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User needs of traffic information system: case study of Sydney commuters

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Abstract:

The concept of Advanced Traveler Information System (ATIS) is a component of Intelligent Transport System (ITS) and is believed to be a valuable resource to travellers. However, the benefits of ATIS are achieved only when travellers respond to the information conveyed by ATIS in a positive manner. In that regard, it is essential to know who will use this information system, what types of information are required and how traffic information effect traveller behaviour. In this context, this paper describes the user needs and preferences derived from a survey of Sydney commuters. The attitudinal survey has inspected driver attitude toward radio traffic information system.

Several radio stations in the Sydney metropolitan area periodically broadcast real-time traffic information. This information is intended to assist drivers make informed trip decisions. In general, the radio traffic information system is a well-established traffic advisory system available to the motorist. Therefore, motorist attitudes and preferences to real time information are investigated using radio based information delivery as a case study.

The main findings are as follows. It is seen that drivers thought of radio traffic information system as generally accurate. Drivers revealed that information on dynamic conditions such as traffic conditions and road accidents are more desired than information on relatively static knowledge such as alternative routes. On the aspect of technology preference, radio has the overwhelming support compared to computers and telephones.

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Introduction

The application of advanced technologies for traffic guidance to relieve transportation problems has been the subject of considerable discussion among transportation professionals As a result, number of new concepts under the broad heading of Intelligent Transport System (ITS) has emerged. ITS refers to a collection of existing and emerging technologies to meet the needs of the field of transportation in terms of productivity, mobility, and safety.

The concept of Advanced Traveler Information System (ATIS) is a components of ITS and is believed to be a valuable resource to travelers and transport managers And such information systems are expected to alleviate at least a portion of the increasing traffic congestion in urban areas by providing real-time and location-specific traffic information to travelers. Alternative types of ATIS, such as computerized route guidance systems, telephone information services, variable message signs and beepers, are under various stages of development in the U.S A., Europe, and Japan.

However, benefits of ATIS are achieved only when travelers respond to the information conveyed by ATIS in a positive manner. In that regard, it is essential to know who will use this information system, what types of information are required and how traffic information affects traveler behaviour. This work is different from traditional transport engineering research, which are primarily founded on technological aspects of ATIS. In contrast, this project investigates user acceptance of these technologies and how ATIS would influence transport related decisions of the traveler.

In this context, this paper describes user needs and preferences derived from a survey of Sydney commuters. The attitudinal survey has inspected the driver attitude toward Radio Traffic Information (RTI) Several radio stations in the Sydney metropolitan area periodically broadcast real-time traffic information. This information is intended to assist drivers to make informed trip decisions In general, the radio traffic information system is a well-established traffic advisory system available to motorist Therefore, in this project, motorist attitudes and preferences to real time information are investigated using radio based information delivery as a case study.

The main objectives of this study are to (a) investigate the driver attitude on radio traffic information, (b) explore the value of such information and (c) technology preference of commuters toward ATIS.

Overseas Experience

In this section, we briefly discuss other studies that have attempted to analyze user needs and preferences related to ATIS The early focus of ATIS has been on empirical evidence of behavioural issues and technological considerations, primarily from a marketing viewpoint. As a result only few studies have addressed user needs and acceptance of ITS products and services.

Many studies agree that commuters are interested in reducing travel times, particularly during peak periods. These commuters are prime candidates for receiving alternative-route information from route guidance systems (Barfield et al., 1990). Khattak et al. (1991), in a survey of 700 downtown Chicago commuters, have found that the majority of automobile commuters have indicated that they have changed their trip decisions at occasions in the past because of radio traffic reports. Khattak et al. (1991) have also found that most commuters use traffic information en-route rather than in the planning stage of their trips.

Ng et al. (1995) conducted a nation-wide mail-back survey in the U.S.A. to obtain information requirements of users for an ATIS. This work conducted at the University of Washington has been supported by Battelle Seattle Research Center under contract to FHWA. The study has showed that 87.7 percent of private vehicle drivers would use an ATIS. Among features that drivers consider important in purchasing an ATIS include the cost of the system, its accuracy, and the timeliness of the information. Type of visual display, system dimension, and audio capabilities are found to be less important to potential users.

Many researchers have studied the question of willingness to pay for an ATIS. Walker and Ben-Akiva (1995) have found that most subjects are willing to pay a one off charge of between US$100 and US$600 for the in-vehicle system and up to US$0.50 per call or up to US$5 per month for a subscription for a phone-based system. Similarly, Ng et al. (1995) have found in their nationwide USA survey that private drivers are willing to pay on the average between US$227 and US$336 for an in-vehicle ATIS, depending on the geographic area of respondents. Marans and Yoakum (1991) have also derived similar results. They have shown that 50 percent of respondents are willing to pay US$0.50 a day (approximately US$10.00 a month) for information on incidents and alternative-route information, whereas only 5 percent are willing to pay US$2.00 per day for such information.

It is also important to note that there is a general agreement that the design of traveler information services should be based on information requirements obtained directly from the end users of the system (Barfield et al., 1990; Davis, 1993 and Mannering et al., 1994).

An Australian investigation conducted by ARRB Transport Research Ltd. has primarily sought to understand what drivers need from intelligent vehicles (see Calrney, 1996). Their survey covered a large geographical spread and the subjects were mainly university students. In the present survey reported here the investigation has been specific to traffic information delivery aspects. The sample size is comparable to the ARRB Transport Research Ltd survey. However, the present survey deliberately avoided university student subjects and targeted randomly selected drivers in the Sydney metropolitan area.

Advanced Traffic Information System

ATIS is defined by IVHS America as systems that "acquire, analyze, communicate, and present information to assist surface transportation travelers in moving from a starting location (origin) to their desired destination" (see IVHS America, 1992). Actual implementations of ATIS include additional functions. These functions are made possible by providing the traveler with information processed by the traffic control centre and other information sources. The main difference between established traffic information systems (before ATIS) and ATIS lies in the field of information transfer; i.e. of collection, collation, and dissemination.

Every information system consists of several components that must be coordinated in their content, form, and media (see Suen and Geehan, 1987). The content is primarily what is being expressed. The media is the method of conveyance of the message. It is important to note that these components are inter-related. For example, the form is affected by content and content is affected by form.

There are numerous ATIS applications worldwide already documented. For example, the Pathfinder cars in the U.S.A. provide map-displayed current information on area of traffic congestion and general highway status. TravTek is another ATIS equipped car type, which have been provided with route guidance functions and traveler information services including electronic "yellow pages" for travellers. Other trade names mentioned in this field include ADVANCE, FAST-TRAC, TRAVINFO, and SMARTRAVLER (see Whelan, 1995).

Survey Description

The only well-established information delivery system presently available for Sydney commuters consists of conventional radio transmissions. Therefore this study begins by investigation of user attitudes toward radio traffic information systems.

Survey Design

Mail-back questionnaire survey method was adopted for this study. 200 Questionnaires have been distributed with stamped envelopes provided to return the completed responses and 83 were returned by post, i.e. the response rate is 41.5 percent. Respondents were randomly selected from morning commuters who drove their own car from home to work during the month of March 1998. The sample selection involved two steps. In the first steps, a number of office buildings within Sydney metropolitan area were randomly selected and in the second step respondents were selected from those offices. This process was adopted to obtain a good distribution of respondents while making the questionnaire distribution process efficient. The commuting considered here is not limited to travel to the central business district but includes inter- and intra-suburb travel as well. The reason for selection of morning commuters is that

work trip is the largest proportion of all types of trips and the stability in behavioural aspects. Also, commuters are known to place a high priority on saving commuting time. Therefore, they are seen as a group particularly sensitive to traffic information

There were 45 questions spread over a total of 8 pages including the cover sheet. The questionnaire consisted of six parts: (a) commuting pattern, (b) experience about radio traffic information broadcasts, (c) significance of the use of traffic information, (d) technology preference, (e) cost of information, and (f) demographics. It was established that it takes about 15 minutes to complete the survey.

Drivers were asked to evaluate radio traffic information on a five-point Likert scale ranging from "strongly agree" to "strongly disagree".

Table 1 General Commuter Characteristics

Characteristic	Category	Percentage
Sex	Male	63.86 %
	Female	36.14 %
Age	Under 20	0 %
	20-29	10.84 %
	30-30	30.12 %
	40-49	33.73 %
	50-59	22.90 %
	Over 60	2.41 %
Annual Income	No Income	0 %
	Under $10,000	2.4 %
	$10,000-$19,999	9.6 %
	$20,000-$29,999	8.5 %
	$30,000-$39,999	22.9 %
	$40,000-$49,999	20.5 %
	$50,000-$59,999	8.4 %
	$60,000-$69,999	10.8 %
	$70,000-$99,999	7.3 %
	Over $100,000	9.6 %
Occupation	Professional	36.1 %
	Managerial	13.3 %
	Administrative	12.1 %
	Engineering	19.3 %
	Marketing, Sales	4.8 %
	Skilled Craft	3.6 %
	Semiskilled	10.8 %

General Commuter Characteristics

Gender, age, occupation and annual income of respondents are obtained from the survey response and summarized in Table 1.

Table 1 shows that about two thirds of respondents are male. Age distribution is approximately even in-groups between 30 to 60 years. Only few drivers over 60 and no drivers under 20 are in the sample. The majority of respondents reported an annual income in the ranges of $30,000-39,999 and $40,000-$49,999 with each group having about 20 percent of respondents. $60,000-$69,999 range contains about 10 percent and all other income groupings have less than 10 percent in each group. Professional occupations, namely lawyers, doctors, and teachers reported the largest proportion in occupation groupings.

Attitudes on Traffic Information

Table 2 provides a summary of the responses reflecting attitudes of drivers toward the existing radio traffic information systems. The numbers indicated in the Table are percentage values and each rows adds up to 100 percent.

As can be seen in Table 2, in the first statement, 43.1 percent of drivers agreed and 12.3 percent strongly agreed with accuracy of radio traffic information. That is about 55 percent of drivers. This indicates that the majority considers radio traffic information as accurate. Although this majority is not overwhelming, it is encouraging to note that there is no one who has strongly disagreed with this particular aspect.

The percentage distribution of the second attribute on sufficiency of information is somewhat different from that of the previous statement. The responses have a wider spread along the range of responses allowed. The largest group agrees about the information sufficiency but the neutral group is also of comparable size. Basically only about one third of motorist are satisfied with the sufficiency of the RTI. This maybe because, in practice, RTI only covers main roads and broadcasts little information on minor roads. The subsequent questions posed on timliness and quantity also show similar patterns indicating that there is a co-relationship in the perception of these attributes on sufficiency, timeliness and quantity.

The last three attributes investigated have been on timeliness, anxiety reduction and quantity and quality properties of RTI. The largest group of respondents for each of these attributes is in the neutral category. For each attribute the response distribution is somewhat skewed to the positive side, but peaks at neutral responses. This general sense of indecision may be due time lag of information broadcast and actual traffic conditions. Polydoropoulou et al. (1994) have already shown that commuters learn to ignore traffic information because of their familiarity with broadcast delays.

These results indicate that, although some drivers ignore traffic information from the radio they seem to have a general confidence on accuracy and level of detail of RTI provided. Timeliness, anxiety reduction characteristics of information and the general level of quantity and quality of RTI show a much less level of satisfaction of commuters.

Table 2 Distribution of Percentage of Respondents to Attitudes and Attributes of Radio Traffic Information

	Attribute	Attitude (%)					Not Appli-cable
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
1	Traffic Information is usually accurate.	12.3	43.1	24.6	6.2	0	13.8
2	Traffic information is sufficient in its detail and variety for myself.	3.1	33.8	29.2	15.4	3.1	15.4
3	I am satisfied with the timeliness.	4.6	26.2	32.3	13.8	4.6	18.5
4	Radio traffic information generally reduces my anxiety and frustration.	4.6	26.2	35.4	15.4	1.5	16.9
5	I am satisfied with the quantity and quality of information.	3.1	33.8	24.6	20.0	3.1	15.4

Preferences on Traffic information

To explore opportunities for improving the traffic information system, drivers were asked to evaluate three suggested improvements in relation to RTI; (a) provide suggestions on alternative routes, (b) provide comparison of normal travel time and current travel time, and (c) predict time required for clearing a major delay. All these suggestions are related to the content of information provided by RTI.

The responses shown in Table 3 indicate that the third proposal is the most favoured followed by the first option. The second suggestion has the least support. Travelers want to know the expected time of clearing a major delay and alternative routes than normal travel time information. Drivers have little use of knowing the travel time by itself. Often, that is not "news" to them. They need to know alternatives and more

importantly they want to know when are these traffic conditions likely to change. They can use such information more productively. This has implications on information provided by projects such as the "Drive Time" program in Melbourne. This particular system has number of information delivery devices providing travel time comparisons and some route guidance information (Hean et al, 1996). The present survey has highlighted the importance of information on dynamic characteristics as provided by system such as "Drive Time" program over static characteristics available from conventional signage. The significance of the classification of the information content in static and dynamic manner would be discussed later.

Table 3 Distribution of Percentage of Respondents Suggested Improvements of Radio Traffic Information

	Improvement	Preference (%)					Not Applicable
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
1	Radio traffic reports should provide suggestion on alternative routes.	38.5	30.8	10.7	6.1	3.1	10.8
2	Radio traffic reports should provide the usual travel time along with the current travel time.	23.1	27.8	13.8	21.5	0	13.8
3	Radio traffic reports should predict the expected time of clearing a major delay.	36.9	40.0	9.2	3.1	0	10.8

Type of Information

Respondents were also asked about the importance of different types of information provided by RTI. The information types considered are (a) weather conditions, (b) traffic conditions, (c) alternative routes, (d) construction activities, and (e) road accidents. It is acknowledged that the importance of information is different in en-route use and pre-trip use However, in present study this distinction was not made. Table 4 shows the importance of the types of information to the commuters.

As shown in Table 4, drivers rated road accident information as very important. More than 50 percent considered this very important, in addition to a further 30 percent who rated this important. Therefore, collectively 85 percent has said very important or important to road accident information The next ranking is achieved by information on

traffic conditions. About 40 percent found this very important and another 35 percent have stated this particular type of information is important to them.

Other types considered here, such as information on weather conditions, alternative routes, and construction activities have relatively low importance than information on road accidents, and traffic conditions. These results are in agreement with the results of preferences of traffic information mentioned before. Information about expected time of clearing of delay is preferred ahead of suggestions on alternative routes. This reflects that drivers want to be kept informed about dynamic aspects of the traffic system rather than static information. This is logical in the context of commuters because they are probably told nothing new with the static information which they have learnt through maps, by experience or word of mouth. The dynamic information is the real "news" to them. Having access to this information may give them a travel time advantage over commuters who do not receive this information.

Table 4 Importance of the Type of Information Provided by Radio Traffic Reports

	Information Type	Importance (%)				
		Very Important	Important	Neutral	Not Important	Not Important at all
1	Weather Conditions	21.5	27.7	29.3	12.3	9.2
2	Traffic Conditions	41.5	35.4	13.8	4.7	4.6
3	Alternative Routes	13.8	35.4	33.8	6.2	10.8
4	Construction Activities	24.6	43.1	15.4	7.7	9.2
5	Road Accidents	52.3	32.3	10.8	0.0	4.6

Technology Preference

There is a possibility that users do not use information sources because of unfamiliar with technological aspects of delivery media. In this context, technology preference is an important issue to planners and information delivery specialists. In this study, respondents were asked two questions related to this issue. First question is about their willingness to use a particular delivery system. Three systems were considered; telephone, radio, and computer. Second question requires respondents to nominate one of the above systems as their first preference to be developed.

As shown in Figure 1, drivers are most likely to make use of radio as a source of information (72.3%). Perhaps this is because of the ready availability of radio on vehicle and at home, thereby aiding both en-route and pre-trip information requirements.

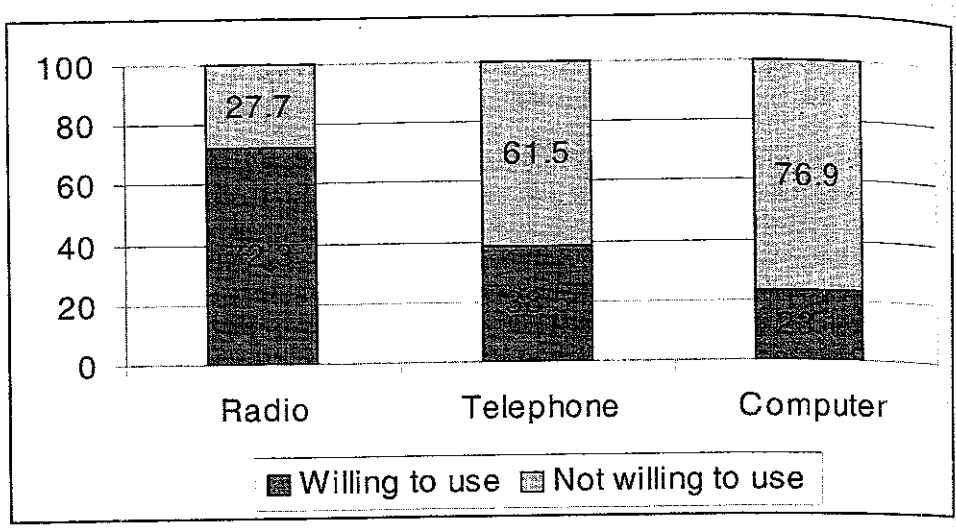

Figure 1 Willingness to Use an Information Delivery System

On the other hand, telephone and computer as traffic information delivery media has little support by public Telephone and computer usage on board does not enjoy the same level of ease of usage as the radio Also the cost of operation of telephone and computer media are probably another cause of their poor popularity for this purpose In this survey no attempt has been made to distinguish between acceptance levels for pre-trip and en-route usage of each of the technologies considered The survey results indicate that ATIS system equipment should be cheap, readily available and easy to use on board

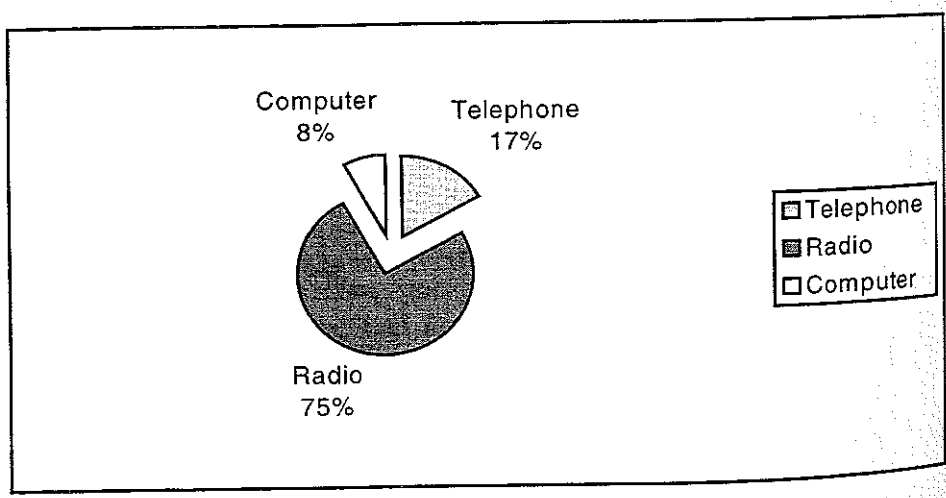

Figure 2 Priority Ranking of Traffic Information Delivery System

The response to the question as to what is the method motorists like to see developed first has yielded results closely in agreement with the above observation of the community preference of radio as the preferred media for road traffic information delivery. As shown in Figure 2, about 75 precent of drivers selected a dedicated radio station for RTI as the one that should be developed first. About 17 percent chose as the telephone, and only about 8 percent chose computer as the first system to be developed.

Cost of Information

An ambitious aspect of this research project is the search for willingness of users to pay for relevant traffic information. Respondents were asked about their willingness to pay for information, preferred type of payment, and preferred subscription fee. Overseas experience in relation to similar questions has been already mentioned in a previous section.

There is a possibility that travelers consider the cost aspect when they use traffic information. Anyhow, it appears they would like to receive this information free. This is not an unexpected outcome. Figure 3 shows that almost 35 percent of drivers have shown an emphatic refusal to pay for such service. This result reveals that ATIS promotors should consider the out of pocket cost aspect when they are planned. Further analysis is being carried out by the authors to develop a model to capture the willingness of users to pay for information.

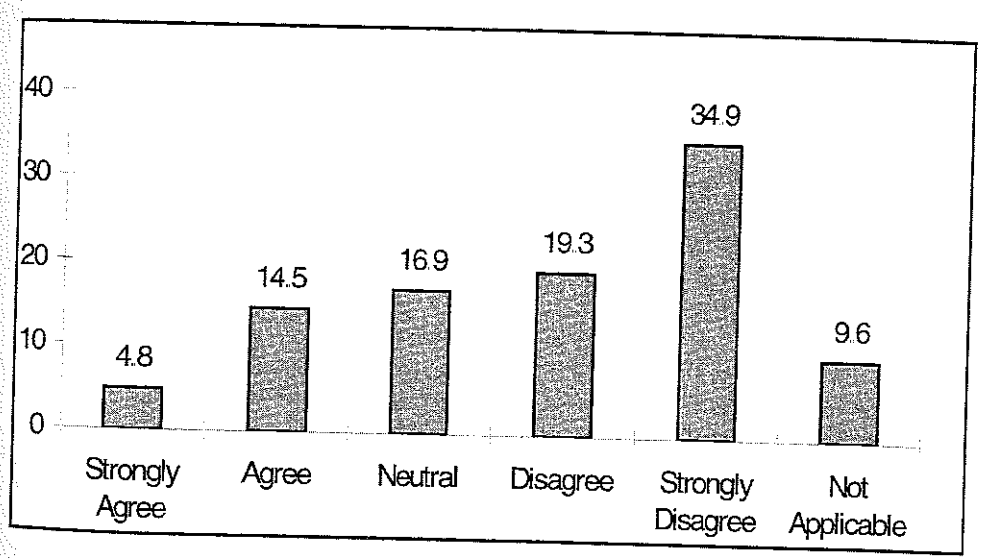

Figure 3 Proportion of Willingness to Pay for Information

As mentioned above, preferred type of payment and the preferred subscription fee has also been inquired. There are two possible types of payment investigated: (a) measured service where travelers are charged on per call service and (b) flat-rate service in which travelers pay a monthly subscription fee. Those who have indicated some willingness to

pay have in general supported a per call based tariff. Nearly 70 percent favoured the measured service (see Figure 4).

The question on the amount of payment for a system based on per call charge has revealed a range of possible tariffs. However the most common fee suggested is 25 cents per call. One third of the respondents who answered this particular question has supported a 25 cents per call charge.

The main finding of this section of the analysis is that commuters are not ready to pay for more traffic information. The challenge to traffic information delivery specialists is to find methods which are cost free to the end users.

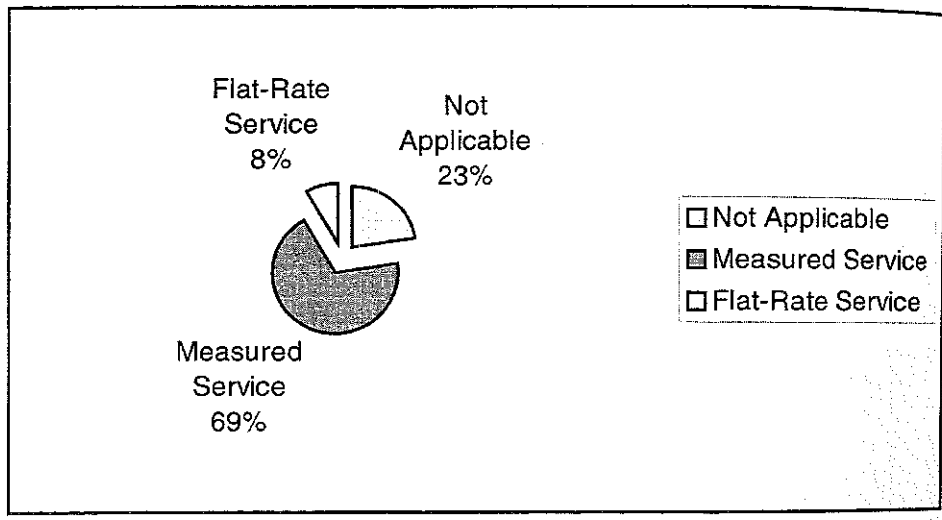

Figure 4 Preferred Type of Payment

Conclusions

The analysis presented in this paper has provided useful insights into commuter needs and preferences of traffic information. This project has also investigated the value of information to commuters. It is seen that drivers consider radio traffic information as generally accurate. However, they are not completely pleased with certain aspects of the current radio traffic information system.

An attempt has been made to measure the importance of each type of information. The results are in agreement with what has already been revealed from the investigation of user attitudes and suggested improvements. Motorists place high level of importance on information on traffic conditions and road accidents. Information on alternative routes,

weather and construction activities are of less importance to commuters. In general, the motorist is after real "news", in other words, information on "dynamic" conditions, which may impact their trip characteristics. "Static" information is not of much use to the commuter.

Preferred traffic information delivery system is found to be a radio station dedicated to broadcasting traffic information. Telephone and computer systems have failed to receive much support by respondents.

As expected, drivers strongly disagree with the suggestion to pay for traffic information. Further modeling work are continuing on the willingness to pay for traffic information provided for en-route navigation and pre-trip planning

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