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Summary:

Travellers' valuation of traffic information with respect to trips to work

Introduction

Funded by the Public Roads Administration's program "Better exploitation of the existing road network by using ITS" (Intelligent Transportation Systems), TOI carried out a pilot study in 2001, with testing of different methodological designs for revealing travellers' valuation of traffic information (Killi, Samstad and Sælensminde, 2001). The study reported here builds on the results of the pilot study with respect to survey design. For det present study we have focused on trips to work and used the methods recommended by the pilot study wherever possible, and implemented the recommended improvements.

In the development and improvements of intelligent transportation systems (ITS) it is important to investigate the needs and preferences of travellers with respect to information. There are in particular two reasons for this:

i) It provides a basis for precise and effective information in the format preferred by the travellers.
ii) At the same, knowledge about travellers' willingness to pay for information makes it possible to improve calculations of the user benefit of information measures.

In this study, a survey was carried out focussing on the use of and the need for information connected to the trip to work in morning rush hours. We have attempted to analyse what kind of information commuters prefer, in which format, and in what way they will make use of improved information. As a starting point, the survey collected data about the kind of problems the travellers experienced today, how frequently these problems occur, and how the travellers make use of the available information. We have focused on information received before the trip and during the trip, e.g. via radio, variable message signs and cellular phone.

Choice of method and survey design

Our target group were people who commute by car to work in Oslo and experience congestion problems on their route. We assumed that Internet accessibility is quite high in this group, and decided to put our questionnaire out on a web site. It would only be accessible with a password provided by us. A great advantage by having an Internet survey is that it is possible to formulate questions based on answers the respondent gave to previous questions about his/her typical trip to work. This is also possible in home interviews where the interviewer brings a portable computer, but that is a far more expensive method. We also designed a hard copy version of the questionnaire in order to make it possible for those without Internet access to participate. Five different versions of the hard copy questionnaire were made. They differed with respect to travel time and distance used in the questions. Based on a few data from the receiver we could then send the version that fitted best in each case.

TOI purchased the software Sawtooth in order to program the survey in such a way that it could be accessible on a web site. Sawtooth has relatively flexible Stated Preference modules, featuring many of the possibilities available in MINT, the programming tool used in the pilot study. It was important for us that by applying Sawtooth we could use Stated Choice analysis. Few other programming tools were designed for that. Two kinds of Stated Preference (SP) techniques were used in our study: *Contingent Valuation* and S*tated Choice*. With the Contingent Valuation method we obtain direct valuation of some factors as the respondent specifies prices. In the Stated Choice analysis the respondents choose between two trips where three factors vary simultaneously.

The questionnaire consisted of four main parts:

- Introductory questions and questions about a specific trip to work and alternative transport possibilities
- Valuation by direct questions (Contingent Valuation) and Stated Choice sequences
- Control questions
- Background questions about the respondents.

Going through the Internet questionnaire took about 25-30 minutes.

In the first part of the questionnaire the respondent got a series of questions about his or her usual trip to work. This trip was used as a starting point for the different

valuation methods where the respondent was to assess different trips and information measures.

In the SP sequences we first used Contingent Valuation in order to obtain direct valuation of different attributes of the trip to work. There were questions about willingness to pay for trips where factors like travel time, arrival time variation (measured by expected delay), driving in congestion and traffic information were either improved or worsened. We asked about only one factor at a time, except for one question about several simultaneous improvements.

Then the respondents were exposed to Stated Choice sequences with choice situations in which they were to choose between two trips with different attributes. There were three choice sequences with nine choice situations in each sequence.

- The factors in sequence 1 were expected travel time, arrival time variation (measured by expected delay) and travel cost.
- The factors in sequence 2 were expected travel time, time spent in congested traffic and travel cost.
- The factors in sequence 3 were expected travel time, type of traffic information and travel cost.

In choice sequence 3 we outlined different types of information that might reduce problems related to delays and congestion. The three types (or levels) of information presented were:

- *Type A (level 3)*: Today you can get traffic information via radio or variable message signs along the road. This will be information about irregular delays, the reasons for these, and re-routing if relevant.
- *Type B (level 2)*: Imagine that, in addition to today's information, you could get dynamic information about driving speed on a chosen road section and if speed is decreasing (more congestion) or increasing (less congestion). This type of information could be given e.g. on variable message signs along the road or by SMS to your cellular phone.
- *Type C (level 1)*: Imagine that, in addition to today's information, you could get dynamic information about the fastest route from home to work when the actual traffic situation on all alternative routes are taken into consideration. This type of information could e.g. be given via radio and a position/navigation system in your car.

The questionnaire also contained questions directly related to information, such as sources of information at home and on trip, which sources the respondent uses today and which ones they would prefer with respect to improved information in the future. Further, they were asked if information has been useful and if so, how it has been used. Questions about perceived reliability of the information and about the impacts on traffic safety were also asked.

The last part of the questionnaire consisted of a few control questions regarding lexicographical answers and control questions for those who had not revealed any willingness to pay for reduced travel time, reduced arrival time variation, reduced time spent in congestion or better traffic information. In the end there were some questions about background data like age, sex and household income.

Data collection

In our study we wanted to reach car users who experience congestion problems on their way to work. Hence we recruited participants along the road during morning rush hours. The main traffic flow towards central Oslo in the morning follows the three main corridors from the west (Asker, Bærum), the northeast and the south (east side of the Oslofjord). The company Oslo Vei had a team of seven persons distributing cards in the following places:

- *Traffic from the south:* E 18 Mosseveien at Nordstrandveien (2 persons)
- *Traffic from the northeast*: Rv 163 Østre Aker vei at Økern (1 person), and the intersection Økernveien – Grenseveien (2 persons)
- *Traffic from the west:* E 18 Drammensveien at the intersection with Bygdøy Allé (1 peron), and Munkedamsveien at Vika, Sjøgate by Cort Adlersgate (1 person).

The distribution took place Tuesday the 24th of September 2002 between 07:15 and 09:30 AM or until all cards were handed out.

The cards told a little about the survey and gave the web site address to the questionnaire and the individual password that would give access. Up to two trials for logging in and participate were possible per password. There were no possibilities for one respondent to view the answers from other respondents. Those who wanted to receive a hard copy questionnaire could fill in name, address, trip distance, usual travel time and congestion time on the back page of the card, and return it to us without cost. They would then receive the questionnaire a few days later.

Participation

The experience with Internet surveys was limited. Considering the comprehensiveness of our questionnaire there was a large degree of uncertainty related to response rate as well as to how representative the sample would be. In total, 1735 cards were handed out and 314 persons

participated on Internet. Some respondents only completed the first choice sequence. 278 completed the whole questionnaire. This gives a response rate of 17.5 percent.

It turned out that about 2/3 of the respondents, or almost 200 persons, responded the same day as they received the card. About 40 responded the day after, and then there were only a few responses daily during the 12 remaining days. Further, only 23 persons made use of the possibility to return the card and get an adjusted hard copy questionnaire by mail. Of these, only 7 returned a completed questionnaire to us. This data set was too small to be included in the analysis, and hence they have been ignored.

Because of the way the participants were recruited, we do not know the identity of those who received the card. Hence we had no possibility of reminding them.

Main results of the study

Background data

Because we chose to use the Internet, we were eager to see if this could lead to a biased sample. It turned out that ¾ of the respondents were men and that there were only a few respondents in the age groups 20-29 and 60 and above. Comparing these figures to data from the travel survey carried out at TOI 2001, extracting data about sex and age for those who work in Oslo and use the car as their main mode of transport to work, we could see that the characteristics of our sample fit well with the travel survey, both with respect to age and sex. Using Internet does not seem to give biases in these respects.

Average travel distance in our survey is 28 km and average travel time is 41 minutes. This gives an average speed of 41 km/h. Traffic information might not be of much use if you are not able to change either transport mode, route, departure time or your decision to travel. Therefore we were interested in people's flexibility concerning their trip to work. We found that:

- About fifty percent work flexible hours.
- 66 percent usually travel alone on their car trip to work.
- 25 percent say that public transport (PT) is a good option for them, while 51 percent say it is possible, but inconvenient to use PT. The rest cannot use PT for different reasons (e.g. need car at work; PT service not available).
- Fifty percent have the possibility to choose alternative routes. The alternative routes were seldom used, and when they were, it was usually due to more than usual congestion on their regular route.
- 53 percent do not have the possibility to change departure time in order to avoid congestion.

Participants were recruited along the three main corridors towards central Oslo. We have also looked at the three corridors separately. Here it is important to be aware that the sample in a single corridor will be smaller, and hence results must be interpreted carefully. If we look at the respondents from the west, they had slightly higher income than those from the south and considerably higher income than those from the northeast. The possibilities of travelling by public transport to work instead of by car are perceived as good for those coming from the west, but travel time will then increase by 18 minutes on average. Among those from the west there are more respondents than in the other corridors who say it is possible to change their departure time in order to avoid congestion.

It seems clear that respondents from the northeast have a lower average household income. Public transport options are available but are more seldom used by these respondents than by the rest of the respondents, probably because travel time increases by 23 minutes on average. A considerably larger fraction of those from the northeast do not work flexible hours, and more than fifty percent say it is difficult for them to choose a different departure time in order to avoid congestion. In addition, it seems like arrival time variation is larger from the northeast than from the other corridors.

Regarding respondents from the south they have the largest fraction of respondents living in a household with one or more children below the age of 16. This might be part of the explanation for the fact that respondents from the south to a larger degree than the others say it is not possible for them to change their departure time. Further, it looks like the access to public transport is not as good as for the others, but for those who have public transport as an option travel time increases by only 12 minutes on average. It must be remembered that the participants are car users and that they might have chosen to travel by car precisely because they belong to a group with poor access to public transport. Further, travellers from the south obviously have the longest travel distances and travel times. They also have the highest average speed level and the largest fraction of travel time driving in congested traffic. At the same time, they save less travel time than the others if congestion is reduced.

Calculation of willingness to pay

Contingent Valuation

Using the Contingent Valuation method we calculated willingness to pay for reduced travel time, reduced arrival time variation (measured by expected delay), reduced time spent in congestion and better information for car

users driving to work. We did this both with and without the inclusion of protest answers.

Half of the respondents have revealed no willingness to pay for the improvements mentioned above. Of these respondents there is a majority (except in the case of better information) who seem to give so-called protest answers ("Already pay enough taxes", "Don't think the improvement is possible"). These can have an actual willingness to pay, but do not reveal it. In Table 1 the figures are written in bold when protest answers have been excluded.

Table 1. Calculated willingness to pay by the contingent valuation method, differentiated with respect to transport corridor.In Norwegian kroner (NOK).

		Respondents from		
Willingness to pay for (NOK/h):	**All**	**west**	**north-east**	**south**
Reduced driving time, all	28	32	21	31
Reduced driving time, without protest answers	**40**	**44**	**29**	**49**
Reduced variation, all	40	41	34	44
Reduced variation, without protest answers	**60**	**55**	**49**	**75**
Reduced congestion, all	42	53	42	36
Reduced congestion, without protest answers	**62**	**71**	**61**	**56**
Willingness to pay for (NOK per trip):				
information of type B, all	2,6	2,2	2,3	3,2
Information of type B, without protest answers	**3,2**	**2,6**	**2,7**	**4,0**
information of type C, all	3,4	3,0	2,3	4,7
Information of type C, without protest answers	**4,2**	**3,6**	**2,7**	**6,0**

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Stated Choice analysis

The intension was to calculate willingness to pay for the different factors by the Contingent Valuation method as well as by the Stated Choice method. In our study the former should be emphasised, as the Stated Choice sequences to some extend seem not to have worked out as intended. The reason for this is probably the complexity of this part of the questionnaire. The same design worked well in the pilot study, but then the respondent could ask the interviewer if something was unclear. In the main survey they were on their own, and there might have been a tendency to ignore what they could not immediately understand.

Other reasons for the difficulties with calculations of willingness to pay could be that the factors travel time and cost might have dominated the factors travel time variation, congestion and information type in the respondents' choices between trips A and B. Consequently, the chosen levels of the latter factors will not reflect actual preferences with respect to those factors.

From the SC sequence with travel time, cost and congestion it was possible to calculate willingness to pay for reduced congestion. However, the value was lower than the value of travel time. From the SC sequence with travel time, cost and information type, the following values were found: Willingness to pay for improving information from type A to B was about 1 krone per hour, and from type A to C about 3 kroner per hour.

Use of information today and in the future

It is a purpose of our study to gain knowledge about the user benefits of traffic information. Part of the survey regards how the respondents use the information available today and how they prefer the information to be designed in the future.

70 percent of the respondents receive traffic information at home before leaving for work, and 87 percent receive information on their way to work. The sources of information are mainly radio stations, and in particular a commercial radio channel which has put a lot of effort in the field of traffic messages. A state-owned radio channel with local broadcasts in the morning and afternoon seems more popular among car users above the age of fifty. This age group also seems to be the most frequent users of RDS (Radio Data System).

Almost 90 percent of the respondents say that the information they have received both before trip and on trip has been useful. Figure 1 shows how they have used the information before trip (left diagram) and on the trip to work (right diagram).

Information is useful not only for changing transport behaviour. Another benefit is the possibility to inform others (often your employer) about your expected delay. 30 percent report that they have sometimes used information that way. Yet another benefit that is not observable from transport behaviour is that people feel less annoyed when they know why they got into unexpected congestion and how long the situation is expected to last. A few respondents have mentioned this.

If there is willingness to pay for obtaining these kinds of benefits (i.e., there is a potential which is measurable in economic terms) they should be included in cost benefit analyses of investments in information measures. This implies that all benefits from information are not necessarily observable in transport models.

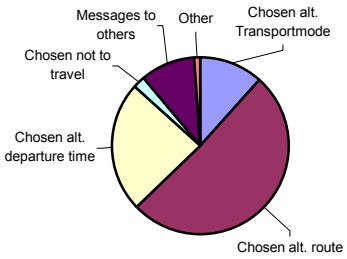

Figure 1a.

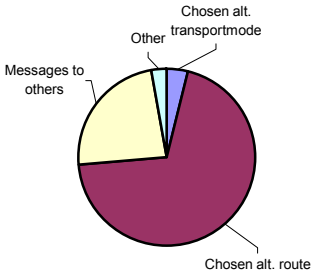

Figure 1b.

Figure 1a and 1 b: How respondents use traffic information before (figure1a) and on trip (figure1b), for trips to work. Multiple answers were allowed. TØI report 620/2002.

Respondents were asked if they wanted more detailed traffic information in the future. 68 percent would like to get more information before leaving for work, and 77 percent would like to get more information on their trip to work. In general, more men than women would prefer more detailed information. For comparison, note that at present there was a larger fraction of women than of men who receive traffic information. Combining the answers with data from the questions about travel time variations, we could see the following tendency: The larger the variations, the higher the probability that the respondent wants more traffic information.

Those who replied that they wanted more information in the future, either at home or during their trip, were asked what sources they preferred. Results are shown in Table 2. Multiple answers were possible.

Table 2. Preferred future sources of information among those who would like to receive more traffic information*

	At home	On trip
Radio	86%	92%
Cellular phone (SMS)	39%	27%
Text TV	14%	-
Internet	7%	-
Internet and WAP	-	5%
Variable message signs	-	53%
Navigation system in car	-	26%

*: Multiple answers were possible TØI report 620/2002

Conclusion

Internet was used as a tool for carrying out our study. This was less resource-demanding than home interviews, and it was possible to adjust questions to each respondent. However, it is important to evaluate whether you will get a representative sample (not everybody has Internet access) and if the questions you wish to answer are suitable for an Internet survey (too long and complicated questionnaires might lead to respondents giving up or not understanding the questions). How respondents are recruited also matters. Our data set seems to imply that our sample of respondents has a lower willingness to pay for reduced congestion than the population average. Further, the analysis of the Stated Choice sequences suggests that the questions in this part of the questionnaire were too complicated and that this have affected the results.

This survey focused on the trip to work. It would have been interesting also to look at other trip purposes, like leisure trips, and also the preferences of professional drivers. These travellers might differ from others both with respect to the kind of traffic information they prefer and in what format they prefer it. Since willingness to pay for traffic information might vary considerably across groups of travellers, and depend on e.g. trip purpose, time constraints and travel frequency, surveys should be carried out also for other groups of travellers than covered here.