FUNDAMENTAL RESTRUCTURING OF DURBAN'S PUBLIC TRANSPORT SYSTEM - THE USER PREFERENCE STUDY

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1 INTRODUCTION

The fundamental restructuring of Durban's public transport network aims to provide an integrated, sustainable and cost-effective public transport system, which maximises the mobility of the users. As part of the process, changes will be introduced to the network including the supply of services, the price of tickets and the level of service.

Stated preference (SP) methods were employed, as they have become the favoured method of analysing travel behaviour. SP methods were used because of the radical nature of the changes, which are proposed in the fundamental restructuring of public transport and the necessity to understand and predict customer reactions to policy adjustments. SP techniques make it possible to understand the degree to which public transport attributes can be varied. The elasticity measures provided as output from SP models provide a basis for determining appropriate policies based on customers' reactions or sensitivity to changes in the attributes.

2 OBJECTIVES

The objectives of the User Preference Surveys were as follows:

- to determine which attributes are important to existing public transport customers, to the extent that they determine their current choice of public transport mode;
- to understand the current use of the transport system to contextualise choices and travel decisions being made by customers through segmented focus groups;
- to design and apply the sp instrument on the basis of choice factors revealed by focus group discussions;
- to apply a behavioural choice model (ALOGIT) to make predictions based on customer reactions to alternatives revealed by the surveys;
- to apply the resultant elasticity measures to obtain forecasts of ridership and revenue changes in response to changes brought about in the public transport system restructuring; and
- to report on the findings and modifications to the preferred public transport attributes for the strategic network identified in Durban.

3 GENERAL APPROACH AND METHODOLOGY

Both Phase 1 and 2 studies were commenced with focus group discussions. These enabled appropriate market segments to be identified and consumer surveys to be prepared. Data files from the surveys were prepared for input to revealed and stated preference models.

In order to calibrate the SP data, as part of the survey, revealed preference data was also collected from the sample of bus, mini-bus taxi and train users. Detailed information was collected from the respondents on the characteristics of the current modes of transport that were used, as well as the modes that were considered as alternatives by the respondents (revealed choices). The stated preference SP variables were selected. Finally a spreadsheet model was prepared using the sensitivity coefficients from the SP model to forecast consumer responses to service level changes.

In summary, the main components of the study were as follows:

- focus group discussions;
- design and application of revealed preference survey;
- design and application of the stated preference survey;
- preparation of data inputs for RP and SP models;
- RP and SP modelling; and
- customer response forecasting.

4 FOCUS GROUP DISCUSSIONS

Focus group participants were restricted to commuters using mini-bus taxis and buses to ascertain why they do not make use of train services and what it would take in the way of changes to train services, to effect a mode of shift to trains. The participants were split roughly evenly between mini-bus taxi and existing bus users.

In the main survey there were six focus group discussions, half male and half female and the areas from which participants were drawn included Chatsworth, Umlazi, Inanda, Ntuzuma and Isipingo. Each focus group comprised between 8 and 10 individuals.

The main conclusions from the focus group discussions were as follows. Crime is not an issue when people are thinking about buses and mini-bus taxi services but becomes most important factor affecting perceptions about trains. Accordingly, personal safety is extremely important as a choice or deterrent factor to the use of rail services. Any attempt to increase train ridership, either by coercion or inducement, should be accompanied by tangible and visible improvements to security at stations and in trains.

When people talk about travel time they are referring to total travel time, that is door-to-door times rather than the other components of travel time, such as waiting and walking. The exception is the difficulty of accessing stations or the long walk to stations for many people.

In respect of proposed new services and their possible impact on travel times it appears that differences of less than 10 minutes would not make a significant difference. Only after 10 minutes do people indicate that in order to have 10 extra minutes at home they may consider switching to train services. This would, however, depend on the services offering the appropriate arrival times for work as well as reliability of arrival.

5 SURVEY DESIGN

The Task 3 results indicated a clear preference for an integrated rail service with north south feeder/distributor services along the north south corridor focused on the Durban CBD. Key features of the rail service were considered in the design of the experiment. Variables that impacted on rail demand were therefore considered, both from the Focus Group results and from the Phase 1 modelling. Also considered were critical issues related to integrating feeder bus and taxi services with the rail service. Phase 2 results, which influenced the experiment, were:

- low values of time;
- fare and through ticketing;
- door-to-door travel time;
- rail security;
- the negative perception of Chatsworth respondents towards rail;
- reluctance to switch modes; and
- the need to keep the experiment simple and limited to 4 or 5 variables.

To design the SP experiment to test the integrated rail service the following details had to be considered and specified.

5.1 Target Market

The key target market was considered to be bus and taxi users living in areas around the existing north-south rail service. It was decided to include rail users from these areas, to provide Revealed Preference information on the rail target market.

5.2 Variables and levels

A wide range of variables were considered relating to factors that could impact on the demand for the new integrated rail service. These included:

- fare, through ticketing and method of payment;
- total travel time, walking and waiting time, transfer time, in-vehicle times in feeder/distributor modes, and in the train;
- rail security factors; and
- type of feeder/distributor mode (bus, taxi).

In view of the Phase 1 results it was decided to select the following four SP variables:

- fare;
- door-to-door travel time;
- security in terms of guards on trains and at stations; and
- security in terms of technology, i.e. panic buttons and surveillance cameras.

The questionnaire was computerised for use in a process known as Computer Aided Personal Interviews (CAPI). The advantage of CAPI is that all legitimate answers can be pre-coded and the responses to questions can be processed to provide built-in quality controls. For example, questions relating to departure and arrival times can be used to calculate the total travel time. These can also be compared with responses to questions about individual components of travel time such as walking, waiting and in-vehicle time. If there is a discrepancy between the total travel time determined by the two methods, CAPI immediately alerts the interviewer and the respondent is re-questioned to ensure that consistency is achieved.

Phase 1 of the Study, which was essentially a pilot study for the main phase, indicated significant differences between Revealed Preference (RP) and Stated Preference (SP) models. It was therefore decided to calibrate both RP and SP models and to develop a combined RP/SP model to gain the benefits of both models. International experience also recommends such an approach.

In the Durban context, the RP model was based on information capturing users' actual choices amongst the existing train, bus and taxi modes. The SP model was based on users stated or intended choices between the new integrated rail service and the current bus and taxi services.

To calibrate the RP model, information was obtained on the travel characteristics of the respondent's preferred mode, as well as on at least one alternative or two alternative modes if available. Typical travel characteristics such as fare, all the time components, including number of transfers and transfer time, and method of payment were collected.

In view of the Phase 1 results it was decided to keep the SP model as simple as possible by including not more than four variables with three levels each.

The Phase 1 models and Focus Group results indicated that all travel time components are valued the same by public transport users and that users are not very time sensitive. This is contrary to international research, which indicated that in western countries, walking and waiting times is valued more than double in-vehicle time. It was therefore decided to include only door-to-door travel time in terms of time variables, and to explore other more important variables such as security, instead of other time components.

Another critical consideration in the SP design was the range in the levels of the variables. Phase 1 indicated that public transport users are reluctant to switch to another, less familiar mode. This was particularly strong amongst Chatsworth residents. It was therefore important to test ranges in the order of 20 to 30 per cent changes to current values in order to persuade respondents to make trade-offs. The different behaviour of Chatsworth residents required a different design in terms of the levels presented, compared to the design used for the other areas.

Table 1 shows the SP variables and the levels as percentage changes to each respondent's reported values for Chatsworth and the rest of the sample.

In order to test only main effects, an orthogonal design of nine choice situations, or show cards, was required. International and local research indicated that interaction effects only explain a small percentage of the variance. This was also felt to be the best balance between the quantity of SP information and the reliability of the information. A tenth arbitrary choice situation was added in order to validate the model after calibration on the nine choice situations.

Figure 1 shows a screen for one SP experiment. In the experiment, existing bus characteristics are compared with the new rail service in terms of the variables, which form part of the experiment. In the example in the figure, the new service offers a 10 minute reduction in door-to-door travel, considerable improvements in security, offset against a fair increase of R6 per week. In response to these trade-offs, the respondent is asked to select either the usual transport or the new service.

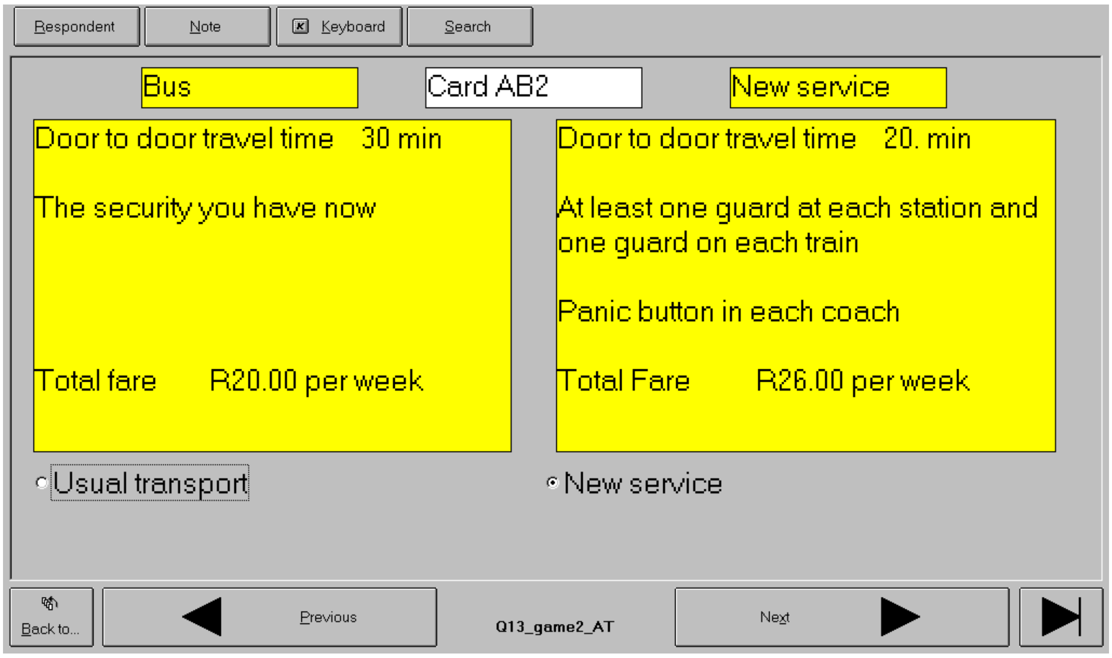
Table 1: Variables and levels used in SP experiment

Variables	Level	Chatsworth (% change from current values)	The rest (% change from current values)
Door-to-Door Time	0	-35%	-25%
	1	-20%	+15%
	2	+15%	+25%
Security 1	0	Security at major stations	Same as Chatsworth
		A guard some trains	
	1	One guard per station	
		One guard per train	
	2	Four guards per station	
		Four guards per train	
Security 2	0	No electronic equipment	Same as Chatsworth
	1	Panic button in each coach	
	2	Panic button and CCTV in each coach	
Through Fare	0	-35%	-30%
	1	-20%	-10%
	2	+10%	+30%

Each experiment is preceded by an introduction given by the interviewer. The introduction explains the experiment and the service changes contemplated. For example:

> *"The authorities would like to improve public transport in your area. One of the possible improvements they are looking into is the following service:*
> *A small bus will pick you up close to your home and take you to the nearest train station. The train will take you to the station closest to your work. At the station you will catch another small bus that will stop close to your work.*
>
> *When thinking about the new service, remember that if you choose it:*
> - *you will be able to buy one ticket for the whole trip;*
> - *the transfers will be well organised;*
> - *the small buses will be roadworthy;*
> - *the drivers will be licensed and trained;*
> - *you will be able to get information about fares and timetables at the stations;*
> - *the new service will be as reliable, or better than the transport you use now; and*
> - *the small buses and trains will not be overcrowded."*

Figure 1: CAPI screen for a typical stated preference experiment



The designs were tested by evaluating boundary arrays implied by each choice situation. In this way the levels were refined to produce a range of different trade-offs, and to test values of time and security in expected ranges.

Finally, the selected designs were simulated by generating choices for 100 sets of nine choice situations. Logit models were calibrated on the simulated choices to determine whether expected coefficients are obtained by the designs.

6 REVEALED PREFERENCES

The main RP/SP Survey involved 250 train users and 375 bus users and the same number of mini-bus taxi users, a total sample of 1000. The sample was distributed evenly in each of 5 areas with 200 respondents being canvassed in each of Ntuzuma, Inanda, Umlazi, Isipingo and Chatsworth.

6.1 Travel Times

Differences in travel times are highlighted in Table 2. On average, mini-bus taxis are 7 minutes quicker than buses and average bus travel times are 7 minutes shorter than train times. The table reveals the advantages and disadvantages of each of the modes as follows:

- walking times to trains are long (between 10 and 14 minutes);
- bus in-vehicle times are longer than other modes; and
- minibus taxi in-vehicle times are significantly lower than those for trains and buses.

Table 2: Components of travel time by main mode of travel

Component	Average time in minutes		
	Train	**Bus**	**Taxi**
Walking time to first mode	12	7	7
Waiting time for first mode	7	7	7
In-vehicle time	35	38	31
Walking time to work	13	7	7
Total travel time	67	60	53

One aspect of travel time, which may significantly impact on the choice of mode, is the punctuality of arrival time. A measure of the reliability of public transport services is provided by the number of times commuters are late for work. In some areas, commuters are late for work between 1 and 2 days per month, and while this might not sound a lot, it is actually between 5 per cent and 9 per cent of all trips to work It appears that train commuters and to a significant but lesser extent, those using mini-bus taxis experience this problem.

6.2 Travel Costs

Train fares average R1.73, bus fares R3.41 and mini-bus taxi fares R3.97. The range of fares is less than 25c for trains, and less than 45c for buses. The mini-bus taxi fare range is higher at R1.24, ranging between R3.17 in Isipingo and R4.41 in Inanda.

Commuters using mini-bus taxis as feeders or distributors to or from train and bus services, generally pay between R1 and R2 more for their transport than those commuters who can access work by means of a single mode. It is, therefore, not surprising that there are very few commuters who currently make transfers.

6.3 Alternatives to the Usual Travel Mode to Work

Table 3 shows the alternatives to the usual mode to work.

Table 3: Alternatives to the usual travel mode to work

Alternative mode to work	**Usual mode to work**		
	Train n = 222	Bus n = 345	Minibus taxi n = 319
Train	-	3	6
Bus	14	-	63
Minibus taxi (MBT)	54	66	-
No alternative	29	29	31

The most striking features of Table 3 are as follows:

- Nearly a third of public transport users by all modes (between 29-31%) indicated that they have no alternative to their usual mode. While for some this may be a perception, people usually have very good reasons for choosing a particular option. There is little difference in the proportion of respondents travelling by train, bus and mini-bus taxi who believe that there is no alternative;
- For train and bus users, the mini-bus taxi appears to be the favoured alternative; and
- For mini-bus taxi users the only alternative mode of transport is the bus service.

These results indicate that trains are not perceived as an alternative mode, which result has important implications for the fundamental restructuring project.

Table 4 shows the cost and time differences between the usual and alternative modes.

Table 4: Average cost and time differences between usual and alternative modes

Area	Usual mode to work					
	Train		Bus		Minibus taxi	
	Cost (R)	Time (min)	Cost (R)	Time (min)	Cost (R)	Time (min)
Chatsworth	2.29	1.78	0.28	-6.82	-0.30	10.81
Umlazi	2.83	-21.72	1.06	-14.67	0.46	17.09
Isipingo	1.86	-17.00	0.37	-6.47	-0.28	12.24
Ntzuma	2.78	-19.80	1.08	-7.79	0.36	14.69
Inanda	1.49	-32.90	1.29	-11.10	0.52	17.08

These differences highlight the distortionary effect of bus and rail subsidies. The large cost difference between train services and the alternatives, indicates the high level of subsidy enjoyed by train commuters. The marginal difference between the cost of bus services and the alternative to bus, which is usually mini-bus taxi, is an indication that the taxi fares are pitched at a level, which is competitive with the subsidised bus services. Thus, bus subsidies are holding down the price of mini-bus taxi services because the competitiveness of buses is bolstered by the subsidy. This makes it difficult for taxi operators to charge an economic fare and, largely accounts for the parlous financial state of many mini-bus taxi operators. The fact that there are minimal differences between the cash fare for mini-bus taxis and the bus alternative is because occasional bus users have to purchase unsubsidised single tickets. This explains why, in some cases, the alternative to the minibus-taxi is more expensive than the taxi, which is generally the most expensive mode.

Table 4 also provides some interesting insights about travel time differences. For example:

- in every area except Chatsworth, the alternatives to train services are much quicker, ranging between 17 minutes faster in Isipingo and nearly 33 minutes in Inanda;
- the alternatives to bus services (mostly mini-bus taxis) are also much faster but by a smaller margin, ranging between 6.5 minutes in Isipingo up to nearly 15 minutes faster in Umlazi; and
- the alternatives to the mini-bus taxi are in all cases, considerably slower, the journey taking between about 11 minutes longer in Chatsworth up to 17 minutes longer in Umlazi and Inanda.

This table helps to explain mode choice factors and why certain users are captive to the different modes. Train commuters are obviously attracted by the low fares of the subsidised service and are relatively indifferent to travel time. On the other hand, mini-bus taxi users clearly indicate that their choice is conditioned by time saving. Bus commuter choices are not so heavily conditioned by cost and time factors and it may be that the safety of the mode, seating comfort and the ability to purchase weekly tickets are the most significant factors accounting for the choice of bus services.

6.4 Reasons for non-use of alternative modes

Table 5 shows the reasons why commuters do not use alternatives to the modes that they usually use to travel to work.

Table 5: Reasons why commuters do not use alternatives modes to work

Reasons	Train as alternative	Bus as alternative	Minibus taxi as alternative	Total %
Too expensive	10	122	255	56.7
Too many accidents	1	2	115	17.3
The transport is crowded	8	50	24	12.0
It takes too long/too slow	6	68	4	11.4
I have to wait too long	11	50	11	10.5
Method of payment	1	4	60	9.5
Long walk from the transport	5	16	26	6.9
Long walk to the transport	5	15	16	5.3
Reckless drivers	0	2	57	8.6
Too many stops along the way	4	49	6	8.6
Loud music	0	1	45	6.7
Rude drivers	0	21	42	6.4
Other	11	59	72	9.8
Total responses	62	440	733	100

The following observations apply to each of the modes:

- few people see trains as an alternative to their present travel mode because of the perceived cost of using trains (this includes the cost of taking a feeder service to stations) and the long walk to and from stations. crowding and perceived long waiting time for train departures are also important;
- people who perceive buses as an alternative but do not use the mode frequently, give as their reasons, the fact that buses are too expensive, too slow, too crowded, impose a long wait and have too many stops; and
- commuters who perceive that the mini-bus taxis are an alternative mode indicate that they are involved in too many accidents, have an inconvenient method of payment (cash) and have many disadvantages related to the behaviour of drivers. The main complaints are reckless driving, rude drivers and the playing of loud music.

6.5 Implications of the Revealed Preference Survey Results for Public Transport Service Improvements.

Results of questions about attitudes to alternative modes provide many revealing insights, which can be used by authorities and operators to give effect to changes in the services, in the case of authorities, or to improve their competitiveness, in the case of the operators.

For train services, there is little that can be done to improve the services without significant investment to improve the penetration (line extensions and increase of capacity). This is not practical and will not be affordable or advisable in view of the inflexibility of trains as a travel mode.

In the case of bus services, the results indicate that an appropriate strategy will be to improve the directness of bus services, provide "Bus Only" lanes to reduce the in-vehicle time and to schedule vehicles so as to optimise the number of stopping places.

All the service improvements to mini-bus taxis lie in the hands of drivers. The reduction of speeding, strategies to reduce accidents and improve the service orientation of drivers could go a long way to effecting improvements in the taxi mode.

7 MODEL DEVELOPMENT

The calibration process consisted of evaluating a large range of different models, starting with simple binary models and building increasingly complex models.

The type of models calibrated in each step of the process were:

- binary SP models :
  - taxi vs. new train
  - bus vs new train
- multi-mode SP models combining bus, taxi and new train in one model
- multi-mode nested SP models specifying the bus/new train and taxi/new train choices in different hierarchies
- various RP models
- scaled SP model with RP model to remove any SP biases
- weighted scaled SP model to make model representative of population shares.

The survey information provided the possibility of segmenting models according to the following categories:

- five sub-areas
- bus vs. taxi modes
- household income (below and above r5 000 per month)
- Chatsworth vs. other areas
- gender
- access to train station from home (within 10 minutes walking, or further)
- access to train station from work (within 10 minutes, or further)

The segmentation was done by either calibrating separate models, or by introducing dummy variables in a single model.

8 APPLICATION OF THE USER PREFERENCE MODEL

8.1 Introduction

Policy analysis can be carried out once a satisfactory model has been developed. This usually involves three stages: (1) definition of a base case and calibration of the SP model, (2) calculation of certain figures of merit for individual attributes (holding of the attributes constant) to summarise the behavioural information in the model (e.g. elasticities/sensitivity), and (3) analysis of aggregate market reaction to specific policies (i.e. multiple simultaneous changes of attributes).

8.2 Definition of the base case and calibrating the model

The estimated market shares on the different corridors are shown in **Table 6**.

Table 6: Current market shares per corridor

Corridor	Current market shares				% of market shares		
	Total	Taxi	Bus	Rail	Taxi	Bus	Rail
Isipingo	5 215	2 795	857	1 563	54%	16%	30%
Umlazi	31 791	17 797	4 971	9 023	56%	16%	28%
Chatsworth	7 039	3 890	2 395	754	55%	34%	11%
Ntuzuma	8 386	5 428	2 958	0	65%	35%	0%
Inanda	5 949	5 127	822	0	86%	14%	0%

The scaling between the RP and SP data was done by using the simultaneous estimation procedure (Nested logit) in the ALOGIT package. The scaling factor that needs to be multiplied with the SP coefficients to make them compatible with the RP model, was 0.58. This implies a significant difference between the RP and SP models.

Table 7 gives the calibration results of the weighted and scaled SP model, selected for policy testing. The coefficients of the variables are given in terms of monetary values to facilitate interpretation. By taking the ratio of the coefficient of a variable to the coefficient of the fare, the equivalent Rand value of the variable is obtained. Variables with a negative impact on demand, such as fare and time, have negative coefficients and their Rand values will therefore be positive. The security variables have a positive impact on demand, and therefore have negative Rand values. For example, a travel time of one hour for higher income taxi users would have the same impact as charging an extra fare of R1.92. Introducing various security measures for Chatsworth residents would have the same impact as reducing the fare between R0.18 and R0.73.

The overall fit of the model is very good with a Rho-Square value greater than the norm of 0.2. All the coefficients have t-values greater than 2, except for the "guards" variables, indicating that coefficients are significantly different from zero at a 95 percent level of confidence.

The scaling factor that needs to be multiplied to the SP coefficients to make them compatible to the RP model was found to be 0.58. This implies a significant difference between the SP and RP models.

The model indicates that:

- higher income public transport users have a much higher value of time than lower income users;
- taxi has a somewhat higher value of time than bus and train;
- users value technological security measures more than guards;
- Chatsworth residents value the technology security measures more than residents of the other areas;
- the modal constants give the intrinsic value of the relevant mode not captured by the other variables in the model. users indicate a bias towards their current bus and taxi modes, relative to the new train service. taxi is valued the same as a fare reduction of between R2.06 and R3.12 in the various sub-areas, while bus is valued somewhat lower at between R1.45 to R1.90; and
- the greater bias of Chatsworth residents towards bus and taxi, or reluctance to change to the new train service is also apparent.

Table 7: Calibration results of weighted and scaled SP model selected for policy testing

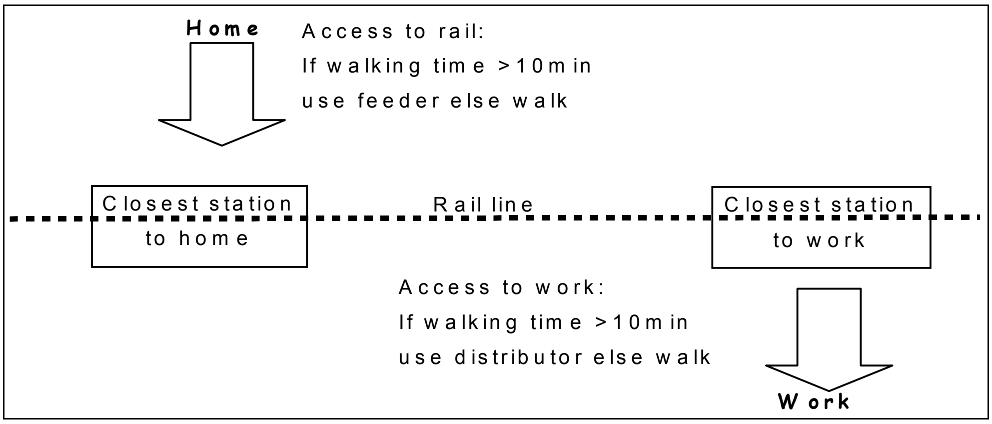
Variables	Rand values	t-values
Fare	R1.00	-8.6
Bus & Train Time Low Income	R0.83 per hour	-4.9
Bus & Train Time High Income	R1.78 per hour	-3.9
Taxi Time Low Income	R0.76 per hour	-3.3
Taxi Time High Income	R1.92 per hour	-3.7
Guards 1 – Rest	R-0.08	1.1*
Guards 2 – Rest	R-0.27	3.2
CCTV 1 – Rest	R-0.30	3.6
CCTC 2 – Rest	R-0.47	4.9
Guards 1 – Chatsworth	R-0.18	1.3*
Guards 2 – Chatsworth	R-0.24	1.7*
CCTV 1 – Chatsworth	R-0.69	4.3
CCTV 2 – Chatsworth	R-0.73	4.3
SP Constants		
Chatsworth Bus	R-2.79	7.8
Chatsworth Taxi	R-3.12	7.5
Umlazi Bus	R-1.45	5.4
Umlazi Taxi	R-2.48	6.5
Isipingo Bus	R-1.58	6.5
Isipingo Taxi	R-2.06	6.5
Inanda & Ntuzuma Bus	R-1.90	6.3
Inanda & Ntuzuma Taxi	R-2.81	6.8
SP Scaling Factor = 0.58		
Rho-Square = 0.27		
Note: * t-value not significant at 95%		

8.3 Definition and assumptions of the restructured rail service

In order to test the restructured rail service, certain assumptions had to be made. The extent of the new service was set in the user preference questionnaires and can not fundamentally different in the model since the model constants and coefficients are dependent upon it. However, the attributes included in the questionnaire can be unbundled. For example, only the door-to door travel time was included in the questionnaire. In the model, the door-to-door travel time can be a combination of walking, waiting, transfer and in-vehicle times.

The extent of the improved rail service is graphically explained in Figure 2.

Figure 2 : Graphical representation of the new rail service.



The door-to-door fare consists of the fare for feeder mode, rail service, and distributor mode. The door-to-door travel time consists of the walking time to the feeder mode stop, the waiting time at the feeder mode stop, the in-vehicle time in the feeder mode, the waiting and transfer time at the closest station to the home, the in-vehicle time in the train, the waiting and transfer time at the closest station to the work, the in-vehicle time in the distributor mode, and the walking time to work. The fare and travel time associated with the feeder and distributor modes are only applicable if the corresponding time to walk the distance between home or work and the closest stations is longer than 10 minutes.

The default values contained in the model are listed in **Table 8**. These values are only default values and smaller elements of the user preference model and can be varied in the forecasting model if required. Refer to Section 8.4 for where some of these values were varied in isolation to identify sensitivity with regards the expected market shares.

Table 8: Assumptions and default values adopted in the model

Description	Value	Based on
Maximum walking time before feeder and/or distributor implemented	10min	As included in the questionnaire
Reduced walking time after feeder and/or distributor implemented	7min	-
Average waiting time for feeder and/or distributor	7min	Current waiting times for train, bus and taxi
Average walking speed	4km/h	-
Average speed of feeder/distributor	35km/h	Typical average speed in semi-urban conditions
Feeder/distributor travel time in cases where walking time to closest stations were unknown	40min	-
Average waiting time for new train service	5min	Current waiting times for train, bus and taxi
Average speed of new train service	40km/hr	Current average train speeds between study areas and city
Rail fare	R0,62+ R0,03/km	Current rail fare (weekly and monthly tickets)
Feeder/distributor fare	R2,37+ R0,05/km	Current bus fare for Durban Transport (weekly and monthly tickets)

There are, however, some fundamental assumptions in the model that cannot be varied and must be kept in mind in the interpretation of the result. These assumptions are as follows:

- through-ticketing is a prerequisite;
- no user preference analysis was carried out on current train users. the model is based on the assumption that all the current rail users will continue to use the new rail service;
- transfer facilities will be "well organised";
- the small buses will be roadworthy;
- the drivers will be licensed and trained;
- information about fares and timetables will be available at the stations;
- the new service will be as reliable as, or better than the transport currently in use; and
- the feeder/distribution buses and trains will not be over-crowded.

8.4 Sensitivity analysis

Table 9 shows the sensitivity of some of the attributes and assumptions included in the model. These values were varied in isolation with regards to a 20% upward and 20% downward variation. It shows that the most sensitive element of the models is the fare for the feeder and distributor modes. The main reason for this is the high fare for these services due to a boarding penalty on the feeder and distributor side. The Durban Metropolitan Council has raised this double boarding penalty issue before, and preliminary indications are that the fare structures will be adapted to accommodate only one boarding penalty.

Table 9: Expected sensitivities in market share due to single attribute changes

Attribute	**-20%**	**0**	**+20%**
Rail fare	+2%	0	-1%
Feed/distribution fare	+7%	0	-5%
Rail speed	-1%	0	+1%
Feed/distribution speed	0%	0	0%
Waiting time	+1%	0	0%
Security attributes	**Level 0**	**Level 1**	**Level 2**
Guards	0	+1%	+2%
Technology	0	+3%	+4%

8.5 Policy testing

In order to test the sensitivity of multiple variations in the assumptions and attributes, certain policy scenarios were created and tested with the model. The impact of the different policies is expresses in terms of the expected market shares.

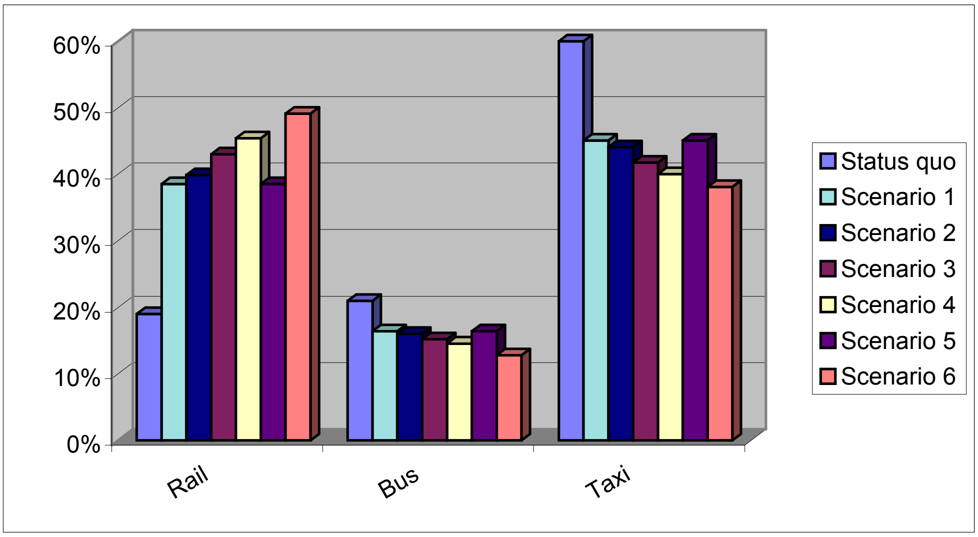
The following 6 scenarios have been tested, relative to current rail characteristics:

- as now;
- express train (15% faster average train speed);
- safer train 1 (as now with 1 guard per train and station together with a panic button on each carriage);
- safer train 2 (as now with 4 guards per train and station together with a panic button and close circuit television on each carriage);

- more expensive train (30% higher fare for trains); and
- cheaper-safe train based on Task 3 Alternative 7 (rail fare = 76c + 3,9c/km feeder fare = 20c + 7,3c/km, 1 guard per station and train and a panic buttons on the train, only focused on passengers working within a 20 minute walking time from the closest station thus no distributor service available).

These results are shown in **Figure 3**.

Figure 3: Estimated market share per policy scenario



9 CONCLUSIONS

Statistically significant SP models (95% confidence) were developed to simulate the preferences of public transport users with regard to mode choices.
The stated preference models were scaled with revealed preference data as well as the current market share in order to utilise the model for market forecasting purposes.

The scaled user preference model was used to develop a spreadsheet based forecasting model that is dependent on door-to-door travel time, door-to-door fare and security.

The introduction of an integrated rail service with feeder and distributor modes will cause an increase in the train market share. The extent of the increase varies from area to area. However, the variables included in the model (travel time, fare and security) are not that sensitive. The mere introduction of the new integrated train service will cause the biggest shift in the market.

10 RECOMMENDATIONS

Durban Metropolitan Council is in the process of considering restructuring the public transport system. The extent of this restructuring has not been finalised and the forecasting model should assist the council in policy decisions with regards to this restructuring. The model can prove useful for the following elements:

- a fare structure for feeder and distributor services;
- the extent of the market (taxi and bus) that will not be attracted to the new integrated rail service; and
- the feasibility of the new integrated rail service as recommended by Task Group 3 in Alternative 7, based on the expected market shares.

The SP and RP models should be incorporated into the transportation model (EMME/2) for more accurate estimation of mode shares.

It is further recommended that the user preference model and the updated EMME/2 model be used to refine the modal and network strategies.

FUNDAMENTAL RESTRUCTURING OF DURBAN'S PUBLIC TRANSPORT SYSTEM - THE USER PREFERENCE STUDY

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The foregoing is Marina's hobby. Her real vocation is being a mother and grandmother. She has 5 children plus a Black "adoptee" who she is putting through school at Pretoria. Boys High School. At the last count she had 7 grandchildren.