A737(T) Dalry Bypass

Transport Scotland

Stage 3 Traffic and Economic Assessment

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A737(T) DALRY BYPASS

Description:	**Stage 3 Traffic and Economic Assessment**
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1 INTRODUCTION

1.1 Background

On behalf of Transport Scotland (TS), SIAS Limited (SIAS) was retained, along with Mouchel Fairhurst Joint Venture, to undertake a Stage 3 Traffic and Economic Assessment of proposals to introduce a bypass to the east of the town of Dalry, on the A737(T). The new road will avoid the current bottleneck experienced during the peak period and will remove the need for high sided HGVs to avoid the low railway bridge to the north of the town. A previous Stage 2 Assessment has also been carried out.

The A737(T) extends from Irvine in the south to the M8 (Renfrew) in the north and constitutes a vital strategic link to the economy of the west of Scotland.

While Mouchel Fairhurst provided detailed engineering and cost estimates for the proposals, SIAS undertook the Traffic and Economic Assessment in support of a number of alternative route options.

The Stage 2 Assessment was completed in 2008, and is reported in *A737(T) Dalry Bypass Stage 2 Traffic and Economic Assessment (SIAS Ref. 69984, July 2008)*. The results of the Assessment indicated that the Scheme would produce a Net Present Value of £46.19M and a Benefit to Cost Ratio of 3.27. Consequently, Transport Scotland made a decision to progress with the scheme.

There is now a requirement to undertake a *DMRB* Stage 3 Assessment. It was acknowledged that the traffic model used in the Stage 2 Assessment is more than 5 years old. An updated S-Paramics model was therefore required based on-up-to-date survey data.

A new Dalry Base model was developed with 2012 flows as part of the Stage 3 Assessment.

This Report summarises the results of the Stage 3 Traffic and Economic Assessment.

1.2 Traffic & Economic Assessment Methodology

The traffic modelling element of this assessment has been undertaken using S-Paramics microsimulation software. The economic analysis has been carried out using PEARS (Program for the Economic Assessment of Road Schemes), a cost/benefit package specifically developed for use with microsimulation.

1.3 Main Objectives of Study

The purpose of the new Dalry Bypass, according to the original STAG planning objectives is to:

Improve the level of service and safety by reducing the effects of driver stress and journey times.

Eradicate conflicts between long distance users and local traffic.

Stabilise the average peak hour journey time on the A737 through Dalry.

Stabilise average bus journey times through Dalry at peak hours.

Wherever practicable incorporate measures for non-motorised users (pedestrians, cyclists & equestrians).

Mitigate the environmental impact of the new works where possible.

Achieve good value for money

These objectives will be addressed throughout the Report. The environmental impact of the new scheme, and the measures to improve accessibility for non motorised road users, is addressed in other aspects of the study.

2 SCHEME CLASSIFICATION

2.1 Background

Following the publication of *SH1/97*, *The Traffic and Economic Assessment of Road Schemes in Scotland (Ref. DMRB 5.1.4)*, Transport Scotland requires that all schemes be assessed for the potential to induce traffic in accordance with the SACTRA scheme classification criteria and procedural guidelines detailed in *DMRB* Vol. 12.

2.2 Classification

SH1/97 specifies that schemes should be assessed for the potential to induce traffic against the following criteria:

- Is the network affected by the scheme close to capacity?
- Is the elasticity of demand high?
- Will the scheme result in large changes in travel costs?

To classify schemes, each of these three criteria must be considered separately and given a low, medium or high marking. On the basis of this assessment, schemes will fall into one of three categories: *simple, intermediate* or *complex*.

Simple schemes are those schemes where low markings are given for all criteria. A fixed trip matrix (FTM) appraisal is acceptable in these circumstances.

Intermediate schemes are those where one of the above criteria merits a high marking or where two or three of the criteria merit medium markings. Variable trip matrices are appropriate for schemes in this category and their use should be considered as sensitivity testing on a fixed trip matrix analysis.

Complex schemes are defined as those where two or three of the criteria indicated above merit a high marking. Variable trip matrices are appropriate for schemes in this category, however, a fixed trip matrix analysis should also be carried out as a benchmark.

2.3 Network Capacity

Advice Note *TA 46/97 (Ref: DMRB 5.1.3)* was used for an operational assessment of the Base and Design networks. *TA 46/97* sets out carriageway standard options related to opening year flow ranges. The flow ranges indicate carriageway standards that are most likely to be economically and operationally acceptable.

Table 2.1 of *TA 46/97* summarises the recommended opening year economic flow ranges for rural road links. The opening year flow is used as the reference year because it is a more reliable indicator of flow than the design year (15th year after opening) adopted in previous Advice Notes.

The Table indicates that single carriageway (S2) road links are appropriate for an opening year flow range of up to 13,000 AADT.

In addition to indicating economically and operationally acceptable flow ranges for each carriageway standard, *TA 46/97* also details a methodology to calculate the 24hr AADT flow threshold above which a carriageway is likely to be severely congested in the peak periods on an average day. This threshold flow is known as the Congestion Reference Flow (CRF).

For the purposes of calculating the CRF, congestion is defined as the situation when the hourly traffic demand exceeds the maximum sustainable hourly throughput of the link. A number of factors are taken into consideration in calculating the CRF, including carriageway width, % HGVs, number of lanes and Annual Average Daily Traffic (AADT).

Consequently, the potential for the network to operate at or near capacity is *Low*.

2.4 Elasticity of Demand

A number of public transport services operate along the A737(T). As well as local services, long distance buses use the route, for example services to Glasgow, however, the localised nature of the proposed schemes is unlikely to affect public transport services. It is also unlikely that there will be any suppressed traffic demand due to lack of congestion in the local area.

Consequently, given the localised nature of the scheme, the potential to affect public transport services and lack of congestion the likely elasticity of demand is *Low*.

2.5 Changes in Cost

The previous Stage 2 Assessment concluded that the journey time savings to individual travellers were low, so the scheme was unlikely to induce traffic from other routes.

2.6 Summary

Given the localised nature of the proposed improvement, the assessment against all three criteria indicates a low potential for inducing traffic, so the schemes should be classified as *Simple*.

Consequently, a Fixed Trip Matrix (FTM) appraisal is considered acceptable.

3 S-PARAMICS & PEARS METHODOLOGY

3.1 General Approach

As indicated, SIAS has undertaken the traffic modelling using S-Paramics microsimulation software and the cost benefit analysis using the ancillary economic assessment package, PEARS.

It is considered that the combination of S-Paramics and PEARS provides a more robust traffic and economic assessment in that the detailed aspects of traffic operation can be captured.

3.2 S-Paramics Overview

S-Paramics is a suite of high performance software tools for microscopic traffic simulation and represents a more robust approach to the understanding, representation and analysis of road traffic. Individual vehicles are modelled in fine detail for the duration of their entire trip, providing traffic flow and related statistical information.

In terms of the A737(T) Dalry Bypass, S-Paramics has a number of significant advantages to bring to the traffic modelling and economic assessment process, including:

- Detailed network definition
  (e.g. hilliness and bendiness derived from OS digital mapping data, traffic calming and other localised characteristics)
- A high level of flexibility in coding and modelling the operating characteristics of different vehicle types
  (e.g. light, medium and heavy vehicles, public service and slow moving vehicles)
- Detailed representation of the variation in traffic flows through specification of time based profiles by vehicle type and origin/destination
  (e.g. different traffic flow profiles can be used for different movements)
- Detailed modelling of individual vehicles and the interaction between cars and slower moving vehicles at junctions, in platoons, and during overtaking manoeuvres
  (e.g. more robust outputs for economic appraisal including the assessment of downstream benefits)

3.3 PEARS Overview

PEARS is an economic assessment package that has been specifically designed for use with the output from traffic microsimulation models. The economic concepts in PEARS are consistent with the FTM methodologies of COBA and NESA (as detailed in *DMRB* Volumes 13 and 15).

PEARS carries out trip-based assessments of changes in travel time costs and vehicle operating costs. The costs of a trip-based assessment are derived by aggregating the costs of each individually modelled vehicle on the network. By comparison, traditional link-based assessments (e.g. COBA, NESA) and matrix-based assessments (e.g. TUBA) rely on a single travel time and vehicle operating cost for each link or origin/destination movement representative of the whole modelled period.

Like the DfT's TUBA program, PEARS does not, at present, consider accidents, so a separate accident assessment is required (usually an 'accident only' COBA or NESA assessment).

4 S-PARAMICS MODEL DEVELOPMENT

4.1 Base Year Road Network

The Base Year road network covers approximately 12km of the A737(T) corridor from Manrahead Roundabout in the north to Wilsons Auction Mart to the South. The route corridor comprises primarily rural single carriageway (S2) standard with a 60mph speed limit. The route through the centre of Dalry comprises single carriageway (S2) standard with a 30mph speed limit. The B780 diversion route through Glengarnock and Kilbirnie mainly comprises single carriageway (S2) standard with a combination of 30mph and 60mph speed limits.

The 2012 Dalry S-Paramics model has utilised an earlier 2008 version of the model which has been upgraded to the most up to date version of S-Paramics version 2011.1. A CAD drawing of the area, in DXF format, was used to check any changes to the road network. In addition, a drive through video of the road network was used to confirm details of any changes to the road network. The main change from the 2008 version of the model was the addition of a one way system in the centre of Dalry. This was included in the model, along with other minor changes to the network.

Base models were developed for both weekday and Saturday scenarios.

The traffic signals at the North Street/A737 and Roche Way/A737 junctions were modified by watching video footage from the traffic surveys carried out in May 2012. The traffic signal timings observed varied according to demand. As an approximation, a representative sample of fixed timings was calculated and input into the model. In addition, a survey of the traffic signals was carried out on Saturday 11 February 2013. Traffic conditions in early afternoon when the visit took place showed light queueing at all junctions.

Gradients are not necessarily required to be entered into an S-Paramics model, but there is value in including them in this model for modelling HGV acceleration and emissions modelling, so they were included in the model.

4.2 Traffic Surveys

A series of traffic surveys were carried out in order to inform the model build. Turn count data, Automated Number Plate Recording, journey time data and queue data was collected.

The surveys were carried out over four different days, reflecting the differing traffic conditions on these days. Two of the survey days were when there was no Wilson’s Auction Mart, and two of the survey days were when an Auctiomart was taking place.

The Economic Assessment will be based on modelling based on days when no Auction Mart was taking place. An Operational Assessment was carried out using modelling based on ‘with Auctionmart’ flows.

Full details of the traffic surveys that took place can be found in SIAS document *Dalry Survey Report (SIAS Ref. 75515, July 2013).*

Figure 4.1 shows the Base model network in encoded in S-Paramics.

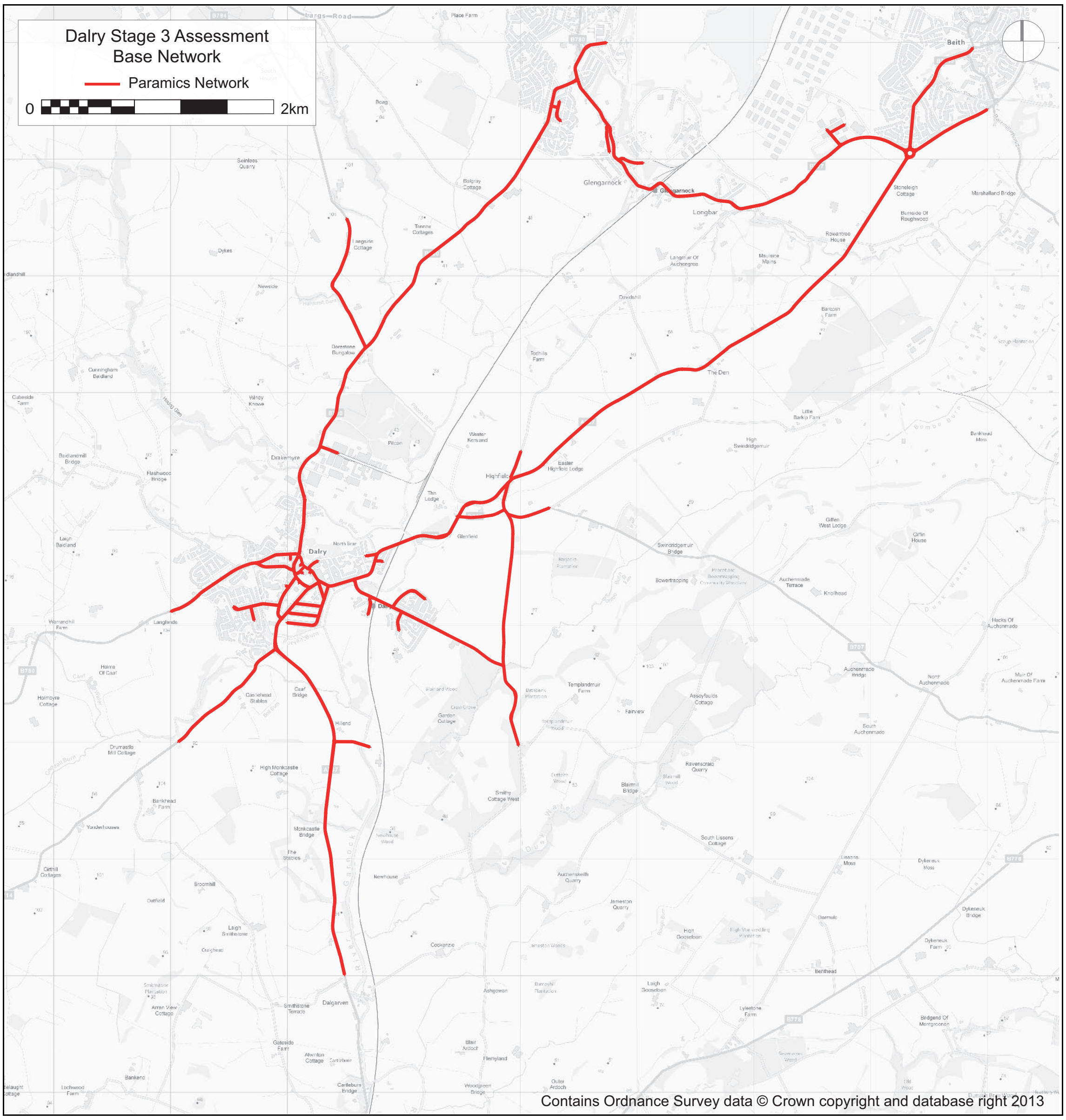

Figure 4.1 : Dalry Base S-Paramics Model

4.3 Base Year Trip Matrices

In common with all traffic model applications, a matrix of travel demand was estimated from link flow and junction turning count data at key locations in the network.

Survey data for a typical weekday and Saturday was required to build and validate a robust traffic model for this assessment.

Survey data was collected by Sky High – Count On Us when there was no Auction held at the Wilsons Auction Mart (31 May 2012), and a Saturday (9 June 2012). These dates were considered representative as they did not coincide with any local or school holidays.

The sites are shown in Figure 4.2 and Figure 4.3.

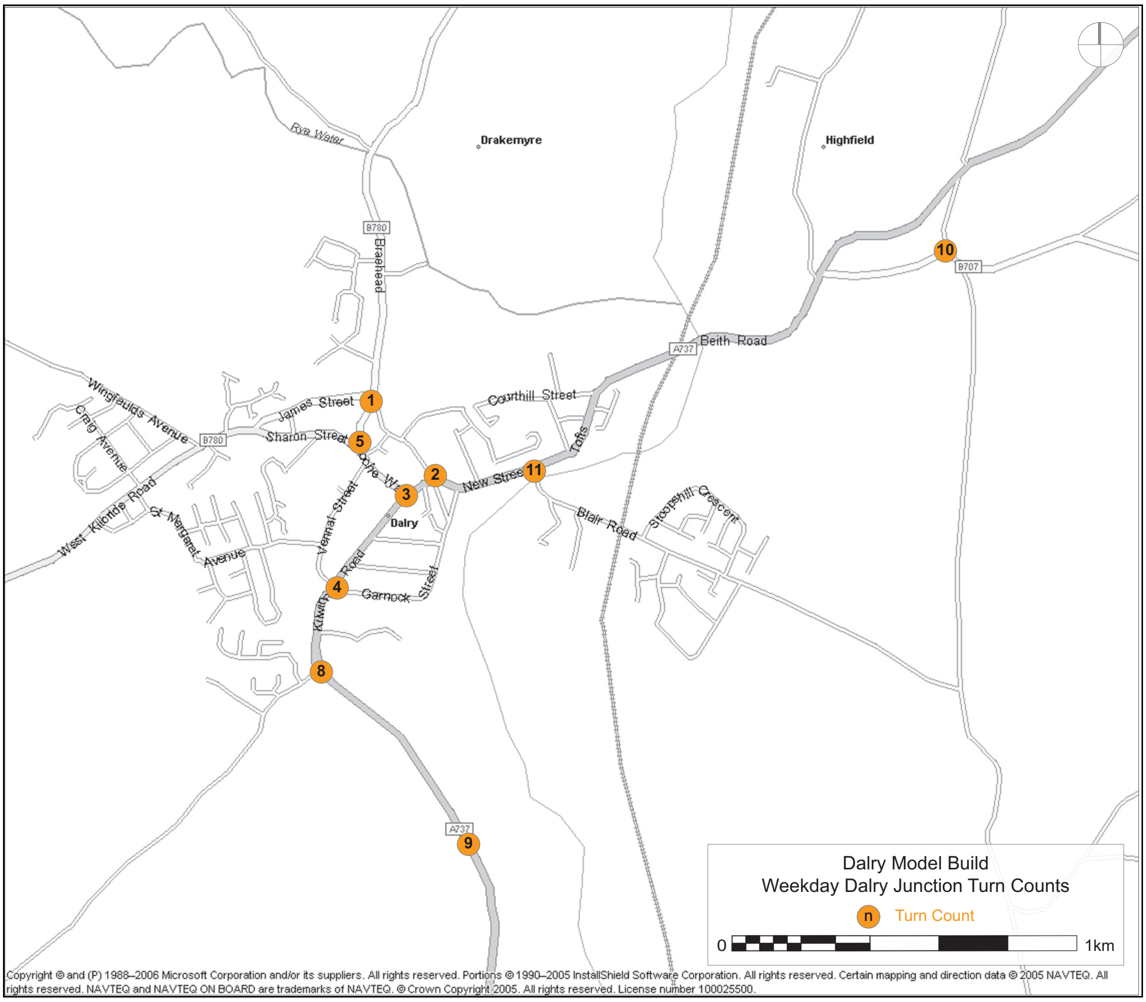

Figure 4.2 : Junction Turn Count Surveys – Dalry Area

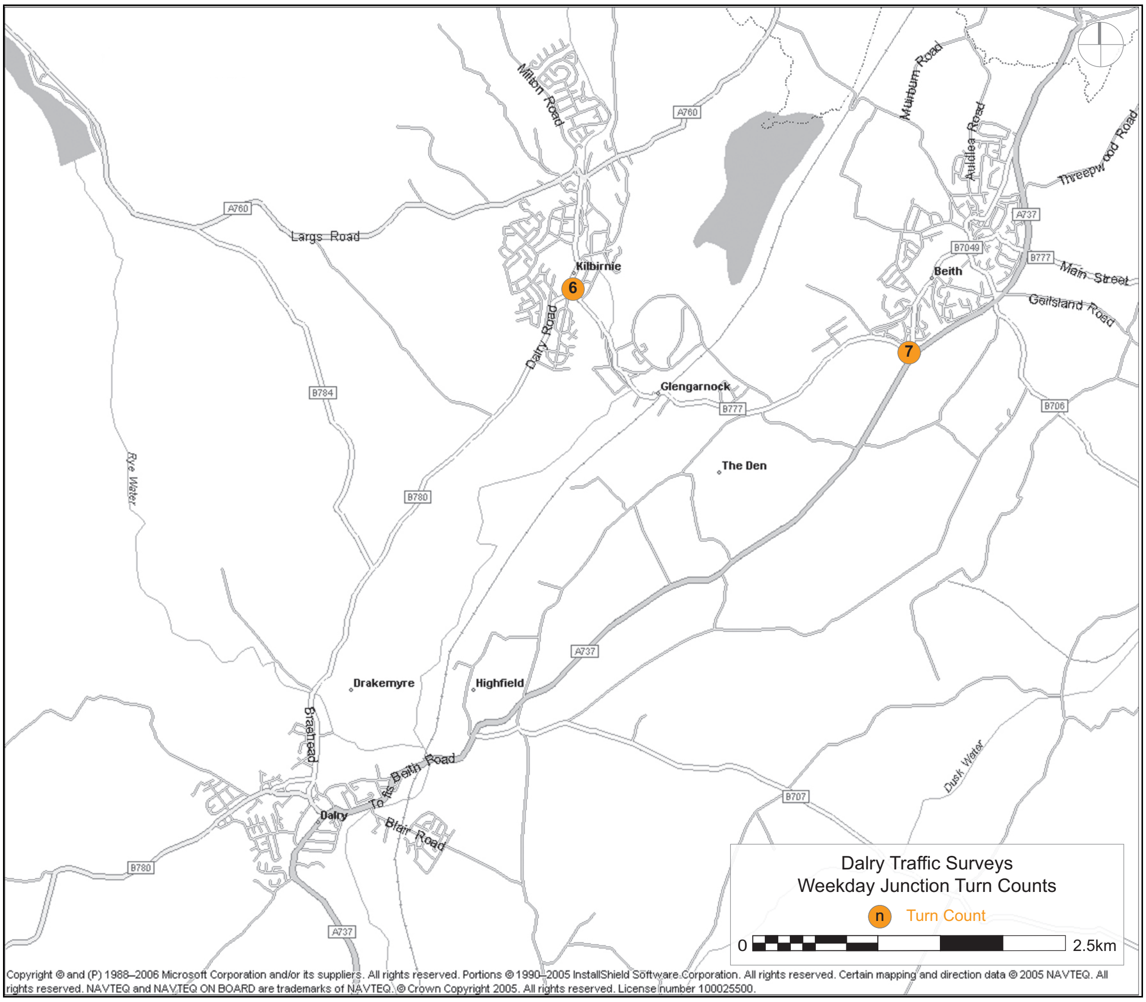

Figure 4.3 : Junction Turn Count Surveys – Wide Area

For the weekday all of the junctions were surveyed over 12hr (07:00 – 19:00) on 31 May 2012. Sites 1, 2 3, 5 and 11 were surveyed over the following 12hr (19:00 – 07:00) so a complete 24hr period profile could be established. For the Saturday surveys, only Sites 2 and 9 were surveyed between 07:00 – 19:00 on Saturday 9 June.

To generate the 24hr weekday counts, the junctions where 24hr counts were undertaken were used to extrapolate 24hr counts for the other junctions.

To generate the Saturday counts Junctions 2 and 9 were examined. The number of vehicles in each 5min period in the Saturday as a proportion of the Weekday period was calculated. This proportion was used to calculate 24hr Saturday counts for every movement in the model.

In addition, the Registration Number Plate (RNP) survey data was used inform the routeing in the model. These surveys placed registration plate survey cameras at various locations in the area of Dalry to determine the number of vehicles that travel between different routes.

The locations of the cameras are shown in Figure 4.4.

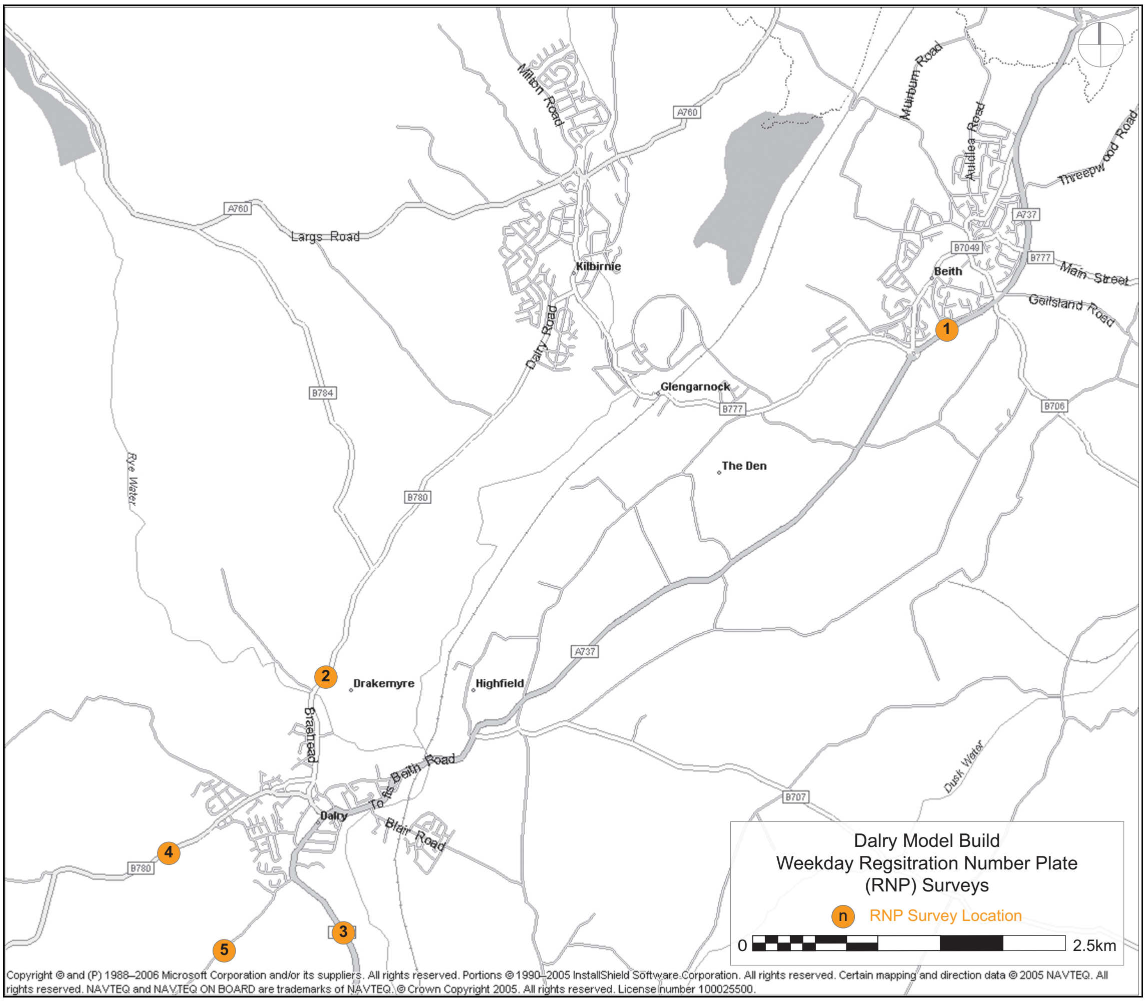

Figure 4.4 : RNP Survey Locations

After analysing the survey data, a set of prior matrices – for both weekday and Saturday – were constructed in the following manner. The same process was used for the different Car, LGV, OGV1, OGV2 and Coach matrices:

- The previous matrices from the Stage 2 modelling were used as the initial matrix for the current weekday and Saturday modelling
- The trip end totals – that is the known number of trips at the edge of the model – were calculated from the survey data
- The new surveyed trip end totals replaced previous trip end totals at the same zones from the previous Stage 2 modelling matrices
- Known zone to zone movements, such as those from the RNP analysis were input into the matrices
- The matrices were then Furnessed to the new trip end totals
- The resulting matrices were then input into the Matrix Estimation module of S-Paramics, and 10 iterations were run

To ensure that the matrices are not changed excessively by the Matrix Estimation model of S-Paramics, the following tables show the changes made after the ten iterations. Table 4.3 shows the weekday changes induced by the ME module.

Table 4.1 : Weekday Pre and Post Matrix Estimation Totals

	Pre-Matrix Estimation Matrix					Post-Matrix Estimation Matrix				
	Period 1	Period 2	Period 3	Period 4	Total	Period 1	Period 2	Period 3	Period 4	Total
Matrix 1	6,612	10,907	8,305	7,775	33,600	6,512	11,167	8,379	7,885	33,943
Matrix 2	1,128	1,900	1,001	718	4,747	1,158	1,879	991	791	4,819
Matrix 3	232	528	94	93	948	164	371	67	64	666
Matrix 4	102	222	38	49	410	82	184	29	40	335
Matrix 5	81	143	43	37	305	64	87	19	24	194
Total	8,156	13,699	9,482	8,672	40,009	7,980	13,688	9,485	8,804	39,957

The results show that the matrix totals have not been changed by a large degree, for any of the matrices. In general, the matrix estimation process has reduced the trip demands. Overall, the matrix has fallen by less than 1%.

Table 4.2 shows the Saturday changes.

Table 4.2 : Saturday Pre and Post Matrix Estimation Totals

	Pre-Matrix Estimation Matrix					Post-Matrix Estimation Matrix				
	Period 1	Period 2	Period 3	Period 4	Total	Period 1	Period 2	Period 3	Period 4	Total
Matrix 1	4,702	10,526	6,502	6,579	28,308	3,884	12,075	6,497	6,632	29,088
Matrix 2	689	959	619	555	2,822	533	927	370	265	2,095
Matrix 3	180	209	152	151	692	109	147	53	41	350
Matrix 4	69	83	58	67	277	22	13	10	12	57
Matrix 5	47	46	46	43	182	7	10	10	8	35
Total	5,686	11,824	7,376	7,394	32,281	4,555	13,172	6,940	6,958	31,625

The results for the Saturday show greater changes in the matrix totals. The reason for this is understandable; because the Saturday prior matrices were based on the Stage 2 weekday matrices, there is greater scope to change the matrices.

4.4 Base Year Traffic Flow Profiles

Microscopic simulation allows the typical surges and troughs in traffic demand throughout the day to be reflected using flow profiles. The observed traffic flow data was disaggregated into 5min time periods and applied to each classified vehicle matrix.

Profiles for a particular zone were chosen when those demands were both known and sufficiently high. For all other zones, the 'General' profile was chosen, which is based on total observed counts in the area. In the Saturday period, heavy vehicle profiles were not created as the low volume of these trips negated the requirement for them.

The profiles for the weekday and the Saturday are shown in Table 4.3 and Table 4.4.

Table 4.3 : Weekday Demand Profiles

Number	Vehicle	Zone
1	Car	1
2	Car	2
3	Car	6
4	Car	7
5	Car	8
6	Car	10
7	Car	17
8	Car	21
9	Car	General
10	LGV	1
11	LGV	2
12	LGV	6
13	LGV	7
14	LGV	8
15	LGV	10
16	LGV	17
17	LGV	21
18	LGV	General
19	Heavy	1
20	Heavy	2
21	Heavy	6
22	Heavy	7
23	Heavy	8
24	Heavy	10
25	Heavy	17
26	Heavy	21
27	Heavy	General

Table 4.4 : Saturday Demand Profiles

Number	Vehicle	Zone
1	All	1
2	All	2
3	All	6
4	All	7
5	All	8
6	All	10
7	All	17
8	All	21
9	All	General

4.5 Overtaking Areas

Vehicles were allowed to overtake in a number of areas in the model, where overtaking would be allowable in reality. These areas were on the A737(T) and on the B780. The areas of overtaking are where there is sufficient straight road to allow overtaking. No overtaking surveys were undertaken, as Transport Scotland did not request these surveys.

5 MODEL CALIBRATION

5.1 Route Choice Methodology

In S-Paramics a vehicle may have a choice of route to its destination. The number of routes and the probability of a vehicle using a route can be determined by a combination of factors:

- Generalised Cost Equation
- Dynamic feedback
- Major/minor routes
- Vehicle familiarity
- Category cost factors
- Perturbation

5.1.1 Generalised Cost Equation and Dynamic Feedback

The default assignment model in S-Paramics is an All or Nothing (AoN) routine, whereby all vehicles will select the minimum cost path based on the generalised cost criterion specified. Instead of AoN, a dynamic re-routeing facility has also been invoked in the Dalry S-Paramics model to allow drivers to react to delays, which occur at certain locations at certain times. This routine passes the junction delay information to drivers at a user defined time interval, so that the route they use to reach their destination can be changed. The feedback routine is only applied to familiar drivers who may been inclined to divert or use 'rat-runs', while unfamiliar drivers route choice remains unaffected by junctions delays. In the Dalry S-Paramics model the feedback calculation interval is set to 5min.

The Generalised Cost Equation (GCE) for Dalry is (0.6 x Time in minutes) + (0.4 x Distance in miles) for all vehicles. The GCE reflects that the perceived cost of a journey comprises of both time and distance. A higher value for the Time parameter, for example, would mean vehicles would prefer a quicker, but longer distanced journey to reach their destination. As specified in the dynamic feedback settings, after every 5min of model time, new times along each route times are recalculated according to the GCE.

The values for the GCE and Dynamic Feedback recalculation period noted above are consistent with the previous Dalry S-Paramics model. Other GCE values, derived from WebTAG, were examined for use in the model, but the routeing adopted by vehicles with the original GCE more closely matched the observed flows with the original cost factors, so the original values were retained.

5.1.2 Major/minor routes and vehicle familiarity.

Some roads are classified as 'major' and others as 'minor', analogous to signposted and 'rat-run' routes. Familiar vehicles do not perceive a difference between the two classes of roads, while unfamiliar drivers perceive minor roads to be twice as expensive to use than major roads.

Vehicles are classified as either 'familiar' or 'unfamiliar'. In the model, 70% of Cars and Vans and 55% of goods vehicles and coaches are familiar in the network, with the remainder being unfamiliar. These values were calibrated to achieve the current routeing through Dalry town centre.

Figure 5.3 shows the major and minor routes within the Dalry model.

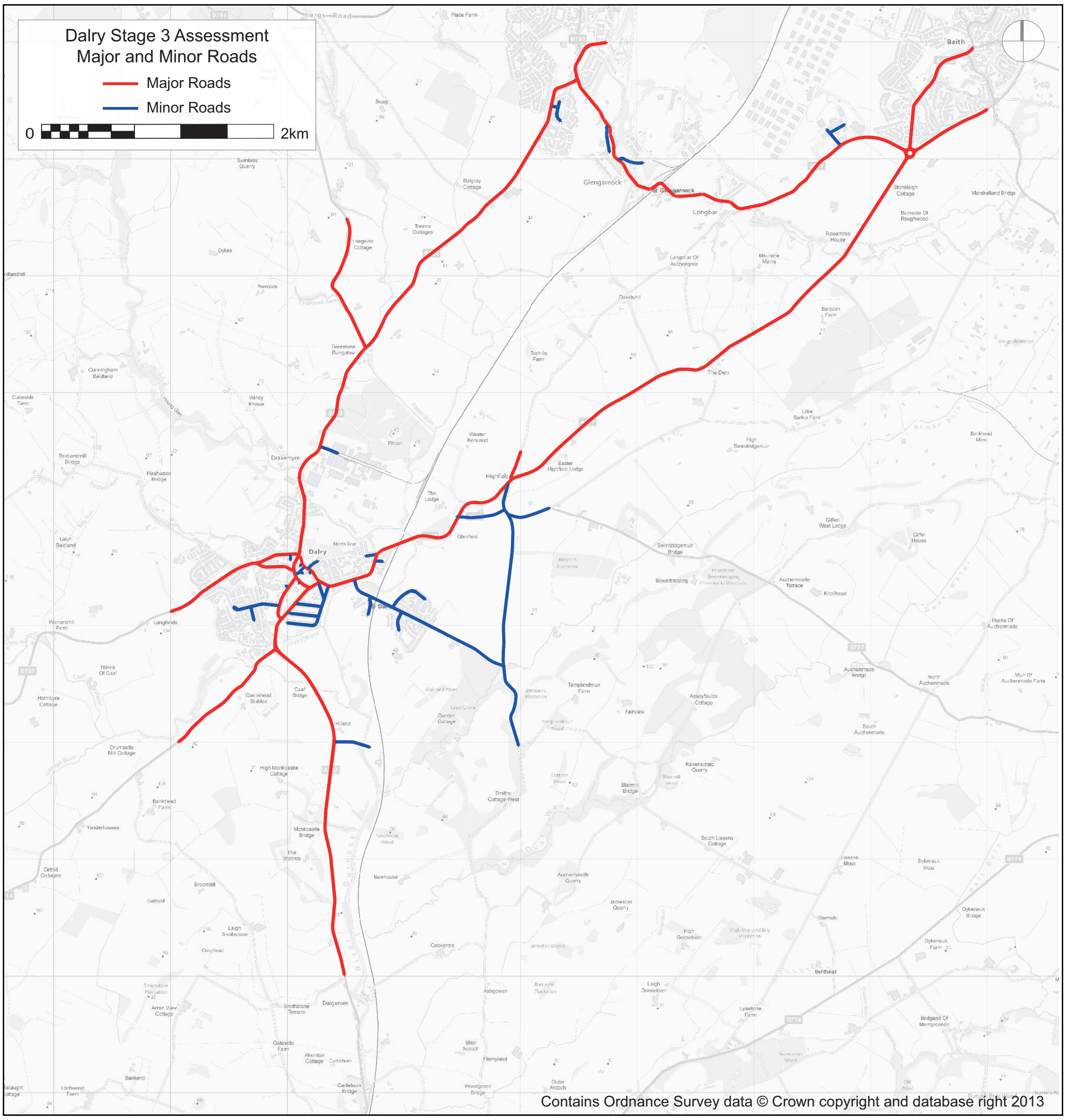

Figure 5.1 : Major and Minor Links in Dalry Base Model

5.1.3 Category cost factors.

Category cost factors have also been applied to the model. These multiply the perceived cost that vehicles incur when they travel along a link. In the Dalry model, most of the links are at the default category cost factor of 1, but cost factors of 1.1, and 1.4 are also used in the model. These additional cost factors were used to reduce the traffic heading along certain routes.

- North Street (Cost Factor 1.4)
- Roche Way, northbound between A737 & Vennel Street (Cost Factor 1.1)
- James Street, westbound (Cost Factor 1.1)
- Vennel Street, southbound (Cost Factor 1.4

5.1.4 Perturbation

A perturbation factor has been specified for all vehicle types. This results in the model randomly changing the calculated costs by a maximum of ±5% to account for differences between drivers perception of the cost to travel between origin 'A' and destination 'B' for each vehicle in the network. This means that where there is only a small difference in perceived cost between two or more routes, not every vehicle will use the lowest cost route. This better conforms to reality.

In summary, the Dalry S-Paramics model has been carefully calibrated to ensure that it matches the observed flows as well as possible.

5.2 Link Speeds

Typical traffic in the model was found to be travelling beyond the speed limit on 50 and 60 miles per hour roads, which had implications for the journey time validation. This was determined to be unrealistic, so in order to improve the simulation of these roads, the target speeds on these roads in the model were reduced. The 30 miles per hour roads were reduced to 25 miles per hour, the 50 miles per hour roads had their speed reduced to 45 miles per hour in the model, and the 60 miles per hour roads were reduced to 50 miles per hour. This was more realistic and improved the journey time validation in the model.

5.3 Traffic Flow Comparisons – Weekday Model

To ensure that the S-Paramics model replicated existing traffic conditions, modelled and observed traffic flows were compared using the validation criteria detailed in *DMRB* 12.2.1.

For comparing traffic flows, the GEH statistic is used. It is defined as:

$$GEH = \sqrt{\frac{(M-C)^2}{0.5(M+C)}}$$

Where M is the modelled flow and C is the observed flow.

The guidelines in *DMRB* suggest that the GEH value for each link flow compared must be less than five in 85% of cases.

The observed and modelled link flows entering exiting each surveyed junction were compared over different time periods: an AM and PM peak hour, 3hr AM and PM peak periods, a 5hr inter-peak period, a 12hr daytime period, and an entire day.

In addition to the link flows, a series of screenlines were created to check the validation. A screenline is a line drawn through various links in the model. The flows on each link, in one particular direction, that the screenline is drawn through are summed, and a similar GEH calculation is performed on the total. The guidelines in *DMRB* suggest that the GEH value for each screenline flow compared must be less than four in 85% of cases.

Four screenlines were created, each with two directions, meaning eight comparisons in total. The screenlines are shown in .

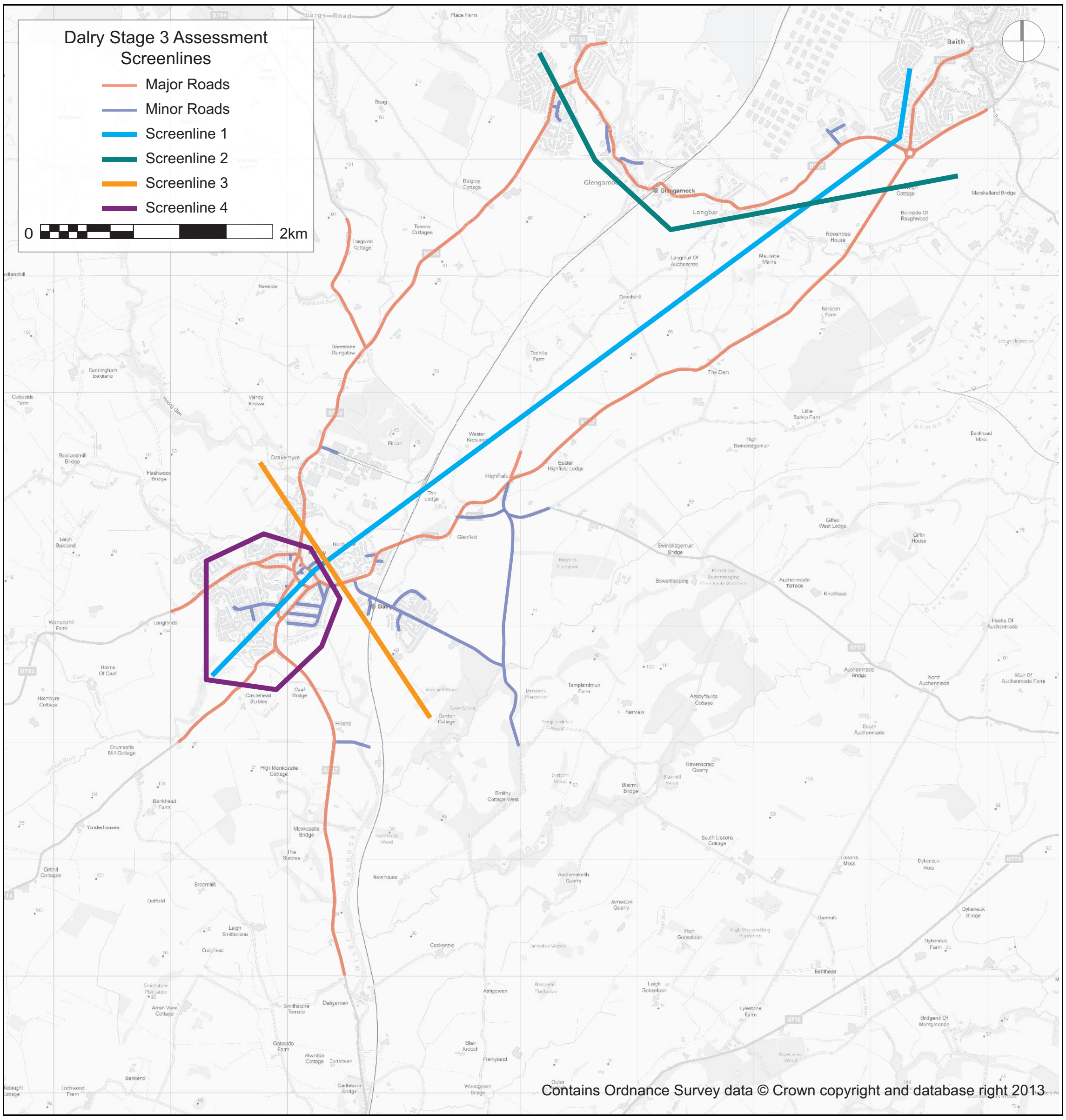

Figure 5.2 : Dalry Screenlines.

Table 5.1 shows the percentage of flow comparisons with a GEH less than a specified value for the weekday model.

Table 5.1 : Link GEH Comparisons – Weekday

	Time From:	08:00	16:30	07:00	10:00	16:00	07:00	00:00
	Time To:	09:00	17:30	10:00	16:00	19:00	19:00	23:59
Percentage of Link Counts with GEH Less Than:	5	100%	96%	100%	99%	99%	93%	92%
	7	100%	100%	100%	100%	99%	99%	99%
	10	100%	100%	100%	100%	100%	100%	100%

In every time period, well over 85% of flow comparisons had a GEH of less than 5, with none with a GEH greater than 10.

Whenever a flow had a GEH greater than 5, it was in a location where there were a number of different routes in the local area, making flow validation difficult to achieve.

The results of the screenline analysis are presented in Table 5.2. The link flow GEH values are also presented for informational purposes, although these are not important for this analysis.

Table 5.2 : Weekday Screenline Results

Screenline	Direction	Road	08:00 - 09:00	16:30 - 17:30	07:00 - 10:00	10:00 - 16:00	16:00 - 19:00	07:00 - 19:00	00:00 - 24:00
			Time Period						
1	Eastbound	B777	0.1	1.1	0.5	1.2	0.5	1.4	0.8
		North Street	0.7	1.3	1.3	4.0	3.7	6.4	5.7
		Roche Way	1.6	7.1	0.8	2.5	9.9	5.1	4.3
		Vennel Street	0.8	4.2	0.5	1.4	3.8	4.3	0.5
		Total	**0.8**	**0.9**	**0.5**	**1.3**	**0.6**	**2.8**	**1.4**
1	Westbound	B777	0.4	2.1	0.5	1.1	1.7	0.6	1.2
		Roche Way	2.0	2.9	2.4	0.4	1.7	2.0	2.4
		Vennel Street	1.7	1.6	3.5	0.1	1.3	3.0	3.5
		Total	**0.5**	**0.1**	**0.6**	**0.7**	**0.4**	**2.6**	**0.3**
2	Northbound	A737 South	2.0	0.6	0.4	0.3	1.2	0.6	0.2
		Dalry Road	1.0	2.3	0.4	0.5	0.1	1.5	0.1
		Total	**0.9**	**1.1**	**0.0**	**0.5**	**0.9**	**0.6**	**0.1**
2	Southbound	A737 South	1.1	0.0	1.1	0.8	1.4	0.0	0.4
		Dalry Road	1.5	1.9	0.8	0.7	0.0	2.0	1.0
		Total	**1.8**	**1.3**	**0.3**	**1.1**	**1.0**	**1.4**	**0.4**
3	Northbound	North St. North	0.2	1.6	0.3	0.7	1.1	1.7	0.1
		A737 West	2.5	0.4	0.9	3.8	0.9	3.5	4.1
		Total	**2.1**	**0.7**	**0.5**	**3.4**	**0.0**	**3.8**	**3.2**
3	Southbound	North St. North	2.9	1.5	0.8	0.9	0.4	1.4	0.6
		A737 West	1.7	5.4	0.9	0.3	2.6	0.9	2.4
		Total	**3.2**	**3.1**	**0.2**	**0.8**	**1.8**	**1.6**	**2.2**
4	Entering	North St. North	2.9	1.5	0.8	0.9	0.4	1.4	0.6
		A737 West	1.7	5.4	0.9	0.3	2.6	0.9	2.4
		A737 South	0.4	0.0	0.5	0.3	0.2	0.1	0.8
		Saltcoats Road	0.1	0.1	0.9	0.2	0.4	0.8	0.0
		James Street	2.3	3.0	1.1	1.1	3.0	1.5	3.0
		Sharon Street	1.5	2.2	0.6	0.6	2.9	2.8	2.1
		Total	**2.5**	**2.2**	**0.8**	**1.0**	**1.3**	**1.4**	**1.8**
4	Exiting	Roche Way	0.4	1.8	1.0	0.7	1.0	0.4	1.2
		A737 West	2.5	0.4	0.9	3.8	0.9	3.5	4.1
		A737 South	2.3	3.2	0.0	0.8	1.3	0.2	0.4
		Saltcoats Road	2.8	1.7	0.3	0.7	1.3	0.4	0.7
		James Street	3.2	0.4	3.9	3.8	3.1	6.9	7.7
		Sharon Street	1.9	1.4	0.7	0.0	1.0	3.0	0.8
		Total	**0.7**	**2.1**	**1.0**	**1.8**	**2.2**	**4.7**	**3.7**

The results show that all of the screenlines GEH values, with one exception, are below four. The one exception was Screenline 4 ‘Exiting’ in the peak 12hr, with a value of 4.7.

The results show that four of the seven periods have 100% of screenlines with GEH values less than four. The remainder of the time periods have only one screenline with values greater than four.

The overall results demonstrate very good validation, which is comfortably above the required

5.4 Traffic Flow Comparisons – Saturday Model

A similar comparison was carried out for the Saturday flows. It is noted that the large majority of 'observed' traffic flows for Saturday have been synthesized from weekday flows.

Table 5.3 shows the percentage of flow comparisons with a GEH less than a specified value for the Saturday model.

Table 5.3 : Link GEH Comparisons – Saturday

	Time From:	08:00	16:30	07:00	10:00	16:00	07:00	00:00
	Time To:	09:00	17:30	10:00	16:00	19:00	19:00	23:59
Percentage of Link Counts with GEH Less Than:	5	100%	100%	100%	99%	99%	97%	97%
	7	100%	100%	100%	100%	99%	100%	99%
	10	100%	100%	100%	100%	100%	100%	100%

The Saturday screenline results are shown in Table 5.4.

The results show a consistently high degree of validation, with at least 95% of turn counts having a GEH of less than 5 with none having a GEH greater than 10.

As with the weekday, GEH failures occur in areas of multiple route choice where validation is difficult to achieve.

Table 5.4 : Saturday Screenline Results

			Time Period						
Screenline	Direction	Road	08:00 - 09:00	16:30 - 17:30	07:00 - 10:00	10:00 - 16:00	16:00 - 19:00	07:00 - 19:00	00:00 - 24:00
1	Eastbound	B777	0.6	1.3	1.1	0.6	0.4	1.1	1.1
		North Street	0.3	2.1	1.3	3.7	1.8	2.5	4.2
		Roche Way	1.1	4.9	0.7	3.3	7.3	4.8	4.7
		Vennel Street	0.2	2.5	2.0	2.8	2.1	0.8	3.3
		Total	**1.1**	**0.5**	**1.9**	**5.3**	**3.5**	**4.6**	**6.6**
1	Westbound	B777	0.1	2.0	0.4	0.5	0.6	0.2	0.0
		Roche Way	0.1	3.8	0.8	0.8	2.4	2.5	0.9
		Vennel Street	1.9	2.1	0.8	1.1	1.8	0.4	1.5
		Total	**1.0**	**0.4**	**0.7**	**1.4**	**0.4**	**1.6**	**1.3**
2	Northbound	A737 South	0.4	0.5	0.8	0.0	1.2	1.0	1.7
		Dalry Road	0.1	2.6	0.2	0.9	0.9	1.4	0.3
		Total	**0.2**	**2.1**	**0.5**	**0.6**	**1.4**	**1.7**	**1.0**
2	Southbound	A737 South	0.1	0.8	0.2	0.1	0.4	1.7	0.6
		Dalry Road	0.5	2.5	0.9	0.2	0.3	1.8	0.0
		Total	**0.4**	**1.1**	**0.8**	**0.1**	**0.5**	**2.5**	**0.4**
3	Northbound	North St. North	0.8	0.6	0.4	0.3	1.8	3.1	2.0
		A737 West	1.2	0.5	1.9	3.5	0.3	1.7	1.8
		Total	**1.4**	**0.8**	**1.8**	**2.5**	**1.4**	**0.8**	**0.1**
3	Southbound	North St. North	1.5	0.2	1.0	0.1	1.2	1.8	1.4
		A737 West	0.1	4.8	0.0	0.1	1.7	0.8	1.6
		Total	**1.1**	**3.5**	**0.6**	**0.2**	**2.1**	**1.8**	**2.2**
4	Entering	North St. North	1.5	0.2	1.0	0.1	1.2	1.8	1.4
		A737 West	0.1	4.8	0.0	0.1	1.7	0.8	1.6
		A737 South	0.3	0.7	0.1	0.1	0.9	0.6	0.4
		Saltcoats Road	1.0	0.5	1.3	1.2	1.1	0.1	0.3
		James Street	1.0	0.5	0.2	0.7	0.2	0.9	0.4
		Sharon Street	0.2	0.4	0.5	0.2	0.0	1.3	0.3
		Total	**1.5**	**2.1**	**1.1**	**0.1**	**0.9**	**1.7**	**1.2**
4	Exiting	Roche Way	0.2	0.4	0.7	2.1	0.8	0.3	1.1
		A737 West	1.2	0.5	1.9	3.5	0.3	1.7	1.8
		A737 South	1.4	3.4	0.6	0.1	3.4	1.6	1.4
		Saltcoats Road	1.9	2.1	0.8	0.1	2.0	0.9	1.1
		James Street	2.3	0.8	1.4	3.0	3.4	5.4	5.6
		Sharon Street	1.7	0.7	0.7	2.5	2.6	1.8	4.4
		Total	**0.4**	**2.2**	**0.2**	**3.1**	**2.2**	**0.5**	**1.2**

The screenline results again show very strong validation.

5.5 Journey Time Comparisons

To confirm the validity of the model in replicating journey times, a number of timed runs were undertaken at the time of the traffic surveys. The runs were in turn broken down into eight different routes. At least four runs were undertaken on each route per time period. Transport Scotland only requested survey data on a weekday, so no Saturday survey data was obtained in order to do a comparison.

The eight routes journey time routes used in the validation are shown in Figure 5.3.

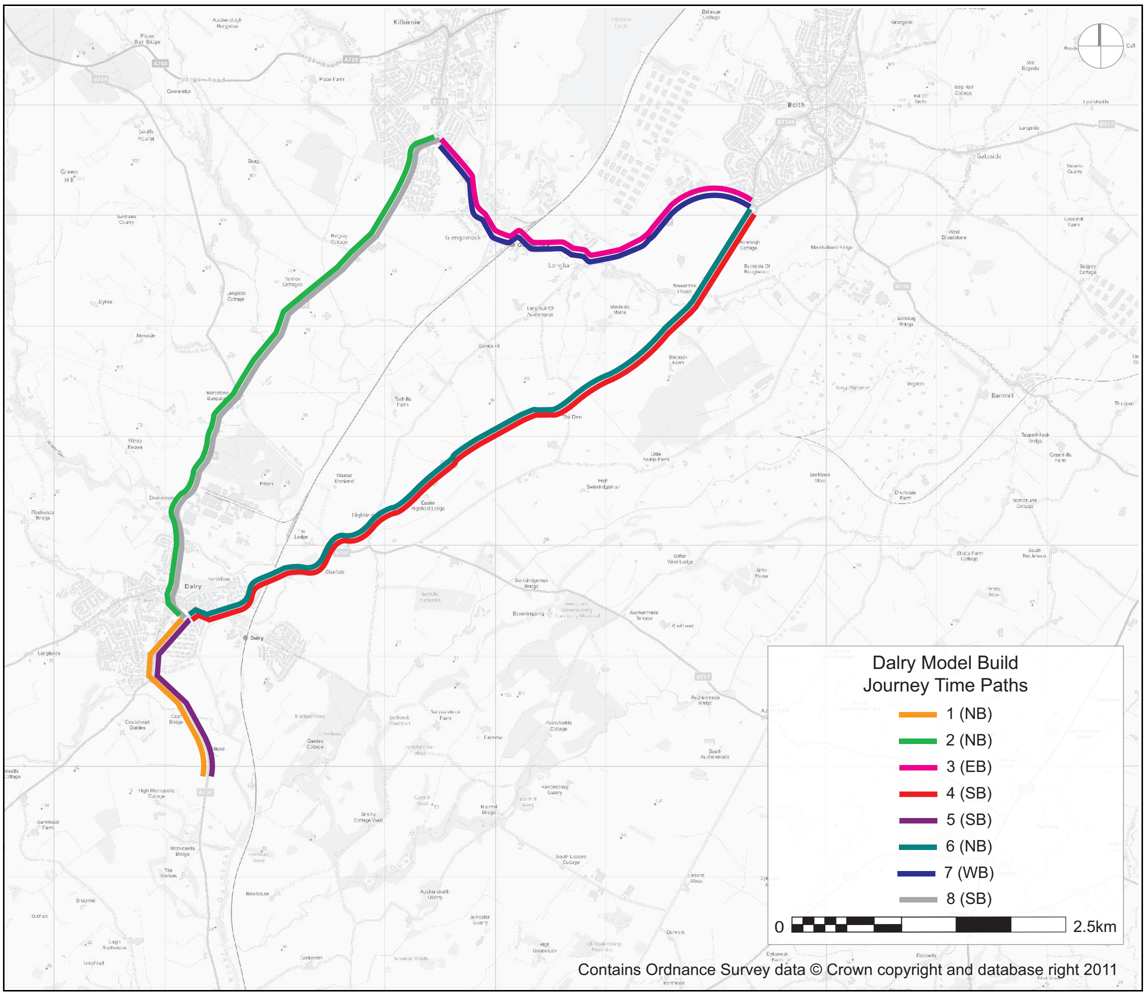

Figure 5.3 : Journey Time Routes

DMRB states that journey times must be within 15%, or 1min if greater, for a particular journey time to validate.

Average journey time data for all vehicles travelling in each direction were extracted from the S-Paramics model for the corresponding time periods, for the weekday scenario. Table 5.5 to Table 5.7 summarise the comparison of observed and modelled journey times for the AM, Off peak and PM periods.

Table 5.5 : AM Journey Time Comparisons

Route	Modelled Time (mm:ss)	Observed Time (mm:ss)	Difference (mm:ss)	%age Difference	Validates?
1	01:44	01:54	-00:10	-9%	YES
2	06:09	05:40	00:29	9%	YES
3	04:37	04:58	-00:21	-7%	YES
4	06:31	06:47	-00:16	-4%	YES
5	02:07	01:44	00:23	22%	YES
6	07:09	06:55	00:14	3%	YES
7	04:38	04:34	00:04	1%	YES
8	05:41	06:40	-00:59	-15%	YES

Table 5.6 : Off Peak Journey Time Comparisons

Route	Modelled Time (mm:ss)	Observed Time (mm:ss)	Difference (mm:ss)	%age Difference	Validates?
1	01:45	02:05	-00:20	-16%	YES
2	06:08	05:44	00:24	7%	YES
3	04:37	04:38	-00:01	0%	YES
4	06:23	07:57	-01:34	-20%	NO
5	01:52	01:43	00:09	9%	YES
6	06:07	07:39	-01:32	-20%	NO
7	04:38	04:46	-00:08	-3%	YES
8	05:41	06:48	-01:07	-16%	NO

Table 5.7 : PM Journey Time Comparisons

Route	Modelled Time (mm:ss)	Observed Time (mm:ss)	Difference (mm:ss)	%age Difference	Validates?
1	01:45	02:02	-00:17	-14%	YES
2	06:40	05:19	01:21	25%	NO
3	04:38	04:52	-00:14	-5%	YES
4	06:39	07:17	-00:38	-9%	YES
5	01:51	01:42	00:09	8%	YES
6	06:53	06:25	00:28	7%	YES
7	04:38	05:15	-00:37	-12%	YES
8	05:48	06:40	-00:52	-13%	YES

5.5.1 The results show that 20 of the 24 journey times (83%) meet the required criteria as stated by *DMRB*. While this is not quite 85% as stated by *DMRB*, 3 of the 4 modelled journeys which do not meet the criteria are within 20% of the observed times.

6 MODEL APPLICATION

6.1 Dalry Scheme Improvement

The proposed new scheme is Option 3A from the previous Stage 2 Assessment. This is a bypass from a new roundabout at Highfield in the north, linking to a new roundabout north of Wilsons Auction Mart in the south. The scheme has both northbound and southbound WS2+1 sections, providing dedicated overtaking opportunities in both directions.

The model with the Dalry Bypass is shown in Figure 6.1.

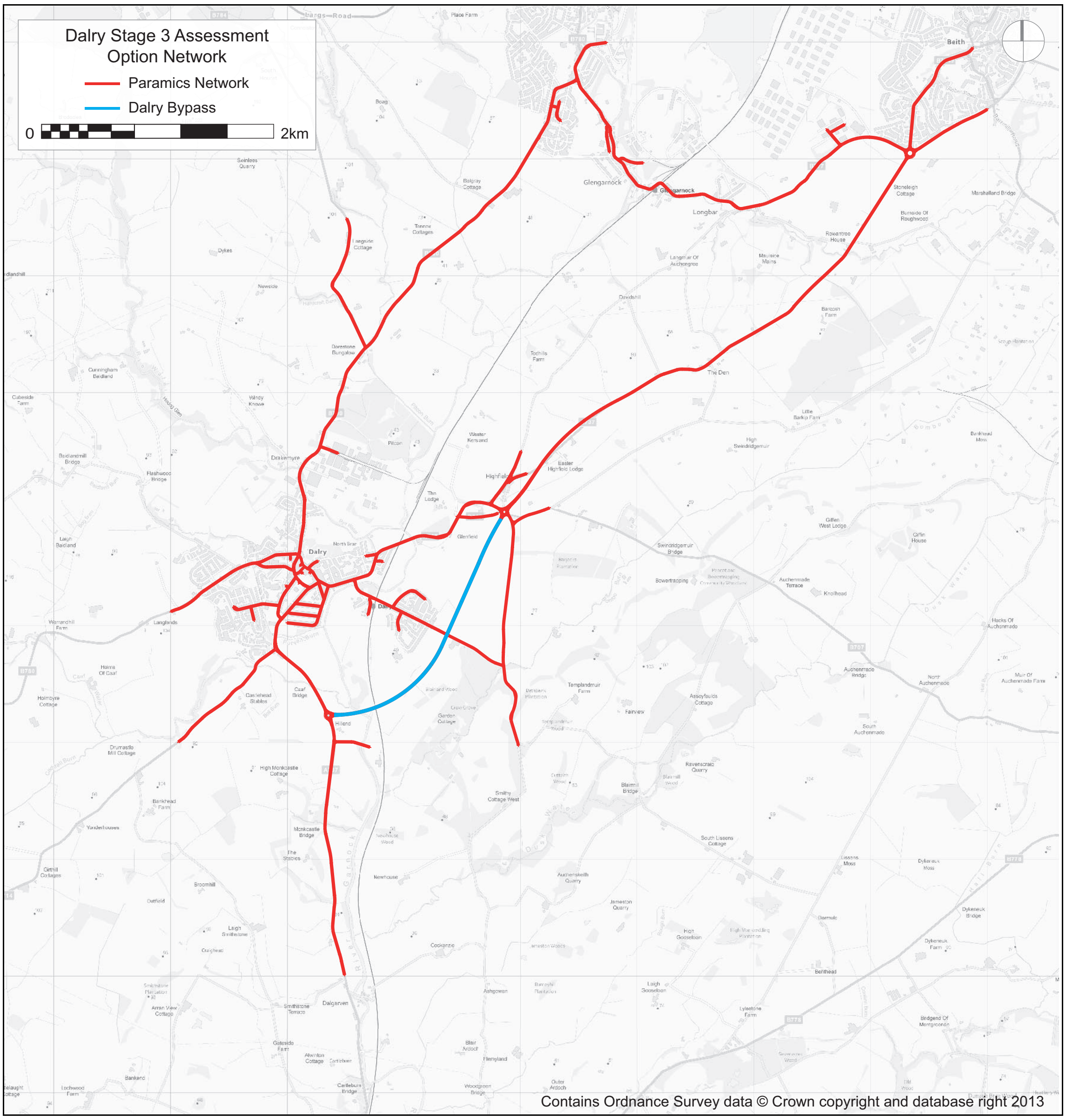

Figure 6.1 : Dalry Bypass S-Paramics Model

6.2 Future Year Demands

For the future year assessments, the years 2016 and 2031 were chosen. These years were selected because 2016 was originally going to be the opening year, and 2031 the 'Design' year; the Bypass is now due to open in 2018. In the Stage 2 Assessment, the demands had to be 'capped' at 2015, as the Do-Minimum network suffered from grid locking if additional demand was loaded onto the network. In contrast, for the Stage 3 Assessment, no such capping was required. This was due to lower Base year demands compared with the earlier work, and low traffic growth.

The methodology for generating the future year demands used the output from two different sources; STEP (Scottish Trip End Program) and TMfS (Transport Model for Scotland) as follows:

a STEP was used to generate the overall growth rates for the demands.

b TMfS07 output to was used to generate internal to external, external to internal, and external to external trip growth.

c The internal to internal trip growth is calculated by finding how much total growth is predicted from STEP and then subtracting the growth predicted by TMfS. For example, if STEP predicted growth of 100 trips, and TMfS predicted growth of 80 vehicles, the internal to internal growth is 20 vehicles.

d As STEP does not generate 2016 or 2031 growth rates, instead the growth rates for 2017 and 2022 were used as a proxy. The 2016 demands were then generated by using the same annual growth between 2012 and 2017. The 2031 demands were generated by assuming the same annual growth between 2017 and 2022.

The matrix totals for 2012, 2016 and 2031 for both the weekday and Saturday scenarios are shown as follows.

Table 6.1 : Weekday Matrix Totals

Year	Car	LGV	Heavy	Total
2012	33,943	4,819	1,195	39,957
2016	34,445	4,869	1,214	40,527
2031	35,897	5,015	1,302	42,214

Table 6.2 : Saturday Matrix Totals

Year	Car	LGV	Heavy	Total
2012	29,088	2,095	442	31,625
2016	29,503	2,118	447	32,067
2031	30,842	2,149	461	33,452

6.3 'With Auction Mart' Flows

TS required an additional assessment of the Bypass network performance when Wilson's Auction was operating, both on a weekday and on a Saturday. This Auction is situated just south of the southernmost roundabout of the new Bypass.

In order to do this, additional traffic surveys were carried out at the junction of the A737 with Wilson's Auction site, along with the A737/North Street junction. The weekday survey was carried out on 30 May 2012, and the Saturday survey was carried out on 29 September 2012.

Traffic flows in the weekday when there is an Auction do not differ markedly from when there is no Auction, although there is a large increase on the Saturday. Figure 6.2 and Figure 6.3 show the flow profiles in and out of the Auction Site for the weekday and Saturday periods.

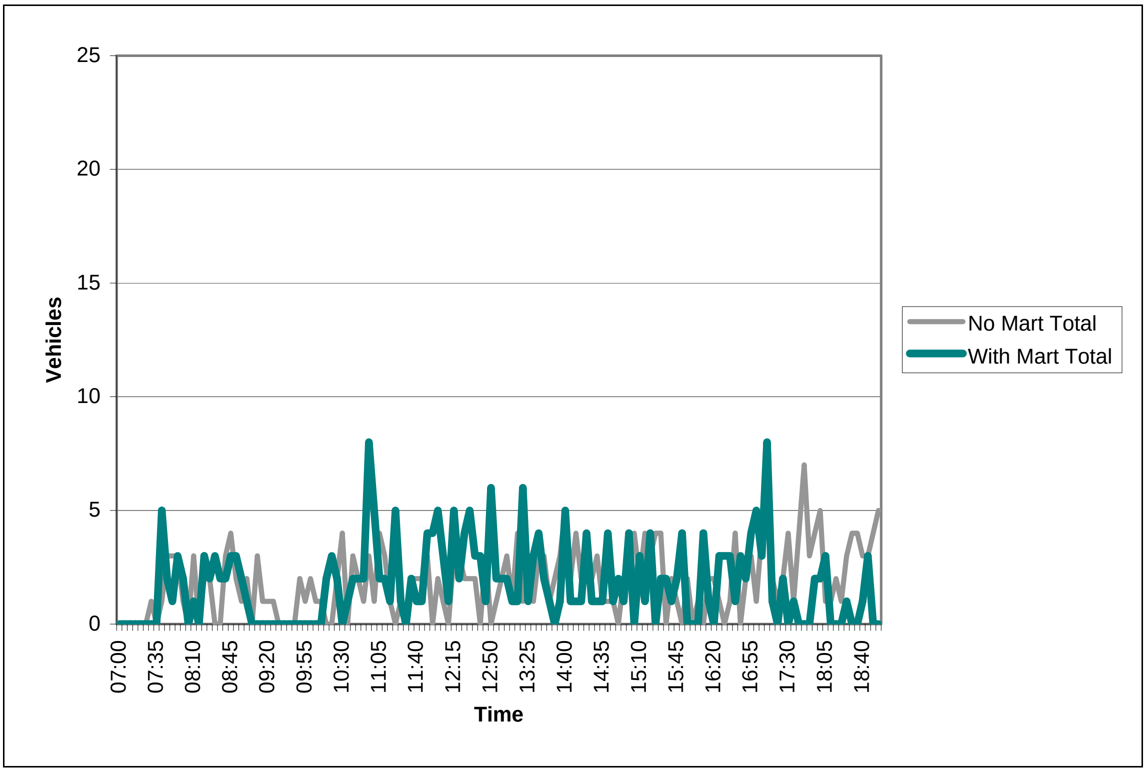

Figure 6.2 : Weekday Flows, In and Out of Wilson's Auction

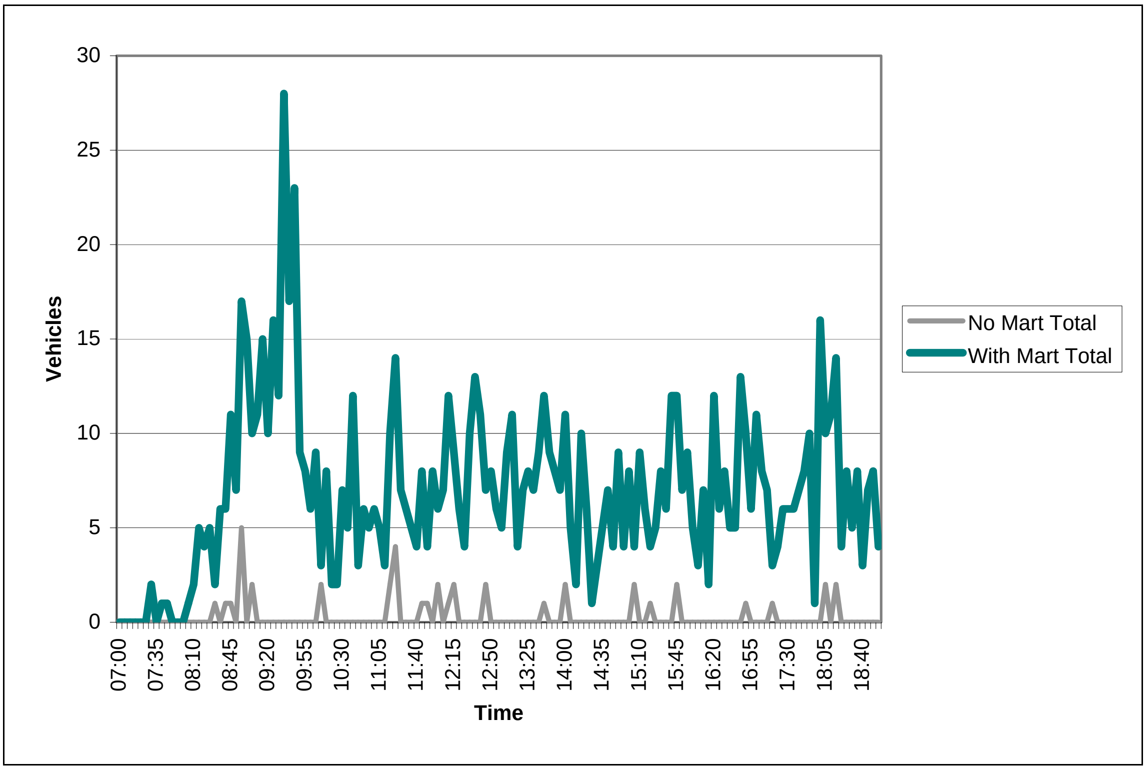

Figure 6.3 : Saturday Flows, In and Out of Wilson's Auction

The result shows that there is little difference between the 'With Auction' and 'Without Auction' in the weekday period. The lack of difference is due to the weekday auctions occurring during the evening, after the surveyed period. Flows are elevated in the Saturday period, especially between the hours of 08:00 – 10:00, as vehicles enter the Auction site.

The total flows between 07:00 – 19:00 for the different scenarios are shown in Table 6.3 and Table 6.4.

Table 6.3 : Weekday Total Flows In and Out of Wilson's Auction

	In	Out
No Auction	160	107
With Auction	116	135

Table 6.4 : Saturday Total Flows In and Out of Wilson's Auction

	In	Out
No Auction	21	20
With Auction	521	480

As can be seen, although flows are highest in the Saturday 'With Auction' scenario, flows average less than 1 vehicle per minute into and out of the site.

In order to test the performance of the network with the Auction, matrices were created for the Auction scenarios in 2031. The matrices were created in the following manner:

- As only two junctions were surveyed for the days with the Auction Mart, turn counts for the remaining junctions had to be created using factors from the 24hr weekday surveys that existed
- The 2031 weekday and Saturday prior matrices created previously for the scenario without the Auction Mart were this time utilised to create matrices
- The new surveyed trip end totals replaced previous trip end totals at the same zones from the previous non-Auction Mart matrices
- The matrices were then Furnessed to the new trip end totals

6.4 Traffic Flows

The modelled traffic flows, without Wilson's Auctions, are shown in Table 6.5 and Table 6.6.

Table 6.5 : Modelled 2031 Weekday 24hr Flows

Location	Direction	Do-Minimum	Option	Difference
North of Southern Entry to Bypass	Northbound	4,190	3,683	-12.1%
	Southbound	4,990	4,221	-15.4%
South of Northern Entry to Bypass	Northbound	5,456	2,854	-47.7%
	Southbound	5,625	2,897	-48.5%
Bypass	Northbound	-	2,950	-
	Southbound	-	3,215	-

Table 6.6 : Modelled 2031 Saturday 24hr Flows

Location	Direction	Do-Minimum	Option	Difference
North of Southern Entry to Bypass	Northbound	3,390	3,205	-5.5%
	Southbound	3,804	3,056	-19.7%
South of Northern Entry to Bypass	Northbound	3,929	2,137	-45.6%
	Southbound	4,624	2,184	-52.8%
Bypass	Northbound	-	1,971	-
	Southbound	-	2,537	-

The results show that flows into and out of Dalry Town Centre fall, especially south of the northern entry to the new Bypass.

Road users who travel along northbound and southbound along the A737 who do not wish to enter Dalry are now shown to be using the Bypass. The only road users that travel into Dalry are those whose final destination is Dalry.

With regard to the scheme objectives, the scheme is shown to:

Eradicate conflicts between long distance users and local traffic.

6.5 Operational Assessment

This section relates to 2031 scenario models.

The weekday journey times, with and without the Auction in place, are shown in Figure 6.4 and Figure 6.5, with the Saturday flows shown in Figure 6.6 and Figure 6.7.

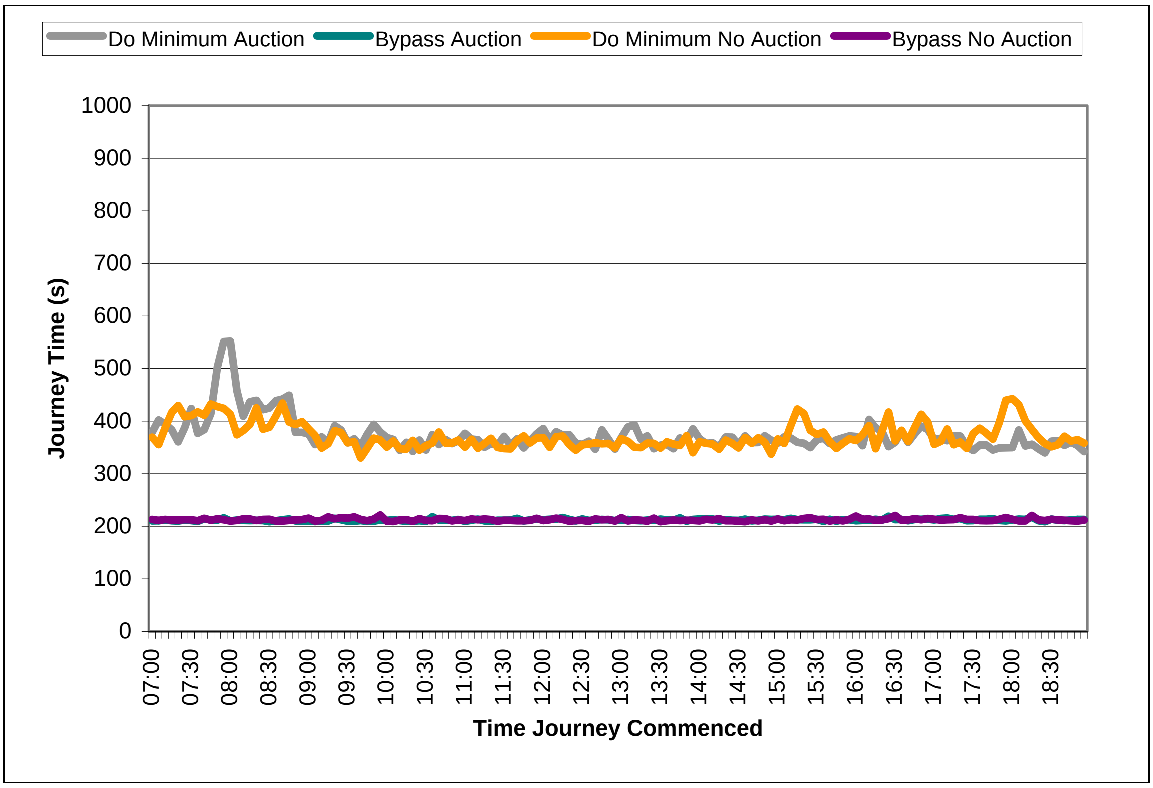

Figure 6.4 : Weekday Northbound Journey Times

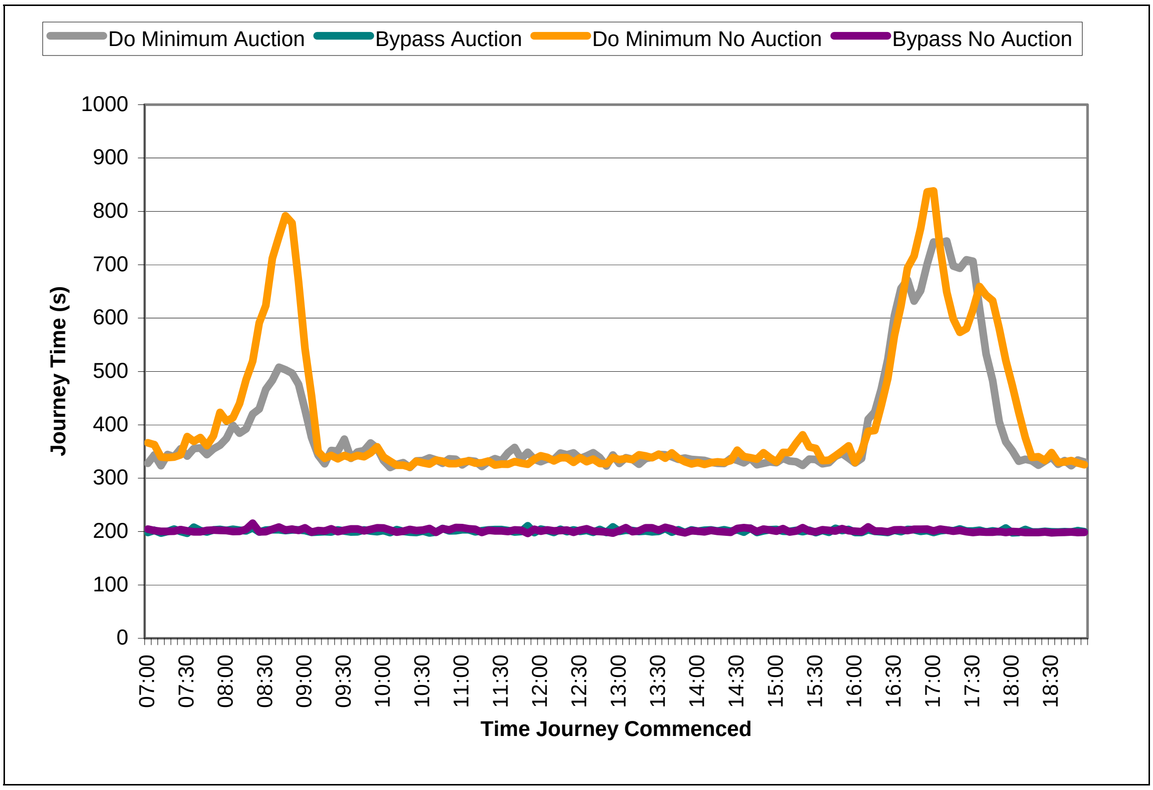

Figure 6.5 : Weekday Southbound Journey Times

The charts show that journey times without the Bypass in place are far higher, and more erratic, than with the Bypass in place. Journey times are especially longer southbound in the Do-Minimum without the Auction in place, reflecting the fact that flows on a day when an Auction took place were lower than those without an Auction.

With the Bypass in place, journey times are identical between the days with the Auction and without the Auction in both directions. This suggests the Bypass works effectively in either scenario.

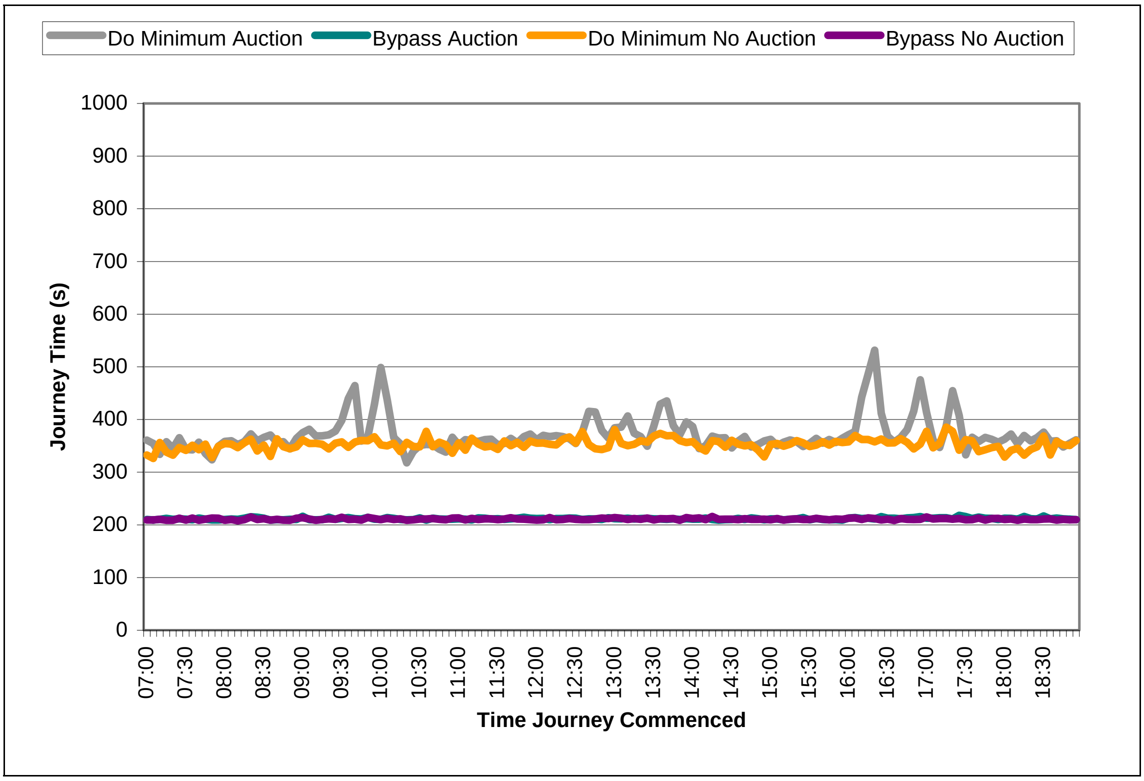

Figure 6.6 : Saturday Northbound Journey Times

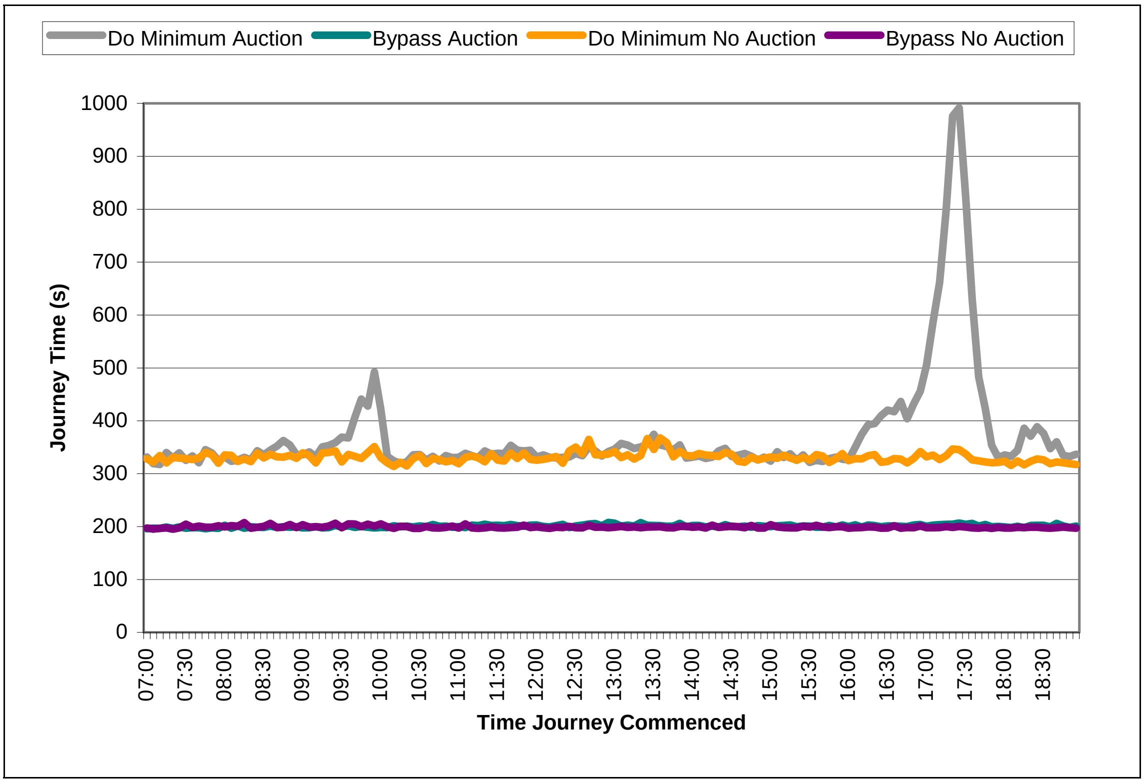

Figure 6.7 : Saturday Southbound Journey Times

Once again, journey times are higher without the Bypass compared with the scenarios with the Bypass. This time, Do-Minimum journey times are higher in the Auction scenario than in the scenario without an Auction, including an especially sharp increase in times between 16:30 – 18:00. With the Bypass in place, journey times are not changed between when Auction is taking place and when it is not taking place, suggesting there is ample capacity at the Bypass.

The new Bypass therefore demonstrates that it both shortens journey times in both uncongested and congested time periods. Journey times which are shown to rise to 1000 seconds from the north of Dalry to the south without the Bypass remain stable at 200s with the Bypass. Bus journey times will be expected to fall as a result of the new Bypass, both within Dalry and those currently travelling through Dalry.

The new Bypass is therefore shown to achieve a number of scheme objectives. Specifically, these are:

Improve the level of service and safety by reducing the effects of driver stress and journey times.

Stabilise the average peak hour journey time on the A737 through Dalry.

Stabilise average bus journey times through Dalry at peak hours.

7 ECONOMIC ASSESSMENT

7.1 Scheme Cost

The cost figures provided in this section were provided by Mouchel Fairhurst in April 2013.

The total cost of the scheme is £41,152,400. This figure is exclusive of VAT, but includes 15% optimism bias. A full risk assessment was carried out by Mouchel Fairhurst making this an appropriate level of optimism bias.

The cost profile provided assumed that 22% of preliminaries and construction costs will be incurred in 2015/16, 66% in 2016/17 and 12% in 2017/18. For the purpose of the PEARS assessment, the 2015 spend is half of the 2015/2016 spend (11%), the 2016 spend is half of the 2015/2016 spend, plus half of the 2016/2017 spend (11% + 33%), and so on.

An April 2013 RPI was used for the assessment; this was 249.5.

The assessment assumed a discount rate of 3.5% for the first 30 years of the appraisal, reducing to 3.0% for the next 45 years to rebase the costs to 2002 prices and values.

7.2 Accident Savings

7.2.1 Accident Rate Assessment

DMRB 15.1.6.5 states

> *the preferred method of evaluating accidents is to separate link and junction accidents, using local data (minimum of 5 years) to define Do-Minimum rates and default rates for new links and junctions in the Do-Something*

It also recommends that default accident costs should be used in both the Do-Minimum and Do-Something.

Local accident data for the corridor was supplied by Transport Scotland, with the most up-to-date data available being to the end of 2011. The data identified 66 Personal Injury Accents (PIAs) over the previous 5 year period (January 2007 to December 2011 as being the latest available). Of these, 41 occurred within the study extents.

Overall, the 41 accidents could be split into 22 which occurred north of Dalry, 16 in Dalry town centre and 3 south of Dalry. North of Dalry, the accident rate equated to 0.141 PIA/MVkm, lower than the TAG default value of 0.381 PIA/MVkm (Link & Junction Combined) for this Road Class (RC26 – Rural Typical Single 7.3m *(Ref: DMRB 15, Table 6/5/2, July 2005)*.

In Dalry town centre the accident rate equated to 0.394 PIA/MVkm, lower than the TAG default value of 0.844 PIA/MVkm (Link & Junction Combined) for this Road Class (RC2 – Urban Single 7.3m *(Ref: DMRB 15, Table 6/5/2, July 2005)*.

South of Dalry the accident rate equated to 0.07 PIA/MVkm, lower than the TAG default value of 0.381 PIA/MVkm (Link & Junction Combined) for this Road Class (RC26 – Rural Typical Single 7.3m *(Ref: DMRB 15, Table 6/5/2, July 2005)*.

DMRB 15.1.6.5 recommends using local accident rates in the Do-Minimum and default rates in the Do-Something (and default costs for both). Given that the local accident rate for the Base was lower than the default rate for the proposed scheme configuration, this would have resulted in an increase in the number of accidents with the scheme in place. The NESA was run with the default accident rates.

The resultant accident benefits calculated were checked to ensure they were not excessive, given the scale of the impact proposed improvement, and were considered reasonable.

Full accident data on the A737 for the previous years is shown in Appendix A.

7.2.2 Accident-Only NESA Assessment

An accident-only NESA model was defined to calculate the potential accident benefits. Whereas NESA11 now allows the user to configure an 'accident-only' model, the full model used in the Stage 2 assessment was retained for consistency.

The Do-Minimum network description was coded using measurements taken from the S-Paramics models. These were used to establish geometric variables such as link lengths, road widths and junction configurations.

Each of the options was also coded using measurements taken from the respective S-Paramics models.

Classified Base year origin-destination trip matrices were extracted from the S-Paramics model and input to the NESA model.

The Do-Minimum and Do-Something node/link diagrams are illustrated in Appendix B.

The results of the respective accident-only NESA assessments were fed back into the economic assessment.

7.3 Maintenance Savings

Group 2 maintenance costs have been assessed using QUADRO. Group 2 costs are traffic related costs comprising both the works costs and traffic delay costs associated with future maintenance.

It should be noted that due to potential bugs with Version 10 of QUADRO, the assessment was carried out using QUADRO 9. This was the latest version still compliant with the 2002 base year.

Maintenance estimates for both Do-Minimum and the option were supplied by Mouchel Fairhurst.

The TAG compatible assessment quantified potential savings in maintenance over the 60 year appraisal period and summarises the results in 2002 prices and values.

The results of the QUADRO assessment were fed back into the economic assessment.

The maintenance schedule is shown in Appendix C.

7.4 Economic Assessment (TAG)

The TAG compatible economic assessment was carried out over a 60 year period using the results of the traffic assignments for the anticipated opening year of 2018.

With the exception of the accident and maintenance analyses, the assessment was carried out in PEARS. Ten runs of the weekday and Saturday scenarios from all of the assessment models were input into PEARS. In addition, as an approximation, the Saturday scenarios were run with 86% of demand in order to generate Sunday runs. The 86% figure was obtained by analysing ATC data in the nearby area.

The economic returns, which are represented in the form of a Net Present Value (NPV) and Benefit Cost Ratio (BCR), are based on the overall costs (scheme costs and maintenance costs) and benefits (travel time, vehicle operating cost and accident savings) of the scheme.

A summary of the TAG compatible costs, benefits and economic returns for the option is given in the following table.

Table 7.1 : Economic Efficiency of the Road System

IMPACT	Table Ref	Source	Total	Cars	Vehs and LGV	Bus and Coach
NON-BUSINESS USER BENEFITS						
Travel Time						
Commuting Travel Time	1		4.97	4.84	0.07	0.06
Other Travel Time	2		8.51	7.99	0.21	0.31
Non-business Travel Time	3	1+2	13.48			
Vehicle Operating Costs						
Commuter Fuel VOC	4		0.35	0.35	0.00	
Commuter Non-fuel VOC	5		0.03	0.03	0.00	
Other Fuel VOC	6		0.39	0.39	0.00	
Other Non-fuel VOC	7		0.04	0.03	0.01	
Non-business Vehicle Operating Costs	8	4+5+6+7	0.81			
During Construction and Maintenance						
Commuting: During Construction and Maintenance *	9		-0.35	-0.35		0.00
Other: During Construction and Maintenance *	10		-0.57	-0.57		0.00
Net Non-Business Benefits: Commuting	11	1+4+5+9	5.00			
Net Non-Business Benefits: Other	12	2+6+7+10	8.37			
Net Non-Business Benefits – Sub Total	13	11+12	13.37			
BUSINESS USER BENEFITS						
User Benefits						
Business Travel Time	14		15.99	11.11	4.77	0.11
Fuel VOC	15		0.35	0.13	0.22	
Non Fuel VOC	16		0.67	0.33	0.34	
Business Vehicle Operating Costs	17	15+16	1.02			
During Construction *	18		-0.80	-0.57	-0.23	0.00
During Maintenance *	19		0.02	0.01	0.01	0.00
During Construction and Maintenance	20	18+19	-0.79			
Net User Benefits – Sub Total	21	14+17+20	16.22			
Private Sector Provider Impacts						
Revenue	22					
Fuel VOC	23		0.02			0.02
Non Fuel VOC	24		0.02			0.02
Private Sector Vehicle Operating Costs	25	23+24	0.04			
Investment Costs	26					
Grant / Subsidy	27					
New Private Sector Provider Impacts – Sub Total	28	22+25+26+27	0.04			
Other Business Impacts						
Developer & Other Contributions	29					
Net Business – Sub Total	30	21+28+29	16.26			
TOTAL PRESENT VALUE OF TEE IMPACTS	31	13+30	29.63			

This analysis is based on MEDIUM traffic growth
Costs are in 2002 prices in multiples of a million pounds and are discounted to 2002
Evaluation Period is 60 years
First Scheme Year is 2018
Current Year is 2013
Discount Rate is 3.5% for first 30 years, thereafter 3.0% for 46 years, thereafter 2.5%

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Table 7.2 : Public Accounts

IMPACT	Table Ref	Source	Total
LOCAL GOVERNMENT FUNDING			
Revenue	32		
Investment Costs	33		
Operating Costs	34		
Maintenance Costs			
Non-Traffic (Group 1)	35		
Traffic Related (Group 2)	36		
Developer & Other Contributions	37		
Grant Subsidy Payment	38		
Local Government Funding – Net Impact	39	ς 32 to 38	0.00
CENTRAL GOVERNMENT FUNDING: TRANSPORT			
Revenue	40		
Investment Costs	41		21.42
Operating Costs	42		
Maintenance Costs			
Non-Traffic (Group 1)	43		0.00
Traffic Related (Group 2)	44		-0.58
Developer & Other Contributions	45		
Grant Subsidy Payment	46		
Central Government Funding: Transport – Net Impact	47	ς 40 to 46	20.84
CENTRAL GOVERNMENT FUNDING: NON-TRANSPORT			
Indirect Tax Revenues	48		0.01
TOTALS			
Broad Transport Budget	49	39+47	20.84
Wider Public Finances	50	48	0.01

This analysis is based on MEDIUM traffic growth
Costs are in 2002 prices in multiples of a million pounds and are discounted to 2002
Evaluation Period is 60 years
First Scheme Year is 2018
Current Year is 2013

Table 7.3 : Analysis of Monetised Costs & Benefits

IMPACT	Table Ref	Source	Total
Noise	51		
Local Air Quality	52		
Greenhouse Gases (Emissions) (low)			0.16
Greenhouse Gases (Emissions) (central)	53		0.34
Greenhouse Gases (Emissions) (high)			0.53
Journey Ambience	54		
Accident Benefits*	55		6.54
Non-Business User Benefits: Commuting	56	11	5.00
Non-Business User Benefits: Other	57	12	8.37
Business User & Provider Benefits	58	30	16.26
Wider Public Finances (Indirect Tax Revenues)	59	-50	-0.01
Option Values	60		
Present Value of Benefits (PVB)	61	ς 51 to 60	36.50
Broad Transport Budget	62	49	20.84
Present Value of Costs (PVC)	63	62	20.84
OVERALL IMPACTS			
Net Present Value (NPV)	64	61-63	15.66
Benefit Cost Ratio (BCR)	65	61/63	1.75

This analysis is based on MEDIUM traffic growth
Costs are in 2002 prices in multiples of a million pounds and are discounted to 2002
Evaluation Period is 60 years
First Scheme Year is 2018
Current Year is 2013
* Includes accidents during construction and maintenance.

Table 7.3 indicates that under a TAG compatible assessment, the scheme would produce a positive NPV of £15.66M and a BCR of 1.75, indicating that the scheme can be justified on economic grounds.

The values are lower than those calculated in the previous Stage 2 Assessment. This is due to lower flows in the baseline and predicted future year situation, however, the benefit to cost ratio is still comfortably above 1.

The new Bypass is shown to provide value for money, which is one of the scheme objectives.

8 SUMMARY AND CONCLUSION

8.1 Summary

Transport Scotland required a Stage 3 Economic Assessment of a proposed Dalry Bypass.

In order to do this a new version of the Dalry model, using 2012 surveyed flows, was created.

The 2012 Base Dalry model was successfully calibrated and validated and was used as the basis of the Stage 3 Assessment.

Future year models were created with traffic growth applied.

In addition, an Option model containing the Dalry Bypass was created. Future year models with this Bypass in place were also created. The option that was carried forward after the Stage 2 assessment was Option 3A. No other option was tested.

The Economic assessment was carried out using a combination of different software programs. PEARS was used to obtain travel time and vehicle operating cost saving figures, NESA was used to obtain accident savings from the new scheme, and QUADRO was used to obtain the costs incurred to drivers during construction and maintenance.

8.2 Conclusion

The Stage 3 Assessment was carried out, and the Bypass was found to have a Net Present Value of £15.66M (in 2002 prices), and to have a Benefit to Cost Ratio of 1.75.

A number of scheme objectives have been shown to be satisfied by the new Bypass. These were:

Improve the level of service and safety by reducing the effects of driver stress and journey times.

Eradicate conflicts between long distance users and local traffic.

Stabilise the average peak hour journey time on the A737 through Dalry.

Stabilise average bus journey times through Dalry at peak hours.

Achieve good value for money

Environmental objectives, and the measures to improve accessibility for non motorised road users are dealt with elsewhere.

A FULL ACCIDENT DATA

Table A.1 : A737 Dalry Bypass Accident Analysis, January 2002 – August 2003

Day	Date	Time	Severity	Road	Weather	Accrefno	Easting	Northing	Lighting	Condition	Casualites	Vehicles
Th	17-Jan-02	920	SERIOUS	A737	UNKNOWN	UA03301	228919	649011	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	1
Mo	04-Feb-02	1145	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA00302	228959	649062	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Sa	23-Feb-02	915	SLIGHT	A737	SNOWING (WITHOUT HIGH WINDS)	UA06302	232183	651134	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Th	11-Apr-02	2155	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA02904	229412	649344	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	3
Su	21-Apr-02	1400	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06404	229360	649334	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	3
We	07-Aug-02	2130	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02308	229561	649388	DARKNESS: NO STREET LIGHTING	DRY	1	2
Su	01-Sep-02	2235	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA00309	235325	653854	DARKNESS: STREET LIGHTS PRESENT AND LIT	DRY	1	2
We	04-Sep-02	745	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA01009	235052	653460	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Sa	07-Sep-02	255	SLIGHT	A737	RAINING WITH HIGH WINDS	UA02109	235355	653973	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	2
Sa	07-Sep-02	1730	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02809	230456	649912	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	2
Su	20-Oct-02	1935	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06110	235327	653861	DARKNESS: STREET LIGHTS PRESENT AND LIT	DRY	1	2
Su	20-Oct-02	715	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA07710	229679	649425	DARKNESS: STREET LIGHTS PRESENT AND LIT	FROST / ICE	3	1
Su	10-Nov-02	1455	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01811	228896	648871	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	2	4
Sa	16-Nov-02	1845	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03811	229067	648656	DARKNESS: STREET LIGHTS PRESENT AND LIT	DRY	1	3
Tu	19-Nov-02	1650	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05611	229189	649317	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	2
We	20-Nov-02	735	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA05911	229642	649413	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Sa	30-Nov-02	1150	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA09511	230912	650239	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Sa	30-Nov-02	1415	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA09711	230170	649766	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Mo	09-Dec-02	1410	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02812	235051	653459	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Su	15-Dec-02	1805	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03912	234354	653021	DARKNESS: NO STREET LIGHTING	DRY	1	3
Mo	23-Dec-02	2000	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA08212	228919	649011	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	2
Sa	04-Jan-03	1325	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01301	235337	654259	DAYLIGHT: NO STREET LIGHTING	FROST / ICE	2	5
Tu	07-Jan-03	335	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA02001	230990	650280	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1
We	15-Jan-03	1800	SLIGHT	A737	FINE WITH HIGH WINDS	UA03401	229005	649115	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	2
Th	23-Jan-03	1500	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05501	232171	651127	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Su	02-Feb-03	1430	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA00702	235309	654431	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	2	3
Th	13-Mar-03	1700	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	KB02003	235819	656023	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
We	19-Mar-03	625	SLIGHT	A737	FOG (OR MIST IF HAZARD)	UA04503	229681	649426	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Tu	15-Apr-03	1525	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03104	230062	649732	DAYLIGHT: NO STREET LIGHTING	DRY	3	2
Sa	17-May-03	2330	SERIOUS	A737	RAINING (WITHOUT HIGH WINDS)	UA05105	229691	649428	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	2
Th	22-May-03	1805	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06405	235325	653854	DAYLIGHT: STREET LIGHTS PRESENT	DRY	3	2
Mo	26-May-03	1510	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA07705	234209	652850	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Su	20-Jul-03	1700	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA07607	229578	649394	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Su	20-Jul-03	1205	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA70707	230468	649931	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	4
Fr	25-Jul-03	1300	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA09607	234306	653067	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	1
We	06-Aug-03	1430	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA01008	235273	654710	DAYLIGHT: STREET LIGHTS PRESENT	DRY	3	2
Mo	11-Aug-03	1215	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02208	235344	653919	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2

Table A.2 : A737 Dalry Bypass Accident Analysis, September 2003 – May 2006

We	03-Sep-03	1550	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA00309	235343	654939	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Tu	09-Sep-03	1950	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02109	229391	648120	DARKNESS: NO STREET LIGHTING	DRY	1	1
Su	14-Sep-03	1205	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03809	229782	649618	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	1
Th	18-Sep-03	910	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05009	235348	654951	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	1
Sa	25-Oct-03	1230	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA05710	228909	648806	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Sa	25-Oct-03	1850	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	KB03210	235888	656302	DARKNESS: NO STREET LIGHTING	DRY	1	3
Th	04-Dec-03	1845	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01212	234044	652590	DARKNESS: NO STREET LIGHTING	DRY	2	2
Fr	19-Dec-03	1230	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA05412	235306	654451	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Fr	26-Dec-03	1330	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA06712	235324	653852	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Fr	16-Jan-04	745	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03801	235021	653439	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Tu	03-Feb-04	845	SERIOUS	A737	FINE WITH HIGH WINDS	UA70102	229308	649356	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	1
Mo	23-Feb-04	939	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA05902	228964	649068	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	1
We	05-May-04	1335	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01605	234315	653023	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	3
Th	06-May-04	1400	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01805	235328	654907	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	4
Sa	24-Jul-04	2225	SERIOUS	A737	RAINING (WITHOUT HIGH WINDS)	UA09007	232863	651430	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	1
We	15-Sep-04	1345	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05509	235513	655268	DAYLIGHT: NO STREET LIGHTING	DRY	3	3
We	15-Sep-04	1925	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05809	234155	652766	DAYLIGHT: NO STREET LIGHTING	DRY	1	4
Fr	08-Oct-04	800	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02810	234040	652584	DAYLIGHT: NO STREET LIGHTING	DRY	2	3
Tu	09-Nov-04	1730	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02311	235042	653453	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	2
Su	28-Nov-04	1300	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA08811	233155	651598	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
Tu	07-Dec-04	725	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA02312	235051	653459	DARKNESS: STREET LIGHTS PRESENT AND LIT	DRY	1	2
We	12-Jan-05	1315	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02501	235325	653854	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	2	2
Th	13-Jan-05	445	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02601	232635	651259	DARKNESS: NO STREET LIGHTING	FROST / ICE	1	1
Sa	05-Feb-05	2215	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01502	232669	651287	DARKNESS: NO STREET LIGHTING	DRY	1	2
We	16-Mar-05	50	SLIGHT	A737	RAINING WITH HIGH WINDS	KB01903	235845	656207	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	1
Fr	18-Mar-05	1630	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA06403	235049	653458	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Su	17-Apr-05	1650	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA05904	229112	649238	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Tu	19-Apr-05	1720	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06704	229348	649336	DAYLIGHT: NO STREET LIGHTING	DRY	2	2
Su	15-May-05	1505	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02905	230239	649756	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Fr	01-Jul-05	1935	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA00207	234317	653005	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Fr	22-Jul-05	1255	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05907	235051	653459	DAYLIGHT: STREET LIGHTS PRESENT	DRY	2	3
Mo	08-Aug-05	1720	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA02108	235325	653854	DAYLIGHT: STREET LIGHTS PRESENT	DRY	3	3
We	10-Aug-05	1430	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02708	229209	648495	DAYLIGHT: NO STREET LIGHTING	DRY	4	3
Th	22-Sep-05	400	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA06509	232682	651297	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	1
Fr	21-Oct-05	320	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	KB01810	235850	655759	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1
Mo	28-Nov-05	1130	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06811	230567	650050	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	2
Sa	14-Jan-06	1340	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03401	235301	654843	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	1
We	12-Apr-06	115	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	KB70304	235859	655876	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1
Su	07-May-06	200	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01505	232632	651257	DARKNESS: NO STREET LIGHTING	WET / DAMP	2	1

Table A.3 : A737 Dalry Bypass Accident Analysis, June 2006 – July 2008

Su	18-Jun-06	900	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA04506	232540	651199	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Tu	27-Jun-06	10	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA07206	235820	655740	DARKNESS: NO STREET LIGHTING	DRY	1	2
Mo	03-Jul-06	630	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA00507	232633	651258	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	3
Su	09-Jul-06	920	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA01807	229234	649343	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Th	24-Aug-06	1930	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA09208	235356	653981	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Sa	26-Aug-06	2310	SERIOUS	A737	RAINING (WITHOUT HIGH WINDS)	UA08508	229164	649296	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	1
We	30-Aug-06	1830	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA10008	235329	653867	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Su	03-Sep-06	15	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA70309	233873	652318	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	1
Sa	09-Sep-06	1520	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	KB00809	235712	655500	DAYLIGHT: NO STREET LIGHTING	DRY	2	2
Th	14-Sep-06	1405	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA03609	233843	652271	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	2
Mo	25-Sep-06	1645	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA08209	229340	649339	DAYLIGHT: STREET LIGHTS PRESENT	DRY	2	2
Mo	30-Oct-06	1530	SLIGHT	A737	RAINING WITH HIGH WINDS	UA08510	232635	651259	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	2	2
Fr	03-Nov-06	1915	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01411	229260	649380	DARKNESS: STREET LIGHTS PRESENT BUT UNLIT	DRY	1	1
Sa	04-Nov-06	1205	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02511	228958	649062	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Tu	02-Jan-07	1240	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA00201	228954	649057	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Sa	27-Jan-07	1620	FATAL	A737	FINE (WITHOUT HIGH WINDS)	UA70501	235326	653858	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	3	2
Tu	20-Feb-07	915	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA04702	229270	649372	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	1
Fr	23-Feb-07	1700	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA05502	229720	649470	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	1
Tu	13-Mar-07	900	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA03603	230772	650088	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
Mo	09-Apr-07	700	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA02004	234306	652996	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Mo	23-Apr-07	650	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06304	233337	651726	DAYLIGHT: STREET LIGHTING UNKNOWN	WET / DAMP	2	2
Th	10-May-07	1415	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03205	232593	651226	DAYLIGHT: NO STREET LIGHTING	DRY	2	2
Su	03-Jun-07	2030	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA01306	235328	653864	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	2
Fr	15-Jun-07	2005	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA04206	235869	655813	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
Su	01-Jul-07	2135	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA00107	229195	648517	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	4	4
Su	15-Jul-07	515	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA03907	229910	649680	DAYLIGHT: NO STREET LIGHTING	DRY	1	1
Th	19-Jul-07	1430	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05307	229792	649628	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Su	22-Jul-07	1600	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06107	235327	653861	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
We	08-Aug-07	640	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02208	233900	652360	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Sa	11-Aug-07	2000	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA03708	230907	650233	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
We	15-Aug-07	1745	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	KB01208	235885	656302	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Tu	09-Oct-07	520	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA02510	233945	652433	DARKNESS: NO STREET LIGHTING	WET / DAMP	1	1
Su	21-Oct-07	1440	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06210	228911	648801	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Su	09-Dec-07	1300	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02612	229308	649356	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Sa	26-Jan-08	2110	SERIOUS	A737	FINE WITH HIGH WINDS	UA70401	235333	653882	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1
Su	24-Feb-08	930	SLIGHT	A737	FINE WITH HIGH WINDS	UA07802	232097	651084	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
Sa	15-Mar-08	530	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	KB01803	235864	655787	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	2
Tu	22-Apr-08	900	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05504	235330	653870	DAYLIGHT: NO STREET LIGHTING	DRY	1	3
Th	22-May-08	2240	SERIOUS	A737	RAINING (WITHOUT HIGH WINDS)	UA04505	230931	650259	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1
Fr	27-Jun-08	1745	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA06306	229691	649428	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	2
Th	17-Jul-08	2050	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA05207	235320	654360	DAYLIGHT: NO STREET LIGHTING	DRY	3	3

Table A.4 : A737 Dalry Bypass Accident Analysis, August 2008 – December 2011

Sa	16-Aug-08	1500	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA04308	231224	650416	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	4	3
Tu	19-Aug-08	1150	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA09708	235386	655027	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	1
Th	21-Aug-08	1625	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA70108	229385	648141	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Fr	07-Nov-08	1730	SLIGHT	A737	RAINING WITH HIGH WINDS	UA70111	228958	649062	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	2
We	04-Feb-09	845	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01502	235130	653530	DAYLIGHT: NO STREET LIGHTING	FROST / ICE	1	1
Fr	06-Feb-09	2300	FATAL	A737	FINE (WITHOUT HIGH WINDS)	UA70202	234722	653285	DARKNESS: NO STREET LIGHTING	DRY	1	1
Sa	21-Feb-09	1345	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06202	231190	650380	DAYLIGHT: NO STREET LIGHTING	DRY	3	3
Su	08-Mar-09	730	SERIOUS	A737	SNOWING WITH HIGH WINDS	UA01703	229394	648101	DAYLIGHT: NO STREET LIGHTING	SNOW	6	3
Th	12-Mar-09	1030	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02903	235110	653510	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	2	3
We	18-Mar-09	845	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA04803	235021	653439	DAYLIGHT: NO STREET LIGHTING	DRY	1	3
We	10-Jun-09	1200	SLIGHT	U	FINE (WITHOUT HIGH WINDS)	UA02606	229570	649391	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Tu	28-Jul-09	710	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06207	228928	648776	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
We	29-Jul-09	1605	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA06807	235330	653870	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Fr	04-Sep-09	10	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA70209	235328	653865	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	3	2
Sa	19-Sep-09	1435	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA03109	229570	649391	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
Fr	25-Sep-09	1905	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA70509	234266	652936	DAYLIGHT: NO STREET LIGHTING	DRY	1	1
Su	11-Oct-09	920	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA02810	231991	651018	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
Fr	06-Nov-09	730	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01311	235329	653867	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	3
Tu	15-Dec-09	1415	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA04412	235356	653981	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	3
Su	28-Feb-10	1810	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA06002	235327	653861	DAYLIGHT: STREET LIGHTS PRESENT	DRY	3	2
Mo	22-Mar-10	750	SLIGHT	A737	RAINING WITH HIGH WINDS	UA04503	235319	654370	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	4	2
Fr	26-Mar-10	2030	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05603	230902	650228	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	2	3
Tu	08-Jun-10	1230	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA02006	230951	650268	DAYLIGHT: STREET LIGHTING UNKNOWN	WET / DAMP	2	1
We	09-Jun-10	1630	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA02906	235278	654760	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Sa	04-Sep-10	830	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA01509	233339	651728	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Tu	28-Sep-10	2030	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA06709	234320	653019	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1
We	29-Sep-10	735	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA06909	229351	649335	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	2
We	13-Oct-10	1430	SLIGHT	A737	RAINING (WITHOUT HIGH WINDS)	UA04110	230160	649766	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Th	18-Nov-10	725	SLIGHT	A737	FINE WITH HIGH WINDS	UA04511	235324	653849	DAYLIGHT: STREET LIGHTS PRESENT	DRY	1	2
Mo	22-Nov-10	1400	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05411	229191	649318	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
Fr	24-Dec-10	1200	SLIGHT	A737	OTHER	UA05312	230439	649880	DAYLIGHT: NO STREET LIGHTING	FROST / ICE	1	2
Th	20-Jan-11	1120	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA04301	235068	653472	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	2
Fr	04-Mar-11	2100	SLIGHT	A737	FOG (OR MIST IF HAZARD)	UA01103	233020	651519	DARKNESS: NO STREET LIGHTING	DRY	2	2
We	29-Jun-11	1615	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA08206	228901	648920	DAYLIGHT: STREET LIGHTS PRESENT	DRY	4	2
Fr	22-Jul-11	1445	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA05807	235355	653971	DAYLIGHT: NO STREET LIGHTING	DRY	1	2
We	03-Aug-11	8	SLIGHT	A737	FINE (WITHOUT HIGH WINDS)	UA04408	229269	649371	DARKNESS: STREET LIGHTS PRESENT AND LIT	DRY	1	1
Fr	02-Sep-11	820	SERIOUS	A737	FINE (WITHOUT HIGH WINDS)	UA00209	235051	653459	DAYLIGHT: STREET LIGHTS PRESENT	WET / DAMP	1	3
Th	13-Oct-11	1335	SLIGHT	A737	OTHER	UA03710	235339	654931	DAYLIGHT: NO STREET LIGHTING	WET / DAMP	1	1
Fr	25-Nov-11	1620	SLIGHT	A737	FINE WITH HIGH WINDS	UA07311	229093	649217	DARKNESS: STREET LIGHTS PRESENT AND LIT	WET / DAMP	1	1

SIAS

B NESA DIAGRAMS

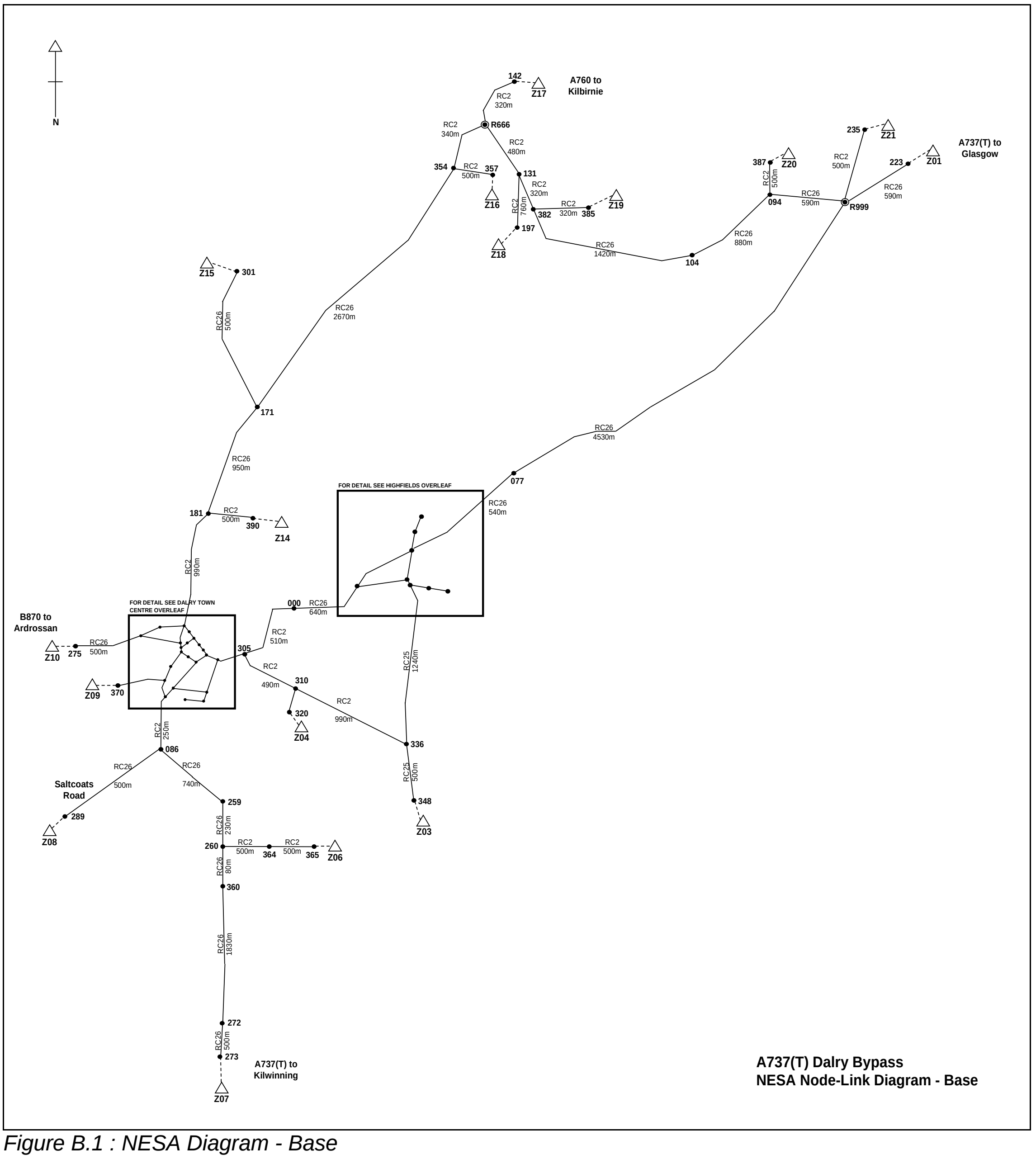

Figure B.1 : NESA Diagram - Base

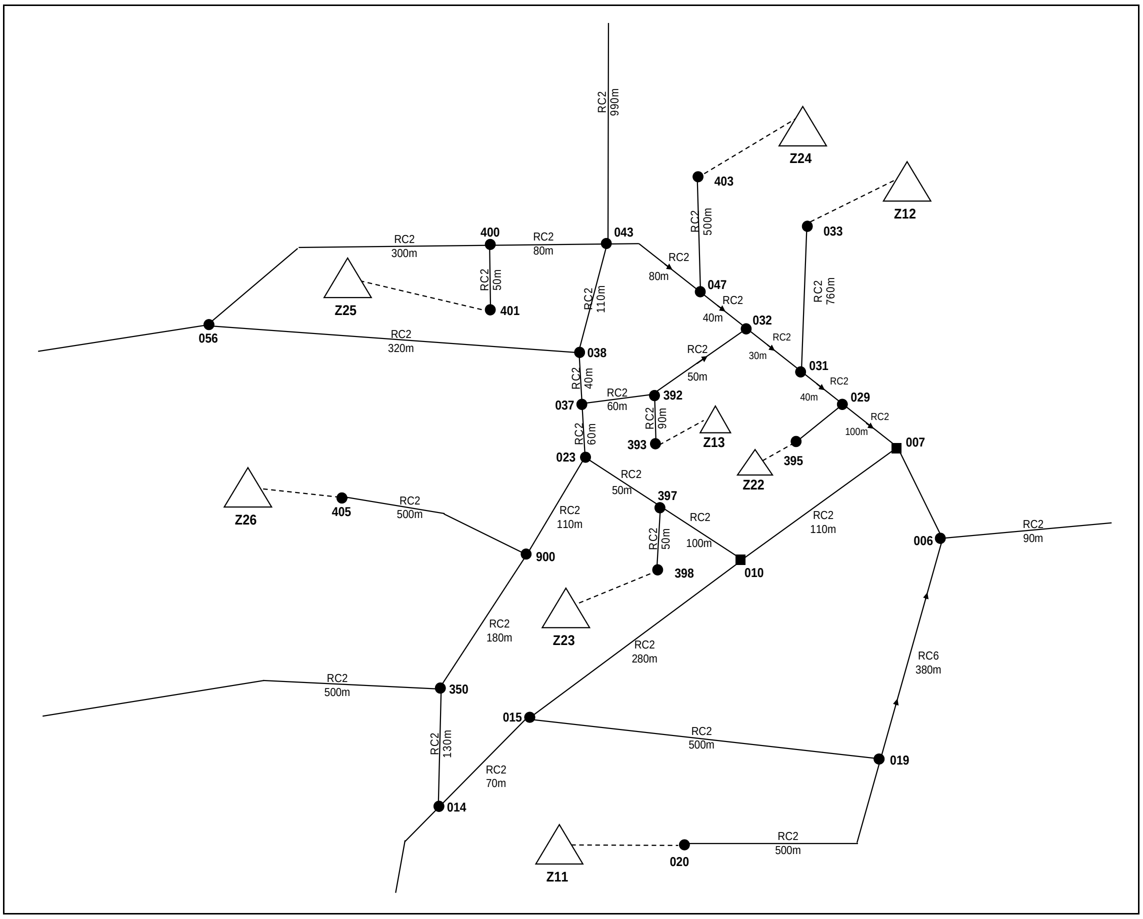

Figure B.2 : NESA Diagram – Base Town Centre (Detail)

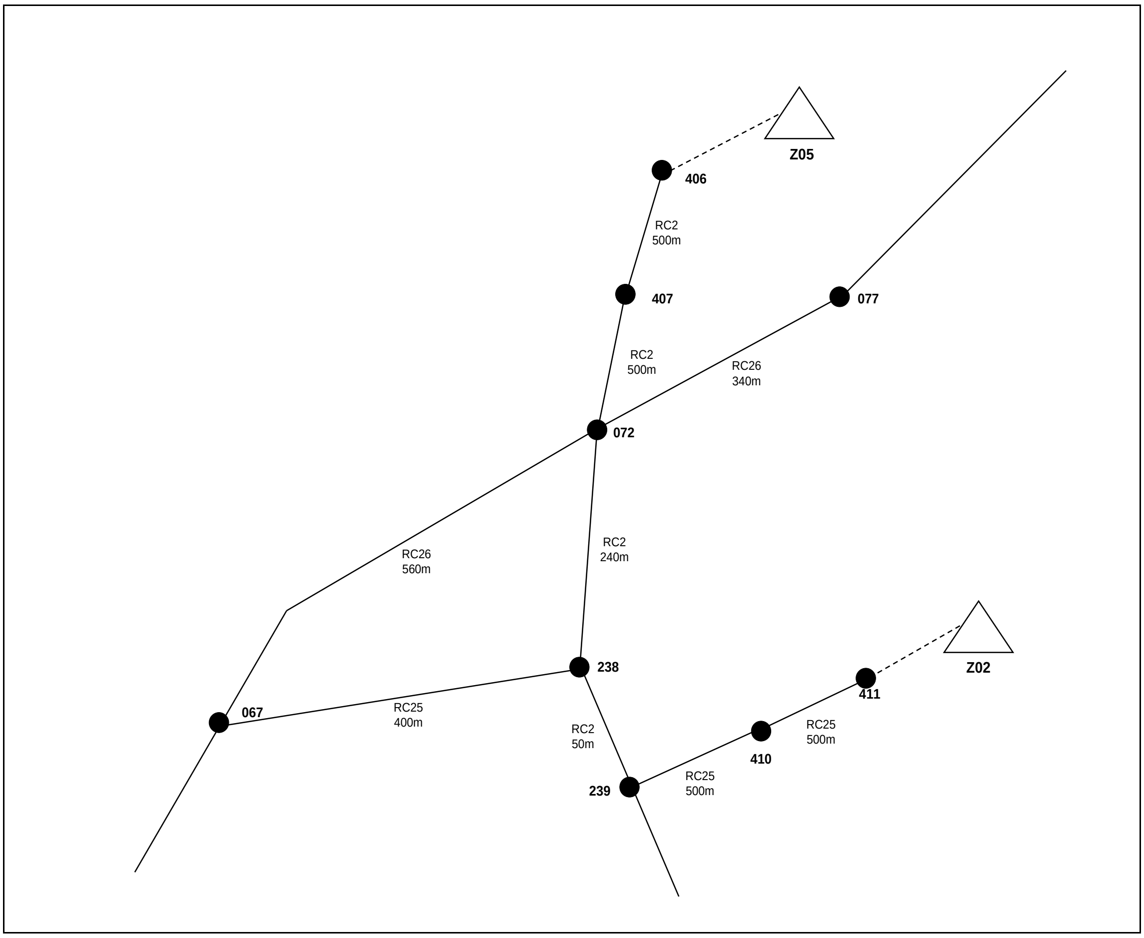

Figure B.3 : NESA Diagram – Base Highfields (Detail)

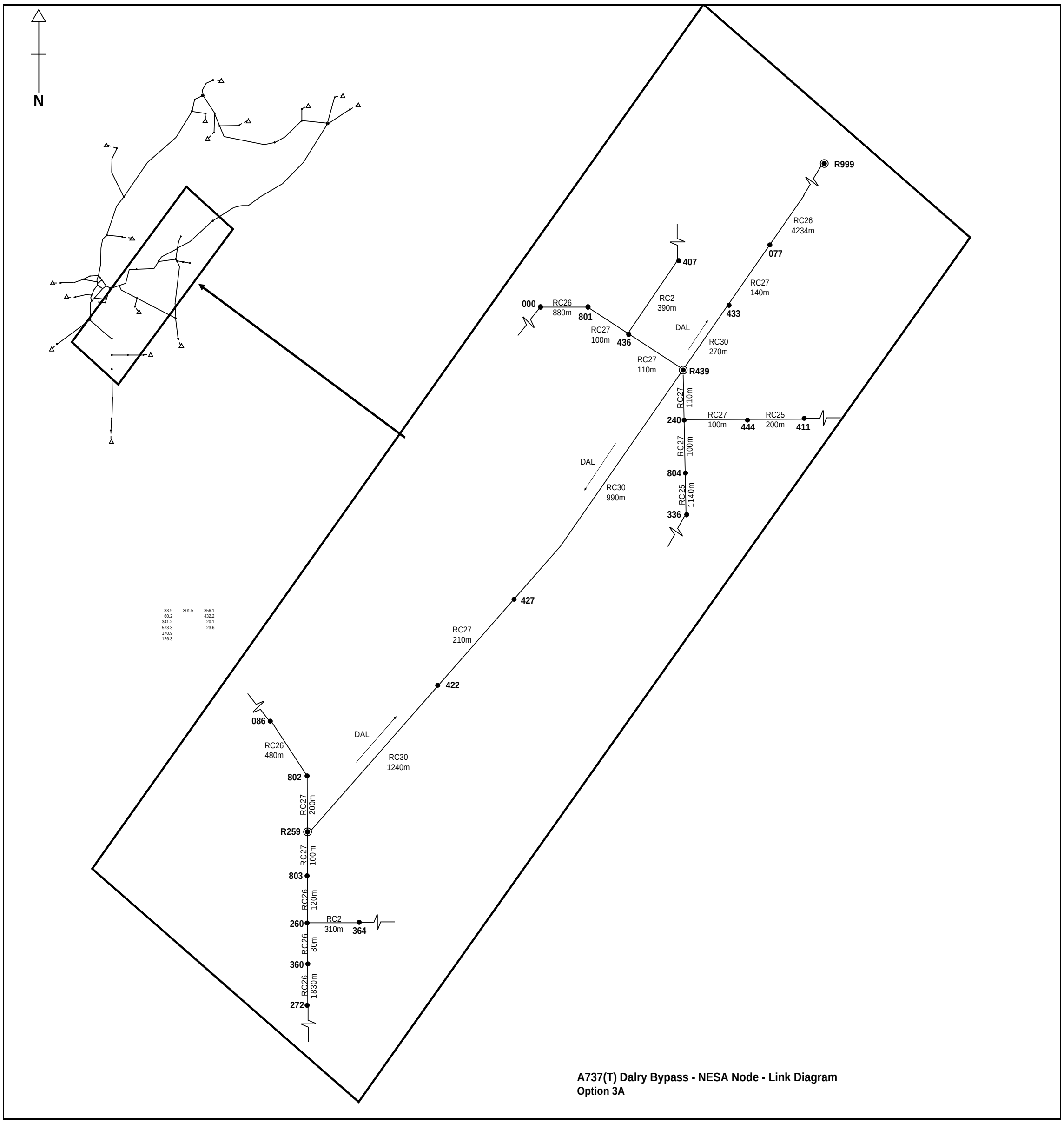

Figure B.4 : NESA Diagram – Bypass

C MAINTENANCE SCHEDULE

Table C.1 : Dalry Bypass Maintenance Schedule

A737 Dalry - Do Minimum Maintenance Forecast Road Area: 33,914

	Year	Description of Works	Duration of Works	Rate (2007) (m^2)	Rate (2013) (m^2)	Area (m^2)	Cost
Existing A75 Maintenance 'Do-minimum' scenario	2013	50% Reconstruction / 50% 100mm structural Inlay	8 weeks convoy working	-	£72.45	16,957	£1,228,535
	2027	50mm structural Inlay	4 weeks convoy working	-	£13.13	33,914	£445,291
	2041	50% Reconstruction / 50% 100mm structural Inlay	8 weeks convoy working	-	£72.45	16,957	£1,228,535
	2053	50% Reconstruction / 50% 100mm structural Inlay	10 weeks convoy working	-	£72.45	16,957	£1,228,535
	2063	50mm structural Inlay	4 weeks convoy working	-	£13.13	33,914	£445,291
	2073	100mm structural Inlay	6 weeks	-	£25.68	33,914	£870,912
							£5,447,097

A737 Dalry Bypass - Preferred Option Maintenance Forecast Road Area: 53,745
An increase of: 58

	Year	Description of Works	Duration of Works	Rate (2007) (m^2)	Rate (2013) (m^2)	Area (m^2)	Cost
Preferred Option Maintenance 'Do something' scenario	2013	Opening Year	-	-		-	-
	2028	40mm inlay	5 weeks	£9.96	£11.57	53,475	£618,894
	2038	50mm overlay	8 weeks convoy working	£8.80	£10.23	53,475	£546,814
	2048	Local patching (10%)	4 weeks convoy working	£10.00	£11.62	5,375	£62,452
	2053	Full Reconstruction	12 weeks convoy working or use alternative route	£51.05	£59.32	53,475	£3,172,142
	2068	40mm inlay	5 weeks	£9.96	£11.57	53,475	£618,894
	2073	-	-	-		-	-
							£5,019,196

* adjusted by RPIX inflation rate from Aug 2007 - Feb 2013 Precentage Increase: 16.2 %