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Focus Measure Evaluation Results

UTR 4.3 Rewarding mobilists for avoiding rush hour

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Executive Summary

Since 2007 extensive infrastructural adaptations are implemented in the "Utrecht-West" area. One of the consequences of this large-scale restructuration is a temporarily decrease of traffic capacity on some main roads and highway junctions. Aware of these traffic disturbances, the city of Utrecht, in close coordination with the national highways authorities, founded a public-private cooperation between five organisations – called 'Stichting Utrecht Bereikbaar' – which has as one objective to limit the negative impacts on the traffic flows due to road works in and around Utrecht. Therefore the 'Stichting Utrecht Bereikbaar' has implemented several measures to prevent traffic disturbances in a short time frame and encourage changes citizens' behaviours towards sustainable mobility options. In MIMOSA this included the measures UTR 4.1 'Mobility Management Policy and UTR 4.2 'Disruption planning and Communication'. At the same time, the Minister of Traffic initiated the elaboration of a future national road pricing system and decided to invest 100 million Euros in pilot projects which contribute to gather experience and learn on rewarding mobilists issues and improvement of accessibility.

In this context, the MIMOSA measure 'Rewarding mobilists for avoiding rush hour' was designed to reach the combined objectives of the national initiative and of the local public-private cooperation. The specific objective of the measure was to reduce the amount of private cars in Utrecht-West area during the morning rush hours (6 am – 10 am) by giving financial incentives to car drivers who chose another itinerary, use another transport mode, or drive before or after the morning peak hours. Therefore a pilot-project was implemented and focused on road sections strategically selected along the national highway A2 and along five main roads in the southern and western part of Utrecht. The principle of the pilot project consists in identifying car owners who usually drive along the selected roads in the morning rush hours and in rewarding them with 4 Euro if they do not drive along these roads at this time of the day during the pilot. Preliminary studies showed that a reduction of 1,000 cars along the selected roads would be sufficient to prevent increases in the length and duration of traffic congestion in the morning rush hours. Consequently, the expected objective of the pilot project was to reach a participation rate of at least 1,000 car drivers pro day. To achieve this goal, the measure was implemented in the following stages:

Stage 1: Defining travel behaviour before the pilot (reference level) as a basis for the reward (April 2009 – July 2009 and September – December 2009) In order to draw a baseline for the pilot-project and for the impact evaluation, the contractor placed number plate readers (cameras) on the selected locations (on highway A2 and the main roads in the south western part of Utrecht leading towards the city). The license plates of each car driving along the selected roads in the morning rush hours were registered and the ones who were identified more than three times within two weeks were selected. The owners of the 15,555 selected cars composed the target group for the pilot project.

Stage 2: Recruitment of the participants (November 2009 – December 2009) From the 15,555 people that were invited by letter to participate, 4,026 car owners decided to participate (26% of the invited people).

Stage 3: Defining travel behaviour of the participants during the pilot to determine the reward (November 2009 – March 2010) The pilot project had been applied during a period of 13 weeks. For each of the 4,026 cars participating, the frequency of use per week of the all main roads leading to the city in the morning rush hours was measured. To do so, a second subcontractor placed surveillance camera system along other strategic main traffic axes to make

sure that the participants did not drive along these axes and increase the traffic flow in this other part of Utrecht during the morning rush hours. The comparison between the number of trips registered during the pilot project period and the number registered during the stage 1 of the measure enabled to determine which cars owners contributed effectively to the measure and should therefore be rewarded.

The **impact** evaluation focused on indicators in the transport sector. By distributing between 767 and 923 rewards per working day it was concluded that the traffic level was reduced between 500 and 700 cars during the morning rush hours. Thus the objective of decreasing 1,000 cars during the morning rush hour was not fully reached.

A Dutch study showed that it is difficult to measure the impacts of rewarding distribution due to the large number of external factors which are also influencing the traffic flow during the pilot project period. Despite the difficulties to draw the direct correlation between the implementation of the pilot-project and the results, three relevant observations on the traffic flow in Utrecht are positive and may be attributed as success of the MIMOSA measure. The first observation is that the traffic flow along selected section of the highway A2 remained stable during the MIMOSA period. The second positive outcome was established in a national report of the Ministry of Traffic which observed a reduction of travel times along the focused section of the A2 during the pilot project period. The third result showed an overall reduction of cars driving along the main traffic axes in the inner city within the period of the pilot project.

The most challenging **barriers** in the implementation were related to the technical difficulties with the licence plate recognition. The subcontractor guaranteed 90 to 95% recognition of the licence plates. In the beginning they spotted only 40%. After some measures they succeeded in improving the recognition and were obliged to extend the measurement period. Additionally, lease companies were not always willing to participate in the experiment, which reduced the number of potential participants. In Utrecht, a large number of car drivers are making their trip with a leased car.

The close cooperation between the region of Utrecht (BRU), the city of Utrecht and the national highway authority (RWS) was an important **driver** since it allowed the combining of different competencies. The participation of the highway authority allowed us to gain access to their license plate database, which was necessary to obtain the corresponding car drivers' addresses, to pre-select and invite them to participate in the experiment.

Several recommendations came out from the rewarding distribution experience. It is crucial to conduct a preliminary research to estimate the feasibility and the potential of incentive measure and to determine the target group. To achieve a successful rewarding system it is indispensable to apply a precise methodology for the data collection: the period of time and the selected area for the data collection should be clearly defined and remain the same for the entire process. The preliminary data collection establishes the references for the pilot project and the time between the collection of the reference data and the rewarding period should be kept as short as possible. Since the quality of the measure depends strongly on the reliability of the surveillance camera system, it is strongly recommended to ensure a good maintenance of the system and to prepare alternative solutions in case of dysfunction.

Despite the difficulty to evaluate the impacts the measure, the overall results showed that the objective to prevent the expected increase of traffic disturbances during the large-scale restructuration in Utrecht was achieved and it can be asserted that the rewarding system contributed to this success.

A Introduction

A1 Objectives

The measure objectives are:

High level objectives:

- Improvement of air quality

Strategic level objectives:

- More efficient use of infrastructure during rush hour.
- To limit the negative impacts on the traffic flow in Utrecht during the major road works in and around Utrecht.

Measure level specific objectives:

- To bring about a shift in private car trips from rush hours to off-peak.
- To investigate if changes in behaviour can be brought about through rewards and if acceptance is sufficient to merit up scaling this method to other areas.
- To decrease the number of cars during rush hours by at least 1,000 vehicles per day during construction works in Utrecht-West.

A2 Description

Why did we start this measure?
Extensive infrastructural adaptations have been and will be implemented in the "Utrecht-West" area from 2007. As a result, road capacity dropped temporarily on some of the most important entry routes and Highways. Due to these road works the city of Utrecht and the national highways authority Rijkswaterstaat Utrecht (RWS Utrecht) expected a lot of disruption, traffic delays and a decrease in the accessibility of Utrecht. Both authorities share the objective to decrease traffic disruption during road works.

To limit the negative impacts of these road works on traffic flows, the City of Utrecht reached unique public/private cooperation 'Platform Stichting Utrecht Bereikbaar' with the following organisations:

1. The Municipality of Utrecht
2. The National highways authority Rijkswaterstaat Utrecht (RWS)
3. The Utrecht Regional Authority (BRU)
4. The Province of Utrecht
5. The Mid Netherlands Chamber of Commerce
6. VNO-NCW Utrecht – employers organisation

A non profit organisation was founded under the name 'Stichting Utrecht Bereikbaar' (Utrecht Accessible Foundation) to execute the program and support the public private partnership.

Picture A2-1: Logo of Utrecht Bereikbaar en of Filemijden

This cooperation extends into the following areas: information and coordination in the fields of planning of public building activities and dynamic traffic management and also making arrangements in the field of city goods distribution, construction logistics and communication (co-sending).

The 'Stichting Utrecht Bereikbaar' has implemented different measures to influence mobility, which include: communications (measure UTR 4.2), FileMijden Utrecht /rewarding mobilists for avoiding rush hour (UTR 4.3) and the Utrecht Bereikbaar (UB) pass (this measure). All have the objective of limiting negative impacts on traffic flows in Utrecht during the major road works in and around Utrecht and reducing traffic disruption. A decrease in the number of incoming cars of between 2,000 and 4,000 per day during rush hours was the shared target result of all of these three measures. This means:

1. in normal circumstances a decrease of 2,000 cars during rush hours;
2. during special peaks (e.g. extra disruption because of extreme winter weather or a major decrease in capacity on the main roads in the city) a decrease of 4,000 cars during rush hours.

While measure 4.1 tried to get car travellers to use public transport and other means of sustainable transport, measure 4.2 aimed to reduce the disruption to a minimum through communication and within measure 4.3 car drivers that avoided travelling during peak hours were financially rewarded.

What was the measure about?

FileMijden Utrecht (FMU) literally means Congestion Avoidance Utrecht. FMU is an initiative of the collaborative regional partners within the foundation 'Utrecht Bereikbaar': Bestuur Regio Utrecht/the regional authority, the city of Utrecht and RWS Utrecht.

Originally the national authority RWS wanted to introduce road pricing in the Netherlands in 2012. In anticipation of this national road pricing system, the Minister of Traffic provided 100 million Euros to experience and learn from different measures aimed at rewarding mobilists and at the same time improving accessibility. FMU was one of these measures. Agreements between RWS and the region about the measure (like finances and time schedules) were recorded in the implementation agreement "Uitvoeringsconvenant Filemijden Utrecht". One of the agreements was that a rewarding-measure had to be implemented at least once, with a maximum of four times.

The measure has been put into action once, in the south-western part of Utrecht. In this area road construction works caused a decreased road capacity. It was assumed that a decrease of 1,000 cars during rush hours, on the roads where this decreased capacity would cause the biggest problems, would be enough to prevent traffic jams growing in terms of duration and distance.

In order to select and recruit participants, we measured which car drivers drove at what times and how often on these roads. Car drivers and motor cyclists that were registered at least three times within two weeks on these roads were invited to participate in the pilot.

Within this pilot a participant was rewarded with € 4 when he/she avoided these roads during the morning rush hours on working days between 6 AM and 10 AM. Experiences with rewards in another pilot in the Netherlands were used to determine this amount, and naturally the available budget relating to the desired number of avoided trips in the rush hours also determined this amount. A car driver could avoid these rush hours by:

1. not making the trip;
2. making the trip earlier or later;
3. travelling via another transport mode;
4. travelling to another destination.

Travelling by car from the same origin to the same destination at the same time but through another route, did not count as avoidance. During the weekend and on Holidays participants were not rewarded because on these days there are less motor vehicles on the roads.

B Measure Implementation

B1 Innovative aspects

The innovative aspect of the measure was:

- experimentation with a **new conceptual approach** – the measure involved reversed road pricing: motorists receiving money for travelling off-peak, instead of charging motorists for using the roads during rush hours.

B2 Research and Technology Development

Within the research and technological development phase an infrastructure / software for the reward system was developed.

The infrastructure for the reward system contained the following main elements:

- 58 traffic cameras;
- local equipment to recognise license plates and send this information to a central information centre;
- a central database to store the registrations;
- a central website with general information as well as personal pages, linked to the database.

Besides this, clear procedures were described on how to manage and operate all the systems. The systems needed to be safe and the personal data of participants had to be protected against unauthorised use. The website was tested extensively for this reason.

Before starting the pilot, various tests were carried out to test all the systems. The systems should work so that the cameras detect all license plates from all passing cars and send these data to a central database. The cameras were tested in different acceptance tests by comparing the collected data with actual video footage.

The database organised the received data so that each participant could find their own information on his or her personal webpage (where did he/she drive and when, how much money had he/she earned). This website had the same lay-out as the general Utrecht Bereikbaar (Utrecht Accessible) website, which was also used for CIVITAS MIMOSA measures 4.1 and 4.2. They also received a regular electronic newsletter with advice and stories from other participants and each month, one participant received a “Rush Hour Avoider of the Month” prize: an extra €200.

B3 Situation before CIVITAS

Extensive infrastructural adaptations have been and will be implemented in the "Utrecht-West" area from 2007. As a result, road capacity dropped temporarily on some of the most important entry routes to Utrecht. Due to these road works, the city of Utrecht and the national highways authority Rijkswaterstaat Utrecht (RWS Utrecht) expected a lot of disruption, traffic delays and a decrease in the accessibility of Utrecht, especially during rush hours. By rewarding people for avoiding driving during these rush hours, the objective was to decrease this disruption. This kind of measure had not been tested in Utrecht before CIVITAS MIMOSA.

B4 Actual implementation of the measure

The FMU pilot took place between the 30th of November 2009 and the 26th of March 2010.

It was assumed that in this period 1,000 cars needed to avoid the morning rush hours each day to prevent an increase in traffic delays.

In general the FMU pilot consisted of the following steps:

1. defining travel behaviour before FMU (reference level) as a basis for the reward;
2. recruitment of participants;
3. defining travel behaviour during FMU to determine the reward.

After the pilot the evaluation was conducted. The main objectives of this evaluation were to calculate the number of cars that had avoided rush hours, gain insight into the impact of the measure on the traffic ‘outside on the roads’ and learn in order to be able to make improvements in potentially similar future measures.

A description of these steps is given in this paragraph.

Stage 1: Defining travel behaviour before FMU (reference level) as a basis for the reward *(20th of April 2009 – 1st of July 2009 and 21st of September – 10th of December 2009)*

To make sure a participant would not get a reward on days he/she would not normally have used the roads anyway, a reference level was used. This reference level shows travel behaviour before the pilot. It is based on the number of times a license plate was registered on specific roads by cameras during the morning rush hours before the pilot.

During two periods (the summer holidays were excluded) cameras with Automatic Number Plate Recognition registered the license plates of all the cars along the roads on which the biggest traffic delays were expected. These were the national highways A2 and A12 and five main roads in the southern and western part of Utrecht. Figure B4-1 shows the locations of the cameras during the baseline measurement.

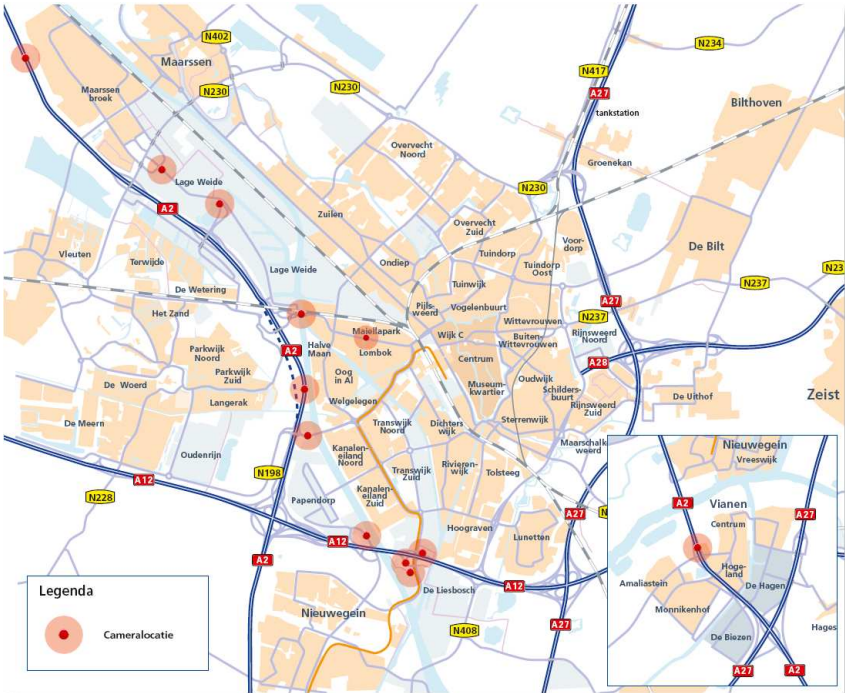


Figure B4-1: Locations of the cameras during the baseline measurement (Goudappel Coffeng)

These reference level measurements were conducted by another organisation separate from the organisation that was involved in recruiting the participants and defining the rewards (see stages 2 and 3). Due to this Utrecht Bereikbaar had more influence on the determination of the target groups.

The first registration period was held from the 20th of April till the 1st of July of 2009 in order to collect the license plate holders who were eligible for the pilot. The second registration period was held from the 21st of September till the 10th of December of 2009 in order to, again, collect the license plate holders who were eligible for the pilot and to verify the first registration. License plates that met the requirements (see stage 2) in the first period, but did not in the second, were excluded. In both of these periods the cameras registered the license plates and these registrations were used to calculate how many times each single car and motorcycle (license plate) had driven on each of the roads. For each of these two periods 30 representative working days were used to define the reference level. These days are stated in tables B4-1 and B4-2.

	Week 17	Week 20	Week 21	Week 23	Week 24	Week 25	Week 26	Week 27
Monday	20-4		18-5		8-6		22-6	29-6
Tuesday	21-4		19-5	2-6	9-6	16-6	23-6	30-6
Wednesday	22-4		20-5	3-6	10-6	17-6	24-6	1-7
Thursday	23-4			4-6	11-6	18-6	25-6	
Friday	24-4	15-5	22-5	5-6	12-6	19-6		

Table B4-1: the dates of the 30 working days in the first registration period (2009) that were used to define the possible participants and the reference level (Goudappel Coffeng).

	Week 39	Week 41	Week 42	Week 46	Week 47	Week 48	Week 49	Week 50
Monday	21-9	5-10	12-10	9-11	16-11		30-11	7-12
Tuesday	22-9	6-10	13-10		17-11		1-12	
Wednesday	23-9	7-10	14-10	11-11	18-11	25-11	2-12	9-12
Thursday			15-10	12-11	19-11	26-11	3-12	10-12
Friday			16-10	13-11		27-11	4-12	

Table B4-2: the dates of the 30 working days in the second registration period (2009) that were used to define the possible participants and the reference level (Goudappel Coffeng).

On these days the registration of the cameras was not affected by failures and these days were not school holidays.

A period of 30 days is more than enough to define the aggregated reference level (sum of the number of trips in the morning rush hour before the pilot of all the participants) as well as the individual reference behaviour level (number of trips in the morning rush hour of one single participant before the pilot) (Goudappel Coffeng).

For both of these periods of 30 days it was calculated how many times a vehicle/license plate made a trip in the morning rush hours (based on the number of times a vehicle/license plate was registered by the cameras on one or more of the involved routes). This was determined as the reference level. If a participant was registered on more than one route, this was still calculated as one trip.

This number was divided by 3, the outcome was defined as the average number of morning rush hour trips per two weeks in the baseline. An example: a person who was registered 5 times in the first 10 days, 5 times in the next 10 days and 7 times in the last 10 days had a reference level of 5.67, which is rounded up to 6.

Stage 2: Recruitment of the participants *(November 2009 – December 2009)*

The owners of cars that were registered at least three times within two weeks at the following locations were invited to participate in the first pilot:

1. at least three times at the same highway location and three times at the same municipal location with a maximum travel time between these two locations of one hour;
2. at least three times at the complete route of highway A2 within the area (between Breukelen and Nieuwegein through Hooggelegen and vice versa; Hooggelegen is one of the main entrances of Utrecht, on the A2);
3. at least three times at the same part of highway A2 (within the area between Breukelen and Hooggelegen or between Nieuwegein and Hooggelegen);
4. at least three times at Hooggelegen;
5. at least three times at the Martin Luther Kinglaan (the main road that leads from the A2 to the city centre);
6. at least three times at one of the municipal locations.

Car drivers living within the area could not participate; participation was meant for people driving past Utrecht or driving to Utrecht.

On the 19th of November 2009, based on the results of the first period of registrations of license plates, 7,244 car owners were invited to participate. A further 3,125 lease car drivers were also invited to participate. Some weeks later another 5,186 car owners were invited, based on the second period of license plates registrations.
Of these 15,555 people that were invited to participate, **4,026 car owners decided to participate** (26% of the invited people) (Goudappel Coffeng).

People who decided to participate were given a reward of 4 Euro for every morning rush hour they did not use the relevant roads, compared to the reference level.

For example: if a participant was registered on average four times a week in morning rush hour before the pilot (reference level) and during the pilot once a week, he was rewarded with 4 Euro three times.

Stage 3: Defining travel behaviour of the participants during the pilot to determine the reward *(November the 30th of 2009 – March the 26th of 2010)*

This measure was aimed at decreasing the number of vehicles in the western part of the city. The participants received a reward for each trip they avoided on the involved roads during the morning rush hours in comparison to the reference level. To prevent FMU causing an increase in the number of cars in the eastern part of the city, due to 'smart' car drivers who decided to choose routes in the eastern part of the city during rush hours to travel to their destination, it was decided that participants would be awarded money only when they did not drive on the A2 along Utrecht or to Utrecht at all during morning rush hours.

In order to verify this, cameras were placed on all the roads leading to Utrecht. A cordon around the city was used to determine the locations of the cameras. These cameras registered the license plates of vehicles on this whole cordon. These registered license plates were used to calculate the number of trips of every single participant on these roads during morning rush hours during the FMU pilot.

Figure B4-2 shows the locations of these cameras during the FMU pilot.

Figure B4-2: locations of the cameras during FMU

During the pilot a participant could act as follows:

1. He/she drove less than he/she did during the reference period. This would result in a decreased number of trips in the morning rush hours.
   The participant received a reward which was related to the difference between his/her personal reference level and his/her behaviour during the FMU pilot.
2. He/she did not change his/her behaviour, the number of trips during morning rush hours did not change and the participant received no reward.

He/she drove more often during morning rush hours than he/she did during the reference level. In this case he/she would have made fewer trips in the morning rush hours. The participant received no reward but there were no negative consequences for the participant either.

The average numbers of paid rewards per two weeks is shown in table B4-3.

period	weeks	Average number of paid rewards per working day
1	49 & 50	328
2	51 & 01	767
3	02 & 03	923
4	04 & 05	867
5	06 & 09	824
6	10 & 11	858
7	12	851

Table B4-3: Average number of paid rewards per working day (Goudappel Coffeng)

Only participants that had activated their participation could be rewarded. At the start of the pilot due to technical problems it was not possible for participants to do this. During the week after the start (halfway week 50) this problem was solved. This resulted in a lower number of rewards at the start of the pilot than during the later period.

The numbers of rewards is bigger than the number of decreased vehicles due to the following reasons:

- The numbers of rewards reflect only the behaviour of the participants who drove less during the morning rush hours. Due to this, the number of rewards is not an indicator for the impact of the measure on the road.
- The way of determining the reference level influenced the numbers of rewards. The reward per participant was determined as follows: the reference level minus the number of trips in the morning rush hours during the pilot. If the result was negative, the reward is zero. If a participant who was registered 5 times in the first 10 days of the reference level period, 5 times in the next 10 days, and 7 times in the last 10 days, he had a reference level of 5.67 = 6. If this participant did not change his travel behaviour, he still received a reward for the first two weeks and for the second two weeks. For the last two weeks he received no reward but no 'punishment' either. So although he did not change his behaviour, this participant twice received 4 euro, while the number of trips did not decrease.

Stage 4: Evaluation (2010-2011)

Upon completion the pilot was evaluated. A (Dutch) report which was written by order of Utrecht Bereikbaar in which the pilot was evaluated based on the registrations of the cameras that were used to measure the reference level and the situation during the pilot, countings of vehicles by detectors on the highways and traffic light detectors on the main roads in Utrecht and a non-response survey (Goudappel Coffeng (www.goudappelcoffeng.nl), May 2011). Furthermore surveys among the participants were conducted by a market research organisation (TNS NIPO (www.tns-nipo.com)). Both reports have been used for this report.

Stage 5: Decision about a second pilot

As no other major road works were foreseen in 2010, it was decided to put the experiment temporarily on stand-by. In the autumn of 2010 it became clear that a second pilot could be executed in relation to the road works planned in the beginning of 2011 at highway A2 and one of the main intersections close to the centre. To establish behavioural change, a pilot period of at least 12 weeks would be necessary. Following a public tender it was decided that besides the operation phase, the subcontractor would also be responsible for the pre-selection of the car

drivers. The subcontractor was supposed to detect license plates (of cars driving on a particular stretch of the highway) so potential participants could be approached.

Even though the second pilot was planned for the beginning of 2011 the subcontractor did not succeed in detecting sufficient number plates because of technical reasons so they could not perform a statistically reliable baseline measurement. Due to this non-performance the subcontractor did not fulfil its contract and the 2nd pilot had to be postponed. It resulted in a delay and subsequently the road works on the target stretch of highway were already (nearly) finished and the pilot became obsolete. Because of this the second pilot was finally stopped in January 2011.

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **UTR 4.1 Mobility Management Policy**
- **UTR 4.2 Disruption planning and Communication**

These three measures were implemented by Stichting Utrecht Bereikbaar in the same period. All had the objective to limit negative impacts on traffic flows in Utrecht during the major road works in and around Utrecht and decrease traffic disruption. The measures received a lot of political attention and were innovative.

The measures had the higher objective of reducing the number of cars in the area of Utrecht West. A decrease in the number of cars could be the result of all three of these measures. Whereas 4.1 tried to get car travellers to use public transport and other means of sustainable transport, measure 4.2 aimed to reduce disruption to a minimum through planning and communication and within this measure 4.3 car drivers that avoided travelling during peak hours were financially rewarded.

C Impact Evaluation Findings

C1 Measurement methodology

C1.1 Impacts and Indicators

This measure aimed to bring about a shift in the use of private car trips from rush hours to off-peak, to decrease the number of cars during rush hours and to investigate if changes in behaviour can be brought about by rewards and whether sufficient acceptance to merit up scaling this method to other areas can be reached. To measure whether these objectives would be reached, societal and transport indicators have been used.

Because of the fact that the first two objectives are quite similar they share the same indicators.

The verifiable result was:

- significant decrease in the numbers of vehicles on the road during rush hour (at least 1,000 vehicles during construction works in Utrecht-West compared to January 2006).

After the analysis of the available data of travel times and traffic flows the conclusion was that a Cost-Benefit Analysis could not be performed due to problems with data collection during the baseline.

The indicators that were used to measure the impacts of this measure are listed in table C1.1.1.

Table C1.1.1 Table of indicators

No.	POINTER indicator number	Evaluation area	Impact	Indicator	Source of data	Related objective
1	--	Transport	Traffic flow levels	The reduction in the number of participant cars on the roads in the morning rush hours per working day	Goudappel Coffeng 'Evaluatie Filemijden Utrecht'	To bring about a shift in the use of private car trips from rush hours to off-peak.
2	--	Transport	Traffic flow levels	The number of vehicles on the involved roads during morning rush hours	Goudappel Coffeng 'Evaluatie Filemijden Utrecht'	To decrease the number of cars during rush hours
3	28	Transport	Modal split	The average number of days per week that FMU participants used the car to travel to work	Questionnaires (TNS/NIPO)	To investigate if changes in behaviour can be brought about through rewards and if sufficient acceptance can be reached to merit the up scaling of this method to other areas
4	--	Transport	Traffic flow levels	The average number of days per week that FMU participants worked at home	Questionnaires (TNS/NIPO)	To investigate if changes in behaviour can be brought about through rewards and if sufficient acceptance can be reached in order to merit the up scaling of this method to other areas
5	--	Transport	Traffic flow levels	The average number of car trips per week, differentiated by periods of the day	Questionnaires (TNS/NIPO)	To decrease the number of cars during rush hours. To investigate if changes in behaviour can be brought about through rewards and if sufficient acceptance can be reached in order to merit the up scaling of this method to other areas
6	16	Society	Acceptance	Reasons for not participating	Goudappel Coffeng 'Evaluatie Filemijden Utrecht'	To investigate if changes in behaviour can be brought about through rewards and if sufficient acceptance can be reached in order to merit the up scaling of this method to other areas

To report the results the following sources have been used:

- The results with regard to indicators 1, 2 and 5 were derived from the evaluation report written by Goudappel Coffeng; this traffic and transport consultancy, evaluated this measure in terms of the number of avoided trips in the morning rush hours by participants and the impacts on traffic.
- The results with regard to indicators 3 and 4 were derived from a survey conducted by TNS/NIPO, a research company (www.tns-nipo.com), among the participants to investigate the changes in travel behaviour of the participants.

Detailed description of the indicator methodologies

Indicator 1: The reduction in participant cars on the roads in the morning rush hours per working day

The number of participant vehicles on the roads in the morning rush hours is analysed and reported in the Filemijden Utrecht report (Goudappel Coffeng).

To determine how many cars of the total 4,026 participants did not drive on the involved roads in the morning rush hours during the pilot, the registrations of the automatic license plates readers were used (see figure B4-2 for the locations). The number of cars during the reference period was measured by a different subcontractor to the one that measured the numbers during the pilot.

The decrease in the number of participant vehicles in the morning rush hours was determined as follows:

- The sum of the reference levels minus the sum of the number of trips by the participants in the morning rush hours during the pilot.

The average numbers per working day were reported for every two weeks.

The average numbers of decreased participant vehicles were the result of:

- The participants who drove less during morning rush hours;
- The participants who did not change their behaviour;
- And the participants who drove more often during morning rush hours.

The decrease in the number of vehicles is less than the number of rewards because the number of rewards reflects only the behaviour of the participants who drove less during the morning rush hours. The participants who drove more often during the pilot than during the reference period had a negative effect on the number of vehicles on the roads.

Indicator 2: The number of vehicles on the involved roads during morning rush hours

To determine the changes in the traffic flows during the pilot, data from traffic detectors on the national highways were used, as well as traffic light detectors on the roads of the city of Utrecht and the data from the cameras with the number plate readers. These numbers were reported in the Filemijden Utrecht report (Goudappel Coffeng).

<u>Highways</u>

Figure C1.1.1 shows the locations of the traffic detectors on the highways surrounding Utrecht that have been used to measure the number of vehicles on these highways. In the analysis only the number of vehicles that drove towards the city centre has been used (in the morning rush hour this is the most crowded direction).

Figure C1.1.1: The three detector locations on the highways surrounding Utrecht. Each lane has its own detector (Goudappel).

Location 1 was selected to determine the Business-as-Usual scenario; the assumption was that this location was not affected by the FMU pilot. The other two locations, lying at the borders of the area of the pilot, were used to determine whether the number of vehicles driving towards Utrecht on these roads decreased during the pilot.

The following periods were used to measure the number of vehicles on these locations on working days:

1. Baseline: September – November 2009
2. FMU pilot: 30 November 2009 – 26 March 2010
3. After measurement: April – June 2010

The number of vehicles was analysed between 5.00am and 11.00am. This is one hour earlier than the measure started and one hour later than the measure ended, to allow us to analyse whether changes in travel times occurred.

In order to do a proper representative evaluation the aim was to have data for 30 working days for each of the three periods. Some days were not representative. These days (holidays, days on which big accidents happened, days with very bad weather, days on which big events took place and the first week after the implementation to get used to the measure) were not used.

After filtering the data the numbers of available days were as follows:

		Number of available working days with data		
		Baseline	FMU pilot	After measure
1	A27	38	31	32
2	A2 R	40	38	39
3	A2 L	35	34	34

Table C1.1.2: The number of representative working days for measuring the numbers of vehicles for the baseline, during the pilot and after the measure (Goudappel Coffeng)

Municipal roads

Figure C1.1.2 shows the locations of the cameras/number plate readers that were used to measure the number of vehicles on the main roads in the south western part of Utrecht. In the analysis only the number of vehicles that drove towards the city centre was used (in the morning rush hour this is the most crowded direction).

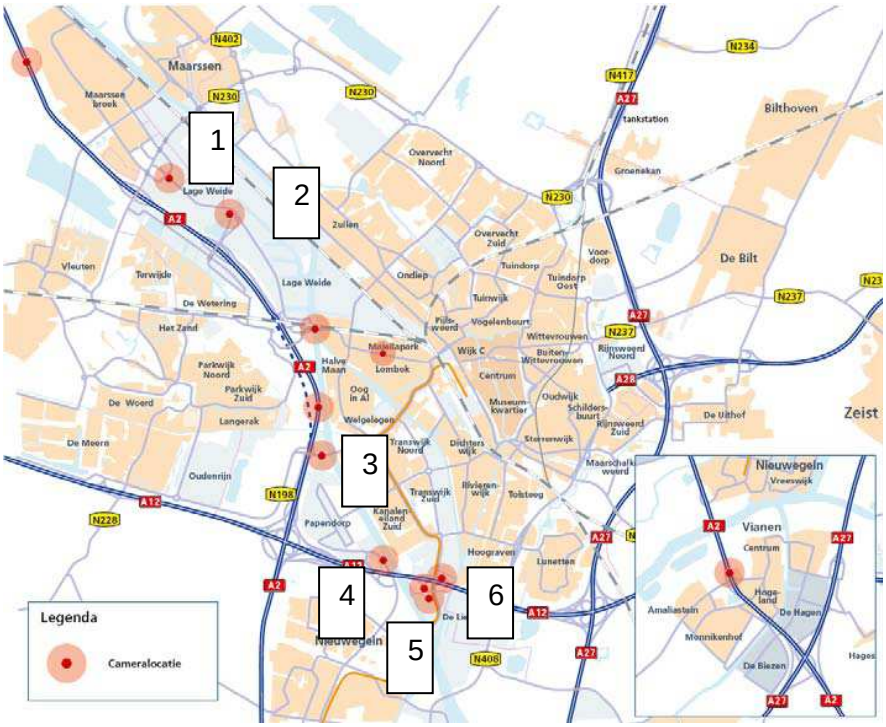


Figure C1.1.2: The six camera locations on the main roads in the western part of Utrecht, leading towards the city centre of Utrecht. Each lane has one camera (Goudappel Coffeng).

To measure the number of vehicles on these roads the same periods and hours as used for the highways were used.

As was the case with the highways, the aim was to have data for 30 working days for each of the three periods. After filtering the data the numbers of available days were as follows:

		Number of available working days with data		
		Baseline	FMU pilot	After measure
1	Lage Weide Atoomweg	28	31	19
2	Lage Weide	36	31	29
3	M.L. Kinglaan	9*	22**	0 (no data)
4	Papendorp	41	31	36
5	A12 exit Europalaan left	40	31	36
6	A12 exit Europalaan right	41	30	36

Table C1.1.2: The number of working days on which the cameras had data about the numbers of vehicles in the baseline, during the pilot and after the measure (Goudappel Coffeng)
** Due to very different numbers of vehicles until October 2009, only 9 days are available.*
*** After the 5th of March 2010, no data were available due to road works.*

Indicator 3: The average number of days per week that FMU participants used the car to travel to work

The travel behaviour of the participants was measured, analysed and reported by TNS-NIPO.

TNS-NIPO had the pilot participants complete online questionnaires at the start and at the end of the pilot. All of the participants of the FMU pilot were invited to fill in an on-line start-questionnaire at the moment they applied. At the end of the pilot a second questionnaire, the end-questionnaire, was conducted.

The results of these questionnaires were analysed and reported in chapter 4 of the report "Monitoring en evaluatie mobiliteitsprojecten ABvM" (TNS NIPO).

1,446 participants of the FMU pilot joined the pilot between 30 November and 14 December 2009 and filled in both the questionnaires they received at the start and at the end of the pilot. For indicators 3, 4 and 5 only the answers of these 1,1446 participants were considered who filled in both questionnaires.

Some background results of the respondents that filled in one or both of the questionnaires:

- 70% are mail and 30% female.
- 85% is 29 – 59 years old.
- 42% have one car available and 51% have two cars available in their household.
- 76% are car owners, 21% have a lease car.
- 79% work fulltime (five days per week or more).
- 71% work 4 or 5 days at one working address (not at home) and work at least one day per week at home.
- 44% have the possibility to work at home, 28% of the respondents can work at home but don't do this.

TNS NIPO reported the average number of days the 1,446 participants drove by car to work before the pilot (start-questionnaire) and during the pilot (end-questionnaire).

Indicator 4: The average number of days per week that FMU participants worked at home

To measure this indicator the same questionnaires as the ones for indicator 3 were used. The respondents answered in both the questionnaires the question how many days per week they travelled to work by which transport mode and how many days per week they did not travel to work.

Indicator 5: The average number of car trips per week, differentiated by periods of the day

To measure this indicator again the same questionnaires as the ones for indicators 3 and 4 have been used. The respondents answered, in both the questionnaires, the question at what times they travelled by car.

Indicator 6: Reasons for not participating

The reasons for not participating were surveyed through a (national) web panel in November 2010. The people in this panel (more than 100,000) were asked the question whether they received the invitation to participate in the FMU pilot. 766 people met the criterium, these respondents were asked several questions about their motivations.

C1.2 Establishing a baseline

The baseline for this measure is the situation before the implementation of the FMU pilot. The baseline shows:

Indicator 1. **The number of participant vehicles on the roads in the morning rush hours**
To determine the number of participant vehicles in the morning rush hours before the FMU pilot, the registrations of the automatic license plates readers conducted for the reference level were used. This resulted in the sum of the number of morning rush hours trips made by all the pilot participants. In the calculations the average numbers of trips per week were used.

Indicator 2. **The number of vehicles on the involved roads during peak hours**
The total number of vehicles on the roads in the baseline period was measured on the locations as mentioned in pictures C1.1.1 and C1.1.2 on representative working days between September and November 2009.

Indicator 3. **The average number of days per week that FMU participants used the car to travel to work**
TNS NIPO reported the average number of days the 1,446 questionnaire respondents said they drove by car to work before the pilot (start-questionnaire).

Indicator 4. **The average number of days per week that FMU participants worked at home**
TNS NIPO reported the average numbers of days the 1,446 questionnaire respondents said they did not travel to work before the pilot (start-questionnaire).

Indicator 5. **The average number of car trips per week, differentiated by periods of the day**
TNS NIPO reported the average number of car trips of the 1,446 questionnaire respondents differentiated by different periods before the pilot (start-questionnaire).

Indicator 6 was not applicable at the baseline.

C1.3 Building the business-as-usual scenario

The business-as-usual scenario consisted of:

Indicator 1. **The number of participant vehicles on the roads in the morning rush hours**
There are no numbers on how many of the participants would have avoided driving their car in the morning rush hours on the involved roads without the implementation of the pilot. Due to the fact that people are very reluctant to change their travel behaviour it was assumed that the number of trips on the involved roads, made by the participants in the morning rush hours would not have changed compared to the situation before the FMU pilot.

Indicator 2. **The number of vehicles on the involved roads during peak hours**
One of the locations where the number of vehicles on the highways were counted was selected to determine the Business-as-Usual scenario (location 1). The assumption was that this location was not affected by the FMU pilot and could be used to determine the B-a-U (to determine the effect of the different season and the development of the number of vehicles anyway).
Besides this the assumption was that the total number of vehicles on the roads in the baseline was measured at the locations as mentioned in pictures C1.1.1 and C1.1.2 on representative working days between September and November 2009.

Indicator 3. **The average number of days per week that FMU participants used the car to travel to work**

Due to the fact that people are very reluctant to change their travel behaviour it was assumed that the average number of days per week the FMU participants used the car to travel to work would not have changed compared to the situation before the FMU pilot.

Indicator 4. The average number of days per week that FMU participants worked at home

Due to the fact that people are very reluctant to change their travel behaviour it was assumed that the average number of days per week the FMU participants did not travel to work would not have changed compared to the situation before the FMU pilot.

Indicator 5. The average number of car trips per week, differentiated by periods of the day

Due to the fact that people are very reluctant to change their travel behaviour it was assumed that the average number of car trips per week of the FMU participants, differentiated by periods of the day would not have changed compared to the situation before the FMU pilot.

Indicator 6 was not applicable in the business-as-usual scenario.

C2 Measure results

The results are presented under sub headings corresponding to the areas used for indicators – economy, energy, environment, society and transport.

C2.1 Economy

Not applicable

C2.2 Energy

Not applicable

C2.3 Environment

Not applicable

C2.4 Transport

Indicator 1: The reduction in the number participant cars on the roads in the morning rush hours per working day

Goudappel Coffeng reported the average numbers of cars among the total 4,026 participants that did not drive during the FMU pilot as shown in table C2.4.1 (Goudappel Coffeng). Due to technical problems participants could not activate their participation at the start of the pilot. This problem was solved halfway through week 50. As a result the number of avoided rush hours was less at the start of the pilot than during the later period. For this reason the first period was excluded from the analysis.

Period	Weeks	Reduced cars per working day
1	49 & 50	205*
2	51 & 01	622
3	02 & 03	715
4	04 & 05	592
5	06 & 09	508
6	10 & 11	510
7	12	394

Table C2.4.1: Average reduction in the number of participant cars on the roads per working day during the FMU pilot (Goudapel Coffeng), based on 4,026 participants.

The average reduction in the number of participant cars per working day was the largest in period 3 and decreased during the following weeks to about 500 cars per working day. This decrease is possibly the result of the fact that participants decided to (again) use the car when the road works were almost finished (and caused less disruption) and to the fact that the disruption caused by the road works was less than expected.

Indicator 2: The number of vehicles on the involved roads during morning rush hours

Highways

Goudappel Coffeng reported that an analysis of the highways data revealed that the disturbance due to other aspects had been too big to be able to tell whether the FMU pilot has led to a decrease.

But: in general road works cause extra disruption. Nevertheless the national government declared there has been no extra disruption during the FMU pilot. Furthermore calculations by the national government show a decrease in travel time of one minute on one of the routes. These calculations are based on all the vehicles on that road, and this decrease could be a combined impact of the UB pass (UTR 4.1), the financial crisis and the FMU pilot.

Reasonably it can be said that the FMU pilot has prevented extra disruption during the road works.

Appendix 1 shows the numbers of vehicles in the three highway locations before, during and after the FMU pilot.

Municipal roads

Goudappel Coffeng reported that the numbers of vehicles measured by the cameras show big differences between the baseline and the situation with the FMU pilot. These differences are larger than what would have been expected as the results of the pilot.

Further analyses showed that the reliability of many measurements was not sufficient.

Furthermore there were road works at location 3 (M.L. Kinglaan) which affected the numbers. Two of the six that supplied good quality data: Lage Weide Atoomweg (location 1) and afrit Europalaan links (location 5). Only the data from these two locations were reported.

		Average number of vehicles			Pilot versus the baseline		Pilot versus the average of baseline and after	
location	**Time period**	**baseline**	**pilot**	**after**	**absolute**	**%**	**absolute**	**%**
Lage Weide Atoomweg	5.00-6.00	55	49	53	-6	-12%	-5	-10%
Lage Weide Atoomweg	6.00-10.00	2,159	1,944	2230	-215	-11%	-250	-11%
Lage Weide Atoomweg	10.00-11.00	414	423	432	9	2%	-1	0%
Afrit Europalaan links	5.00-6.00	52	45	47	-7	-16%	-4	-8%
Afrit Europalaan links	6.00-10.00	1931	1,632	1744	-299	-18%	-205	-11%
Afrit Europalaan links	10.00-11.00	544	501	463	-43	-9%	-3	-1%

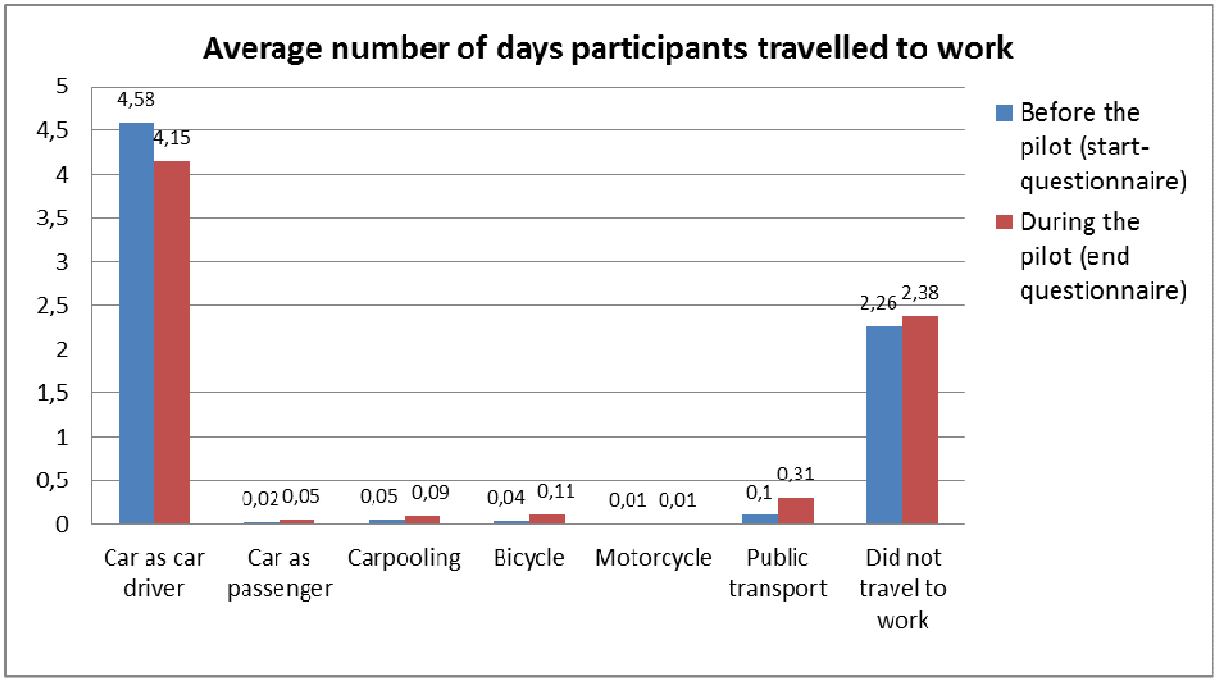
Table C2.4.4: Transport indicator 3 results (Goudappel Coffeng)

Goudappel Coffeng states that the effects on the numbers in table C2.4.4 are very probably due in a large part to the effect of the pilot. The different season has also had an effect, but the decrease is larger than would have been expected from the season alone.

Indicator 3: The average number of days per week that FMU participants used the car to travel to work

TNS-NIPO reported the average number of days the 1,446 respondents (all participants of the FMU pilot) used the car to travel to work.

Graph C2.4.1 shows the results.



Graph C2.4.1: Average number of days per week the FMU participants travelled to work, differentiated by transport mode (n = 1,446) (TNS-NIPO)

During the FMU-pilot respondents used the car less often for travelling to work (see graph C2.4.1). Instead they used public transport more often (major increase of 210%), carpooled (increase of 80%), cycled (increase of 175%) or did not travel to work (increase of 5%).

Indicator 4: The average number of days per week that FMU participants worked at home

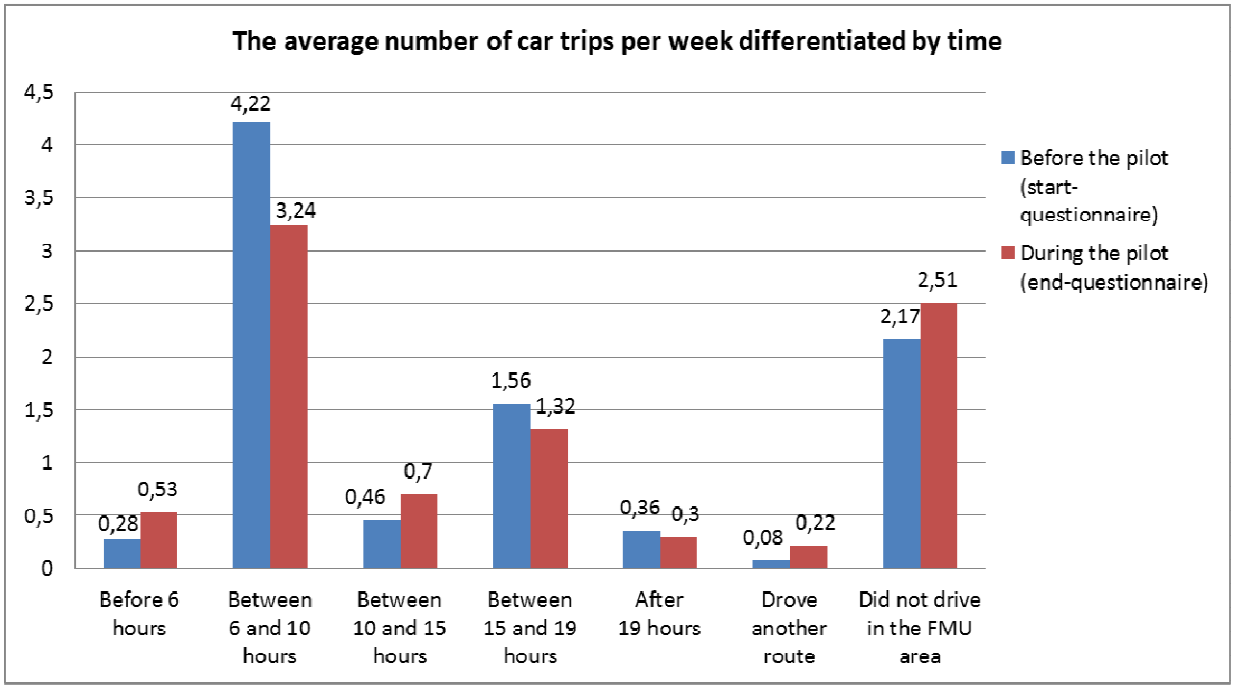
Graph C2.4.1 shows that during the pilot the FMU participant travelled less often to work than before the pilot. On average the participants did not travel to work on 2.38 days per week compared to 2.26 days before the pilot. This was an increase of 5%.

Indicator 5: The average number of car trips per week, differentiated by periods of the day

Participants could also avoid the rush hours by travelling at other times. Graph C 2.4.2 shows that there has been a shift from people driving in the morning rush hour, to earlier and later times.

The average number of trips made between 6am and 10am by the respondents decreased by 23% while the number of trips made between 6am and 7am increased by 89% and between 10am and 3pm by 52% during the pilot. Also the number of trips in the afternoon peak hours decreased. The increase in the average number of days respondents did not travel within the

pilot area was probably caused by the fact that participants worked more days at home or used public transport more often.

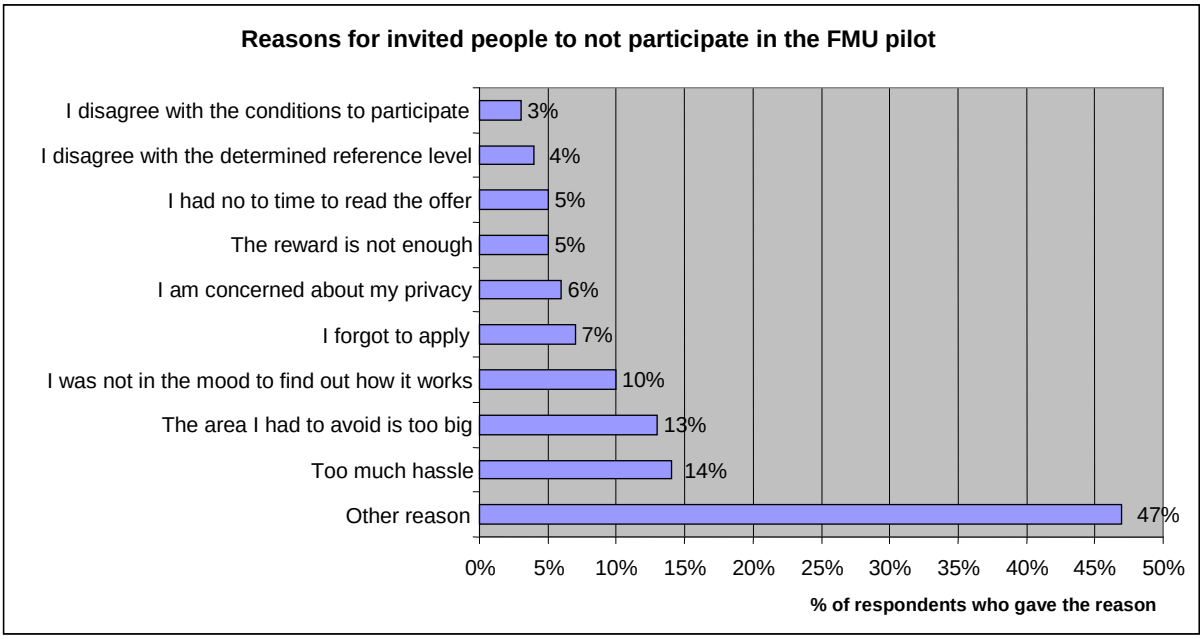


Graph C2.4.2: Average number of days per week the respondents travelled by car on the roads within the pilot area, differentiated by time of the day (n = 1,446) (TNS-NIPO)

C2.5 Society

Indicator 6: Reasons for not participating

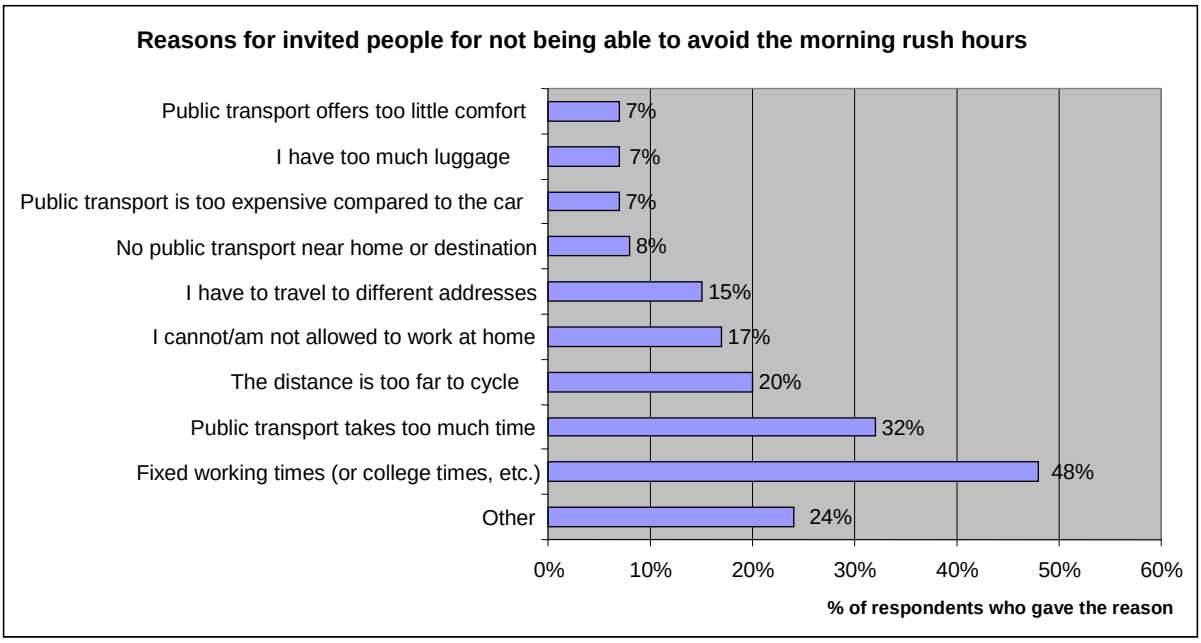
The reasons for not participating have been surveyed among 766 people that were invited to participate in the FMU pilot, but decided not to. They were asked several questions about their motivations for not participating. 59% were positive about the offer of the pilot, 8% were negative. 58% of the respondents indicated that it would be possible for them to avoid the rush hours. Nevertheless they decided to not participate due to the following reasons (they could pick more than one answer):



Graph C2.5.1: The percentages of answers participants (people who were invited to participate but decided not to) gave for not participating in the FMU pilot (n = 766) (Goudappel Coffeng)

47% gave (also) another reason; the answers in this category 'other' were very diverse (the main reasons were 'I can avoid the traffic jams by myself', 'I experience no disruption from traffic jams' and 'I am going to live or work somewhere else').

The people who said that they were not able to avoid the morning rush hours gave the following reasons (they could pick more than one answer):



Graph C2.5.2: The percentages of answers participants (people who were invited to participate but decided not to) gave for not being able to avoid the morning rush hours (Goudappel Coffeng)

Fixed working times were the main reason why people said they could not avoid driving in the morning rush hours. Furthermore the alternatives were perceived as a problem, although only 29% thinks the distance to work is too far to cycle.

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	To bring about a shift in private car trips from rush hours to off-peak	*
2	To investigate if changes in behaviour can be brought about by rewards and if sufficient acceptance can be reached in order to merit the up scaling of this method to other areas	**
3	To decrease the number of cars during rush hours by at least 1,000 vehicles per day during construction works in Utrecht-West	*

NA = Not Assessed O = Not Achieved * = Substantially achieved (at least 50%)

**** = Achieved in full *** = Exceeded**

Within this measure on average 767 to 923 rewards have been paid per working day. This comes close to the objective to pay 1,000 rewards per working day. The decrease in the number of cars and the impact on the traffic flow was hard to determine for various reasons. Nevertheless the following arguments make it credible that the objectives aimed for were reached:

- Despite the road works, the reduced capacity and the winter period there was no increased disruption/traffic jams on the involved part of highway A2. The estimated 500 participants who avoided the morning rush hours definitely contributed to this.
- A further analysis at national level by the Ministry of Traffic showed that within the period of the FMU pilot the travel times improved on the involved part of highway A2.
- The number of vehicles on the main roads within the city of Utrecht decreased within the period of the FMU pilot although the capacity did not decrease on these roads.

Apparently a positive financial reward does make people change their behaviour.

C4 Up-scaling of results

The results of the FMU pilot were also used at national level to evaluate whether rewarding measures are effective to achieve behaviour change. In order to complete this evaluation, they also analysed other rewarding measures. Their conclusion was that rewarding measures can lead to a considerable contribution in decreasing traffic jams in the rush hours, but these measures have to be custom-made.

C5 Appraisal of evaluation approach

Indicator 1: The number of participant vehicles on the roads in the morning rush hours

Business-as-Usual: the assumption was that participants would not have changed their travel behaviour if this measure was not implemented due to the fact that people are very reluctant to change. It could be however, that due to the road works that caused a decrease in the capacity, an undefined number of car drivers would have chosen other transport modes, other travel times, or maybe even would not have made their trip.

Goudappel Coffeng reported that the real impact of the pilot on the number of trips by the participants is very difficult to determine due to for example:

- The rounding up/off led to a bigger reference level than the real number of trips (see stage 3 of section B4). People with such a reference level probably tended to participate sooner.
- Due to the period between the reference level and the pilot in the meantime a participant could have moved or got another job elsewhere. If he for example had to be in Utrecht on all five working days during the reference level measurements, but was working somewhere else during the FMU pilot this person received five rewards, although he could still be travelling by car five times a week
- The number of Fridays in the reference level was less than the number of other working days. Due to the fact that in general on Fridays (and Wednesdays) fewer trips from home to work are being made, the number of trips in the reference level is a little over-estimated.
- To determine the reference level a smaller area was used than the cordon that was used to determine the number of trips during the pilot. Due to this the reference level of the participants who also used the other roads during the reference level, was under-estimated, because during the pilot they had to avoid these other roads too, while in the reference level the trips on these roads were not counted.
- The influence of reduced road capacity due to the road works.
- The quality of the used cameras in the reference level and during the pilot.

It is not possible to determine the exact effects of these, but in almost every case these will decrease the impacts of the measure. It must be taken into account, when the results in chapter C2 are read, that the pure effect of the FMU pilot on the decrease in the number of cars in the rush hours could be lower.

Indicator 2: The number of vehicles on the involved roads during peak hours
Goudappel Coffeng reported that in the analysis of the data and by comparing the data before the pilot with the data during the pilot, the following disturbing aspects have to be taken into consideration:

- The influence of the seasons: in the summer there is usually less traffic, especially in the morning rush hour, than in the winter. It was decided to not wait a year for the right season for the after measurements. In the analysis other roads have been measured too, and compared before and after the pilot (control site).
- Economical and demographical changes affect the traffic.
- In addition, car drivers change their travel behaviour during road works anyway due to the expected disruption of these.
- The road works influence the capacity and number of vehicles on the roads (due to the decrease in capacity fewer vehicles can pass and road users decide to take other roads, or not to go by car, et cetera) and the travel times (due to the road works the travel times increase).
- Other circumstances (like accidents or very bad weather) which disturb the traffic flows.

To decrease the disturbances of these aspects, only data from days on which there were no accidents or other abnormal circumstances have been used. 30 of these days before, during and after the pilot are enough to be able to give significant results (Goudappel Coffeng). Furthermore Goudappel Coffeng reported:

- Highways: an analysis of the highways data revealed that the disturbance due to other aspects had been too big to be able to tell whether the FMU pilot has led to a decrease. Nevertheless the conclusion was that it can reasonably be said that the FMU pilot has prevented extra disruption during the road works.

- Municipal roads: the numbers of vehicles measured by the cameras show big differences between the baseline and the situation with the FMU pilot. These differences are bigger than what would have been expected as the results of the pilot.
  Further analyses showed that the reliability of the measured numbers at some of the six locations (see table C1.1.2) was not sufficient enough.
  Nevertheless it was stated that the effects on the numbers are very probably for a large part the effect of the pilot. Also the different season has had an effect, but the decrease is larger than that which would have been expected from the season alone.

Indicator 3, 4 and 5: Change in travel behaviour of the participants

To measure the change in behaviour of the participants, questionnaires were used. 1,521 FMU pilot participants filled in both the start and the end questionnaire. The questionnaires before and during the pilot delivered statistically sufficient and valid data. Nevertheless the data gave no indication whether the behaviour change was permanent.

Indicator 6: Reasons for not participating

The reasons for not participating were investigated through a web panel in November 2010 among 766 people that were invited to participate in the FMU pilot, but decided not to. The questionnaires before and during the pilot delivered statistically sufficient and valid data.

C6 Summary of evaluation results

The key results are as follows:

- Rewarding led to a change in behaviour, but the impacts are not easily visible on the involved roads. Different arguments make it credible that the aimed objectives have been reached.
- The number of paid rewards was on average 767 to 923 per working day. This comes close to the objective to pay 1,000 rewards per working day.
- The decrease in the number of participant vehicles in the morning rush hours was on average 500 to 700 per working day. The real impact of the pilot on the number of trips by the participants was very difficult to determine for various reasons. It is not possible to determine the exact effects of these, but in almost every case these will have decreased the impacts of the measure.
- The total number of vehicles on two of the main roads within Utrecht for which sufficient data were available decreased; the decrease is bigger than that which what would have been expected as the results of the pilot.
- During the FMU-pilot participants used the car less often for travelling to work. Instead they used public transport more, carpooled, cycled or did not travel to work (increase of 5%). On average the participants did not travel to work on 2.38 days per week compared to 2.26 days before the pilot. Furthermore they travelled before and after the morning rush hours more days per week.

C7 Future activities relating to the measure

There has been no decision yet for another rewarding measure in Utrecht. At national level there are no plans to implement a rewarding, or paying measure.

D Process Evaluation Findings

D.0 Focused measure

2	1	Most important reason	The measure fits into the city policy towards sustainable urban transport and / or towards sustainability in general
4	2	Second most important reason	The high level of innovativeness of the measure with respect to technique, consortium, process, learning etc
5	3	Third most important reason	The measure is typical for a group of measures or a specific context

D.1 Deviations from the original plan

- The main deviation from the original plan comprised the fact that even though a second pilot was planned for the beginning of 2011 this pilot was stopped due to non-performance of the subcontractor. This resulted in a delay and subsequently the road works on the target stretch of highway were already (nearly) finished and the pilot became obsolete.
- Another deviation was that due to a delay in the political approval of the pilot the participants of the pilot could not activate their participation in the first week of the pilot.
- The subcontractor experienced a problem in the period of defining the reference level with the recognition of the license plate numbers. Due to this the measurement period was extended.

D.2 Barriers and drivers

D.2.1 Barriers

Preparation phase

- It was considered to be **a political barrier that the responsible alderman changed twice**. This created risks in the continuation of the project/experiment and resulted in delays, and at a specific moment even to a potential early end of the experiment. The change in aldermans in 2009 delayed the approval of the measure because the new alderman feared the privacy of the participants would be violated. Because the privacy conditions were met, the measure was continued. Due to this delay the participants could sign up for the pilot at the start, but could not activate their participation. One week after the start this problem was solved. After the local elections of April 2010 the new councillor fully supported the local project.

Implementation phase

- The subcontractor who measured the reference level had several **technical problems with the licence plate recognition**. They guaranteed 90 to 95% recognition of the licence plates. In the beginning they spotted in reality only 40% of the license plates. After some measures they succeeded in improving the recognition. They were obliged to extend the measurement period.
- A second technical barrier experienced was **the provision of electricity for the camera systems**. During the participant selection phase the subcontractor made use of more

expensive aggregates, while the contractor who measured license plates during the pilot encountered a number of bureaucratic (i.e. different responsible authorities for the electricity at different locations) and technical delays (i.e. bringing the electricity from the network to the place of the camera positions)

- A large number of car drivers are making their trip with a lease car. **Lease companies were not always willing to participate** in the experiment, which reduced the number of potential participants.

Operation phase

- After a successful first pilot, the second pilot did not go ahead due to **non-performance of the subcontractor**. This was due to **technical reasons**. It resulted in a delay and subsequently the road works on the target stretch of highway were already (nearly) finished and the pilot became obsolete. This led to the decision to not implement a second pilot anymore after all.

D.2.2 Drivers

Overall drivers

- A general driver for this measure was that **at the regional/national level there was cooperation** in terms of stimulating people to change their behaviour using rewards rather than punishments. And also that the congestion caused by the road works made it necessary to act.

Preparation phase

- The large municipal infrastructure works together with highway A2-works provided the opportunity to execute the pilot. It became a **necessity to temporarily reduce the traffic levels** at the respective parts of the ring road.
- Another driver was the wish of the national government to **support with a subsidy a number of experiments** in order to understand the potential benefits and issues related to this new system. The set deadline accompanying these subsidies also forced the projects to go-ahead.

Implementation phase

- The **close cooperation** between the region of Utrecht (BRU), the city of Utrecht and the national highway authority (RWS) **allowed the combining of different competencies**. The participation of the highway authority allowed us to gain access to their license plate database, which was necessary to obtain the corresponding car drivers' addresses, to pre-select and invite them to participate in the experiment.

D.2.3 Activities

Overall activities

- The experiment was considered **politically** sensitive. For this reason it was **closely managed**. The advantages and potential effects of such a measure were made clear and **communication** towards, and with the responsible political authorities took place and was monitored.

Implementation phase

- **Meetings with and supervision of the subcontractor** about the quality of the recognition of the license plate numbers by the cameras were conducted.
- The **measurement period** to measure the reference level **was extended**.

Operation phase

- Utrecht **dealt with the legal consequences** of the non-performance of the subcontractor in detecting sufficient number plates to perform a statistically reliable baseline measurement for a possible second pilot.

D.3 Participation

D.3.1. Measure Partners

- **Stichting Utrecht Bereikbaar -** A unique public/private cooperation which was responsible for the implementation of the FMU pilot with the following partners: municipality of Utrecht, the National highways authority Rijkswaterstaat Utrecht (RWS), the Utrecht Regional Authority (BRU), the Province of Utrecht, the Mid Netherlands Chamber of Commerce and VNO-NCW Utrecht – employers organisation.
- **Subcontractors** – Two subcontractors were involved in defining the reference level, inviting participants and defining the number of rewards.

D.3.2 Stakeholders

- **Participants of the pilot**
- **Drivers on the main roads** which do not participate in the pilot but profit from the reduced traffic level

D.4 Recommendations

D.4.1 Recommendations: measure replication

Goudappel Coffeng stated the following recommendations:

- Make an effort to **involve more participants** in order to make the results on the roads more visible. In their opinion, a bigger reward is not necessary, conduct targeted marketing campaigns, involve the participants more in the measure, offer Value Added Services (like travel- or parking information).
- **Make it appealing for private organisations to apply new techniques**, so experiences can be made with new techniques for the registration of avoided trips, like using GPS applications.
- **Make it appealing for private organisations to offer Value Added Services** like information about parking facilities or travel information. These can stimulate participants to avoid driving in the peak hours. Furthermore these Value Added Services will result in more participants and more avoided trips.

Furthermore the following recommendations can be made:

- The public tendering of the different tasks requires a large amount of knowledge on the side of the authority. It is advisable to **involve a specialist** who can assist throughout the entire process.

- **Consider the provision of electricity** for the ANPR-camera systems, unless one makes use of the expensive aggregates. Careful and realistic planning should accompany the installation of the cameras.
- **Strong project management** is considered primordial for such a technically and organisationally complicated project.

D.4.2 Recommendations: process (related to barrier-, driver- and action fields)

Goudappel Coffeng suggested the following recommendations:

- **Make sure to define the reference level as precisely as possible**. Choose a period of at least 28 days which is normative for the traffic level on the route(s). Distribute the different days of the week proportional to this reference level. Also make sure to have a short period between the reference period and the rewarding period. Define the reference level on the same road or in the same area in which the reward will be determined. Carelessness leads to too large a discrepancy between the number of paid rewards and the actual decrease in cars on the road.
- **Choose the area in which the rewarding measure will be implemented carefully**. Prevent a situation whereby people will drive through the 'mazes' but take into account that within the area the traffic flows bring such fluctuations that an impact on the road will be difficult to show, even if there is a real impact. Carefully consider this in setting up the evaluation.
- **Conduct research on the traffic in the target area before deciding to start a rewarding measure**. In order to determine the measure and the people to invite you need to know how often they drive, why they drive, whether they have other options and whether they want to change their behaviour. Through this analysis it will be clear whether a rewarding measure has a sufficient chance of succeeding and which group should be targeted. As a result the measure can be more efficient. Also it becomes clear whether the measure will result in a decrease in vehicles sufficient to compensate for the reduced capacity of the road(s).
- Define the reference level on the same road or in the same area in which the reward will be determined but **invite mainly people who were registered on those roads where the reduction in vehicle needs to be achieved to participate**.
- **Secure the quality of the cameras**. The measurements of the impact and to determine the number of rewards that need to be paid, depend on the cameras. Test the quality of the cameras and test whether the cameras register all the vehicles. Make agreements with the subcontractors about technical failures. Make agreements that in cases where a camera fails, the participant will receive a reward but this reward may not be calculated as an avoided trip.

In addition the following recommendations can be made:

- The measure is considered **politically sensitive and requires close management**. The advantages and potential effects of such a measure are to be made clear and monitored communication towards, and with the responsible political authorities should be requested.
- According to the experts the **technology used** (license plate registration with cameras) is able to perform in line with the expectation. Nevertheless a **careful monitoring of its performance** should take place. It is clear that even with a possible 90 to 95% level of license plate recognition; certain participants might be incorrectly rewarded. It is

recommended to build into the experiment the possibility to control the provided data (e.g. by making use of on the road car counting systems) and to withhold rewards for a short period allowing time to repair any system anomalies that might appear.

- A **careful planning of the execution** of the experiment itself is necessary. Data is quickly outdated. Only a short time period can exist between the identification, selection of the car driver and execution of the experiment. Due to its nature it looks like the experiment is specifically useful for temporarily expected traffic congestions, e.g. due to major road works.

E References

TNS NIPO, Monitoring en evaluatie mobiliteitsprojecten ABvM, © TNS NIPO, 26th of July 2010

Goudappel Coffeng,Evaluatie FileMijden Utrecht, 6th of May 2011

Appendix 1: The number of vehicles on the highways, before, during and after the FMU pilot.

Table appendix 1-1 shows the number of vehicles in the location on the highway A27 for which the assumption was that the FMU pilot would not affect this number. The results show that there has been a certain seasonal influence; the number of vehicles during the pilot is lower than before and after. Because of the quite short baseline and pilot periods , the influence of this uncontrolled change can be neglected.

A27	baseline		pilot		after	
Time period	Veh./hour	%	Veh./hour	%	Veh./hour	%
5.00-6.00	677	100%	592	87%	691	102%
6.00-10.00	3,715	100%	3,520	95%	3,757	101%
10.00-11.00	3,024	100%	2,949	98%	3,246	107%
Total	18,561	100%	17,621	95%	18,968	102%

Table appendix 1-1: Transport indicator 2 results for location 1 on the highway (B-a-U) (Goudappel Coffeng)

Table appendix 1-2 shows the numbers of vehicles in location 2 (the A2R, direction south). The results in this location are not significantly different from the results in location 1. A shift from rush hours to 5am-6am or 10am-11am was not observed either. It can be concluded that there has been no provable impact on the number of vehicles on this highway.

A2 R	baseline		pilot		after	
Time period	Veh./hour	%	Veh./hour	%	Veh./hour	%
5.00-6.00	854	100%	747	87%	862	101%
6.00-10.00	4,144	100%	3,928	95%	4,293	104%
10.00-11.00	3,989	100%	3,801	95%	4,087	102%
Total	21,417	100%	20,260	95%	22,119	103%

Table appendix 1-2: Transport indicator 2 results for location 2 on the highway (Goudappel Coffeng)

Finally table appendix 1-3 shows the numbers of vehicles on in location 3 (the A2L, direction north). Again there is no provable impact. Actually the number of vehicles during the pilot was bigger than would be expected compared to location 1(B-a-U) or location 2 (the other direction).

A2 L	baseline		pilot		after	
Time period	Veh./hour	%	Veh./hour	%	Veh./hour	%
5.00-6.00	2,562	100%	2,330	91%	2,552	100%
6.00-10.00	5,346	100%	5,295	99%	5,500	103%
10.00-11.00	4,315	100%	4,312	100%	4,450	103%
Total	28,261	100%	27,823	98%	29,001	103%

Table appendix 1-3: Transport indicator 2 results for location 3 on the highway (Goudappel Coffeng)

It is important to mention that the road works had a significant impact on traffic flows. The assumption is that a certain number of road users probably decided to use other routes or other travel times. Due to this the analysis could not lead to provable results.