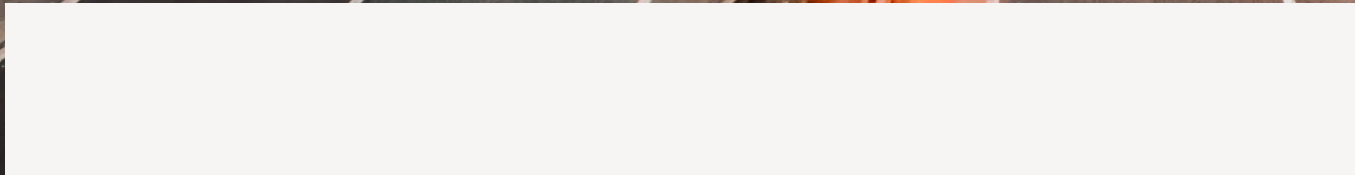


# Transport Improvement Study

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A75 Gretna - Stranraer  
A77 Ayr - Stranraer

Strategic and Economic Impacts  
Report



# Foreword

The A77 Action Group was first formed in October 2016. The establishment of the Action Group, now recognised as the A77 Campaign Team, was as a result of years of neglect and lack of investment to the road infrastructure in the South West of Scotland, and followed years of individuals campaigning over the many decades dating back to 1936 when the Maybole bypass was first pegged out and, again, in the early 1980's when it was raised at Westminster to dual carriageway the A77 to Stranraer.

Working alongside partners in the local authorities on both sides of the Irish Sea, the A77 Campaign Team welcome Dumfries and Galloway Council, South Ayrshire Council and Mid and East Antrim Borough Council bringing forward their Strategic and Economic Impacts (S&EI) Report that all three Councils have been working hard in partnership to produce.

This S&EI Report will add to the weight of evidence being gathered supporting the need for improving the A75 and A77 trunk roads to dual carriageway standards. This will boost the local economy and strengthen Stena Line's case for having a proper road system serving the International Ports of Cairnryan with its intended massive £500 million green investment which would make Lochryan Port the first Green Port in the whole of the UK and on the North Channel Sea Crossing, provided the trunk roads are upgraded.

The S&EI Report will not only provide valuable information on the effect the poor conditions of the A75 and A77 trunk roads have on the region's economy, but it will also provide valuable information for attracting real inward investment that is needed to develop our manufacturing base thereby, creating jobs, increase our gross domestic product and, essentially, outline what it will mean to have faster access to National and European markets. On top of these benefits, it will build on our tourist market by making connectivity much easier with the upgrading of these arterial routes to the Central belt of Scotland, the rest of the UK and Europe through Southern Ireland.

The improvements to these trunk roads will assist in reaching Climate Change targets by reducing greatly the CO2 emissions that the environs are subjected to on a daily basis in towns and villages on the A77 and will see the roads made safer for the communities, as witnessed just how dangerous these trunk roads are with the recent road traffic accident (RTA) at Crocketford on the A75. A frequent occurrence on both trunk roads with RTA's causing the trunk roads to be closed for lengthy times almost on a weekly basis.

The Strategic and Economic Launch Event is welcomed by the A77 Campaign Team who were instrumental at bringing together the 3 Local Authorities. It will be for the Scottish and UK Governments to demonstrate that they can put aside Political Party ideology and work together to bring about the improvements the A75 and A77 arterial trunk roads need to bring them up to dual carriageway standards.

## A77 Campaign Team





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# 1 Introduction

## 1.1 Overview

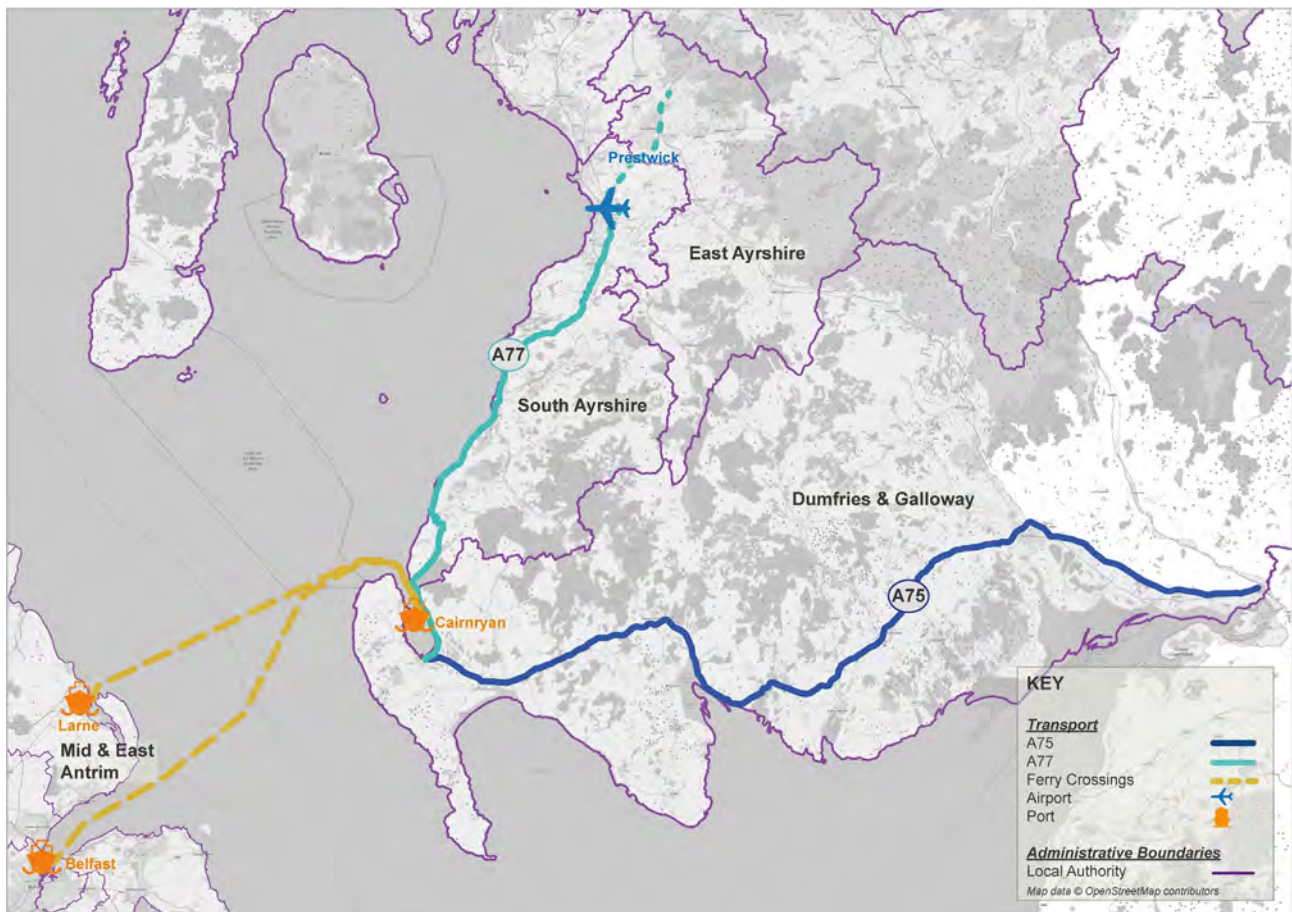
Sweco UK Ltd was commissioned jointly by Dumfries & Galloway, South Ayrshire, and Mid & East Antrim Borough Councils to produce a Strategic and Economic Impacts Report for a package of proposed improvements to the A75 and A77 trunk roads.

The A75/A77 trunk roads are the key strategic corridors serving the Ports of Cairnryan and they account for all passenger journeys and freight movements between mainland UK and Northern Ireland via the Cairnryan-Larne and Cairnryan-Belfast crossings. They are, therefore, assigned the highest level of functionality of any transport link in the region.

The A75 travels east-west through the Dumfries & Galloway Council area and meets the A77 at Stranraer, before the A77 travels north past the Ports of Cairnryan and through the East and South Ayrshire Council areas. Cairnryan is Scotland's main port for carrying good and passengers to Northern Ireland and sailings arrive in Larne, situated in the Mid & East Antrim Borough Council area, and Belfast.

The relevant geography is presented in Figure 1-1.

FIGURE 1-1: A75 AND A77 GEOGRAPHY



## 1.2 Project Background

The A75 and A77 form part of what the recent 'Union Connectivity Review' (Department for Transport, 2021) termed the 'North Channel Corridor'. It is described as "critical for connectivity for passengers and freight between England, Scotland and Northern Ireland" and Cairnryan is described to be "Scotland's busiest port", providing the shortest trip between Great Britain and Northern Ireland.

Despite their critical role for freight movements and domestic travel, the A75 and A77 are primarily single carriageway roads on which, in Scotland, heavy goods vehicles (HGVs) are limited to speeds of 40mph. Both routes also travel through several towns and villages where further speed limits and congestion negatively impact on journey time reliability and safety.

The routes have been subject to improvements by Transport Scotland, at various stages of completion at the time of writing, as presented in Table 1-1.

**TABLE 1-1: EXISTING IMPROVEMENTS MADE TO THE A75 AND A77**

Route	Improvements
A75	Dunragit Village Bypass Increased Overtaking Opportunities at: <ul style="list-style-type: none"> <li>Planting End to Drumflower</li> <li>Newton Stewart</li> <li>Hardgrove</li> <li>Cairntop to Barlae</li> <li>Barfil to Bettyknowes</li> </ul>
A77	Maybole Town Bypass Increased Overtaking Opportunities at: <ul style="list-style-type: none"> <li>Park End to Bennane</li> <li>Glen App</li> </ul> Junction Improvements at Symington and Bogend Toll Addition of Climbing Lane at Haggstone

More recent studies have proposed improvements to alleviate current issues and serve the ports of Cairnryan. These include, but are not limited to, the following:

### 1.2.1 Union Connectivity Review

The review of UK connectivity, undertaken independently by Sir Peter Hendy on behalf of the UK Government, examines how best to improve road, rail, air, and sea links across the UK and to bring forward funding to accelerate infrastructure projects. The A75 is identified as a crucial freight link, carrying “2 in 3 of all HGV traffic from the ports at Cairnryan” for travel onwards to England, while the A77 is noted as critical for journeys between Belfast, Glasgow, and Aberdeen.

Cairnryan is also highlighted as Scotland’s busiest port, handling 2.7 million tonnes of domestic cargo in 2020 and the Cairnryan-Belfast crossing is the second busiest passenger ferry route between Great Britain and the island of Ireland with 1.3 million passengers annually. It is in this context that the following recommendations are made for the A75 and A77 trunk roads.

### 1.2.2 Strategic Transport Projects Review 2 (STPR2) (Transport Scotland, 2021)

The STPR2 forms a Scotland-wide review of the strategic transport network across all transport modes, including walking, wheeling, cycling, bus, rail, and car, as well as reviewing wider island and rural connectivity. It was prepared to “guide the Scottish Government’s transport investment programme in Scotland for the next 20 years and help to deliver the vision, priorities and outcomes that are set out in the new National Transport Strategy (NTS2)”. Cairnryan is classified as a Major Port and is identified as one of the country’s key transport hubs, being at one end of the main freight corridor between Scotland and the island of Ireland.

The A75 is stated to link the port with England, and the A77 with the Scottish Central Belt. Combined, the roads are estimated to carry a total of £67 million worth of goods per day. A number of improvements to both roads are included in the ‘options sifted in for further consideration through STPR2’ and will be progressed in line with the Scottish Transport Appraisal Guidance (STAG) process. These largely comprise road network improvements and are focused on the A75, with additional improvements assigned for the A77.

### 1.2.3 South West Scotland Transport Study (Transport Scotland, 2020)

The South West Scotland Transport Study (SWSTS) Initial Appraisal (‘The Study’) was published in January 2020. It sets out a key aim to “consider the rationale for improvements to road, rail, public transport and active travel on key strategic corridors” in the region and outlines “a particular focus on access to the ports at Cairnryan”.

“As a particularly poorly performing part of the proposed UKNET, and one which is critical for connectivity between Northern Ireland and the rest of the UK, the UK Government should offer funding to support the upgrade of the A75 to improve journeys between Northern Ireland and Great Britain.”

*Union Connectivity Review (2021) p.45*

“The Review also encourages the Scottish Government to improve the A77 to support journeys between Belfast, Glasgow and Aberdeen.”

*Union Connectivity Review (2021) p.45*

The study takes a multi-modal approach and looks at the problems and opportunities for each mode and the interchanges between modes. For the road network, the following problems are identified:

- The mix of local and strategic traffic, high proportions of HGVs, and platooning (or convoys) of vehicles
- Limited overtaking opportunities due to single-carriageway roads and poor sightlines, road alignment and geometry
- A high number of unprotected right-hand turns

A range of data is provided to evidence these problems, including stakeholder opinions obtained by X. It is sad “travel times between the motorway network and the ports at Cairnryan are seen by many stakeholders as posing a threat to the future of the ports” (p.110).

As part of the STAG process, transport planning objectives (TPOs) are set to inform the assessment of potential options/interventions and align with the aim to address the identified issues of slow journey times; road safety concerns; lack of network resilience; and perceptions of poor journey quality on the road network. The overarching TPOs are outlined as follows:

- TP01 – Reduce journey times across the strategic transport network in the study area to the ports at Cairnryan
- TP02 – Reduce accident rates and the severity of accidents on the trunk road network in the South West of Scotland
- TP03 – Improve the resilience of the strategic transport network across the South West of Scotland
- TP04 – Improve journey quality across the road, public transport, and active travel networks in the South West of Scotland
- TP05 – Improve connectivity (across all modes) for communities in the South West of Scotland to key economic, education, health and cultural centres including Glasgow, Edinburgh, Ayr, Kilmarnock, and Carlisle.

An extensive list of options was generated, and the initial sifting and packaging exercise resulted in 23 multi-modal option packages. The following option packages, presented in Table 1-2 were recommended for further appraisal.

**TABLE 1-1: SWSTS PACKAGES FOR FURTHER APPRAISAL**

Package Number	Package Name	Package Description
2	Development of the Strategic Active Travel Network	Package of measures to develop the Strategic Active Travel Network in the South West of Scotland to better connect communities, including cycle paths parallel to trunk roads and improvements to the National Cycle Network.
12	Development of Enhanced Diversionary Routes and Route Planning	Package of measures and improvements to develop the secondary road network which performs a function when the trunk road network is closed to increase resilience of the transport network.
13	Development of Enhanced Service, Rest Areas, and Laybys	Package of measures to deliver improved rest provision for all road users in the South West of Scotland, such as truck/lorry stops and rest facilities on the A75 and A77 and enhanced laybys for buses on main routes.
14	HGV Speed Limit Increase	HGV speed limit increase to 50mph on the trunk road network in the South West of Scotland.
15	A75 Capacity Enhancements	Development of capacity enhancement measures on the A75, such as partial dualling, town/village bypasses and improved overtaking opportunities.
16	A75 Safety Measures	Implementation of targeted measures, such as improvements to road geometry, bends and junction improvements to improve safety on the A75. Package will also include consideration of safety camera deployments through the Scottish Safety Camera Programme annual site prioritisation exercise.
17	A77 Capacity Enhancements	Development of capacity enhancement measures on the A77, such as partial dualling, town/village bypasses and improved overtaking opportunities.
18	A77 Safety Measures	Implementation of targeted measures, such as improvements to the road geometry, bends and junction improvements to improve safety on the A77. Package will also include consideration of safety camera deployments through the Scottish Safety Camera Programme annual site prioritisation exercise.

### 1.3 The Scope

Following on from the findings of the Union Connectivity Review, STPR2, and SWSTS’ Initial Appraisal, Dumfries & Galloway, South Ayrshire, and Mid & East Antrim Borough Councils have commissioned Sweco to undertake and produce a Strategic and Economic Impact Report that considers a range of interventions along both the A75 (between Gretna and Stranraer) and the A77 (Stranraer to Ayr).

Seven intervention packages, containing a range of interventions, have been considered, modelled, and analysed. The intervention packages are detailed in Table 1-3 and presented visually in Figure 1-2. It should be noted that packages 4 and 7, presented in Table 1-3, do not form part of this report. These packages have been excluded because analysis of the modelling results showed that



packages 5 and 8 returned more realistic and logical routing / outcomes. Package 3 can be considered as the 'do-maximum' package of improvements as this package includes full dualling along both the A75 and A77 corridors.

TABLE 1-1: STRATEGIC AND ECONOMIC IMPACTS REPORT INTERVENTION PACKAGES

Package	A75	A77	Intersections	Dualling	Other
1	Measures and bypasses	Measures and bypasses	Roundabouts	-	Rail improvements
2	Measures and bypasses	Measures and bypasses	T-junctions	-	Rail improvements
3	Measures and bypasses	Measures and bypasses	Roundabouts	Both	Rail improvements
4	Measures and bypasses	-	Roundabouts	-	Rail improvements
5	Measures and bypasses	-	T-junctions	-	Rail improvements
6	Measures and bypasses	-	Roundabouts	A75	Rail improvements
7	-	Measures and bypasses	Roundabouts	-	Rail improvements
8	-	Measures and bypasses	T-junctions	-	Rail improvements
9	-	Measures and bypasses	Roundabouts	A77	Rail improvements

Figure 1-3 to Figure 1-5 provide more detail of the particular interventions forming part of the A75 measures and bypasses, A77 measures and bypasses, A75 dualling, A77 dualling and the rail improvements. Appendix A details these interventions in tabular form.

FIGURE 1-2: STRATEGIC AND ECONOMIC IMPACTS REPORT INTERVENTION PACKAGES

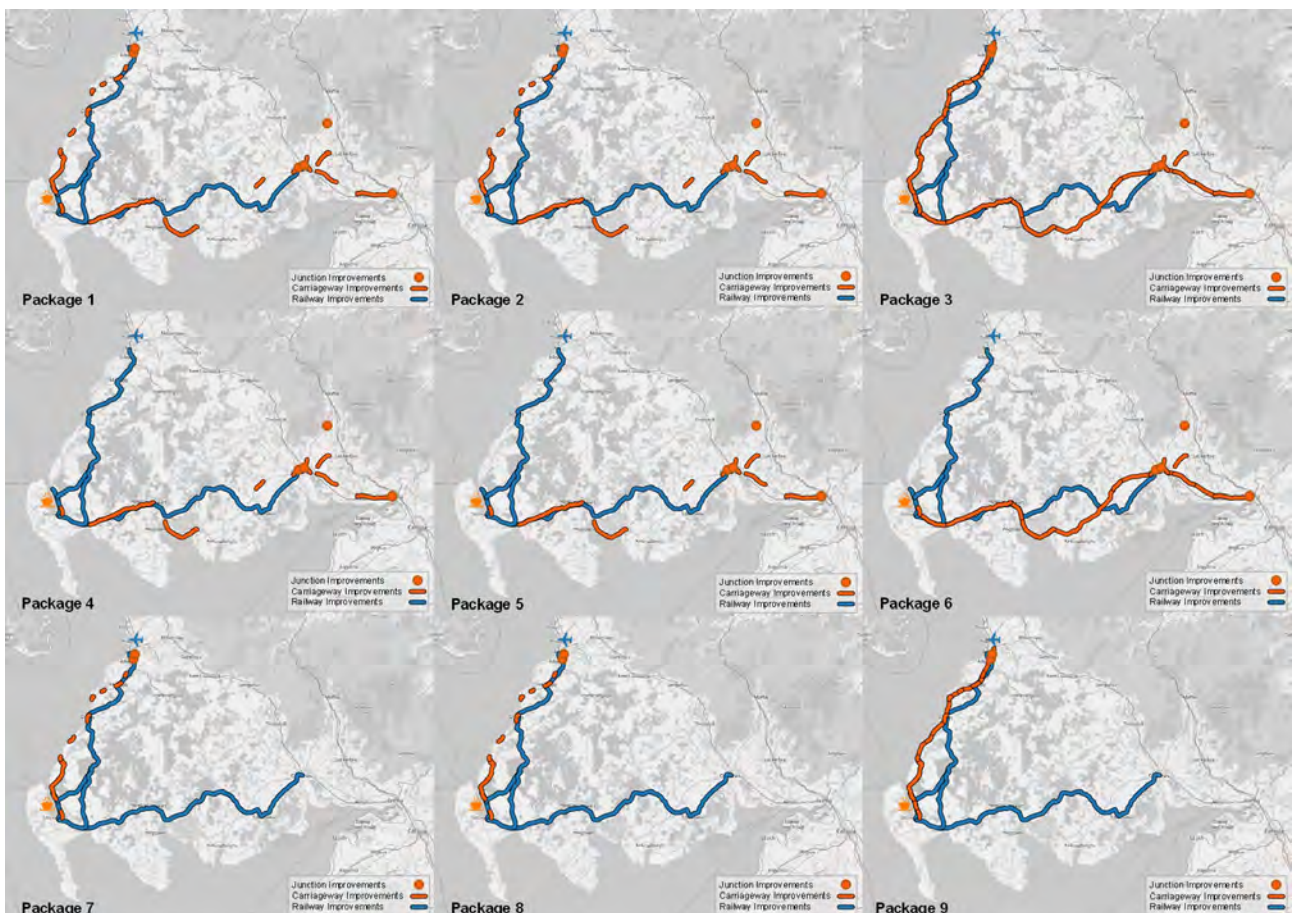


FIGURE 1-3: STRATEGIC AND ECONOMIC IMPACTS REPORT INTERVENTIONS – MEASURES AND BYPASSES

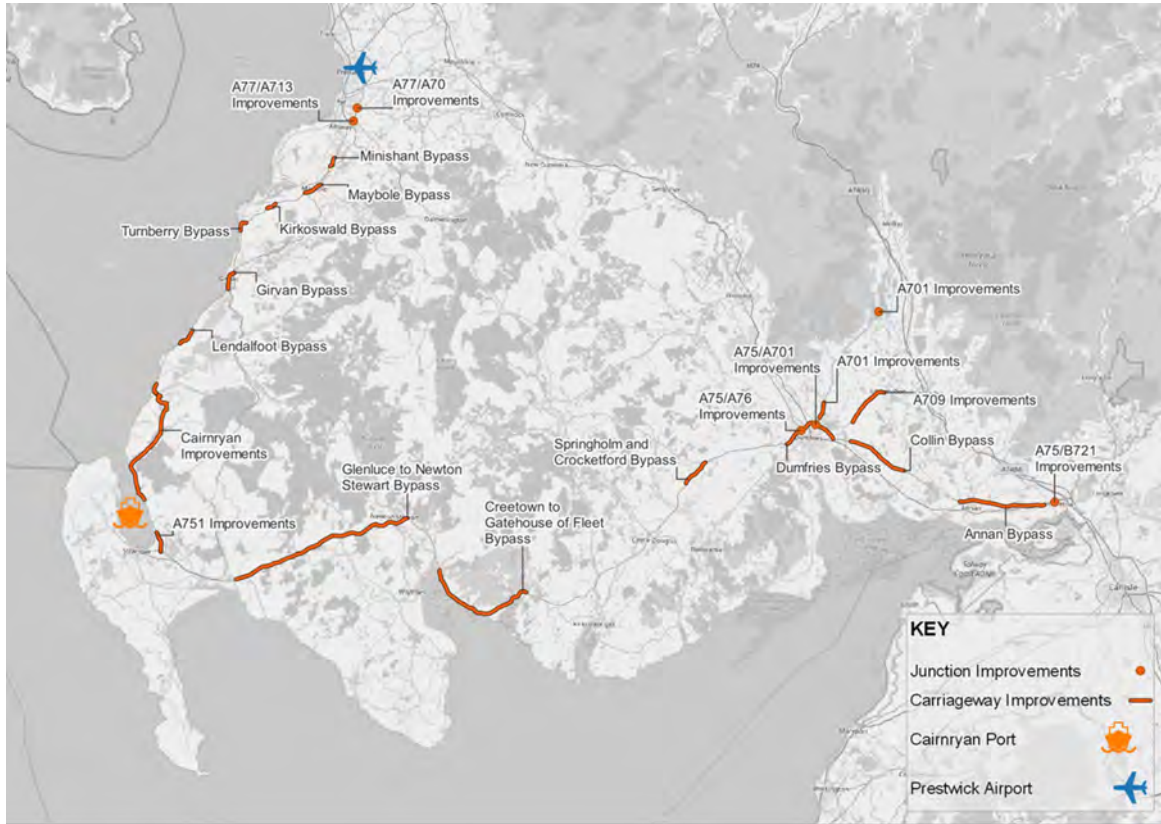


FIGURE 1-4: STRATEGIC AND ECONOMIC IMPACTS REPORT INTERVENTIONS – DUALLING

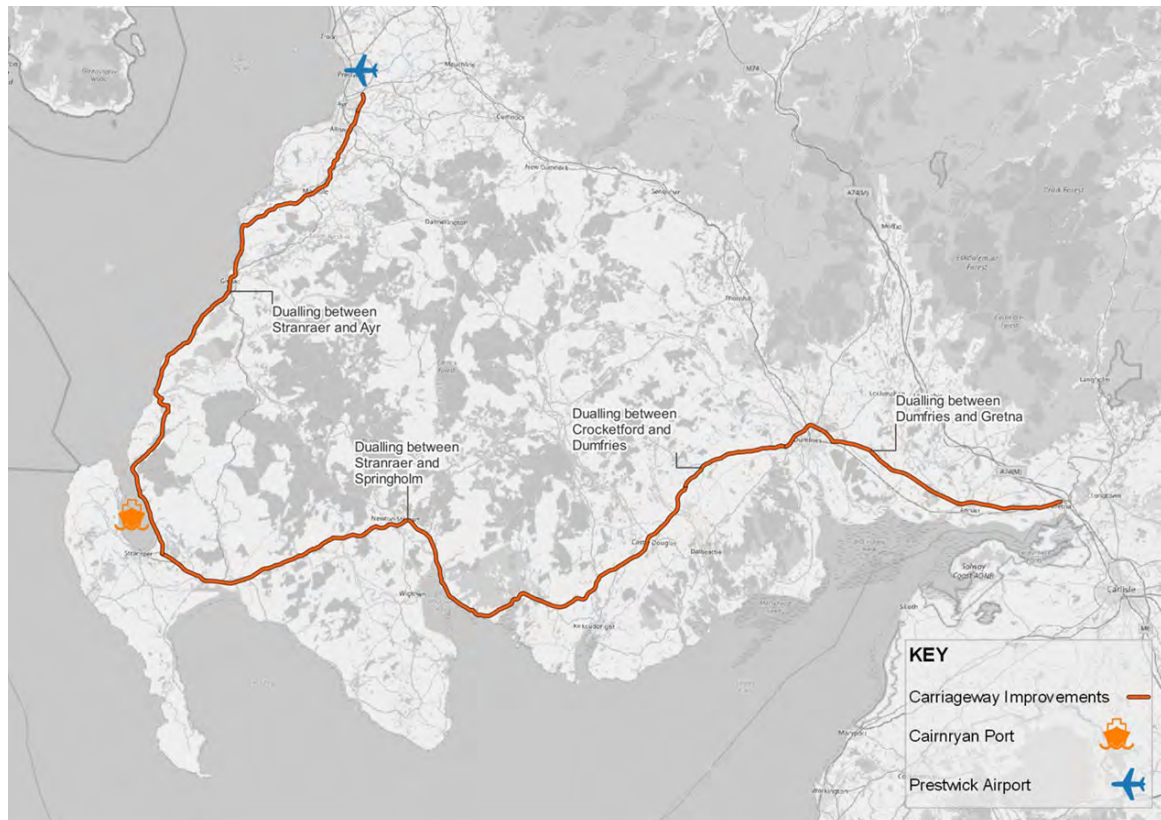
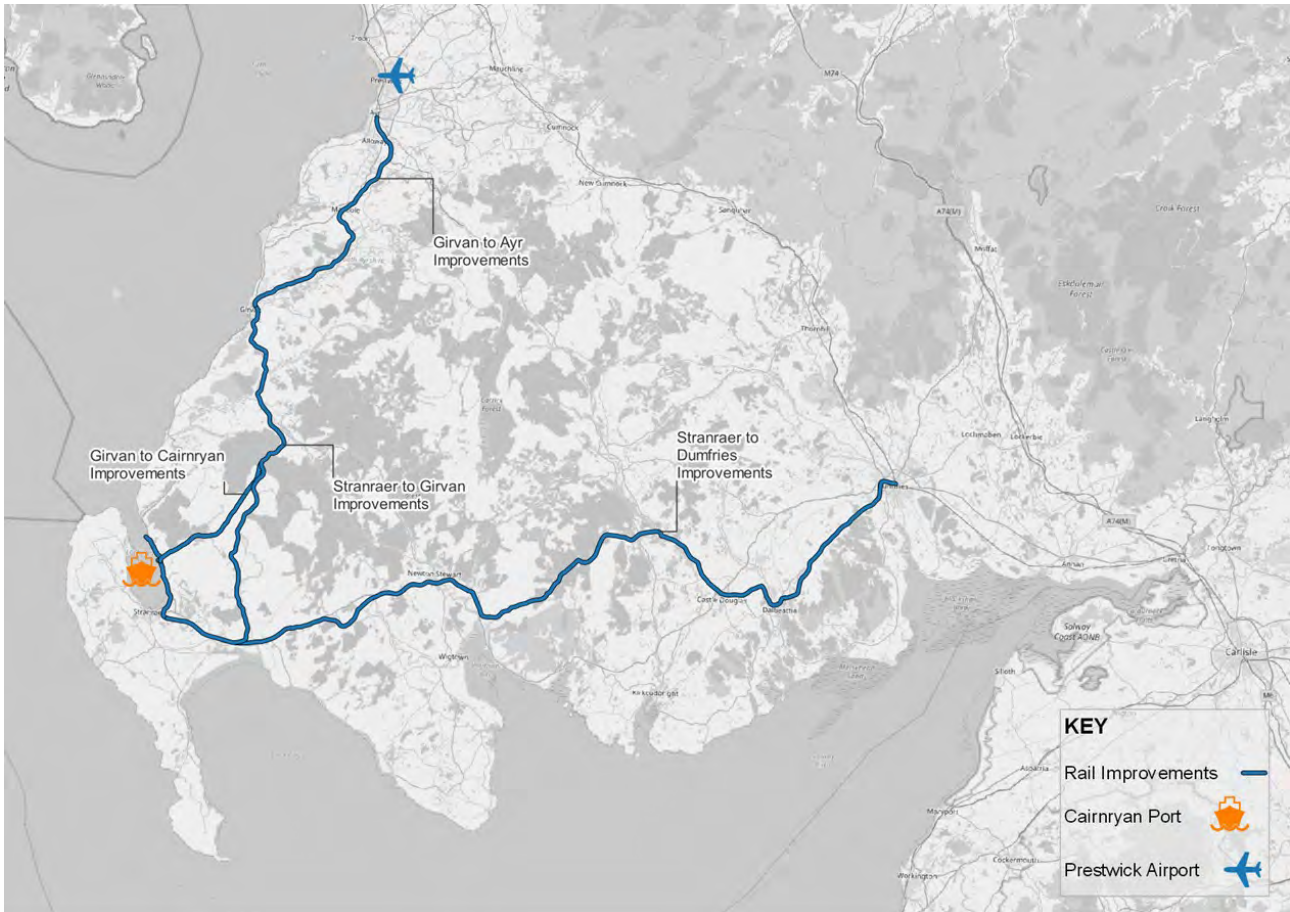


FIGURE 1-5: STRATEGIC AND ECONOMIC IMPACTS REPORT INTERVENTIONS – RAIL UPGRADES



Each of the seven intervention packages have been subject to a strategic and economic assessment. The purpose of the assessment is to estimate the benefits of a transport intervention using information on travel demand, traffic flows, journey times and other data extracted from the traffic model / other reliable data sources. The benefits of each package captured have been categorised as established monetised impacts, evolving monetised impacts, indicative monetised impacts, and additional monetised impacts. More detail relating to each benefit and impact can be found in Section 2.4.

- Established monetised impacts:
  - Road user benefits – savings in travel time and vehicle operating costs (VOC) as a result of the package, calculated using Transport User Benefit Appraisal (TUBA)
  - Public transport user benefits – savings in travel time for public transport passengers as a result of the package, calculated using TUBA
  - Safety benefits – accident savings as a result of the package, calculated using Cost and Benefit to Accidents – Light Touch (COBA-LT)
  - Indirect tax revenue – changes in the amount of fuel purchased and the associated impact to revenue from fuel duty as a result of the package, calculated using TUBA
- Evolving monetised impacts:
  - Wider economic impacts (WEIs) – based on connectivity / accessibility improvements, without the consideration of explicit land use change, capturing static agglomeration, more people working and increased output in imperfectly competitive markets, calculated using Wider Impacts in Transport Appraisal (WITA)
- Indicative monetised impacts:
  - Transformational impacts – ability of the package to have effects on the number and location of homes and jobs, capturing dynamic agglomeration and the effect of people moving to more productive jobs in response to the package improvements and land use change, calculated using TELMoS and Wider Impacts Calculator (WIC)

- Wider spatial and social context impacts – benefits and disbenefits to households and other actors, using measures of benefit from improved accessibility as the means of capturing both the direct benefits of the package improvement and land-use effects. These represent the value that actors in the land-use markets – households and firms – place on accessibility to destinations, as opposed to the value that users in the transport system place on time savings, calculated using Unified Land-Use / Transport Appraisal (ULTrA, accessibility-based land-use and transport appraisal software developed by David Simmonds Consultancy)
- Additional monetised impacts:
  - Freight facilities – review of the opportunities for transporting freight by rail, including dedicated facilities at Barrhill, Cairnryan / Stranraer and Ayr

#### 1.4 Report Structure

The remainder of this report describes the stages involved in the development of the economic assessment and contains appropriate reporting of the outputs from the process. The structure of the remainder of this report is as follows:

- **Chapter 2: Assessment Approach** – provides an overview of the transport modelling undertaken and explains the economic assessment approach adopted
- **Chapter 3: Economic Assessment Results** – provides a summary of the economic assessment results
- **Chapter 4: Summary and Conclusions** – provides a summary and conclusion to the above



## 2 Assessment Approach

### 2.1 Introduction

The purpose of the assessment is to estimate the economic impact of interventions along the A75 and A77. The economic impact is informed by comparing economic benefits of each package. Assessing a wide array of benefits ensures that the full impact of each package, and improvements to the A75 and A77 more specifically, are generated and presented.

Benefits have been estimated over a 60-year assessment period, standard for a transport intervention as per Transport Appraisal Guidance (TAG) and STAG. All values have been converted to the TAG and STAG standard of 2010 costs and values, to allow a direct comparison between effects occurring in different years. Discount rates of 3.5% and 3.0% were applied to benefits for the initial 30 years from the year currently in (2022) and subsequent years respectively.

The discounted benefits have been summed to give the Present Value of Benefits (PVB). This PVB presents the total monetary benefit / impact of the package in question. For typical transport economic assessments, a Net Present Value (NPV), calculated by subtracting the Present Value of Costs (PVC) of the intervention:  $NPV = PVB - PVC$ , would also be presented. However, as discussed in detail in Section 2.3, for this report it has been deemed inappropriate to develop a PVC. Thus, this report primarily focuses on the benefits that such interventions would generate.

### 2.2 Transport Modelling Overview

The Transport Model for Scotland (TMfS) is a strategic transport model, which provides a broad representation of transport supply and estimates of transport demand, owned by Transport Scotland, and operated by approved users. The model:

- Covers the whole population of Scotland
- Details the choices made by people on how, where, why, and when they travel
- Links with an interactive land-use model, TELMoS, which provides a land-use transport interaction
- Is designed for broad option identification, ranking and scheme / policy appraisal
- Does not model the operation of junctions or congestion
- Has a wide range of model outputs

The development of TMfS is underpinned by an extensive bank of transport data, which can be found on Transport Scotland's website.

Systra Ltd, an approved user of TMfS, were commissioned by Sweco to undertake the TMfS18 modelling of improvements to the A75 and A77 road and rail corridors. The TMfS18 do-minimum (without policy / intervention) scenarios for the 2030 and 2045 forecast years were used as a basis for scenario development. The full specifics / details of the interventions coded and modelled by Systra Ltd can be found in Appendix B.

Upon successful completion of the modelling of the packages of interventions into TMfS, model analysis was undertaken, with the following findings:

- Packages 1 and 2 indicate a moderate journey time saving of one to nine minutes with the A77 and A75 bypasses and measures only in place. The higher savings are seen generally to and from Stranraer due to the bypasses on the A77 and Castle Douglas to and from Annan / Moffat / Peebles, likely due to a combined effect of the bypasses at Crocketford and Lockarbriggs and the dualling of the Dumfries Bypass
- Package 3 indicates a significant journey time saving of one to 24 minutes with the A77 and A75 bypasses, measures and full dualling in place. The greatest savings are seen for Stranraer to and from all other locations compared, with over 20 minutes saved to / from Annan on the A75 and 15-17 minutes saved to / from Ayr on the A77
- Package 5 (A75 bypasses and measures only) journey time savings reach a maximum benefit of five to six minutes and along the A75 only, such as Castle Douglas to and from Annan / Moffat / Peebles and Stranraer to / from Annan / Moffat
- Package 6 (A75 bypasses, measures and full dualling) mimics the benefits of Package 3 along the A75 corridor, with over 20 minutes saved Stranraer to / from Annan. The journey time difference between the do-minimum (without scheme) and Package 6 for Stranraer to Ayr was zero
- Package 8 (A77 bypasses and measures only) journey times savings reach a maximum benefit of eight to nine minutes Stranraer to / from Ayr only, with a minor two minute benefit Stranraer to / from Peebles. There is no difference between the do-minimum and Package 8 along the A75 corridor
- Package 9 (A77 bypasses, measures and full dualling) replicates the Package 3 savings for Stranraer to Ayr only, along the A77. There is a reduced benefit for Stranraer to / from Peebles of only seven to eight minutes, whereas in Package 3 the saving was 13-15 minutes. All origin and destination pairs along the A75 show no journey time difference compared to the do-minimum

- The only area to exceed +10 or -10 passenger flow shift was from bus to rail along the A75 corridor. The change in passenger flow was generally the same volume across all packages, for both 2030 and 2045, and for both the AM and PM periods. The AM and PM flows do differ, but they are broadly consistent across all packages. The general pattern that emerged was as follows:
  - An overall increase in passenger flow on the new Dumfries-Stranraer rail line
  - An overall decrease in passenger flow on buses on the A75
  - 2030 showed a larger increase in passenger volume on rail than 2045, though both show an increase
  - In the AM period, the eastbound rail flow is larger than the westbound flow
  - In the PM period, the westbound rail flow is larger than the eastbound flow
  - A larger passenger flow increase is shown between Castle Douglas and Dumfries, as opposed to between Castle Douglas and Stranraer
  - An overall increase in passenger flow on the upgraded Stranraer-Barrhill rail line
  - An overall decrease in passenger flow on buses on the A77 between Stranraer and Barrhill

To inform the economic assessments required for this report, forecast outputs from TMfS were provided at the following levels of detail:

- Highway network configurations:
  - Do-Minimum (DM) –without the proposed package interventions
  - Do-Something (DS) – with the proposed package interventions
- Forecast years:
  - Opening year of 2030
  - Design year of 2045
- Model periods:
  - AM Peak Hour
  - Average Inter-Peak (IP) Hour
  - PM Peak Hour
- Assignment user class (UC) segmentation:
  - UC1: Cars employers' business
  - UC2: Cars commuting
  - UC3: Cars other purposes
  - UC4: Light goods vehicles (LGVs)
  - UC5: Heavy goods vehicles (HGVs)
  - UC6: Passenger employers' business
  - UC7: Passenger commuting
  - UC8: Passenger other purposes

### 2.3 Capital and Operating Expenditure / Monetised Costs

Capital expenditure usually includes preparation costs, supervision costs, land costs and construction costs. Each of these cost items would be inflated to outturn costs using reliable projected construction related inflation figures. These figures would be informed by detailed designs and corresponding bills of quantities.

Operating expenditure, also known as maintenance costs, can be classified into two groups:

- **Group 1** – includes: drainage, street lighting, footway/cycle tracks, safety fence/barrier, boundary fences, bridges/culverts/subways, remedial earthworks, verge maintenance, sweeping, gully emptying, signals/signs/crossings, road markings, salt/snow plough/fencing and motorway compounds
- **Group 2** – includes: reconstruction, overlay, resurfacing, surface dressing and patching

These cost figures are informed by detailed operating and maintenance cost models built in line with predicted procedures for maintenance. Similar to capital expenditure, operating expenditure would be inflated to outturn costs using reliable projected construction related inflation figures.

Considering the detail and certainty required in developing even preliminary capital and operating expenditure estimates, the current status of the A75 and A77 interventions does not allow for reliable and meaningful cost estimates to be generated. For this reason, this report does not provide any indication of potential capital and operational expenditure, and instead focuses purely on the benefits that would accrue from such interventions.

It would be anticipated, that as interventions / packages progress further into design, cost estimates could be derived and be incorporated into future economic assessments and / or business cases as required.

## 2.4 Monetised Benefits

Appraisal techniques at Level 1 (Established Monetised Impacts), where benefits are primarily focused on impacts on users of the transport network (such as time saving, accident savings, and highway decongestion), are well established. The methods used for estimating impacts and their monetary values are accepted, well researched, and tried and tested. Values can be derived from current and predicted future market prices (e.g., fuel prices) or monetary values derived from research (e.g., values of travel time saved). These draw on the TMfS which Transport Scotland has developed and refined over time.

At Level 2 (Evolving Monetised Impacts), additional areas of benefit are included, for which the calculation approach is less established and more uncertain. Some evidence exists to support the estimation of a monetary value, but this is less widely accepted, well researched or tried and tested. These include further benefits to transport users e.g., journey reliability improvements. Significantly, at Level 2, Wider Economic Impacts (WEIs) driven by changes in accessibility are also captured, assuming no land-use change between without and with scheme situations. These Level 2 WEIs include the economic benefit of bringing businesses effectively closer together ('static agglomeration') by reducing journey times. The greatest value of such benefits will come from enhancing connectivity between locations in the South West of Scotland.

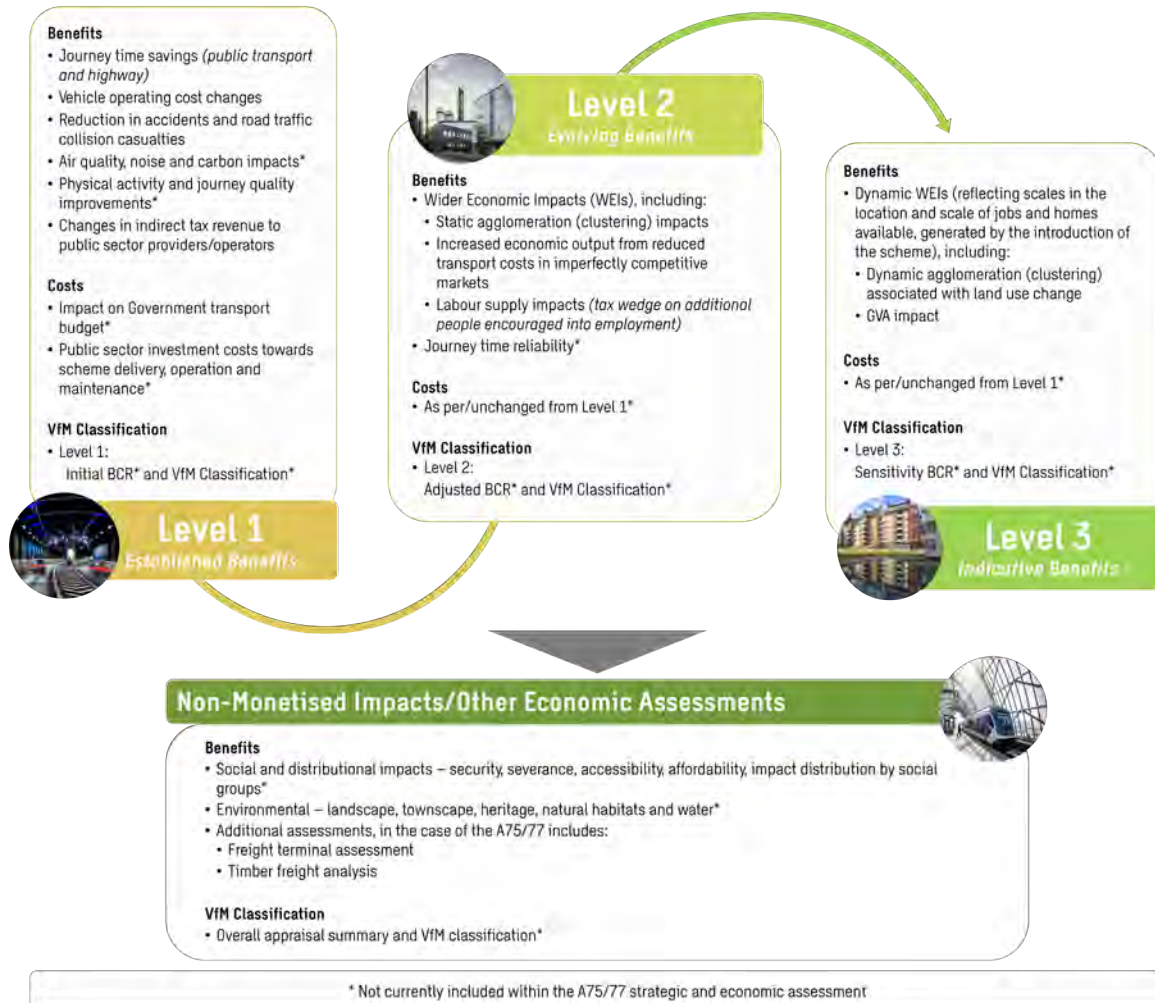
At Level 3 (Indicative Monetised Impacts), the potential for a scheme to have transformational effects on the number and location of homes and jobs, thereby generating further WEIs, is reflected, with assessments of 'dynamic agglomeration' (i.e., in the context of induced land-use change), and the effect of people moving to more productive jobs (MTMPJ) in response to the combination of transport improvements and land-use change. In addition, at Level 3, the net welfare effects of increased housing supply directly enabled by the scheme are captured. These reflect net increases in the affordability and condition of housing experienced by households across the market, net of any loss of value to property owners and wider externalities and costs associated with the development. Monetary valuation methods at Level 3 are not considered sufficiently widely accepted, well researched or tried and tested to be definitive. The methodologies are generally developing and a high degree of uncertainty in the magnitude of the impacts exists.

Additional assessments, monetary and non-monetary, are then included into the economic assessment after Level 3 benefits. In the case of this report, these additional assessments relate to a review of the opportunities for rail freight at Barrhill, Stranraer / Cairnryan and Ayr.

Figure 2-1 visually presents the detail of Level 1, 2 and 3 assessments, whilst also providing an indication of the assessments that won't form part of this A75 and A77 Strategic and Economic Impacts Report.



FIGURE 2-1: KEY ECONOMIC ASSESSMENT PROCESS AND COMPONENTS



### 2.4.1 Transport Economic Efficiency

The impacts of each package on travel times and vehicle operating costs have been assessed using the latest Department for Transport’s TUBA program available at the time of assessment (version 1.9.17).

TUBA is a bespoke software package developed on behalf of the DfT to estimate the impacts of transport schemes in terms of the costs and benefits experienced by users and providers of the transport system, and the associated indirect taxation impacts. All impacts are considered in monetary terms.

TUBA estimates costs and benefits experienced by users and providers of the transport system by comparing transport conditions in a with package scenario against conditions in a without package scenario. To this end, for transport schemes, TUBA uses information from the TMFS to:

- Calculate user benefits by vehicle type and for each element of journey cost (such as travel time and vehicle operating costs)
- Calculate the changes in the indirect tax income received by the government (for highway schemes this primarily reflects the levels of indirect taxation incurred on fuel cost)

The following sections provide more information on the key inputs to TUBA, such as:

- Economic parameters
- Scheme parameters
- Time slices and annualisation factors
- User classes
- Input matrices

#### 2.4.1.1 Economic Parameters

TUBA provides a complete set of default economic parameters in its standard economics file, including values for variables such as values of time, vehicle operating costs data, tax rates and economic growth rates.

#### 2.4.1.2 Scheme Parameters

The scheme related parameters in the TUBA scheme file were largely determined by the parameters used in the TMfS, namely:

- First year – 2030 (scheme opening year)
- Second year – 2045 (scheme design year)
- Last year – 2089 (60 years from opening year)
- Modelled years – 2030, 2045
- Current year – 2022

No further growth in traffic or benefits are assumed beyond the last forecast year 2045 (apart from an allowance from continued growth in the real values of time, in line with TAG).

#### 2.4.1.3 Time Slices and Annualisation Factors

The TMfS consists of the following time periods:

- AM peak hour (weekday 08:00 – 09:00)
- IP average hour (weekday 10:00 – 16:00)
- PM peak hour (weekday 17:00 – 18:00)

In TUBA a distinction is made between time periods and time slices. Time periods have standard definitions supplied in the economics file. They are:

- AM peak (weekday 0700-1000)
- PM peak (weekday 1600-1900)
- IP (weekday 1000-1600)

Expansion factors from the peak hours to peak periods to annual periods were based on the number of times those periods would occur per year. The final annualisation factors inputted into TUBA are:

- AM car driver – 570
- AM public transport – 540
- Inter-peak car driver – 3,700
- Inter-peak public transport – 3,000
- PM car driver – 660
- PM public transport – 680

The full derivation of these factors can be found within the TMfS suite of documentation.

#### 2.4.1.4 User Classes

The modelled user classes in TMfS were split into more detailed user classes as required for the TUBA economic appraisal:

TABLE 2-1. MODELLED USER CLASSES TO TUBA USER CLASSES

Modelled user class	TUBA trip purpose	Factor
1. Car business	1. Car business	1.00
2. Car commuting	2. Car commuting	1.00
3. Car other	3. Car other	1.00
4. LGV	4. LGV personal*	0.12
	5. LGV freight*	0.88
5. HGV	6. OGV1**	0.50
	7. OGV2**	0.50
6. Passenger employers' business	8. Bus business**	0.10
	9. Rail business**	0.88
7. Passenger commuting	10. Bus commuting**	0.29
	11. Rail commuting**	0.70
8. Passenger other purposes	12. Bus other**	0.34
	13. Rail other**	0.65

\* The split of trips between purpose for LGVs (personal and freight) for all time periods were based on the default proportion split as per Table A1.3.4 in the TAG Databook

\*\*The split of trips between purpose for HGVs and public transport for all time periods were based on TMFS documentation

It should be noted that it has assumed that vehicle occupancies were to be in line with TUBA default figures for all vehicle types.

#### 2.4.1.5 Input Matrices

Data input into TUBA comprised of trip, flow weighted average travel time and travel distance matrices. Travel demand, travel time and distance matrices for each user class were extracted for each scenario (with and without package intervention) and modelled years and used as an input into TUBA.

The TMFS outputs model data in kilometres and hours as units, which is in line with TAG and the TAG Databook (and therefore TUBA). The trip matrices are in vehicles or passengers when consider bus and rail trips and therefore no adjustments are applied to the TUBA units.

#### 2.4.1.6 Scenarios

Within TUBA, each modelled option is termed as a scenario, and these were classified as either without package (DM) or with package (DS).

The without package scenario comprised of the existing road network. The with package scenario comprised of the existing road network with the addition of each package.

#### 2.4.1.7 TUBA Warnings and Logic Checking

TUBA undertakes a check on the inputs provided and identifies any large cost or matrix changes between the scenarios. The top 50 warnings of each TUBA type were output, with a sample of these being reviewed and fully checked as a part of the quality assurance process.

This process identified the need to mask the TUBA results, in order to remove unrealistic changes / noises in the model, such as routing changes occurring in Edinburgh and Aberdeen, i.e., not directly impacted, or influenced by the A75 or A77. The mask applied to the results retained all movements and hence results that originated, ended, or travelled through Dumfries & Galloway, South Ayrshire, East Ayrshire, North Ayrshire, East Renfrewshire, and South Lanarkshire.

With the mask applied, the origin-destination route patterns were as expected given the location of the A75 and A77, so the warnings highlighted by TUBA were “genuine” traffic re-routings taking place. It is worth mentioning that there is a significant number of warnings triggered by TUBA which have zero trips, so in these cases the warnings are irrelevant. The reasonings for the remaining warnings relate to:

- Traffic using the new interventions with longer distances travelled but with time savings associated due to higher speeds
- Additional or lower delays on origin-destination routes which affected both journey time and distance travelled, for instance higher or lower junction delay due to traffic reassignment because of the scheme

Other ‘sense’ checks were also carried out in terms of matrix level totals and mapping different benefits to sector level to check the benefits patterns.

#### 2.4.2 Accident Savings

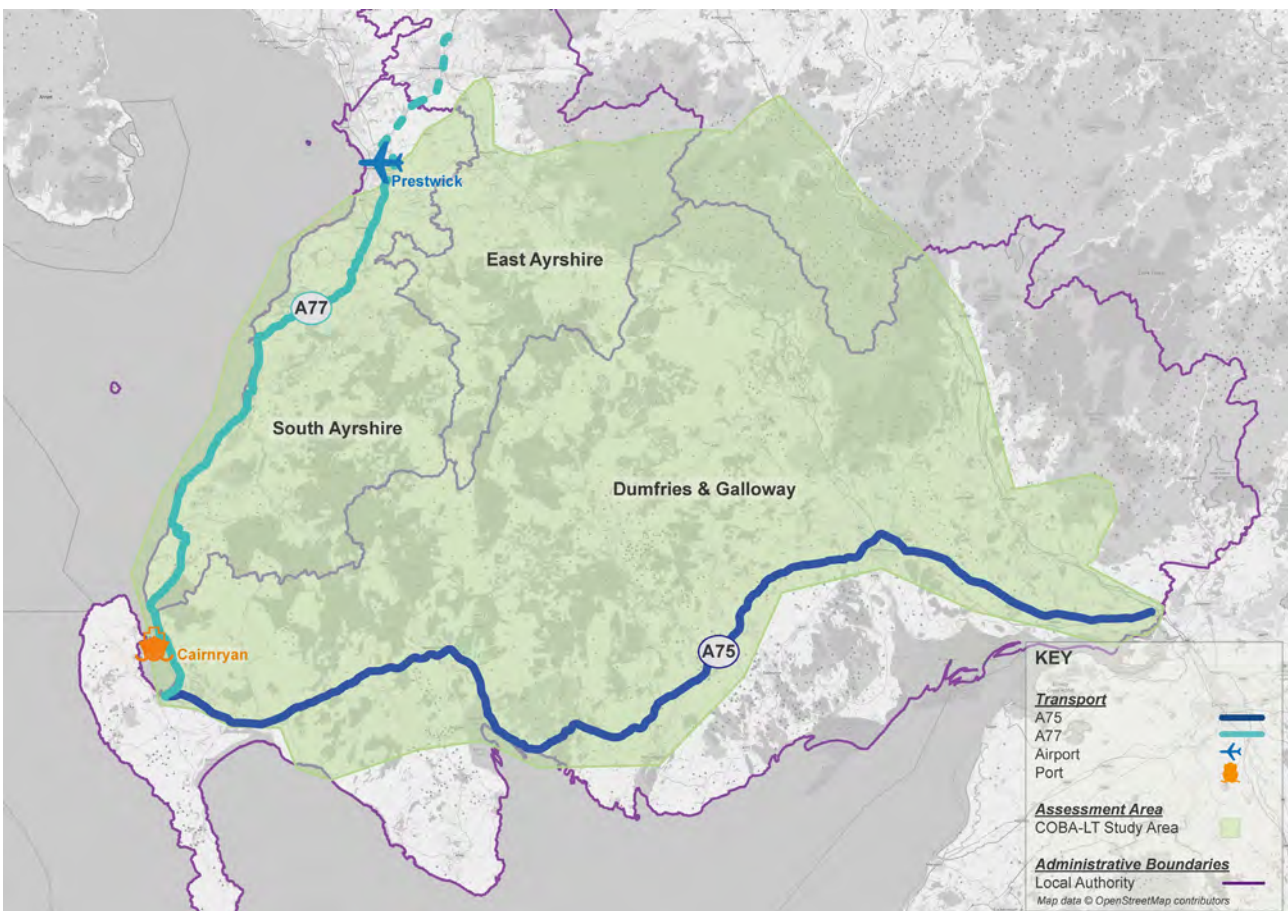
The DfT’s COBA-LT software has been used to provide an assessment of the predicted impact of each package on accidents, including a monetised impact. To be consistent with the TUBA assessment, the COBA-LT assessment considered impacts over a 60-year appraisal period, assuming no further change in traffic or benefits beyond 2045 (apart from an allowance for continued growth in the real value of accidents which is in line with TAG).

The current version of the COBA-LT software (version 2.3) and economic parameters file (consistent with TAG Databook v1.18) were used.

##### 2.4.2.1 Study Area

The COBA-LT study area as shown in Figure 2-2, is a cordoned area of the TMFS. The cordoned network used within the assessment contains all model links where there is a significant change in flows between with and without package scenarios.

FIGURE 2-2: COBA-LT STUDY AREA APPROACH



#### 2.4.2.2 Approach

For each package of interventions, the following approach was undertaken for the COBA-LT assessment:

- The links and junctions 'combined approach' was considered
- Default accident rates and casualty severity rates were assigned to all links due to the size / sheer quantity of links within the assessments

#### 2.4.2.3 Network Details

Data was extracted from the TMfS for the 2018 base year and 2030 and 2045 forecast years for input into the COBA-LT assessments. This data included network structure (link length, speed limit and link type / speed flow curves) and forecast traffic flows.

Links that are edited, added, or deleted in the different modelling scenarios must be accounted for in the COBA-LT coding. Such links must be coded separately for COBA-LT to take account of the difference between scenarios.

COBA-LT requires the definition of each link type to be consistent with those that can be found in the COBA-LT user manual. The speed flow curves, and link classes assigned in the TMfS were used to categorise all of the model links.

Link traffic flows are required as average annual daily traffic (AADT) flows. 24-hour AADT flows for the 2018 base year, without package and with package scenarios have been derived from the TMfS. The factors used to expand the modelled time periods to 24-hour AADT flows are based on those contained in TMfS documentation.

#### 2.4.3 Wider Economic Impacts

STAG Section 9 sets out approaches to estimating wider economic impacts (WEIs) that can be considered to be supplementary to the welfare economic benefits captured through the conventional appraisal described in the previous sections. These WEIs occur as individuals and businesses change their behaviour in response to the transport change.

The WEIs identified are categorised into two levels:

- Level 2 WEIs based on connectivity / accessibility improvements, without the consideration of explicit land use change, capturing static agglomeration, more people working and increased output in imperfectly competitive markets
- Level 3 WEIs involving explicit land use change and / or additional economic modelling, including: dynamic agglomeration, move to more productive jobs and dependent development

##### 2.4.3.1 Static Wider Economic Impacts

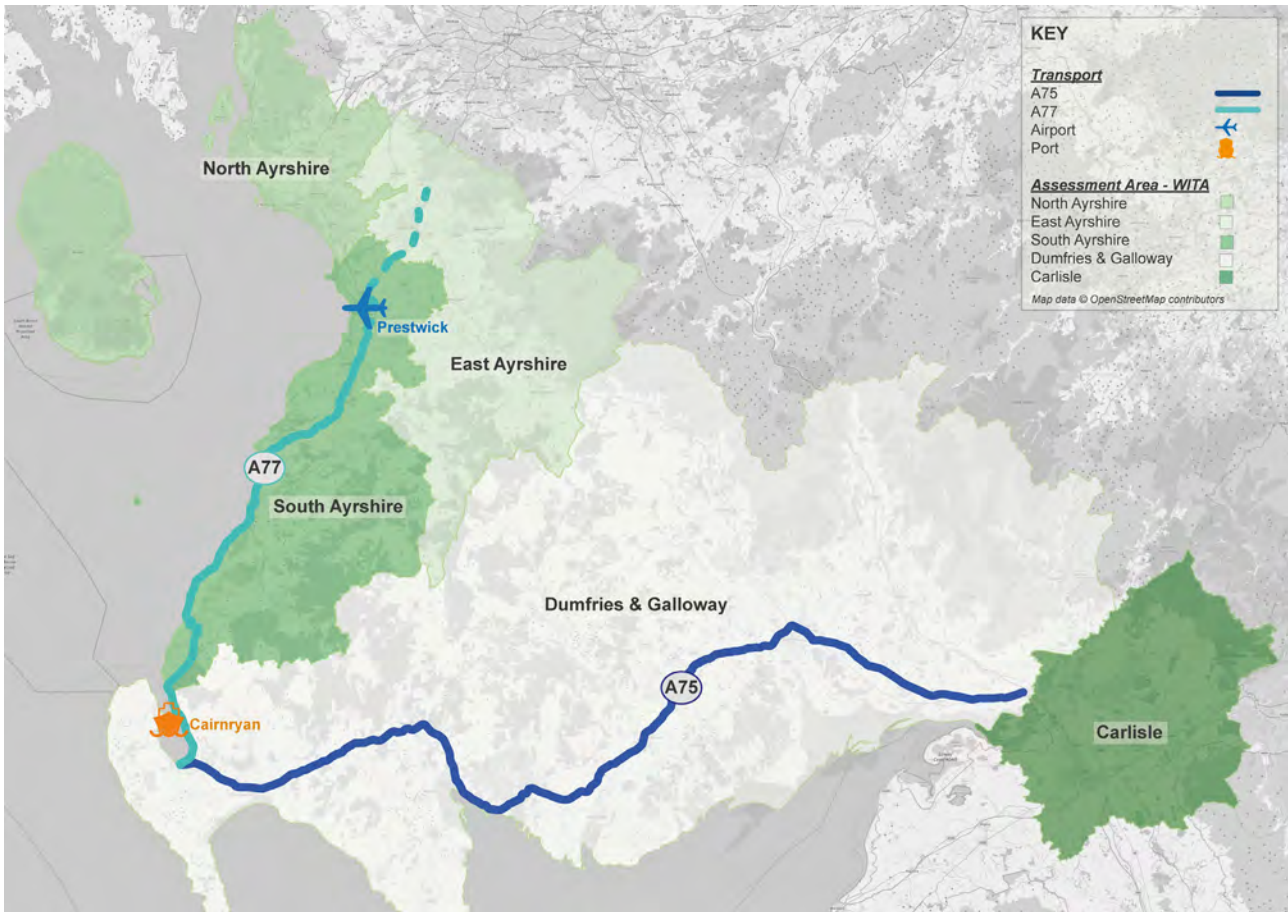
To assess Level 2 WEIs, DfT's Wider Impacts in Transport Appraisal (WITA) software was used. The assessment utilising WITA assumes that employment between the with and without package is consistent and therefore as a result does not consider the move to more / less productive jobs. The following three WEIs have been assessed within WITA:

- Agglomeration: firms derive productivity benefits from being close to one another. These productivity impacts are driven due to access to larger product, input and labour markets and knowledge and technology spill-overs. Output change in imperfectly competitive markets: companies benefit from time savings due to a transport scheme, which is effectively a reduction in production costs, incentivising firms to increase their output whilst maintaining an attractive price-cost margin
- Tax revenues arising from labour supply impacts: the effect on taxes due to a change in the number of people attracted into work as a result of an improvement in travel costs. It should be noted that commuting decisions are based on after tax income, therefore the VOT used for ordinary time savings appraisals does not include exchequer benefits.

The following methodology has been adopted for assessing the WEIs identified above using WITA:

- TMfS model data for the forecast years of 2030 and 2045 has been used within WITA version 2.2
- Opening year of the scheme is 2030 with a horizon year of 2089
- Local authority economic parameters and number of workers were obtained from the DfT's July 2021 wider impacts dataset
- TUBA v1.9.17 economics file was used and therefore is consistent with the latest version of the TAG Databook at the time of undertaking the WITA assessment. The assessment has considered the impacts on car commuting, car business, LGV freight, and HGV (OGV1 / OGV2) trip purposes
- In order to eliminate model noise and unrealistic benefits, the WITA outputs have been filtered at Local Authority District level so that only the direct impacts of the scheme are captured. The area considered is shown in Figure 2-3.

FIGURE 2-3: LOCAL AUTHORITY DISTRICTS INCLUDED WITHIN THE WITA ANALYSIS



#### 2.4.3.2 Dynamic / Transformational Wider Economic Impacts

The Transport and Economic Land-use Model of Scotland (TELMoS) is a land use model which provides a view of future land use and a representation of the interaction between the pattern of land use and transport demand over time. TELMoS is owned by Transport Scotland and operated by approved users. Therefore, to enable use of TELMoS, Sweco commissioned Systra Ltd / David Simmonds Consultancy (DSC).

The use of TELMoS allows for the calculation of dynamic agglomeration effects, all through tight integration with the Wider Impacts Calculator (WIC), a STAG-compliant appraisal tool developed by DSC. In more detail, dynamic agglomeration was calculated following the below methodology:

- Running TELMoS for the without package scenario using outputs from Systra Ltd.'s running of TMfS18, with updated forecasts of employment growth at Cairnryan, and checking the forecasts produced
- Running TELMoS again for the with package scenarios, using the corresponding outputs from TMfS18
- Running WIC using with and without package TELMoS outputs to produce results relating to dynamic agglomeration

As the proposals include cross-border links – M6 / Carlisle via A75, Northern Ireland ferry crossings via A77 – significant impacts would be expected in England and Northern Ireland. These are outside the scope of the modelling undertaken here, and as such the wider impacts presented are not indicative of the overall expected effect of the proposals.

More details on TELMoS as well as the methodology adopted can be found in Appendix C.

#### 2.4.4 Wider Spatial and Social Context Impacts – Additional Welfare Benefits

Wider spatial and social context expenditure is often neglected by conventional methods of economic appraisal. For this reason, DSC have an accessibility-based land-use and transport appraisal software called ULTrA. To make use of this software, Sweco have commissioned Sysstra Ltd / DSC to use ULTrA for the A75 and A77.

ULTrA goes beyond the wider economic impacts appraisal to address the wider spatial and social impact of transport (and land-use) interventions. A relatively new approach, it applies conventional welfare-based cost-benefit analysis to the zonal variables of TELMoS, to estimate transfers between broad sectors of economic actors at different spatial levels.

The approach measures benefits and disbenefits to households and other actors, using measures of benefit from improved accessibility as the means of capturing both the direct benefits of improvement and land-use effects. The choice of approach means that direct effects of transport change appear in accessibility variable. These represent the value that actors in the land-use markets – households and firms – place on accessibility to destinations, as opposed to the value that users in the transport system place on time savings.

Similar to dynamic agglomeration, as the proposals include cross-border links – M6 / Carlisle via A75, Northern Ireland ferry crossings via A77 – significant impacts would be expected in England and Northern Ireland. These are outside the scope of the modelling undertaken here, and as such the impacts presented are not indicative of the overall expected effect of the proposals.

More details on ULTrA as well as the methodology adopted can be found in Appendix C.

#### 2.4.5 Rail Freight Facilities

To assess the impacts of rail freight improvements, Sweco commissioned Sysstra Ltd to undertake relevant assessments. The high-level review / assessment considers a freight loading site at Barrhill, an assessment of associated rail flows to understand the shift in flows from road and associated carbon savings, and an initial review of the freight opportunities at Cairnryan / Stranraer.

##### 2.4.5.1 Review of Barrhill Timber Loading Site

The area around Barrhill station has been reviewed to understand its suitability, from a rail perspective for use as a timber loading facility. The desk based review used OS maps, satellite images, the Network Rail Sectional Appendix and signalling plans for the area to provide a view on if suitable land is available for a loading site and what works would be required to achieve this. An initial scope of works for the site has been produced to identify what would be required, and in doing so has also identified how easily delivered the site would be, which ultimately determines both timescales for delivery and the overall commercial / economic viability of the site.

##### 2.4.5.2 Rail Based Timber Flow Assessment

An assessment of the market for timber by rail from Barrhill has been undertaken using available data on final destinations for timber from the Barrhill area and also existing rail timber flows to establish a trip distribution. A high level routing of services and estimation of the number of services operating each week has been developed. The carbon savings of using rail versus road haulage for such trips using rail and road distances has been estimated. It should be noted that services heading to England will incur a distance penalty for rail due to the need for all services to route via Ayr and Dumfries.

The output is an estimate of, destinations, annual volumes moved, the number of HGV trips removed, and the volume of CO2 saved.

##### 2.4.5.3 Review of Cairnryan Terminal

The opportunities presented by a container terminal at Cairnryan have been reviewed. A key assumption in this review is that the use of shipping containers replaces accompanied HGV trailers on flows towards Northern Ireland making them suitable for transfer to rail freight. Data on current freight flows between Northern Ireland and the rest of the UK, both via Cairnryan but also via other routes has been used where available. Using this data, the number of container routes that might be developed has been explored. The potential scale of the market and the number of trains that might be operated has been developed, and as with the Barrhill site an estimation of the carbon savings from mode shift to rail has been calculated.

##### 2.4.5.4 Review of Ayr Terminal

The opportunities for a rail freight terminal to be provided near to Ayr, including the identification of a suitable site and the works which may be required to achieve this, have been reviewed and reported. The key objective of such a facility would be to encourage modal shift from road to rail for the transfer of freight to and from the surrounding area. Freight flows from the Ayr area have been explored and identified using TMfS and research into existing rail based freight flows. Using this data, the number of container routes that might be developed has been explored. The potential scale of the market and the number of trains that might be operated has then been developed, and as with the other sites, an estimation of the carbon savings from mode shift to rail has been calculated.

## 3 Economic Assessment Results

### 3.1 Introduction

The different types of benefits, as well as the methodology for deriving them, have been discussed in the previous sections. This section presents a summary of the economic assessment results and how they have been used to derive the overall Present Value of Benefits (PVB) for each package of interventions.

### 3.2 Highway Transport Economic Efficiency Results

As expected, the introduction of each package of interventions is predicted to reduce journey times along the A75 and A77 and on the wider network. Vehicle usage incurs costs such as fuel, maintenance and wear and tear, which are classified under the term vehicle operating costs. When each package is implemented, a variety of changes in speed and distance are likely to occur. These changes occur due to the following reasons:

- Traffic transferring onto the higher capacity A75 and A77 will experience less delay, travel at faster speeds, and therefore have quicker journeys. However, some of the traffic rerouting onto the A75 and A77 will travel slightly longer distances (even if they are quicker)
- Other local trips are likely to experience improved travel times as a result of the reduced levels of traffic on the wider local network

Figure 3-1 shows the analysis of the benefits by trip purpose. The figure and results indicate that approximately 60% of the benefits are experienced by business trip purposes, 25% due to other trips and 15% due to commuting trips. This is expected because strategic roads, like the A75 and A77, are likely to have a higher proportion of business trips. The A75 in particular provides direct access between Stranraer and Dumfries, two key economic hubs and destinations in the South West of Scotland. Business trips also have a higher value of time therefore leading to large benefits, and in general, travel longer distances.

Commuting and other purpose trips experience VOC disbenefits. These disbenefits are driven by changes in non-fuel vehicle operating costs between the with and without package scenarios. Due to the implementation of each package, vehicles (making long distance trips) are travelling longer distances but at faster speeds and with travel time savings as a result of improved efficiency along the A75 and A77. These increased trip distances drive the vehicle operating cost disbenefits as the travel time factor within the non-fuel vehicle operating cost calculation is zero for non-work trips.

Overall, when considering journey time benefits and vehicle operating costs, the packages are ranked in the following order:

1. Package 3 – Full dualling of the A75 and A77 including bypasses of key towns and junction improvements
2. Package 6 – Full dualling of the A75 including bypasses of key towns and junction improvements
3. Package 9 – Full dualling of the A77 including bypasses of key towns and junction improvements
4. Package 2 – Bypasses of key towns and junction improvements along both the A75 and A77
5. Package 1 – Bypasses of key towns and junction improvements along both the A75 and A77
6. Package 5 – Bypasses of key towns and junction improvements along the A75
7. Package 8 – Bypasses of key towns and junction improvements along the A77

As expected full dualling of the A75 and the A77 along with bypasses at key towns and targeted junction improvements ranks the highest generating over £700 million worth of journey time and vehicle operating cost benefits. Package 6 then ranks second, generating approximately £520 million worth of benefits, followed by package 9 in third, generating approximately £230 million worth of benefits. This ranking shows that dualling of both the A75 and A77 would bring about wide spreading benefits, however improvements to the A75 should be a priority over the A77, with the A75 accruing more than double the benefits than the A77 does. The results stress the importance of the A75 and the benefits that would be experienced by the significant volumes of traffic travelling along it to access Cairnryan and England.

The other packages follow a similar trend, with packages 2 and 1 ranking fourth and fifth respectively, and then packages 5 and 8 ranking sixth and seventh respectively. It should be noted that these packages do still accrue significant positive benefits, they just aren't to the same scale as Package 3.



FIGURE 3-1: USER BENEFITS (TIME AND VEHICLE OPERATING COSTS) BY PURPOSE, £ MILLIONS, DISCOUNTED 2010 PRICES

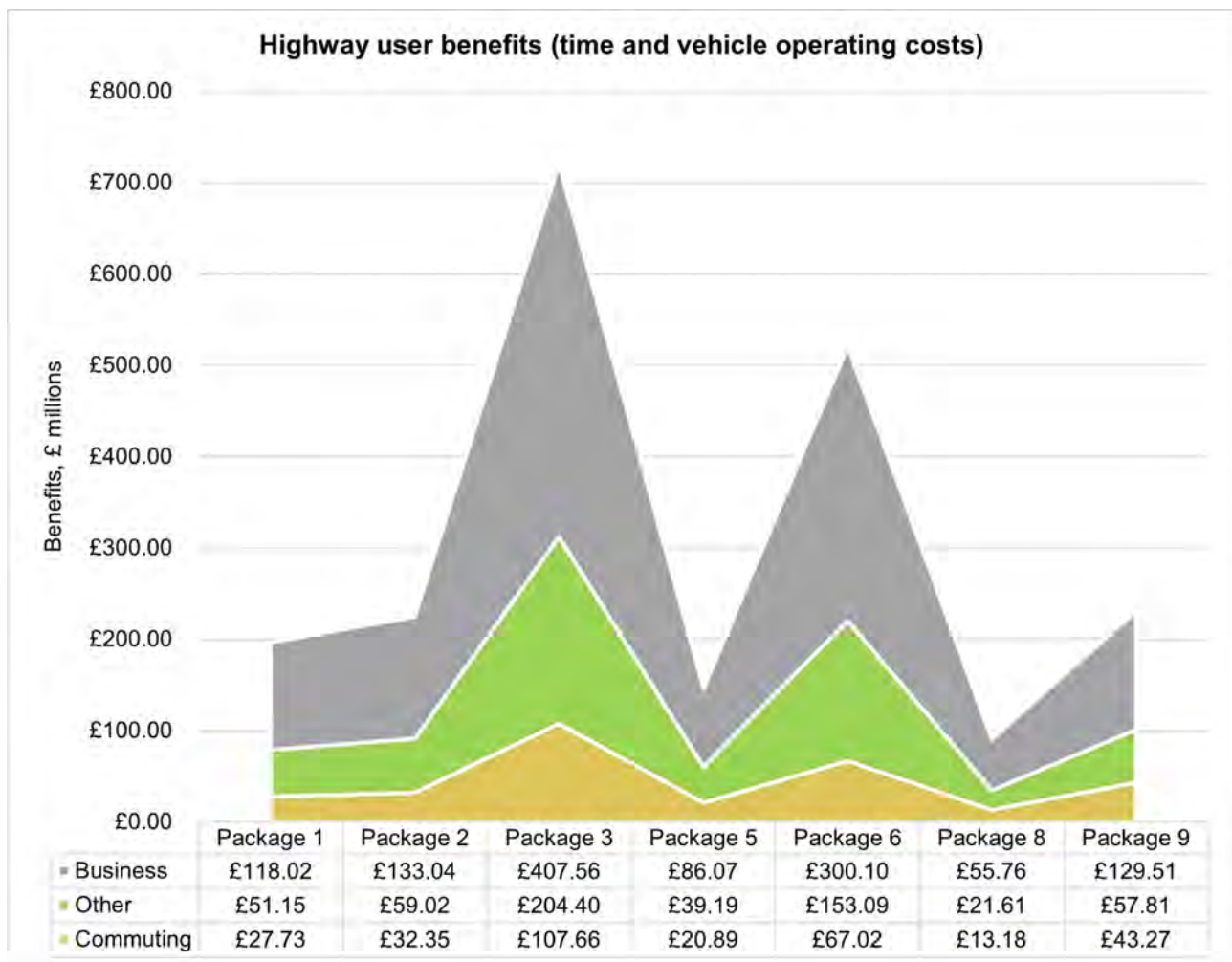
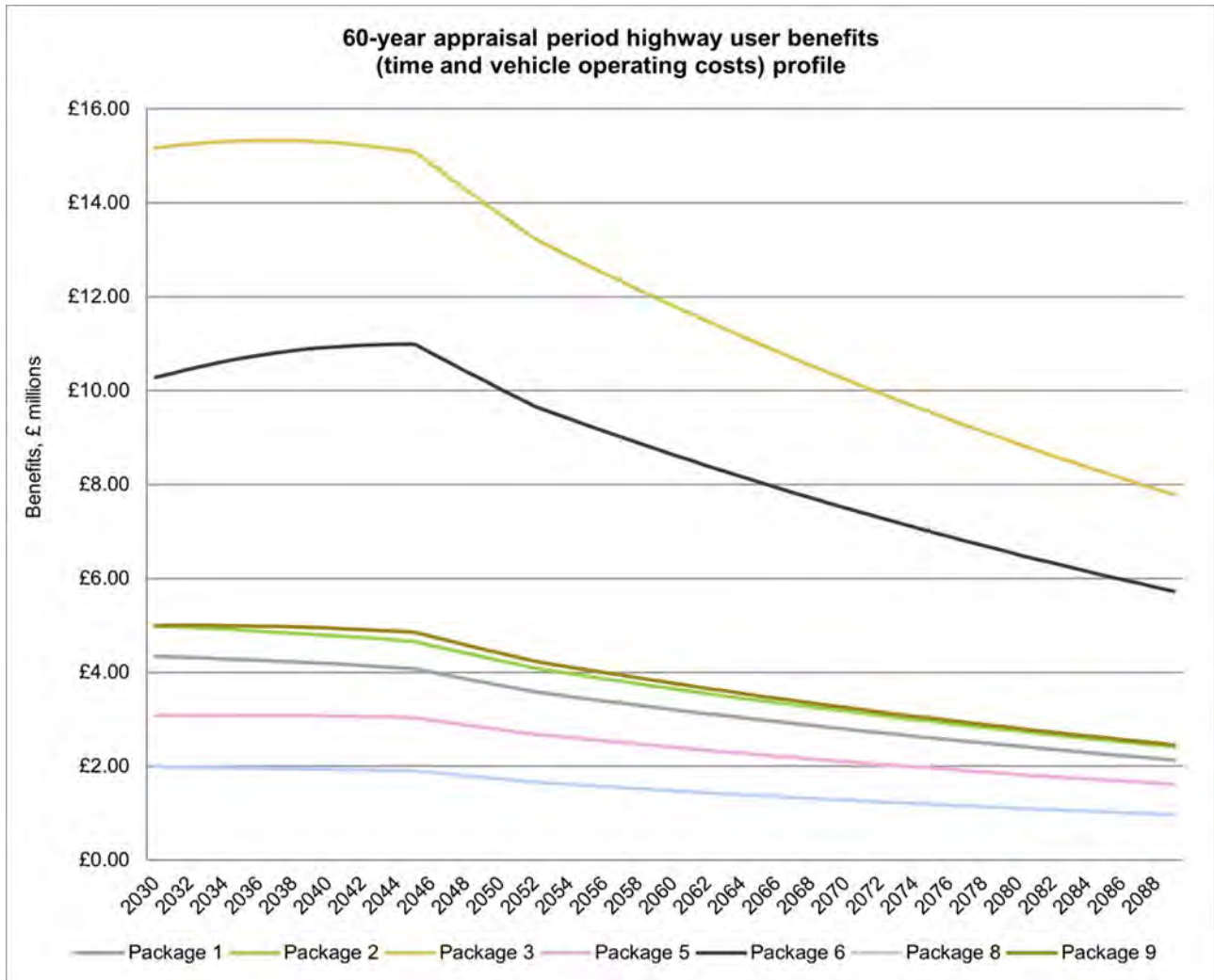


Figure 3-2 shows the 60-year benefit profiles which includes time benefits, and vehicle operating costs. The benefit profile presents whether the benefits of each package occur towards the beginning of the package opening or later into the future.

The benefit profiles of all packages indicates that a significant proportion of the benefits occur between the opening year (2030) and design year (2045). The profile shows the benefits gradually decrease from opening year to design year, with a steady decrease in benefits after design year. The steady decrease in benefits after the design year is due to the effect of discounting. Though the discounted benefits decline over the life of the scheme, this does not indicate that the actual undiscounted benefits would be declining.

FIGURE 3-2: USER BENEFITS PROFILE, £ MILLIONS, DISCOUNTED 2010 PRICES



The TUBA assessment and therefore the benefit outputs have been analysed at model sector level. This allows user benefits between model zone origin and destination pairs to be aggregated into larger geographical areas. The relationship between model sectors and zones is defined in the TUBA input and the sector files.

For each package there were 55 sectors which divided up the whole of the TMfS which covered the whole of Great Britain. The A75 is located in the sectors labelled Dumfries, Dalbeattie and Castle Douglas, Newton Stewart, and Stranraer. The A77 is located in the sectors labelled Stranraer, Girvan, and Ayr.

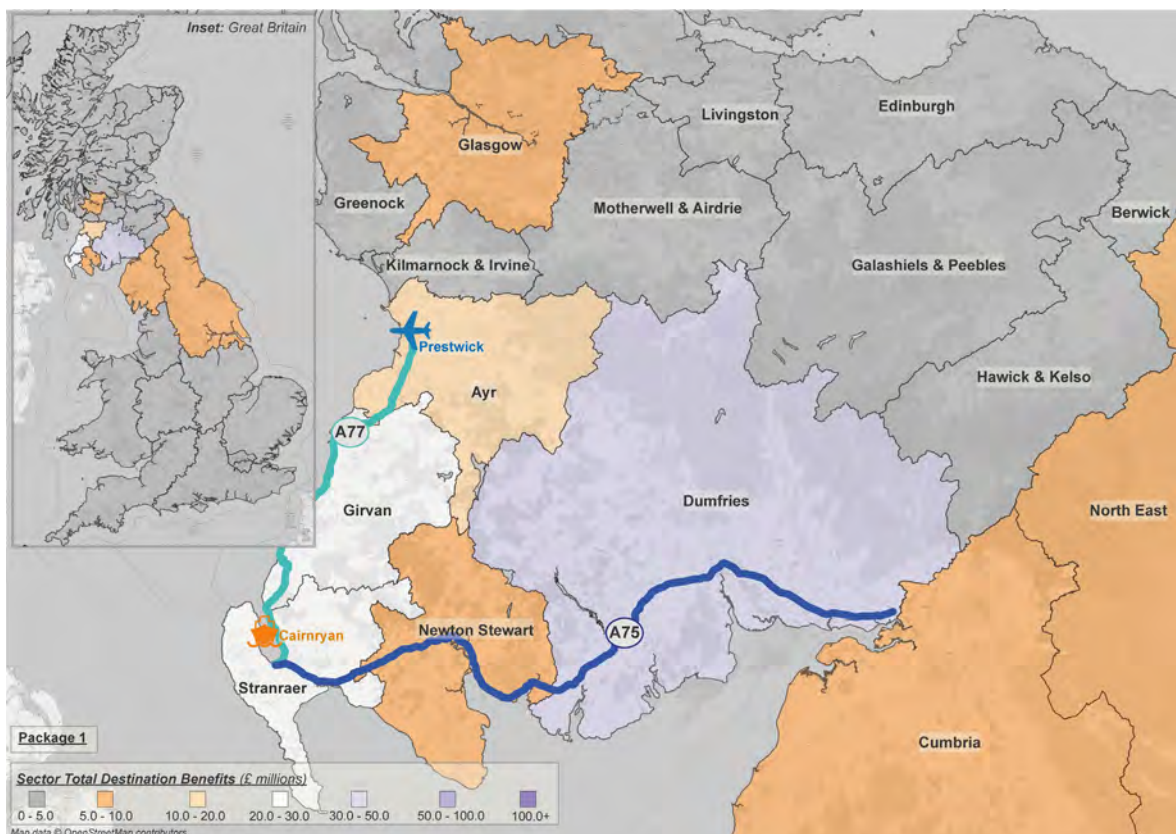
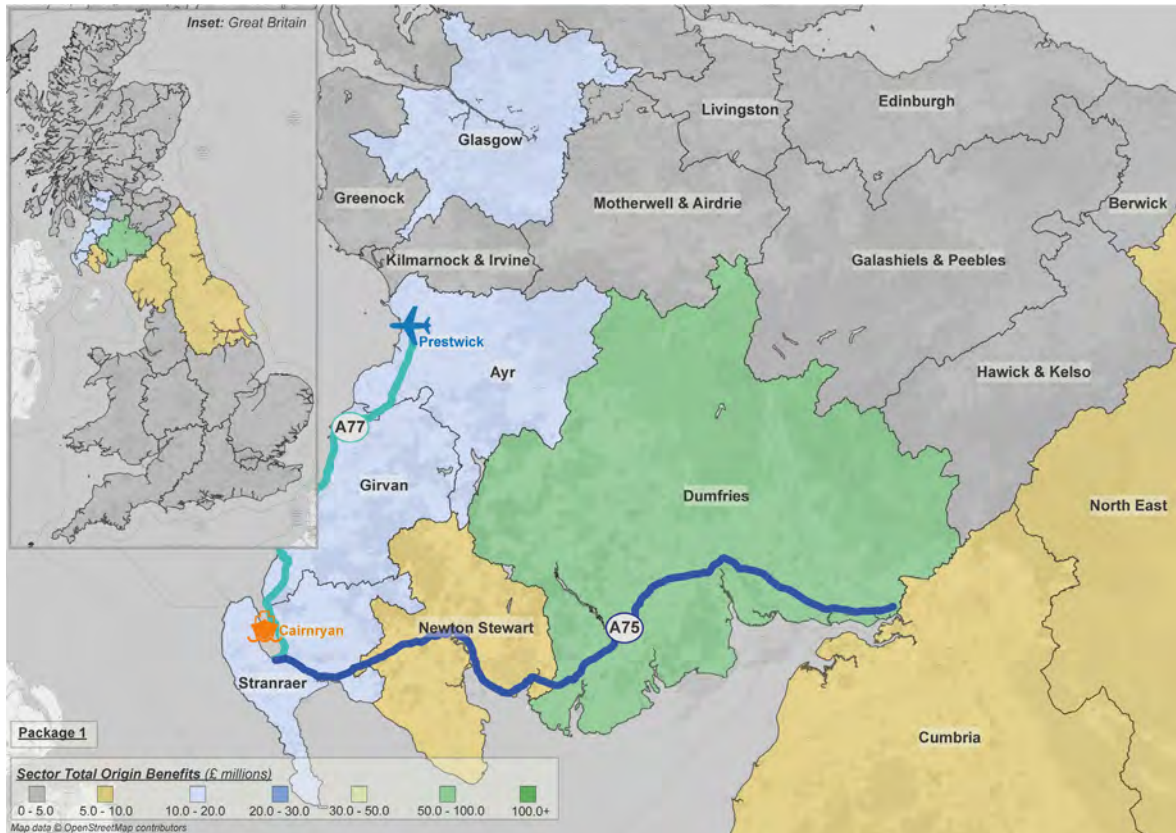
Figure 3-3 to Figure 3-9 present the origin and destination sector totals. As would be expected, the figures show that the sectors within close proximity to the A75 and A77 accrue the majority of benefits dependent on the scale of the packages intervention.

When considering packages 1, 2 and 3 (Figure 3-3, Figure 3-4 and Figure 3-5), Dumfries accrues the largest share of the benefits. Other sectors such as Stranraer, Newton Stewart, Dalbeattie and Castle Douglas, Newton Stewart, Girvan, and Ayr also are expected to experience benefits as a result of the bypasses and junction improvements delivered along the A75 and A77. The benefits seen in Kilmarnock and Irvine, Glasgow, Cumbria and Berwick Upon Tweed, which are particularly prevalent in package 3, show the large reaching impact of the improvements.

Packages 5 and 6 (Figure 3-6 and Figure 3-7), which only consider improvement to the A75, see the benefits concentrated to Dumfries, Stranraer, Newton Stewart, and Dalbeattie and Castle Douglas. Packages 8 and 9 (Figure 3-8 and Figure 3-9), which consider only improvements to the A77, see the benefits concentrated to Stranraer, Girvan, Ayr and Kilmarnock and Irvine. These two packages also generate benefits in Glasgow due to the direct linkage between the A77 and the M77 which flows directly into Glasgow.

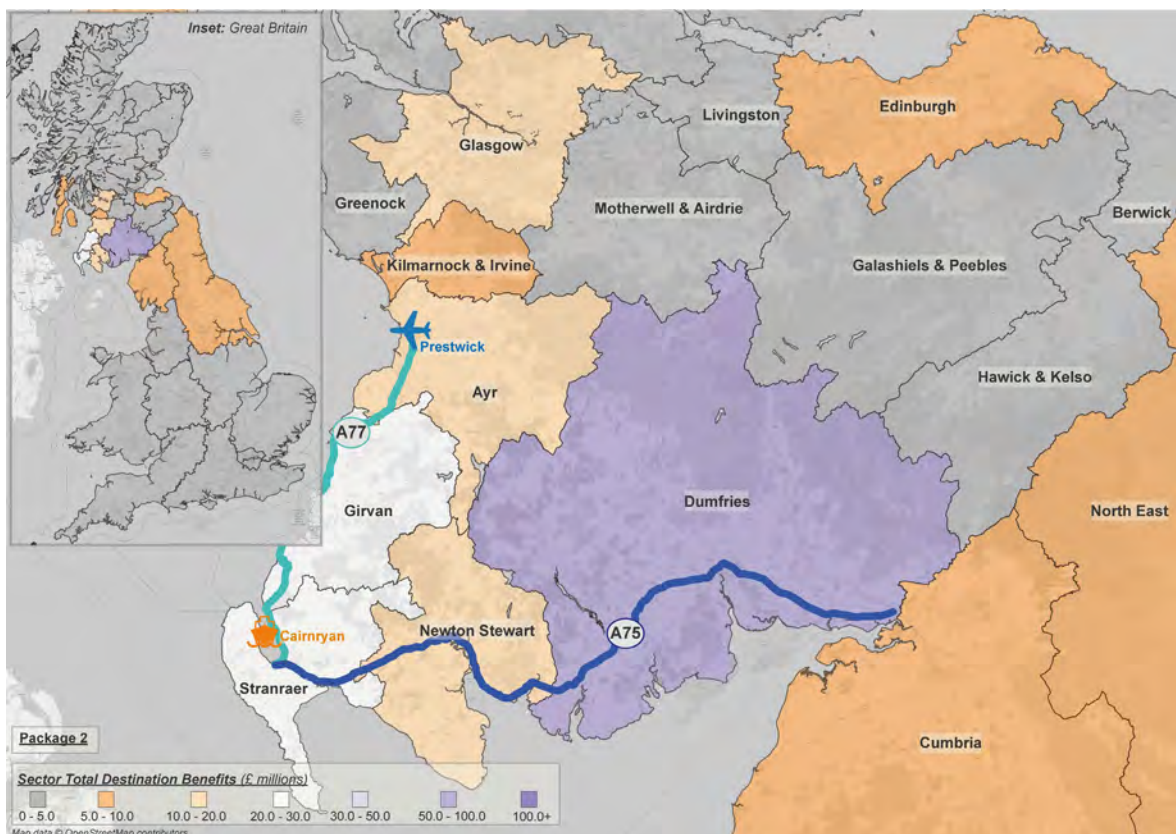
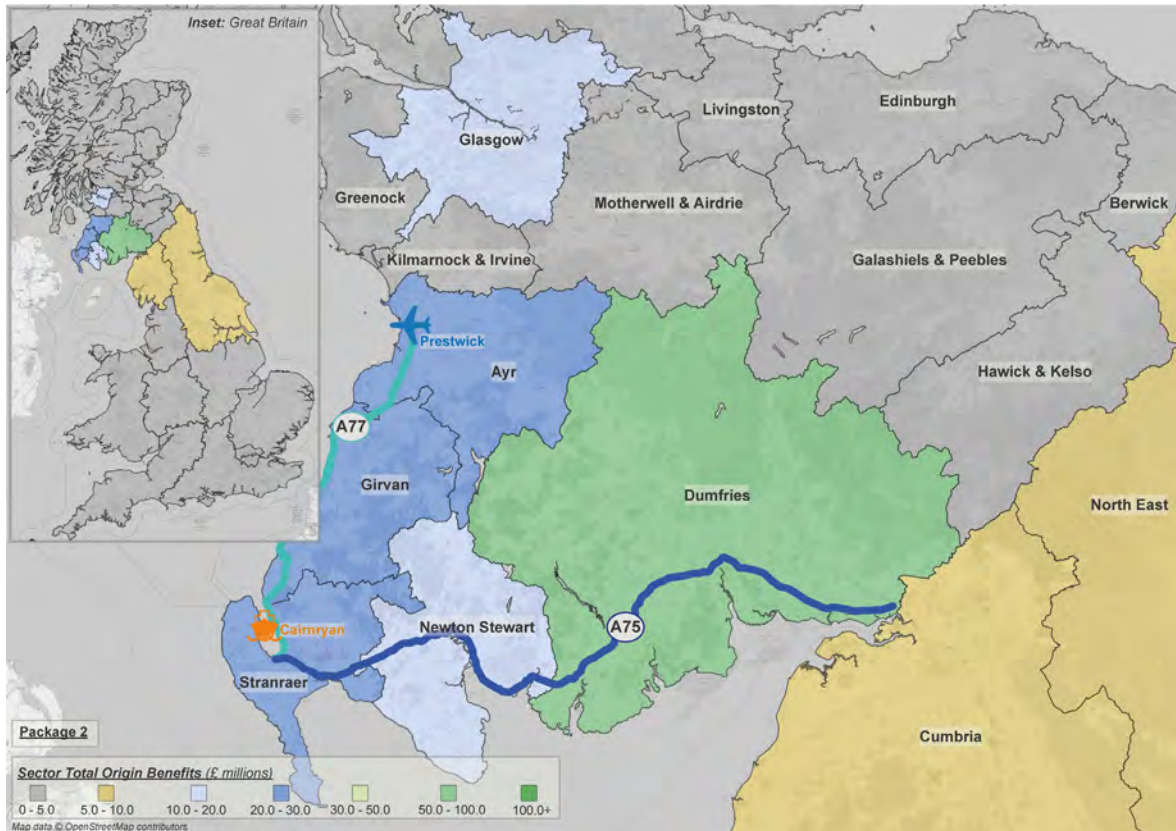
**Package 1**

**FIGURE 3-3: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 1**



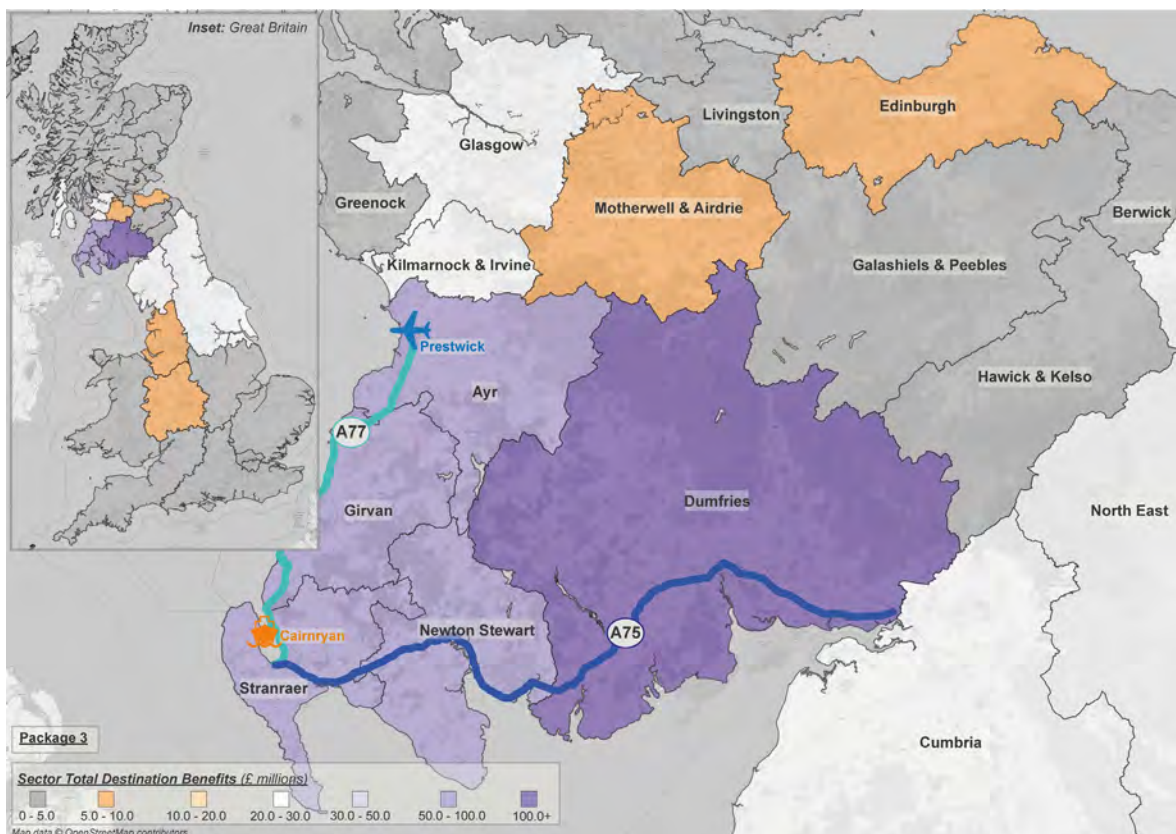
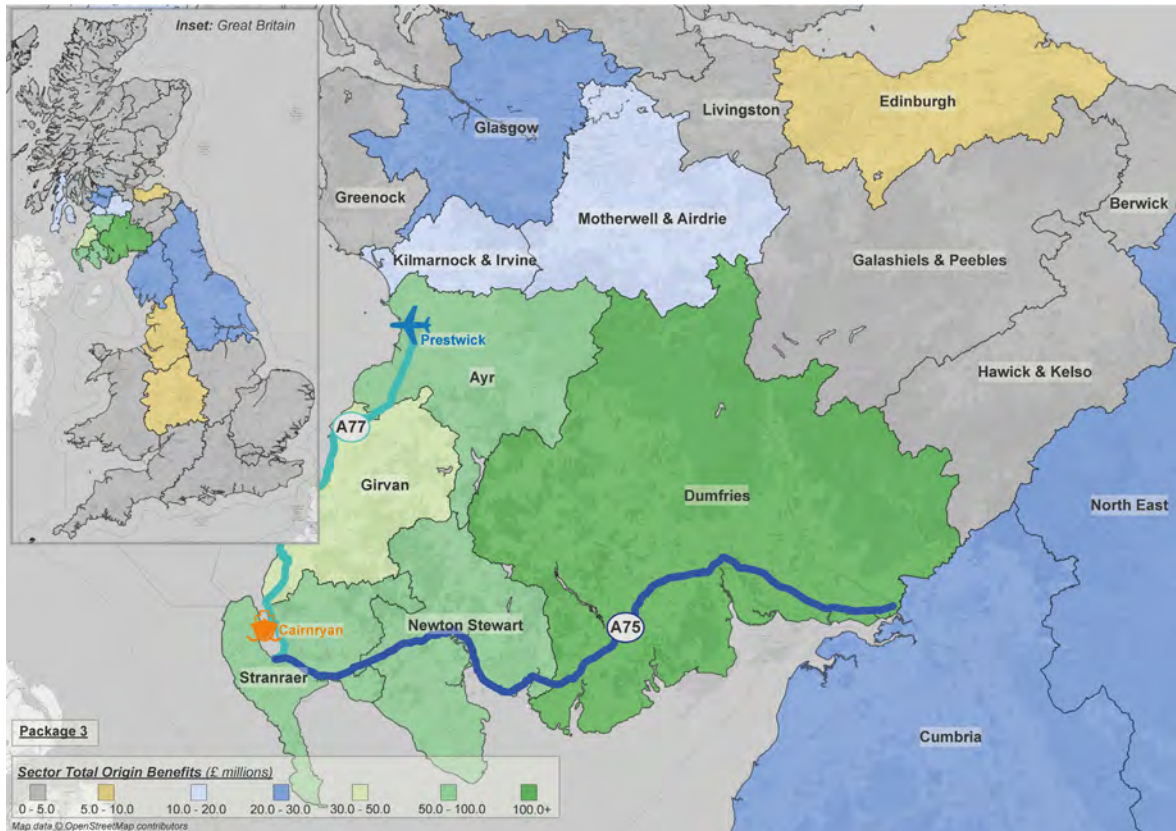
**Package 2**

**FIGURE 3-4: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 2**



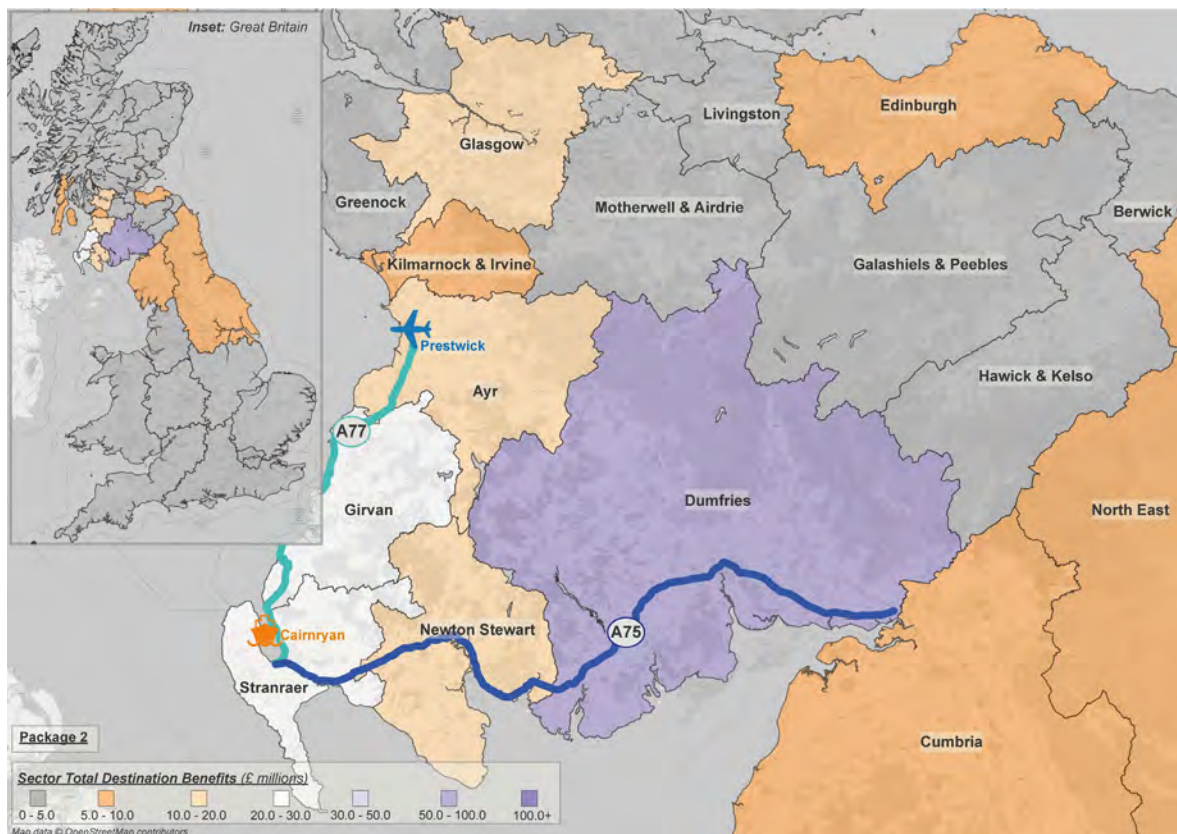
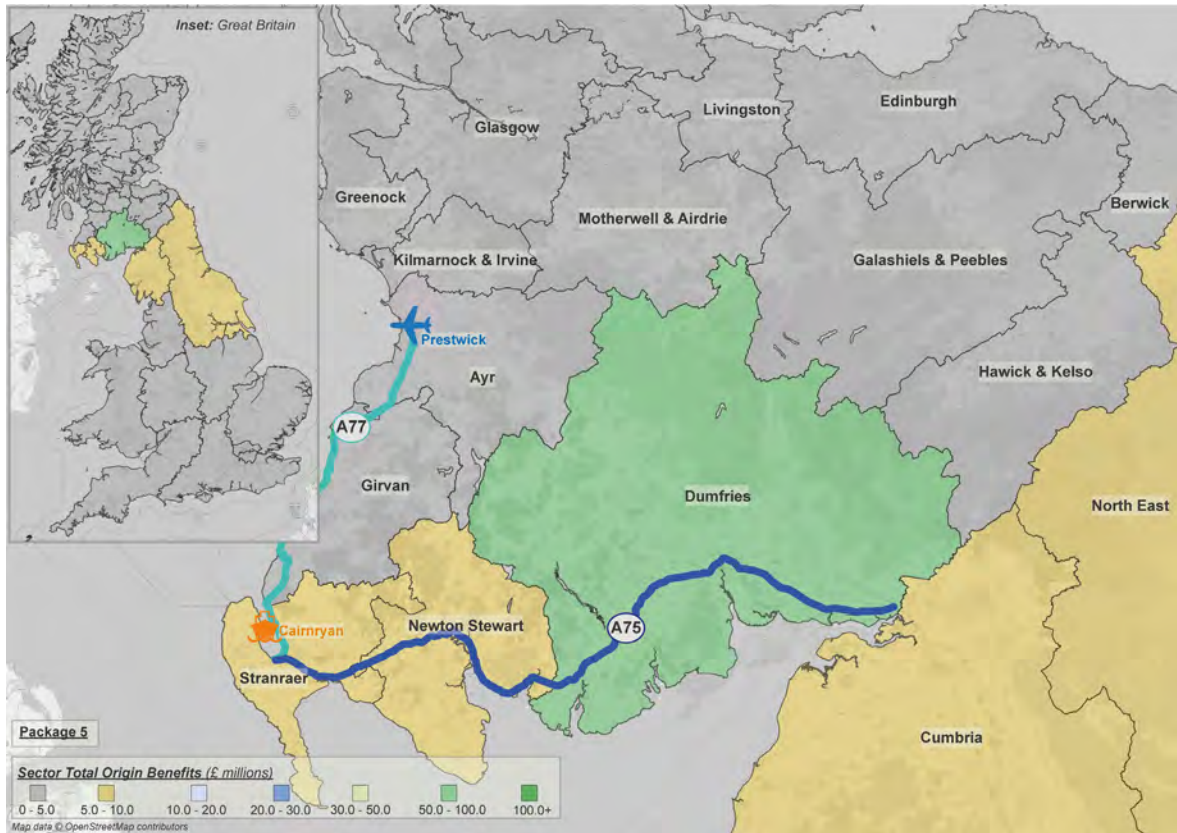
**Package 3**

**FIGURE 3-5: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 3 PACKAGE 3**



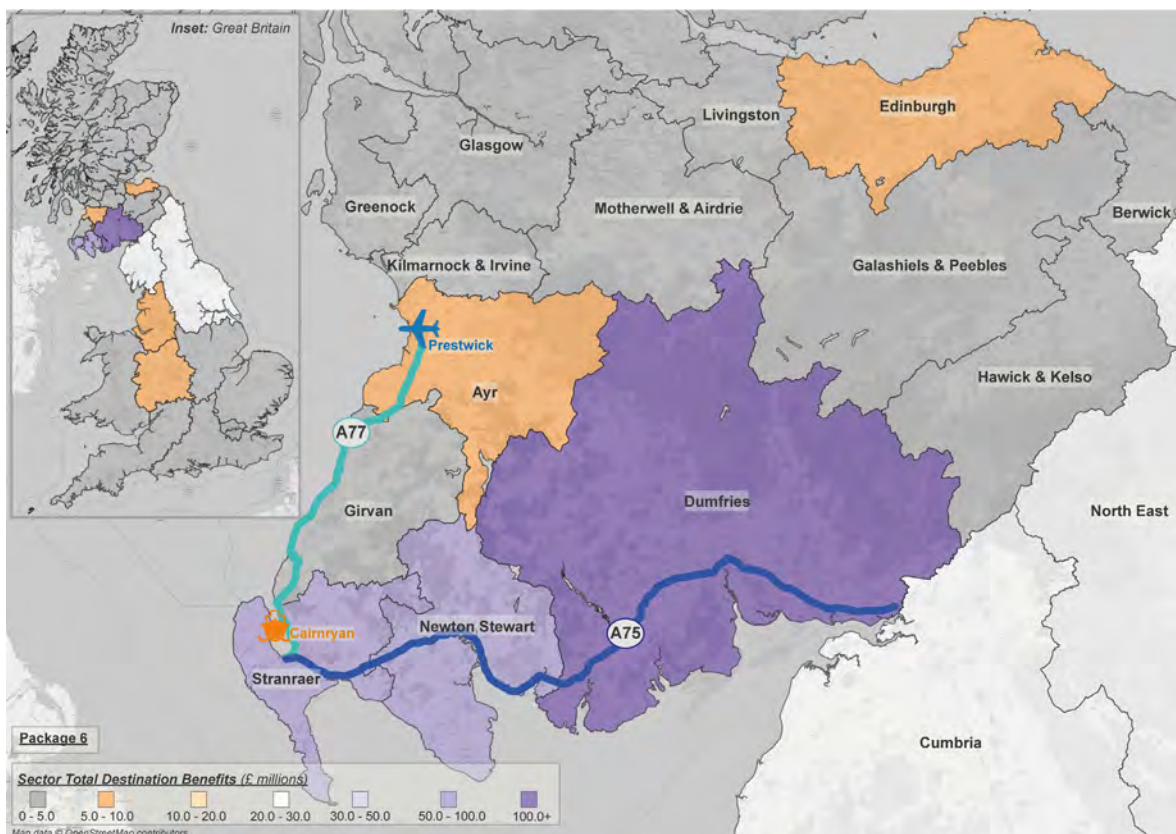
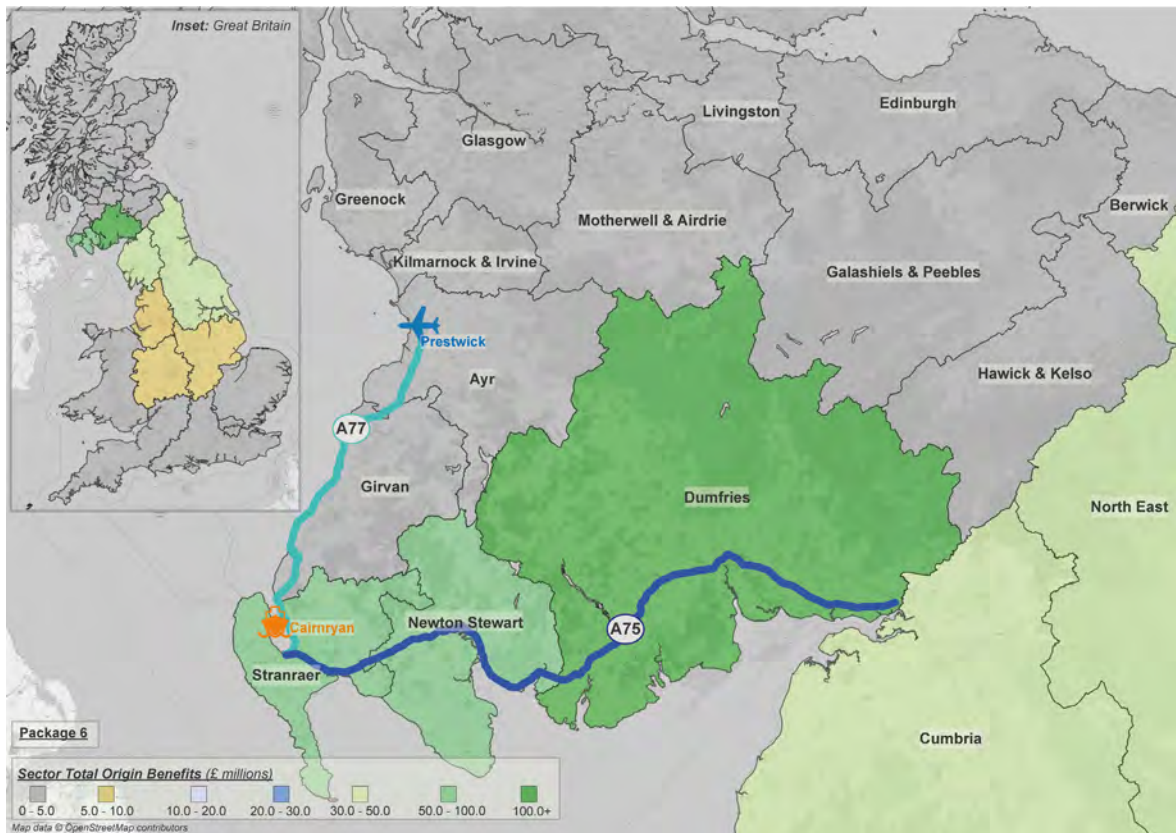
**Package 5**

**FIGURE 3-6: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES -PACKAGE 5 PACKAGE 5**



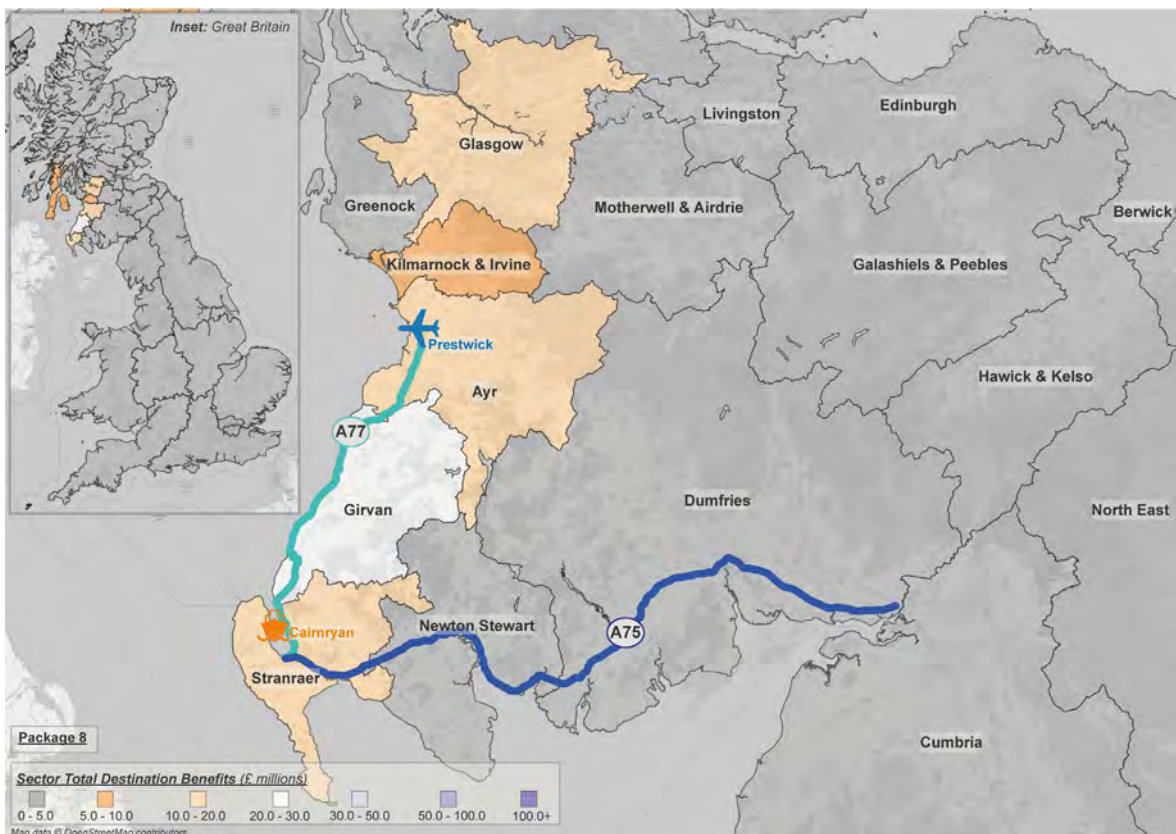
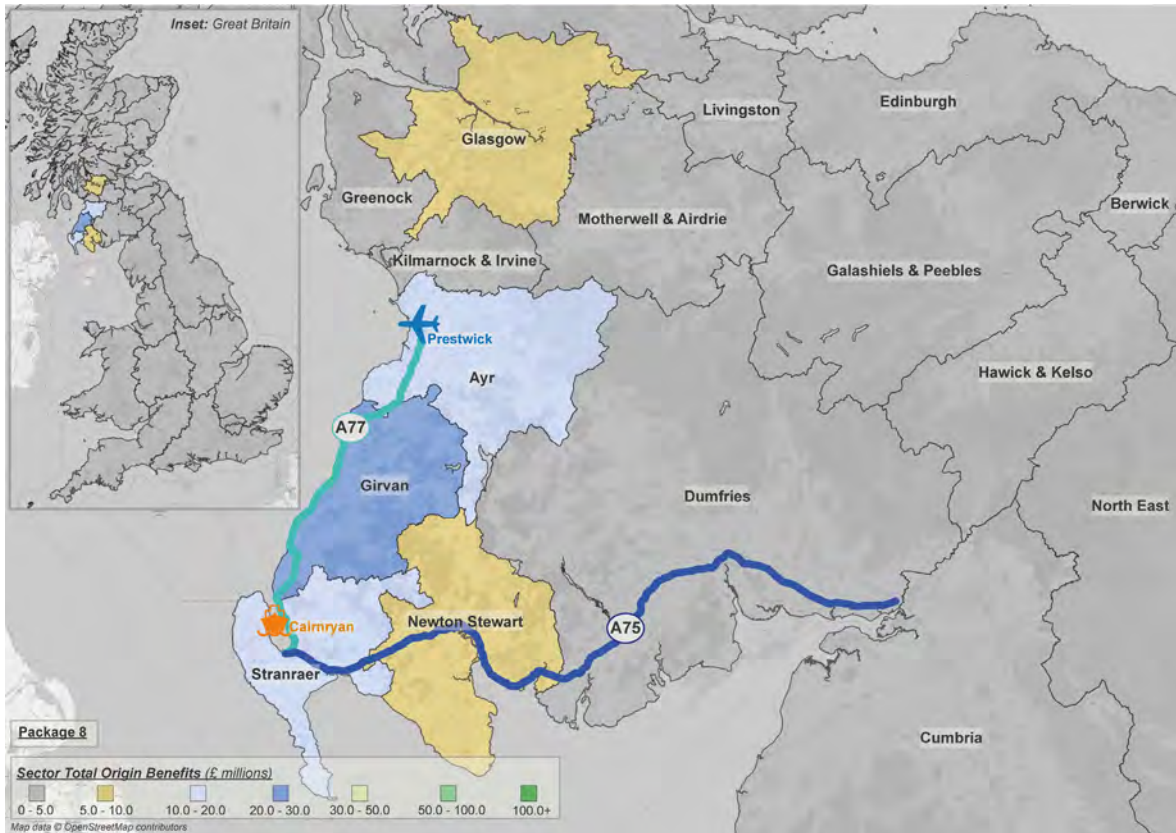
**Package 6**

**FIGURE 3-7: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 6 PACKAGE 5**



**Package 8**

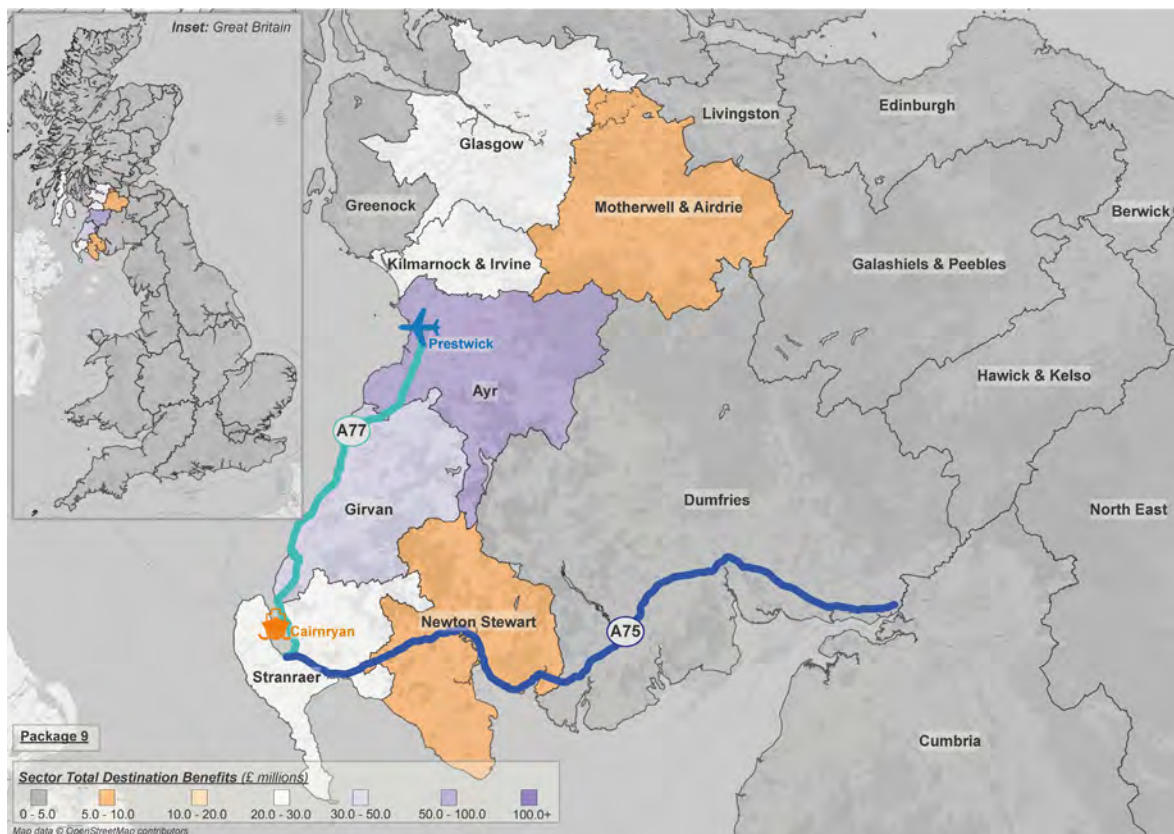
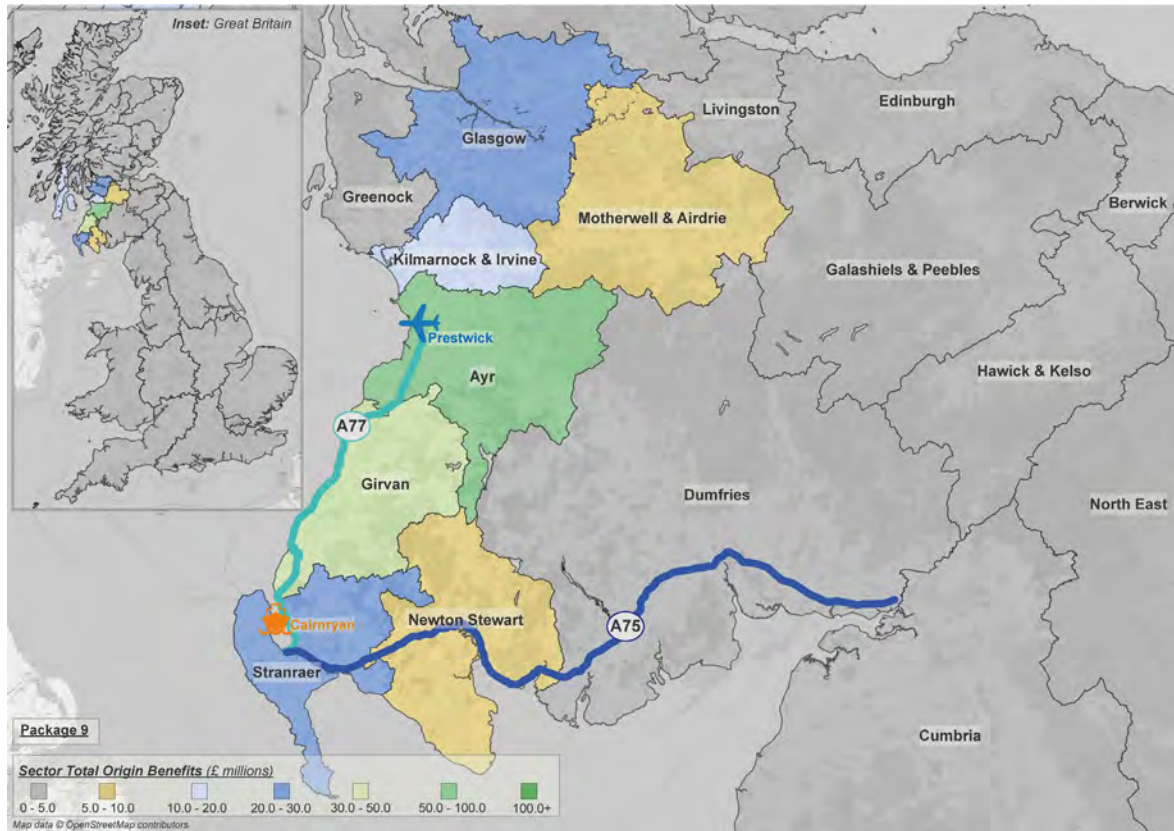
**FIGURE 3-8: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 8**





**Package 9**

**FIGURE 3-9: USER BENEFITS SECTOR RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 9**



### 3.3 Bus and Rail Transport Economic Efficiency Results

#### 3.3.1 Bus

Figure 3-10 presents the bus passenger time benefits for the seven packages of improvements. The results show that buses experience modest positive time benefits across all packages, with package 3 accruing the largest share of the benefits. The magnitude of these benefits is not to the same scale as the highway benefits, which is expected, as the demand for bus travel is significantly lower and the packages do not directly include dedicated bus improvements.

Bus users would experience improved journey times due to the improvements in road capacity on the A75 and A77 causing a reduction in congestion and delays. Most notably for bus trips will be impact of reduced congestion on the wider local network, which is used more frequently by bus services. The ability of the improvements to attract traffic onto the A75 and A77, will improve the reliability of bus services using the wider local network.

Commuting and other user trip purposes experience a comparatively large proportion of the overall time benefits when compared to business users. This is due to the rural locality of the packages and limited trips undertaken by business purposes. Where business purpose trips are undertaken, these would be mainly freight trips due to the port and local industry and would use highway based modes rather than bus services. This reflects the level of time benefits seen.

Currently, only bus user time benefits have been considered but there are other elements that would accrue relating to buses. Operator revenue and user fare changes would occur as a result of the interventions as mode shift may occur due to increased attractiveness of the bus network, but these impacts are likely to be minimal.

#### 3.3.2 Rail

Figure 3-11 presents the rail passenger time benefits for the seven packages of improvements. The results show that rail passengers experience positive time benefits overall across all packages, with package 3 generating the largest share of benefits. Similar to the benefits seen for buses, the benefits for rail passengers are not to the same scale as the highway benefits. This is expected because the rail improvements considered within this Strategic and Economic Impacts Report are largely focused on rail freight as opposed to passenger rail, for the reason of removing HGVs from the highway network.

Rail users would experience improvements to journey times due to the improvements in rail provision and capacity by upgrading the existing line and the creation of a new station. This would improve the frequency and availability of services, improving reliability which leads to a reduction in travel times for rail users.

In the same way as bus passengers, commuting and other user trip purposes experience a comparatively large proportion of overall time benefits when compared to business users. This is again due to the rural locality of the packages and limited trips undertaken by business purposes.

Currently, only rail passenger user time benefits have been considered but there are other economic impacts that would accrue for rail passengers. Operator revenue and user fare changes would occur as a result of the proposed interventions as mode shift may occur due to increased attractiveness of the rail network.

FIGURE 3-10: BUS PASSENGER JOURNEY TIME BENEFITS BY PURPOSE, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES

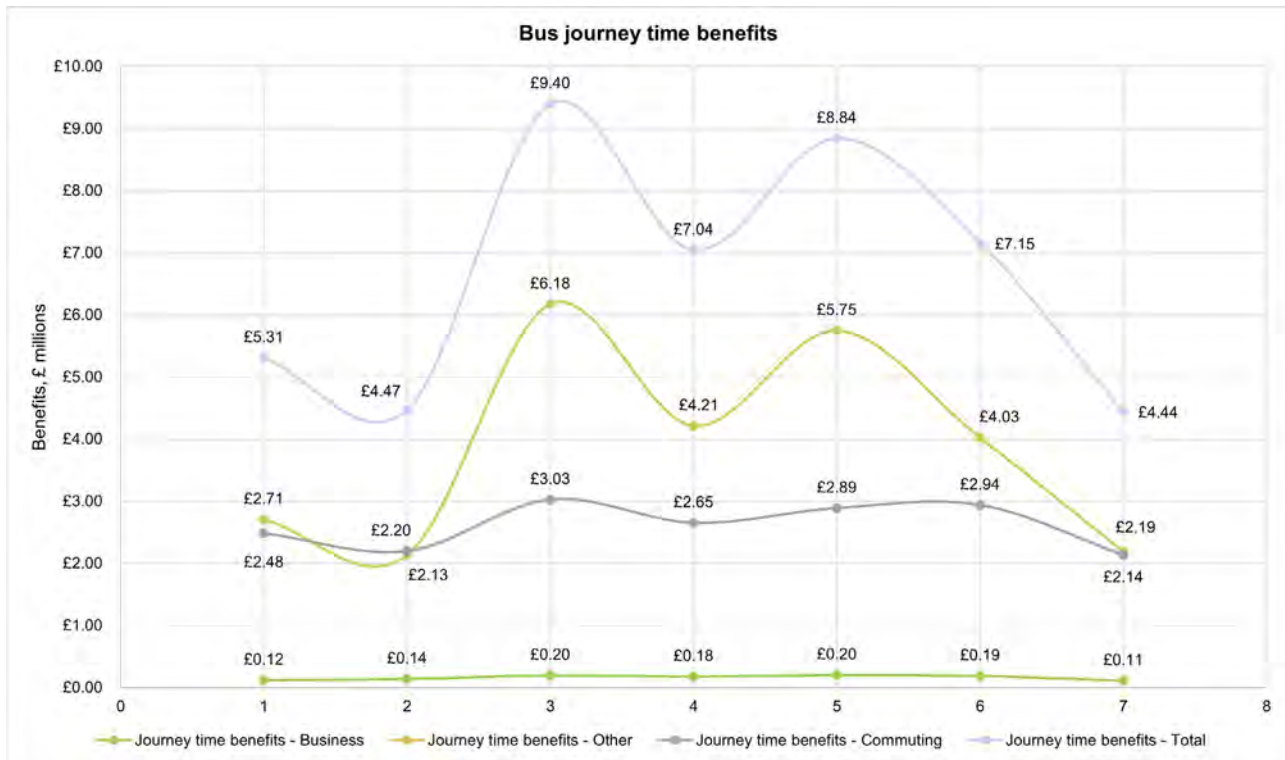
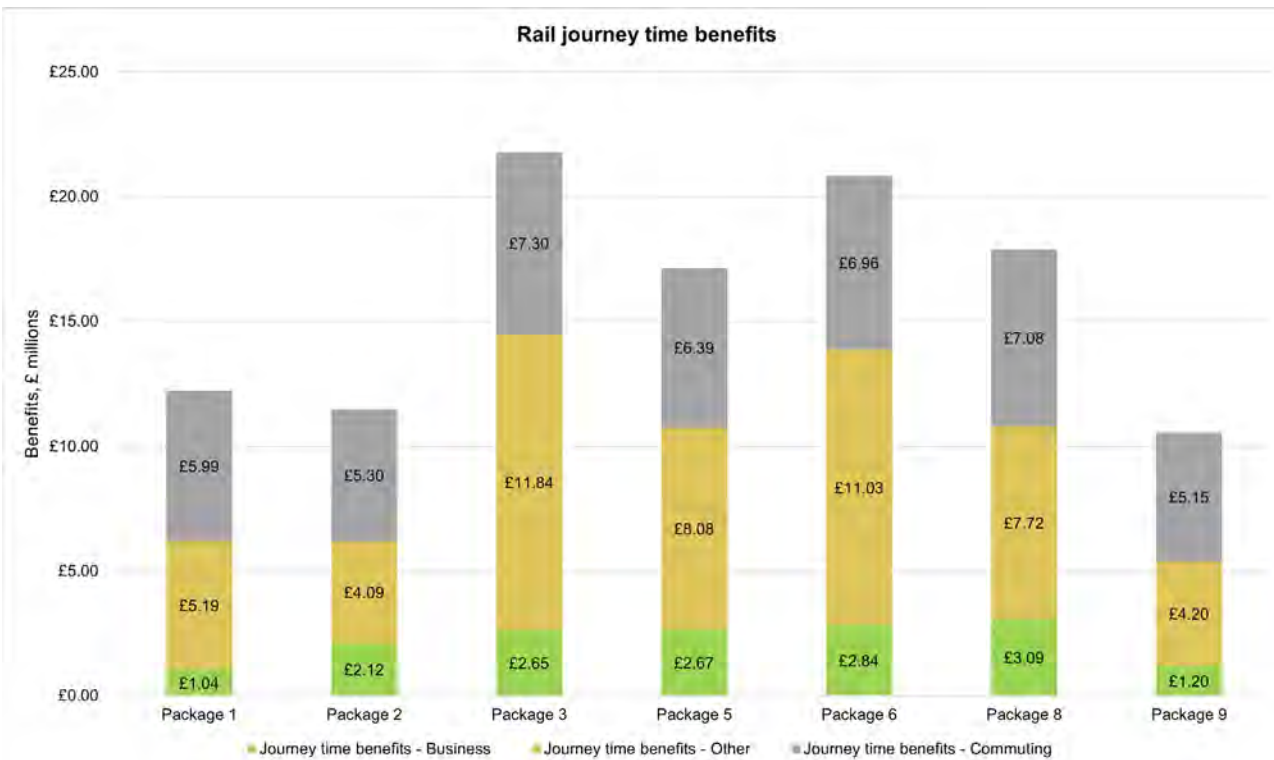


FIGURE 3-11: RAIL PASSENGER JOURNEY TIME BENEFITS BY PURPOSE, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES



### 3.4 Accident Savings Results

Figure 3-12 presents the predicted accident benefits that would occur due to the implementation of the various package of improvements.

As expected full dualling of the A75 and the A77 along with bypasses at key towns and targeted junction improvements ranks the highest generating over £250 million worth of accident benefits. Package 6 then ranks second, generating approximately £190 million worth of benefits, followed by package 9 in third, generating approximately £75 million worth of benefits. Following the same trend as the journey time and vehicle operating cost results, the accident results echo that dualling of both the A75 and A77 would bring about substantial benefits, however improvements to the A75 should be a priority over the A77, with the A75 accruing more than double the benefits of the A77. The results stress the importance of improvements to the A75 and the accident savings that would be experienced by delivering a high standard dual carriageway that bypasses constrained network areas and key settlements. The other packages follow a similar trend, with packages 1 and 2 ranking fourth and fifth respectively, and then packages 5 and 8 ranking sixth and seventh respectively. It should be noted that these packages do still accrue significant positive benefits, they just aren't to the same scale as package 3.

FIGURE 3-12: ACCIDENT SAVING BENEFITS, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES

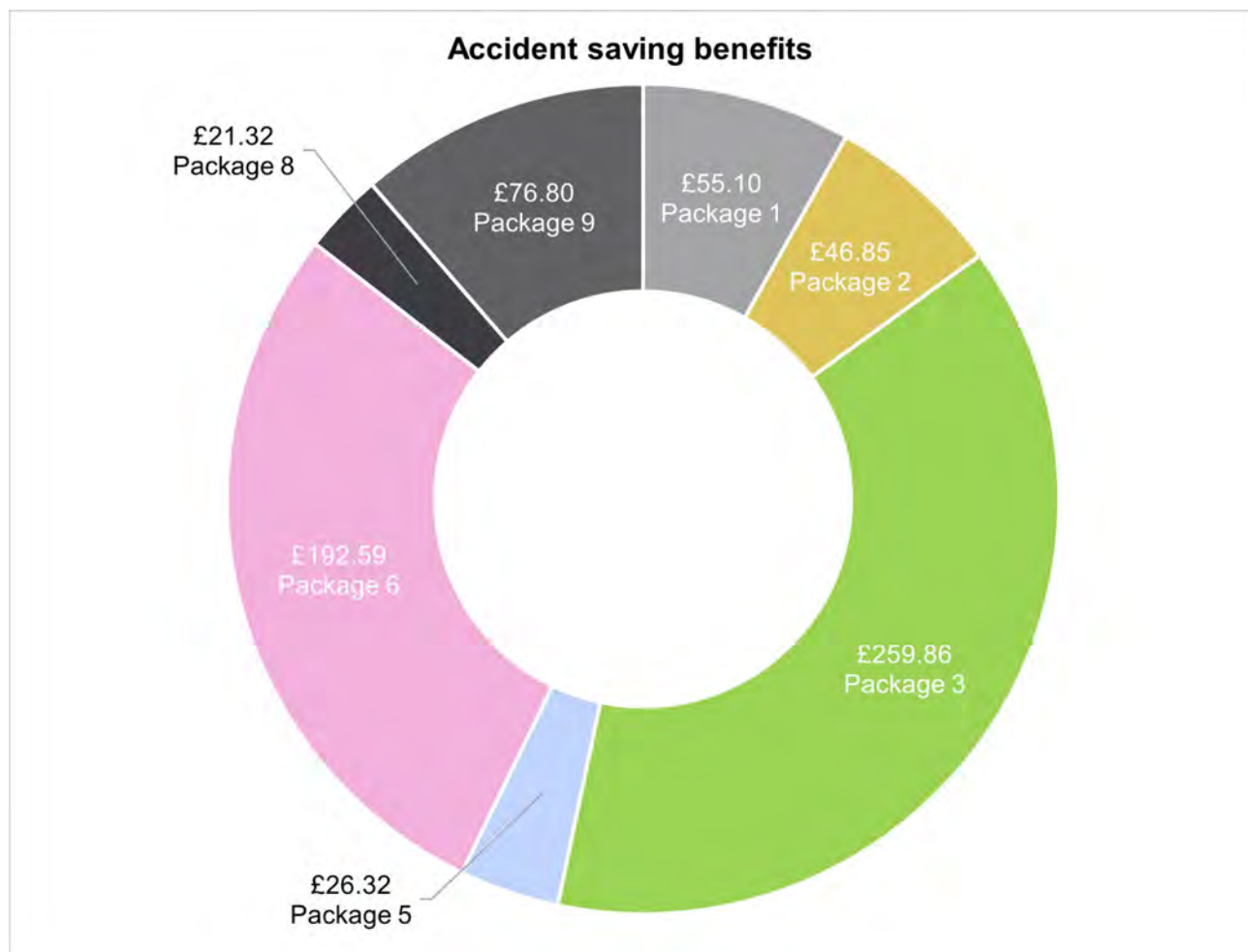
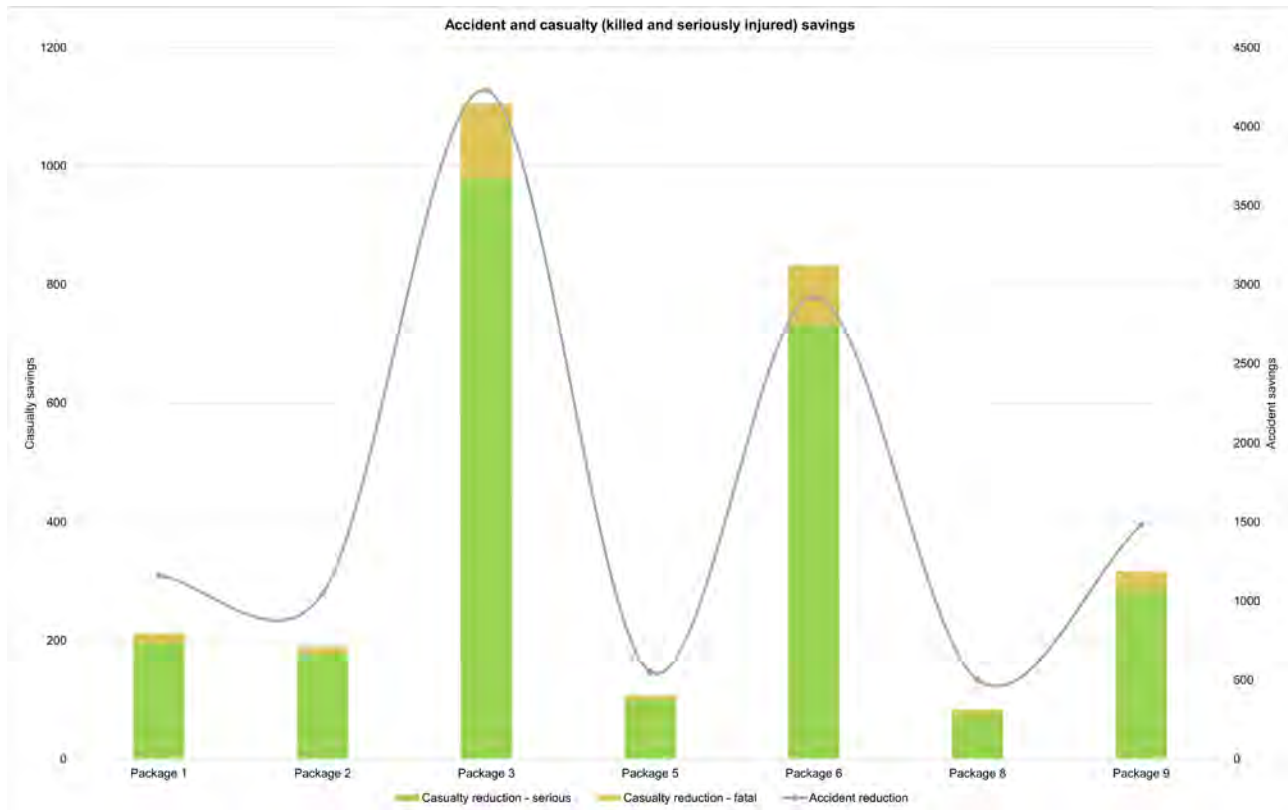


Figure 3-13 provides further detailed results of the accident assessment. These detailed results include actual accident reductions and casualty savings by severity.

FIGURE 3-13: ACCIDENT AND CASUALTY SAVINGS / REDUCTIONS – ALL PACKAGES



### 3.5 Wider Economic Impacts Results – Static

Wider economic impacts refer to the additional benefits or disbenefits that can arise as the impact of transport improvements is transmitted into the wider economy, beyond those businesses and passengers that are directly affected by the transport change. The key metric is “economic welfare”, not GVA or GDP; this is the basis for including non-traded benefits such as time savings in leisure travel.

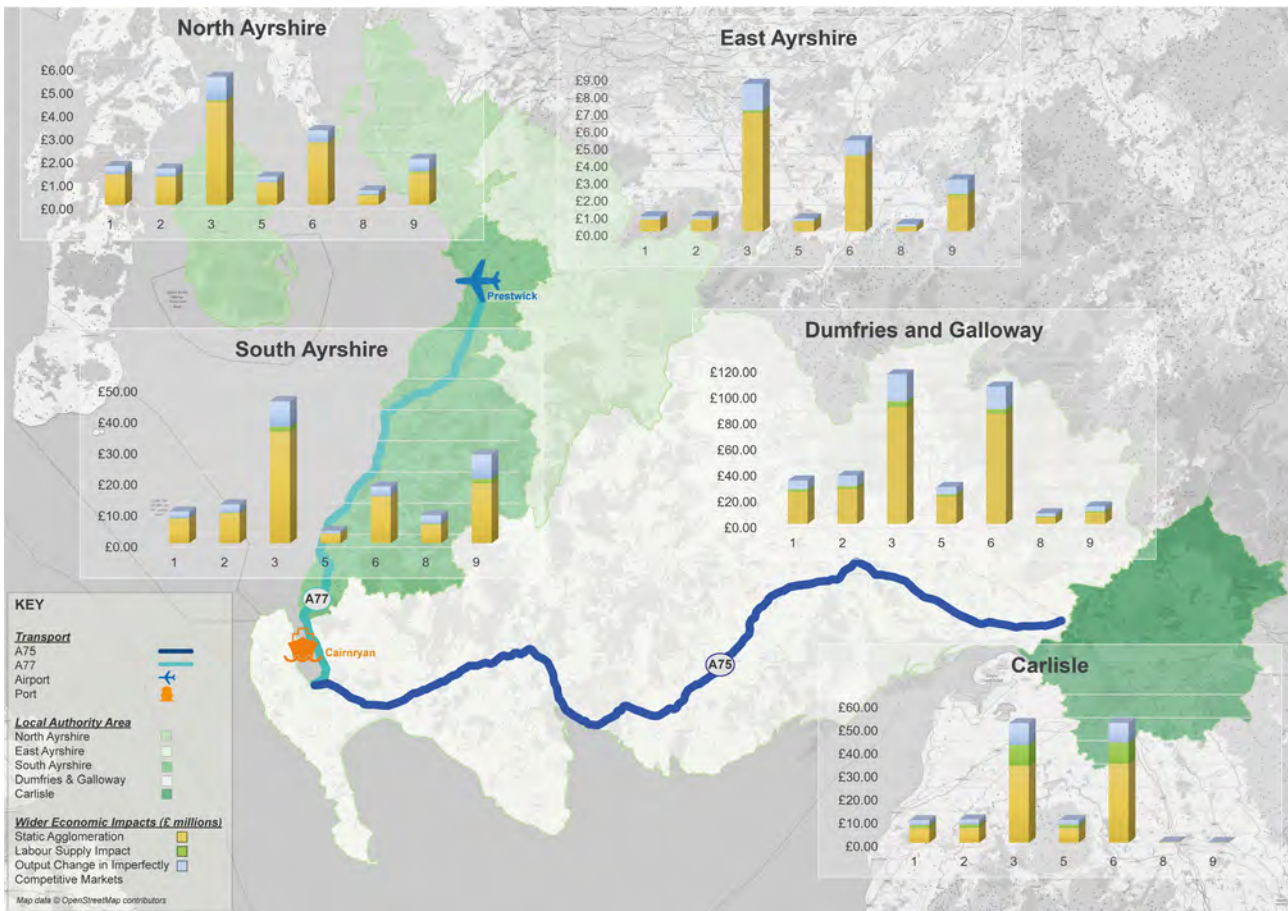
Figure 3-14 presents the static agglomeration, labour supply impact and output change in imperfectly competitive market results for all packages of improvements. For all packages the impacts are positive, which suggest that each package will have a positive outcome on non-transport markets, contributing to an increase in productivity and government income. The highest contribution comes from agglomeration impacts. This suggests that business users are the main beneficiaries from the enhanced connectivity and congestion reductions brought about by the packages.

The lowest wider economic impact is related to taxes arising from the labour supply increase. Calculations for this element are based on the link between the cost of going to work (commuting benefits) and the increase in labour supply. This suggests that commuters currently in work have relatively low benefits arising from the packages. It does not reflect the movement or increase in people joining the labour force as a result of the packages of improvements but is the increase in taxes arising due to the increase in the labour force.

Figure 3-14 shows the results by local authority district. For packages 1 to 6, the majority of the benefits / positive impacts generated are attributed to Dumfries & Galloway. South Ayrshire and Carlisle do also generate generous benefits / positive impacts for these packages. For packages 8 and 9, South Ayrshire accrues the largest share of the benefits / positive impacts, with a substantial share also generated in Dumfries & Galloway.

As expected full dualling of the A75 and the A77 produces the largest positive impact / benefit, totalling over £220 million. Package 6 then ranks second, generating approximately £180 million. The other packages accrue positive impacts / benefits but not to the same magnitude as the other packages already mentioned. Again, this highlights the importance of enhanced connectivity and congestion reductions to the A75 and A77, but specifically the A75, that bring businesses effectively close together and increase productivity.

FIGURE 3-14: STATIC AGGLOMERATION, LABOUR SUPPLY IMPACT AND OUTPUT CHANGE IN IMPERFECTLY COMPETITIVE MARKET RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES BY LOCAL AUTHORITY



### 3.6 Land Use Change Results

#### 3.6.1 Accessibility

Accessibility is a key concept in TELMoS. There is no single measure of accessibility, but a range of different variables of different kinds. The accessibility measures combine land use data output earlier in TELMoS with transport data mainly from TMfS. Accessibilities can change because of land use changes even when transport costs are not changing at all; this plays a significant role in the linkages between different land use activities. Note that if total employment is increasing over time, all the measures that are related to numbers of jobs or numbers of workers will tend to improve over time, even if there are no changes in transport and the numbers of jobs and workers increases by the same proportion.

For households, the accessibility measures are conditional on car ownership, i.e., for each activity in each zone, there is a different measure of accessibility for each possible car-ownership level. Higher car-ownership levels always have better accessibility. The difference between levels is typically most marked between no-car and one-car, and greater in rural areas than in large urban ones (where public transport is more significant, and equally available to car-owners and non-car-owners).

Figure 3-15 to Figure 3-18 present the impacts of the improvements in terms of accessibility for all packages. The convention used in the maps is that negatives represent an improvement in accessibility, and they are represented in a scale of red. Worsening in accessibility is represented by a positive number and a scale of grey colours. The darker the colour is, the higher the difference in accessibility between the package and the do-minimum test is.

#### 3.6.1.1 Package 1

The largest impacts in terms of accessibility are observed for non-car owners. As one would expect, an improvement in the public transport offer would improve the accessibility of people that do not own a car and hence rely completely on trains and buses to access their workplaces. The other two car-ownership levels show smaller, but still positive impacts from the improvements.

Dumfries and Galloway shows the largest improvements in accessibility with the largest impact occurring in Newton Stewart and St. Johns. Small impacts far from the study area (such as in the central belt and south east of Edinburgh) are due to noise in the models and can be disregarded.

#### 3.6.1.2 Package 3

In package 3 accessibility is much higher than that seen in package 1, and this is due to the A75 and A77 dualling improvements that are included in this package and that increases the positive impact on car-owners. While the very positive impact on accessibility for non-car owners is localised (mainly in Dumfries, Newton Stewart, St. John's, and Kirkcudbright), the additional road improvements that are included in the package, contribute to accessibility improvements for car-owners on a wider geographical scale (involving most of the Dumfries and Galloway as well as South Ayrshire).

#### 3.6.1.3 Package 6

In package 6 accessibility is higher than that of package 1 (but obviously lower than package 3), and this is due to the A75 dualling improvements that is included in this package and that increases the positive impact on car-owners. While the very positive impact on accessibility for non-car owners is localised (mainly in Dumfries, Newton Stewart, St. John's, and Kirkcudbright), the additional road improvements that are included in the package, contributes to accessibility improvements for car-owners on a wider geographical scale (involving more areas along the A75 corridor).

#### 3.6.1.4 Package 9

Improvements in accessibility for non-car owners is shown in Newton Stewart, St. John's, Dalbeattie and Kirkcudbright while the increase in accessibility is mainly occurring in the A77 corridor (involving areas in South Ayrshire and in the western area of Dumfries and Galloway) as result of the A77 dualling improvements that are included in this package and that increases the positive impact on car-owners.

FIGURE 3-15: ABSOLUTE DIFFERENCE IN ACCESSIBILITY TO THE WORKPLACE BY CAR AVAILABILITY (LEFT – NO-CAR, MIDDLE – 1 CAR, RIGHT 2+ CARS) – PACKAGE 1

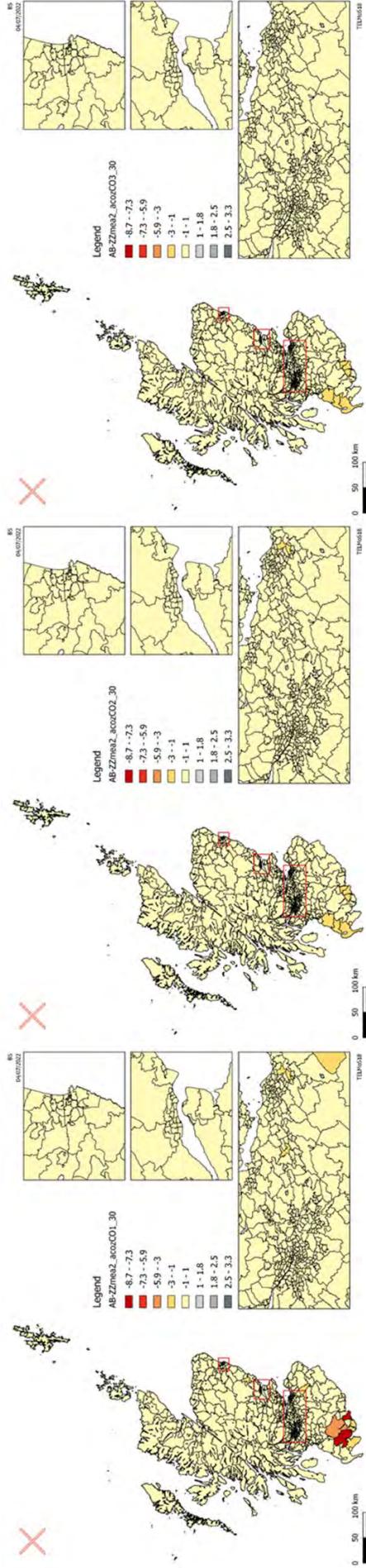


FIGURE 3-16: ABSOLUTE DIFFERENCE IN ACCESSIBILITY TO THE WORKPLACE BY CAR AVAILABILITY (LEFT – NO-CAR, MIDDLE – 1 CAR, RIGHT 2+ CARS) – PACKAGE 3

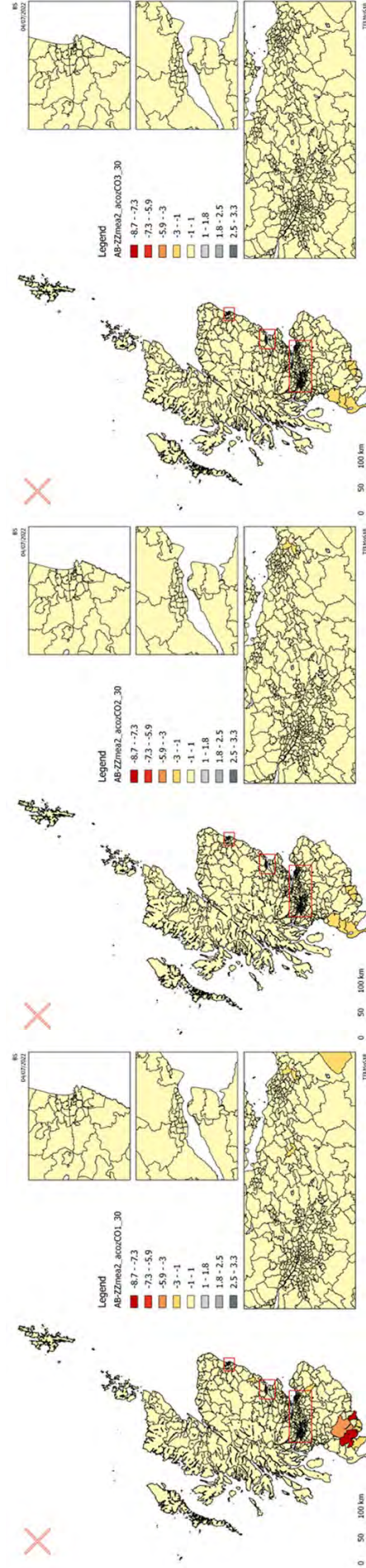




FIGURE 3-17: ABSOLUTE DIFFERENCE IN ACCESSIBILITY TO THE WORKPLACE BY CAR AVAILABILITY (LEFT – NO-CAR, MIDDLE – 1 CAR, RIGHT 2+ CARS) – PACKAGE 6

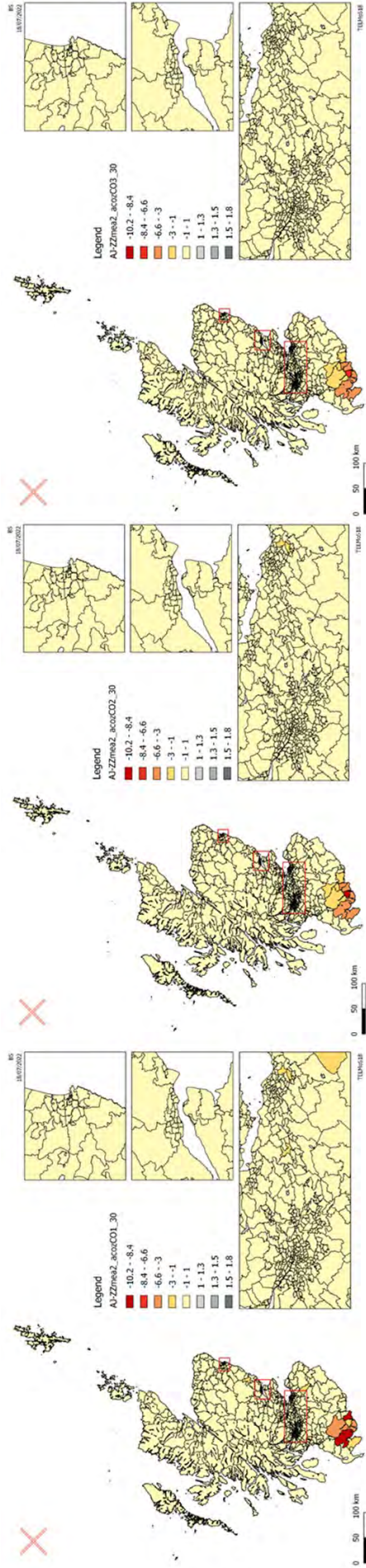
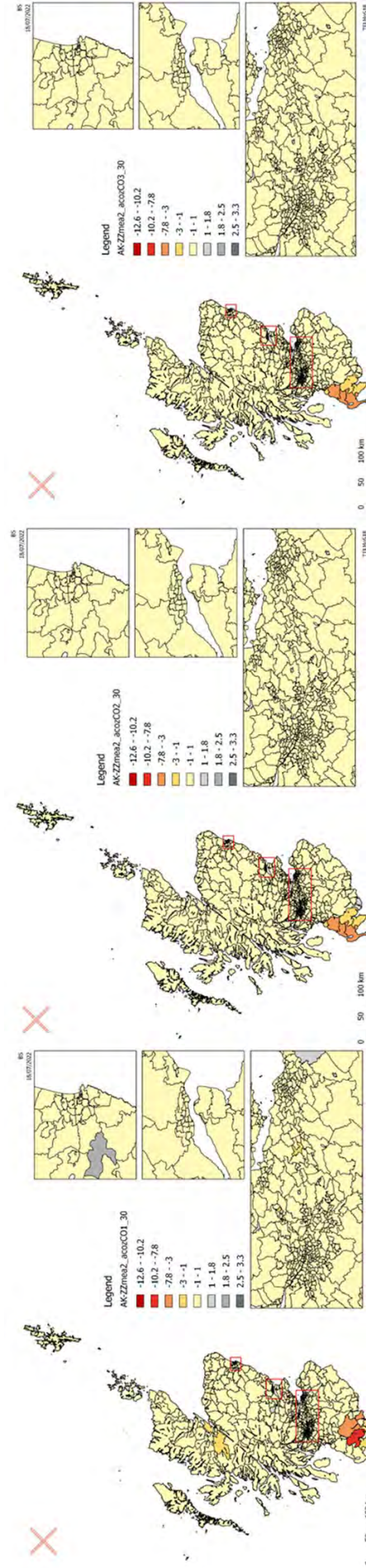


FIGURE 3-18: ABSOLUTE DIFFERENCE IN ACCESSIBILITY TO THE WORKPLACE BY CAR AVAILABILITY (LEFT – NO-CAR, MIDDLE – 1 CAR, RIGHT 2+ CARS) – PACKAGE 9



### 3.6.2 Employment

For all employment activities, the distribution of jobs is influenced by the previous numbers of that activity. The default is that in any one year, each activity will grow or decline by the same proportion. For most activities, this default assumption is modified by:

- Changes in accessibility
- Changes in the amount of floorspace available
- Changes in the cost of occupying that floorspace, i.e., changes in rent modified by any changes in the floorspace occupied per worker

The effect of floorspace works through:

- Total supply – other things being equal, jobs will tend to distribute in proportion to the available space
- The effect of rent on the cost of locating each job
- The rent of each type of floorspace is iteratively adjusted until all of the available stock is accounted for as:
- Occupied by located jobs (product of number of jobs and floorspace per worker)
- Left vacant by a user-defined input (typically to allow floorspace to be demolished in the following year)
- Held vacant by landlords because they do not consider it worthwhile letting at current rents

The proportion of floorspace kept vacant by landlords is the previous level of vacancy adjusted in response to rents i.e., if rents increase, the vacancy rate will decrease, and vice versa. Note that vacant office space may in some circumstances be redeveloped as housing.

Figure 3-19 presents the absolute impact of the improvements for all packages on employment after 15 years from the opening of the rail and the implementation of the road improvements. The convention here is that gains are shown in green, with darker shades of green for more positive percentages whilst losses are shown in grey (with darker shades of grey for more negative percentages).

#### 3.6.2.1 Package 1

The greatest impacts on employment are in Dumfries and Galloway and in South Ayrshire, the area's most directly affected by the transport improvements. Most of the zones in Dumfries and Galloway gain employment, however, there are a few zones with some small losses where jobs are locating to the neighbouring zones which have better accessibility. Overall Dumfries and Galloway gains about 800 jobs (1.2% more jobs) and South Ayrshire gains about 122 jobs (part of which are partly displaced from East Ayrshire). The pattern of employment location clearly shows that jobs are moving towards areas that gain better accessibilities (Stranraer, Girvan, Ayr, and Dumfries).

#### 3.6.2.2 Package 3

The location of employment is very much in line with package 1, but the geographical scale and the figures are larger, especially for the three Ayrshire local authorities. Overall Dumfries and Galloway gains about 1,500 jobs (2.4% more jobs) and South Ayrshire gains about 550 jobs (1.2% more jobs). The impact is almost double that of package 1.

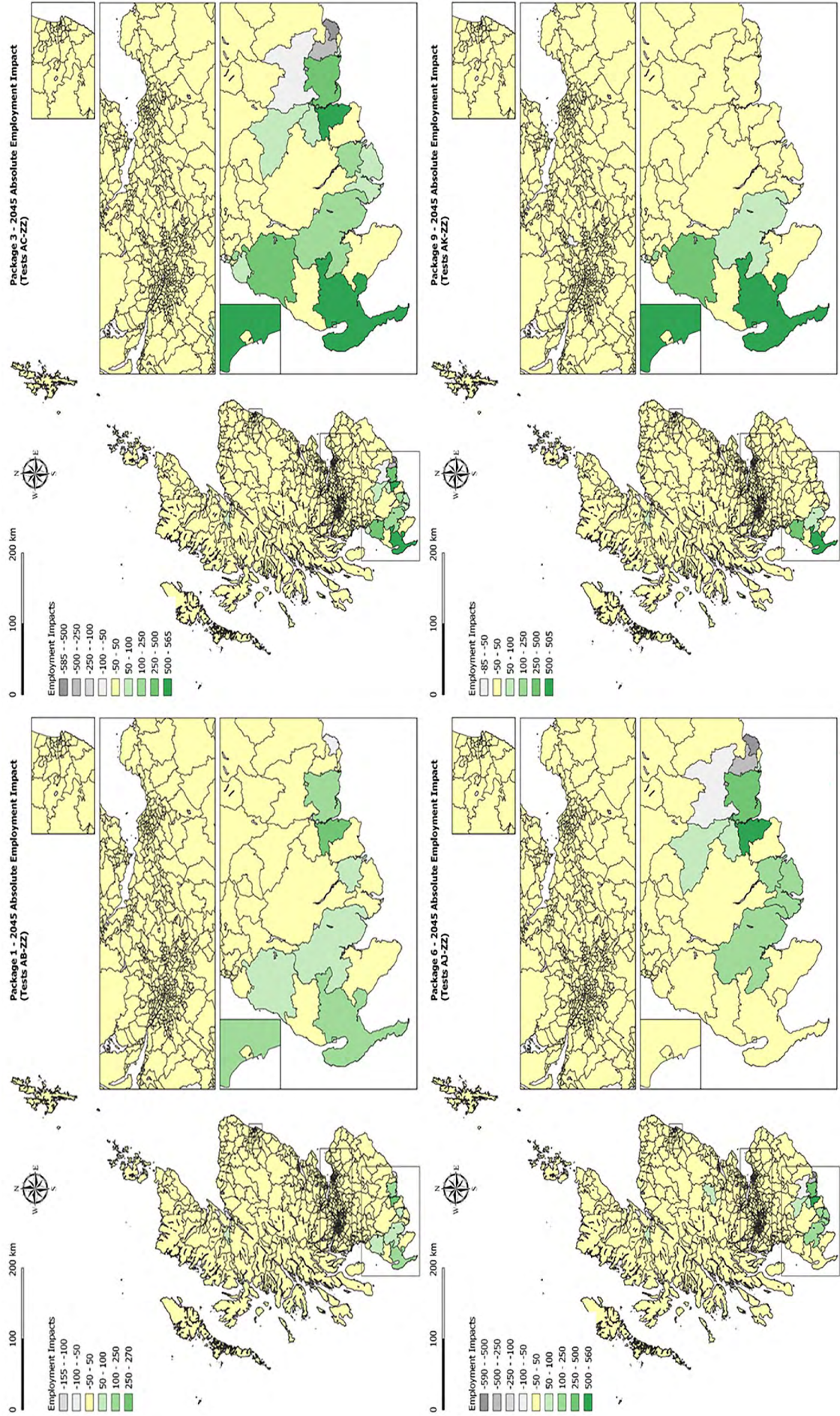
#### 3.6.2.3 Package 6

Again, the greatest impacts on employment are in Dumfries and Galloway. However, in this package east of Dumfries, especially Gretna, there are losses of about 500 jobs as a result of relocation to the neighbouring areas which have better accessibility. Overall Dumfries and Galloway gains about 1,100 jobs (1.7% more jobs).

#### 3.6.2.4 Package 9

Stranraer and Newton Stewart gain employment, while all other areas show small losses. Overall Dumfries and Galloway gains about 406 jobs (0.6% more jobs). South Ayrshire sees 580 extra jobs locating in various areas along the A77 corridor (which represent an increase of 1.3% more jobs).

**FIGURE 3-19: ABSOLUTE EMPLOYMENT IMPACT, ALL PACKAGES**



### 3.6.3 Households

TELMoS also forecasts changes in the number, composition and incomes of households, and their responses to changing circumstances. These changes are due to:

- Changes in numbers and composition of households
- Household migration (longer-distance moves within Scotland)
- Household location (shorter-distance moves, and the local detail of longer-distance arrivals) and the housing market
- Employment status and commuting
- Incomes
- Car ownership

Figure 3-20 presents the absolute impact of the improvements for all packages on households after 15 years from the opening of the rail and the implementation of the road improvements. The convention here is that gains are shown in blue, with darker shades of blue for more positive percentages whilst losses are shown in grey (with darker shades of grey for more negative percentages).

#### 3.6.3.1 Package 1

The greatest impacts can be seen in Dumfries and surrounding areas, along with Stranraer. Other reductions further afield in the Highlands can be attributed to model noise. As such, the improvement impacts drive a relatively small-scale, local boost in growth in land uses. There are much less but still significant impacts on the population and the households. Households' location tends to follow the employment location, but the impacts are usually smaller and develop later in the time period. Dumfries and Galloway gains about 400 extra households while the impact in South Ayrshire is marginal (the whole local authority only gains about 40 households).

#### 3.6.3.2 Package 3

The impacts are larger and much more distributed within Dumfries and Galloway and South Ayrshire in comparison to package 1. The largest impacts are still in Dumfries and surrounding areas, along with Stranraer and Ayr. The reduction in households further afield in the Glasgow and Edinburgh can be attributed to model noise. The impacts on households and population are less than the impact on employment but they are still significant. Overall Dumfries and Galloway gains about 850 households and the Ayrshires all together gain about 350 households.

Likewise, with what was happening in package 1, households locate to Dumfries, Stranraer, Ayr, but households are also locating west of Dumfries and south of Ayr as result of the dualling of the A75 and A77.

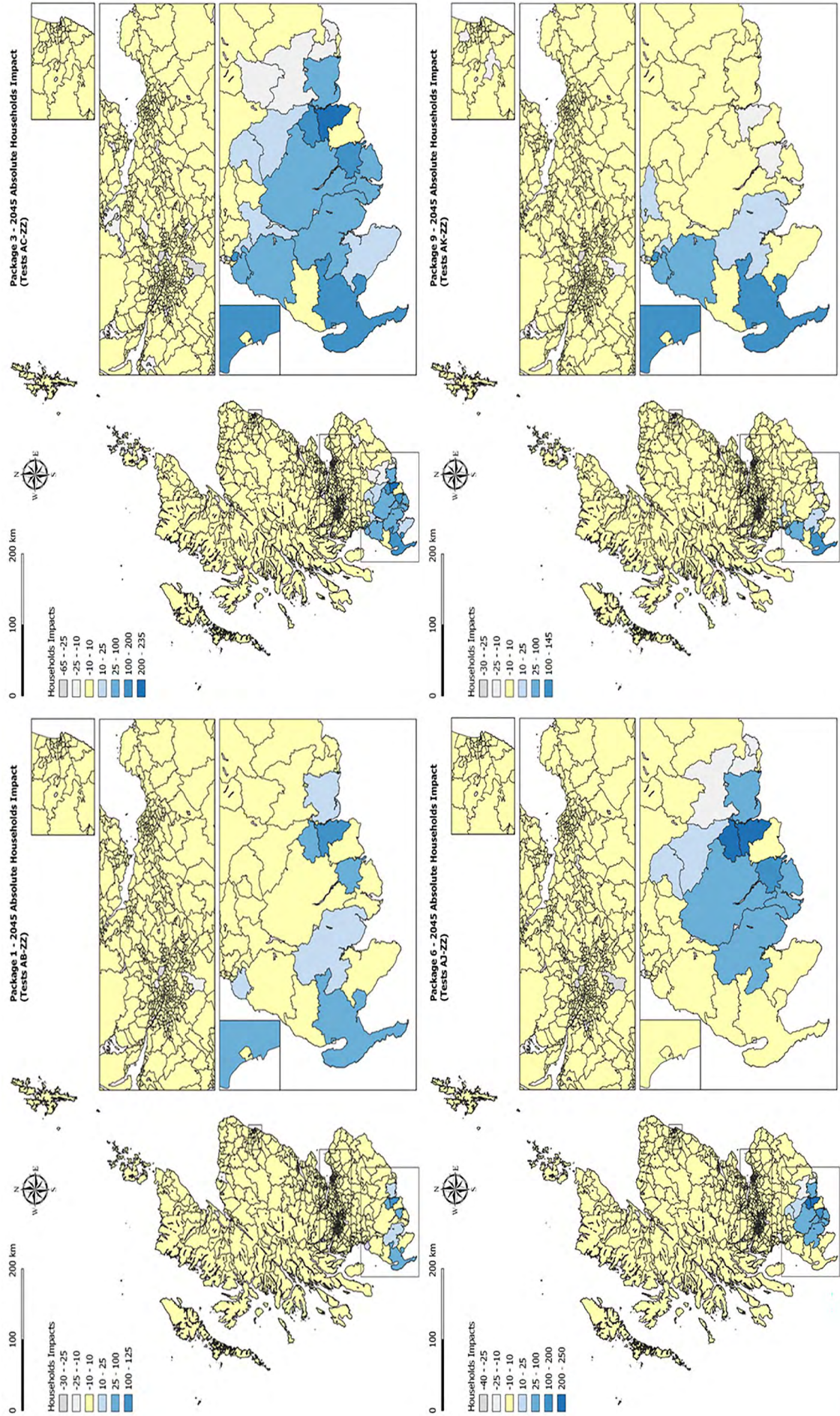
#### 3.6.3.3 Package 6

The pattern of household location is very much in line with the employment location as one would expect but the impacts are smaller. The greatest land use impacts are seen at the eastern end of the corridor, highlighting the enhanced accessibility brought about in Dumfries. Overall Dumfries and Galloway gains about 730 households and there are small losses in all other local authority areas. The areas that gain most of the households are along the A75 and the new railway corridors (with the highest number of households moving to Castle Douglas, Newtonairds and Maxwelltown).

#### 3.6.3.4 Package 9

The pattern of household location is very much in line with the employment location as one would expect but the impacts are smaller. The greatest land use impacts are seen in South Ayrshire and the western end of Dumfries and Galloway, highlighting the enhanced accessibility brought about with the A77 dualling. Overall Dumfries and Galloway gains only 81 households and they are mainly going to Stranraer. South Ayrshire, gains about 275 households, mainly located in Glenparks, Maybole and Girvan.

**FIGURE 3-20: ABSOLUTE HOUSEHOLDS' IMPACT, ALL PACKAGES**



### 3.6.4 Rent and Floorspace

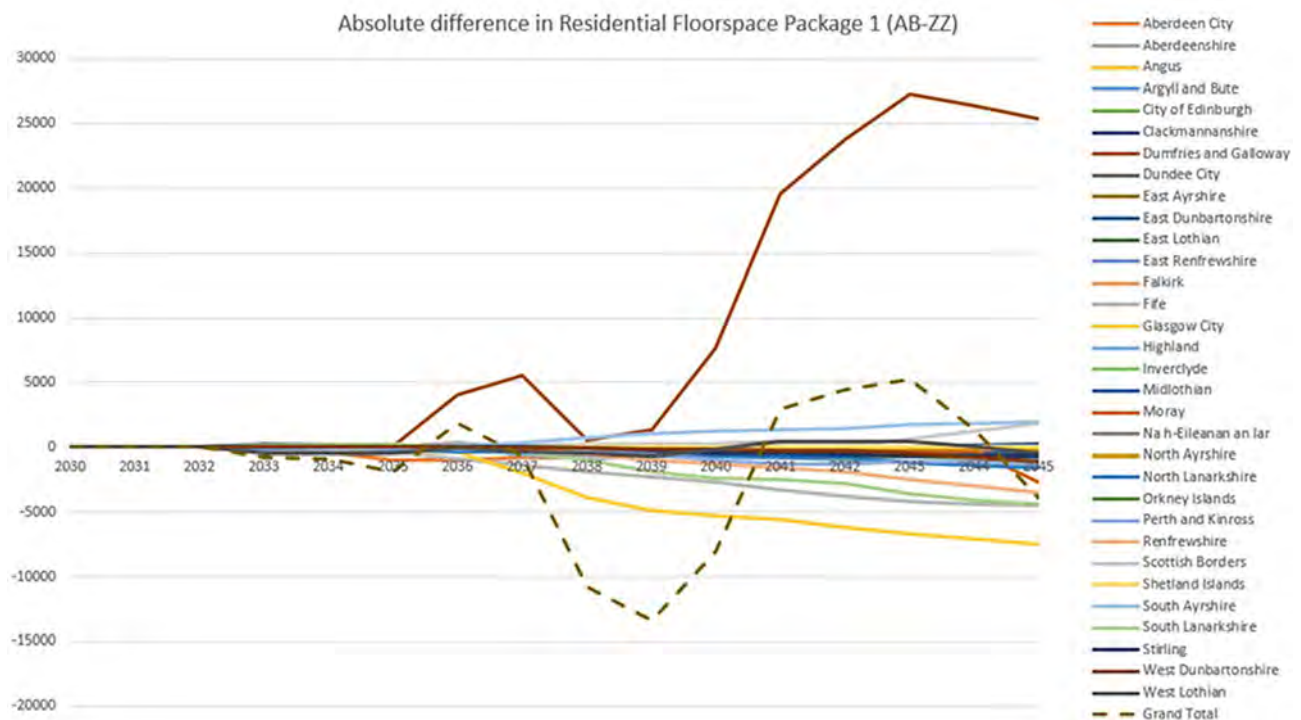
Rents only change in response to changes in the balance of supply and demand. The TELMoS solution starts from the rents and vacancy rates in the previous year and calculates where the mobile and pool households will locate at those rents, and how much space each type of household will occupy. This initially produces a mismatch: households trying to occupy more space than is available and leaving space vacant. The model then adjusts rents, increasing them where too much space is demanded and reducing them where demand is too low. TELMoS focuses only on residential development.

Figure 3-25 presents the absolute impact of the improvements for all packages on residential floorspace after 15 years from the opening of the rail and the implementation of the road improvements. The convention here is that gains are shown in red, with darker shades of red for more positive percentages whilst losses are shown in grey (with darker shades of grey for more negative percentages).

#### 3.6.4.1 Package 1

The increase in households, mainly in Dumfries and Galloway, leads to increases in demand for residential floorspace which results in higher rents that in turn encourage developers to provide additional floorspace more quickly. The average residential rent increases by 1% but there is some significant variation where differences range between -1% and +4% (with the maximum increase in Maxwelltown, Dumfries). As one would expect, the largest increase in rent occurs in areas that are better connected and especially where there is a larger demand and more limited supply of floorspace. It is predicted that there are about 25,000 sqm of residential floorspace that gets developed in Dumfries and Galloway. Most of the development takes place in the last 5 years as more households move into these areas and hence the demand for floorspace increases. The development though, doesn't occur uniformly and it mainly takes place in Castle Douglas and in Dumfries and Stranraer.

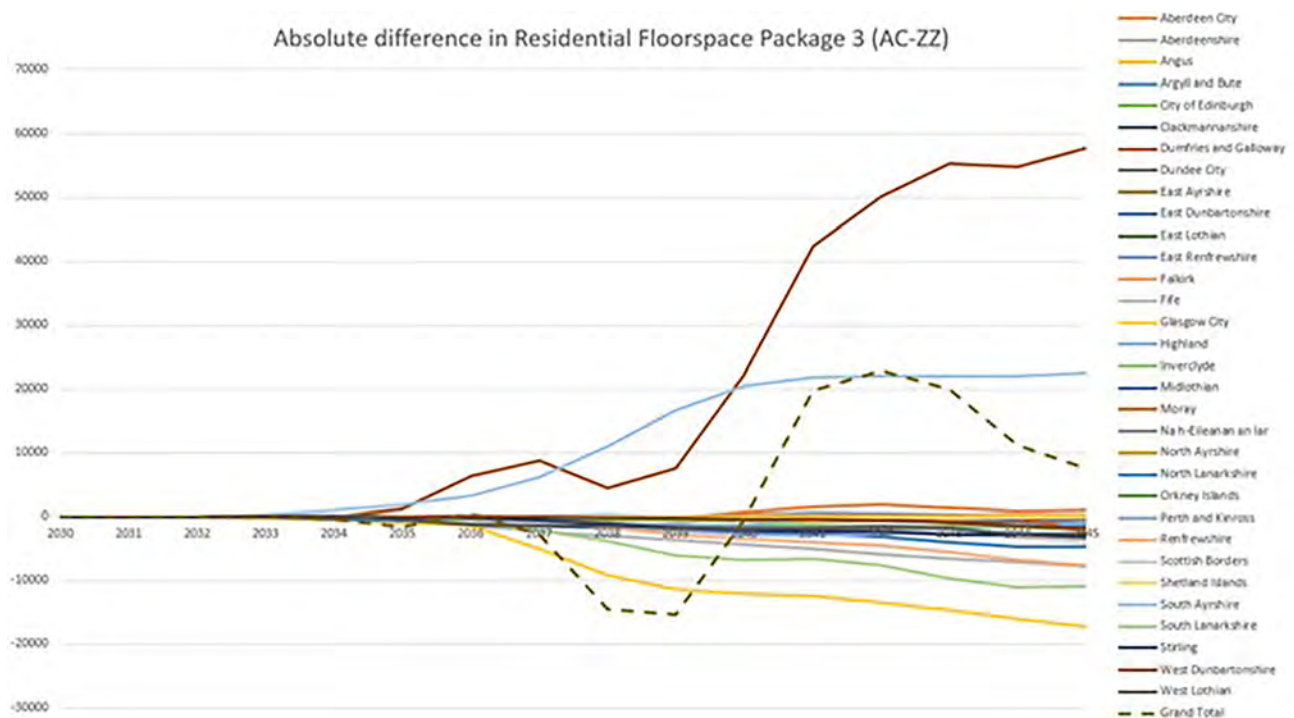
FIGURE 3-21: ABSOLUTE DIFFERENCE IN RESIDENTIAL FLOORSPACE



### 3.6.4.2 Package 3

The impacts of the package 3 improvements on residential rents is larger than what is seen in package 1 and once again, the impact in South Ayrshire is larger with the introduction of the road dualling improvements. The average residential rent increases by 1% but there is some significant variation where differences range between -5% and +6% (with the maximum increase in Newtonairds). Some significant changes in residential rent can also be seen in South Ayrshire with the largest percentage increase occurring in Barrhill and Maybole. It is predicted there are about 22,500sqm of residential floorspace that gets developed in South Ayrshire and about 58,000sqm in Dumfries and Galloway. Most of the development takes place in the last 5 years as more households move into these areas and hence the demand for floorspace increases. The development though, doesn't occur uniformly and it mainly takes place in Castle Douglas, Dumfries and Stranraer in Dumfries and Galloway and in Glenparks, Maybole and Girvan in South Ayrshire. The extra residential floorspace developed in South Ayrshire and Dumfries and Galloway results in less development occurring in Glasgow, Renfrewshire, and South Lanarkshire, but there is also an overall gain for the whole of Scotland due to the improvements implemented.

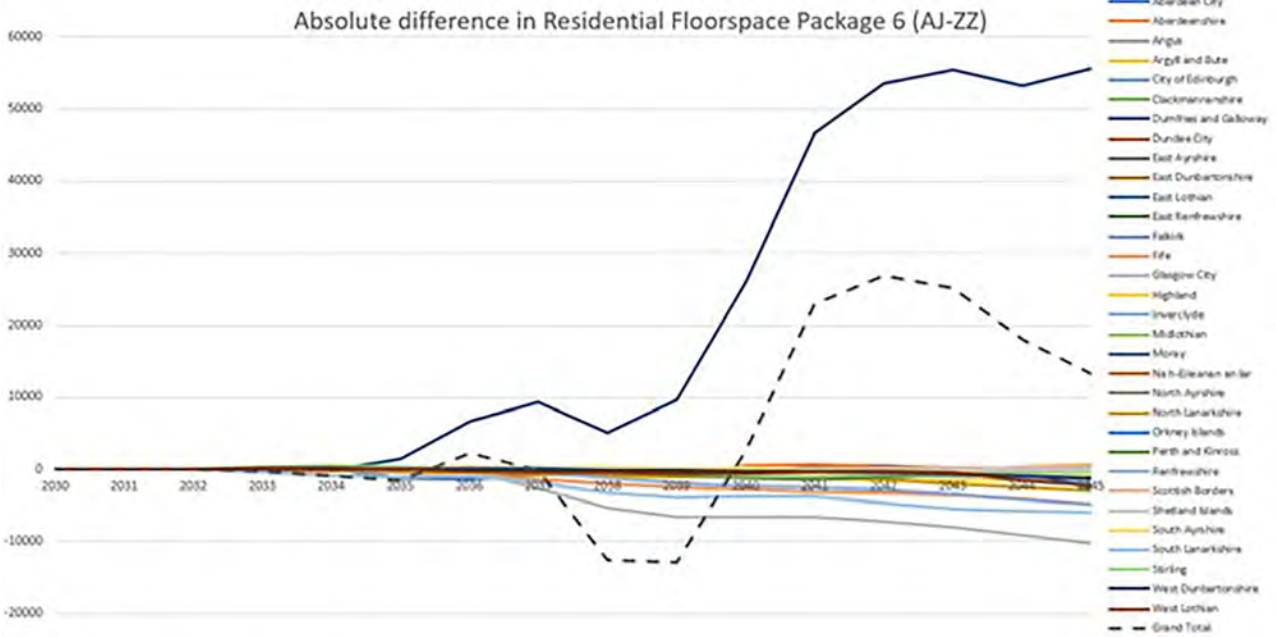
FIGURE 3-22: ABSOLUTE DIFFERENCE IN RESIDENTIAL FLOORSPACE



### 3.6.4.3 Package 6

The impacts of the package 6 improvements on residential rents are mainly localised in Dumfries and Galloway, but there are small impacts also in some of the southern zones of South Ayrshire (though the impact on rents is very small and doesn't generate any extra development). The average residential rent increases by 0.6% but there is some significant zonal variation where differences range between -5% and +6% (with the maximum increase in Newtonairds). It is predicted that there are about 55,000sqm of residential floorspace that gets developed in Dumfries and Galloway. Most of the development takes place between 2037 and 2042, as result of the increase in demand for floorspace due to households moving into these areas. The development though, doesn't occur uniformly and it mainly takes place in Castle Douglas and in Dumfries. Also, in package 6 the model forecasts a higher supply of residential floorspace at a national level.

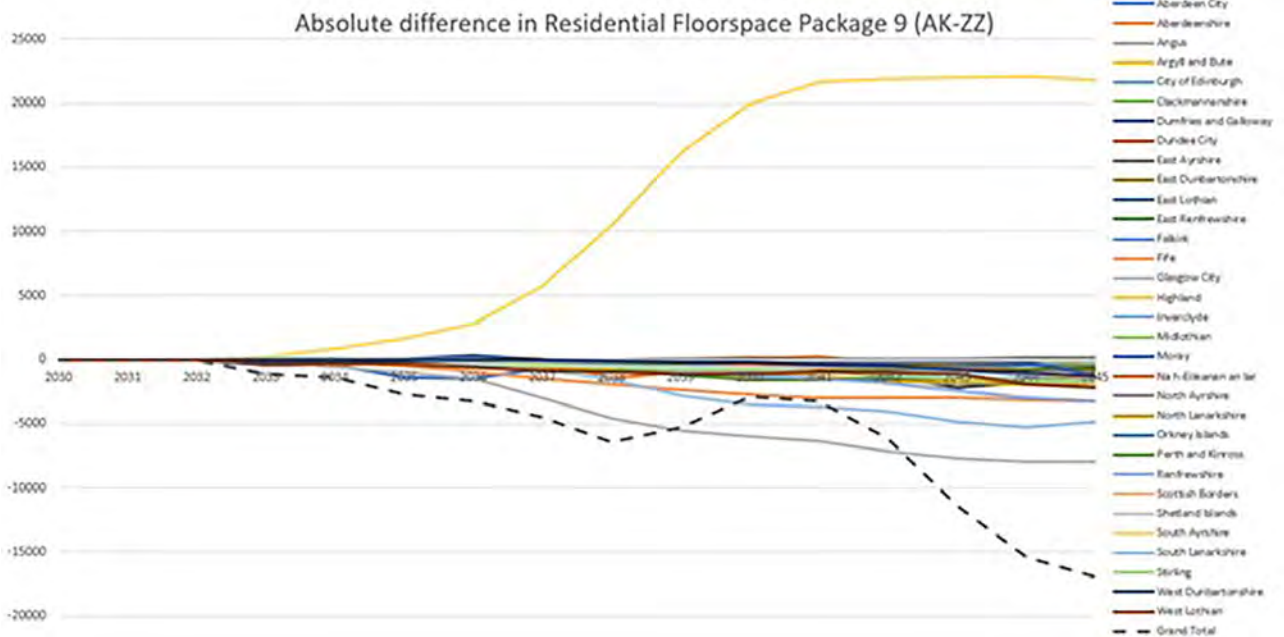
FIGURE 3-23: ABSOLUTE DIFFERENCE IN RESIDENTIAL FLOORSPACE



3.6.4.4 Package 9

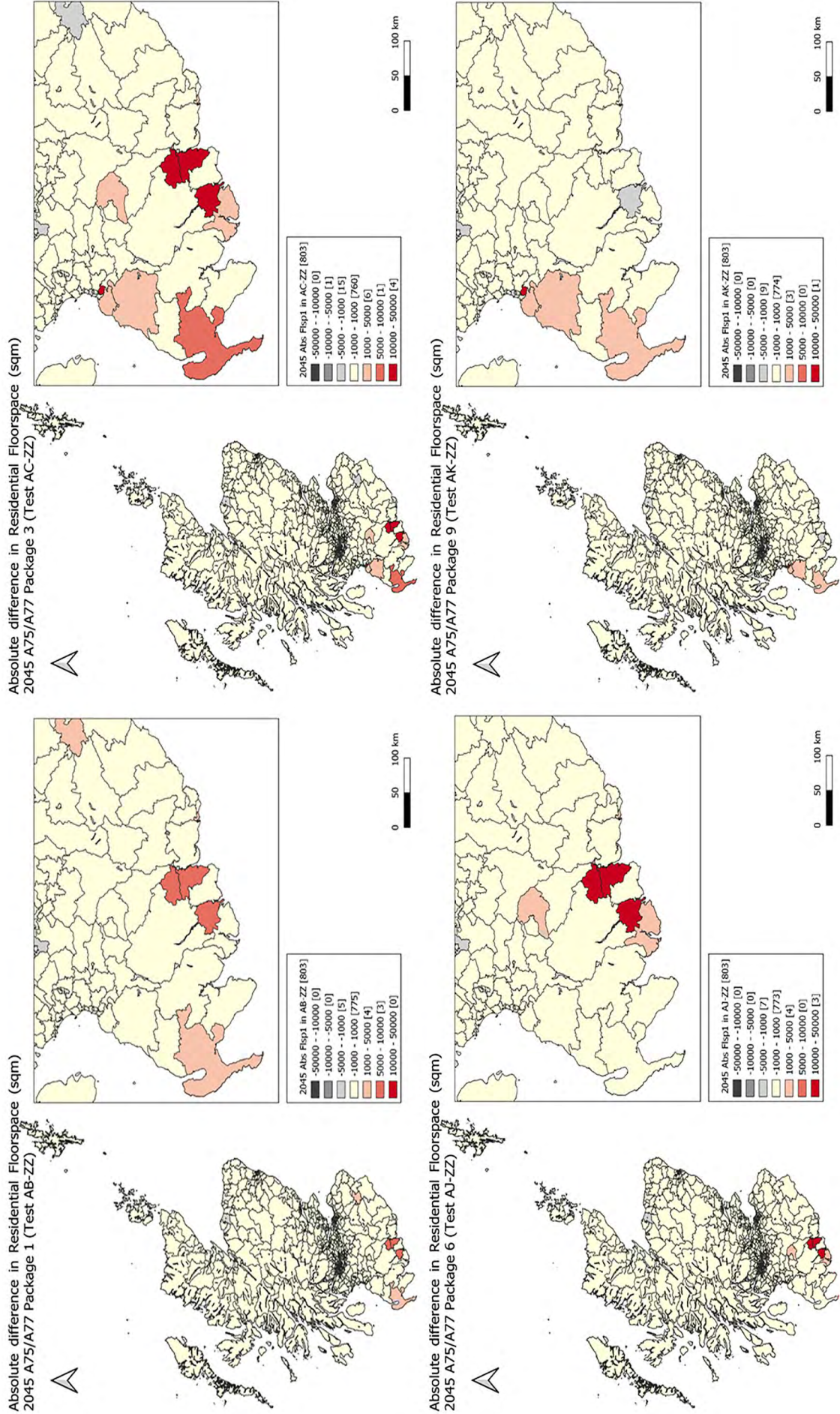
The impacts of the package 9 improvements on residential rents is mainly localised along the A77 corridor. The impact on residential rent is significant in Stranraer and in all the other South Ayrshire areas along the A77 corridor. The increase in households causes an increase in the average residential rent in South Ayrshire (where the average rents are 0.4% higher and Glenpark experiences about 7% increase in rents). It is predicted that the overall floorspace developed in Scotland is less than what would be developed without the package of interventions (about 17,000sqm less). South Ayrshire is the only local authority where more residential floorspace gets developed (about 22,000sqm) while Glasgow and South Lanarkshire see less development taking place.

FIGURE 3-24: ABSOLUTE DIFFERENCE IN RESIDENTIAL FLOORSPACE





**FIGURE 3-25: ABSOLUTE RESIDENTIAL FLOORSPACE IMPACT, ALL PACKAGES**



### 3.7 Transformational Impacts – Wider Economic Impacts Results

The potential for a scheme/package of schemes to have transformational effects on the number and location of homes and jobs, thereby generating further WEIs, is reflected, with assessments of 'dynamic agglomeration' (i.e., in the context of induced land-use change), and the effect of people moving to more productive jobs (MTMPJ) in response to the combination of transport improvements and land-use change.

Figure 3-26 presents the dynamic agglomeration results for all packages of improvements, i.e., taking into account both generalised cost changes and employment location changes/ land use changes in calculating the changes in agglomeration.

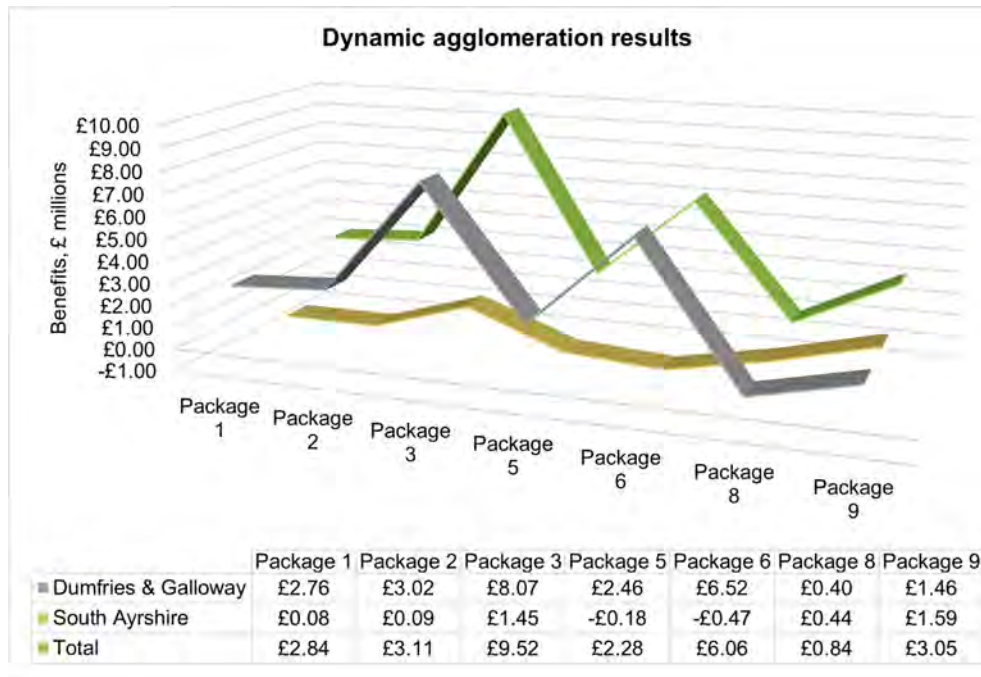
For all packages the overall impacts are positive, which suggests that each package will see an increase in employment growth and hence economic activity. However, for packages 5 and 6, there is a negative dynamic agglomeration impact in South Ayrshire. This suggests that improvements solely focused on the A75 will result in employment growth being drawn into Dumfries & Galloway from South Ayrshire.

Following the same trend as preceding sections, full dualling of the A75 and the A77 produces the largest positive impact / benefit, totalling over £9 million. Package 6 then ranks second, generating approximately £6 million. The other packages accrue positive impacts / benefits but not to the same magnitude as the other packages already mentioned.

This assessment presents the importance of improved connectivity and congestion reductions to the A75 and A77, but specifically the A75, as it will result in greater impacts than just journey time savings. It will drive employment growth in the South West of Scotland, thus helping to boost economic activity.

Appendix C provides greater detail around the results presented, and also presents the employment impacts spatially. It should be noted that the results presented in this report differ from those in Appendix C. For the purpose of this report, the results in Appendix C have been rebased and discounted from 2018 to 2010 in line with all other monetary values presented using appropriate values from the TAG Databook.

FIGURE 3-26: DYNAMIC AGGLOMERATION RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES BY LOCAL AUTHORITY



### 3.8 Wider Spatial and Social Context Results – Additional Welfare Benefits

ULtRA (Unified Land-Use / Transport Appraisal) is DSC's accessibility-based land-use and transport appraisal software. It aims to give attention to the wider spatial and social context of public expenditure, otherwise not captured elsewhere (as an alternative to the land value uplift approach identified in TAG). The approach is to measure benefits and disbenefits to households and other actors, using measures of benefit from improved accessibility as the means of capturing both the direct benefits of transport improvement and land-use effects. Note, that the choice of approach means that direct effects of transport change appear in the accessibility variable. These represent the value that actors in the land-use markets – households and firms – place on accessibility to destination, as opposed to the value that users in the transport system place on time savings.

Table 3-1 to Table 3-4 present the results from ULTrA (considering both highway and rail-based improvements) for packages 1, 3, 6 and 9.

Appendix C provides greater detail around the results presented, and also presents clarity around the definitions used. It should be noted that the results presented in this report differ from those in Appendix C. For the purpose of this report, the results in Appendix C have been rebased and discounted from 2018 to 2010 in line with all other monetary values presented using appropriate values from the TAG Databook.

### Package 1

TABLE 3-1: WIDER SPATIAL AND SOCIAL CONTEXT RESULTS (ULTRA), £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 1

Benefits / costs	Scotland	Dumfries & Galloway	Cairnryan	
Households	Accessibility	£773.45	£514.31	£169.67
	Car ownership costs	-£1.99	-£1.99	-£0.66
	Income	£22.53	£135.87	£43.74
	Leisure time	-£3.31	-£29.82	-£8.62
	Housing quality	£9.94	£39.10	£10.60
	Housing consumption	-£7.95	-£39.77	-£11.27
	Commuting cost	-£7.29	-£19.88	-£3.98
<b>Total</b>	<b>£785.38</b>	<b>£597.82</b>	<b>£199.49</b>	
Firms	Accessibility	£73.57	£43.08	£13.92
	Costs	-£60.31	-£50.37	-£16.57
	Production	-£29.16	£170.33	£34.46
	Corporation tax savings	-£1.33	-£6.63	-£0.66
<b>Total</b>	<b>-£17.23</b>	<b>£156.41</b>	<b>£31.15</b>	
Developers	Development costs	£71.58	£21.21	-£5.30
	Rental income	£55.01	£203.47	£57.66
	Property owners' tax savings	-£1.33	-£9.94	-£1.99
<b>Total</b>	<b>£125.26</b>	<b>£214.74</b>	<b>£50.37</b>	
Public sector	Income tax revenue	£13.26		
	VAT revenues	£3.31		
	Unemployment benefit savings	£10.60		
	Council tax revenues	£1.33		
	business rates revenues	£3.98		
	Tax on profit	£1.33		
	Property owners' tax revenues	£1.33		
<b>Total</b>	<b>£35.13</b>	<b>£0.00</b>	<b>£0.00</b>	
Rebalancing benefits	Shadow value of jobs for workers in deprived zones	£5.30	£18.56	£10.60
	Social infrastructure savings	£1.99	-£5.30	-£0.66
<b>Total</b>	<b>£7.29</b>	<b>£13.26</b>	<b>£9.94</b>	
<b>Total</b>	<b>£935.83</b>	<b>£982.22</b>	<b>£290.96</b>	

**Package 3**

**TABLE 3-2: WIDER SPATIAL AND SOCIAL CONTEXT RESULTS (ULTRA), £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 3**

<b>Benefits / costs</b>		<b>Scotland</b>	<b>Dumfries &amp; Galloway</b>	<b>Cairnryan</b>
Households	Accessibility	£2,917.50	£2,163.94	£625.65
	Car ownership costs	-£5.96	-£4.64	-£1.33
	Income	£167.02	£306.86	£99.42
	Leisure time	-£21.87	-£66.94	-£21.21
	Housing quality	£43.74	£89.47	£25.19
	Housing consumption	£5.30	-£92.12	-£24.52
	Commuting cost	-£25.85	-£45.73	-£9.94
<b>Total</b>		<b>£3,079.88</b>	<b>£2,350.84</b>	<b>£693.26</b>
Firms	Accessibility	£315.48	£210.10	£62.30
	Costs	-£75.56	-£125.93	-£45.73
	Production	£0.00	£182.92	£63.63
	Corporation tax savings	-£3.31	-£14.58	-£0.66
<b>Total</b>		<b>£236.61</b>	<b>£252.51</b>	<b>£79.53</b>
Developers	Development costs	-£95.44	-£47.72	-£21.87
	Rental income	£108.69	£499.06	£150.45
	Property owners' tax savings	-£3.98	-£22.53	-£4.64
<b>Total</b>		<b>£9.28</b>	<b>£428.81</b>	<b>£123.94</b>
Public sector	Income tax revenue	£94.11		
	VAT revenues	£19.22		
	Unemployment benefit savings	£53.02		
	Council tax revenues	£1.99		
	business rates revenues	£8.62		
	Tax on profit	£3.31		
	Property owners' tax revenues	£3.98		
<b>Total</b>		<b>£184.25</b>	<b>£0.00</b>	<b>£0.00</b>
Rebalancing benefits	Shadow value of jobs for workers in deprived zones	£26.51	£52.36	£23.20
	Social infrastructure savings	£5.30	-£10.60	-£1.99
<b>Total</b>		<b>£31.81</b>	<b>£41.75</b>	<b>£21.21</b>
<b>Total</b>		<b>£3,541.83</b>	<b>£3,073.92</b>	<b>£917.93</b>

**Package 6**

**TABLE 3-3: WIDER SPATIAL AND SOCIAL CONTEXT RESULTS (ULTRA), £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 6**

<b>Benefits / costs</b>		<b>Scotland</b>	<b>Dumfries &amp; Galloway</b>	<b>Cairnryan</b>
Households	Accessibility	£1,715.24	£1,446.82	£167.68
	Car ownership costs	£-3.31	£-2.65	£0.00
	Income	£96.76	£190.21	£5.30
	Leisure time	£-16.57	£-41.09	£-0.66
	Housing quality	£16.57	£60.31	£2.65
	Housing consumption	£-3.98	£-45.73	£-1.99
	Commuting cost	£6.63	£-31.15	£-0.66
	<b>Total</b>	<b>£1,811.34</b>	<b>£1,576.72</b>	<b>£172.32</b>
Firms	Accessibility	£145.15	£151.11	£32.48
	Costs	£-9.94	£-72.90	£-1.33
	Production	£-50.37	£159.73	£-5.30
	Corporation tax savings	£-0.66	£-14.58	£0.00
	<b>Total</b>	<b>£84.17</b>	<b>£223.35</b>	<b>£25.85</b>
Developers	Development costs	£-80.19	£-52.36	£-0.66
	Rental income	£71.58	£304.21	£6.63
	Property owners' tax savings	£-1.99	£-15.91	£0.00
	<b>Total</b>	<b>£-10.60</b>	<b>£235.95</b>	<b>£5.96</b>
Public sector	Income tax revenue	£49.04		
	VAT revenues	£10.60		
	Unemployment benefit savings	£40.43		
	Council tax revenues	£1.33		
	business rates revenues	£5.96		
	Tax on profit	£0.66		
	Property owners' tax revenues	£1.99		
	<b>Total</b>	<b>£110.02</b>	<b>£0.00</b>	<b>£0.00</b>
Rebalancing benefits	Shadow value of jobs for workers in deprived zones	£5.30	£30.49	£0.66
	Social infrastructure savings	£4.64	£-15.91	£0.00
	<b>Total</b>	<b>£9.94</b>	<b>£14.58</b>	<b>£0.66</b>
<b>Total</b>	<b>£2,004.87</b>	<b>£2,050.60</b>	<b>£204.80</b>	

Package 9

TABLE 3-4: WIDER SPATIAL AND SOCIAL CONTEXT RESULTS (ULTRA), £ MILLIONS, DISCOUNTED 2010 PRICES – PACKAGE 9

Benefits / costs		Scotland	Dumfries & Galloway	Cairnryan
Households	Accessibility	£1,037.23	£451.34	£369.16
	Car ownership costs	-£3.31	-£1.33	-£1.33
	Income	£64.29	£79.53	£71.58
	Leisure time	-£5.96	-£19.88	-£16.57
	Housing quality	£9.94	£18.56	£17.89
	Housing consumption	-£21.21	-£21.87	-£20.55
	Commuting cost	£10.60	-£9.94	-£7.95
<b>Total</b>		<b>£1,091.58</b>	<b>£496.41</b>	<b>£412.24</b>
Firms	Accessibility	£113.33	£15.91	£13.92
	Costs	-£11.27	-£26.51	-£35.79
	Production	£14.58	£41.75	£31.81
	Corporation tax savings	-£1.33	£1.99	£1.33
<b>Total</b>		<b>£115.32</b>	<b>£33.14</b>	<b>£11.27</b>
Developers	Development costs	-£41.09	-£17.23	-£13.92
	Rental income	£68.27	£92.79	£115.98
	Property owners' tax savings	£0.00	-£2.65	-£3.31
<b>Total</b>		<b>£27.17</b>	<b>£72.90</b>	<b>£98.75</b>
Public sector	Income tax revenue	£35.79		
	VAT revenues	£7.29		
	Unemployment benefit savings	£15.24		
	Council tax revenues	£1.99		
	business rates revenues	£4.64		
	Tax on profit	£1.33		
	Property owners' tax revenues	£0.00		
<b>Total</b>		<b>£66.28</b>	<b>£0.00</b>	<b>£0.00</b>
Rebalancing benefits	Shadow value of jobs for workers in deprived zones	£15.91	£22.53	£22.53
	Social infrastructure savings	£2.65	-£2.65	-£2.65
<b>Total</b>		<b>£18.56</b>	<b>£19.88</b>	<b>£19.88</b>
<b>Total</b>		<b>£1,318.91</b>	<b>£622.34</b>	<b>£542.14</b>

### 3.8.1 Benefits to Households

#### 3.8.1.1 Accessibility

For all the four packages tested, the benefits to households represent the most significant part of the overall benefits at all spatial levels. The benefits to households are dominated by the benefits in accessibility as one would expect due to the nature of the interventions being tested. These gains arise primarily from the transport improvements themselves (incorporating the time savings achieved through each of the packages), allowing easier access to employment and to services, but are supplemented by the increase in local opportunities for work and services resulting from the employment gains in the corridor authorities.

Package 3 is the one with the largest accessibility benefits to households and firms at a national level and most of these benefits are occurring in Dumfries and Galloway (30% of the benefits are to be accrued to the Cairnryan and Stranraer zones) while very little benefits are occurring in South Ayrshire. This highlights that in South Ayrshire there is a conflict between the A75 and A77 dualling improvements that, when tested separately in packages 6 and 9 bring some significant benefits to the local authority, but when they are combined in package 3, the result is that most of the benefits are accrued to Dumfries and Galloway instead.

Dumfries and Galloway is the local authority that gets the highest household accessibility benefits from all the four packages while South Ayrshire gets much smaller benefits apart from package 9 where it gets almost 30% of the overall households' benefits.

There are slight losses of accessibility in all the local authorities across southern Scotland and the central belt, which are the result of the corresponding small losses in employment and income from those areas.

#### 3.8.1.2 Income and Housing

In all the four packages there is an additional benefit in income and in housing quality at a national level. Housing quality benefits generally arise where new housing is being built or where incomes are increasing (allowing better maintenance and more improvement). These benefits therefore tend to be positively correlated with incomes and negatively correlated with housing consumption benefits. The housing quality effect has still to be fully analysed but is believed to be a result of higher incomes from increased employment. The largest impacts in income and housing quality in the four packages are in Dumfries and Galloway; South Ayrshire gets some significant benefits in package 9 while showing disbenefits in packages 3 and 6.

Gains in income usually occur where job opportunities are created. However, where the net national impact is very slight (package 1), this is because net additional jobs are only generated through agglomeration effects, and the majority of employment relocation is displacement.

At a national level there are very small disbenefits in terms of housing consumption which are to be connected to the increased rents. These disbenefits are much larger in Dumfries and Galloway where the increase in residential rents is more significant; this means that there are benefits from other local authorities that are mitigating the disbenefits in Dumfries and Galloway at a national level. The only small benefit in housing consumption at national level comes from package 3.

#### 3.8.1.3 Car Ownership

Changes in car ownership contribute to accessibility benefits (or disbenefits). The car-ownership costs line shows that there are costs from increased car ownership; the workings of the car ownership model are such that these tend to be directly related to increases or decreases in income.

The results for benefits in car ownership costs, and leisure time are all negative as would be expected from the increased employment and higher incomes. The disbenefit in car ownership costs implies that more cars are being owned at national level (with package 3 having the highest cost likely due to the fact that both highway improvements are implemented in it). Most of these negative impacts are in Dumfries and Galloway while South Ayrshire gets very small benefits from all the packages apart from package 9.

Leisure time and commuting costs are generally positive (more leisure time, less commuting cost) where employment is lost, and negative where it is gained. As such these are negatively correlated with the benefits in changed incomes.

As result of increase in income due to more household members in work, there is a loss in leisure time for all the packages and an increase in commuting costs.

#### 3.8.1.4 Housing Consumption

The housing consumption row shows benefits accruing to households from occupying more housing floorspace or paying less for it. In a spatial system where the supply of housing is relatively inelastic, these benefits also tend to be negatively correlated with the changes in employment and in income, in that where the demand for housing increases (typically through a mixture of incomes increasing and additional households arriving in response to improvement employment opportunities), the housing supply usually does not (or cannot) respond proportionately. Rents then increase, giving a disbenefit in the housing consumption measure. Where demand decreases, supply (new building) may be reduced, but typically not in proportion; rents then fall, and benefits accrue to residents. This pattern can generally be observed across the housing consumption row.

### 3.8.2 Benefits to Firms

The benefits to firms show significant positives in terms of accessibility at all spatial levels. The accessibility benefits represent the expected savings in costs from the changes in the transport system (business travel and goods vehicle movement) and from land uses impacts affecting the distribution of destinations that need to be reached. It can be seen that the substantial gains are in Dumfries and Galloway.

It is worth to notice that the direct accessibility benefits to households are much greater than those to firms. This reflects the greater importance of local public transport, in personal travel rather than for business travels.

The accessibility gains are offset by the increased costs. Higher expected revenue results in a slight increase in corporation tax.

Costs are essentially rent-related costs, which tend to be negative (malefits) where the demand for floorspace is increasing and positive (benefits) where it is decreasing. The disbenefits due to the increase in rents are much greater relative to the accessibility benefits for firms than for households; this reflects the forecast that additional housing will be built in the local authority on a scale comparable with the increase in households, while that does not happen for employment space and jobs.

The production row represents the gains to firms' profits (after paying wages and salaries) from gains in productivity due to agglomeration effects or moving to more or less productive locations. The production results at national level are negative or at their best slightly positive (in package 9). The greatest gains here occur in Dumfries and Galloway (with some large benefits in Cairnryan and Stranraer), and there are very little or negative figures for South Ayrshire. The benefits in Dumfries and Galloway are outweighed by disbenefits in South Ayrshire and other local authorities.

Corporation tax savings are positive if the profits made by firms decrease (less tax paid), and negative if profits increase (more tax paid).

### 3.8.3 Benefits to Developers

This category includes all owners and developers of the property (floorspace) modelled. It therefore includes owner occupiers as owners as if they were receiving rent from themselves (i.e., an imputed rent).

There are two significant lines here: development costs and rental income. Development costs are savings to the sector from developing less or cheaper floorspace – so any intervention which, say, induces a net increase in housebuilding will tend to show a negative total on this line. Rental income means what it says, counting both real and imputed rents. Both lines combine results for all the modelled floorspace types.

As one would expect for a transport improvement, the largest categories of benefits are the accessibility gains to households and firms, though a large proportion of these are “captured” by property owners in the form of rents received (rental income). As a result, there are disbenefits to households in housing consumption (more rent paid for less floorspace) and to firms in costs (of space). Those are usually referred to as indirect benefits (e.g., rent income to property owners and developers).

The additional development is reflected in the negative value for property owners' development costs. Package 1 forecasts a saving in the development costs at national and local authority levels while the other three packages are characterized by some extra developments at National level and also at local authority level.

The rent income results are as one might expect generally positive in the corridor, and negative elsewhere. The overall result at national level is positive for all the packages (i.e., a gain of income to owners) and even larger benefits are produced at local authority level for Dumfries and Galloway (which suggests that there are negative impacts in other local authorities).

### 3.8.4 Benefits to Others

In other (English) ULTrA work possible ways of valuing the additional benefit of achieving regeneration in lagging or more deprived areas has been looked at. Benefits in “regeneration” or “rebalancing” are often excluded from formal cost benefit analysis and, at least in the case of transport improvements, are treated as part of the “strategic” case rather than the more formal “economic” case – the implication being that any achievements in regeneration or rebalancing do not contribute to the “value for money” assessed in the economic case, despite the long history of public expenditure towards such objectives. It has long been considered that treatment inappropriate, and that it should be possible to bring such effects into the economic case. That would in particular help to inform comparisons between improvements involving different trade-offs, e.g., improvements which deliver different levels of regeneration benefits, at different costs.

In the regeneration effects in Dumfries and Galloway, the shadow value of locating jobs to benefit workers in deprived areas is positive, showing that on balance the redistribution of jobs is towards the more deprived areas; however, the social infrastructure savings is negative, indicating that on balance, households are being attracted from cheaper to more expensive locations, adding to the costs of providing schools and hospitals. Very small rebalancing and regeneration effects are occurring in South Ayrshire.



### 3.8.5 Benefits to the Public Sector

The public sector (tax) effects are only calculated at the Scotland level, so the overall totals of the local authorities or finer geographic level will not include them.

As corporation, income and property tax receipts increase from the enhancements to accessibility and increases in employment, there is a net gain to the public purse across all the packages. Likewise, a marginal gain is seen across the board for rebalancing benefits – reflecting successes in bringing working age people out of unemployment.

The increase in employment is forecast to be captured by the public sector contribution comes from the reduction in government expenditure due to less unemployment benefit paid. All of the improvements result in new jobs created at national level which means that more opportunities will be created for people to enter in the job market and hence the government will have to pay less unemployment benefits.

Not surprisingly the largest benefits are produced by package 3, the largest package of the four. A significant part of the overall benefit is forecast to be captured by the public sector in additional tax revenues (note that this is simply by existing taxes, without additional value capture measures; note also that this is before considering how profits might be reused or distributed, which would modify the tax results).

### 3.8.6 Summary

Across the packages, households benefit the most of all the actors included. Of the household impacts, by far the most significant is accessibility, incorporating the time savings achieved through each of the packages. Across the board, household income is expected to increase, and household leisure time is expected to decrease – a clear indicator of the employment benefits of the packages. Positive income benefits also accrue in housing quality, as homeowners invest in their physical environment. Increased costs of car ownership and commuting reflect a higher level of work and therefore a higher need for each. Commuting costs, however, reduce marginally for packages 6 and 9.

Firms, too, gain significantly from accessibility across all packages. Offsetting accessibility gains, however, are increased costs – most likely in rent, as demand for floorspace increases with enhanced accessibility. Higher expected revenue results in a slight increase in corporation tax.

For developers, rental incomes are expected to be positively impacted, reflecting the increased demand for floorspace, and quality of housing. This is however offset by increased development costs.

As corporation, income and property tax receipts increase from the enhancements to accessibility and increases in employment, there is a net gain to the public purse across the packages. Likewise, a marginal gain is seen across the board for rebalancing benefits – reflecting successes in bringing working age people out of unemployment.

In all, package 1 is estimated to generate approximately £900 million of impacts; packages 6 and 9, are estimated to accrue approximately £2 billion and £1.3 billion, respectively. Reflecting synergy between the A75 and A77 dualling and measures, package 3 is estimated produce £3.5 billion worth of benefits.

## 3.9 Rail Freight Facilities Results

Appendix D to Appendix F have been produced for the purpose of supporting this Strategic and Economic Impacts Report. Appendix D reviews the opportunities for transporting timber by rail from the Arecleoch and Glentroll Forests. Achieving this requires the development of a timber loading terminal in the Barrhill area (located on the Ayr to Stranraer line) and the operation of a new rail freight service. The objective of this would be to encourage mode shift from road to rail for the transfer of timber to customers. Appendix E reviews the opportunities for transporting freight by rail to and from the ports at Cairnryan. Achieving this requires the development of a suitable transshipment facility, and operation of a new rail freight service. The objective of this would be to deliver mode shift from road to rail for the transfer of freight for onward shipment to Northern Ireland. Appendix F reviews the opportunities for a rail freight terminal to be provided near to Ayr. Achieving this requires the development of a suitable transshipment facility, at locations such as Falkland Yard, High Glengall, and Prestwick Airport. The key objective of such a facility would be to encourage modal shift from road to rail for the transfer of freight to and from the surrounding area.

The route between Barrhill and Carlisle Kingmoor Yard contains a mixture of both 25KV AC electrified, and unelectrified sections. While the line south of Ayr is unelectrified, the route north of Ayr is electrified, which via the East and West Coast Main Lines (WCML), provide electrified routes across central Scotland and towards England. Going forward it will be possible to make use of bi-mode locomotives, including the Class 88 or Class 93 (currently on order for a freight operator), on electrified sections reducing the impacts of these services.

The electrified infrastructure is in two sections between Barrhill and Carlisle Kingmoor Yard – these being Ayr to Barassie Junctions (7 miles 59 chains) and Gretna Junction to Carlisle Kingmoor Yard (7 miles 7 chains), with the remainder of the route being unelectrified. For services towards the West Midlands, the WCML would be most suitable which is electrified in its entirety. Accessing

the WCML from Stranraer would most likely require use of the Glasgow South Western Line via Kilmarnock. While it would be possible to undertake the journey from Ayr to Carlisle Kingmoor Yard on entirely electrified infrastructure, this requires operation via Paisley Gilmour Street, adding approximately 80 miles when compared to the route via Mauchline Junction. In any case obtaining train paths this route and the WCML would be extremely challenging.

Emissions have been calculated, using the 2022 UK Conversion Factors for Greenhouse Gas Reporting, for both road and rail. This assumes 100% (in the case of Barrhill) and 50% (in the case of Stranraer and Ayr) load on all journeys, which is assumed to be achievable. The high density of freshly cut timber in the area makes 100% a reasonable assumption for Barrhill. While these emissions factors do not consider empty journeys to and from the depot, the net impact of these is likely to be minimal.

As can be seen in Table 3-5, which presents results of the Barrhill - Carlisle Kingmoor Yard, when operating with purely diesel traction the reduction in CO<sub>2</sub>e is substantial, with rail freight operation saving over 3 million kilogram CO<sub>2</sub>e compared to moving the equivalent load by HGV. This in spite of longer routing for rail services via Ayr rather than the more direct road via Newton Stewart.

Using data from the TAG Databook the monetary value of the CO<sub>2</sub>e has been calculated and shows a saving of in excess of £7.9 million for both routing options when compared to road.

**TABLE 3-5: BARRHILL - CARLISLE KINGMOOR YARD RAIL FREIGHT FACILITIES RESULTS (CARBON SAVINGS), £ MILLIONS, DISCOUNTED 2010 PRICES**

Emissions Calculations - Barrhill - Carlisle Kingmoor Yard		Road	Rail (via Mauchline Branch)	Rail (via Kilmarnock)
Tare weight	t	19	909	909
Payload	t	25	1,275	1,275
Total weight	t	44	2,184	2,184
Distance	km	162	201	223
Laden CO <sub>2</sub> e	kg/t.km	0.06	0.03	0.03
Unladen CO <sub>2</sub> e	kg/t.km	0.04	0.02	0.02
CO <sub>2</sub> e per train equivalent	kg/t.km	27,553	15,343	16,969
Round trips per day		51	1	1
Days operation per year		260	260	260
Total CO <sub>2</sub> e	kg/year	7,164,009	3,989,406	4,412,124
Total CO <sub>2</sub> e	t/year	7,164	3,989	4,412
Value of CO <sub>2</sub> e	£	£20.72	£11.54	£12.76
<b>Value of CO<sub>2</sub>e vs. Road</b>	<b>£</b>	<b>£0</b>	<b>£9.18</b>	<b>£7.96</b>

As can be seen in Table 3-6, which presents results of the Stranraer – Hams Hall Rail Freight Terminal, when operating with purely diesel traction the reduction in CO<sub>2</sub>e is substantial, with rail freight operation saving over 20-million-kilogram CO<sub>2</sub>e compared to moving the equivalent load by HGV. This in spite of longer routing for rail services via Ayr and Kilmarnock rather than the more direct road via Newton Stewart.

Using data from the TAG Databook the monetary value of the CO<sub>2</sub>e has been calculated and shows a saving of in excess of £60.2 million when compared to road.

**TABLE 3-6: STRANRAER - HAMS HALL RAIL FREIGHT TERMINAL FACILITIES RESULTS (CARBON SAVINGS), £ MILLIONS, DISCOUNTED 2010 PRICES**

<b>Emissions Calculations - Stranraer – Hams Hall Rail Freight Terminal</b>		<b>Road</b>	<b>Rail (via Kilmarnock)</b>
Tare weight	t	16	406
Payload	t	28	914
Total weight	t	44	1,320
Distance	km	492	592
Laden CO2e	kg/t.km	0.10	0
CO2e per train equivalent	kg/t.km	90,448	16,402
Round trips per day		30	1
Days operation per year		312	312
Total CO2e	kg/year	25,940,733	5,117,658
Total CO2e	t/year	25,940	5,117
Value of CO2e	£	£75.03	£14.80
<b>Value of CO2e vs. Road</b>	<b>£</b>	<b>£0</b>	<b>£60.23</b>

As can be seen in Table 3-7, which presents results of the Ayr Rail Freight Terminal, when operating with purely diesel traction the reduction in CO2e is substantial, with rail freight operation saving over 9 million kilogram CO2e compared to moving the equivalent load by HGV.

Using data from the TAG Databook the monetary value of the CO2e has been calculated and shows a saving of in excess of £26.4 million when compared to road.

**TABLE 3-7: AYR – TRAFFORD PARK RAIL FREIGHT TERMINAL RESULTS (CARBON SAVINGS), £ MILLIONS, DISCOUNTED 2010 PRICES**

<b>Emissions Calculations - Stranraer – Hams Hall Rail Freight Terminal</b>		<b>Road</b>	<b>Rail</b>
Tare weight	t	16	572
Payload	t	28	1,462
Total weight	t	44	2,034
Distance	km	338	369
Laden CO2e	kg/t.km	0.10	0
CO2e per train equivalent	kg/t.km	50,825	15,766
Round trips per day		24	1
Days operation per year		260	260
Total CO2e	kg/year	13,214,426	4,099,240
Total CO2e	t/year	13,214	4,099
Value of CO2e	£	£38.20	£11.85
<b>Value of CO2e vs. Road</b>	<b>£</b>	<b>£0</b>	<b>£26.35</b>

The proposed operation of timber loading facilities and container loading facilities and associated rail-based timber and container flows would bring significant benefits to the South West of Scotland, and the increased throughput may in turn unlock further rail-based freight flows and timber extraction opportunities.

Although there is a requirement for investment in infrastructure, a rail freight service would make a very substantial contribution to reducing the carbon impacts of HGV haulage, as well as reducing the number of these using the surrounding highways network.

If dedicated rail freight facilities are established, it would require significant mode shift from road to rail to be viable. It may be possible however to make use of the existing Ro-Ro services and send the containers on unaccompanied port to port dollies, acting in a similar fashion to unaccompanied HGV trailers, while still achieving the ambition of removing HGVs from the road network and assisting in decarbonisation. This would however introduce complications with transhipment.

For rail freight to be successful on this corridor it is likely that there would be a need for either a wider change in policy to promote substantial mode shift and / or a change in the economics of road haulage, driven either by tariffs and taxes or by a rise in the cost of fuel or driver costs. Furthermore, there would need to be a shift from the use of trailers to containers for short and medium distance freight traffic.

### 3.10 Summary

Section 3 has presented the wide array of economic results relating to varying improvements along the A75 and A77. These results include established monetised impacts, evolving monetised impacts, indicative monetised impacts, and additional monetised impacts.

Figure 3-27 provides a visual summary of all the benefits captured for the packages considered. For all packages the largest contributor to the overall PVB is the indicative PVB results. These represent the value that actors in the land-use markets – households and firms – place on accessibility to destination, as opposed to the value that users in the transport system place on time savings. The established monetised impacts also make up a significant portion of the benefits of each package. These impacts are focused on impacts on users of the transport network (such as time savings, and accident reductions).

Overall, when considering all benefits, the packages are ranked in the following order:

1. Package 3 – Full dualling of the A75 and A77 including bypasses of key towns and junction improvements
2. Package 6 – Full dualling of the A75 including bypasses of key towns and junction improvements
3. Package 9 – Full dualling of the A77 including bypasses of key towns and junction improvements
4. Package 2 – Bypasses of key towns and junction improvements along both the A75 and A77
5. Package 1 – Bypasses of key towns and junction improvements along both the A75 and A77
6. Package 5 – Bypasses of key towns and junction improvements along the A75
7. Package 8 – Bypasses of key towns and junction improvements along the A77

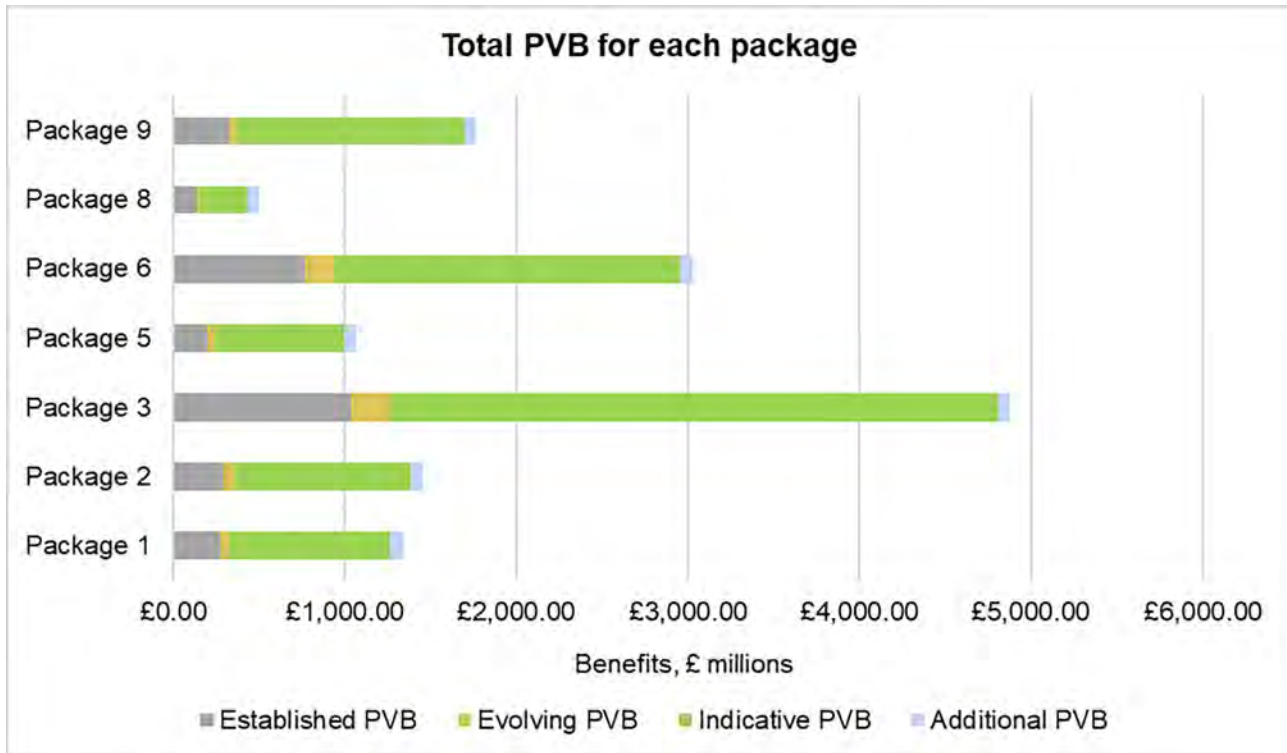
It should be noted that each package also includes rail improvements:

- Construction of a new rail link between Stranraer and Dumfries.
- Construction of an additional rail link between Stranraer and Cairnryan
- Improvements to the existing rail link between Girvan and Stranraer to service the ports at Cairnryan
- New stations at Newton Stewart, Castle Douglas, Stranraer and Dalbeattie

As expected full dualling of the A75 and the A77 along with bypasses at key towns and targeted junction improvements ranks the highest generating close to £5 billion worth of positive benefits. Package 6 then ranks second, generating approximately £3 billion worth of positive benefits, followed by package 9 in third, generating approximately £1.8c billion worth of positive benefits.

These results show that dualling of both the A75 and A77 would bring about wide spreading benefits, to transport users, businesses, the working population, and the region through increased economic activity. However, improvements to the A75 should be a priority over the A77, with dualling of the A75 accruing almost double the benefits of the A77. The results stress the importance of the A75 and the benefits that would be experienced by significantly improving accessibility between Cairnryan, Dumfries, and England.

FIGURE 3-27: SUMMARY OF ECONOMIC ASSESSMENT RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES



The other packages follow a similar trend, with packages 2 and 1 ranking fourth and fifth respectively, and then packages 5 and 8 ranking sixth and seventh respectively. Packages 1, 2 and 5 still accrue positive benefits in excess of £1 billion, showing that there is still merit in more localised improvements through bypasses and junction improvements. However, these improvements won't generate the same magnitude of economic change / growth.

Table 3-8 provides a comprehensive summary of the results used to inform Figure 3-27. The table breaks the results into established monetised impacts, evolving monetised impacts, indicative monetised impacts, and additional monetised impacts, presenting the PVB at each of these levels / stages.

TABLE 3-8: SUMMARY OF ECONOMIC ASSESSMENT RESULTS, £ MILLIONS, DISCOUNTED 2010 PRICES – ALL PACKAGES

		Package 1	Package 2	Package 3	Package 5	Package 6	Package 8	Package 9	
Established (Level 1) benefits	Commuting user benefits								
		Highway	£27.73	£32.35	£107.66	£20.89	£67.02	£13.18	£43.27
		Bus	£2.48	£2.20	£3.03	£2.65	£2.89	£2.94	£2.14
		Rail	£5.99	£5.30	£7.30	£6.39	£6.96	£7.08	£5.15
		<b>Net benefits</b>	<b>£36.20</b>	<b>£39.85</b>	<b>£117.98</b>	<b>£29.94</b>	<b>£76.87</b>	<b>£23.21</b>	<b>£50.56</b>
		Other user benefits							
		Highway	£51.15	£59.02	£204.40	£39.19	£153.09	£21.61	£57.81
		Bus	£2.71	£2.13	£6.18	£4.21	£5.75	£4.03	£2.19
		Rail	£5.19	£4.09	£11.84	£8.08	£11.03	£7.72	£4.20
		<b>Net benefits</b>	<b>£59.04</b>	<b>£65.24</b>	<b>£222.41</b>	<b>£51.48</b>	<b>£169.86</b>	<b>£33.35</b>	<b>£64.21</b>
	Business user benefits								
	Highway	£118.02	£133.04	£407.56	£86.07	£300.10	£55.76	£129.51	
	Bus	£0.12	£0.14	£0.20	£0.18	£0.20	£0.19	£0.11	
	Rail	£1.04	£2.12	£2.65	£2.67	£2.84	£3.09	£1.20	
	<b>Net benefits</b>	<b>£119.18</b>	<b>£135.30</b>	<b>£410.41</b>	<b>£88.92</b>	<b>£303.15</b>	<b>£59.04</b>	<b>£130.82</b>	
	Accidents benefits	£55.10	£46.85	£259.86	£26.32	£192.59	£21.32	£76.80	
	Indirect tax revenues	£5.61	£5.36	£22.83	£4.96	£21.34	£1.31	£3.43	
	<b>Established PVB</b>	<b>£275.13</b>	<b>£292.59</b>	<b>£1,033.49</b>	<b>£201.62</b>	<b>£763.81</b>	<b>£138.22</b>	<b>£325.82</b>	
Evolving (Level 2) benefits	Static agglomeration	£40.76	£45.05	£170.27	£32.57	£141.29	£12.04	£31.59	
	Wider economic impacts								
		Labour supply impact	£3.45	£3.78	£15.69	£2.96	£12.92	£1.01	£2.87
		Output change in imperfectly competitive markets	£11.80	£13.30	£40.76	£8.61	£30.01	£5.58	£12.95
	<b>Evolving PVB</b>	<b>£56.01</b>	<b>£62.13</b>	<b>£226.72</b>	<b>£44.14</b>	<b>£184.22</b>	<b>£18.63</b>	<b>£47.41</b>	
Indicative (Level 2) benefits	Wider economic impacts								
		Dynamic agglomeration*	£2.84	£3.11	£9.52	£2.28	£6.06	£0.84	£3.05
	Wider social and spatial context impacts*	£935.83	£1,024.37	£3,541.83	£752.09	£2,004.87	£276.24	£1,318.91	
	<b>Indicative PVB</b>	<b>£938.67</b>	<b>£1,027.48</b>	<b>£3,551.35</b>	<b>£754.37</b>	<b>£2,010.93</b>	<b>£277.08</b>	<b>£1,321.95</b>	
Additional benefits	Carbon savings - Rail freight	£94.54	£94.54	£94.54	£94.54	£94.54	£94.54	£94.54	
	<b>Total PVB</b>	<b>£1,364.35</b>	<b>£1,476.74</b>	<b>£4,906.09</b>	<b>£1,094.67</b>	<b>£3,053.50</b>	<b>£528.47</b>	<b>£1,789.72</b>	

\*Dynamic agglomeration and wider social and spatial context impacts were not quantified for packages 2, 5 and 8. Therefore, for these three packages the percentage difference between package 1 and each package when considering Level 2 evolving benefits were applied to estimate the potential dynamic agglomeration and wider social and spatial context impacts.



## 4 Summary

This Strategic and Economic Impacts Report has been produced in the light of the findings of the Union Connectivity Review, STPR2, and SWSTS' Initial Appraisal, and the growing pressure for the need for improvements in the South West of Scotland. Despite their critical role for freight movements and domestic travel, the A75 and A77 are primarily single carriageway roads on which, in Scotland, HGVs are limited to speeds of 40mph. Both routes also travel through several towns and villages where further speed limits and congestion negatively impact on journey time reliability and safety.

This report has considered an array of different packages that span from full dualling of the A75 and the A77 to localised bypasses and junctions on just the A75 and separately on the A77. Rail based improvements have also been investigated, with improvements such as the construction of a new rail link between Stranraer and Dumfries, improvements to the existing rail link between Girvan and Stranraer to service the ports at Cairnryan and new stations at Newton Stewart, Castle Douglas, Stranraer and Dalbeattie under consideration.

Each of the intervention packages have been subject to a strategic and economic assessment. The purpose of the assessment is to estimate the benefits of a transport intervention. The benefits of each package captured include:

Road user benefits – savings in travel time and vehicle operating costs (VOC);

- Public transport user benefits – savings in travel time for public transport passengers;
- Safety benefits – accident savings;
- Indirect tax revenue – changes in the amount of fuel purchased and the associated impact to revenue from fuel duty;
- Wider economic impacts (WEIs) – based on connectivity / accessibility improvements, without the consideration of explicit land use change, capturing static agglomeration, more people working and increased output in imperfectly competitive markets; Transformational impacts – ability of the package to have effects on the number and location of homes and jobs, capturing dynamic agglomeration and the effect of people moving to more productive;
- Wider spatial and social context impacts – benefits and disbenefits to households and other actors, using measures of benefit from improved accessibility as the means of capturing both the direct benefits of the package improvement and land-use effects. These represent the value that actors in the land-use markets – households and firms – place on accessibility to destinations, as opposed to the value that users in the transport system place on time savings; and
- Freight facilities – review of the opportunities for transporting freight by rail, including dedicated facilities at Barrhill, Cairnryan / Stranraer and Ayr.

Considering the detail and certainty required in developing capital and operating expenditure estimates, the current status of the A75 and A77 interventions did not allow for reliable and meaningful cost estimates to be generated. For this reason, this report did not provide any indication of potential capital and operational expenditure, and instead focused purely on the benefits that would accrue from such interventions. For this reason, the report does not present a Benefit Cost Ratio (BCR). It would be anticipated, that as interventions / packages progress further into design, cost estimates and corresponding BCRs could be derived and incorporated into future economic assessments and / or business cases as required.

The introduction of each package of interventions is predicted to reduce journey times along the A75 and A77 and on the wider network. Full dualling of the A75 and the A77 ranks the highest generating over £700 million worth of journey time and vehicle operating cost benefits. Package 6 then ranks second, generating approximately £520 million worth of benefits, followed by package 9 in third, generating approximately £230 million worth of benefits. Bus and rail passengers would also experience improved journey times, as a result of improved highway operation and the additional provision of rail facilities. The benefits for rail passengers are not to the same scale as the highway benefits. This is expected because the rail improvements considered within this Strategic and Economic Impacts Report are largely focused on rail freight as opposed to passenger rail, for the reason of removing HGVs from the highway network.

The rail freight assessment considered improved facilities at Barrhill, Cairnryan / Stranraer and Ayr. The results of the Barrhill - Carlisle Kingmoor Yard, when operating with purely diesel traction the reduction in CO<sub>2</sub>e is substantial, with rail freight operation saving over 3 million kilogram CO<sub>2</sub>e compared to moving the equivalent load by HGV. This equates to a monetary value of CO<sub>2</sub>e savings in excess of £7.9 million. The results of the Stranraer – Hams Hall Rail Freight Terminal show a rail freight operation saving over 20 million kilogram CO<sub>2</sub>e compared to moving the equivalent load by HGV. This equates to a monetary value of CO<sub>2</sub>e savings in excess of £60.2 million when compared to road. The Ayr Rail Freight Terminal, when operating with purely diesel traction, sees a reduction in CO<sub>2</sub>e of over 9 million kilogram CO<sub>2</sub>e compared to moving the equivalent load by HGV. This equates to a monetary value of CO<sub>2</sub>e in excess of £26.4 million when compared to road.



When considering the impacts of the packages on safety, full dualling of the A75 and the A77 ranks the highest generating over £250 million worth of accident benefits. Package 6 then ranks second, generating approximately £190 million worth of benefits, followed by package 9 in third, generating approximately £75 million worth of benefits.

Wider economic impacts refer to the additional benefits or disbenefits that can arise as the impact of transport improvements is transmitted into the wider economy, beyond those businesses and passengers that are directly affected by the transport change. The results of the static agglomeration, dynamic agglomeration, labour supply impact and output change in imperfectly competitive markets assessments suggest that the majority of the benefits / positive impacts generated are attributed to Dumfries & Galloway, with South Ayrshire and Carlisle also generating generous benefits / positive impacts. As expected full dualling of the A75 and the A77 produces the largest positive impact, totalling over £235 million. Package 6 then ranks second, generating approximately £190 million. The other packages accrue positive impacts but not to the same magnitude.

Taking the transformational impact assessment one step further, ULTrA (Unified Land-Use / Transport Appraisal) an accessibility-based land-use and transport appraisal software was used to give attention to the wider spatial and social context of public expenditure, otherwise not captured elsewhere (as an alternative to the land value uplift approach more commonly known). In all, package 1 is estimated to generate approximately £900 million of impacts; packages 6 and 9, are estimated to accrue approximately £2 billion and £1.3 billion, respectively. Reflecting synergy between the A75 and A77 dualling, package 3 is estimated produce £3.5 billion worth of benefits.

Overall, when considering all benefits, the packages (which all include rail based improvements) are ranked in the following order:

- 1. Package 3** – Full dualling of the A75 and A77 including bypasses of key towns and junction improvements
- 2. Package 6** – Full dualling of the A75 including bypasses of key towns and junction improvements
- 3. Package 9** – Full dualling of the A77 including bypasses of key towns and junction improvements
- 4. Package 2** – Bypasses of key towns and junction improvements along both the A75 and A77
- 5. Package 1** – Bypasses of key towns and junction improvements along both the A75 and A77
- 6. Package 5** – Bypasses of key towns and junction improvements along the A75
- 7. Package 8** – Bypasses of key towns and junction improvements along the A77

Full dualling of the A75 and the A77 along with bypasses at key towns and targeted junction improvements ranks the highest generating close to £5 billion worth of positive benefits. Package 6 then ranks second, generating approximately £3 billion worth of positive benefits, followed by package 9 in third, generating approximately £1.8 billion worth of positive benefits.

These results show that dualling of both the A75 and A77 would bring about wide spreading benefits, to transport users, businesses, the working population, and the region through increased economic activity. However, improvements to the A75 should be a priority over the A77, with dualling of the A75 accruing almost double the benefits of the A77. The other packages follow a similar trend, with packages 2 and 1 ranking fourth and fifth respectively, and then packages 5 and 8 ranking sixth and seventh respectively. Packages 1, 2 and 5 still accrue positive benefits in excess of £1 billion, showing that there is still merit in more localised improvements through bypasses and junction improvements. However, these improvements won't generate the same magnitude of economic change / growth.



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