in traffic. Also, one of the goals was to teach drivers on how to decrease the use of energy while driving.



The procedure of transferring data and voice within the system of surveillance and traffic management

Besides all tram drivers, the maintenance personnel were also trained. Altogether more than 700 ZET tram drivers and maintenance personnel were trained since April 2008 until the end of January 2010.

3.3. Surveys on passengers' satisfaction

3.3.1. ZET survey

In order to find out the PT costumers' level of satisfaction, a survey was prepared and conducted by ZET. A questionnaire with seven questions was prepared to collect basic information about the respondents and their habits and opinions on PT and the new trams.

Altogether 240 respondents filled in the questionnaire, out of which 25 were not filled in correctly. Therefore, the analysis was made based on 215 correctly filled in questionnaires.

The survey showed that new trams are welcomed by PT users, as 102 of the respondents think that only new trams should be used; 86 of them think that more new trams should be introduced to PT, while 22 think that there are enough new trams. Most of the respondents (195) think that the decision to buy new trams is good.

The satisfaction of PT users was obtained by posing a set of 26 questions: the results show that respondents are very satisfied with the low floors of the new trams as they allow easier entering to tram. What they are not satisfied with is the available number of seats. Yet, the average satisfaction with the new trams was very good. The results are grouped into several similar categories, e.g. based on characteristics of outer design (quality, safety, etc.); inside (comfortable, light, air-condition, space, seats, etc.). The results show that high grades were given for the improvement of PT since the new trams were introduced. On the other hand, the respondents are not willing to pay more for the ride in the new low-floor trams.

The detailed results are included in Annex 1.

3.3.2. ODRAZ survey

A survey entitled „Status of transport possibilities, perception of PT and users habits in the corridor - Survey, step 2“ was conducted within measure 2.5-ZAG. The survey started in January and the results are available to the public since 1 March 2010.

The questionnaire was divided into three parts. In the second part, citizens were invited to evaluate PT in Zagreb by attributing 1-5 points to the listed PT features, separately for trams, buses and railways. Out of 441 collected questionnaires 430 were filled in correctly by visitors of the CIVITAS-ELAN info point and urban railway users at two stations.

In their written comments citizens were almost unanimous in their judgment that the new low-floor trams and buses are the major recent PT improvement. New technology improvements, like displays in the vehicles were also highly praised.

3.3.3. Comments of Info-point visitors

ODRAZ analysed the comments made by visitor to the info point in note-books posted in the info point and prepared comprehensive report on findings, including those related to PT and new trams. The findings are presented on Zagreb's local CIVITAS-ELAN website at http://civitas-elan.zagreb.hr/userfiles/PDF/Prijedlozi_gradana_-_knjiga_utisaka_0909_0410.pdf.

The comments could be divided in several areas: ZET/ trams and buses, city railway traffic, cycling, improvements of PT and traffic conditions, traffic management, ticketing, safety and other issues. In general, the info point visitors are satisfied with PT but they also formulated comments and suggestions and expressed their needs with regard to city traffic. The new trams and displays with real time information were commended. They proposed more tramway vehicles, concrete new routes/ extended tram lines, fines for drivers using yellow lines for PT vehicles, etc. They also noticed 'black' spots/ areas for PT, especially during rush hours, one of them is Savska street, the CIVITAS-ELAN demonstration corridor.

3.4. Promotion

- CIVITAS ELAN tram line no. 20 ran along the project corridor (Sava bridge - Savska street - Main square) from 20 – 25 April 2009 as a promotional activity marking the new trams on the occasion of the ELAN Project Management Group meeting. For this, ZET and Čistoća put CIVITAS -ELAN signs on the trams and presented leaflets on the project in the trams.

- A leaflet “Did you know?” for the CIVITAS Day 2009 was prepared by ODRAZ in cooperation with ZET, explaining PT in Zagreb from its beginning until today (see Annex 2).

- Each new vehicle was introduced by the Mayor of Zagreb. Those events were regularly covered by the media, thus the public was constantly informed on the increasing number of new trams.

Mayor of Zagreb entering new tram

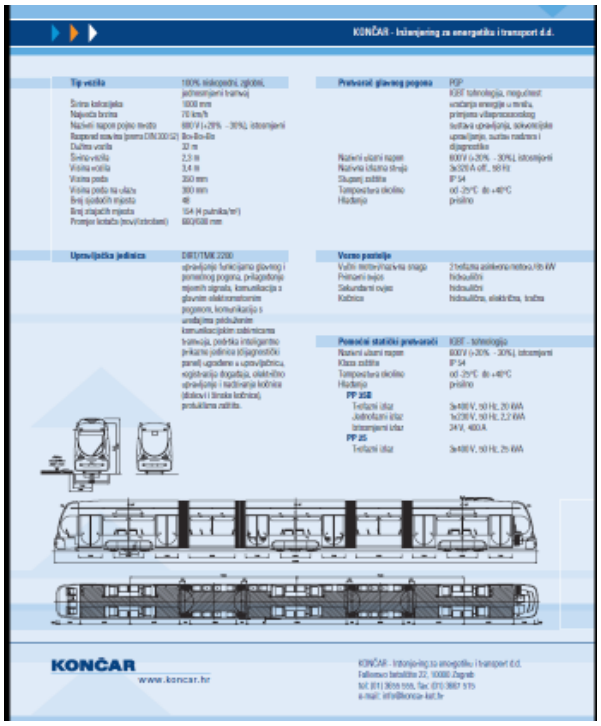
The last tram of the 2nd series

- ZET also organised a promotion event by forming a „caterpillar“ of new trams, driving through Zagreb. This event received widespread interest from the media.

Presentation of new trams in the form of a „caterpillar"

4. Conclusion

Within the second round, partly co-financed through CIVITAS ELAN, an additional 70 trams were introduced to PT in Zagreb. The last, the 70th tram of the second series (NT 2200), was delivered by Crotram on 30 June 2010. On that day the intensive modernisation of Zagreb's tram fleet was officially completed. Since then, the quality of PT as well as drivers' working conditions have significantly improved.



5. Annexes

5.1. Annex 1: Results from survey on PT consumers' satisfaction

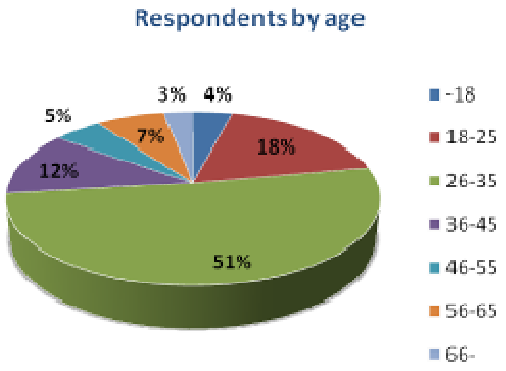
In order to learn about the PT consumers' level of satisfaction, a survey was prepared and conducted by ZET. The questionnaire consisted of seven questions on basic information about the respondents, their habits and opinions on PT and the new trams.

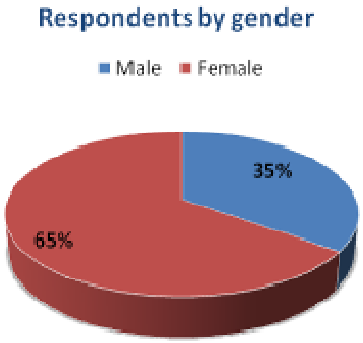
Altogether, 240 respondents filled in the questionnaire, of which 25 were not filled in correctly. Therefore, the analysis was made based on 215 questionnaires.

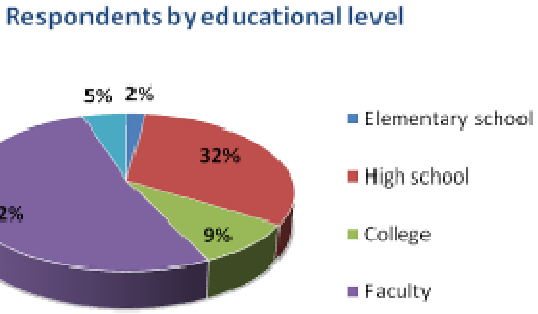
SURVEY RESULTS

Basic information on respondents:

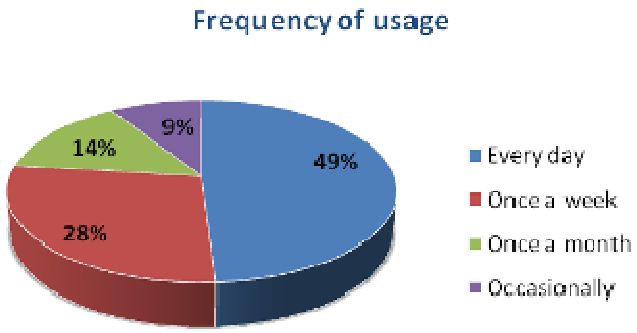
- By gender – 76 male (36%) and 139 female (65%)
- By age – 110 between 26-35 years; 38 between 18-25; 25 between 36-45; 15 between 56-65; 11 between 46-45; eight under 18 and seven over 66 years old
- Based on education level – four respondents finished elementary school; 64 high school; 20 college; 113 have faculty diploma and 10 respondents with post graduated level.



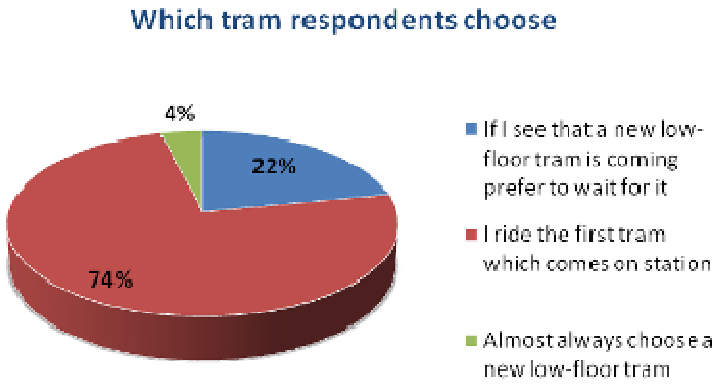




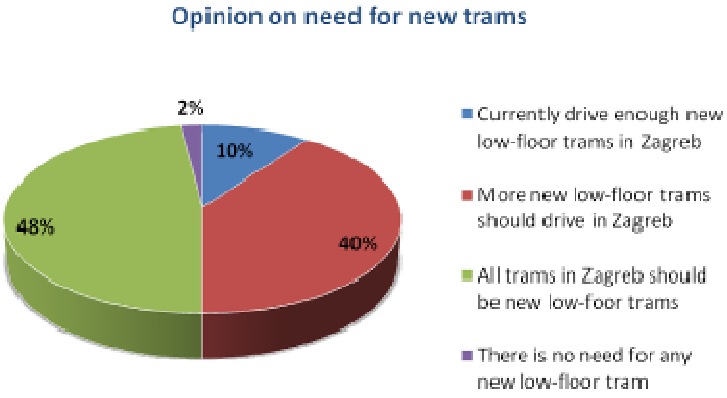
Most of the respondents use tram as a **mode of transport** very often (106 every day and 60 once a week); some of them occasionally (30 once a month and 19 very rarely).



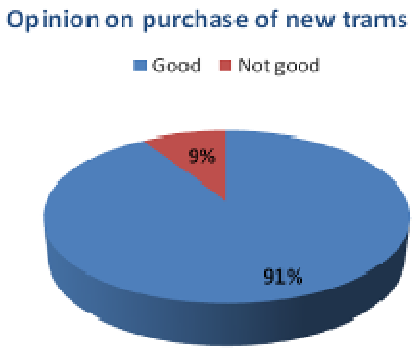
Most passengers use the first tram that appears on the tram station, while 47 wait for the new, low-floor tram if they see it coming. Only eight respondents use only the new trams.



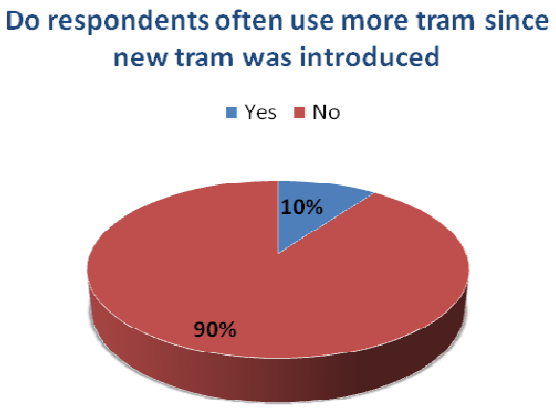
The survey showed that the **new trams are welcomed by PT users**, as 102 of the respondents think that only new trams should be used; 86 of them think that more new trams should be introduced to PT, while 22 think that there are enough new trams. It was a surprise to find out that five respondents thought that Zagreb did not need new trams at all.



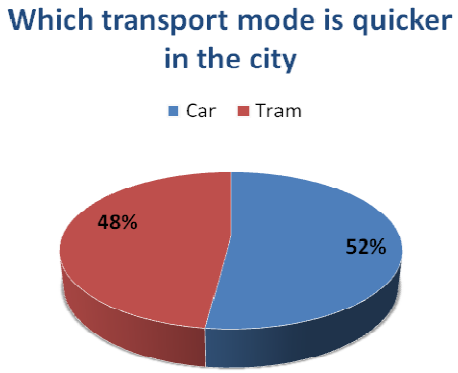
Most of the respondents (195) think that the **decision to buy new trams** was good and only nine of them do not think that it was a good idea.



The purchase of the new trams, although most of the respondents regarded it as a good decision, did not lead towards an increase in the usage of trams in general. Only 22 respondents mentioned that because of the new trams they use this kind of PT more often.



To the answer on the question **which transport mode is quicker in the city**, respondents had different views. While 112 think that cars are quicker, 103 think the same for trams.



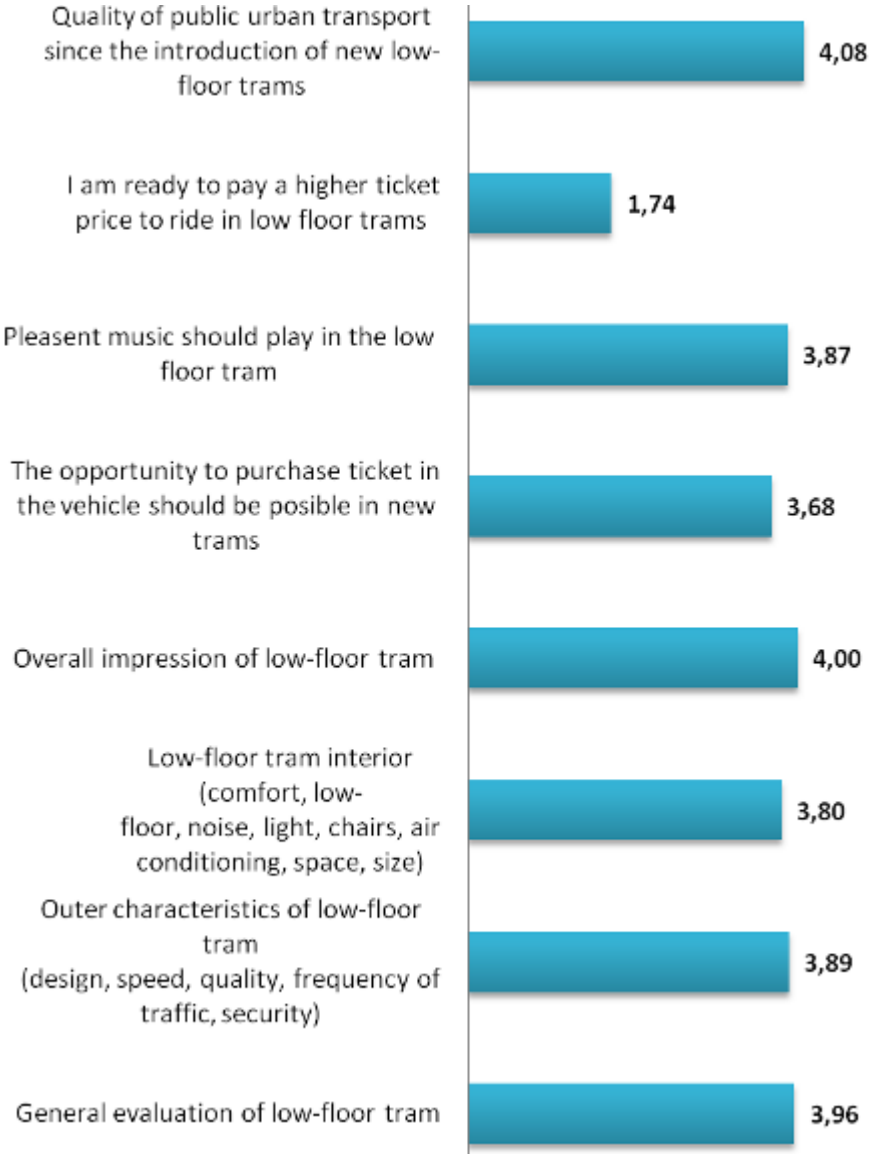
The level of satisfaction of PT users was obtained by answers given on 26 questions.

The respondents gave grades on posed statements (Lickert scale, from 1-5). The results show that respondents are very satisfied with the low floors of the new trams as they allow easier entering of the tram (4,7 grade). They are not very satisfied with the number of available seats (2,75).

The overall average satisfaction with the new tram was very good (3,96).

The results were grouped into several similar categories, e.g. based on characteristics of outer design (quality, safety, etc.) and inside (comfort, light, air-condition, space, amount of seats, etc.).

The results show that high grades were given for the improvement of PT since the new trams were introduced. On the other hand, the respondents are not willing to pay more for the ride in the new low-floor trams.



5.2. Annex 2: ZET Leaflet

5.3. Annex 3: New trams in the media

aktivnosti izvršnih odbora u ZET-u

Dva gradonačelnika pustila u promet 124. tramvaj... sindikat o tome nije imao pojma...

JOŠ ČETIRI PREOSTALA

U promet pušten 136. niskopodni tramvaj

Riječ je o tramvaju koji je uključen u redovan promet na liniji broj 12, a prvi putnici bili su gradonačelnik Bandić, proizvođači i ZET-ovci

Autor: Tanja Nikšanec

Od jutros prometuje i 136. niskopodni tramvaj čiji su prvi putnici tradicionalno bili gradonačelnik Milan Bandić sa suradnicima, predstavnicima proizvođača i ZET-a.
Riječ je o tramvaju koji je uključen u redovan promet na liniji broj 12.

Prvi niskopodni tramvaj u Zagrebu je pušten 2005. godine, a napravili su ga Tvornica željezničkih vozila Gredelj i Končar električna vozila. Do svibnja ći u promet trebalo biti pušteno i ostala četiri niskopodna tramvaja.

Vezani članci: U promet pušten 136. niskopodni Slične teme: TRAMVAJI NISKOPODNI

www.zagreb.hr 30.6.2010.

U prometu i 140. niskopodac, zadnji iz druge serije / u pet godina još 60 tramvaja

U nazočnosti gradonačenika Milana Bandića, potpredsjednice Gradske Skupštine Tatjane Holjevac, predsjednika ZG Holdinga Ive Čovića, v.d. voditelja podružnice ZET Dubravka Baričevića, predstavnika gradske uprave i konzorcija CROTRAM , jutros je, uz prigodnu svečanost pušten u promet i 140 niskopodni tramvaj. To je za sada posljednji tramvaj iz serije TMK 2200, a ako je suditi po najavi gradonačelnika Bandića, u narednih pet godina očekuje nas daljnjih 60 tramvaja.

Već uobičajeno, tramvaj je vozio na relaciji trešnjevačka remiza - Trg bana Jelačića i dalje linijom 12, ali je ovaj put stao i kod Petrićeve ulice gdje je otvorena nova prodavaonica karata i ZET-ov Info centar, suvremeni prostor površine 49,5 m2 i vrijedan 420 tisuća kuna.

Tjedni bilten

Dobrovoljno davanje krvi u petak, 9. srpnja na trešnjevačkoj remizi od 8 do 12 sati, u Podsusedu od 9 do 13 i u Dubravi od 9 do 12 sati. Budite humani, darujte krv!

U prometu i zadnji – 140. niskopodni tramvaj

Ljetovanje za djecu branitelja

Nova prodavaonica karata u Petrićevoj

Izmjena radnog vremena

CIVITAS ELAN Gradonačelnik kod Tehničkog muzeja otvorio info-punkt

Tramvaj umjesto 130 automobila

U sklopu projekta, gradski oci nastavljaju uvoziti nove tramvaje i autobuse, jedinstven sustav naplaćivanja karata i veću sigurnost u prometu

Građani Novinari http://www.javno.info/gn/pr.php?id=colonia.tino&m=2&rbr=22931

Zagrebom vozi tramvaj broj 20

Ljudi su se zbunili pojavom tramvaja broj 20. Naime, nekoliko tramvaja s natpisom "Civitas Elan" vozilo je zagrebačkim ulicama, od Savskog mosta, preko Trga bana Jelačića, pa sve do Trga žrtava fašizma. Riječ je o projektima boljeg i ekološki prihvatljivijeg transporta koji bi trebali poboljšati život građana.

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Objavljeno: 20.04.2009. u 23:48h


Zagreb
KRATKO I VAŽNO
KOLIKO STANOVNICIMA DUBRAVE I ŠPANSKOG TREBA DO KAZALIŠNOG TRGA
Budi se istok i zapad grada, novinarska ekipa juri na posao biciklom, autom...
Brzi i žestoki žure na posao, tko će stići prvi?