THE USE OF DISCRETE CHOICE MODELS IN THE DETERMINATION OF COMMUNITY PREFERENCES TOWARDS SUB-ARTERIAL TRAFFIC MANAGEMENT DEVICES

David HENSHER
Professor of Management
The University of Sydney
Sydney - Australia

Helen BATTELLINO
Lecturer in Transport Management
The University of Sydney
Sydney - Australia

INTRODUCTION

Responsible local governments are increasingly recognising the need to be sensitive to the local environmental implications of decisions taken in the course of developing strategies to ensure the efficient use of scarce resources. Rather than rely on the pressures of lobby groups to direct government behaviour in relation to community concerns, an alternative strategy is to identify the preferences and choices of the community as a whole and to use information from a representative cross-section from the community to aid in making environmentally-linked decisions which maximise the benefits to the affected community.

This paper discusses a study which was undertaken in a suburb of Sydney, Australia to determine the local community's preferences towards the construction of a scheme of traffic control devices on their local streets. The study was conducted as a before-and-after study of community attitudes towards three types of traffic management devices: roundabouts, thresholds and midblocks. The comparison of the responses to the "before" and "after" surveys enables us to establish the transferability of "before" responses in establishing guidelines for community preferences towards alternative devices and schemes (i.e. combinations of devices).

The paper begins with a brief outline of the empirical context in order to establish an appreciation of the issue of public concern. This is followed by the development of a stated preference experiment and a discussion of the use of discrete choice models in this context. The "before" and "after" survey instruments and data collection procedures are discussed followed by the descriptive and econometric results. We test and confirm the null hypothesis that the utility associated with each device in a scheme is independent of the scheme within which the device is contained. This result is important in that it enables future scheme evaluations to be undertaken with a knowledge only of the utility associated with the devices. This property enhances the spatial as well as the temporal transferability of the results.

1. AIM OF THE STUDY

Increasing traffic flows directed towards major industrial and commercial centres are in many western cities exceeding the capacity of the major arterial road system. Consequently motorists, particularly peak hour commuters, are continually searching for alternative traffic routes to avoid congestion bottlenecks in an attempt to minimise travel time. Thus traffic spills over from the major arterials to subarterial roads and local streets which in the Sydney suburban context are predominantly residential streets. The additional traffic which is channelled onto routes not designed either for the speed or volume of traffic flow which is forced upon them, especially in peak periods, creates negative externalities of noise pollution, air pollution and a hazardous safety environment for local residents. These externalities impact on the day to day quality of life of the number of other important hypotheses arose and were tested in addition to the temporal transferability of the models. The evolution of the set of hypotheses has contributed to our understanding of the process of community evaluation of traffic control schemes and to the use of discrete choice models in explaining that process.

2. DESIGNING THE STUDY

A stated preference, or conjoint, experiment was used to evaluate the community's preference towards a scheme of devices before the installation stage and then some time after the installation when community experience with the scheme had been established. This required a face to face survey instrument to be administered to a sample of residents in a "before" study and then a similar face to face survey instrument administered to a subsample of the "before sample" respondents in an "after" study. A sample of 201 residents was interviewed in the "before" survey and 116 in the "after" survey. The sampling strategy and questionnaire design is discussed in detail in Hensher et al. 1992.

2.1. "Before" study

2.1.1. The stated preference experiments

The main feature of the survey was the stated preference experiment designed to provide the data for the choice models. The devices and the schemes were defined in terms of four attributes considered to be most important to residents in evaluating the impact of the devices on their environment. The residents' main concerns were exposure to risk which was represented by speed at the device/scheme and speed after leaving the device/scheme, environmental pollution which was represented by the noise level of the traffic associated with negotiating the device and the allocation of community resources represented by the cost of the device and the source of those funds. Each of the attributes had three levels (Table 1a). A full factorial would require 81 combinations of attribute levels. An orthogonal, main effects fraction generated a sample of 9 alternatives. This design limits us to estimates of main effects. The final set of 9 devices selected from the full factorial treatments reduced to 6 per device in the "before" survey and 8 per device in the "after" survey after allowing for dominance.

The stated preference experiment was designed in two parts. A first experiment was given to determine the resident's preferences for the devices individually and then a second experiment was used in which four predetermined schemes of devices were defined in terms of the same four attributes for the scheme as a whole. In the first experiment the respondent was shown a randomly selected card outlining the attributes of a device. This was repeated for each of the three types of device. In the second experiment the respondent was shown a diagram of each of the schemes, illustrating how it would appear on the street and given a randomly selected card defining the levels of the attributes for the scheme as a whole.

In this way community preferences for devices and also schemes could be evaluated. The rating scale was used to obtain a metric measure of relative utility. This scale can be transformed into a choice index in a number of ways. Ratings can be approximated by rankings, treated as ordinal categories, and/or the highest actual or predicted rating treated as a first preference choice. These alternative ratings transformations can be analysed at the individual or group level. The former generates choice probabilities, the latter generates choice proportions. We used the highest rating as the first preference choice and the multinomial logit technique to model these preferences.

In the "before" survey respondents were being asked to rate their preferences for residents and also have wider financial implications as property values are eroded.

Understandably many residents who find themselves in such a situation place pressure on their local council to take corrective traffic planning steps to reduce the negative impacts on their environment. In the particular suburb of Sydney under study the local council when faced with such a problem had decided to install a set of traffic control devices in an attempt to alleviate the deterioration in the quality of life of its residents. The roads in question which had been subjected to the increased volumes of traffic were classified by the Roads and Traffic Authority of N.S.W., the state road planning body, as subarterial roads, a classification, in terms of traffic volume capacity, above that of local residential street but below that of major traffic arterial.

The use of traffic management devices, such as roundabouts, speed humps and thresholds are common place on many local residential streets in the Sydney suburbs and are used to discourage non-local traffic from using these streets by either impeding the flow of traffic through the street or by significantly reducing the speed at which vehicles can travel in the street. Thus peak hour commuting traffic, which has a high value of travel time savings, is forced to stay on the major arterial roads. In some areas some of this traffic has found its way onto the subarterial roads which, prior to this study, had not been a target for traffic control schemes.

The challenge facing the local council and its traffic engineers in designing a traffic control scheme for the subarterial roads was to install devices which would reduce the speed of the through traffic sufficiently to appease the disgruntled residents but not to such an extent that it was diverted onto surrounding local residential streets which were not designed to carry such volumes of traffic, or back onto the major arterials which were already stretched to capacity. A set of three traffic control devices were designed which were particularly adapted to suit the requirements of the subarterial road. These included the familiar roundabout, a modified threshold device which did not include a raised surface or speed hump, and a new device which was called a midblock island, which is an elliptical shaped traffic island placed in the centre of the road between intersections. It was planned that combinations of these devices, constrained mainly by engineering considerations, would be placed in the streets in question to make up a scheme of traffic control devices designed to achieve the aims as outlined above.

Before installing such a scheme it was recognised that here was an opportunity to test a number of hypotheses relating to community preferences both before and after they had experienced the impact of the planned scheme in their environment. It was thought that if a choice model could be developed based on the "before" preferences of the community which could accurately reflect the preferences of that community after they had experienced the planning change then guidelines could be developed which could be used to determine the traffic control schemes which would have the highest level of community acceptance. This would provide local government with a planning tool for allocation of its scarce resources in such a way as to maximise the benefit to the community as a whole.

The aim of this study was to develop a discrete-choice model based on data of community preferences towards the planned sub-arterial traffic management (known as SATM) devices and schemes (being a combination of devices). The preferences of residents derived from this model would then be compared with those derived from data on the preferences of residents after the devices and schemes had been installed. If the "before" model demonstrated temporal transferability, in that it was able to accurately represent the "after" preferences and choices of residents, it would thus be able to be used to evaluate the community's acceptance of future planned schemes without having to undertake an extensive data collection exercise each time. In the course of the study a devices and schemes with which they had no direct experience in the context of their local streets. They had some experience with roundabouts, but as the midblock was a newly designed device they had no experience with it, nor of the modified threshold device. They were shown photographs of similar devices, some of which were only partially constructed, to help them form their opinions. We were essentially asking them to predict their satisfaction with each device based on some limited experience with similar devices. The reliability of these predicted preferences were to be tested by comparing them with the preference responses after the scheme of devices had been completed.

Table 1a. Levels of the attributes for the "before" surveys

Attributes	Levels	Definition
Speed at device	3	20kph, 45kph, 70kph
Speed 100 metres from device	3	60kph, 55kph, 80kph
Noise level at device	3	more, same, less
Source of funding	3	Council, State Government rates increase

Table 1b. Extended set of levels of the attributes for the "after" surveys

Attributes	Levels	Definition
Speed at device	3	20kph, 40kph, 60kph
Speed 100 metres from device	3	40kph, 60kph, 80kph
Noise level at device	3	more, same, less
Source of funding	3	Council, State Government rates increase

2.2. The "after" study

2.2.1. The stated preference experiment

The first of the stated preference experiments, that relating to the choice of particular devices, was repeated in the "after" study but using two sets of levels for the attributes. One set was identical to the "before" study (Table 1a.), while the other set was substantially different (Table 1b.). Each set was given to half of the sample. This enabled us to investigate the presence or absence of any systematic differences in responses due to the combinations and levels of attributes. The "after" study also gave each respondent two replications of the device experiment, whereas the "before" study administered only one replication. The device experiment as used in the "before" study when repeated in the "after" study allowed us to evaluate the community responses to the devices per se both before and after they were introduced.

The stated preference experiment relating to the rating of the schemes as a whole was not repeated in the "after" study. This was for a number of reasons. Firstly, our prime objective was to assist the Roads and Traffic Authority of N.S.W. in the preparation of some guidelines on the way community preferences and attitudes can be used in the process of selecting SATM schemes. It was thus necessary to treat each device in a way which enabled us to evaluate the community's preferences for all combinations of devices. The emphasis on a limited number of schemes as depicted in the "before" study was a significant constraint on the transferability of information to settings in which other combinations of devices or single devices may be more appropriate, either from a community point of view or from an engineering perspective, or both.

Secondly, schemes are difficult to evaluate without reference to the actual placement of devices, but given that the combination and placement of devices is generally dictated by engineering constraints, and that some of the schemes actually installed were not one of the four depicted in the experiment, the prospect of evaluating meaningful transferable preference data on schemes appeared limited.

It was thus assumed that the preference responses derived for the individual devices could be used to determine the preference for schemes or combinations of those devices if it was assumed that the utility derived from the scheme as a whole equalled the sum of the utilities of the individual devices. This would suggest that consumers' attitudes towards individual devices are not influenced by the other devices located near them within the overall traffic management scheme. This hypothesis seemed intuitively plausible and it was the basis on which we proceeded in the "after" study. However it was a hypothesis which we had at that stage not tested. This we were to do later and the results are discussed in a later section of this paper.

3. DESCRIPTIVE ANALYSIS OF THE "BEFORE" AND "AFTER" RESULTS

As well as providing some useful choice models for determining community preferences towards SATM schemes a descriptive analysis of the data also yielded some interesting insights into the community's attitudes to these schemes before and after they had experienced them in their own locality. The descriptive findings were useful in supporting and providing a check for the econometric results.

The findings were also useful for the local council in evaluating the community's perception of the success of the scheme in achieving the desired level of traffic management. In conjunction with this community attitude study the standard traffic engineering monitoring procedures were put in place to evaluate the physical impact of the devices. These were used to measure any changes in traffic speed, volume and noise levels following the installation of the scheme. However this data is not sufficient in itself in determining the success or otherwise of a traffic planning initiative for it is the community's perception of the impact of the scheme that determines the residents' acceptance and satisfaction with the decisions and actions of their local council. It is also the realisation or otherwise of the community's expectations with respect to the planned initiative that influences their disposition towards the local authority.

Some of the more interesting "before" and "after" comparisons are discussed below which illustrate how the community's expectations and perceptions prior to their experience with the scheme differed from those after the scheme had been introduced.

The majority of residents overall approved of the construction of the scheme. There was a general perception that the speed of traffic in the street had slowed and consequently residents felt that their exposure to risk had been reduced. However all three devices had not been as effective in reducing speed as the residents had expected before the construction of the scheme. It may be that residents generally had too great an expectation of the impact of the scheme expecting it to be as effective as the traffic management schemes found in local streets. But as explained earlier, the SATM scheme had to be designed to continue to allow a high volume of through traffic rather than divert traffic as in the local schemes. The roundabout was still considered to be the most effective device in reducing speed but there was general disappointment regarding the impact of the threshold devices. The midblock island was generally perceived as a more effective device in terms of reducing speed in the "after" study than had been anticipated by residents in the "before" study. This most likely reflects the fact that they had no previous experience with this new device.

In the "after" study there was an increase in the number of residents who said that they would object to the construction of any of the devices immediately outside their own property. Residents were particularly concerned about access to their property, the difficulty of which is exacerbated in a heavy traffic environment, and obstruction to parking in the street near their home. Residents were particularly pleased in the "after" study with the attempts by the local council to landscape the devices to enhance their impact on the streetscape. There had been some concern in the "before" study that landscaping with plants and shrubs could render the devices dangerous to traffic, however the council had succeeded in achieving an acceptable and safe level of landscaping making the devices less visually obtrusive.

4. EMPIRICAL RESULTS

The stated preference data were transformed into a choice response with the highest rating assumed to be the most preferred alternative. The unit of analysis is an individual respondent, each respondent had a choice set of three devices. The multinomial logit technique was used to obtain parameter estimates for the design variables and the covariates. The primary purpose of the discrete choice model is to investigate the extent of transferability of community preferences identified from the "before" data base to situations which will exist after the implementation of devices. By comparing the results from the "after" study with the "before" study we can establish the extent to which a once-off "before" study is able to provide reliable information on community preferences towards SATM devices.

The following empirical approach was implemented to evaluate the transferability potential of community preferences for SATM devices (Hensher et.al. 1992):

1. Three "after" models were estimated: (i) for the entire sample, (ii) for the sample of residents asked to respond to combinations of attribute levels identical to the levels administered to the "before" sample and (iii) for the sample of residents asked to respond to the new attribute levels.
2. The "before" model was estimated using the specification of the "after" model. Three "before" models were also estimated: (i) for the entire sample, (ii) for the sample of residents who participated in the "after" study and (iii) for the sample of residents who did not participate in the "after" study.

The literature on transferability is extensive (See Hensher and Johnson 1981 for a review). In the current context there is one "test" worthy of consideration. It involves a comparison of the marginal effects and the choice elasticities with respect to the design attributes, especially speed at the devices and speed 100 metres from the devices. Greene (1990) suggests that the parameter estimates from a discrete choice model are in themselves uninformative. A more appropriate basis of comparison involves the application of the parameter estimates in the derivation of the marginal effects and the choice elasticities. Since the marginal effects and the choice elasticities are related to each other, where the particular device attribute is continuous (notably the two speed variables) it makes good sense to use the elasticity measure as the basis for establishing the transferability potential of community preferences. The marginal effects can be used where the attributes are dichotomous (namely the level of noise and "who pays").

Formally the marginal effect of an attribute is a measure of the effect of the particular attribute on the probability of choosing a particular device P_j, holding all other influences constant, and algebraically is given by:

$$dP/dx_j = P_j(1-P_j)\beta$$

where j denotes the jth device (j=1,...,3), x_j is the level of design attribute, and β is the parameter estimate associated with x_j. The (direct) elasticity of the probability of choosing a device with respect to an attribute is defined as the percentage change in the probability of choosing the device divided by the percentage change in the attribute level. Formally this is defined as $DE_j = x_j\,(1-P_j)\beta$ and all other terms are as defined above. Note that the marginal effect and the device choice elasticity are related; the marginal effect = DE^*P_j/x_j.

Some examples of the empirical evidence on device choice elasticities and marginal effects are given in Table 2 for the six applications contexts. The models from which the elasticities and marginal effects were derived are reported in Hensher et.al. (1992).

Some important conclusions can be drawn from the comparison of the marginal effects and device choice elasticities. The evidence suggests that residents with some experience with devices "after" have different preferences to residents with little or no experience with devices "before". This is particularly borne out by the device choice elasticities with respect to speed at the device, where we see a much greater sensitivity "after" the introduction of devices than "before". Of particular note is the almost reversed device choice probabilities for midblocks and roundabouts (with threshold probabilities remaining almost unchanged). We suspect that in the "before" study that community preferences for roundabouts were greater than for mid-blocks as there was greater awareness of the speed benefits of a roundabout when compared to an essentially unknown device, the midblock. However, "after" the implementation of the devices, the speed benefits of midblocks become much more apparent resulting in greater support for midblocks than there was prior to its introduction. The results for thresholds tend to go in the opposite direction suggesting that the expectations of speed benefits associated with the introduction of thresholds were not realised.

The respondents in column one, "both stages in the before" study, and the fourth column, "old design in the after" study, were both administered the same choice attribute levels. Where the marginal effects are statistically significant we find that the impact of a change in the attribute levels (primarily noise level) changes the probability of device choice significantly more for mid-blocks and roundabouts after their implementation and significantly less for thresholds. The mid-block specific personal income effect changes sign, being negative in the "before" situation and positive after the introduction of the devices. For roundabouts and midblocks most ratings fell over time. For thresholds all ratings decreased, and some quite substantially over time.

This is an important message. It suggests that community preference models estimated prior to the introduction of devices are not an appropriate medium for establishing the community's real levels of support for devices. In setting guidelines for community acceptance of devices we strongly support the application of community preference models estimated from a sample of residents who have been exposed to the full range of potentially applicable devices through either experience and/or an educational program.

Table 2. The empirical evidence on the transferability of community preferences for devices

Attribute	Stage I "before"			Stage II "after"		
	Both Stages	Stage I Only	Full Sample	Old Design	New Design	Full Sample
Marginal effects						
Less Noise (M)	0.2879	0.3311	0.1910	0.3126	0.4094	0.2259
	0.1469	0.2279	0.0771	0.1686	0.2606	0.1390
Less Noise (R)	0.3335	0.2244	0.4206	0.2545	0.3284	0.2627
	0.1287	0.0937	0.2047	0.1378	0.1759	0.1681
Less Noise (T)	0.2310	0.2882	0.1729	0.2627	0.2176	0.3923
	0.1201	0.1525	0.1041	0.1452	0.1236	0.2700
Personal Inc (M)	-0.00017*	-0.0003	0.00007*	0.0003	0.0005	0.0001
	0.00009*	0.00022	0.00004	0.00016	0.0003	0.00006
Elasticities						
Speed at Device:						
Midblock	-0.163*	-0.370	0.028*	-0.270	0.018*	-0.440
Roundabout	-0.162*	-0.370	0.028*	-0.270	0.018*	-0.450
Threshold	-0.162*	-0.370	0.028*	-0.270	0.018*	-0.439
Probability of Choice						
Midblock	0.287	0.250	0.333	0.401	0.385	0.421
Roundabout	0.408	0.423	0.389	0.279	0.281	0.276
Threshold	0.305	0.326	0.278	0.320	0.333	0.303

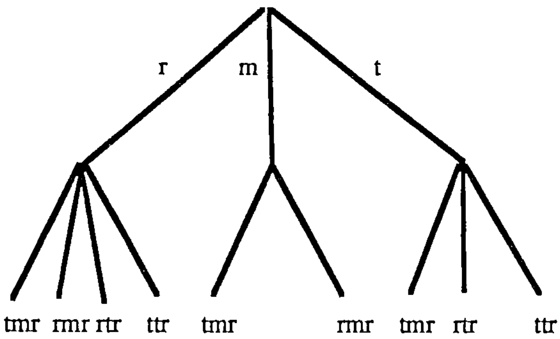
Notes: Means and standard deviations are given for the marginal effects.
Means are given for the elasticities and probability of choice.
Items starred (*) are derived using parameter estimates which are not statistically significant.

5. THE RELATIONSHIP BETWEEN DEVICE AND SCHEME PREFERENCES

The empirical investigation reported above has assumed that the preferences for each device are independent of the scheme (i.e. combination of devices) within which a device is placed. If we can demonstrate statistically that each device in a scheme is evaluated independently, then we are able to apply the device-specific findings to a large number of situations in which any configuration of more than one device is contemplated. The need to evaluate overall schemes in addition to a simple summation of the device utilities becomes redundant. The anecdotal evidence from many users of roads with installed devices is that they tend to form an attitude towards each device in a sequential manner, with a previous or subsequent device having little if any relevance, given the typical distances between devices in schemes.

The empirical assessment of the linkage between scheme choices and device choices involved the estimation of a nested-logit model in which the lower level represents the choice amongst schemes conditional on a device being present in the scheme, and the upper level represents the choice amongst devices (Figure 1).

Figure 1. The Scheme and Device Nested-Logit Specification



The particular specification of the nested-logit model is different to previous applications in the literature. Because a respondent has common alternatives in the lower branches, which arises because of the presence of more than one scheme containing a particular device, it is not possible to jointly estimate the hierarchical logit model using the method of full information maximum likelihood. Each of the three lower level "choice sets" are estimated independently (involving respectively 4, 2 and 3 alternatives), followed by the estimation of the upper level 3-alternative device choice. What we have are four independently estimated multinomial logit models. The linkage between the upper and lower levels however is achieved by the derivation of the index of expected maximum utility (or inclusive value) (Hensher and Johnson 1981). The index is introduced as an explanatory variable in the device choice model, and the estimated parameter of this index is used to establish the extent of statistical association betwen the choice of schemes conditional on the presence of a device and the choice of devices.

Formally the nested-logit model system is:

(1) $$P_{sd}=P_{s|d}P_d$$

(2) $$P_{s|d}=\frac{\exp(V_{s|d})}{\sum_{s'|d}\exp(V_{s'|d})},\ P_d=\frac{\exp(V_d+\theta\ln\sum_{s'|d}\exp(V_{s'|d}))}{\sum_{d'}\exp(V_d+\theta\ln\sum_{s'|d'}\exp(V_{s'|d'}))}$$

where:

P_{sd} = the joint probability of choosing a scheme containing devices

$P_{s|d}$ = the probability of choosing a scheme conditional on it containing device d

P_d = the marginal probability of choosing device d

$V_{s|d}$ = the relative utility associated with scheme s conditional on device d, defined in terms of the parameterised set of scheme-specific attributes and contextual conditioning variables

V_d = the relative utility associated with device d, defined in terms of the parameterised set of device-specific attributes and contextual conditioning variables

The second term in the P_d equation is the expected maximum utility associated with the choice process underlying the scheme selection. The parameter "theta" provides the statistical test for linkage between the residents choice of devices and schemes. A coefficient which is not statistically significantly different from zero implies a degenerate relationship. That is, there is no meaningful relationship between the probability of choosing devices and the probability of choosing schemes conditional on device. This result would enable us to conclude that the relative utility associated with a device is independent of the scheme configuration containing the device.

The empirical results are summarised in Table 3. The selection of the explanatory variables in the scheme and device models is based on the evidence reported in Hensher (1991) and Hensher et.al. (1992). The reader can refer to these papers for detailed assessment of the set of influences on scheme and device choice. The current interest is on the significance of the parameter estimate for the expected maximum utility index. The mean estimate is -0.091, with a t-value of -.332. The t-values in the upper level of the tree use the corrected standard errors, to allow for the downwardly biased estimated standard errors when a nested-logit model is sequentially estimated.

Theory tells us that for a nested logit choice model to conform with the necessary and sufficient conditions for random utility maximisation in a global sense (the underlying behavioural postulate of the logit model), the parameter estimate for expected maximum utility (EMU) should lie withing the range of positive zero and one. A negative estimate may be consistent with random utility maximisation in a local sense rather than a global sense; that is, for a particular data set a negative result may satisfy the sufficient conditions for local consistency. Borsch-Supan (1987) has proposed a theorem which enables one to check all data points to determine whether they are contained in an interval in which the choice probabilities have non-negative mixed partial derivatives of any order up to the number of alternatives minus one. Application of the Borsch-Supan theorem leads us to conclude that our model structure is compatible with random utility maximisation. However, as comforting as this is, the t-value for EMU is not statistically significantly different from zero, leading us to conclude that the relative utility associated with a device in a device choice model is statistically unaffected by the scheme within which the device is contained. This degenerate outcome supports the anecdotal evidence accumulated during the "before" and "after" study.

Table 3. The Empirical Estimation of the Scheme and Device Nested Logit Model

Explanatory Variable
r=roundabout, m=mid-block island, t=threshold.

		r		m		t	
		Param	t-stat	param	t-stat	param	t-stat
I. The Scheme Choice Conditional on Device							
Scheme Specific Constant	TMR	-0.338	-0.80	-0.699	-1.99	-0.430	-0.94
Scheme Specific Constant	RMR	0.408	1.00				
Scheme Specific Constant	RTR	-0.426	-1.01			-0.512	-1.10
Noise increase dummy	TTR	-0.576	-1.02			-0.508	-0.80
Noise reduction dummy	TTR	1.011	2.28			0.779	1.43
Council funded dummy	RMR	-1.220	-2.69	-1.010	-1.58		
Speed between devices interacted with daily pedestrian use		-0.040	-5.29	-0.048	-2.81	-0.056	-4.90
Local resident dummy	TMR	0.567	1.13			0.412	0.74
Local resident dummy	RMR	0.664	1.50	0.178	0.37		
Local resident dummy	RTR	0.662	1.32			0.532	0.96
Sample size		165		86		110	
Log-likelihood at convergence		-197.35		-49.75		-98.13	
Log-likelihood at zero		-228.74		-60.05		-120.85	
II. Device Choice							
Device Specific Constant	M	-0.529	-0.56				
Device Specific Constant	R	-1.410	-1.59				
Speed at the device	MRT	-0.011	-1.22				
Speed from device	M	-0.039	-3.08				
Speed from device	R	-0.028	-2.26				
Speed from device	T	-0.054	-4.15				
Council pays dummy	MRT	0.258	0.67				
Noise reduction dummy	M	1.825	3.50				
Noise reduction dummy	R	1.950	4.11				
Noise reduction dummy	T	1.438	3.01				
Personal income	M	-0.001	-1.20				
Landscape/danger dummy	M	-0.684	1.47				
Expected maximum utility	MRT	-0.091	-0.33				
Sample Size		164					
Log-likelihood at convergence		-133.06					
Log-likelihood at zero		-180.17					

CONCLUSIONS

The involvement of potentially affected communities in any traffic plan is very important. The choice modelling approach applied in this study provides an appealing framework within which to address public policy issues that impact on local communities.Combined with stated preference data at an individual resident level, the modelling approach provides a method to identify which traffic management decisions will accord with the greater desires of the community.

The "before" and "after" approach has shown that the results from the "before" survey were not totally indicative of the results obtained in the "after" survey. This is due in part to the lack of experience of the residents with the scheme and its devices. When setting guidelines for community acceptance of devices we strongly suggest that they are based on a sample of residents who have been exposed to the devices under consideration. However, this should be combined with a community education programme "before" the installation of the devices, and/or an attitudinal survey. Local residents must be involved in the decision making process if maximum acceptance of a scheme is to be achieved. There should be opportunities for the community to provide input to the planning process, and they should be kept informed of any proposed developments.

The evidence that resident preferences for particular devices are independent of the scheme within which a device is placed is an important finding for practitioners. It provides support for a simplified assessment of each device independent of the ultimate scheme selected enabling local traffic engineers to evaluate a large number of combinations of devices as a desk-top application of device-specific preference data.

BIBLIOGRAPHY

Borsch-Supan, A. Econometric Analysis of Discrete Choice, Lecture Notes in Economics and Mathematical Systems 296,Berlin: Springer Verlag, 1987.

Greene, William H. Econometric Analysis, New York: MacMillan Publishing Company,1990.

Hensher, David A. The Use of Discrete Choice Models in the Determination of Community Choices in Public Issue Areas Impacting on Business Decision Making, J. Business Research 23(4), December,1991, 299-309.

Hensher, David A. and Johnson, Lester W. Applied Discrete-Choice Modelling, Wiley, New York, 1981.

Hensher, D.A., Battellino, H.C. and Gee, J.L. The Role of Stated Preferences and Discrete Choice Models in Identifying Community Preferences for Traffic Management Devices. Paper presented at the 6th International Conference on Travel Demand Modelling, Quebec, May 1991, and to appear in a book of selective papers from the Conference (edited P.M. Jones), 1992.

Louviere, Jordan J., Conjoint Analysis Modelling of Stated Preferences. J. Transport Economics and Policy, XXII, January 1988, 93-120.