

	'generated trips' Appears Line 1 patronage is not adjusted. Line 2 wonders if Line 1 is double counting the impacts in LUTI. Notes the need for such a factor has not been established, or the appropriate value
Cap the off peak fare to half the Day Saver fare in revenue calculations	M&AWG didn't discuss. Line 1 Not done - very few trips would be affected. Line 2 recommends this procedure is adopted for Line 2 and Network Effects. Impact on Line 2 off-peak revenue is only about 1%
Revenue loss factor due to passes, savers and concessions	M&AWG - Line 1 using 0.8, Line 2 suggesting 0.74 including fare evasion (approx 0.8 excluding fare evasion). Line 2 comments that a higher value may be appropriate
Revenue loss due to fare evasion	M&AWG notes Line 2 suggesting between 3% and 15%. Line 1 using 5%, Line 2 suggesting 7% but will adopt Line 1 figure of 5%
Initial year of Operation	Line 1 using 2009, Line 2 will adopt this for consistency
Ramp up	Line 1 base demand extrapolated to 2009 using linear 2011-2026 trend. 2009=75%, 2010=85%, 2011=95%, 2011+=100% Line 2 to adopt this for consistency, despite minor differences
Revenue beyond 2026	Line 1 base demand extrapolated to 2028 using linear 2011-2026 trend. Line 2 suggest more conservative approach, but will adopt for consistency unless MVA or DSC recommend otherwise

15	Faber Maunsel	19/08/2003	Revenue Loss	Tables from Lothian Buses relating to patronage, ticket type and time of day (commercially confidential)	Paper notes that the tables replicate values giving the assumption of 93% revenue loss for a total day	none
16	Faber Maunsell	18/08/2003	Intermediate Patronage and Revenue Forecast Report	Report, detailing all work undertaken to date, and is still 'work in progress'. Introduces the Line 2 Route, sets out Modelling Assumptions, identifies Changes to the Model, reports Model Runs and Base Forecasts (annual patronage and annual revenue), considers Newbridge Shuttle and Airport Heavy Rail, undertakes Sensitivity Tests and Benchmarking against other UK systems	This is a full report updates doc 5 more detail regarding Model Runs and Forecasts	Details models used - LUTI, Highway DAM, and PT DAM Assignment parameters used: Tram fare = 1.33x urban Bus fare (except Newbridge tram fare=1.33xinter-urban bus fare, Airport fare=half Airlink bus return fare, walk time weight = 1.6. Wait time weight = 1.8, Bus ride time weight = 1.1, Rail ride time = 1.0, Interchange penalty = 10min. Urban Bus Fares 2001 Lothian Buses (50p up to 800m ride, 80p up to 7km ride and 90p up to 15km ride. Ramp-up continues as 75%/85%/95% over initial 3 years

A.5.3 MVA

Doc	Author	Date	Title	Context	Issue	Resolution
1	MVA	16/01/2003	LRT Testing - Main Steps, Timescales and Other Issues v2	sets out the background of LUTI, TRAM and DELTA models and their operation/interface/ timescales for running.	Current Reference Case includes: extension to CPZ, West Edinburgh Busway, Straiton-Leith QBC, Newcraighall station and Edinburgh Park station - NO post 2001 highway schemes included. City Centre Traffic Management measures are NOT included. Need to agree a list of 'Reference Case' measures at strategic and detailed assignment levels, to include junction changes etc Planning forecasts for TRAM do not extend beyond 2010.	Vehicle operating costs and values of time are taken directly from, or derived from TEN. Bus fares based on May 2001. Bus services based on March 2001 Edinburgh Travel Map, Rail based on Winter 2000/01 timetable. Parking charges are 2001 actual charges. £2 congestion charge assumed to remain the same in real terms Urban Bus Fares (50p up to 800m ride, 80p up to 7km ride and 90p up to 15km ride and increase linearly above 15km) Interchange penalty = 10min, In vehicle time default 1.1 for bus and 1.0 for rail BUT 1.2 used for bus and 1.0 for rail/LRT in the first Line 1 runs. Waiting time default is 1.8, bur 1.7 used in initial Line 1 runs. Boarding penalty can be applied, default is zero, Line 1 work so far uses 15minutes
					Notes other issues - Reductions in road capacity from on-street LRT running; Effects of LRT on junction capacities/operation; Bus Speeds; Approach to modelling	Capacity being reduced by 50% where on-street running; junction capacities have not been revised; CSTM3 models bus speed as 75% of car, LRT speeds reflect SDG

					Greenways; and Selective vehicle detection	timetable coding; effect of Greenways is currently modelled; SVD can be modelled by factoring down junction delays
2	MVA	05/02/2003	Use of CEC/tie LUTI Model - Aspects of PT Modelling	note deals with three major areas within the framework of the LUTI model, namely representation of fares, use of common assignment parameters, and possible enhancements to the model of relevance to the LRT modelling work	TRAM model updated to allow 'rover' type ticketing. PT DAM model uses Lothian Buses 2001 fares and CSTM default rail fares. No facility for modelling season tickets, or 'additional' journeys made by holders in either model. Through ticketing is not currently assumed in either model. Improved interchange facilities cannot be reflected in PT DAM interchange penalty. Real time information provision - cannot accurately model this	Propose to use REDFxx function (is this for PT DAM??) to model 'rover' tickets. TRAM model can be modified for through ticketing, more difficult in PT DAM
					PT Assignment Parameters for PT DAM - discussion of weighting factors	good evidence to support current weighting for walk and wait times - 1.6 and 1.8 respectively (TRAM to be revised) CSTM IVT values to be applied to TRAM - 1.1 bus and 1.0 Rail, and IVT for LRT should be 1.0. Interchange penalty should remain at 10minutes (TRAM to be revised) Changes in real value of time from Transport Economic Note will be used. If these parameters are used, LRT fare of busx33% would seem excessive

3	MVA	05/02/2003	Assignment Models - Ensuring Consistency	discusses issues associated with use of LUTI DAM models, both highway (DAM-H) and public transport (DAM-PT) to establish consistent approach for each Line	considers how model updates and validation will be undertaken, and the relationship between TRAM/DELTA and DAM-PT and DAM-H	Agree model assignments Agree base year network coding (additional junctions and other base year changes) and agree base year zoning. Outlines which consultancies can undertake or co-ordinate update work
4	MVA	18/02/2003	Planning Assumptions	lays out Planning Assumptions used as forecast inputs in the DELTA element of the LUTI model. Inputs are required for each forecast year regarding the amount of 'developable' floorspace for Residential, Retail, Office, and Industrial land use. Model takes as input this 'permissible development' and internal mechanisms within DELTA determine how much of, and where this developable land is 'taken up'	Lothian Structure Plan to 2016 used as datasource, in some cases land use categories broken down to district level. Constant annual release of land assumed. Beyond 2016 the model assumes the same annual pattern of land release.	Take-up rates vary, residential currently around 90%, Retail is 85% and Industrial at 40%. Office take-up at around 25% is not unreasonable. Exogenous development can be manually added to DELTA
5	MVA	19/02/2003	Public Transport Modelling - Final Parameters v1	summarised the final parameters selected for PT modelling at both the strategic level (TRAM) and the TRIPS based Detailed Assignment Model (DAM)		Final Specification: Walk time weighting = 1.6, Wait time weighting = 1.8. IVT Bus = 1.1, IVT Rail = 1.0, and IVT LRT = 0.9. Modal constants are not used. Interchange penalty = 10 minutes (5min for LRT/LRT) No boarding penalty. Forecast changes in real values of time specified in Transport Economic Note will be used. LRT fare will

						be bus + 33% until advised otherwise
5	MVA	24/06/2003	Public Transport Modelling - Final Parameters v2	summarised the final parameters selected for PT modelling at both the strategic level (TRAM) and the TRIPS based Detailed Assignment Model (DAM)		as above, but tabulates Key Parameters and identifies Running Batch Files changed
6	MVA	17/03/2003	Edinburgh Trams - Model Application Report	a record of the application of the LUTI family of models in the context of the development work for Edinburgh LRT Lines 1, 2 and 3	a descriptive report, detailing the purpose and relationship between the various modelling packages used. LUTI family comprises strategic multi-modal transport model (TRAM) and a land use model (DELTA) which together form LUTI. Forecast growth from LUTI is disaggregated and applied to separate TRIPS based Detailed Assignment Models (DAM) for highway (DAM-H) and public transport (DAM-PT)	MVA continues to run TRAM/DELTA models, but Line teams will run DAM models in their own offices, but feeding back changes to MVA for incorporation into 'master' networks
7	MVA	12/05/2003	Upgrade of JIFGRO	describes changes to the JIFGRO process to incorporate a 'public transport elasticity' factor. JIFGRO is an interface used to disaggregate TRAM/DELTA matrix forecasts to the DAM matrix level	Elasticity factor 'directs' growth in public transport trips within a strategic zone to the zones which have seen the greatest improvement in PT supply. The key to the process is that overall growth or decline for the origin-destination movements at the DAM level is always controlled by the strategic model output.	Elasticity value of -0.5 is proposed for this work. New CSTM3 forecast for 2001 is being produced using CSTM3A planning data to provide more sensible 2001 DAM matrices. DELTA is being updated to incorporate 2001 CSTM3A planning data. JIFGRO has been re-jigged to work in terms of adding trips bases on TRAM/DELTA growth to the

						DAM 2001 matrices rather than using growth factors
8	MVA	16/06/2003	DAM Batch Files	details changes made by MVA to DAM model batch files in response to requests from the tram line teams		
9	MVA	01/09/2003	Annualisation Factors	details the assumptions made in the development of annualisation factors		Car: AM to annual 585 IP to annual 2,288, PM to annual 656 PT: AM to annual 557 IP average to annual 2,425, PM to average 563 (IP to Annual Line 1 2,335, IP to annual Line 2 2,515)
10	MVA	07/08/2003	Model Update - Summary, New Data Collection and Analysis	summarises the current position regarding the LUTI models in respect of age of underlying base demand data, benefits of updating the model, main elements of the survey programme, proposed survey timetables, and incorporation of 2001 Census data	underlying OD data comes from late 1980s. 2001 census contains relevant travel to work/education data. An upgraded model would benefit TIE, CEC and others in the coming years	proposes a package of measures to gather new data and construct new DAM-H and DAM-PT matrices, and incorporate into revised TRAM matrices. Validate new '2003' DAM-H and DAM-PT, re-validate TRAM and then update DELTA base year database and Reference Case
11	MVA	27/08/2003	Modelling Issues - August 2003	Information note prepared to describe modelling issues which could be seen as being of concern, in terms of the successful provision of model results to TIE and their study teams	age of base data	new highway and PT OD data to be collected Autumn 2003 2001 census data to be incorporated into DELTA
					Model Convergence	level of convergence is monitored for each test, so any suspect convergence is identified before

						release and investigated
					Future growth in Commute Trips	more detailed application of fresh data sources proposed
					Parking in Non-City Centre Zones	may be possible to experiment with additional links to relevant zone centroids coded with specific speed-flow relationships to stimulate parking restraint to some extent
					Limitations of Modelling Pay-Once Tolls	can be well modelled in TRAM. Simplified post-assignment adjustments are necessary, based on SHS Travel Diary data. 'pay-once' tolls cannot currently be modelled in DAM-H
					Resources	TRAM being fine tuned to reduce iteration rates and new PC being used
					Park and Ride	may be necessary/desirable to adjust P&R element of Line 2 forecasts to obtain more conservative estimate of patronage
					General Model Updates	number of enhancements made to TRAM and DELTA recently in response to MAWG inputs. Also coding changes to DAM networks via various study teams
12	MVA	08/10/2003	Bus Counts/Modelled Flow Comparisons	this note updates Faber Maunsell note of 24th June	2001 matrices have been updated and recoded to incorporate March 2003 Lothian and First 'city' bus	there is no programme at present to improve the base year model validation from the current

					services. This now gives much greater correlation between bus and passenger numbers observed and in the model	situation
13	MVA	16/01/2003	LRT Testing - Main Steps, Timescales and Other Issues Information Note 11, v1	to set up the steps required to run the various elements of the LUTI model, and the implied timescales for undertaking different types of runs		Parameter assumptions are those set out in MAWG Note - LRT Testing - Main Steps, Timescales and Other Issues - since superceded
14	MVA	14/07/2003	LUTI Model - Background to Data Sources Information Note 12, v1	explains the history of the underlying data used in the development of the LUTI Model. Considers how CSTM model provides data for different levels within LUTI model, and how/when the raw data was gathered.	highlights OD information from late 1980s is still in core CSTM,	fresh OD data is required, 2001 census data to replace 2001 forecasts, PT network has been updated to March 2003
15	MVA	31/07/2003	LUTI Model 2003 Update Information Note 13, v2	describes the benefits of an upgrade with new up-to-date data, proposes a detailed data collection programme for Autumn 2003, the main steps in upgrading the model, and proposes possible model enhancements	the objective of an update would be to re-calibrate and re-validate both the TRAM/DELTA model and the DAM-H and DAM-PT assignment models based on new transport survey, 2001 Census and planning data	costed proposal identifying 6 tasks, from data collection to model validation
16	MVA	25/08/2003	Development and Use of the CEC LUTI Model Information Note 14, v2	this note summarises the development, enhancement and use of the CEC LUTI Model	provided Background, Construction and Calibration Information, details of Subsequent Changes and Enhancements Made to the Model, and identifies the Uses of the Model to date	

A.5.4 David Simmonds Consultancy (DSC)

Doc	Author	Date	Title	Context	Issue	Resolution
1	DSC		not made available			
2	DSC		not made available			
3	DSC		not made available			
4	DSC		not made available			
5	DSC	16/10/2001	Proposals for involvement of Property and Development Specialists	discusses the way in which additional property and development researchers could provide additional input to the study process	considers an interview based approach against a paper questionnaire approach, and identifies fine-tuning inputs to DELTA as being the most likely output	
6	DSC	19/10/2001	Proposals for Local Economic Model Acceptance Tests	proposals for strategy tests to demonstrate that the Local Economic Impact model (LEI) is performing reasonably	proposes a series of tests to validate the LEI model, both at LUTI alone and LUTI/LEI levels	states which scenarios should be used for testing
7	DSC	25/10/2001	Inputs to Define Land-use/Economic Scenarios	sets out the range of inputs to the LUTI/LEI models which are needed in order to define the scenarios within which alternative strategies are being tested	discusses the various inputs required, under Demographic Scenario and Economic Scenario, and local variations	does not prescribe any particular variables, recommends discussion to agree.
8	DSC	26/10/2001	Structure Plan Interpretation	identifies key conclusions with regard to information contained within the structure plan relating to residential, employment and retail	Housing	households to increase by 61,500 between 2000 and 2015, total of 72,300 dwellings to be built, equivalent to 4,800 per annum. Sites will come from Housing Land Audit, Local Plan sites not yet included in Housing Land



						Audit, Widnfall sites and New allocations
					Economic Development	number of jobs to rise by 43,000 between 2000&2015, to expected total of 448,000 by 2015. Land supply identified in audit is 1200ha, but only 900ha is marketable
					retail development	should be located in town centres first and foremost, with development only occurring outside it it "caters for a need that cannot be satisfied by development in the town centres'
9	DSC	10/01/2002	Use of Housing Needs Assessment Survey (revised)	explains how this survey questionnaire was drawn on ot provide certain inputs to DELTA, and test some of the hypotheses in the model	Discusses Use of the Survey, Reasons for Moving, Length of Time in Present Dwelling and Housing Expenditure and Value	allows the rates of response in the model to be based on Edinburgh data rather than from British Household Panel Survey
10		03/12/2001	Use of Observed Data on 1991-2001 Land Use Changes (revised)	TRAM base year will be 2001, and LUTI/LEI modelling will progress in 1-year steps from there, but historic data is required to model time-lags which refer to changes over the past 10 years	the note describes - the different data available, the different approaches which could be taken, the approach chosen and its implementation, some related points on the use of transport model outputs and of the non-household population, and the DELTA software features to be used	Identifies how data should be used
11	DSC	06/12/2001	Generalised Cost Files from TRAM	deals with the production of the combined TRAM/CSTM3	merging TRAM and CSTM generalised cocts	combine TRAM and CSTM3 data into one consistent set of matrices

			and CSTM3 (revised)	generalised cost file needed by DELTA		at the 93-zone level before passing to DELTA, for DELTA to do the aggregation from zone to area level
					Trip or Tour numbers	critical that figures be produced on a production-attraction basis, not origin-destination basis. Only need to deal with trip or tour numbers from TRAM model
					Output File and Format	specifies how the coding should be presented
12	DSC	03/12/2001	Proposals for Treatment of Environmental and Other 'Soft' Factors (revised)	responds to view that more attention needs to be paid to environmental and other 'soft' factors as influences on the decisions of households and firms, and considers Segal Quince Wicksteed report on environmental improvements in the Royal Mile	considers the 'default' treatment of environmental and 'soft' factors in the model design, and considers potential improvements given the findings of the SQW report	presents a table of proposed changes to the modelling process, for discussion, relating to Shopping, Tourism, Household Migration, Household Location, Business Location (within area) and Business Location (investment by area)
13	DSC	03/12/2001	Proposals for Calculation of Generalised Costs Outputs from TRAM (first draft)	specifies the generalised costs to be output from the TRAM program, following the decision that it is impractical to output them from EVAL		presents calculations to derive generalised costs
14	DSC	11/01/2002	Proposals for DELTA-to-TRAM Interface	note sets out the suggested details for the DELTA-to-TRAM interface	identifies ways in which the interface can be refined, considering three categories of data: Changes in travel-to-work patterns; Changes in goods vehicle movement patterns; and	highlights key points which need agreement, and factors which need further consideration

					other planning data from which the EFM calculates growth factors	
15			not made available			
16	DSC	23/01/2002	Implementing the Treatment of Environmental and Soft Factors (revised)	follows discussion of points made in Project Note 12. Summarises the agreed treatment of environmental and soft factors, and identifies the inputs needed from the transport model, the additional changes needed in the land-use/economic model, and the additional coefficients to be defined in the land-use/economic model		identifies required modifications in the treatment of environmental and soft factors, and identifies a series of additional coefficients required for incorporation.
17	DSC	30/01/2002	Additional Processing of Environmental Inputs from TRAM (revised)	this note defines some software changes and additions needed to process the environmental inputs expected from TRAM (more precisely, from ENEVAL)	need to convert Zonal Totals to Ratios, and to Tabulate Environmental Variables	technical coding issues
18	DSC	30/01/2002	Additional Processing of Accessibility Outputs from DELTA	this note defines some software changes and additions needed to process the accessibility outputs for presentation	need to output accessibility variables to CSF files for tabulation and mapping	technical coding issues
19	DSC	07/02/2002	Progress and Results for Discussion at Academic Panel Meeting, 12th Feb	summarises the progress of the Edinburgh Land-Use/Transport Interaction and Local Economic Models to date	outlines the progress to date - DELTA largely operational, TRAM only just becoming available, and interfaces between TRAM and DELTA are prepared, but largely unused. Outlines testing of the model under	paper for discussion

Reference Case and 5 Strategies					
20	DSC	13/03/2002	Implementing the Economic Scenario	records what has been done and remains to be done to implement the economic scenario for LUTI/LEI modelling	inputs to define scenarios taken from Cambridge Econometrics forecasts supplied by Scottish Executive used to identify growth rate forecasts for 2001 onwards, and adjust DELTA to reproduce those growth rates for 'value added' and for 'employment@'
21	DSC	14/03/2002	Implementing the New Treatment of Travel Costs	note specifies/records the implementation of the new functions for treatment of travel costs as proposed in PN15	<p>Accessibility Calculations</p> <p>unaffected, but AC12 money cost outputs to be checked for reasonableness</p>
					<p>Accessibility and Cost Calculations</p> <p>need to set up the IA12.INP file, and decide whether to interpolate values of time for years between TRAM runs, or keep values consistent with the particular TRAM run</p>
					<p>Locational Sub-Model Coefficients</p> <p>need to adjust the alpha coefficients</p>
					<p>Base year and earlier data</p> <p>modifying UCSA to calculate new utility of location, after subtracting the travel costs, and to output the SAZN file with this extra variable</p>
					<p>Regional Economic Model</p> <p>having removed household's transport expenditure out of the urban model it must return to the regional economic model. Discusses how to do this under</p>

						different Strategies
22	DSC	02/04/2002	Creating the Non-Household Population Database	describes the process used to create the 2001 non-household population database (residents who are not members of households)	this group is ignored within DELTA itself, but are included in the interface between DELTA and TRAM, and is added to the population data passed to the EFM	figures derived for 1991 and 1997 from 1991 Census, 1991 Census/NOMIS database and CEC publications. Seeking advice on factoring to 2001, and how this might change over time
23	DSC	16/04/2002	LEIM-Only and LUTIM-Only Options	One of the requirements for the LUTI-LEI model system has always been that it should be possible to run LEIM in a 'stand-alone' mode. It is also desirable fro testing purposes to be able to run the LUTI model alone. This note specifies what these options should do	describes the requirements, design and implementation of each model in a 'stand-alone' role	recommends a change in the chaining option to facilitate simpler stand-alone operation
24	DSC	09/04/2002	Contents of the LUTI and LEI Model Databases	provides an outline of the data available from the DELTA database set up in connection with LUTI and LEI models	base year is 2001. Since 2001 Census data not available, 1991 data has been used, and rolled forward to 2001 using DELTA software itself	document then lists all the zonal estimate sub-categories within the headings of Households and Population, Employment and Economy, and Housing and Floorspace
25	DSC	04/10/2002	Response to Academic Panel Comments	6 topics considered and discussed as a result of comments from the Academic Panel	implications of treating all households (and businesses as renters rather than owner-occupiers	no changes proposed
					lack of a distance-decay effect in modelling local moves	2 potential solutions considered, no definitive resolution.
					importance of distinguishing between part-time and full-time	DSC are not clear how, or what to model (notes 'part-time' is not

				workers	easy to define)	
				desirability of measuring scope for development as seen by developers rather than as controlled by the planning system	developers decisions are not solely influenced by the current stock of permissions. No definitive resolution	
				significance of new housing for longer-distance migrants	no definitive resolution	
				why do population and household impacts often diminish over time	situations change, people react, then settle down again. No change proposed	
26			not made available			
27	DSC	04/07/2002	Transport:Trade Ratios for LEIM	documents the revised version of the values defining the volume of travel and transport per unit of trade in LEI model	2 key ratios - the value density (average money value of one unit of the sector's output in £/tonne) and average payload(tonnes per output per goods vehicle. Ratio for the delivery trip = $10^6 / (\text{value density} * \text{average payload})$ also refers to Service Trips and Business Travel, and Shopping Trips	<i>ncm - I can't actually identify all the resolutions in this one</i>
28	DSC	13/08/2002	Impact of Environmental Improvements	note documents the implementation of the impacts of environmental improvements, through pedestrianisation and other schemes, in the Do-Something case. It was agreed that these should be defined by the model user, and not made automatic in the model.	notes that pedestrianisation and other enhancements attract more shoppers, and therefore retail employment rises. However changes of traffic congestion may affect other zones	quality factor increase calculated as (fraction of zone pedestrianises)*0.25+(fraction of zone with other improvements)*0.1

					impact on visitors and tourists by additional exogenous expenditure in the Edinburgh area, with some reduction elsewhere in Scotland	the modified model inputs are "an additional £51m of visitor expenditure in the Edinburgh area" and "reduction of £9m in visitor expenditure in the rest of Scotland" the effects occur gradually over time, meaning changes to model inputs are phased over 5 years
29	DSC	10/09/2003	Comments on Results (revised)	comments on the land-use/economic results of recent test runs. All of the tests were carried out using the combined LUTI/LEI model, therefore have the potential to vary the size and composition of the Lothian economy as well as to vary the location of activities within Lothian	the tests under consideration differ in terms of: charging on the city centre cordon - applied in all cases except the Reference Case; charging on the outer cordon - differences in whether it is applied, and is so, for what parts of the day; and the public transport investment and improvement package - a "single" or "double" level of improvements	
30				not made available		
31				not made available		
32				not made available		
33	DSC	18/11/2002	Structure Plan Scenario: Proposals	sets out proposals for implementing a Structure Plan Scenario in LUTI/LEI	1) adjust Scottish demographic results to produce appropriate results in terms of population by age band and of household sizes; 2) check Scottish economic assumptions and adjust Scottish economic scenario if appropriate information available; 3) adjust	Note that: a) SPSP only provides figures up to 2016; we propose to extrapolate results to 2016 (for running TRAM) and not (for the moment) to try to develop the "Structure Plan Scenario" beyond that year b) all adjustments to match SPSP at Lothian level will

					REM model inputs to match BSL economic (employment) scenario for Lothian and 4) check household/population results for Lothian - if results are similar to or rather higher than SPSD Chap 2 then stop - if lower or much higher then adjust migration model inputs so as to encourage /discourage migration into Lothian	be done so LUTI/LEI will continue to produce (slightly) different results when run with Do-Something strategies and c) all figures in SPSD are broken down to district level; however we (in contrast to the Lothian level) currently have no practical way to reproduce these without using constraints which would prevent LUTI model from producing different results for Do-Something strategies. we therefore propose to leave the LUTI/LEI model producing its own forecasts at district (and zonal) level)
34	DSC	19/12/2002	Sensitivity Tests for Reliability Effects: Proposals	outlines proposals for implementing sensitivity tests related to reliability effects in LUTI/LEI models	to test the premis that "gfeneralised costs by car/goods vehicle and public transport are reduced by x% for all journeys or parts of journeys inside the outer cordon" Will be tested with x being 5% and 10%	"pure" sensitivity tests, not attempting to relate these improvements back to changes in network conditions
35				not made available		
36	DSC	28/05/2003	Planning Policy Inputs for Tram Scheme Modelling (revised)	to clarify what is done, and what can be done, with the planning policy inputs to the DELTA model. 7 topics raised at MAWG, plus one further needs to be considered	Planning Policy Inputs	measured as "quantity of permissible development", and any not used is carried forward. To ensure a development will definitely occur, must be specified as 'exogenous development'
					Lumpiness of Proposed Developments	inputs are generally total quantities from Structure Plan,

Developments	divided by 15 to obtain annual 'flow' of permissions. This need not be the case
Planning inputs for the longer term	transport plans typically have much longer time horizons than land-use plans. Should model inputs attempt to 'forecast' beyond the time horizon of present plans, or should model inputs represent a 'null plan' of equal pro rata additions in all zones
Take-up of permissible development	for major development areas (like The Waterfront) initial round of development should be treated as exogenous
take-up of completed floorspace	model outputs to be monitored and discussed
Treatment of Floorspace quality	DSC are (externally) developing a new model feature which allows the character of each floorspace type to be defined more precisely (eg: at Waterfront, could distinguish between existing Granton floorspace and new Waterfront floorspace).
Already completed development	many land uses use 1991 data, and there is merit in updating these with more up-to-date values where possible
Major non-floorspace developments	particularly education, health and recreational services are not

					developments	treated in the modelling inputs Can be introduced by using constraint mechanisms to control particular types of employment in particular zones
37	DSC	02/05/2003	Proposed Enhancements to the Land-Use and Economic Models	following discussions with TIE and MVA, a number of enhancements to existing LUTI/LEI model are proposed, to be implemented later this year, and make the model more robust against possible criticism at Public Inquiry in spring/summer 2004	Minor changes - 6 identified in first category, 3 in second and 3 in third category	some which do not require changes to software. Some are being put into effect in the current re-run of the Reference case. A second category require new software features which DSC is already developing as part of general DELTA development. Third group of (relatively) minor changes would use software enhancements being developed for other projects
					Major Model Changes - 4 listed	these involve more substantial changes to both the software and the initial database, relating to issues identified as of particular importance. They have the effect of further strengthening the model's treatment of the effect of transport changes in terms of changes in household location and expenditure, and the workings of the labour market.
					Updating the Database	involving updating from 1991 to 2001 Census data, supplemented by Scottish Household Expenditure Survey of 2001 and

					most recent Scottish Input-Output tables. Scottish Household Survey may also be relevant
				Other Possibilities	identifies some other enhancements, but the issues are not seen as priorities for further work in the Edinburgh context
38	DSC	02/05/2003	Clarification of LUTI/LEI Model in Relation to "Key Sectors of Edinburgh's Economy"	prepared to assist Academic Panel compare City of Edinburgh Council's "Report into the key sectors of Edinburgh's Economy" report with the Economic Impact Report based on the LUTI/LEI modelling	<i>the information contained about the LUTI/LEI model provided in this note should nearly all be contained in the model documentation previously supplied, but it would not be easy for someone outside the model development team to identify exactly how the model represents (or does not represent) the matters discussed by CEC</i>
39	DSC	12/05/2003	Response to Questions from Vickerman Review (revised)	prepared in response to a submission by Prof Vickerman	issue by issue commentary, cross referencing and addressing points made by Vickerman
40	DSC	18/06/2003	Comments on Latest Preferred Option Results	comments on comparison between model run JO, Latest Set of Preferred Options against JD - Reference Case	comments are made on results, not modelling parameters
41	DSC	19/06/2003	Planning Policy Inputs and Planning Data Outputs in the Tram Corridors	to inform TIE and MAWG of progress in refining the treatment of planning inputs to the North and West Edinburgh corridors	highlights some 'oddities' (high densities) in relation to ratios of employment to floorspace which need to be reduced or eliminated in the Reference Case, and

					identifies exogenous development to be included in West Edinburgh corridor	
42	DSC	08/07/2003	Exogenous Development in the Tram Corridors v3	for discussion with CEC and MAWG to establish appropriate levels of exogenous development used along the tram corridors	the note covers a series of test runs to try and establish a suitable level of exogenous development used along the tram corridors in North and West Edinburgh; results of test runs, and consideration of Structure Plan estimates and developers proposals	regognition that rate of endogenous development within the model is probably still too low; this will be adjusted in parallel with the move to a CSTM3A derived database
43	DSC	16/07/2003	Case for Updating and Enhancing the LUIT/LEI Models v1 (Draft)	Prepared at request of TIE to set out the case for updating and enhancing the LUTI and LEI models	Table of 16 proposed changes presented	Table identifying minor changes being done, or already done, several more significant changes though not necessarily requiring major changes to the model database, and finally, some fairly major changes to model design and the associated database
44	DSC	25/07/2003	Revised Model Tests in the Tram Corridors v2	2 main tests, KF and KG (see above). Sections describe how each of the changes has been implemented, then descriptions of the model results.	KF sees population, household and employment trends reflect steady growth. Annual rate of office development has improved, and future growth in all floorspace types is realistic illustrating sensible trends.	
					KG sees Employment make considerable gains in North and West Edinburgh, Office floorspace in Waterfront and West Edinburgh zones increase rapidly	

					in first few years, then gain at a sensible rate. Office rents in these areas rise steadily over time, and Increases in office rents in those zones leads to higher rate of endogenous development	
45	DSC	14/08/2003	Additional Development Outputs from the Revised Model Tests v2	2 main tests 1) New Reference Case, (KF) with CSTM3A based data, more realistic total level of office development, revised figures for development already completed or under construction, and revised Structure Plan inputs. 2) Development Case (KG) assuming a significant phase of development will be completed in the Waterfront zones and Zone 52, and these developments will successfully attract tenants at rents similar to Edinburgh Park	both tests run in DELTA-only form, and Paper concentrates on Reference Case scenario only	90% of residential permissions between 2002 and 2016 are built, 80% of retail permissions in same time period, office permissions are not taken up as extensively, but are realistic. Little industrial development between 2002 and 2016, but what little there is sees 85% take-up
46			not made available			
47			not made available			
48	DSC	02/09/2003	Summary of Economic and Activity Location Impact Analysis v2	presents a summary of results from the EALI 1) outlines LUTI/LEI Model 2) Development and results of Reference Case 3) describes the Preferred Option and presents results and 4) reviews the performance and results of themodelling system in light of other work	Reference Case key forecasts 2001 to 2026 - 11% increase in total trip making, 38% increase in trips by car, 2% increase in PT trips, 35% decrease in walk/cycle trips and a trebling of congestion (resulting in 4% reduction in economic growth in Lothian. Taking the Preferred Option, growth in car trips is 30%, PT	Preferred Option interventions are forecast to have a marginally positive impact on the Lothian economy in the medium and long term, stabilising at about +1.5% by 2021. The review suggests that rather more positive results than those produced by the model may be achieved

other work

trips increase by 51% and time
lost due to congestion in 2026 is
reduced by over one-third



GILLESPIES



McLEAN
HAZEL LTD



 **Babtie**

 **steer davis gleave**

Appendix B: Environmental Appraisal

B.1 Noise and Vibration - Noise Appraisal Methodology

B.1.1 Construction

General Approach

Construction noise will be predicted in accordance with the methodology outlined in British Standard (BS) 5228: Part 1: 1997 ⁽¹⁾. This Standard sets out indicative noise level outputs for a wide range of construction plant items. The noise levels indicated, in terms of Sound Power Levels (L_{WA}) and Activity L_{Aeq} , are considered as typical for the specific activities set out in BS5228. The prediction framework allows the quoted noise levels to be extrapolated to potential noise-sensitive receptor positions (eg residential dwellings and schools) and $L_{Aeq, period}$ noise levels derived. Factors that are considered in the prediction methodology include:

- the sound power outputs of processes and plant;
- the periods of operation of process and plant;
- the distances between the noise source and the receptor;
- the presence of screening by barriers;
- the reflection of sound; and
- soft ground attenuation.

For the purpose of this assessment, the following phases of construction have been assumed:

- enabling works;
- track laying; and
- stop construction.

Noise levels associated with enabling works and track laying are most typical of what will be experienced on a day-to-day basis during the construction phase. It should also be noted that whilst enabling works and track-laying may affect receptors along the length of the proposed alignment, stop construction works are only likely to affect those receptors located within the immediate vicinity of these works.

OLE (Overhead Line Equipment) equipment installation has been assumed to involve relative minor activities and will take place for a short period of time at each location.

An inventory of construction site plant has been estimated for each phase of construction, from which an effective total sound power level (L_{WA}) has been calculated for each team of plant. This has been used to estimate noise levels ($L_{Aeq, period}$) at noise-sensitive receptors based on the distance of the receptor from the centre of the plant team.

(1) BS 5228 Noise and vibration control on construction and open sites, Part 1, Code of practice for basic information and procedures for noise and vibration control, BSI 1997.



Where the construction works area is in very close proximity to a noise-sensitive receptor, the noise source has been assumed to be at a distance of 10 m. This is to allow for the effect of plant moving around the works area. In practice not all the plant could be bunched close to the receptor building because minimum safe working distances will make it necessary to spread plant away from receptors.

The following types of equipment are likely to be used on site during the construction phase:

- tracked excavators and dozers;
- pneumatic breakers;
- lifting equipment such as cranes and hoists;
- concrete plant including lorries, mixers and pumps;
- asphalt spreaders and road rollers; and
- miscellaneous equipment e.g. compressors, hand tools, lorries etc.

Construction Noise Assessment Methodology

When considering the impacts of construction noise it is necessary to establish criteria above which some noticeable adverse effect may be experienced and also the amount by which the criteria are exceeded. Both of these factors have been considered in this assessment. The duration of any impacts is also discussed although the contractor will determine precise programme details.

A summary of the relevant criteria for assessing the impact of construction noise at all noise sensitive receptors is provided below in Table B.1.

Table B.1 Criteria for Evaluating the Significance of Noise During Construction

Period	Building/Location	Criteria for Assessment L_{Aeq}	Purpose
Daytime (0700 – 1900)	Dwellings/Offices (façade)	75 dB	To maintain speech intelligibility
	Educational Buildings (façade)	65 dB	To maintain speech intelligibility in classrooms
Evening (1900 – 2300)	Dwellings (façade)	65 dB	To avoid disturbance
Night-time (2300 – 0700)	Dwellings (façade)	45 dB ⁽²⁾	To avoid sleep disturbance

⁽¹⁾ or equal to ambient L_{Aeq} levels if the ambient noise level is higher than 45 dB

The noise criteria in Table B.1 apply at 1m from the facades of neighbouring residential and noise sensitive commercial properties. These criteria are not aimed at providing noise limits for construction activities, but are proposed as criteria for the assessment of the significance of noise impacts associated with the construction programme.

The normal hours of work will be agreed with the City of Edinburgh Council Environmental Health Officer (CEC EHO). They may vary from site to site depending upon the nature of the area through which works are being constructed. It has been assumed that normal hours of work will be:

- Monday to Friday 0800 hours to 1800 hours; and

- Saturday 0800 hours to 1300 hours.

Work may be required outside these hours, and where this is the case, it will be subject to the approval of CEC EHO. For example, where works to the road are required within the city centre or at major junctions, these may be carried out outside of 0800 to 1800 hours, in order to avoid peak rush-hour traffic and to minimise the effects of the works on road-users.

The requirement for night-time working has also been identified in a number of areas. There may also be the possibility of works required on Sundays and Bank Holidays. Consent to carry put these works will be sought from CEC as appropriate, prior to the commencement of the works.

The Contractor will be required to obtain a prior consent under Section 61 of the Control of Pollution Act from the local authority as appropriate to carry out the works, so noise limits, mitigation and working hours will be reviewed during this process.

Construction Vibration Assessment Methodology

It is not expected that piling will be required at any point during the route construction. There are two types of vibration impact that need consideration:

- the effects on people or equipment within buildings; and
- the effect on buildings (or other structures) themselves.

A summary of the relevant criteria for assessing the impact of vibration during construction is provided below in Table B.2.

Table B.2 Criteria for Evaluating the Significance of Vibration During Construction

Period	Building/Location	Criterion	Purpose ^(a)
Anytime	Any location	0.1 mm/s rms^(b)	Limit of perception
Daytime (0700 – 2300)	Inside dwellings	0.4 m/s ^{1.75} VDV ^(c)	Annoyance threshold
Night-time (2300 – 0700)	Inside dwellings	0.13 m/s ^{1.75} VDV	Annoyance threshold
Anytime	Reinforced or framed buildings	50 mm/s PPV ^{(d)(e)}	Protection of building structure
Anytime	Un-reinforced or light framed buildings	15 mm/s PPV	Protection of building structure

^(a) Equipment manufacturers should be consulted where sensitive equipment malfunction is possible.
^(b) Root mean square velocity.
^(c) VDV denotes vibration dose value, as given in BS 6472, 1992.
^(d) PPV denotes peak particle velocity, as given in BS 7385 Part 2, 1993.
^(e) The CoCP should limit the vibration from construction to below these criteria.

There is little published data on vibration from construction in terms of VDV values and the data in BS 5228 is given in terms of PPV (Peak Particle Velocity). A detailed knowledge of the time for which events that may cause vibration would also be required to carry out an assessment in terms of VDV and this is not available at this stage.

B.1.2 Operation

General

There are two main potential impacts that can arise from light rail schemes such as this. These are:

Table B.3 Summary of Noise Assessment Criteria

Predicted Tram Noise Level $L_{Aeq, period}$	Increase in Ambient (L_{Aeq}) Noise caused by Tram Operation or Exceedance of Threshold by Tram Noise	Impact Descriptor
Day < 55 dB (0700-2300 hrs)	N/A	No Impact
Night < 45 dB (2300-0700 hrs)	N/A	No Impact
Day > 55 dB (0700-2300 hrs) < 66 dB (0600-2400 hrs).	< 1 dB 1 to 3 dB ⁽¹⁾ 3 to 5 dB 5 to 10 dB >10 dB	No impact Slight impact Moderate impact Substantial impact Severe impact
Night >45 dB (2300-0700 hrs) < 61 dB (2400-0600 hrs)	< 1 dB 1 to 3 dB 3 to 5 dB 5 to 10 dB >10 dB	No impact Slight impact Moderate impact Substantial impact Severe impact

(1) Where increases are at the border between two impact descriptors, the impact has been described by the less significant of the two significance descriptors.

Maximum pass-by noise levels (L_{Amax} , the instantaneous ‘peak’ as the tram passes) are also assessed against the PAN56 free-field noise standard for sleep disturbance of 82dB.

In Scotland there is no statutory requirement for mitigation of railway noise but for this scheme mitigation will be given a higher priority where more significant impacts are predicted. For example, if the sleep disturbance assessment criterion (L_{Amax} 82 dB) is exceeded, then mitigation at source will be provided if it is feasible to do so. It is recognised that a combination of many local factors will determine if noise mitigation is feasible and appropriate, including effects on road and pedestrian traffic, safety considerations, environmental dis-benefits (including visual impact and severance), numbers of people affected and cost/effectiveness. These factors may outweigh the noise benefits of a barrier in more marginal cases. Mitigation is discussed further below.

Ground Vibration

Vibration Dose Value (VDV) is a measure of the accumulated level of ground vibration over a period and, through the application of BS 6472 ⁽⁴⁾ is the standard metric for predicting the likelihood of adverse comments from effected building occupants. The standard gives the following VDV levels at or below which the probability of adverse comments is low:

- Day (0700-2300 hours) 0.4 m/s^{1.75}; and
- Night (2300-0700 hours) 0.1 m/s^{1.75}.

These criteria have been used in this report as the basis of the assessment.

In addition to human perception of accumulated vibration, the movement of trams could potentially give rise to disturbing levels of ground vibration or groundborne noise for the brief period while the

(4) British Standard BS 6472 (1984) Guide to the evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz).

tram passes by particularly sensitive properties. Ground vibration is potentially perceptible above peak particle velocities (PPVs) of 0.15 to 0.3 mm/s and route mean square velocities of 0.1 mm/s (rms), but higher levels are often experienced from various sources, and will often be acceptable.

There may also be concern that vibration from tram vehicles could damage building structures. Vibration levels above which damage may potentially occur are as follows:

- reinforced or framed buildings 50 mm/s PPV; and
- un-reinforced or light framed buildings 15 mm/s PPV.

Groundborne noise from the tram system (ie noise radiating from the ground within a receptor as a result of ground vibration) will generally be at levels below noise arriving via the conventional airborne path, and for this reason is generally more of a concern for underground railways where airborne noise is absent. However, particularly sensitive buildings, that may be well insulated against external airborne noise sources, could potentially be effected.

A ground borne noise standard of L_{Amax} 40 dB is often adopted for noise sensitive receptors above underground railways, but may not be appropriate for special buildings housing particularly noise-sensitive uses.

Noise Prediction Methodology

The established methodology for predicting noise from railways in the UK is the Calculation of Railway Noise (CRN), produced by the Department of Transport in 1995. It is a chart-based method developed for wide application to railways in the UK, and it advocates the use of noise measurements wherever possible. It is important to note that several features of the scheme are not typical of the type of railways for which the CRN prediction methodology was principally developed, namely:

- tram speeds are low;
- receivers are very close in some areas; and
- street-running track is used for the majority of the route.

The noise predictions have been carried out using a spreadsheet noise model implementing calculation routines based on the CRN procedure. The source noise levels for the street running operation were based on measurements taken on Croydon Tramlink scheme (Bombardier C400 vehicle) and other comparable street-running systems.

Positional information relating to receiver buildings, reflective structures, terrain and the rail tracks was extracted from 1:1000 Ordnance Survey mapping, engineering drawings, and site inspections.

The frequency of the proposed service is an important factor in determining L_{Aeq} noise levels. For the purposes of this assessment, the following future train service has been assumed:

Monday to Friday –	0500-0700 4 trams per hour
	0700-0930 8 trams per hour
	0930-1630 8 trams per hour
	1630-1900 8 trams per hour
	1900-0000 4 trams per hour
Saturday -	0600-0900 4trams per hour
	0900-1800 8 trams per hour
	1800-0000 8 trams per hour

