

Measure title: Access and parking management for the Debrecen city centre

City: **Debrecen**

Project: **MOBILIS**

Measure number: 6.5.D

A Introduction

A1 Objectives

The measure's overall goal is to provide a soft control of the traffic through the urban traffic control centre. The specific objectives are the following:

- decrease of transit traffic in the city centre
- limit the traffic accessing the city centre at peak hours
- renew parking policy at city centre
- improve the traffic flow at high traffic junctions
- improve the drivers and passengers comfort feeling
- improve traffic safety

A2 Description

The City started the installation of the electronic countdown displays before the project, but due to the financial difficulties and budget limitation the development had to be stopped. This facility helps not only monitor and control the traffic itself, but from the point of view of the drivers it supports them as well to prepare to start for the green signal. Better preparation to start results in a less stressed state of the drivers, what's more, the number of vehicles crossing a junction has increased as well. Without the project, the installation of the necessary amount of countdowners could not be realised.

The display system shows the seconds remaining until the next signal (red/green) in digits for both drivers and passengers. The displays are mounted next to the signal lights. The system provides better traffic flow (due to better preparation more vehicles can pass the junction) and improved traffic safety (before red signal the drivers can break in advance).

During Mobilis, connected to the measure described above, a new traffic control system has also been set up which controls and monitors the traffic signals and traffic counter detectors. As for parking management, the P+R parking facility has also been implemented. According to the expectation of the City and of mobility experts, on the long term it will decrease the number of cars entering into the city, since the P+R is connected to PT lines ready to use by car.owners as well.

B Measure implementation

B1 Innovative aspects

The innovative aspects of the measure are:

Use of new technology/ITS:

The measure will provide a soft control of the traffic through the urban traffic control centre.

The electronic signal end countdown display system provides only information (not control), but drivers can better prepare for starting the vehicles, which increases the number of vehicles passing the junction per signal period. The technology itself consists of hardware and of the related software implementation.

B2 Situation before CIVITAS

The protected downtown covers 40 000 square meters street parking facilities and 2 600 parking lots. Citizens can find public parking facilities at major shopping malls, which are usually located to the surrounding area – Debrecen had only one shopping centre located in the heart of the city, but at the moment, as part of the renovation of the old market, another mall is being built. The building is planned to be finished in 2009. Both have parking facilities, but citizens still prefer to use the traditional parking facilities, creating quite of a traffic jam in peak hours. Thus, further extension of the controlled parking area is planned, which could result in an easier city centre traffic.

Parking charges are spatially differentiated, thus the centre zone is more expensive. The underground garage constructed at the conference hall and at the connected exhibition facility is open for public use. The Főnix event hall, located in line of the entrance road no 4, pretty far from the centre has large parking capacity as well, though it is unfrequented when there are no events in the hall.

There is a 25 000 square meters pedestrian zone in the city centre, to which only the public transport has exclusive access (tram). Individual traffic causes often bad traffic situations in the city centre which can affect public transport as well.

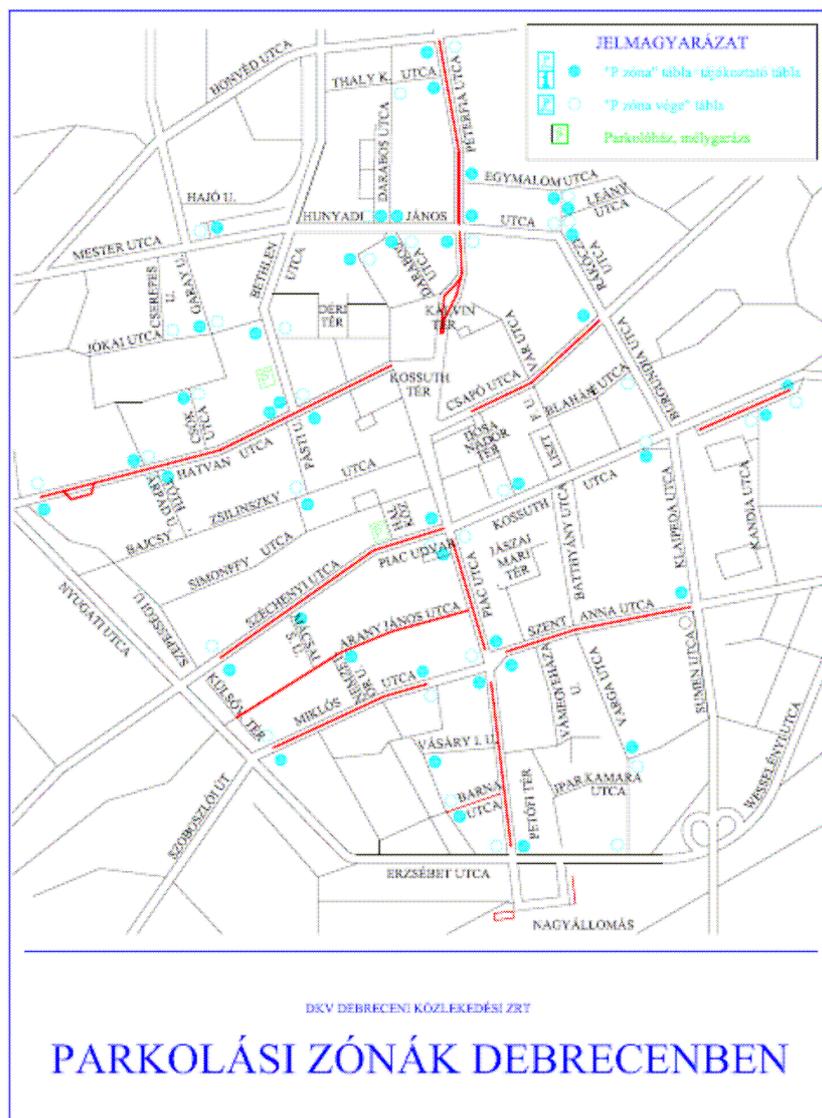


Figure 1: Parking zone in Debrecen centre

(o End of parking zone sign, • Parking zone information sign, P: Underground parking facility)

B3 Actual implementation of the measure

1. **Preparation of the study for access restriction.** The study for access restriction and management has been prepared, thus this working document was the basis of the further developments. The General Assembly accepted the Plan /date: 5th July 2007; Decision number: 179/2007. (VII.5.) Ö.h./. The access restriction and management consists of reorganising the parking areas and promoting underground parking facilities.
2. **Installation of the electronic countdown system.** Based on the results of the study 50 electronic signal end countdown displays have been procured and installed at 15 traffic junctions in the first semester of the project (June, 2005).
3. **Reorganisation of the signal periods.** Based on the traffic signal plan the reorganisation of the signal periods has been accomplished.
4. **Installation of static information signs.** Static information signs and variable message signs have been installed on Road 4 in order to inform the drivers about the P+R possibility at Főnix hall. The investment finished in April 2008.

B4 Deviations from the original plan

The measure has been carried out according to the envisaged realisation path; only – due to bureaucratic reasons - a minor delay occurred concerning the implementation of the traffic control plan. (For the installation of the variable message sign a complete plan is compulsory, that has to be submitted to the State Road Maintenance Company in order to get permit. The licensing procedure was longer than it was expected due to some problems concerning the electrical plan.)

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

No.	Measure title	Relation
11.5.D	Sustainable city-traffic development plan	Alternative mobility modes
6.1.T	Definition and implementation of a new parking management policy in Toulouse	Parking management strategies
6.7.V	Parking management strategies for Mestre (Venice mainland)	Parking management strategies
6.10.O	Environmental zones for Odense municipality	Access management

C Evaluation – methodology and results

C1 Measurement methodology

C1.1 Impacts and Indicators

Table of Indicators

No.	Impact	Indicator	Used	Comments
1	Transport: congestion	Variation of the number of vehicles crossing the traffic junctions	Yes	Counting the number of vehicles in selected time-periods at appointed junctions representing the town
2	Transport:	Increased number of cars using out-downtown parking facilities (P+R at Fónix Hall)	NO	Counting the number of vehicles parking at the facility in different periods of the week and the day
3	Society: acceptance	The drivers feel eased and can better prepare for start when the lamp turns green	Yes	Survey carried among drivers of the town
4	Society:	Information about car-using customs of the citizens	Yes	Survey carried among drivers of the town

Detailed description of the indicator methodologies:

Indicator 1: Vehicle count. The objective method to measure the changes in traffic flow is to count the number of vehicles crossing a junction in selected periods of the day and the week.

Indicator 2: Vehicle-count at Fónix Hall parking facilities. This indicator has not been used, since according to the evaluation team the time passed between the implementation of P+R signs and the possible timing of the research was not enough to point out considerable increase in the usage-level. Given that the popularity of Fónix Hall as well as the increasing number of events may well attract more and more citizens and tourists as well, it is highly probable that in year's time a real increase will be observed in P&R use.

For all indicators, the selected time-periods of the day represented the morning rush hours, mid-day hours and the evening rush hours as well:

1. counting and survey period	Between 6.30 am and 11.30 am
2. counting and survey period	Between 11.30 am and 4.30 pm

3. counting and survey period	Between 4.30 pm and 9.30 pm
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Indicator 3, 4: Survey carried among drivers of the town. A survey (using quota research sampling) has been carried out based on the same timetable.

C1.2 Establishing a baseline

On 14 (Tuesday, representing a weekday) and 17 (Friday, representing a peak-day), November, 2006, students of the Department of Sociology have carried out a traffic-count at two junctions of the city: in both cases we have chosen 2-2 lamps (junctions) directly following each-other, one equipped with the countdown display and one without it, for that the differences of transmissivity could be analyzed.

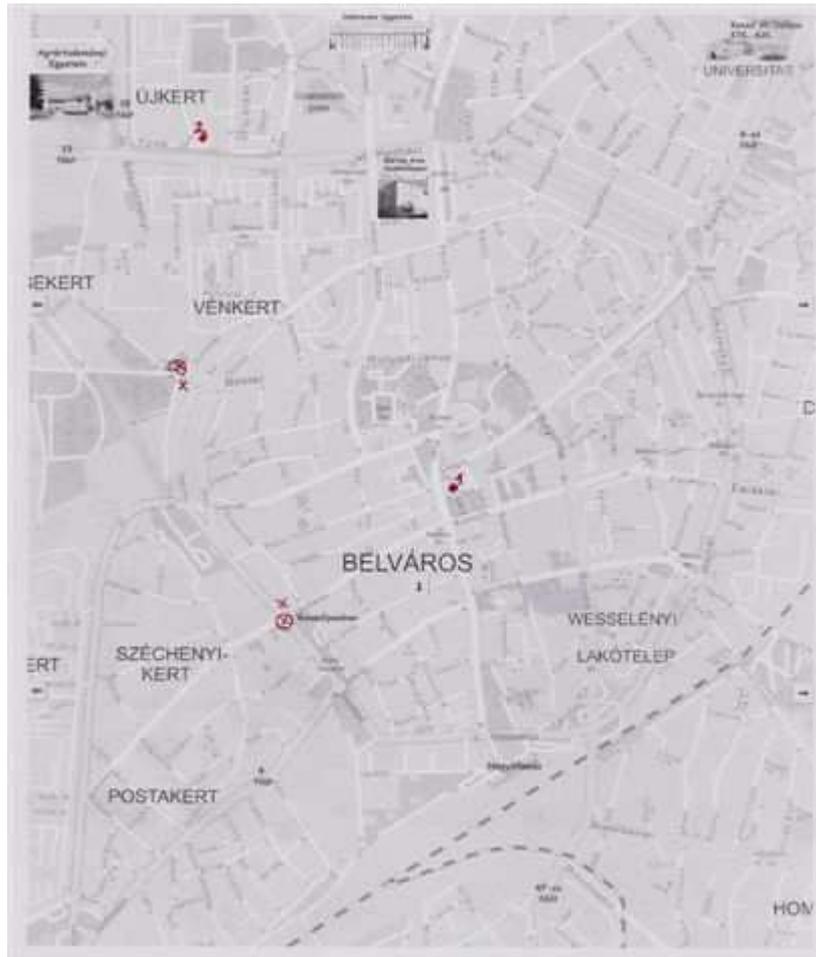
On 21 (Tuesday, representing a weekday) and (Friday, representing a peak-day) 24 (Friday, representing a peak-day), November, 2006, at two parking facilities of Debrecen. One of them can be found in the very heart of the city (Dósa Nádor square), while the other is placed nearby a shopping center (Interspar), right on the way of the recently placed displays.

For needs assessment and for measuring the population’s satisfaction related to a given Measure, quota sampling and a relatively small number of questioned citizens are most commonly used (this case **the number of interviewed citizens was 292**). To measure satisfaction, scale-designed variables have been used when it was possible. In certain cases – in purpose of an easier interpretation – we have transformed the values of the variables into a 100-grade scale. The value of the transformed variable would be 100 if all respondent gave the maximum value, and it would be 0 if all of them gave the minimal value of the original variable. The values under 50 points rather interpret condemnation, a kind of negative attitude, while the points above 50 points rather refer to positive opinions. In case of comparing means or cell-distributions, on the basis of ANOVA or Cramer’s V test, we have taken into consideration only the statistically relevant, thus significant variances.

As for the distribution of answers by place and time of questioning, the next tables show the results.

Location of data collection (%)

1. Dósa Nádor square, parking facility	48
2. IINTERSPAR shopping-centre, parking facility	52



(x: lamp without counter, o: lamp equipped with counter)

Time of data collection (%)

Between 6.30 am and 11.30 am	35
Between 11.30 am and 4.30 pm	40
Between 4.30 pm and 9.30 pm	25

C1.3 Building the business-as-usual scenario

The installation of the countdown system, as well the reorganisation of signal periods and the installation of the traffic control system all have a short-time impact on the city centre's traffic situation. Without the implementation of the measure, the bad situation at peak hours, the high number of traffic jams would remain, and probably became worth. The citizens' driving behaviour has long been stressed - this strongly affects pedestrians and cyclists as well, increasing the probability of accidents. Any ease of such a stressed attitude serves the safety of not only car-owners but also PT-users and all participants of urban transportation.

C2 Measure results

C2.1 Economy

The measure brought a long-term impact on the development of traffic control in Debrecen – it is probable that the system would provide a continuous tool for handling not even the

present situation, but also future changes in traffic situation of the city. The countdowners make drivers possible to prepare for the next green/ed signal, which can also decrease fuel consumption.

C2.2 Energy

In case of countdown displays, the better preparation may also affect the fuel-consumption of the cars, thus a slight decrease in consumption is expected.

C2.3 Environment

In case drivers entering the town will commonly use the P+R parking facilities and more and more drivers will leave the car there and continue to get into the centre by PT, the heavy pollution of the city centre is expected to decrease. Also, the increasing use of the centre's parking facilities (Conference Hall – underground parking facility, Plaza Shopping Centre underground parking facility) may affect the enlarging use of the pedestrian zone, thus reducing air-pollution as well. Such a change in drivers' behaviour nevertheless can only become visible in the long term.

C2.4 Transport

Results of counting

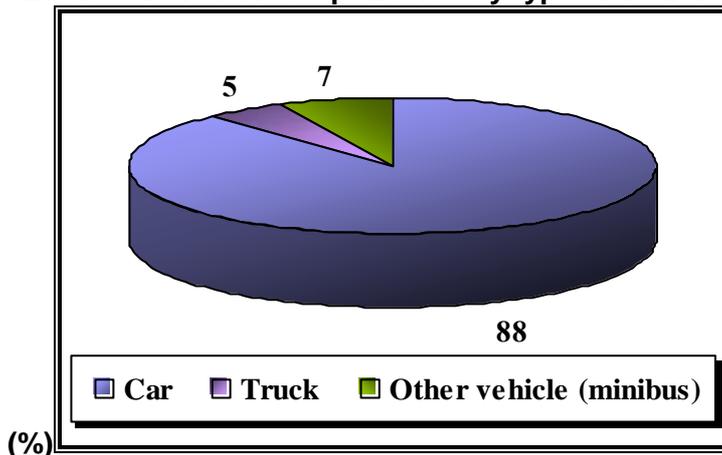
The results of the counting of the vehicles crossing a junction show a significant increase in the number of vehicles crossing in a signal period. Though variances expected to have a significant impact on this number, we can conclude that in all time periods and in weekdays as well as in peak-days the number of private cars has significantly increased (an increase of 8,5%). This is not true for trucks, their number has not increased due to the system, but since the trucks used are usually very old with an old engine, it is understandable that they cannot start faster even if they know when the lamp will turn green.

Average number of vehicles crossing a junction per hour

Traffic lamp equipped with electronic signal end countdown display	
Automobiles	356, 2
Trucks	78,4
Traffic lamp without electronic signal end countdown display	
Automobiles	300
Trucks	84,6

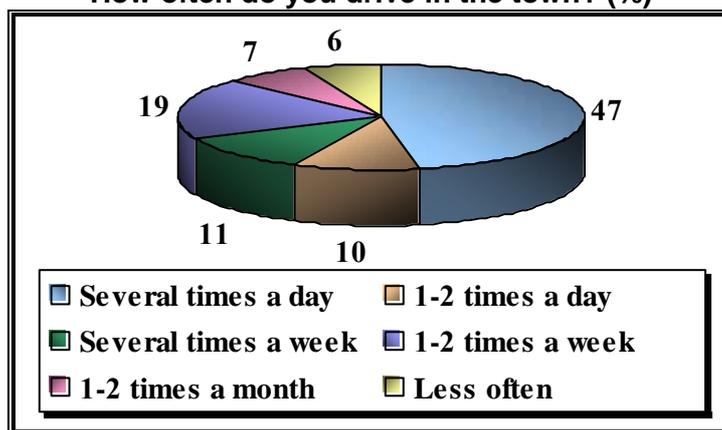
The **overwhelming majority of the respondents (88%) travel with car**, but the proportion of other vehicles (trucks and minibuses) might also be taken into consideration.

Distribution of the respondents by type of vehicle



Near half of the respondents (47%) drive more, than once a day in the town. The proportion of those who use their car for traveling in the town 1-2 times a week is also numerous (19%), but the proportion of those who drive less often (13%) refers that the majority of the sample is characterized by intensive car-using.

How often do you drive in the town? (%)

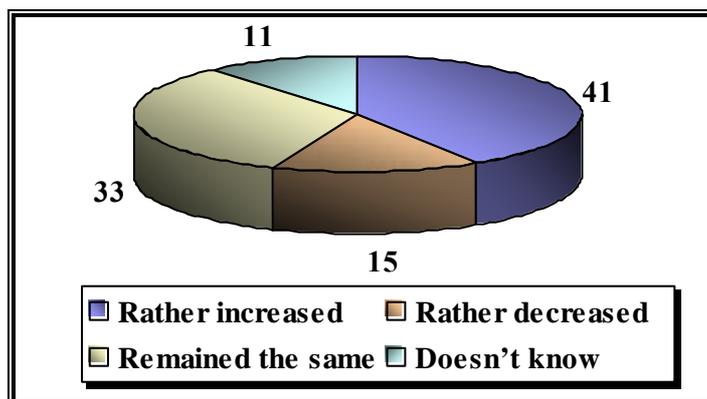


According to our previous expectations, the most intensive car-using in the town is characteristic for middle-aged citizens: 40% of those who drive at least 1-2 times a day is 35-49 years old, one third of them (32%) is 34 years old or younger, while 28% of them is 50 years old or older. Besides the significant age-parameters, the groups created by employment status are also characterized by a significantly relevant variance: two-third (74%) of those who drives on a daily rate works, while among those who drives less the proportion of employees is only 42%.

Satisfaction of drivers concerning the countdown system

Concerning the efficiency of the signal end countdown system, the relative majority of the drivers (41%) represent a positive judgment, though the proportion of the uncertain is also high (11%). Not more than 15% of the sample presumed that the traffic decrease (decrease in the number of vehicles crossing the junction) can be due to the countdown system, while on the contrary 45% of the drivers experienced a traffic increase, though every third respondent (33%) feel no changes in the volume of traffic.

Due to the countdown system, the number of vehicles crossing the junctions has... (%)



The previously significant age-factor also has a differentiating role, since elder drivers presume the impact of the new system on everyday traffic positive: among middle-aged drivers (50%) and the elderly (47%) the proportion of the respondents who experience an increasing traffic volume is significantly higher than among youngsters (28%). Following this logic, the proportion of those who don't feel any change is much higher among youngsters (45%) than in the two other age cohorts (middle-aged: 16%, elderly: 12%), while among the drivers who experienced a decrease in traffic volume no substantial difference can be found.

Interestingly, the type of the vehicle has also turned out to have significant impact on perception of changes in traffic flow: concerning the traffic truck-drivers presume a definite speeding up in a higher proportion than car-owners. 46% of truck-drivers experienced an increase, 27% a decrease in traffic volume, while 15% has not experienced any changes – the same proportions among car-owners is 41, 13 and 35%.

C2.4 Transport

The development of traffic control system, and the easing of drivers stress, as well as the increase in traffic speed in the city centre resulted in a safer and flexible traffic situation in the city centre, affecting PT-users, pedestrians and last but not least cyclists as well.

C2.5 Society

Among the drivers men are traditionally overrepresented, therefore it is not surprising that in our sample the same tendency prevails: **the proportion of men is definitely higher (61%)** than that of women (39%).

Distribution of the sample by gender (%)

Man	61
Woman	39

On the basis of ages – for the sake of further analysis – **we have divided the sample into three groups** representing the same number. In the following we will refer to the different age cohorts with the denominations as follows:

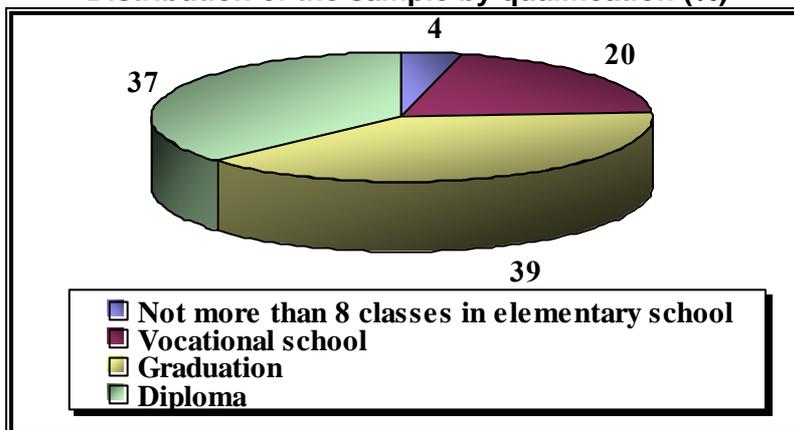
- youngsters (34 years and younger),
- middle-aged (35-49 years) and
- Elderly (50 years or older).

Distribution of the sample by age (%)

youngsters (34 years and younger)	35
middle-aged (35-49 years)	32
elderly (50 years or older)	33

The complete **sample’s qualification is much higher than the qualification of the adult population of the citizens of Debrecen** (data of the population is available in the database of Central Statistic Bureau, www.ksh.hu): more than three-quarter of the respondents (76%) have at least graduated, every third respondent (37%) has a diploma, while the proportion of those who has not more than 8 classes in elementary school is only 4%.

Distribution of the sample by qualification (%)



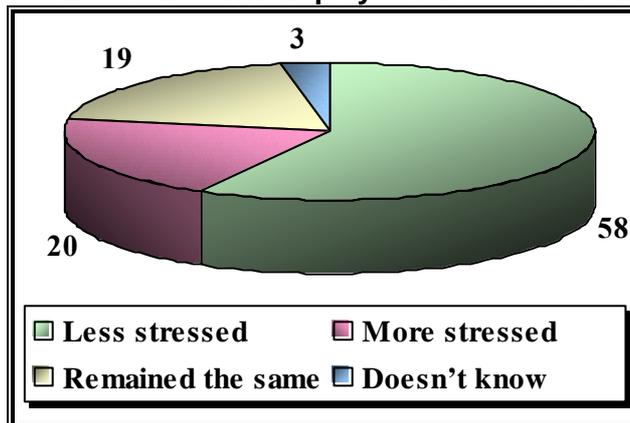
The majority, two-third of the sample (60%) is employed, every fifth respondent (20%) is retired and every tenth is a student (11%).

Distribution of the sample by status of employment (%)

Employed	60
Maternity benefit	3
Retired	20
Unemployed	4
Housewife	1
Pupil	11
Other inactive	1

The positive judgment of the countdown system prevail not only concerning traffic volume but also the behavior of the drivers. The majority of them (58%) presumed that drivers behave less stressed in the street, nevertheless every fifth respondent (20%) take the opposite side: according to them, drivers are more stressed due to the new system. The proportion of those who do not feel any changes is almost the same (19%).

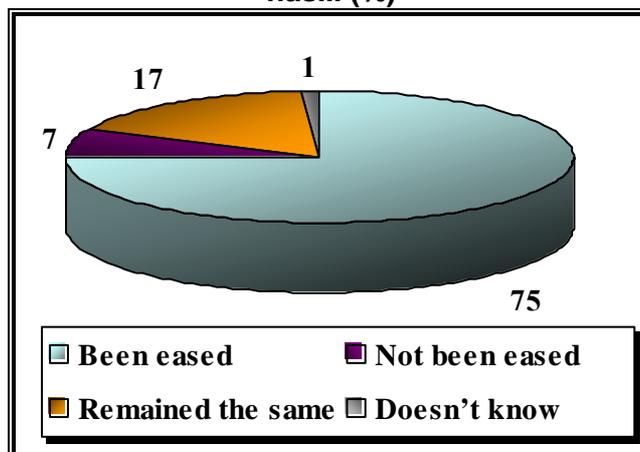
Due to the countdown displays drivers behave ... (%)



Unlike previous data, the judgment on the new system's impact on drivers' behavior differs significantly among groups created by qualification and the frequency of city-traffic. **The positive judgment of the system (drivers are less stressed) is significantly more characteristic to the group of the less educated who more often travel in the town.**

A third-quarter of the respondents (75%) presumes that both pedestrians' and drivers' everyday transport has been eased, only a minority (7%) experienced negative affects, and the proportion of the respondent feeling no change is not high either (17%).

Due to the countdown system, the transport (cooperation) of passengers and drivers has... (%)



According to the drivers, the countdown system has increased both the security and the speed of traffic. The means of the 100-grade scale (60 and 64 points) both suit the consequences coming from the previous responses: the drivers of the sample judge the operation of the countdown system positive from the viewpoint of the town.

How do you think the following issues have changed due to the countdown system? (100-grade scale, 0: has not increased at all, 100: has definitely increased)

The safety of traffic	64
The speed of traffic	60

Further analysis has confirmed that car-drivers presume the changes in traffic-safety significantly more favorable (65 points) than truck-drivers (57 points).

According to evaluation results, the majority of drivers are satisfied with the traffic-development realized in the framework of Mobilis, they feel that traffic became safer and faster as well, also drivers themselves perceive a decrease of the stress level regarding other on roads.

C3 Achievement of quantifiable targets

No.	Target	Rating
1	Implementation of a flexible and up-to-date traffic control system	**
2	Creating more safe traffic environment	**
3	Increasing the speed of traffic	**
4	Promotion of parking facilities outside of city centre	*
NA = Not Assessed * = Not achieved ** = Achieved in full *** = Exceeded		

C4 Up-scaling of results

Since the measure was only part of a long-term city traffic development plan, the results of this measure are attached to a wider development strategy, where inter-relation of impacts are expected to have a multiplicity of impacts on city traffic.

C5 Appraisal of evaluation approach

The approach, used in the course of the evaluation is proved to be a useful source of information both about the objective efficiency of the countdown displays and its perception among drivers as well. The evaluation of the efficiency of the installation of information signs about P+R parking facilities can only be measured on the long term, therefore at the moment a counting of cars cannot be carried out. It is regrettable that no “before” data has been prepared, therefore it is not possible either to compare existing traffic data with previous ones.

C6 Summary of evaluation results

Key result 1 – the number of private cars crossing a junction has increased by 8,5%, the number of trucks has not changed.

Key result 2– almost half of the respondents feel a significant increase in traffic speed due to the new displays, middle-age citizens and the elderly feel it stronger than the youngsters.

Key result 3 - though the display’s impact on speed could not be detected in case of trucks, truck-drivers feel more the speeding up of traffic than car-users.

~~D Lessons learned~~

D1 Barriers and drivers

D1.1 Barriers

No relevant barriers has been noticed

D1.2 Drivers

- **Driver 1** – the measure is a part of a long-term development strategy, thus it has short- and long-term impacts as well.

D2 Participation of stakeholders

- **Stakeholder 1** – DKV (Municipal Transport Company) had a major part in the installation of the traffic control system, as well in the installation of the countdown displays.
- **Stakeholder 2** – The city experts took part in the development of working materials and in bureaucratic processes of approval the developments.

D3 Recommendations

Recommendation 1 – the short-term impact of the countdown displays, as well as its relatively low costs ensures its efficiency in speeding up traffic in all towns. By using the displays the safety of traffic also increases.

Recommendation 2 – the promotion of such a display system is ensured by its visibility, therefore no additional costs of promotion have to occur.

D4 Future activities relating to the measure

The city will further develop Debrecen's traffic system according to the steps of the Development Plan, approved by the Urban Mobility Workgroup (Advisory body).