



Annex A

A96 BUSINESS CASE SUPPORT WIDER IMPACTS CALCULATIONS

LATIS Lot 3 Project Note 11

Prepared for Transport Scotland

Prepared by

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Abbreviations

Abbreviation	Meaning
DELTA	Land-use/economic modelling package developed by DSC
DfT	Department for Transport
DSC	David Simmonds Consultancy Limited
GDP	gross domestic product
TEE	Transport Economic Efficiency [appraisal], ie standard cost-benefit analysis of transport schemes
TELMoS	Transport/Economic/Land-use Model of Scotland
TMfS	Transport Model for Scotland
REM	Regional Economic Model (within TELMoS)
STAG	Scottish Transport Appraisal Guidance
WEBS	Wider Economic Benefits
WebTAG	DfT's web-based Transport Appraisal Guidance

1 INTRODUCTION

1.1 Context

1.1.1 Task Order A8148965 requires David Simmonds Consultancy (DSC) to undertake the following tasks:

- the creation of a revised Do-Minimum case for the period 2027-2037;
- running five do something tests based on 2032 costs provided by Jacobs
- Wider Economic Impact (WEI) calculations; and
- preparation of inputs for the main Strategic Business Case report: This report has included the tables and figures identified by Jacobs in emails received on 21st March.

1.1.2 This note describes the approach used in calculating the Wider Impacts of the five options in the A96 Support and presents the results which include tables and graphs for Employment, GVA, Population and the Wider Economic Benefits.

1.1.3 A new reference case has been created with new Do Minimum costs in 2032 and 2037. This is described as the Do-Minimum case. The options will be compared against it.

1.1.4 The five options are:

- Test CS = Option 4 - Targeted Trunk Road Improvements and New (Single Carriageway) Bypasses on A96, referred to as HSiN;
- Test CT = Option 2: Rail service enhancements to allow a 15 minute frequency into both cities during peak periods with a 30 minute frequency for services into both cities, referred to as RCom;
- Test CU = Option 6 - A96 Full Dualling, Referred to as Hdual;
- Test CV = Option 5 - Dual Carriageway Bypasses and Dualling of Heavily Trafficked Sections of the A96 plus Targeted Trunk Road Improvements, referred to as OPT 5; and
- Test CW = Option 1 - Rail Enhancements / Rolling Stock Improvements to Provide an End-To-End Travel Time of Around 1hr 45mins; referred to as R145 in the reporting of outputs.

1.1.5 There were no changes made to the land-use model inputs as part of this exercise. All land-use model runs had the same assumptions on economic and demographic growth and identical planning policy inputs. Only the transport model assumptions (as described above) varied between the tests.

1.1.6 The analysis reported in this note compares the land use model outputs from the reference case and each of the option runs; the difference in outputs between the

reference case and each option will be the result of the changes made within the transport model.

1.2 Structure of the note

1.2.1 This Note reports on

- The Wider Economic Impacts (definitions and calculations) – Section 2
- The Methods Adopted – Section 3
- The presentation of Results – Section 4
- Conclusion – Section 5.

2 THE CALCULATION OF WIDER ECONOMIC BENEFITS

2.1 Background

2.1.1 The Department for Transport's WebTAG Unit 2.8 explains that in the presence of imperfect markets, wider impacts are not estimated as part of transport user benefits and must therefore be estimated separately. They provide guidance on how to appraise the wider impacts including:

- agglomeration (WB1)
- more (or less) people working (GP1); and
- the move to more (or less) productive jobs (GP3).

2.1.2 (The identifiers WB1 etc are those originally used by DfT, and differ slightly from current WebTAG terms.)

2.1.3 The term agglomeration refers to the concentration of economic activity within an area. In turn, this may affect the levels of productivity of firms and workers in the area. Changes in accessibility within an area can influence the level of agglomeration. The WEBs estimation calculates the impact of transport on agglomeration and the subsequent effect on the economy in money units.

2.1.4 More people in work are a result of the costs and benefits that are impacted on individuals by transportation. The cost of travel affects decisions on whether or not to work. Changes in transport costs may affect the overall labour supply in the economy. The WEB calculation estimates the extent to which these changes in labour supply affect the economy in GDP terms.

2.1.5 Finally the move to more productive jobs relates to the influence that, transport and accessibility have on location decisions of firms and employees. This impact is based upon the premise that employers are often more or less productive in different locations and that employment trends in different areas will therefore have implications for productivity. The extent to which workers are employed in their most productive uses, in high productive jobs, will ultimately affect the economy. The resulting benefits in GDP terms of moves to more productive jobs are estimated in the WEBs computation.

2.2 Other information of Wider Impacts

2.2.1 GP1 and GP3 in our work have the same meanings as in the original Department for Transport (2005) paper which introduced the present kinds of wider benefits.

2.2.2 It classified benefits into

- “GP” benefits which contribute to GDP (the impact on national accounts, if it could be identified, would show that were better off as a results of implementing the scheme) and
 - “WB” benefits which contribute to welfare (people would say they were better off if they could directly compare the with-scheme against the without-scheme situation)
- 2.2.3 Some of the individual measures can be counted in both categories; others can be counted in one but not the other; and others appear fully in one and partly in the other.
- 2.2.4 GP1, (the gain in GDP due to "increase in labour force participation") and GP3 (the increase in labour productivity due to the relocation of jobs to higher-productivity locations) are both counted primarily as changes in GDP. Neither appears directly in the WB benefits as originally specified by DfT, because it was assumed that any welfare benefits to the individuals affected were already captured in the conventional (TEE) transport appraisal.
- 2.2.5 However, any such benefits to the individual are based on incomes after tax (eg if someone travels further to get to a better-paying job, it is because they expect to be better off after tax). The extra taxes paid by people who decide to work, or to take more productive jobs, because of the scheme, count as welfare gains, if only because they could reduce the amount of tax that other people have to pay. So the DfT specification is that a proportion of GP1 and GP3, representing the extra "tax take" from the additional people in work and from the people who've moved to more productive (higher-paying) jobs, is calculated and counted as WB4.
- 2.2.6 The average tax rate is defined as 30% (in TAG unit A2.1) so WB4 is 30% of the sum of GP1 and GP3.
- 2.2.7 WB3 is completely separate: this is increased output in imperfectly competitive markets. DfT guidance is to calculate this as an extra 10% of the conventional benefits in terms of time savings and reliability benefits for business travel (including goods movement). This is best calculated from the time/reliability benefits by purpose in the transport appraisal, so whilst it's part of the wider benefits we do not calculate it in the DELTA WEBs programs.
- 2.2.8 The DfT approach to “moves to more productive jobs” is focussed on forecasting the national effect, which in this context seems to mean the net effect on the economy of GB. All job moves are treated as if they were moves from or to a hypothetical areas of average productivity. The results is that increased jobs in an area of blow average productivity appear as negative benefits and a decrease in jobs in such an area appears as positive benefits.
- 2.2.9 We find it more informative (and more intuitive) to look at the overall change in GVA by area that results from changes in job location. In this GP3 version (used for the 5 options), we have multiplied the change in jobs by the productivity (GVA per jobs) in that area. This means that any area which gains jobs will show a positive GP3 benefit, and any area which loses jobs will show a negative. The net benefit to Scotland is the same as in the standard calculation. The numbers by area are much larger but easier to explain. The size of the numbers is due to significant

job relocation and very high values of GVA/job (somewhere around £70,000/year) in 2037.

- 2.2.10 In the GP3 version used for the A96 support as described above, we have only added the value 1 to the DfT Productivity Index for the Scottish districts thereby assuming that the average productivity index is 1 rather than 0.
- 2.2.11 The DfT relative productivity of the districts to the average is there not disturbed in any way.

3 METHODS

3.1 Overview

- 3.1.1 A full description for calculating wider economic impacts is contained in Project Note 8 (Transport Scotland document A6370484).
- 3.1.2 In this note we report upon the calculation of the following wider economic impacts:
- agglomeration (W11);
 - more (or less) people working (GP1); and
 - the move to more (or less) productive jobs (GP3).
- 3.1.3 For this Task we have used the logsum approach in calculating the weighted generalised costs.
- 3.1.4 The weighted costs have been used to calculate the benefits for the transport years 2032 and 2037.
- 3.1.5 These benefits have been interpolated between these 2 years (2032, 2037) and extrapolated beyond 2037.
- 3.1.6 The Net Present Benefits are then calculated on each of the Wider Impacts by discounting over a 60 year period from 2032 to 2091.

3.2 Preparing generalised costs for WEBs calculations

- 3.2.1 This approach uses the logsum averaging of generalised costs over modes which is routinely produced as part of TELMoS itself. The calculations are carried out by the DELTA package AC12 program and the outputs – the logsum average generalised cost between each pair of zones (including intrazonals) for each purpose and car-ownership level – is written to file GENC<>>.DAT for each year of each test.
- 3.2.2 For the GP1 (more people in work) calculations, the input file PRPW<>>.csv was prepared by reformatting the GENC<>>.DAT outputs for purpose “commuting”, and car ownership level 2 (one car).
- 3.2.3 For the W11 (agglomeration) calculations, the input file PRPE<year><test>.csv was produced by reformatting the GENC<>>.DAT outputs for purpose “business travel” and car ownership level 3 (2+ cars) (on the assumption that business travellers have a high level of car availability).
- 3.2.4 For both PRPW and PRPE files, the logsum average generalised cost calculated by AC12 is based on

- the generalised costs for car and public transport received from the transport model,
- the generalised costs for walking calculated (from distances) within TELMoS, and
- the coefficients which TELMoS uses to represent expected mode choice in its accessibility calculations.

3.2.5 Note that the logsum average is not affected by the numbers of trips using the modelled modes; it is worked out strictly from the generalised costs and the coefficients. The logsum average represents the “expected average generalised cost” given the generalised cost of each mode and the sensitivity to generalised cost differences which is implied by the coefficients. It has the characteristics that

- if one mode is much better than the other two, the “expected average generalised cost” will be equal to the generalised cost for that mode – since the model will implicitly forecast that everyone will choose that mode;
- if two modes are comparably good and better than the third, or if all three are comparably good, the “expected average generalised cost” will be somewhat better (less) than the minimum generalised cost among those good modes. This is because the model implicitly assumes that in such a case, other characteristics not represented in generalised cost will come into play (eg better opportunities to work/drink/sleep on the train, or greater freedom to stop along the way in a car) which will for each traveller result in a slightly better outcome than the generalised cost itself would indicate;
- an improvement in any one of three modes will always produce an improvement in the “expected average” providing it is of some relevance. (An irrelevant improvement, such as 10 minute improvement in the walking time from Aberdeen to Glasgow, will have no effect at all.) This is not always the case with a trip-weighted average, where an improvement in an inferior mode can lead to an increase in the average cost because it increases the weight (the number of trips) on the mode with the higher cost.

3.3 Calculating Net Present Values

3.3.1 The Agglomeration (WB1), More people in Work (GP1) and moves to more productive jobs (GP3) benefits are interpolated between the year of scheme implementation 2032 and the model future transport year 2037.

3.3.2 A 2% growth index is applied in the extrapolation of the 2037 benefits for the years beyond 2037

3.3.3 A discount rate of 3.5% is used to discount the benefits up till 2039. A discount rate of 3.0% is used for years 2040 and beyond.

3.3.4 The conversion from average to marginal productivity means that the GP1 results need to be multiplied by a parameter that “captures the lower productivity of new entrants to the labour force”, specified by DfT at 0.69.

3.3.5 The benefits are summed over the 60 year period from year of implementation 2032.

4 RESULTS

4.1 Overview

4.1.1 Wider Economic Benefits have been calculated for the following five packages:

- Option 1 - Rail Enhancements / Rolling Stock Improvements to Provide an End-To-End Travel Time of Around 1hr 45mins; referred to as R145 in the reporting of outputs;
- Option 2: Rail service enhancements to allow a 15 minute frequency into both cities during peak periods with a 30 minute frequency for services into both cities; referred to as RCom;
- Option 4 - Targeted Trunk Road Improvements and New (Single Carriageway) Bypasses on A96; referred to as HSin;
- Option 5 - Dual Carriageway Bypasses and Dualling of Heavily Trafficked Sections of the A96 plus Targeted Trunk Road Improvements; referred to as OPT 5;
- Option 6 - A96 Full Dualling. Referred to as Hdual.

4.1.2 In each case the benefits are calculated relative to the “do minimum”.

4.1.3 Five model runs were undertaken of TMfS12 and TELMoS12. These are summarised in Table 4.1. For each scheme one test was run.

Table 4-1 Summary of test runs

Test Code for TELMoS:12 test	Title	Details of Model run post 2032
CY	Do-Minimum	-TMfS run in 2032 with 'Do-minimum schemes -TELMoS run 2033-2037
DA	HSin	-TMfS run in 2032 with HSin option -TELMoS run 2033-2037
DC	RCom	-TMfS run in 2032 with RCom option -TELMoS run 2033-2037
CZ	HDual	-TMfS run in 2032 with HDual option -TELMoS run 2033-2037
DB	Opt5	-TMfS run in 2032 with the OPT5 option -TELMoS run 2033-2037

Test Code for TELMoS:12 test	Title	Details of Model run post 2032
DD	R145	-TMfS run in 2032 with R145 option -TELMoS run 2033-2037

4.1.4 The results are presented in tables below. The column headings are:

- WB1 – the agglomeration benefits
- GP1 - the impact of more people in work on GDP
- MPIW – the increase in people in work
- GP3 – the impact of move to more productive jobs.

4.1.5 With the exception of the MPIW data, all the data in table are in £ (pounds) and undiscounted.

4.1.6 Note that

- In the tables, the GP1 results are gross values, assuming that the marginal workers drawn into employment are of average productivity and counting their production in full; however in the NPV calculations the GP1 values have been factored by a ratio 0.69.
- the GP3 results are likewise gross values, counting the extra production in full.

4.2 Presentation of results

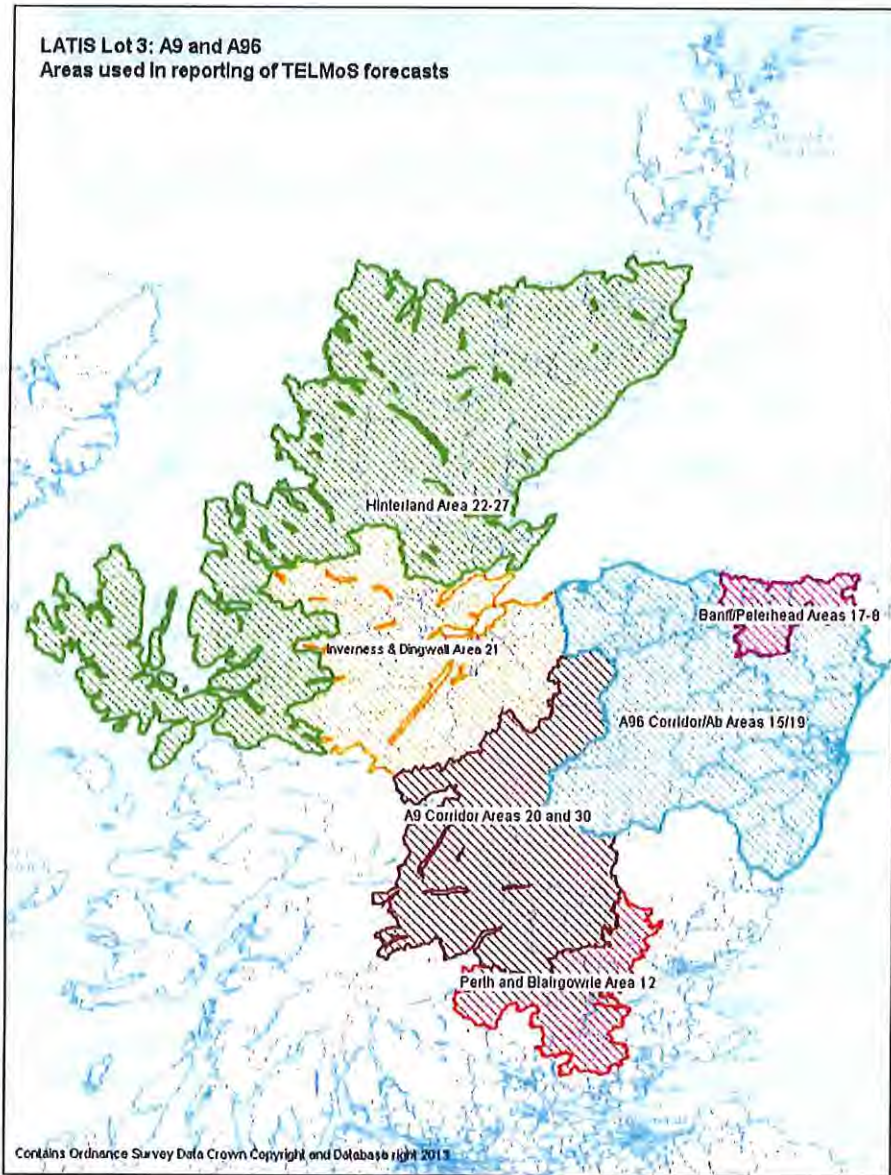
4.2.1 The WEB programs, described above, have been run in the forecast years when the transport model was run (ie 2027, 2032 and 2037). The benefits for intermediate years have been interpolated based on the transport-year calculation of benefits.

4.2.2 The reporting focuses upon a similar aggregation of DELTA Areas to that used in reporting the land use impacts of the three model runs in Project Note 5. To re-cap, these are:

- Inverness and Dingwall (Area 21)
- Perth and Blairgowrie (Area 12)
- Areas along the route of the A96 (Area 15)
- Aberdeen: (Area 19)
- Areas forming Inverness' hinterland: Areas 22 to 27
- Other Areas in proximity to the A96: Areas 17 and 18

4.2.3 These areas are shown in Figure 4-1.

Figure 4-1 TELMoS Areas



4.3 Accessibility Outputs

- 4.3.1 The accessibility changes resulting from the options are mapped to illustrate the areas which have improved accessibilities. The mapped accessibilities are origin accessibility measures weighted by manual and non-manual workers in car owning households.
- 4.3.2 As expected the single carriage way improvements and the Commuter rail investments are having improved accessibility in the A96 corridor and the Aberdeen areas.
- 4.3.3 The A96 dualling and the Option 5 have very high accessibility improvements in the A96 corridor (Moray) and the Aberdeen Areas. There is also a very significant improvement in connectivity to the highlands resulting from the options

- 4.3.4 The R145 performs relatively poorly in terms of connectivity to the northern parts of Scotland.
- 4.3.5 The figures 4.2 to 4.6 below represent the spatial distribution of change in origin accessibility weighted by Manual and Non-Manual workers in one car and two plus car households in 2037.

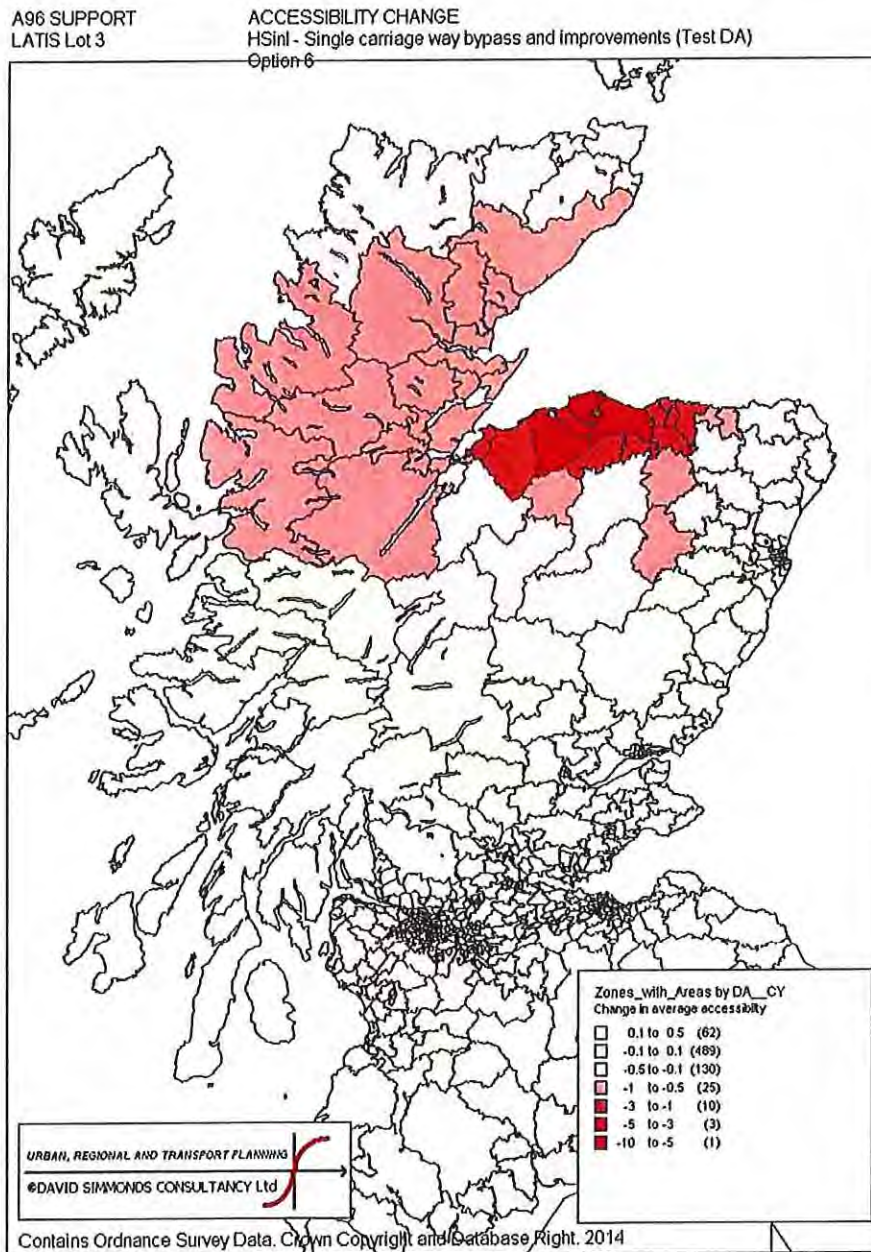


Figure 4-2 Change in weighted accessibility for origin zones in the Single carriage way improvement (HSin) option

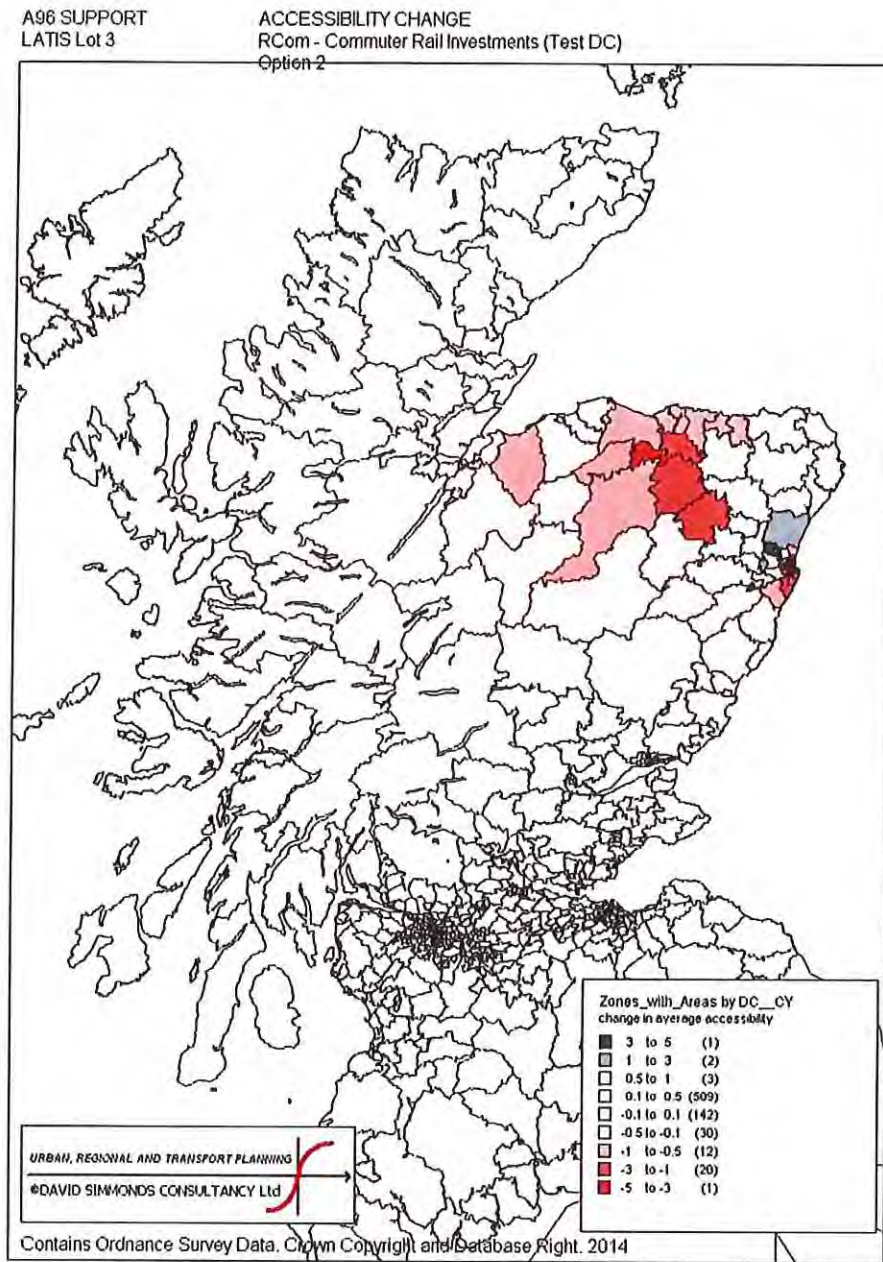


Figure 4-3 Change in weighted accessibility for origin zones in the Commuter rail improvement (RCom) option

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ACCESSIBILITY CHANGE
Hdual - A96 Full Dualling (Test CZ)
Option 6

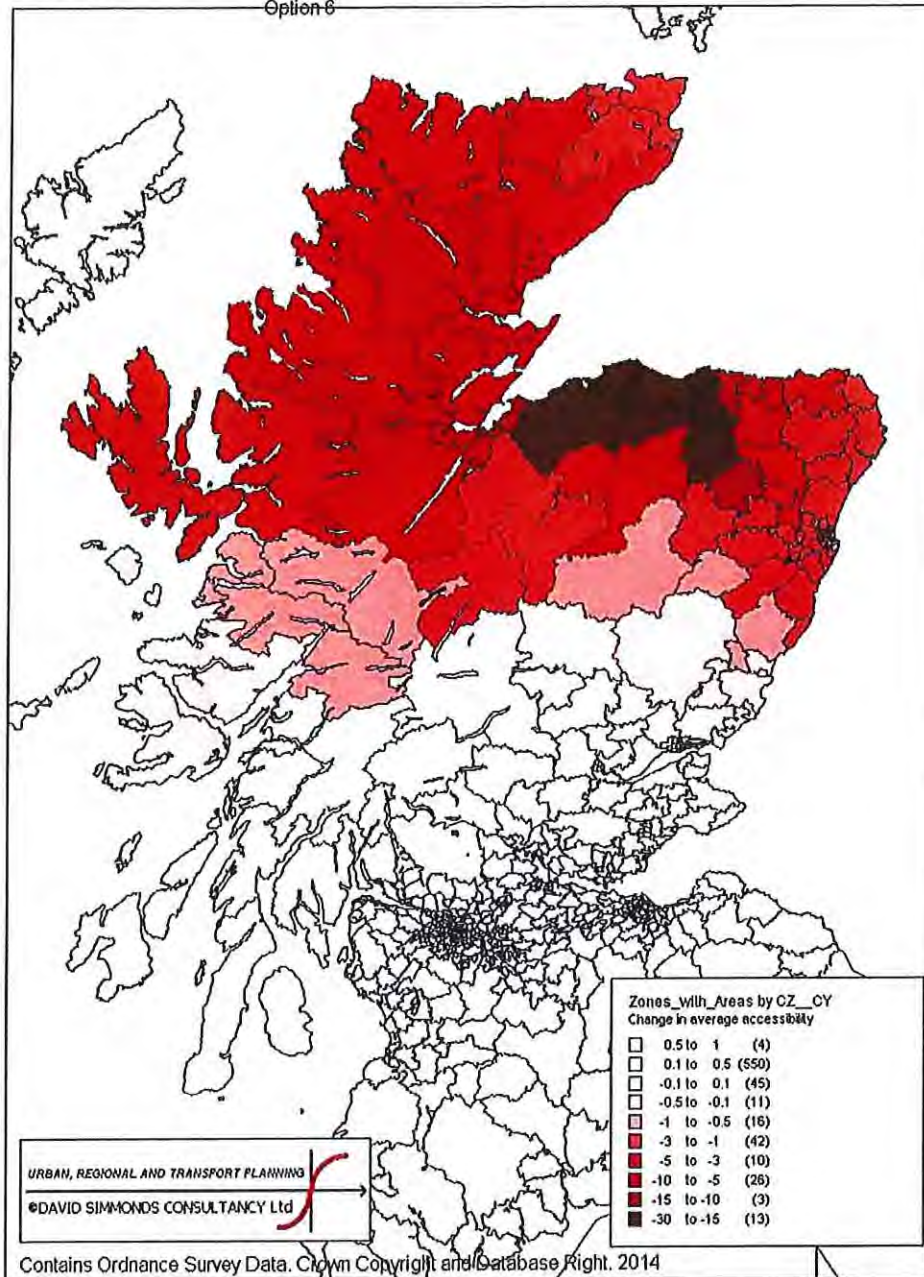


Figure 4-4: Change in weighted accessibility for origin zones in A96 Dualling (HDual)

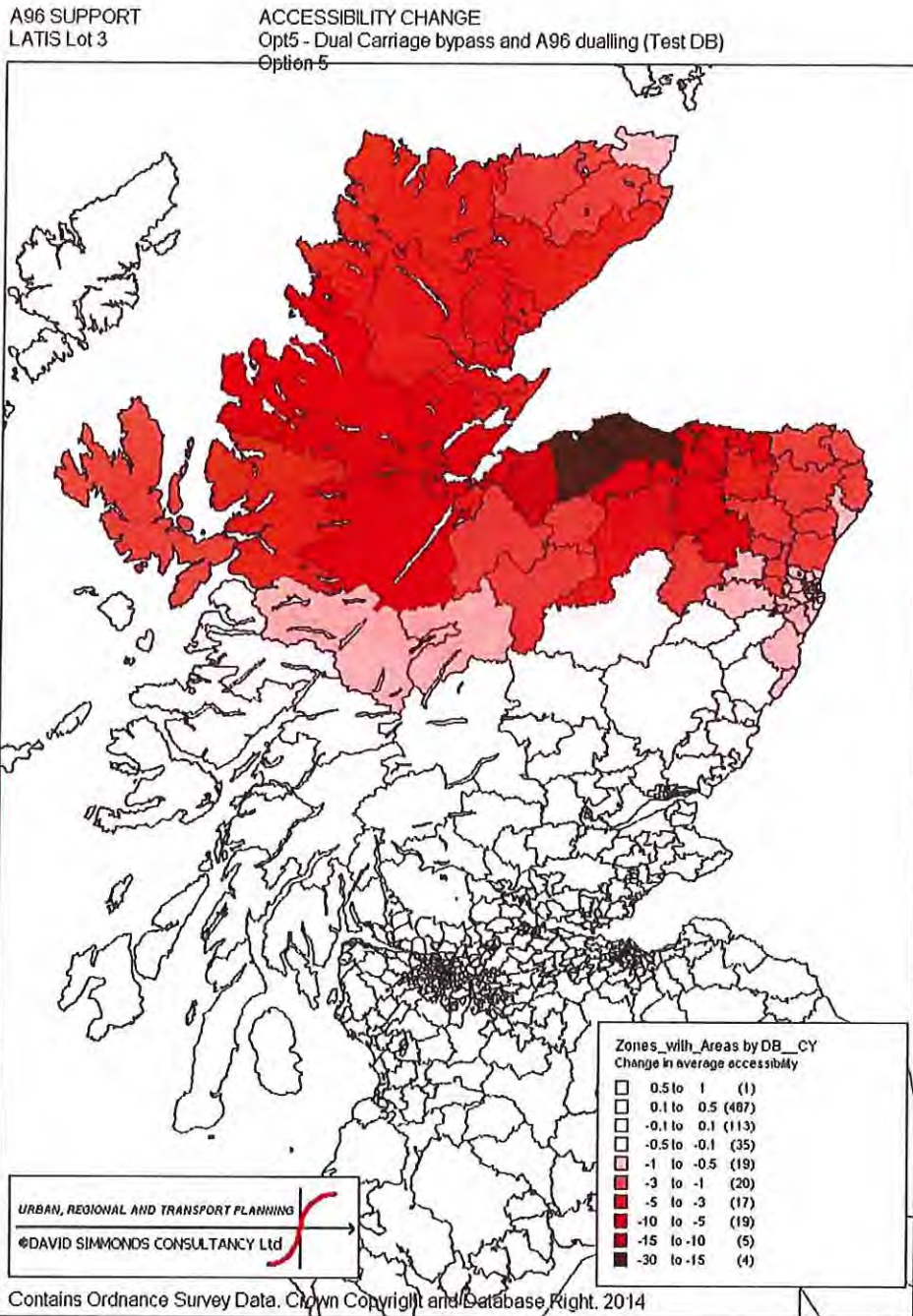


Figure 4-5: Change in weighted accessibility for origin zones in Option 5

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ACCESSIBILITY CHANGE
R145 - Rail Enhancements / Rolling Stock Improvements (Test DD)
Option 1

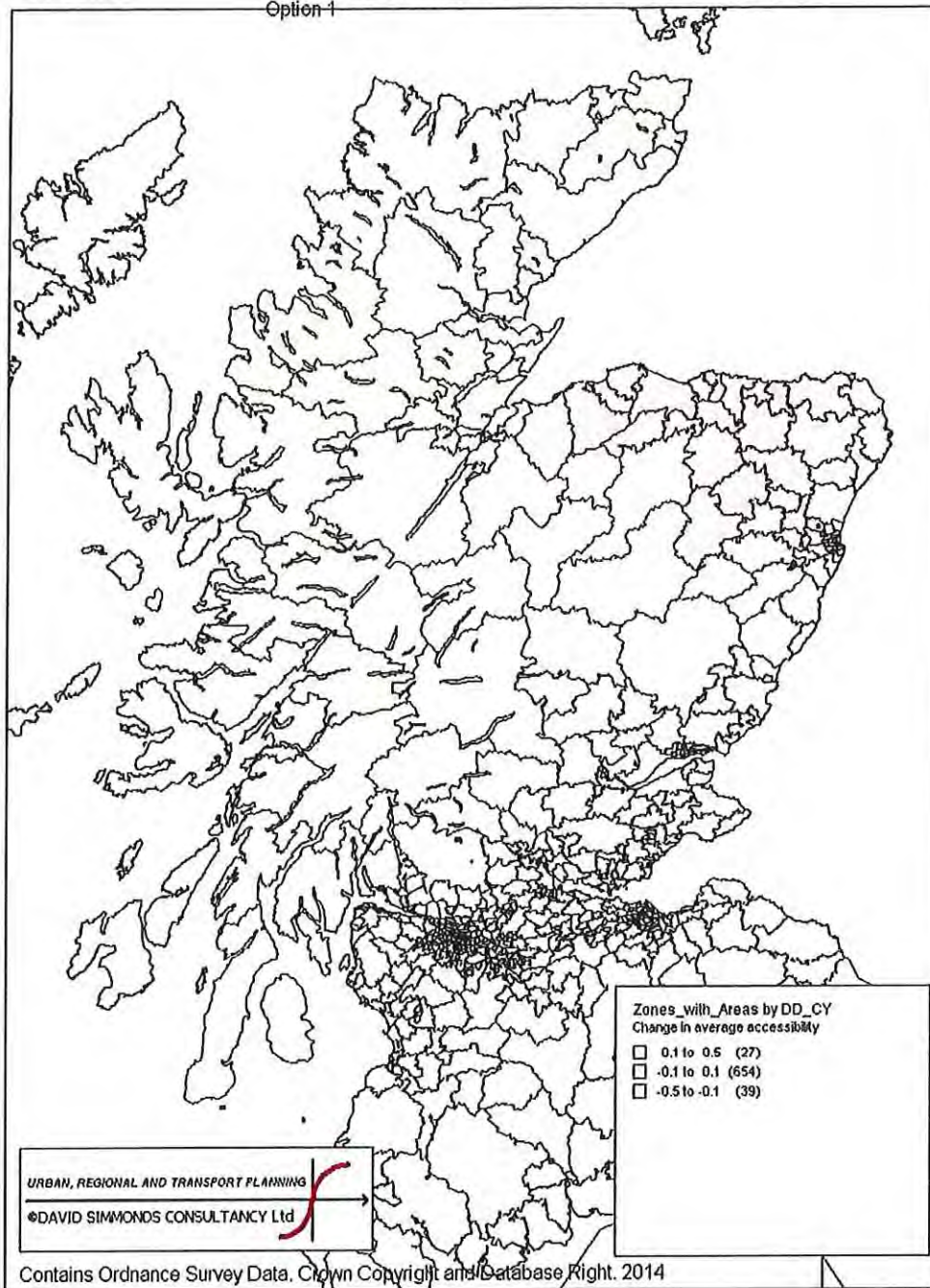


Figure 4-6: Change in weighted accessibility for origin zones in Option 1 (R145)

4.4 Employment

- 4.4.1 The impacts of the options on employment within the five areas are presented in tables and graphs.
- 4.4.2 The single carriage way option HSin results in a 2.90% increase in employment by 2037 in the A96 corridor (Moray), DELTA Area 19. This is the area with the highest employment growth. The other Areas reported in this note have relatively no change in jobs.
- 4.4.3 The Commuter rail scheme has the greatest impact upon the Aberdeen Area, where employment grows by about 1.09% by 2037.. The scheme has a relatively insignificant impact on the other areas, with the exception of t Inverness where there is a growth in employment of 0.4%.
- 4.4.4 The tables in this section represents the Do Minimum employment levels in 2037 and the changes in employment resulting from the five options HSin, RCom, Hdual, Opt5 & R145.
- 4.4.5 The graphs in this section illustrate the patterns of the changes in employment over time from 2032 to 2037 for the 5 areas that are affected by the options.

Area	Do Min - CR	HSin - DA		RCom – DC	
	2037	2037		2037	
Inverness	63,099	-125	-0.20%	257	0.41%
Perth and Blairgowrie	48,480	-40	-0.08%	-96	-0.20%
A96 Corridor - Moray (area 19)	31,252	908	2.90%	-49	-0.16%
Aberdeen (area 15)	251,519	-307	-0.12%	2,738	1.09%
Inverness Hinterland	27,650	-2	-0.01%	-45	-0.16%
Banff and Fraserburgh	14,295	-11	-0.08%	-34	-0.24%

Table 4-2: Employment changes in 2037 for the HSin and RCom tests

- 4.4.6 Table 4-3 presents the employment impacts on the three other options Hdual, OPT5 and R145
- 4.4.7 The Opt 5 and HDual schemes have the largest impact upon employment within the A96 corridor, Moray (Area 19).
- 4.4.8 The Option 5 which models Dual Carriageway Bypasses and Dualling of Heavily Trafficked Sections of the A96 plus Targeted Trunk Road Improvements has employment growth of 9.89% withinin the Moray area.
- 4.4.9 Option 6 models the full dualling of the A96 has the highest impact of all the options. There is a 10.19% growth in employment in the Moray area.

4.4.10 Option 1 models Rail Enhancements / Rolling Stock Improvements. It does not have any significant impact on employment.

Area	Do Min - CY	HDual - CZ		Opt5 - DB		R145 - DD	
	2037	2037		2037		2037	
Inverness	63,099	-97	-0.15%	-151	-0.24%	-140	-0.22%
Perth and Blairgowrie	48,480	-136	-0.28%	-198	-0.41%	-44	-0.09%
A96 Corridor - Moray (area 19)	31,252	3,186	10.19%	3,092	9.89%	34	0.11%
Aberdeen (area 15)	251,519	1,553	0.62%	430	0.17%	204	0.08%
Inverness Hinterland	27,650	-29	-0.11%	-19	-0.07%	1	0.00%
Banff and Fraserburgh	14,295	-69	-0.48%	-58	-0.41%	19	0.13%

Table 4-3: Employment changes in 2037 for the Hdual, Opt5 and R145

4.4.11 The graphs below illustrate the trend over time for the five schemes. The vertical axis represents the differences in absolute growth in jobs and the horizontal axis represents the years.

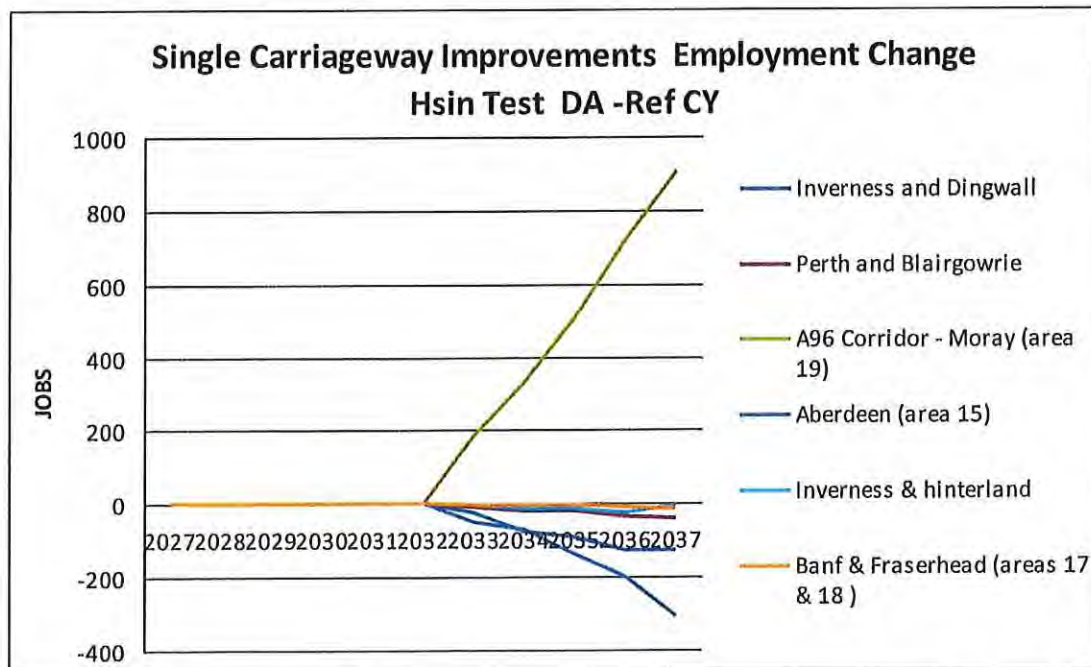


Figure 4-7: The impacts of the single carriage way improvements on jobs from 2032 to 2037

4.4.12 By 2037 the HSin single carriageway improvements (Option 4) which was implemented in 2032 result in an additional 900 jobs in the Moray area. Aberdeen loses about 300 jobs in the same period.

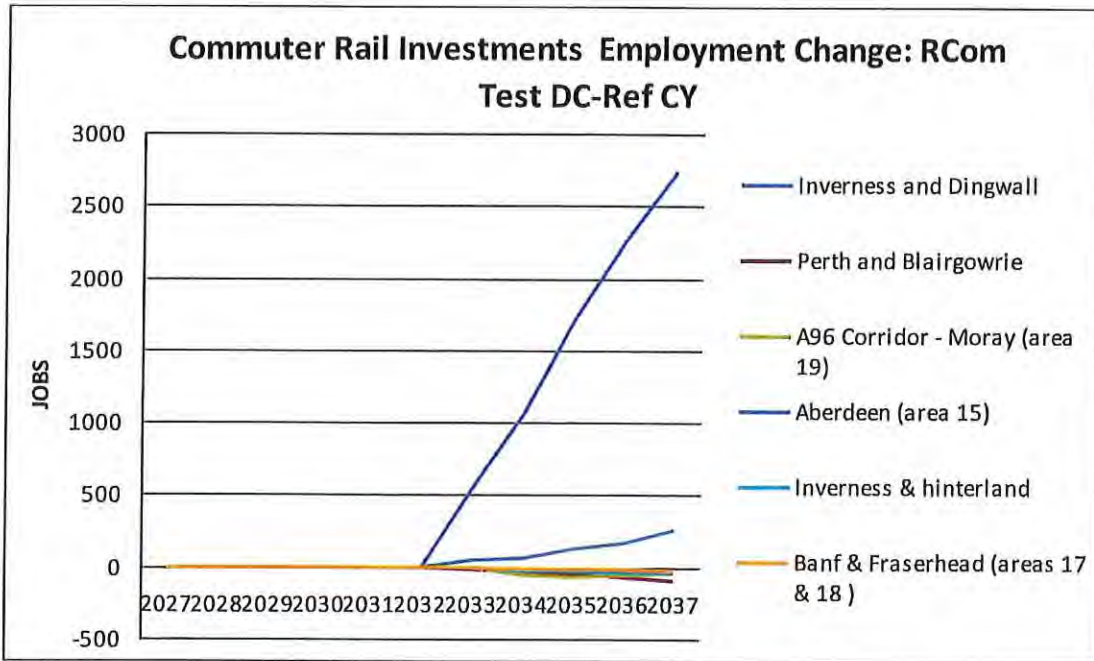


Figure 4-8: The impacts of the commuter rail investments on jobs from 2032 to 2037

4.4.13 The commuter rail investment option results in around an additional 3,000 jobs, in Aberdeen, in the period from 2032 to 2037. Inverness gains around 250 jobs in the same period. All the other areas are not significantly affected.

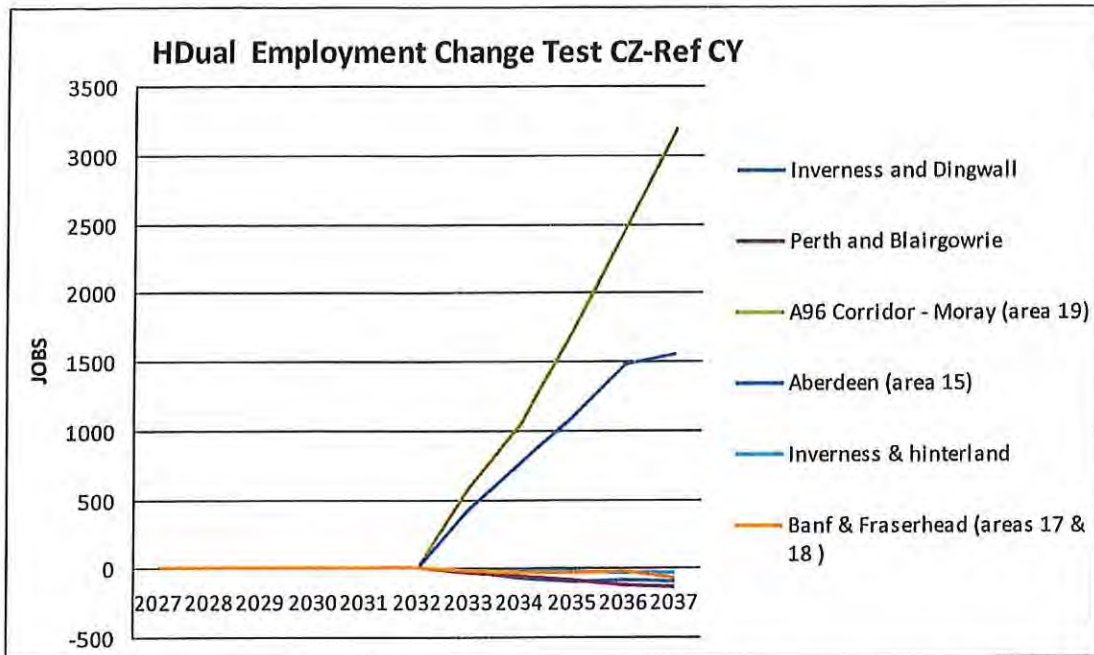


Figure 4-9: The impacts of the Option 6 - A96 Full Dualling on jobs from 2032 to 2037

4.4.14 The A96 full dualling (HDual) had a significant impact on employment in the Moray area. Moray gains slightly above 3,000 jobs by 2037 while the Aberdeen Area gains about 1,500 jobs in the same period from 2032 to 2037

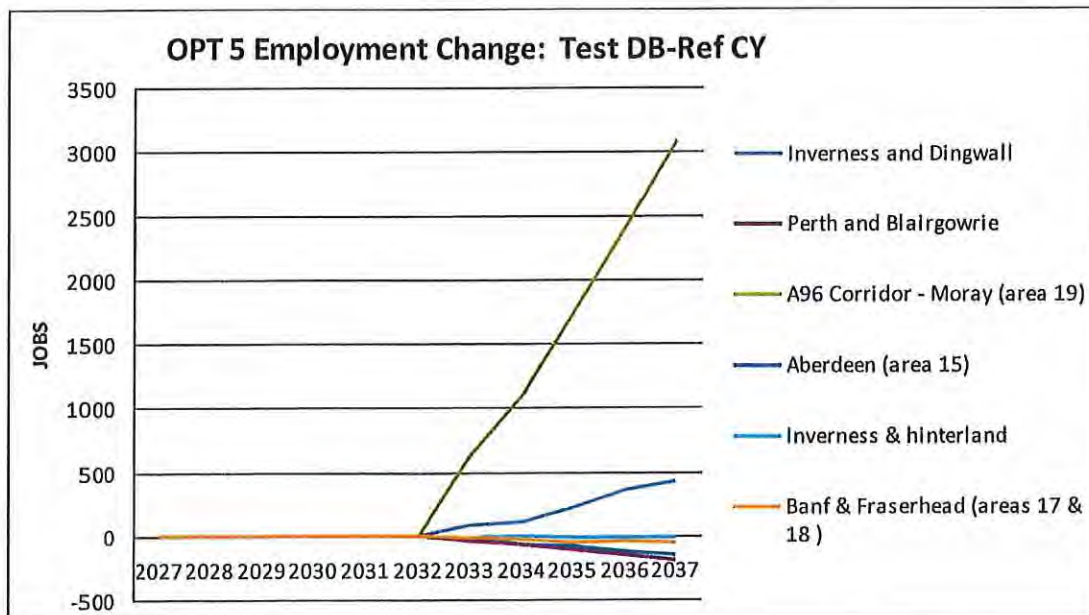


Figure 4-10: The impacts of the Option 5 on jobs from 2032 to 2037

4.4.15 The Option 5 improvements have a significant impact on employment in the Moray area. Moray gains slightly above 3,000 jobs by 2037 while the Aberdeen gains just under 500 jobs in the same period from 2032 to 2037.

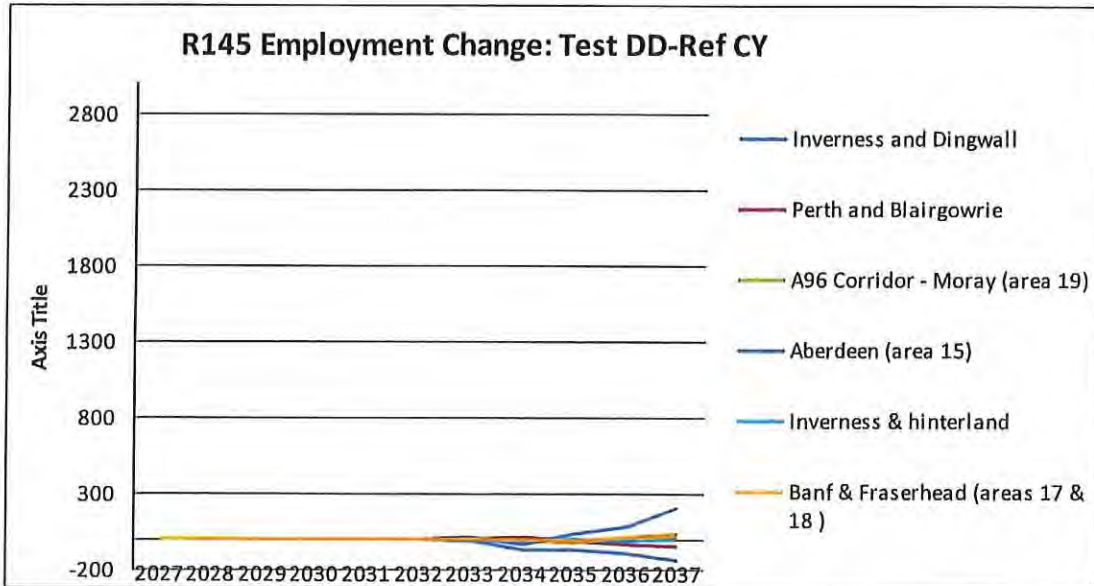


Figure 4-11: 1 – The impacts of the Option 1 - Rail Enhancements / Rolling Stock Improvements on jobs from 2032 to 2037

4.4.16 Option 1 has had relatively low impacts on employment in the study areas. The highest impact, in Aberdeen, is just under 300 jobs by 2037.

4.5 GVA outputs

4.5.1 The GVA impacts resulting from the five options are represented in the tables below.

4.5.2 The single carriage way option has the largest impact within the A96 corridor (Moray), where GVA grows by 1.63% by 2037

4.5.3 The Commuter rail investment has the largest impact within the Aberdeen area, where GVA grows by 0.73% by 2037.

Area	Do Min - CY	HSin - DA		RCom - DC	
	2037	2037		2037	
Inverness	3,898.9	-3.6	-0.09%	15.3	0.39%
Perth and Blairgowrie	2,920.1	-2.1	-0.07%	-4.3	-0.15%
A96 Corridor - Moray (area 19)	2,116.7	34.4	1.63%	-9.7	-0.46%

Aberdeen (area 15)	16,067.0	-14.0	-0.09%	117.0	0.73%
Inverness Hinterland	1,821.6	1.2	0.06%	-2.7	-0.15%
Banff and Fraserburgh	1,006.7	-0.8	-0.07%	-2.6	-0.26%

Table 4-4: GVA impacts in 2037 for RCom & HSin options (£millions)

- 4.5.4 Table 4.5 shows the GVA impacts for the other 3 options, HDual, OPT5 and R145.
- 4.5.5 The option 6 - A96 Full Dualling- impact is greatest in the A96 corridor (Moray), where GVA grows by 3.94% by 2037.
- 4.5.6 The Option 5's impact is greatest in the A96 corridor (Moray) where GVA grows by 5.02% by 2037.
- 4.5.7 The option 1 (R145) has a relatively low impacts on the areas. The highest effects were in the Aberdeen, Banf and Fraserburgh areas where GVA increases of under 0.2% are forecast, by 2037.

Area	Do Min - CY	HDual - CZ		Opt5 - DB		R1455 - DD	
	2037	2037		2037		2037	
Inverness	3,898.9	-5.8	-0.15%	4.7	0.12%	-7.7	-0.20%
Perth and Blairgowrie	2,920.1	-5.3	-0.18%	-8.5	-0.29%	-3.3	-0.11%
A96 Corridor - Moray (area 19)	2,116.7	83.5	3.94%	106.3	5.02%	1.7	0.08%
Aberdeen (area 15)	16,067.0	102.0	0.63%	32.0	0.20%	27.0	0.17%
Inverness Hinterland	1,821.6	0.3	0.01%	1.1	0.06%	0.7	0.04%
Banff and Fraserburgh	1,006.7	-7.2	-0.71%	-4.3	-0.42%	1.9	0.19%

Table 4-5: GVA impacts in 2037 for HDual, Opt5 & R145 options

4.6 Population outputs

- 4.6.1 The population impacts resulting from the five options are represented in the tables below.
- 4.6.2 The single carriage way option has its highest population impact in the A96 corridor (Moray), where an increase of 0.31% is forecast by 2037.
- 4.6.3 The Commuter rail investment also has its highest population impact in the same area (A96 corridor – Moray). Here the population is forecast to grow by 0.48% by 2037.

Area	Do Min - CY	HSIn - DA		RCom - DC	
	2037	2037		2037	
Inverness	130,914	-50	-0.04%	-21	-0.02%
Perth and Blairgowrie	134,785	13	0.01%	-15	-0.01%
A96 Corridor - Moray (area 19)	101,140	315	0.31%	485	0.48%
Aberdeen (area 15)	433,407	-187	-0.04%	-142	-0.03%
Inverness Hinterland	89,666	45	0.05%	17	0.02%
Banff and Fraserburgh	46,260	15	0.03%	17	0.04%

Table 4-6: Population changes in 2037 for HSIn and RCom options

- 4.6.4 The table below shows the impacts on population at the area level for the 3 other options: HDual, Opt5 and R145.
- 4.6.5 The full A96 HDual option results in a 2.36% growth in population by 2037 in the A96 corridor (Moray). This is the greatest population impact of all the options.
- 4.6.6 Option 5's population growth is also greatest in the same area (A96 corridor – Moray). Here growth of 1.49% is forecast by 2037/
- 4.6.7 The option 1 - 1 - Rail Enhancements / Rolling Stock Improvements had only minimal impacts on population.

Area	Do Min - CR	HDual - CU		Opt5 - CV		R145 - CW	
	2037	2037		2037		2037	
Inverness	130,914	108	0.08%	47	0.04%	-36	-0.03%
Perth and Blairgowrie	134,785	-22	-0.02%	4	0.00%	-17	-0.01%
A96 Corridor - Moray (area 19)	101,140	2,385	2.36%	1,504	1.49%	70	0.07%
Aberdeen (area 15)	433,407	-946	-0.22%	-719	-0.17%	46	0.01%
Inverness Hinterland	89,666	-79	-0.09%	-1	0.00%	22	0.02%
Banff and Fraserburgh	46,260	-42	-0.09%	83	0.18%	-4	-0.01%

Table 4-7: Population changes in 2037 for HDual, Opt5 & R145 options

4.7 Wider impacts – outputs

4.7.1 The tables below represents the Wider Impact results for the five options modelled. The headers are described as

- agglomeration benefits (WI1);
- more people into work (GP1);
- moves to more productive work (GP3)
- increase in more people in work (MPIW)

Option 4 - Targeted Trunk Road Improvements and New (Single Carriageway) Bypasses on A96; (HSin)

4.7.2 The benefit from more people in work (GP1) of the Single carriageway improvements is about £548,000 in the A96 area (Moray). The benefit within other Areas is lower.

4.7.3 The agglomeration benefits (WI1) for the A96 corridor (Moray) and the Aberdeen areas are about £250,000 each.

4.7.4 The benefit in the Moves to more productive jobs (GP3) is about £62M by 2037 along the A96 corridor.

		HSin - Test DA				
Inverness and Dingwall		GP1	GP3	MPIW	WI1	Total
	2032	86,815	0	1	136,165	222,980
	2033	98,818	-1,826,313	1	-78,190	-1,805,685
	2034	110,822	-3,652,627	2	-292,545	-3,834,350
	2035	122,825	-5,478,940	2	-506,900	-5,863,014
	2036	134,829	-7,305,254	2	-721,255	-7,891,679
	2037	146,833	-9,131,567	2	-935,609	-9,920,344
Perth and Blairgowrie		GP1	GP3	MPIW	WI1	Total
	2032	25,261	0	0	691,405	716,666
	2033	19,756	-627,477	0	552,966	-54,755
	2034	14,250	-1,254,954	0	414,527	-826,176
	2035	8,745	-1,882,431	0	276,089	-1,597,597
	2036	3,240	-2,509,907	0	137,650	-2,369,018
	2037	-2,265	-3,137,384	0	-789	-3,140,438
A96 Corridor - Moray (area 19)		GP1	GP3	MPIW	WI1	Total
	2032	451,342	0	7	191,625	642,968

		HSin - Test DA				
	2033	470,797	12,406,801	7	204,930	13,082,529
	2034	490,252	24,813,602	7	218,235	25,522,090
	2035	509,707	37,220,404	7	231,540	37,961,651
	2036	529,162	49,627,205	7	244,845	50,401,212
	2037	548,617	62,034,006	7	258,150	62,840,773
	Aberdeen (area 15)	GP1	GP3	MPIW	WI1	Total
	2032	-22,503	0	0	213,270	190,768
	2033	-18,388	-5,056,357	1	219,747	-4,854,998
	2034	-14,273	-10,112,714	3	226,224	-9,900,763
	2035	-10,159	-15,169,071	4	232,701	-14,946,529
	2036	-6,044	-20,225,428	6	239,177	-19,992,294
	2037	-1,930	-25,281,785	7	245,654	-25,038,060
	Inverness & hinterland	GP1	GP3	MPIW	WI1	Total
	2032	231,764	0	3	250,561	482,324
	2033	231,227	-23,625	3	256,757	464,359
	2034	230,689	-47,250	3	262,953	446,393
	2035	230,152	-70,875	3	269,150	428,427
	2036	229,615	-94,500	3	275,346	410,461
	2037	229,078	-118,125	3	281,543	392,495
	Banf & Fraserhead (areas 17 & 18)	GP1	GP3	MPIW	WI1	Total
	2032	-539	0	0	54,955	54,416
	2033	-420	-172,774	0	58,640	-114,554
	2034	-301	-345,549	0	62,325	-283,525
	2035	-182	-518,323	0	66,010	-452,495
	2036	-64	-691,097	0	69,695	-621,466
	2037	55	-863,872	0	73,380	-790,436
	Total Scotland	GP1	GP3	MPIW	WI1	Total
	2032	1,126,391	0	17	1,666,582	2,792,973

	HSin - Test DA				
2033	1,163,146	-3,111,628	17	-1,627,792	-3,576,274
2034	1,199,901	-6,223,256	17	-4,922,166	-9,945,521
2035	1,236,656	-9,334,884	17	-8,216,540	-16,314,768
2036	1,273,411	-12,446,512	18	-11,510,914	-22,684,015
2037	1,310,166	-15,558,140	18	-14,805,288	-29,053,262

Table 4-8: Wider Economic Impacts of the HSin Option

Option 2: Rail service enhancements to allow a 15 minute frequency into both cities during peak periods with a 30 minute frequency for services into both cities. (RCom)

- 4.7.5 The Aberdeen area benefits most through Agglomeration (WI1) from the Commuter rail investment (RCom) option, In 2037 the benefit amounts to around £2.0M. The benefits from more people in work (GP1) are highest in the Aberdeen area.
- 4.7.6 In the RCom option, benefits from Moves to more productive jobs (GP3) are relatively high in the Aberdeen areas where benefits of around £217M are calculated in 2037.

	RCom - Test DC				
Inverness and Dingwall	GP1	GP3	MPIW	WI1	Total
2032	31,278	0	0	861,630	892,908
2033	28,729	3,770,395	0	1,025,246	4,824,370
2034	26,179	7,540,790	0	1,188,863	8,755,832
2035	23,630	11,311,186	0	1,352,479	12,687,294
2036	21,080	15,081,581	0	1,516,095	16,618,756
2037	18,531	18,851,976	0	1,679,711	20,550,218
Perth and Blairgowrie	GP1	GP3	MPIW	WI1	Total
2032	15,679	0	0	3,995	19,674
2033	9,577	-1,500,169	0	654	-1,489,938
2034	3,475	-3,000,337	0	-2,688	-2,999,549
2035	-2,626	-4,500,506	0	-6,029	-4,509,161
2036	-8,728	-6,000,674	0	-9,371	-6,018,773

		RCom - Test DC				
Inverness and Dingwall		GP1	GP3	MPIW	WI1	Total
2037		-14,830	-7,500,843	0	-12,712	-7,528,385
A96 Corridor - Moray (area 19)		GP1	GP3	MPIW	WI1	Total
2032		34,126	0	1	6,968	41,094
2033		34,973	-665,526	1	7,690	-622,864
2034		35,819	-1,331,053	1	8,412	-1,286,822
2035		36,666	-1,996,579	1	9,134	-1,950,779
2036		37,513	-2,662,106	1	9,855	-2,614,737
2037		38,359	-3,327,632	1	10,577	-3,278,695
Aberdeen (area 15)		GP1	GP3	MPIW	WI1	Total
2032		74,816	0	1	1,391,970	1,466,786
2033		87,083	43,579,941	1	1,517,870	45,184,894
2034		99,350	87,159,881	1	1,643,771	88,903,002
2035		111,618	130,739,822	1	1,769,671	132,621,111
2036		123,885	174,319,763	1	1,895,571	176,339,219
2037		136,152	217,899,703	1	2,021,471	220,057,327
Inverness & hinterland		GP1	GP3	MPIW	WI1	Total
2032		8,024	0	0	1,233	9,257
2033		8,503	-658,914	0	885	-649,526
2034		8,982	-1,317,827	0	537	-1,308,309
2035		9,460	-1,976,741	0	189	-1,967,092
2036		9,939	-2,635,655	0	-159	-2,625,875
2037		10,417	-3,294,568	0	-507	-3,284,657

		RCom - Test DC				
Inverness and Dingwall		GP1	GP3	MPIW	WI1	Total
Banf & Fraserhead (areas 17 & 18)		GP1	GP3	MPIW	WI1	Total
2032		384	0	0	2,748	3,132
2033		333	-511,626	0	2,735	-508,558
2034		282	-1,023,252	0	2,723	-1,020,247
2035		231	-1,534,878	0	2,710	-1,531,937
2036		181	-2,046,504	0	2,697	-2,043,627
2037		130	-2,558,131	0	2,684	-2,555,316

Total Scotland	GP1	GP3	MPIW	WI1	Total
2032	199,138	0	3	2,267,674	2,466,813
2033	213,234	1,338,368	3	-330,710	1,220,891
2034	227,329	2,676,736	3	-2,929,095	-25,030
2035	241,425	4,015,104	3	-5,527,480	-1,270,951
2036	255,521	5,353,472	4	-8,125,864	-2,516,872
2037	269,616	6,691,840	4	-10,724,249	-3,762,793

Table 4-9: Wider Economic Impacts of RCom option

Option 6 - A96 Full Dualling. (Hdual)

- 4.7.7 Both the A96 corridor (Moray) and Aberdeen have very high Wider Impact benefits from the Hdual option.
- 4.7.8 Moray has a forecasted Agglomeration effect benefit of £3.5M, and Aberdeen a £6M benefit in 2037.
- 4.7.9 Moray benefited most in the GP3 impacts with £217M, by 2037. Aberdeen has the second highest benefit, £118M in 2037.

		Hdual - Test CZ				
Inverness and Dingwall		GP1	GP3	MPIW	WI1	Total
2032		1,218,277	0	18	3,317,958	4,536,235
2033		1,237,991	-1,425,090	18	4,010,989	3,823,890
2034		1,257,706	-2,850,180	18	4,704,019	3,111,546

Hdual - Test CZ					
Inverness and Dingwall	GP1	GP3	MPIW	WI1	Total
2035	1,277,421	-4,275,269	18	5,397,050	2,399,201
2036	1,297,135	-5,700,359	18	6,090,081	1,686,857
2037	1,316,850	-7,125,449	18	6,783,111	974,512
Perth and Blairgowrie	GP1	GP3	MPIW	WI1	Total
2032	60,461	0	1	5,712	66,173
2033	58,536	-2,118,573	1	3,960	-2,056,078
2034	56,610	-4,237,146	1	2,207	-4,178,328
2035	54,685	-6,355,718	1	455	-6,300,579
2036	52,759	-8,474,291	1	-1,297	-8,422,829
2037	50,833	-10,592,864	1	-3,049	-10,545,080
A96 Corridor - Moray (area 19)	GP1	GP3	MPIW	WI1	Total
2032	3,198,954	0	48	2,529,643	5,728,597
2033	3,340,602	43,539,427	49	2,732,792	49,612,820
2034	3,482,250	87,078,854	50	2,935,940	93,497,044
2035	3,623,898	130,618,280	51	3,139,089	137,381,267
2036	3,765,546	174,157,707	52	3,342,237	181,265,490
2037	3,907,194	217,697,134	53	3,545,385	225,149,713
Aberdeen (area 15)	GP1	GP3	MPIW	WI1	Total
2032	384,784	0	6	4,077,083	4,461,867
2033	396,319	23,611,794	15	4,459,461	28,467,575
2034	407,854	47,223,589	25	4,841,840	52,473,282
2035	419,389	70,835,383	34	5,224,218	76,478,990
2036	430,925	94,447,177	43	5,606,596	100,484,698
2037	442,460	118,058,971	53	5,988,975	124,490,406
Inverness & hinterland	GP1	GP3	MPIW	WI1	Total
2032	1,592,144	0	24	1,666,647	3,258,791

Hdual - Test CZ					
Inverness and Dingwall	GP1	GP3	MPIW	WI1	Total
2033	1,635,118	-425,150	24	1,721,515	2,931,483
2034	1,678,092	-850,301	24	1,776,383	2,604,174
2035	1,721,066	-1,275,451	24	1,831,251	2,276,866
2036	1,764,040	-1,700,601	24	1,886,119	1,949,557
2037	1,807,014	-2,125,752	24	1,940,987	1,622,249
Banf & Fraserhead (areas 17 & 18)	GP1	GP3	MPIW	WI1	Total
2032	62,655	0	1	412,299	474,954
2033	64,305	-1,051,047	1	437,142	-549,600
2034	65,954	-2,102,095	1	461,985	-1,574,155
2035	67,604	-3,153,142	1	486,828	-2,598,710
2036	69,254	-4,204,190	1	511,671	-3,623,265
2037	70,904	-5,255,237	1	536,514	-4,647,819
Total Scotland	GP1	GP3	MPIW	WI1	Total
2032	8,059,987	0	120	9,221,494	17,281,481
2033	8,340,689	-5,624,298	122	7,984,052	10,700,442
2034	8,621,390	-11,248,597	123	6,746,609	4,119,403
2035	8,902,092	-16,872,895	125	5,509,167	-2,461,637
2036	9,182,794	-22,497,194	126	4,271,724	-9,042,676
2037	9,463,495	-28,121,492	128	3,034,282	-15,623,715

Table 4-10: Wider Economic Impacts of HDual Option

Option 5 - Dual Carriageway Bypasses and Dualling of Heavily Trafficked Sections of the A96 plus Targeted Trunk Road Improvements; referred to as OPT 5

- 4.7.10 Most of the benefits associated with More people in work, Agglomeration and Moves to Productive jobs are within the A96 corridor (Moray) Area.
- 4.7.11 This area accumulated a total of £216M total benefits in 2037 with £2.7M agglomeration impacts and £211 impacts from productivity in job moves.

Opt 5 - Test DB	
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Inverness and Dingwall		GP1	GP3	MPIW	WI1	Total
2032		869,908	0	13	28,705	898,614
2033		867,593	-2,210,915	13	666,195	-677,127
2034		865,278	-4,421,829	12	1,303,684	-2,252,867
2035		862,963	-6,632,744	12	1,941,174	-3,828,608
2036		860,647	-8,843,658	12	2,578,663	-5,404,348
2037		858,332	-11,054,573	12	3,216,152	-6,980,089
Perth and Blairgowrie		GP1	GP3	MPIW	WI1	Total
2032		33,721	0	1	18	33,739
2033		17,771	-3,078,672	0	1,541	-3,059,360
2034		1,822	-6,157,344	0	3,064	-6,152,458
2035		-14,127	-9,236,016	0	4,587	-9,245,556
2036		-30,076	-12,314,688	0	6,110	-12,338,654
2037		-46,025	-15,393,360	-1	7,632	-15,431,753
A96 Corridor - Moray (area 19)		GP1	GP3	MPIW	WI1	Total
2032		1,985,538	0	30	1,959,320	3,944,858
2033		2,063,771	42,256,805	30	2,122,418	46,442,994
2034		2,142,004	84,513,610	31	2,285,515	88,941,129
2035		2,220,238	126,770,414	31	2,448,613	131,439,265
2036		2,298,471	169,027,219	32	2,611,710	173,937,400
2037		2,376,704	211,284,024	32	2,774,808	216,435,536
Aberdeen (area 15)		GP1	GP3	MPIW	WI1	Total
2032		155,245	0	2	4,549,889	4,705,134
2033		161,893	6,215,364	8	4,311,562	10,688,818
2034		168,541	12,430,728	14	4,073,235	16,672,503
2035		175,189	18,646,092	20	3,834,907	22,656,188
2036		181,837	24,861,456	26	3,596,580	28,639,872

Opt 5 - Test DB					
Inverness and Dingwall	GP1	GP3	MPIW	WI1	Total
2037	188,485	31,076,820	32	3,358,253	34,623,557
Inverness & hinterland	GP1	GP3	MPIW	WI1	Total
2032	1,038,684	0	16	1,184,086	2,222,769
2033	1,063,703	-272,938	16	1,221,265	2,012,030
2034	1,088,723	-545,875	16	1,258,444	1,801,291
2035	1,113,742	-818,813	16	1,295,623	1,590,552
2036	1,138,762	-1,091,750	16	1,332,802	1,379,813
2037	1,163,781	-1,364,688	16	1,369,981	1,169,074
Banf & Fraserhead (areas 17 & 18)	GP1	GP3	MPIW	WI1	Total
2032	35,599	0	1	319,012	354,610
2033	36,425	-883,877	1	336,643	-510,809
2034	37,251	-1,767,754	1	354,275	-1,376,229
2035	38,077	-2,651,632	1	371,907	-2,241,648
2036	38,903	-3,535,509	1	389,538	-3,107,068
2037	39,729	-4,419,386	1	407,170	-3,972,487

Total Scotland	GP1	GP3	MPIW	WI1	Total
2032	5,092,230	0	76	4,970,141	10,062,370
2033	5,188,800	-6,490,175	76	3,242,056	1,940,680
2034	5,285,370	-12,980,350	76	1,513,971	-6,181,010
2035	5,381,941	-19,470,526	76	-214,114	-14,302,699
2036	5,478,511	-25,960,701	76	-1,942,199	-22,424,389
2037	5,575,081	-32,450,876	75	-3,670,284	-30,546,079

Table 4-11: Wider Economic Impacts for the Option 5

Option 1 - Rail Enhancements / Rolling Stock Improvements to Provide an End-To-End Travel Time of Around 1hr 45mins; referred to as R145 in the reporting of outputs

4.7.12 The R145 option is having relatively low wider economic impacts on the areas reported.

		R145 5 - Test DD				
Inverness and Dingwall		GP1	GP3	MPIW	WI1	Total
2032		-507	0	0	-1,100,033	-1,100,540
2033		4,301	-2,039,058	0	-568,660	-2,603,417
2034		9,109	-4,078,116	0	-37,287	-4,106,293
2035		13,917	-6,117,173	0	494,086	-5,609,170
2036		18,726	-8,156,231	0	1,025,459	-7,112,046
2037		23,534	-10,195,289	0	1,556,832	-8,614,923
Perth and Blairgowrie		GP1	GP3	MPIW	WI1	Total
2032		51,521	0	1	753	52,274
2033		37,097	-676,567	1	185,441	-454,029
2034		22,673	-1,353,133	0	370,128	-960,332
2035		8,249	-2,029,700	0	554,816	-1,466,635
2036		-6,175	-2,706,266	0	739,504	-1,972,938
2037		-20,599	-3,382,833	0	924,191	-2,479,241
A96 Corridor - Moray (area 19)		GP1	GP3	MPIW	WI1	Total
2032		7,324	0	0	2,039	9,363
2033		6,342	473,233	0	2,248	481,823
2034		5,361	946,466	0	2,457	954,284
2035		4,379	1,419,699	0	2,667	1,426,745
2036		3,397	1,892,932	0	2,876	1,899,205
2037		2,416	2,366,165	0	3,085	2,371,666

		R145 5 - Test DD				
Aberdeen (area 15)		GP1	GP3	MPIW	WI1	Total
2032		-6,508	0	0	2,386,587	2,380,079
2033		-1,836	3,056,152	0	1,914,090	4,968,406
2034		2,835	6,112,304	0	1,441,593	7,556,732
2035		7,507	9,168,455	0	969,096	10,145,058
2036		12,178	12,224,607	0	496,599	12,733,385
2037		16,850	15,280,759	0	24,102	15,321,711
Inverness & hinterland		GP1	GP3	MPIW	WI1	Total
2032		1,469	0	0	192	1,661
2033		1,477	11,678	0	1,392	14,547
2034		1,485	23,355	0	2,592	27,432
2035		1,494	35,033	0	3,791	40,318
2036		1,502	46,711	0	4,991	53,203
2037		1,510	58,388	0	6,190	66,089
Banf & Fraserhead (areas 17 & 18)		GP1	GP3	MPIW	WI1	Total
2032		488	0	0	791	1,279
2033		546	289,584	0	791	290,922
2034		604	579,169	0	792	580,565
2035		662	868,753	0	793	870,208
2036		720	1,158,337	0	794	1,159,851
2037		778	1,447,922	0	794	1,449,494

Total Scotland	GP1	GP3	MPIW	WI1	Total
2032	219,141	0	3	1,277,699	1,496,839
2033	227,620	-133,003	3	-1,877,790	-1,783,173
2034	236,100	-266,007	3	-5,033,279	-5,063,185

	R145 5 - Test DD				
2035	244,580	-399,010	3	-8,188,768	-8,343,198
2036	253,060	-532,014	3	-11,344,256	-11,623,210
2037	261,540	-665,017	4	-14,499,745	-14,903,222

Table 4-12: Wider Economic Impacts of Option 1 (R145)

4.8 Net Present Benefits

4.8.1 The Net Present Benefits calculated for the five options are shown in the tables below. The cells highlighted in pink gives an indication of the Area or Areas with high benefits.

4.8.2 These are benefits discounted over 60 years taking into account all the discounting parameters described in section 3.3

4.8.3 The discounted period is from 2032 to 2091.

4.8.4 The figures presented in the tables are all in millions of £.

RCOM – option 2

AREAS	NPV GP1	NPV GP3	NPV WB1
Inverness and Dingwall	0.175181	331.513	30.69721
Perth and Blairgowrie	-0.11412	-131.903	-0.21817
A96 Corridor - Moray (area 19)	0.343017	-58.5166	0.195379
Aberdeen (area 15)	1.187828	3831.778	37.4207
Inverness & hinterland	0.092358	-57.9352	-0.00725
Banf & Fraserhead (areas 17 & 18)	0.001332	-44.9849	0.050904

Table 4-13: Net Present Benefits (NPV) over 60 years for RCom option

HSIN – option 4

AREAS	NPV GP1	NPV GP3	NPV WB1
Inverness and Dingwall	1.284935	-160.579	-16.2695
Perth and Blairgowrie	-0.00278	-55.1711	0.916464
A96 Corridor - Moray (area 19)	4.8823	1090.871	4.797421
Aberdeen (area 15)	-0.03057	-444.582	4.606814
Inverness & hinterland	2.066368	-2.07723	5.288091
Banf & Fraserhead (areas 17 & 18)	0.000118	-15.1912	1.364345

Table 4-14: Table 4 13: Net Present Benefits (NPV) over 60 years for HSin option HDUAL – option 6

AREAS	NPV GP1	NPV GP3	NPV WB1
Inverness and Dingwall	11.80546	-125.301	123.746
Perth and Blairgowrie	0.464323	-186.276	-0.04593
A96 Corridor - Moray (area 19)	34.76133	3828.216	65.74964
Aberdeen (area 15)	3.950887	2076.074	110.8025
Inverness & hinterland Banf & Fraserhead (areas 17 & 18)	16.14874	-37.3815	36.37497
	0.633763	-92.4136	9.98941

Table 4-15: Table 4 13: Net Present Benefits (NPV) over 60 years for HDual option

OPT5 – option 5

AREAS	NPV GP1	NPV GP3	NPV WB1
Inverness and Dingwall	7.743455	-194.395	56.59484
Perth and Blairgowrie	-0.36373	-270.693	0.134241
A96 Corridor - Moray (area 19)	21.17034	3715.441	51.43157
Aberdeen (area 15)	1.677496	546.4876	65.1773
Inverness & hinterland Banf & Fraserhead (areas 17 & 18)	10.40887	-23.9981	25.68447
	0.355423	-77.7151	7.589366

Table 4-16: Table 4 13: Net Present Benefits (NPV) over 60 years for Opt5 option

R145 – option 1

AREAS	NPV GP1	NPV GP3	NPV WB1
Inverness and Dingwall	0.196707	-179.285	25.8968
Perth and Blairgowrie	-0.13945	-59.4873	16.25297
A96 Corridor - Moray (area 19)	0.024918	41.60915	0.056995
Aberdeen (area 15)	0.136904	268.713	3.635174
Inverness & hinterland Banf & Fraserhead (areas 17 & 18)	0.013584	1.02676	0.109114
	0.006827	25.46179	0.015034

Table 4-17: Table 4 13: Net Present Benefits (NPV) over 60 years for R145 option

5 CONCLUSION

5.1.1 This report describes the calculation of Wider Economic Impacts of the five options in the A96 support case. Three calculations are made:

- agglomeration benefits (WB1);
- more people into work (GP1);
- moves to more productive work (GP3).

5.1.2 The logsum averages of costs have been used in preparing generalised cost inputs for the Wider Impacts Calculations.

5.1.3 The DfT WebTAG guidance has been adhered to in the calculations of the outputs.

5.1.4 A full description for calculating wider economic impacts is contained in Project Note 8 (Transport Scotland document A6370484) which reported on all the parameters and coefficients used in the last round of A9 & A96 work.

5.1.5 This A96 support case round of work have been based on the same parameters and coefficients used and reported for the work on A9 improvements.