Estimating the Impacts of Integrated Transport White Paper Policies

Technical Report on Spend Impact Database (SID) Relationships – Updated October 2002

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1. INTRODUCTION

BACKGROUND

1.1 This report is an updated version of a report produced in February 2001 by Atkins for the Department for Transport (DfT then the DETR). The original report described enhancements and alterations made to the Spend Impact Database (SID) to tie in with the revisions made to the National Transport Model (NTM) framework. During 2002 further alterations have been made to SID to enhance the relationships used and to reflect the revised area type system used within the NTM. This report includes descriptions of both phases of enhancement so as to provide a complete overview of SID as of October 2002.

1.2 SID is a spreadsheet model that was developed to enable assumptions on Local Action (i.e. the level of spend on local transport infrastructure and/or local transport policies such as demand management) to be translated into some measure of change in the generalised cost of travel by different modes. This was to enable the generalised cost changes to be passed to DfT's Pass 1 demand model.

1.3 SID was initially developed by Atkins as part of an earlier commission for DfT and was used to support the modelling work underpinning the DfT 10-year plan[1]. The development of SID Version 1 (SID1) to support the 10-year plan modelling work is described in an earlier technical report[2].

1.4 SID1 formed part of a linked framework of models which DfT have since replaced with a multi-modal modelling framework. The current framework provides the ability to forecast, on a consistent basis across modes, the traffic and travel impacts of the types of policies put forward in the 1998 Integrated

[1] Transport 2010 - The Background Analysis, DETR, July 2000
[2] Development of ITWP Impacts Analysis: Modelling Local Policies. Final Report, December 2000

Transport White Paper (ITWP)[3] and subsequently articulated in the 10-year plan[4].

1.5 SID Version 3 (SID3 – February 2001) and Version 4 (SID4 – September 2002) have been developed to feed into the current multi-modal framework with the particular aim of allowing assessments of the impact of the local transport policies set out in the Local Transport Plan submissions. SID3 also played a role in the development of congestion benchmarks.

1.6 As part of the initial enhancement programme (producing SID3), Atkins was commissioned to undertake the following tasks:

(i) Assess how the impact of 10-year plan policies other than Local Action can be handled within the NTM framework, and, as appropriate, incorporate the impact of these policies within SID;

(ii) Review and, where possible, enhance the spend-impact relationships employed in SID using information available from the LTP submissions; and

(iii) Develop an Expenditure-Policy Database (EPD) that enables local authorities' policies to be represented in a form that can be used as input to SID and the NTM framework.

1.7 For the second phase of enhancement (producing SID4), Atkins was commissioned to undertake the following further tasks:

(iv) Add flexibility and functionality to the EPD – to allow scenarios to be defined more flexibly and revisions to scheme data to be made by the user;

(v) Revise the EPD to incorporate the latest area types being used in the NTM;

(vi) Streamline and revise SID to incorporate the latest area types, purposes and distance bands; and

[3] A New Deal for Transport - Better for Everyone, DETR, July 1998
[4] Transport 2010 - The 10 Year Plan, DETR, July 2000

(vii) Further enhance the spend-impact relationships used in SID.

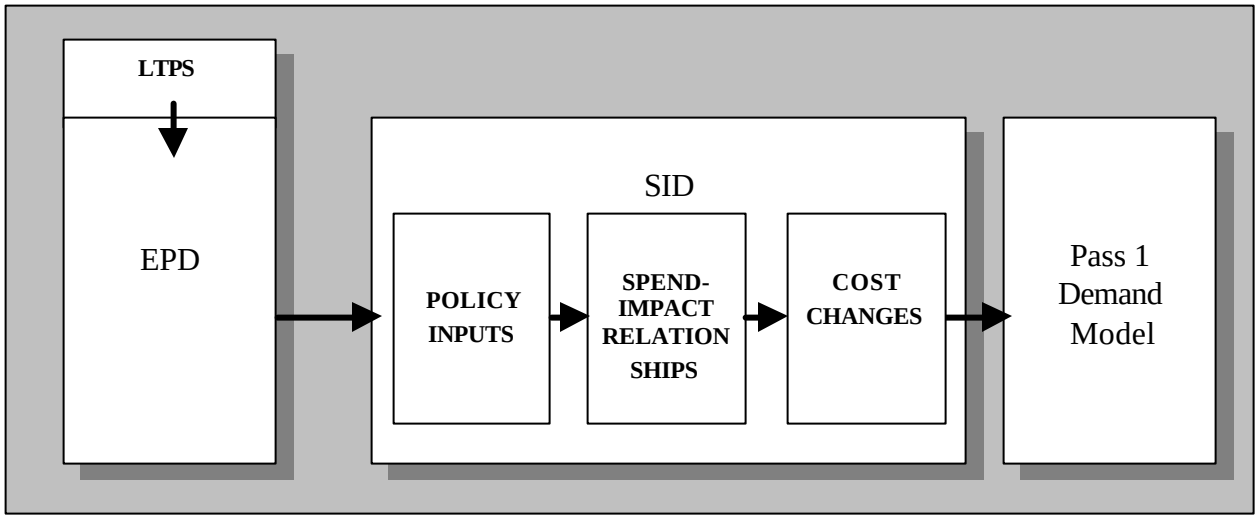
1.8 This report focuses on Tasks (i), (ii), (vi) and (vii) above. Tasks (iii), (iv) and (v) (relating to the development of the EPD) are reported in a separate Technical Report[5].

SID AND THE NTM MODELLING FRAMEWORK

1.9 SID Version 3 (SID3) was developed during the first phase of enhancement (completed in February 2001) to replace the earlier SID1 which had been used to support the 10-year plan modelling work. In September 2002, following the second phase of enhancement, SID Version 4 (SID4) replaced SID3.

1.10 Figure 1.1 shows how EPD, SID and the Pass 1 demand model link together. The same linkages apply in SID 3 and SID 4.

Figure 1.1 - Key Linkages Between EPD, SID and the Pass 1 Demand Model



1.11 SID translates policy assumptions, defined in terms either of spending on, or intensity of application of, different local transport measures, into changes in the generalised cost of travel for different modes. Different policy assumptions can be input for each area type.

[5] Estimating the Impacts of Integrated Transport White Paper Policies: Expenditure Policy Database - Technical Report – Updated October 2002, Atkins, October 2002

1.12 The generalised cost changes generated by SID are employed by the NTM trip-based Pass 1 demand model to modify base case 'without-policy' costs to represent the generalised costs of a 'with-policy' scenario. These costs can then be used by Pass 1 to generate 'with-policy' demand estimates.

1.13 The EPD's key role is to translate the spending and policy assumptions as set out in the LTPs into a form that can be input to SID. This ultimately enables a scenario based on information from the LTPs to be represented in the Pass 1 demand model (via SID).

DOCUMENT STRUCTURE

1.14 The remainder of this document is structured as follows:

- Chapter 2 sets out the structure of SID (Versions 3 & 4), describing in detail the linkages with the Pass 1 demand model;
- Chapter 3 describes the enhancements made to Local Action spend-impact relationships included in SID; and
- Chapter 4 describes the treatment of the non-Local Action policy areas.

2. SID STRUCTURE

INTRODUCTION

2.1 SID (3&4) provides a means of representing the impact of different types of policies in a way that can be input to the DfT's Pass 1 demand model. Broadly policies can be categorised as:

- **Local Action** – i.e. policy measures that can be implemented by local authorities as part of the LTP process; and
- **Non-Local Action** policies – comprising Individual Action, Passenger Rail Improvements, Sustainable Distribution and Land Use policies.

2.2 SID (3&4) has been developed focussing on representing Local Action policies. However, as described below it has also been used as the vehicle to pass assumptions about the impact of non-Local Action policies to the Pass 1 model or other elements of the NTM framework.

2.3 This chapter describes the structure of SID (3&4) and the ways in which it represents the impacts of Local Action policies.

LOCAL ACTION POLICIES

2.4 The Local Action policy measures that DfT wished to be able to test using the multimodal NTM framework are as follows:

- PT improvements
- Parking policies
- Road user charging
- Travel Awareness policies
- Planning policies

2.5 Each of these policies is assumed to impact upon private and public transport generalised costs in some way. It is noted that:

- Travel Awareness policies are assumed to subsume Individual Action (identified as a non-Local Action policy area above). This recognises that there is an interaction between the Local Action and Individual Action policy areas.

- Highway capacity changes, which were included within Local Action in SID1, are now treated as part of a separate non-Local Action policy area (see below and in Chapter 3).

2.6 The input to SID (3&4) is the specification of a policy scenario which defines the scale and intensity of implementation of measures in Britain under each of the above policy areas. The calculations within SID then translate these inputs into a series of outputs which fall into one of the following categories:

- factors which need to be applied to the base generalised cost components represented in the Pass 1 demand model;

- factors which need to be applied to certain model parameters in the Pass 1 demand model;

- monetary values (e.g. for a road use cordon charge) for use in calculating generalised cost in the demand model;

- proportions – representing a parameter to be used in calculating generalised cost in the demand model (e.g. the % of trips assumed affected by a road user charging) ; or

- indicators (High, Medium or Low) representing the scale of change in disutility that should be applied to certain modes.

SEGMENTATION

2.7 The Pass 1 demand model is segmented by purpose, trip length band and (aggregations of) NTM area types. The SID – Pass 1 linkage does not need to operate at this full level of disaggregation, nor is it practical to do so. Pass 1 calculates generalised costs for distance bands etc. using the key elements

of generalised cost (i.e. in-vehicle time, monetary costs etc.). SID only needs to make changes to these key generalised cost elements. The only disaggregation to be used is for area types and journey purpose, although the SID outputs will also distinguish between the impacts of policies in area types according to whether the trip is produced by or attracted to the area.

2.8 Both the area type and journey purpose categorisations used in SID were updated for SID4 to bring them into line with the current categorisations used in the Pass 1 demand model. Table 2.1 shows the area type categorisation and Table 2.2 the journey purpose categorisation currently used.

2.9 Disaggregating the SID outputs by purpose helps to simplify the interface between the SID and Pass 1. Additionally, it provides a means of reflecting in the 24 hour model the effects of policies with impacts that vary by time period. This is achieved through estimates (from NTS) of the proportion of total trips for each purpose that occur in each time period. These proportions can be used to generate an all day weighted average impact for trips for that purpose from the impacts for each time period. So, for instance, if RUC is only to be applied in the peak, this would be reflected in higher additional costs for average (all day) HB Work trips than for HB Shopping, Leisure and Personal Business trips because a higher proportion of HB Work trips occur in the peak.

2.10 The Pass 1 demand model is set up in terms of trip Productions and Attractions and is based on the convention that for Home Based purposes, a single trip production or attraction is associated with two one-way trips (out and return). Meanwhile, for Non Home Based purposes, a single trip production or attraction is associated with only one one-way trip. Therefore, any absolute value to be added to travel costs in Pass 1 from SID will need to be divided by 2 (in SID) for Home Based purposes and assumed to apply to both the outward and return trips. The additional costs for Non Home Based trips will be assumed to apply to only the single one-way trip and therefore will not be divided by 2. This issue will only apply to WPPL and RUC charges as all the other cost changes generated by SID to feed into Pass1 will be produced as factors or percentage changes.

Table 2.1 - NTM Area Types employed in SID

Area Type	Description
1	Central London
2	Inner London
3	Outer London
4	Inner Conurbation – E
5	Inner Conurbation – W
6	Outer Conurbation – E
7	Outer Conurbation – W
8	Big Urban (>250k) - E
9	Big Urban (>250k) – W
10	Big Urban (>250k) – S
11	Unused
12	Large Urban (100K – 250K) - E
13	Large Urban (100K – 250K) – W
14	Large Urban (100K – 250K) – S
15	Unused
16	Medium Urban (25K – 100K)
17	Small Rural (<25K)

Table 2.2 - Journey purposes employed in SID

No.	Purpose
1	HB Work
2	HB Employers Business
3	HB Education
4	HB Shopping & Personal Business
5	HB Holiday/ Day trip
6	HB Recreation
7	NHB Employers Business
8	NHB Other

LOCAL PT IMPROVEMENTS

2.11 Table 2.3 sets out the outputs provided by SID to enable local PT improvement scenarios to be represented in the Pass 1 demand model. These outputs are provided separately for trips produced by and attracted to each area type.

Table 2.3 - Representing local PT improvements

Item	Name	Type	NTM area type								
			1	2	…	….	….	…..	….	16	17
Bus In-vehicle time	Bus_ivt	GC Factor									
Bus wait time	Bus_wait	GC Factor									
Bus access/egress time	Bus_aetime	GC Factor									
Bus average full fare	Bus_fare	GC Factor									
Rail In-vehicle time	Rail_ivt	GC Factor									
Rail wait time	Rail_wait	GC Factor									
Rail access/egress time	Rail_aetime	GC Factor									
Rail average full fare	Rail_fare	GC Factor									
Bus fare concession (Person type >65)	Bus_Cf_1	Factor									
Bus fare concession (Person type <16)	Bus_Cf_2	Factor									
Rail fare concession (Person type >65)	Rail_Cf_1	Factor									
Rail fare concession (Person type <16)	Rail_Cf_2	Factor									
Bus disutility change indicator (to represent service quality and network coverage aspects)	Bus_ind	Indicator									
Rail disutility change indicator (to represent service quality and network coverage aspects)	Rail_ind	Indicator									

SID relationships

2.12 This requires SID to have the following relationships:

a) *Bus_ivt, Bus_wait, Bus_aetime = f(spend on Bus improvements)*

b) *Rail_ivt, Rail_wait, Rail_aetime= f(spend on Rail improvements)*

c) *Bus_fare, Bus_Cf_1, Bus_Cf_2 = f(spend on Bus revenue support)*

d) *Rail_fare, Rail_Cf_1, Rail_Cf_2= f(spend on Rail revenue support)*

e) *Bus_ind = f(spend on bus infrastructure)*

f) *Rail_ind = f(spend on rail infrastructure)*

2.13 Relationships (a) and (b) are derived from the available information extracted from transport models as part of the development of the Traffic Change Factor Model (TCFM also known as the 'ready reckoner') and from additional information provided in the 2000 LTPs. (Chapter 3 provides more information on the form of this relationship).

2.14 Relationships (c) and (d) are as defined for SID1 (estimating change in fare levels bought by revenue support on the basis of existing fare levels and passenger kilometres and standard fare elasticity equations)[6].

2.15 Relationships (e) and (f) are based on an analysis of the range of levels of spend on bus and rail infrastructure proposed by local authorities in their LTP submissions. This is discussed further in Chapter 3.

HIGHWAY CAPACITY

2.16 The treatment of highway capacity changes has been substantially revised from the approach adopted in SID1. Capacity changes are no longer treated as a Local Action policy and are not directly handled by SID (3&4). However, the spreadsheet (*Capacity.xls*) which produces estimates of the percentage change in highway kilometres by road type based on the assumed level of

[6] Further information is provided in the SID1 report – Development of ITWP Impacts Analysis: Modelling Local Policies, Final Report, WS Atkins, December 2000

spend on different types of highway schemes can be accessed via SID (3&4). The estimated percentage changes are then stored within SID from where they can be input to FORGE. This is discussed further in Chapter 3.

PARKING POLICIES

2.17 Table 2.4 sets out the outputs produced by SID to enable parking policies to be represented in the Pass 1 demand model. (These outputs are provided for each journey purpose, for trips produced by and attracted to each area type and the average WPPL charge and percentages paying to park and for WPPL are provided by journey purpose).

Table 2.4 - Representing Parking Policies

Item	Name	Type	NTM area type								
			1	2	…	….	….	…..	….	16	17
Change in average parking charge for those who pay	Pvpkc	GC Factor									
Change in average search time for those parking	Pvestime	GC Factor									
% of person trips paying to park – by purpose	Pvpay	%									
Average charge per person trip from WPPL – by purpose	Wppl_levy	Value (/2 for HB trips)									
% of person trips paying WPPL - by purpose	Wppl_prop	%									

SID relationships

2.18 This requires the SID to have the following relationships:

g) *Pvpkc = f(parking restraint policy)*

h) *Pvestime = f(parking restraint policy, existing parking demand and capacity)*

i) *Pvpay = f(parking restraint policy)*

j) *Wppl_levy = f(WPPL policy, charge, % of charges passed on to employees)*

k) *Wppl_prop = f (WPPL policy, number of trips affected).*

2.19 *Pvpkc* in relationship (g) is simply an input variable to a policy scenario.

2.20 Relationship (h) employs standard parking supply-demand curves and is based on input assumptions defining the changes in paid parking supply and demand and the search time for those parking for free. The base case search times used are shown in Appendix A.

2.21 *Pvpay* in relationship (i) is also an input variable that is drawn initially from NTS data but can be changed to represent, for example, the imposition of a larger charging area. The default base NTS figures are also detailed in Appendix A

2.22 Relationships (j) and (k) have been defined drawing upon information available from the ROCOL study.[7] Again further details of the assumptions used in Relationships (j) and (k) are outlined in Appendix A.

ROAD USER CHARGING

2.23 Table 2.5 sets out the outputs provided by SID to enable cordon-based road user charging scenarios to be represented in the Pass 1 demand model. (Again these outputs are provided for each journey purpose and for trips produced by and attracted to each area type).

Table 2.5 - Representing Cordon-based Road User Charging

Item	Name	Type	NTM area type								
			1	2	…	….	….	…..	….	16	17
Average road user charge per person for those who cross the cordon – by purpose	Ruc	Value (/2 for HB trips)									
% of person trips crossing the charging cordon – by purpose	Ruc_prop	%									

[7] Review of Congestion Charging Options for London (ROCOL), DETR, February 2000

SID relationships

2.24 This requires SID to have the following relationships:

l) *Ruc= f(RUC charging policy)*

m) *Ruc_prop = f(RUC cordon, RUC charge level)*

2.25 *Ruc* in relationship (l) is derived for each journey purpose from the RUC charges input to the policy scenario for each time period on the basis of the proportions of journeys for that purpose occurring in each time period. The charges are translated from a vehicle-based charge to a person trip based charge on the basis of vehicle occupancy by purpose figures.

2.26 Relationship (m) is more difficult, since the number who pay to cross the cordon will vary depending upon the size of the cordoned area, the availability of alternative modes and routes and the level of charge. Information in available model reports was used to produce estimates of the percentages of trips crossing the cordon in different area types, as set out in Appendix A.

TRAVEL AWARENESS POLICIES

2.27 Travel Awareness policies have been represented in the Pass 1 model through adjustments to the car disutilities used. SID produces as an output an indicator representing the intensity of application of Travel Awareness policies and therefore the extent to which the car disutilities should be adjusted to represent them. This output is summarised in Table 2.6 below.

Table 2.6 - Representing Travel Awareness Policies

Item	Name	Type	NTM area type								
			1	2	…	….	….	…..	….	16	17
Travel Awareness	TA_int	Indicator									

SID relationships

2.28 This requires SID to have the following relationships:

n) *TA_int = f(spend on Travel Awareness schemes)*

2.29 Relationship n is based on an analysis of the level of spend on Travel Awareness schemes proposed by local authorities in their LTP submissions. This is discussed further in Chapter 3.

PLANNING POLICIES

2.30 Finally, Table 2.7 shows the outputs produced by SID to represent certain planning policies. (Again these outputs are provided for trips produced by and attracted to each area type). Planning policies here are distinct from assumptions on location of development, which will be fed into the demand model in the form of new trip end assumptions. The policies represented in SID are those which, by encouraging higher development densities and provision of PT services, can be assumed to reduce PT access/egress times.

Table 2.7 - Representing Planning Policies

Item	Name	Type	NTM area type								
			1	2	…	….	….	…..	….	16	17
Density of new development reducing PT access/egress time	Ptaetime_2	GC Factor									

SID relationships

2.31 This requires SID to have the following relationships:

o) *Ptaetime_2 = f(assumed intensity and type of new development)*

2.32 Relationship (o) cannot be defined using existing data. Broad assumptions on potential access/egress time improvements are specified simply by specifying the intensity of the policy as Low, Moderate or High. Factors appropriate to these broad levels of intensity are applied to total access and egress times (as in SID1).

REVENUE SUPPORT

2.33 SID (3&4) also provides the ability to undertake a 'hypothecation loop'. This is a mechanism through which the anticipated revenue from RUC and WPPL measures (and other sources) can be fed into the processes for estimating predicted changes in generalised costs. The input sheet has entries for the

available revenue in the forecast year and the proportions in which it is split between fares reductions and capital expenditure on public transport.

2.34 Once these proportions and the total available revenue (based on an initial run of SID and the Pass1 model) have been entered, SID adds the implied additional spend on public transport and fares reductions to the original input spend levels. The new combined spend totals are then fed into the spend impact and fare reduction calculations outlined above (and in Chapter 3) to produce new estimates of generalised cost change to feed into a second model run for the scenario.

3. ENHANCING THE SPEND-IMPACT RELATIONSHIPS

INTRODUCTION

3.1 A number of spend-impact relationships were established as part of the development of SID1. This chapter describes how these relationships have been modified as part of the development of SID3 and then SID4.

PUBLIC TRANSPORT INFRASTRUCTURE INVESTMENT

3.2 SID1 estimated a change in public transport (PT) generalised costs as a function of the level of spend on different types of public transport infrastructure. The relationships used in SID (3&4) follow a similar form but have been revised and enhanced. Two key enhancements were made for SID3 (and retained in SID4):

- The model information was supplemented by additional scheme data drawn from the appraisal reports provided for major schemes included with the LTP submissions; and
- The relationship was re-defined so as to provide an estimate of the change in generalised cost separately for:
  - Bus (including bus-based Park-and-Ride); and
  - Rail (comprising heavy rail and light rail).

3.3 For SID4 the relationship was re-defined again (using the same data) so that it incorporated an element of diminishing returns (i.e. the level of generalised cost change for a given spend decreases as the level of total spend increases).

Supplementary Information

3.4 In order to estimate a spend-impact relationship, a dataset is needed which provides estimates of scheme capital costs and the average change in area-wide generalised travel costs for a range public transport schemes. In SID1 the spend-impact function was estimated using information available from transport models originally used to estimate the Traffic Change Factor Model (TCFM – also known as the 'ready reckoner').[8]

3.5 The LTPs including major PT schemes were expected to include supplementary information setting out the appraisal of the scheme according to the DfT's Guidance on Full Local Transport Plans (Annex E). However, in many instances the detailed information required to determine average generalised cost changes is absent. For example, many appraisals present only a discounted estimate of travel time savings (rather than the savings specific to a particular forecast year) or do not present sufficiently detailed demand information. In most cases, LTPs state that the detailed appraisal of their scheme is yet to be undertaken, or is to be submitted to DfT at a later date (e.g. Bristol LRT, Merseyside LRT and Luton-Dunstable Translink). Additionally, it is clear that the detailed approach to appraisal is different between schemes and authorities. Without detailed information on the modelling and appraisal approach adopted it is difficult to be certain that results for different schemes are genuinely comparable.

3.6 For these reasons only a limited set of scheme appraisals could be used to supplement the spend-impact relationship dataset for SID3 (&4). These schemes are shown in Table 3.1 below.

Table 3.1 - Scheme appraisals used to supplement the PT spend-impact relationship estimation dataset

Scheme	LTP
Croxley Rail Link	Hertfordshire
South Hampshire Rapid Transit	Hampshire
Derby City Centre Integrated Transport Project	Derbyshire
Chester-Deeside Transport System	Cheshire
Kent Thameside Fastrack	Kent

[8] The approach to estimating these relationships is described in the SID1 technical report, Development of ITWP Impacts Analysis: Modelling Local Policies. Final Report, December 2000

The estimated relationships

3.7 For SID3, multiple linear regression analysis on datasets from the spend impact database was undertaken to derive a relationship linking generalised cost change to spend. The regression analysis was based on the untransformed spend and generalised cost data and produced a linear relationship between Spend/PT trip and Change in Generalised Cost of an average PT trip[9].

3.8 The relationship used in SID4 was based on the same dataset. However, the relationship was enhanced so that the link between spend and cost change incorporated an element of diminishing returns (of cost change achieved for increased spend) rather than being a simple linear relationship. To achieve this, two alterations were made to the form of the data before the linear regression analysis was undertaken:

- The spend information was converted into spend/trip km (rather than spend/trip as used in SID3);
- The spend/tripkm information was then transformed into ^{3}Ö [(Capital expend.)(/1998 PT trip km))] for bus spend and ^{5}Ö [(Capital expend.) (/1998 PT trip km)] ^{4} for rail spend

3.9 The relationship derived for SID4 is shown below. Appendix B provides further information on the regression analysis process and the statistical significance of the relationship produced.

Change in Av. GC per PT trip (mins)	=	*-0.3255* ^{3}Ö [(Capital expend. on Bus) (/1998 PT trip km(£))]*	+	*-0.0514*^{5}Ö [(Capital expend. on Rail) (/1998 PT trip km (£))]^{4}*

[9] Further information on the SID3 relationship is provided in the original version of this report - Estimating the Impacts of Integrated Transport – Technical Report on Spend Impact Database (SID) Relationships, WS Atkins, February 2001

Dividing Average PT GC Change between Modes

3.10 This spend impact relationship generates an absolute change, in minutes, in average generalised cost of a Public Transport journey. However, the Pass 1 model requires separate cost change factors for Rail and Bus trips. Therefore SID (3&4) incorporates a mechanism to split the estimated average PT generalised cost change between modes

3.11 This split is achieved by assuming that spend on Bus schemes only affects the generalised cost of Bus trips and spend on Rail schemes only affects the generalised cost of Rail trips. Using this assumption, it is possible to derive the overall change in generalised costs of Bus and Rail trips using the following relationships:

Change in Av. GC per Bus trip (mins)	=	*-0.3255* $\sqrt[3]{}$ [(Capital expend. on Bus) (/1998 PT trip km(£))]*	*	*1 (/Bus mode share)*

Change in Av. GC per Rail trip (mins)	=	*-0.0514* $\sqrt[5]{}$ [(Capital expend. on Rail) (/1998 PT trip km (£))]^4*	*	*1 (/Rail mode share)*

Dividing Overall Trip GC Change between Trip Elements

3.12 For each mode, Pass 1 also requires separate cost change factors for the different elements of journeys' costs (access/egress time, wait time and in vehicle time). Therefore SID (3&4) also incorporates a mechanism to divide the cost change for the whole trip (which is calculated for each mode by the relationships presented above) between the different elements of the journey. Appendix B outlines the methods and weights used to achieve this split.

Heavy Rail and LRT

3.13 It is noted that heavy rail and LRT have been included in a single rail mode category. This is because the Pass 1 model does not distinguish between the rail sub-modes. A separate Technical Note[10] describes a proposed treatment for rail cost change factors based on area type and distance band. The proposed approach is to use the SID (3&4) relationships to represent short-

[10] Technical Note 8 - Options for Treatment of LRT/Rail Costs from SID3, WS Atkins, November 2000

distance urban area movements, whereby the cost change factors represent the impact of spend on light rail and urban heavy rail schemes. For longer distance movements it is suggested that cost changes are taken from strategic rail cost matrices.

Limitations

3.14 While we have sought to use whatever information is readily available for SID, it needs to be recognised that the available data on which to base the spend-impact relationships remains scarce. Analysis of information on the physical delivery of PT infrastructure (available in the LTP F4 finance forms) was undertaken, but the data was insufficient to support the estimation of separate relationships for different area types. Given the need for such relationships to translate spend assumptions into generalised cost changes, more effort is needed to track down and obtain data in a suitable form to significantly increase the size of the dataset. Given the range of studies being undertaken for both PT scheme assessment and multi-modal studies this should, in theory, be possible.

Park and Ride Treatment

3.15 It is noted that Park and Ride is not treated as a separate mode in the Pass 1 demand model. The treatment of Park and Ride spend in SID (3&4) follows the Traffic Change Factor (TCF) approach used for all spend-impact relationships in the 10-year plan modelling work (since the Pass 1 Demand model was not then available). Park and Ride spend is translated into a generalised cost change and then, by using the TCFM (Traffic Change Factor Model or 'Ready Reckoner', a TCF is estimated for each area type. The TCF can then be applied to Post-FORGE NTM traffic levels to replicate the reduction in car vehicle kilometres that can be attributed to Park and Ride schemes in urban areas.

Service quality and coverage enhancements

3.16 The PT spend-impact relationship described above only deals with changes in journey times and not in changes in perceptions of PT modes. Step changes in service quality (e.g. moving from conventional bus to either guided bus or LRT) are generally recognised as changing travellers' perception of PT. A similar change in perception may result from significant increases in network coverage.

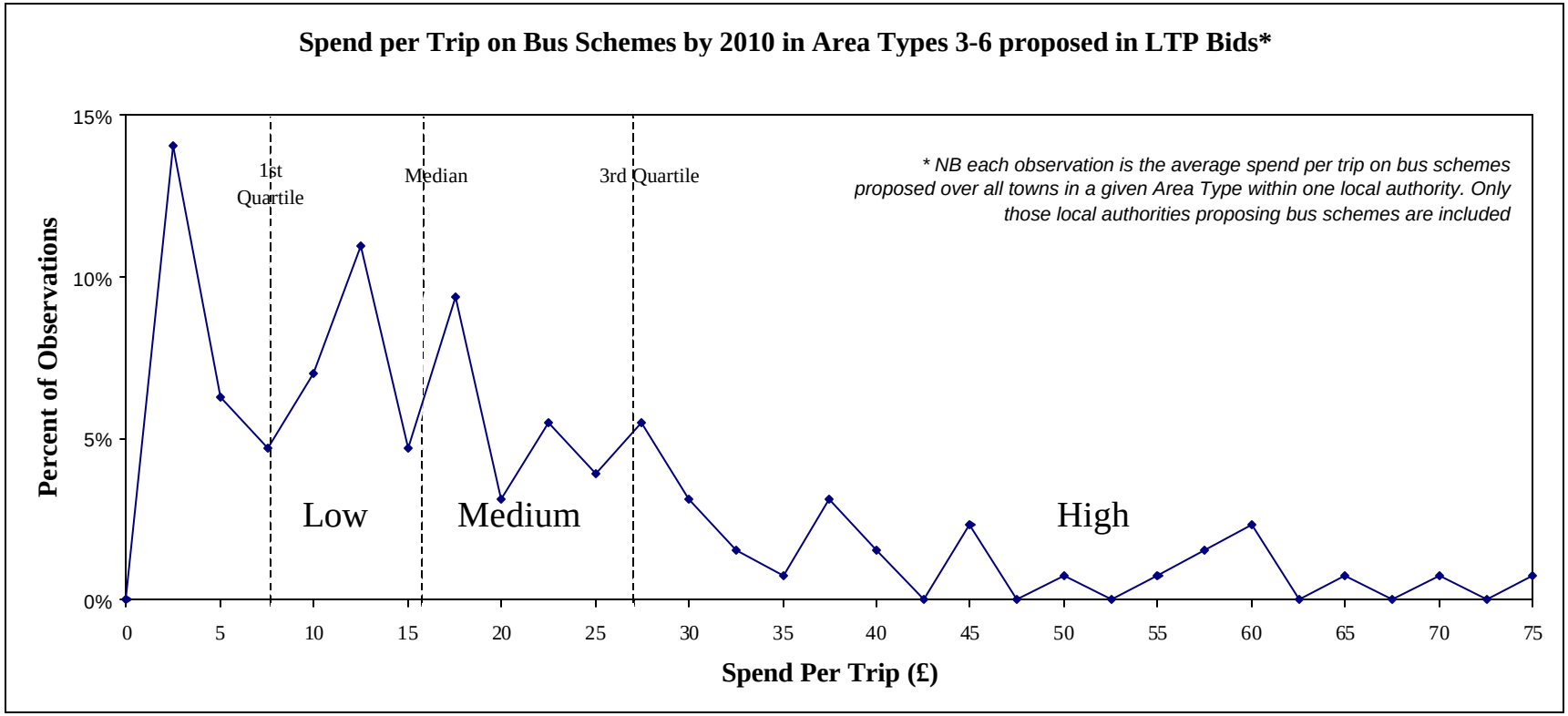
3.17 SID (3&4) allows proposed Bus schemes to be separately categorised as representing a Low/Medium or High level of change in service quality and coverage (or No Change). These categorisations are used as indicators to reflect the extent to which the Bus disutilities employed in the Pass 1 Demand model should be adjusted to represent service quality and coverage enhancement.

3.18 The actual changes in disutilities associated with each categorisation (H/M or L) have been determined by ITEA on the basis of estimates of the percentage changes in Bus trips that would be caused by the different intensities of service quality and coverage enhancements. The values and basis for these target percentages are set out in a separate Technical Note[11] (reproduced in Appendix C).

3.19 When EPD outputs are used to define a SID scenario, spend levels are used as the basis for determining the level of change in service quality and coverage caused by Bus schemes. The spend level boundaries determining Low/Medium and High intensity schemes (or no change) have been determined on the basis of analysis of the range of spend levels proposed by local authorities in their LTP submissions. Figure 3.1 shows the distribution of Bus spend (expressed in terms of spend per trip) for different area types within each local authority. As shown in the diagram, a purely subjective judgement on what constitutes Low or High has been made by taking the quartiles of the distribution.

[11] Technical Note 10 – Impact Targets for Setting Modal Constant Adjustments, WS Atkins, March 2001

Figure 3.1 - Distribution of Bus Spend per Trip



HIGHWAY CAPACITY CHANGES

3.20 As discussed in Chapter 2, highway measures are not treated as Local Action policies in SID (3&4) and so the impact of spending on highway measures is not estimated directly within SID. However a separate spreadsheet (*Capacity.xls*) can be used to translate spending on highway measures into estimated percentage changes in lengths of different road types in different DfT regions. This spreadsheet can be accessed via SID (3&4) and its output percentage changes in road length can then be stored within SID from where they can be passed to FORGE. FORGE can then represent changes in highway capacity as part of its speed-flow calculations.

3.21 It is noted that this spreadsheet only calculates highway capacity changes for the non-strategic road network. The strategic network is handled via a separate (non-SID) interface with FORGE.

3.22 The relationships between spend and changes in highway capacity were estimated using information available from the LTP submissions. The LTPs provided the local authorities' statements on the funds required for different types of road scheme (in the F2 and F3 finance forms) and an estimate of the delivery of different types of scheme in terms of kilometres of new road or number of schemes.

3.23 Relationships of the following form were estimated:

Change in road kms = spend on road schemes/(cost/km)

3.24 It is noted that the categorisation of schemes did not necessarily lend itself to mapping schemes onto different road types. It is also noted that the quality of the F4 data was such that it was not considered reasonable to develop separate relationships for different regions or area types.

3.25 The estimated relationships and the road types assumed affected by the spend are shown in Table 3.2. Percentage changes in road capacity (defined purely in terms of lengths of different types of road) are calculated by comparing the estimated changes against base 1998 road kilometres by region (as supplied by DfT).

3.26 It is noted that, unlike SID1, no mechanism has been included to represent the impact of traffic management schemes or junction improvements on highway capacity. This is because of the limitation caused by providing inputs to FORGE as changes in total route kilometres by road type. This means that, at present, no impact upon highway speeds and times caused by the total spend on junction improvements, traffic management or traffic calming schemes can be represented. It is recommended that this treatment is reviewed as part of any further enhancement.

Table 3.2 - Highway capacity spend-impact relationships

Scheme Type	Cost rate (£ mill per km, 1998 prices)	Road types affected
BP – Bypass	8.58	Principal Dual and Principal Single in Area Type 8 (Rural) only
DU – Dualling	1.6	Principal Single – assumed to convert to Principal Dual
RR – Relief Road	17.2	Principal Dual and Principal Single in urban areas (Area Types 1-7 and 9) only
TM – Traffic Management	0.2 per scheme	Not used
UT – Urban Traffic Control	0.5 per scheme	Not used
JI – Junction Improvements	0.5 per scheme	Not used
NJ – New Junction	0.1 per scheme	Not used

SLOW MODES

3.27 The Pass 1 demand model includes walk/cycle as an explicit mode choice. Given that much of the proposed expenditure in the LTPs is focussed on improving conditions for walking and cycling, some mechanism to represent the impact of the spend on the attractiveness of Slow Modes is required within the SID/ Pass1 interface.

3.28 The approach adopted for representing Slow Mode schemes is to make adjustments to the Slow Mode disutilities used within Pass 1. The scale of adjustments made in each scenario is determined on the basis of a judgement on the scale and intensity of Slow Mode improvements proposed. Only limited information is available on the impacts that spending on Slow Mode improvements would have. Therefore a similar approach to that used for step changes in PT service quality has been adopted and Slow Mode

improvements are categorised in terms of No Change, Low, Medium or High intensity change. These categorisations are then used as indicators to reflect the extent to which the Slow Mode disutilities employed in Pass 1 should be adjusted to represent Slow Mode improvements.

3.29 The actual changes in disutilities associated with each categorisation (H/M or L) have been determined by ITEA on the basis of estimates of the percentage changes in Slow Mode trips that would be caused by the different intensities of Slow Mode improvements. The values and basis for these target percentages are set out in a separate Technical Note[12] (reproduced in Appendix C).

3.30 When EPD outputs are used to define a SID scenario, spend levels are used as the basis for determining whether Slow Mode schemes are High, Medium or Low intensity. The spend level boundaries determining the Low, Medium and High intensity categories (or no change) have been determined on the basis of analysis of the range of spend levels proposed by local authorities in their LTP submissions. Figure 3.2 shows the distribution of spend on slow modes (expressed in terms of spend per trip) for different area types within each local authority. As shown in the diagram, a purely subjective judgement on what constitutes Low or High has been made by taking the quartiles of the distribution.

TRAVEL AWARENESS

3.31 A similar approach to that for Slow Modes has been adopted for Travel Awareness measures. SID produces an output indicator for each area type representing the scale and intensity of application of Travel Awareness measures. These indicators reflect the extent to which the car disutilities used within Pass 1 should be adjusted to represent the impact of Travel Awareness policies. The actual adjustments to disutilities associated with each indicator have been estimated by ITEA on the basis of estimates of the percentage reductions in traffic levels that would be caused by the different intensities of Travel Awareness policies. Trial runs of Pass 1 were undertaken in which the car disutilities used were adjusted until the model outputs replicated the estimated traffic impacts.

[12] Technical Note 10 – Impact Targets for Setting Modal Constant Adjustments, WS Atkins, March 2001

3.32 The predicted traffic reductions are shown in a separate technical note reproduced in Appendix C[13] and were derived from the analysis undertaken to produce Traffic Change Factors to represent Travel Awareness policies for SID1. In line with SID1, it has been assumed that Travel Awareness policies mainly consist of Company and School Travel Plans and therefore affect journeys for Work, Business and Education purposes only. The adjustments to disutilities made in Pass 1 to represent Travel Awareness policies are therefore only applied to Work, Business and Education related trips.

3.33 Again, when EPD outputs are used to define a SID scenario, spend levels are used as the basis for determining whether Travel Awareness measures are High, Medium or Low intensity. The spend level boundaries determining the Low, Medium and High intensity categories have been determined on the basis of analysis of the range of spend levels proposed by local authorities in their LTP submissions. Figure 3.3 shows the distribution of spend on Travel Awareness modes (expressed in terms of spend per trip) for different area types within each local authority. As shown in the diagram, a purely subjective judgement on what constitutes Low or High has been made by taking the quartiles of the distribution.

[13] Technical Note 10 – Impact Targets for Setting Modal Constant Adjustments, WS Atkins, March 2001

Figure 3.2 - Categorisation of Spend on Slow Mode Measures

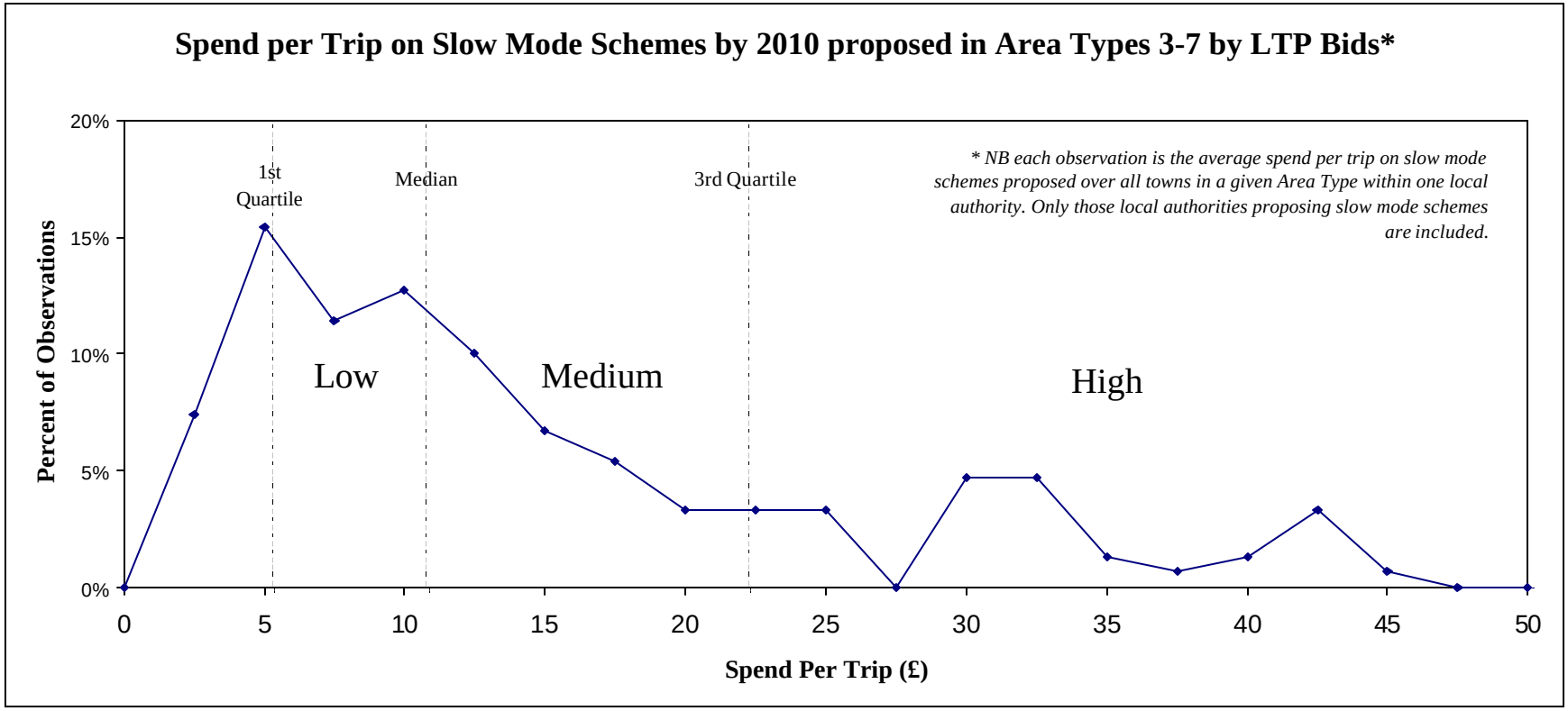
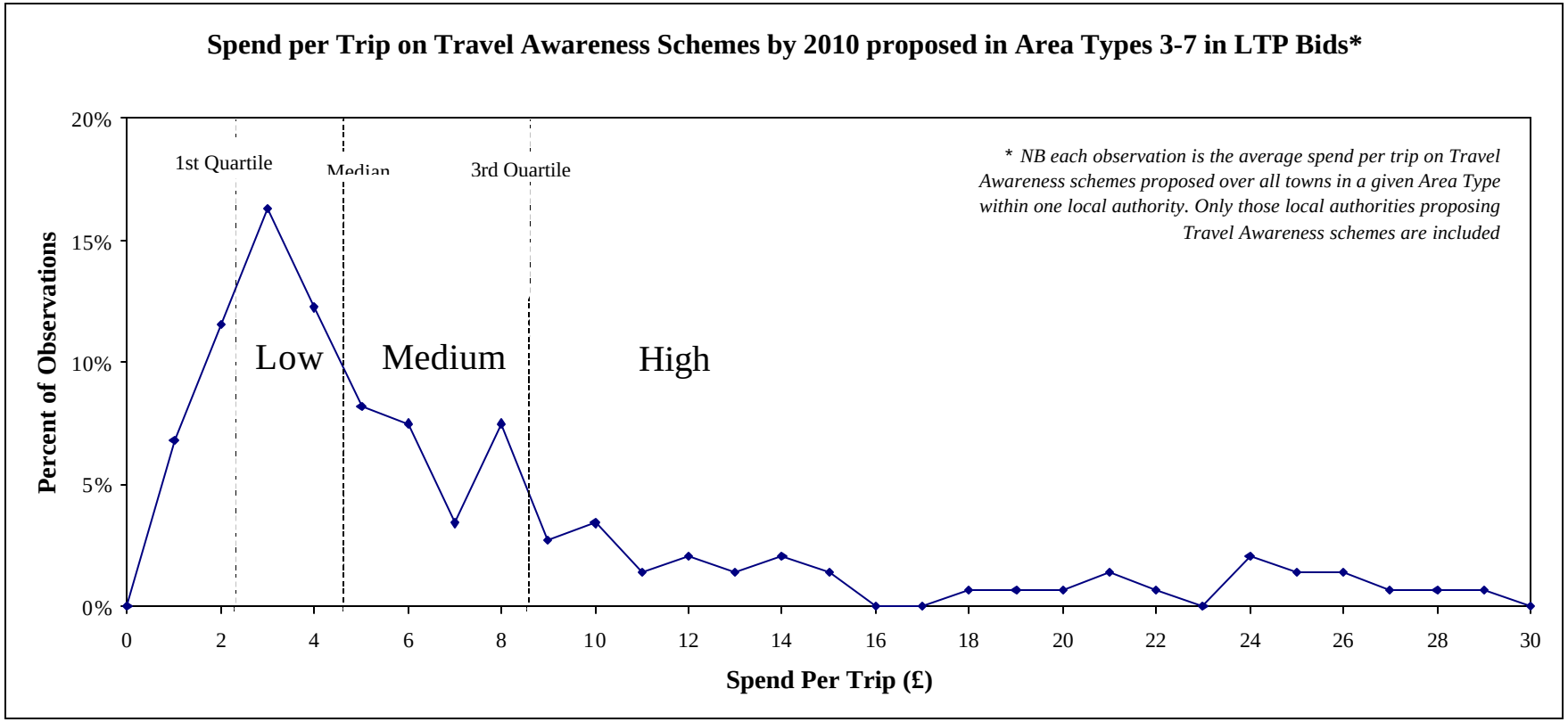


Figure 3.3 - Categorisation on Travel Awareness Spend



4. NON-LOCAL ACTION POLICY AREAS

4.1 As outlined in the previous chapter, SID (3&4) is used as a means of accessing and calculating outputs to represent Highway Capacity measures even though they are not treated as Local Action policies. This mechanism was established with the aim of simplifying and integrating the process of defining a complete policy scenario for a given NTM run.

4.2 For the same reason, SID3 also incorporated means of selecting and storing inputs and assumptions for other Non Local Action policies (passenger rail, freight, sustainable distribution and land use policies). However, experience with using SID3 revealed that, in practice, the options for defining these other non-Local Action policy areas were not used. Therefore, during the process of streamlining SID4 the options to define Passenger Rail and Freight, Sustainable Distribution and Land use policies were removed.

APPENDIX A

Traffic Restraint Assumptions in SID (3&4)

A. TRAFFIC RESTRAINT ASSUMPTIONS

1) TYPES OF ASSUMPTIONS WITHIN SID

A.1 SID (3&4) contains two types of assumptions that are used in producing the cost changes to feed into Pass 1 to represent the impacts of traffic restraint policies (i.e. parking restraint, RUC and WPPL).

- A set of assumptions used in calculating the cost changes caused by the traffic restraint policies. This includes a set of default values for certain SID input variables to provide guidance on inputs for any SID scenarios that are defined manually (i.e. independently of LTP/EPD scenarios).

- A set of assumptions used to convert the traffic restraint related outputs produced by an EPD scenario into the inputs required by SID to define these measures. These assumptions are required because none of the LTPs quantified their parking restraint, RUC and WPPL measures sufficiently to provide the information required by SID. The role of the assumptions is to convert the information output by the EPD into relevant inputs for SID.

A.2 The following sections deal with each of these sets of assumptions in turn.

2) ASSUMPTIONS USED IN CALCULATING PASS 1 COST CHANGE FACTORS AND DEFAULT VALUES FOR NON LTP/EPD SID SCENARIOS

Public Parking

A.3 As outlined in Chapter 2 of the main report, SID (3&4) produces the following outputs to feed into Pass 1 to represent the impact of policies to restrain public parking:

- Change in average parking charge for those who pay;
- Proportion of person trips paying to park (by purpose);
- Change in average parking search time.

A.4 The change in average parking charge for those who pay is input directly to SID as part of the scenario definition.

A.5 The percentage of trips paying to park is also an input value. However, default percentages for each journey purpose and area type are provided within SID to provide guidance in the process of manually defining a SID scenario.

These default percentages are based on the 1998 NTS values and are outlined in Table A1 below.

Table A.1 - Default Percentages Paying to Park

Area Type	Percentage Parking in Public Car Park					
	Work	Employers Business	Education	Personal Business	Recreation	Hol
1	25.0%	7.1%	0.6%	11.7%	4.8%	17.8%
2	3.2%	7.1%	0.6%	11.7%	4.8%	17.8%
3	4.8%	4.0%	3.2%	14.4%	1.1%	3.9%
4	1.0%	3.4%	2.2%	7.5%	0.7%	3.2%
5	2.4%	2.1%	0.5%	9.3%	0.8%	11.1%
6	1.0%	3.4%	2.2%	7.5%	0.7%	3.2%
7	2.4%	2.1%	0.5%	9.3%	0.8%	11.1%
8	1.6%	6.4%	0.4%	10.4%	0.8%	9.5%
9	1.6%	6.4%	0.4%	10.4%	0.8%	9.5%
10	1.6%	6.4%	0.4%	10.4%	0.8%	9.5%
11	na	na	na	na	na	na
12	2.1%	4.1%	1.1%	10.1%	0.7%	9.5%
13	2.1%	4.1%	1.1%	10.1%	0.7%	9.5%
14	2.1%	4.1%	1.1%	10.1%	0.7%	9.5%
15	na	na	na	na	na	na
16	2.3%	2.8%	0.3%	10.3%	0.8%	9.4%
17	2.7%	4.0%	0.6%	9.8%	0.8%	8.3%

A.6 The change in average parking search time is dependent on the change in paid parking supply, change in search time for free parking, the proportion of trips paying to park, a relationship linking parking search time to the relative levels of parking supply and demand and the 'without policy' search time for the forecast year.

A.7 The change in paid parking supply, change in search time for free parking and proportion of trips paying to park (as outlined above) are all input directly to SID as part of the scenario definition. The relationship linking parking search time to supply and demand levels was taken (as in SID1) from the MVA Merits report[2].

A.8 The 'without policy' parking search time for the forecast year was derived using the same method as was used in SID1 (as outlined in the earlier

technical report[14]). The calculation is dependent on the growth in the number of car trips (i.e. parking demand) between 1998 and the forecast year and the 1998 base case parking search time. The 1998 search times used in SID4 are shown in Table A.2 below. They are based on the NTS average figures and an assumption about the average search time for paid parking in each area type which was based on the relationships in the Merits report[15]. An additional base search time component has been added to search time in SID4. This is the assumed underlying time taken to search for a space even when all spaces are empty and was added to represent the unique conditions in Central London

Table A.2 - Parking Search Time in 1998

Area Type	Search Time (mins)			
	Average (from NTS)	Paid Parking	Free Parking	Base Search time*
1	13.00	5.0	12.71	10.00
2	3.00	5.0	2.86	0
3	2.00	2.5	1.97	0
4	4.00	5.0	3.97	0
5	4.00	5.0	3.96	0
6	2.00	2.5	1.98	0
7	2.00	2.5	1.98	0
8	2.00	2.5	1.98	0
9	2.00	2.5	1.98	0
10	2.00	2.5	1.98	0
11	na	na	Na	na
12	2.00	2.5	1.98	0
13	2.00	2.5	1.98	0
14	2.00	2.5	1.98	0
15	na	na	Na	na
16	2.00	2.5	1.98	0
17	2.00	5.0	1.87	0

*Time spent searching for a space even when all spaces are empty.

Work Place Parking Levies

A.9 Chapter 2 also outlines the two following outputs which are produced by SID (3&4) to feed into Pass 1 to represent the travel costs caused by the proposed WPPL policies:

[14] Development of ITWP Impacts Analysis: Modelling Local Policies. Final Report. December 2000
[15] Merits Final Report – The MVA Consultancy, 1993

- Average charge per person trip affected by WPPL;
- % of person trips paying WPPL.

A.10 The average charge paid per person trip by those affected by WPPL depends on the annual WPPL charge proposed (input as part of the scenario definition), average vehicle occupancy (based on NTS information) and the number of return work related trips made for each annual WPPL charge (assumed to be 200 (5*40)).

A.11 The proportion of trips that involve paying WPPL depends on the journey purpose (i.e. only Work and Employers Business trips are assumed to be affected), the proportion of employees whose employers pass on the charge and the proportion of trips assumed to end in workplace parking. SID (3&4) uses the assumption that 20% of those potentially subject to WPPL charges have the cost passed on to them by their employers (based on information in ROCOL[16]). The assumptions used about the proportions of Work and Employers Business related trips that park in workplace parking were derived from information published in NTS 95/97[17] and Transport Trends 2000[18] and are presented in Table A.3 below.

Table A.3 - Proportion of Journeys Parking in Workplace Parking

Area Type	Work	Employers Business
1	39%	40%
2	39%	40%
3	64%	40%
4	68%	40%
5	68%	40%
6	75%	40%
7	75%	40%
8	75%	40%
9	75%	40%
10	75%	40%
11	na	na
12	75%	40%
13	75%	40%
14	75%	40%
15	na	na

[16] Review of Congestion Charging Options for London (ROCOL), DETR, February 2000
[17] National Travel Survey 1995/97 in Focus on Personal Travel, DETR, November 1998
[18] Transport Trends 2000, DETR, 2000

16	75%	40%
17	84%	40%

RUC Proposals

A.12 SID (3&4) produces 2 outputs to feed into Pass 1 to represent the impacts of RUC proposals:

- The average RUC paid per person by those who cross the cordon (by purpose);
- The proportion of person trips crossing the charging cordon.

A.13 The average Road User Charge paid per person for each journey purpose and area type is dependent on the proposed charge in each time period (input as part of the scenario definition), the relative proportion of trips for each purpose that occur in each time period (from NTS) and the average vehicle occupancy (from NTS).

A.14 The percentage of trips crossing the RUC cordon is also an input entered into SID (3&4) as part of the scenario definition process. However, default percentages for each area type are provided within SID to provide guidance in the process of manual (non EPD) scenario definition. These percentages were based on the limited existing information on RUC schemes and were derived in the same way as those used in SID1, as outlined in the earlier technical report[19]. Table A4 presents the default percentages used.

[19] Development of ITWP Impacts Analysis: Modelling Local Policies. Final Report., Atkins, December 2000

Table A.4 - Default Percentage of Trips Crossing the RUC Cordons

NTM Area Type	All Time Periods	
	If London Central & Inner Cordon	If London Central Cordon Only
1	75%	75%
2	22%	16%
3	9%	5%
4	3%	3%
5	3%	3%
6	1%	1%
7	1%	1%
8	12%	12%
9	12%	12%
10	12%	12%
11	na	na
12	22%	22%
13	22%	22%
14	22%	22%
15	0%	0%
16	33%	33%
17	na	na

A.15 SID (3&4) does contain the mechanisms to allow the percentages crossing the cordon to be varied by purpose to represent the different Origin and Destination patterns of different journey purposes (for instance Work trips might be more likely to cross the cordon than Education trips). However, there is currently no information available to inform this differentiation and therefore the percentages are set to the figures in Table A.4 for all purposes.

3) DEFAULT VALUES FOR EPD/ LTP BASED SCENARIOS

Public Parking

A.16 Parking restraint policies are defined in SID (3&4) in terms of 5 input variables:

- Percentage change in average charge from the base case;
- Percentage change in the supply of paid parking spaces from the base case;
- Percentage change in the average time taken searching for a free parking space from the base case;
- Percentage of trips parking in paid parking (by journey purpose);
- Percentage of trips parking in WPPL (by journey purpose).

A.17 However, none of the LTP submissions quantified their parking restraint proposals in sufficient detail to enable them to be represented in these terms. Therefore the outputs produced by the EPD to define a scenario for SID only represent parking restraint policies in terms of an average level of intensity (High, Medium or Low) of implementation for the selected towns in each area type, as reported in the Technical Report of the EPD[20].

A.18 SID (3&4) therefore incorporates a number of assumptions as to how High, Medium and Low intensity parking restraint should be represented in terms of the parking related inputs to SID (3&4). The following tables A4 to A7 present the assumptions currently used within SID4. Tables A4 to A6 show the assumed level of average parking charge, paid parking supply and free parking search time respectively compared to the base case under Low, Medium and High intensity parking restraint policies. These values are directly input to the SID Scenario definition sheet. Table A7 shows the level of trips assumed to park in paid parking compared to the base case under each intensity of implementation of parking restraint. These percentages are multiplied by the base case percentages paying to park (listed in Table A1 as the default values for non EPD SID scenarios) to produce the values to input to SID.

A.19 SID (3&4) also provides the potential to alter the percentage parking in workplace parking to reflect the impact of parking restraint policies. However currently this facility is not used for EPD/LTP based scenarios because of the

[20] Estimating the Impacts of Integrated Transport White Paper Policies: Expenditure Policy Database – Technical Report – Updated October 2002, Atkins , October 2002

difficulty of quantifying the opposing influences of reducing on street parking space (potentially increasing work place parking) and WPPL (potentially decreasing work place parking).

A.20 The figures in all the Tables A4 to A7 are assumed to apply simultaneously. Therefore if Low intensity parking restraint is selected in a given area type, the Low intensity factor from each of the tables below will be applied (i.e. 120% of base parking charge, 95% of base parking supply, 120% of base free parking search time and 120% of default percentages parking in paid parking).

A.21 These assumptions are only intended as a broad estimate of the likely level of impact of the proposed parking restraint policies. Any or all of the resultant SID inputs can be changed in the Inputs sheet for a given policy scenario. (Alternatively the default assumptions can be changed permanently in the *EPDDefaultAss* sheet within SID).

Table A.5 – SID4 Default Assumptions for Low, Medium & High Intensity Parking Charge Policies (% of Base Charge)

	NTM Area Type																
Intensity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Low	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	na	120%	120%	120%	na	120%	120%
Medium	150%	150%	150%	150%	150%	150%	150%	150%	150%	150%	na	150%	150%	150%	na	150%	150%
High	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	na	200%	200%	200%	na	200%	200%

Table A.6 – SID4 Default Assumptions for Low, Medium & High Intensity Paid Parking Supply Policies (% of Base Supply)

	NTM Area Type																
Intensity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Low	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	na	95%	95%	95%	na	95%	95%
Medium	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	na	90%	90%	90%	na	90%	90%
High	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	na	80%	80%	80%	na	80%	80%

Table A.7 – SID4 Default Assumptions for Low, Medium & High Intensity Impacts on Free Parking Search Time (% of Base Search Time)

	NTM Area Type																
Intensity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Low	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	na	120%	120%	120%	na	120%	120%
Medium	150%	150%	150%	150%	150%	150%	150%	150%	150%	150%	na	150%	150%	150%	na	150%	150%
High	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	na	200%	200%	200%	na	200%	200%

Table A.8 – SID4 Default Assumptions for Low, Medium & High Intensity Impacts on the % trips parking in paid parking (% of Base Proportion)

	NTM Area Type																
Intensity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Low	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%	na	120%	120%	120%	na	120%	120%
Medium	150%	150%	150%	150%	150%	150%	150%	150%	150%	150%	na	150%	150%	150%	na	150%	150%
High	200%	200%	200%	200%	200%	200%	200%	200%	200%	200%	na	200%	200%	200%	na	200%	200%

Workplace Parking

A.22 SID requires WPPL plans to be defined in terms of a proposed annual charge and the proportion of workplace parking spaces to be affected. The LTP submissions provided no quantification of their WPPL proposals and therefore the EPD SID Scenario outputs only describe WPPL proposals in terms of the number of trips within each area type that fall within authorities proposing WPPL.

A.23 This output is currently converted into the input variables required by SID using the following assumptions:

- 50% of workplace spaces within an authority implementing WPPL are affected by the levy;
- the annual WPPL charge in affected areas will be £1000 (informed by the levels of charge mentioned in LTP submissions etc.)

A.24 Either of these assumptions could be changed within the SID input sheet to represent a different charging regime.

Road User Charging

A.25 SID requires RUC proposals to be defined in terms of a proposed charge per inbound trip in each time period and the proportion of trips assumed to be crossing the cordon in each time period. The LTP submissions provided no quantification of their RUC proposals and therefore an assumption has been made within the EPD as to the proportion of trips within towns implementing RUC that will be affected by the charge, as detailed in the Technical Report on the EPD[21]. The EPD therefore outputs a proportion of all trips in all the selected towns in each area type that are affected by RUC charges.

A.26 This percentage output from the EPD provides the default value which is input to the SID scenario definition as the proportion of trips crossing the cordon. The second required input, the charge per cordon crossing trip is assumed, as a default, to be £1.00 in each time period. Again both of these assumptions are only intended as a broad estimate of the likely level of impact and both can be changed by the user to represent different charging regimes.

[21] Estimating the Impacts of Integrated Transport White Paper Policies: Expenditure Policy Database – Technical Report – Updated October 2002, Atkins, October 2002

APPENDIX B

Estimating PT Cost Change Factors

B. ESTIMATING PT COST CHANGE FACTORS

1) SPEND IMPACT RELATIONSHIP

Derivation of Spend Impact Relationship

B.1 Chapter 3 outlines the relationship derived to link change in average generalised cost of a PT trip to spend on PT schemes. This relationship is a summary of a database of information about the cost and impact of various PT schemes. The information in the database was derived from the transport models originally used to estimate the TCFM and from the limited number of suitable scheme appraisals provided in the LTP submissions (as described in Chapter 3). The information in each database record includes the implementation cost of a PT scheme, the average PT generalised cost (PTGC) change that it has been predicted to cause in the study area and the number of trips in the study area in 1998.

B.2 As outlined in the main report, the database is fairly small due to the shortage of available information in a suitable format for inclusion. However, for SID3 a statistically significant relationship linking PT GC change to PT spend was derived by undertaking a multiple linear regression using datasets derived from the database. The regression analysis used "change in GC per average PT trip" as the y variable and "spend on bus schemes per 1998 PT trip" and "spend on rail schemes per 1998 PT trip". Further information on the SID3 relationship is available in the original version of this report[22].

B.3 For SID4, the relationship was revised to incorporate an element of diminishing returns. To achieve this, the spend data was transformed before linear regression analysis was undertaken so the x variables became "$\sqrt[3]{}$(spend on bus schemes per 1998 PT tripkm)" and "$\sqrt[5]{}$(spend on rail schemes per 1998 PT tripkm)^4" (the y variable remained "change in GC per average PT trip") Again a statistically significant relationship was produced and Table B1 below shows the relevant statistical measures.

Table B.1 -Statistical Measures for SID4 PT Spend Impact Regression Equation

Statistic/Parameter	Value	Critical Value (at 95% Confidence Level)	Significant ?
R^2 (measure of amount of variation in y variable explained by x variables)	0.90	NA	
F (significance of R^2)	130	3.32	Y

[22] Estimating the Impacts of ITWP – Technical Report on Spend Impact Database (SID) Relationships – Appendices, Atkins, February 2001

Bus Coefficient T statistic (measure of significance)	-6.4	1.3	Y
Rail Coefficient T statistic (measure of significance)	-21.4	1.3	Y

B.4 Various possible forms of regression relationships linking PTGC to PT spend were considered for SID4. The relationship outlined above (and in Chapter 3) was chosen because it provided consistency with the relationships used in SID1 and SID3 and followed the required pattern of diminishing returns and because of the strength of measures of statistical significance. Further information on the other relationships considered for SID4 is provided in two separate technical notes[23]

Definition of Spend

B.5 The definition of spend included in the spend impact relationship is broad. Spend on rail schemes includes improvement to and extension of local rail services, including both heavy and light rail schemes. Spend on bus schemes includes improvement to and extension of local bus services including Park and Ride and Guided bus schemes.

Estimation of Spend per Tripkm

B.6 The PT spend impact relationship considers expenditure on a per tripkm basis and therefore allows the size of the urban area receiving the expenditure to be taken into account when estimating its likely impacts on GC. This compensates to an extent for the absence of area type specific relationships.

B.7 However, in the SID4 inputs sheet, PT measures are defined in terms of total capital expenditure over each area type. Therefore, before it is fed into the relationship, the input expenditure for each area type is divided by an estimate of the total number of PT tripkms in the areas affected by the expenditure. This estimated number of PT tripkms is based on:

a) an estimate of the total number of trips in the area type nationally (Britain - output from Pass 1);

b) the proportion of those trips assumed to be affected by the scenario measures (input as part of the scenario definition); and

c) an average length for PT trips (in 1998) within the areas affected (based on analysis of output from Pass 1).

[23] a)Alterations to SID Relationships –Technical Note – Atkins, August 2002; and
b)Alterations to SID Relationships–Additional Possible Relationships-Technical Note,Atkins,Aug 2002

2) ESTIMATING COST CHANGE FACTORS BY MODE AND JOURNEY ELEMENT

B.8 The spend impact relationship produces an estimate of average GC change per PT trip. However, Pass 1 requires separate cost change factors for Bus and Rail trips and for different elements of the trips' costs (access/egress, wait and in vehicle times). Therefore SID (3&4) incorporates mechanisms to split the estimated average PT generalised cost change between modes and journey elements.

B.9 The relationships used to derive the overall GC changes for bus and rail trips from the overall PT GC change are presented in Chapter 3 of the main report. These overall cost changes by mode then need to be split between journey elements. However, there is no readily available information about the changes caused to specific elements of PT journey costs by different types of PT investment.

B.10 In the absence of such information, SID (3&4) bases the split on the proportion of the total base case journey costs represented by each cost element. These proportions are shown in Tables B2 and B3 for bus and rail respectively. As an example, the overall predicted GC change for a bus trip in area type 4 would be split so that 32% of the change was removed from the base case access/egress time, 21% from the wait time and 47% from the in vehicle time.

Table B.2 - Proportions of overall GC Change assumed to apply to each element of Journey Cost – Bus

Area Type	Access/Egress Time	Wait Time	In Vehicle Time
1	35%	10%	55%
2	30%	24%	46%
3	29%	22%	49%
4	32%	21%	47%
5	34%	22%	44%
6	31%	27%	42%
7	30%	27%	43%
8	32%	26%	42%
9	32%	29%	39%
10	32%	26%	42%
11	na	na	na
12	34%	26%	40%
13	33%	28%	38%
14	34%	27%	39%
15	na	na	na

16	35%	28%	37%
17	36%	21%	43%

Table B.3 - Proportions of overall GC Change assumed to apply to each element of Journey Cost – Rail

Area Type	Access/Egress Time	Wait Time	In Vehicle Time
1	65%	3%	32%
2	49%	19%	33%
3	48%	21%	30%
4	61%	25%	13%
5	54%	26%	20%
6	52%	23%	25%
7	49%	24%	27%
8	67%	22%	11%
9	67%	23%	11%
10	63%	20%	17%
11	na	na	na
12	74%	19%	7%
13	72%	19%	9%
14	72%	18%	10%
15	na	na	na
16	65%	24%	11%
17	46%	9%	45%

APPENDIX C

Copy of Technical Note –

"Impact Targets for Setting Modal Constant Adjustments"

INTEGRATED TRANSPORT WHITE PAPER IMPACTS ANALYSIS **BV1024**
WS ATKINS PLANNING CONSULTANTS TECHNICAL NOTE **24 MARCH 2001**

TECHNICAL NOTE 10 - IMPACT TARGETS FOR SETTING MODAL CONSTANT ADJUSTMENTS

1.1 This note briefly sets out "indicative targets" for demand changes to which constant adjustments for use in the Pass 1 model can be calibrated. The aim of the modal constant adjustments is to replicate the impact of likely responses to policy measures included in SID that cannot be represented by changes to generalised cost components. These are:

- Impact of travel awareness measures (STPs, CTPs etc.)
- Impact of changes in PT service quality;
- Impact of changes in PT network coverage;
- Improvements to slow modes.

Impact of travel awareness measures (STPs, CTPs etc.)

1.2 The targets for travel awareness measures are shown in Table 1 below. These have been derived from the analysis undertaken to produce Traffic Change Factors to represent Travel Awareness policies for the Assessing the Effects of Transport White Paper Policies (AETWPP) study for DETR (that fed Tackling Congestion and Pollution).

1.3 In line with AETWPP, it has been assumed that Travel Awareness policies consist of Company and School Travel Plans and therefore affect journeys for Work, Business and Education purposes only. The adjustments to disutilities made in Pass 1 to represent Travel Awareness policies should therefore only be applied to Work, Business and Education related trips.

1.4 The categorisation of the level of intensity of policy implementation is indicative of the types of travel awareness measures that could be pursued by local authorities, as reviewed as part of the AETWPP work for DETR.

Table 1 - Target Percentage Traffic Reductions to be Achieved by Disutility Adjustments for Travel Awareness Schemes

	Target Percentage Traffic Reductions		
Purpose	**Low**	**Medium**	**High**
HB Work	-0.2%	-2.9%	-5.5%
HB Education	-1.3%	-8.3%	-15.3%
HB Employer's Business	-0.2%	-2.8%	-5.4%
HB Personal Business	0.0%	0.0%	0.0%
HB Holiday/ Day Trip	0.0%	0.0%	0.0%
NHB Employer's Business	-0.2%	-2.8%	-5.4%
NHB Other	-0.1%	-1.2%	-2.3%

Table Notes

i) %ages are reductions in all day car traffic levels in 2010

ii) These figures are based on the assumptions that CTPs and STPs are the most influential travel awareness policies and that the only trips affected are Education, Work and Employers Business (all HB and NHB)

iii) HB = Home Based, NHB = Non Home Based

Impact of changes to PT service quality and coverage

1.5 In identifying possible linkages between SID and the Pass 1 Model, it was recognised that certain PT policy measures would not be covered by changes to the generalised cost of travel. These are measures that are assumed to significantly alter traveller's perceptions of the travel choices available to them. Given that LRT is represented as a rail mode in the Pass 1 model these step change impacts are assumed to apply to bus and are assumed to include:

- Changes in perceptions due to a step change in service quality - for example a change from conventional bus to Quality Bus or to guided bus.

- Changes in service coverage such that an expansion of service coverage results in a mode that was previously not considered as available becoming

a viable choice. This is considered relevant for rural areas only (area type 8 in the revised NTM 9 area type definition).

1.6 However, estimating the impacts of such changes at a highly aggregate level is difficult. Target increases in bus use have been derived by applying a very simple mode choice model. The model is defined according to NTM9 (revised) area types and uses the same base year generalised costs as employed in SID3. However, the model has been parameterised using a sensitivity parameter derived from general experience. Modal constants have then been derived for each area type to ensure that the model replicates aggregate base mode shares.

1.7 Different assumptions have been adopted to define how changes in service quality or coverage would affect the PT modal constant. This is shown in Table 2.

Table 2 - Assumptions defining impact on modal constant for different levels of intensity of service quality improvements and network coverage

Measure and Intensity	Change in modal constant	Justification
Service Quality		
L	-2%	Considered equivalent to Quality Bus corridor relative to conventional bus. Assuming a typical conventional bus modal constant of 30 minutes relative to car, the new mode modal constant would be around 25 minutes - i.e. a reduction of 17%. Assuming that 10% of routes in an area are improved gives an average model constant reduction of 0.5 minutes. This is equivalent to a reduction of 2%.
M	-4%	As for L but assuming 25% of routes are Quality Bus corridors gives an average modal constant reduction of 1.25 minutes. This is equivalent to a reduction of 4%.
H	-17%	Considered equivalent to Quality Bus corridor relative to conventional bus plus some corridors as Guided Bus. Assuming a typical conventional bus modal constant of 30 minutes relative to car, the new mode modal constant for a Guided Bus would be around 15 minutes - i.e. a reduction of 50%. Assuming that 25% of routes in an area are improved as Guided Buses and 25% as Quality Bus corridors gives an average modal constant reduction of 5 minutes across an area. This is equivalent to a reduction of 17%
Network coverage		
L	-6 % (Area Type 8 rural only)	Assumed that 80% of travellers have no bus service available so modal constant for these people is very large (assume 60 minutes). The remaining 20% have a modal constant of 30 minutes relative to car. Average modal constant is 54 minutes. Assume that Low intensity increases coverage to a further 10% of travellers = 30%. This gives an average modal constant of 51

		minutes, i.e. a reduction of 6%
M	-11 % (Area Type 8 rural only)	As above but assuming that 40% of travellers have access to the bus network.
H	-17 % (Area Type 8 rural only)	As above but assuming that 50% of travellers have access to the bus network.

1.9 Clearly, selecting the modal constant change is critical and is difficult to do. The table gives some systematic justification to the levels chosen drawing upon general experience.

1.10 Estimates of the impact of the change in modal constant on bus demand by area type have been made using the simple mode choice model. These changes are shown in Table 3. It is noted that these impacts need to be seen as indicative only and are aggregated across all distance bands

Table 3 - Change in bus demand by intensity level for service quality and coverage changes

Area Type	PT service quality			PT coverage		
	L	M	H	L	M	H
1	2%	4%	17%	0%	0%	0%
2	3%	6%	28%	0%	0%	0%
3	1%	3%	13%	0%	0%	0%
4	2%	5%	23%	0%	0%	0%
5	2%	6%	24%	0%	0%	0%
6	2%	6%	27%	0%	0%	0%
7	2%	6%	27%	0%	0%	0%
8	3%	6%	28%	9%	18%	28%
9	1%	3%	12%	0%	0%	0%
All	**2%**	**6%**	**24%**	**2%**	**4%**	**7%**

Improvements to slow modes.

1.11 A similar approach has been undertaken for slow modes as for PT modes above. However, the application of a simple mode choice model representing the choice between motorised and non-motorised modes has been restricted to trips of less than 5 miles in length, thus the adjustments in the Pass 1 model should be applied only to distance bands 1 and 4.

1.12 Table 4 sets out the adjustments to slow mode generalised costs (rather than an adjustment to the modal constant as applied for PT above). This is used in the simple mode choice model to represent Low, Medium and high intensity measures.

Table 4 - Assumptions defining impact on generalised cost for different levels of intensity of slow mode improvement

Measure and Intensity	Change in generalised cost	Justification
L	-5%	None - indicative only
M	-10%	None - indicative only
H	-15%	None - indicative only

1.13 Estimates of the impact of the change in generalised cost on slow mode demand by area type have been made using the simple mode choice model. These changes are shown in Table 5. It is noted that these impacts need to be seen as indicative only.

Table 5 - Change in slow mode demand by intensity level for distance bands 1-4

Area Type	Slow Mode improvements		
	L	M	H
1	1%	3%	4%
2	1%	2%	4%
3	2%	3%	5%
4	1%	3%	4%
5	1%	2%	3%
6	1%	2%	3%

7	1%	2%	3%
8	1%	2%	3%
9	2%	3%	5%
All	**1%**	**2%**	**4%**