REWARDING FOR AVOIDING THE PEAK PERIOD IN ROTTERDAM

Henri Palm
Goudappel Coffeng BV
PO Box 161
7400 AD DEVENTER
The Netherlands
T +31 570 666 222
F +31 570 666 888
hpalm@goudappel.nl

Marcel van der Meulen
De Verkeersonderneming
PO Box 556
3000 AN ROTTERDAM
The Netherlands
T +31 6 51 39 78 92
marcel.vander.meulen@verkeersonderneming.nl

Submission date: July 18, 2013

Text 3,400
Tables 5 x 250 = 1,250
Figures 10 x 250 = 2,500
Total 7,150
ABSTRACT

To keep the harbour accessible the peak avoidance project Rotterdam stimulated car drivers, who were frequently using the A15, to reduce their peak trips in return for a monetary reward and new information services. The project was unique in several aspects, namely the long duration of more than three years, the use of smartphones and a fee for the number of peak avoidances and not, as with other projects, on the a number of participants.

A monitoring system was developed to measure the daily travel behaviour of each individual participant. Different types of data were collected: intentions, GPS data sent by the smartphone and camera detection. Web-based surveys also provided insights into personal characteristics and satisfaction ratings.

In total more than 800,000 peak avoidances were made by approximately two thousand participants. In the morning peak hours 54% of the trips were converted to non-peak trips. A lot of alternatives were used for the first time, so participants became more aware of other travel options. For participants the project was the beginning of a long-term change. More than half of the participants said they maintain their peak avoidances without a monetary reward.
INTRODUCTION

In several urban regions in the Netherlands the Dutch Government has initiated mobility projects including those for peak avoidance. These projects have four objectives; i) decrease the number of vehicle kilometres during peak hours; ii) make motorists more aware of the alternatives; iii) measure the impact of financial and information incentives; and iv) provide operational experience with new technology and systems.

This paper presents the mobility project at the A15 in the Rotterdam region. The A15 motorway connects the Rotterdam harbour with the Dutch and German hinterland and therefore it is of great economic interest to the region. In 2012 construction works have started to add additional lanes to the A15. During these construction works several measures are implemented to keep the harbour accessible. One of the mobility demand management measures stimulates car drivers, who are frequently using the A15, to reduce their peak trips in return for a monetary reward and new information services.

The peak avoidance project in Rotterdam started at October 26th 2009 and finished December 21st 2012. The project is commissioned by De Verkeers-onderneming1. A consortium of BNV Mobility, Technolution, ABN AMRO and Goudappel Coffeng executed the project. The fee for the contractors was based on the number of peak avoidances and not, as with other projects, on the number of participants. The total budget for the project was is approximately 11 million Euros.

The structure of the paper is as follows: first the project outline is described, containing the concept of the project and the value-added-services. Then some characteristics of the participants are shown. The next part presents the behavioural impacts of rewarding peak avoidances and after the financial reward expired. Also a short comparison with other peak avoidance projects is made. Finally some conclusions are drawn.

PROJECT OUTLINE

The Concept

The A15 motorway connects the Rotterdam harbour with the hinterland. Between the harbour and the city of Rotterdam there is not only a lot of peak traffic towards the city of Rotterdam but also in the direction of the harbour. Car drivers who used this stretch of motorway more than 5 times in four consecutive weeks became part of the target group. They were contacted by direct mail and asked to participate. The proposition was to reduce their usual number of peak trips on working days in return for a monetary reward and access to information services.

FIGURE 1 A15 Corridor

During the project the rewarding scheme has changed several times. At the start of the project participants could earn € 5,- per peak avoidance in the morning peak westbound (towards the harbour). Since May 2011 they could also earn € 1,50 per peak avoidance in the evening peak.
eastbound. From August 2012 to the end of the project participants were rewarded with € 3,- for avoiding the morning and € 3,50 for the evening peak.

To prevent the use of alternative routes through towns along the A15 an additional road network was defined to be avoided. The corridor is shown in Figure 1.

Participants received a smartphone (Figure 2) to communicate with the project. This device supported the project objective of promoting modal shift since it is focussed on the user rather than on a specific mode of transport. The smartphone was used daily by the participant to indicate their mode of transport for the next day, so called intention. The alternatives were: drive to work before or after the morning peak, make a carpool appointment, use mass transportation or slow mode or work from home. Participants stated their intention daily by means of a special application on the smartphone.

GPS signals from the smartphone combined with registration by ANPR-cameras were used to verify that the participant’s stated intentions matches their behaviour.

After one year and more than 100 peak avoidances a participant became owner of the smartphone. The transfer of money to the participants took place on a monthly basis by automatic electronic transfer. Hence, a reward of 20 days x 6.5 Euros = 130 Euros could potentially be earned every month.

In addition, a fraud prevention protocol has been drafted, which defines a set of fraud detection and prevention measures. Fraud was detected by way of data-mining and a sampling test (for instance through mobile ANPR cameras). If a participant was found to be committing fraud, he was excluded from the project.

Value-Added-Services
In order to encourage participants to choose an alternative that avoids travelling by car in the peak period, value-added-services (VAS) were developed. The first service concerned a web-based multimodal trip planner, which assists the commuter in choosing an appropriate departure time and a travel mode (Figure 3).

Figure 3 shows the routes and travel times from Breda to Rotterdam by car or public transport. Car travel times varies between 47 and 65 minutes due to congestion. During the peak hours public transport offers competitive travel times (a shortest route of 63 minutes).

The following value-added-service were also available:
- a carpool planner, which assists commuters in finding carpool ‘buddies’ with more or less the same work trip;
- an Outlook Plug-in which schedules travel times in the Outlook calendar before and after a scheduled appointment;
- an alert service for car and train when a disruption or unforeseen delay arises on a user defined trip.
- a cycling planner for short distances.
Because of limited use, behavioural changes due to these services could not be identified.
THE PARTICIPANTS

Car drivers were recruited by direct mail and free registration on the internet. At the same time an extensive marketing campaign was held to promote the project among car drivers on the A15. Figure 4 shows the course of participation. The direct mail events are identifiable by the increases. The last direct mail took place in July 2012. In total more than two thousand participants were involved. Some of them stopped due to rehousing, a new job, no pleasure or bad performance. During the project the number of active participants varied between 1,650 and 1,900.

FIGURE 4 Number of Participants

The participants were mostly men (85% male and 15% female). The average age is 43, the youngest 19 and the oldest 76. Their education levels are shown in Table 1.

TABLE 1 Education Levels of Participants

<table>
<thead>
<tr>
<th>Education level</th>
<th>8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>preparatory secondary vocational</td>
<td>8%</td>
</tr>
<tr>
<td>senior secondary vocational,</td>
<td>29%</td>
</tr>
<tr>
<td>senior secondary general, pre-university</td>
<td>9%</td>
</tr>
<tr>
<td>University</td>
<td>45%</td>
</tr>
<tr>
<td>Unknown</td>
<td>8%</td>
</tr>
</tbody>
</table>
The high proportion of highly educated people is remarkable. It is likely that they have a larger degree of freedom regarding working times and working from home.

Changes in travel behaviour can also affect activity patterns at home. The family composition of the participants is that 80% cohabit with a partner and 52% have children. So the majority could not change their travel behaviour without consequences at home.

**CHANGES IN TRAVEL BEHAVIOUR DURING THE PROJECT**

A monitoring system was developed to measure the daily travel behaviour of each individual participant. Different types of data were collected from this monitoring system: intentions, GPS data sent by the smartphone and camera detection. Furthermore web-based surveys provided insights into personal characteristics and satisfaction ratings.

The next part describes the changes in travel behaviour by rewarding peak avoidances. This paper presents the results from October 2009 to December 2012. This time period consists of 32 four-week periods. From period 17 onwards, the avoidance of the evening peak was also rewarded.

**Number of Reduced Trips**

Figure 5 shows the average number of peak avoidance per day in both directions.

**FIGURE 5 Number of Peak Avoidances**

When the project started, the consortium had an obligation to achieve 530 peak avoidances per morning peak towards the harbour, e.g. 5% less passenger cars. In 2011 the obligation was increased to 715, e.g. 7%. This objective is amply achieved. From time period 17 (May 2011) also peak avoidances in the evening peak were rewarded. In total more than 800,000 peak avoidances have been made.

The variation in peak avoidances is strongly correlated to the number of participants, while participants had a pretty constant behaviour in terms of peak avoidances.

Furthermore we see fewer peak avoidances in the evening peak. The lower reward in the evening peak seems to be an important explanation. In the last four time periods the reward in the evening peak was higher than in the morning peak. The number of peak avoidances increased but did not transcend the peak avoidances in the morning peak. In addition a survey distinguishes shows differences in the effort to avoid: 45% chose the morning peak as the easiest period while 17% chose the evening peak.
Use of Alternatives

The alternatives to avoid peak hours were: drive to work before or after the morning peak, use other transport, use routes outside the corridor or work from home. The changes in travel behaviour are shown in Figure 6, where peak trips can be interpreted as ‘no change’.

FIGURE 6  Travel Behaviour of the Participants (morning peak)

In the morning peak 54% of the trips were converted to non-peak trips: 33% of the trips were made outside the peak hours, 9% took other routes, 8% shifted to other transport modes, and 4% worked from home. The shift to other transport is low because of the lack of good public transport towards the harbour.

Almost half of the participants used only one alternative. The other half used two or more alternatives. The participants were asked if they had used these alternatives also before participation or if they were new to them (Figure 7).

FIGURE 7  Familiarity with alternatives

All alternatives were used more during participation then before. So the project contributed to more awareness for other travel options.
Rewarding the Other Direction
During the first part of the project participants could earn € 5 in the morning peak towards the harbour. From May 2011 to July 2012 they could also earn € 1.50 in the evening peak in the other direction. The participants were asked how this new rewarding scheme has influenced their travel behaviour (Table 2).

TABLE 2 Changes in Travel Behaviour Rewarding the Evening Peak

<table>
<thead>
<tr>
<th>Change in travel behaviour evening peak?</th>
<th>Good performers</th>
<th>Bad performers</th>
</tr>
</thead>
<tbody>
<tr>
<td>No, evening peak has already been avoided</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>No, continue travelling during the evening peak</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Yes, evening peak will be avoided because of the reward</td>
<td>39%</td>
<td></td>
</tr>
<tr>
<td>Yes, other reasons</td>
<td>8%</td>
<td></td>
</tr>
</tbody>
</table>

Almost one half (53%) of the participants did not change their travel behaviour in the evening peak. Most of them were already avoiding the evening peak as a logical consequence of avoiding the morning peak. For example, because they were working at home the entire day. As a result of morning peak avoidance, there is a third of free-catch peak avoidances in the evening peak. The other half (47%) changed their behaviour, mainly because of a relative, small reward. Again it can be concluded that a financial reward is a sufficient method to achieve behavioural changes.

Good and bad performers
Among the participants there were good and bad performers. Good means more than 50% peak avoidances and bad less than 50%. To identify them, background characteristics were related to the level of peak avoidance (Table 3).

TABLE 3 Backgrounds Good and Bad Performers

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Good performers</th>
<th>Bad performers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference level (number of peak trips average per week in one direction)</td>
<td>3.55</td>
<td>3.48</td>
</tr>
<tr>
<td>Car kilometres* (average per year)</td>
<td>26,200</td>
<td>29,200</td>
</tr>
<tr>
<td>Flexible working hours</td>
<td>58%</td>
<td>59%</td>
</tr>
<tr>
<td>Cohabiting</td>
<td>83%</td>
<td>78%</td>
</tr>
<tr>
<td>Highly educated</td>
<td>42%</td>
<td>56%</td>
</tr>
</tbody>
</table>

* prior to participation

Good performers had on average a slightly higher reference level. They also drove fewer kilometres per year. Maybe they are less car dependent or live closer to their work (so taking the bike is a good alternative). It is remarkable that they were often cohabiting, while changing behaviour effects other members of the family. Maybe other family members stimulated their participating partner. Bad performers were more highly educated.

The possibility for other work hours seemed to hardly effect the possibility of peak avoidance. However this does not mean that working conditions do not play a role. For non-participants it could be that their working conditions were not suitable for peak avoidance.

Slacking behaviour?
The project has run more than three years. Participants from the start of the project could slack because the money was insufficient or the effort became too big. Therefore, participants with different start dates are mutually compared. Figure 8 shows five groups of participants, distinguished by their start date. For each group the percentage of participants, who were still active in June 2012, the average peak avoidance (per week in the morning peak) in June 2012 are shown.

With the groups that started earlier, the percentage of active participants decreases. This can be explained by changes in personal circumstances, less enthusiasm or exclusion because of bad
performance. Nevertheless a majority was still participating in June 2012 and their peak avoidance
behaviour hardly differs from newer participants.

FIGURE 8 Duration and Peak Avoidances in relation to Start Times

Asking about their motives participants indicated the reward as the most significant incentive, but also
less traffic while driving off-peak and a personal contribution to reduce congestion were important
incentives to avoid the peak (Figure 9).

FIGURE 9 Reasons to Participate

TRAVEL BEHAVIOUR AFTER THE PROJECT

The results of the project show that a financial reward achieved the desired effect. Apparently, a
reward is an effective method to recruit participants and achieve a behavioural change. An important
question is what participants will do when the financial reward expire.

Two months after the monetary reward was expired the former participants were asked how
their travel behaviour was changed (Table 4).
TABLE 4  Travel Behaviour after the Project

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>avoid peak hours in the same extent</td>
<td>44%</td>
</tr>
<tr>
<td>avoid even more peak hours</td>
<td>10%</td>
</tr>
<tr>
<td>avoid less peak hours</td>
<td>46%</td>
</tr>
</tbody>
</table>

More than half of the participants said they maintain their peak avoidances without a monetary reward. Probably they accustomed the new behaviour and experiences the benefits (for example, a shorter journey time outside peak hours).

Figure 10 shows a comparison of travel frequencies before, during and after the project. These frequencies were derived from web-based surveys at the start and in the end of the project.

FIGURE 10  Travel Frequency before, during and after the Project

After the project participants make less peak trips than before the project. Peak trips especially shifted to off-peak hours.

By offering financial incentives, participants came in contact with an alternative way to travel. They experienced the benefits of alternatives. For a part of the participants this was the beginning of a long-term change. Another part of the participants indicated that without the reward they picked up their old behaviour. For these participants, the temporary financial reward was not a sustainable solution.

COMPARISON WITH OTHER PEAK AVOIDANCE PROJECTS

There have been several smaller peak avoidance projects in the Netherlands, but the Rotterdam project covered a larger geographic area and a longer time scale. Furthermore the Rotterdam project was applied as a service to support participants in their daily mobility behaviour by rewarding, monitoring, assisting them and keeping them involved. A predefined performance of the contractors was required. The fee for the contractors was based on the actual results on the road and not, as with other projects, on the a number of participants/

Bliemer e.a. (2009) provided an overview of three reward projects in the Netherlands. Table 5 lists the projects, together with the results of peak avoidance project Rotterdam.
TABLE 5 Summary of Results from other Peak Avoidance Projects in the Netherlands

<table>
<thead>
<tr>
<th></th>
<th>A12 I</th>
<th>A12 II</th>
<th>A6</th>
<th>A16</th>
<th>A15</th>
</tr>
</thead>
<tbody>
<tr>
<td>reward</td>
<td>€3</td>
<td>€7</td>
<td>€4</td>
<td>€4</td>
<td>€5</td>
</tr>
<tr>
<td>peak period</td>
<td>8-9h</td>
<td>7:30-9:30h</td>
<td>6:30-9:30h</td>
<td>6-10h</td>
<td>15-19h</td>
</tr>
<tr>
<td>duration</td>
<td>10 weeks</td>
<td>9 months</td>
<td>1 year</td>
<td>2.5 months</td>
<td>2.5 years</td>
</tr>
<tr>
<td>participants</td>
<td>232</td>
<td>771</td>
<td>2,975</td>
<td>2,703</td>
<td>2,000</td>
</tr>
<tr>
<td>peak trips</td>
<td>54%</td>
<td>39%</td>
<td>39%</td>
<td>60%</td>
<td>46%</td>
</tr>
<tr>
<td>peak avoidances</td>
<td>46%</td>
<td>61%</td>
<td>61%</td>
<td>40%</td>
<td>54%</td>
</tr>
<tr>
<td>- outside the peak</td>
<td>35%</td>
<td>44%</td>
<td>38%</td>
<td>18%</td>
<td>15%</td>
</tr>
<tr>
<td>- other routes</td>
<td>0%</td>
<td>0%</td>
<td>9%</td>
<td>28%</td>
<td>9%</td>
</tr>
<tr>
<td>- other transport</td>
<td>10%</td>
<td>14%</td>
<td>25%</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>- working home</td>
<td>1%</td>
<td>3%</td>
<td>5%</td>
<td>6%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Bliemer e.a. concluded that by introducing a peak avoidance rewarding of 3 or 4 Euros, about 50% of the trips made by participants will disappear from the peak period. The Rotterdam project delivers 54% through a reward of 5 Euros, so not significantly higher. The low use of other modes (especially public transport) and few route alternatives are the main reasons for a further increase in peak avoidances. The Rotterdam results seem also to confirm the Bliemer e.a. conclusion: higher reward levels yield higher shifts, however these are relatively minor.

CONCLUSIONS

The project achieved a reduction of 7% (or 800) passenger cars during the morning peak (between 6 am and 9 am). In the second half of the project avoiding the evening peak (between 4 pm and 7 pm) in the other direction was also rewarded. The reduction was 600 cars on average. Most of participants were already avoiding the evening peak as a logical consequence of avoiding the morning peak. Therefore a rewarding scheme of €5 in the morning peak and €1.50 in the evening has been used.

In August 2012 the reward scheme has been changed in €3 in the morning peak and €3.50 in the evening peak. The number of peak avoidances increased but did not transcend the peak avoidances in the morning peak.

During the project, the composition of the group of participants has been relatively constant. Approximately two third of the participants who started in 2009 or 2010 were still active in June 2012.

The main effect of rewarding for peak avoidance was that car drivers change their departure time or to a lesser extent, take another route. Working from home and changing mode does occur, but at a much lower frequency. The shift towards public transport is limited because of the limited number of public transport alternatives towards the Rotterdam harbour. Most of the participants use one alternative. These alternatives were generally not used before the project. Therefore the project contributes to more awareness of alternatives.

There are some slight differences between good and bad performers. Good performers have on average a slightly higher reference level. Bad performers are more highly educated. The possibility for other work hours hardly effected the peak avoidance behaviour. However this does not mean that working conditions do not play a role. For non-participants it could be that their working conditions were not suitable for peak avoidance.

In order to encourage participants to choose an alternative that avoids travelling by car in the peak period, three value-added-services were developed. Because of limited use, the behavioural changes could not be identified.

Hard conclusions about structural changes in travel behaviour can not be drawn. Participants become familiar with alternatives and experience the benefits. A web survey showed that a majority of the participants stated to continue their new behaviour after the reward scheme stopped.

In comparison with previous smaller peak avoidance projects the level of peak avoidances are relatively similar. However, the use of alternatives differs due to different availability.
References


Notes

1 De Verkeersonderneming is established by Municipality Rotterdam, Rotterdam Metropolitan Region, Ministry of Transport, Public Works and Watermanagement and Port of Rotterdam Authority