CARBON ACCOUNT FOR TRANSPORT

No. 4: 2012 Edition

This document provides an annual update of the Carbon Account for Transport, first published in August 2009. Future updates will be released as new data becomes available.

Contents

Chapter 1: Introduction

1.1 Policy Context

The Government Economic Strategy[1] states that the Purpose of the Scottish Government is to:

"focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth" (The Government Economic Strategy 2011, p12).

In support of the Strategy, the Climate Change (Scotland) Act[2] creates the statutory framework for greenhouse gas emissions reductions in Scotland by setting an interim 42% reduction target for 2020, and an 80% reduction target for 2050. To help ensure the delivery of these targets, the Act also requires Scottish Ministers to set batches of annual targets for Scottish emissions in the period 2010 to 2050. In October 2010, the Scottish Parliament passed legislation setting the first batch of annual targets for the years 2010 to 2022[3].

Finalised in March 2011, Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022: The Report on Proposals and Policies[4], and the Low Carbon Economic Strategy (LCES)[5] together set out how we can meet these climate change targets and secure the transition to a low-carbon economy.

In line with the requirements of the Climate Change (Scotland) Act, the next batch of annual targets covering the period 2023-27 were agreed in October 2011[6].

Delivering the interim and final emissions reduction target will be challenging and all sectors of the economy will need to play their part in its delivery. Tackling emissions

[1] http://www.scotland.gov.uk/Publications/2011/09/13091128/0
[2] http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact
[3] The Climate Change (Annual Targets) (Scotland) Order 2010, SSI 2010 no.359
[4] http://scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/rpp
[5] http://www.scotland.gov.uk/Publications/2010/11/15085756/0
[6] http://www.legislation.gov.uk/ssi/2011/353/made

from transport will require a combination of both reserved and devolved policies to ensure the sector plays its full part.

1.2 Purpose of the Carbon Account for Transport

The National Transport Strategy (NTS)[7] outlines three key strategic outcomes for transport in Scotland:

- Improve journey times and connections
- Reduce emissions
- Improve quality, accessibility and affordability

The 'reduced emissions' outcome includes a commitment to develop a carbon balance sheet for transport with the expectation that:

"This will present the impact of all Scottish transport policies and projects that are expected to have a significant impact on carbon, whether positive or negative."(National Transport Strategy, p46)

This commitment is met by the regular publication of the Carbon Account for Transport (CAT). The CAT provides updates on the following information:

- Official Scottish transport emissions data from 1990 up to 2010
- The emissions efficiency of passenger vehicles
- Key forward looking transport indicators
- Scottish transport infrastructure projects likely to have a significant impact upon emissions
- Assessments of likely impact of Scottish, UK and EU wide regulatory and fiscal measures

Each of these components is used to monitor and review progress towards achievement of the 'reduced emissions' strategic outcome for transport and further

[7] Scotland's National Transport Strategy (2006), The Scottish Executive.

supports the development and implementation of actions to reduce emissions in accordance with the targets in the Climate Change (Scotland) Act.

It is important to be clear from the outset that the CAT is not a decision making tool at either the individual project or policy level. Nor is its function to reject those projects or policies that have a negative impact on emissions. Instead, its purpose is to present in a clear and consistent manner relevant data and analysis to inform the Scottish Government and Transport Scotland's consideration of future transport options. Scottish Transport Appraisal Guidance (STAG)[8] remains the process for appraising new transport policies and projects, with the impact on the environment being one of the five criteria considered alongside economy, safety, integration and accessibility and social inclusion.

To avoid misrepresentation of the data or the drawing of incorrect conclusions, the CAT does not attempt to aggregate the impacts of these individual measures or to compare them to a business as usual baseline. The CAT does though continue to provide an estimate of the net impact of all devolved interventions that fall within the competence of the Scottish Government or other Scottish public bodies. Details of the methodology and the results from the current assessment are set out in section 3.4.

In achieving its objectives, the CAT will also constitute an important element of a wider monitoring framework adopted across the Scottish Government with the aim of reducing emissions. The 'Report on Policies and Proposals' sets out the policies that are already in place to cut emissions across all sectors and further proposals to enable Scotland to meet annual emissions targets from 2010 to 2022.

[8] http://www.transportscotland.gov.uk/stag/home

Chapter 2: Historical emissions analysis

2.1 Background

The emissions data presented in this chapter are from the 'Greenhouse Gas Inventory for England, Scotland, Wales and Northern Ireland: 1990-2010'[9] (GHGI) unless stated referenced. The GHGI is compiled on an annual basis and the full time series of all greenhouse gases is updated in each publication to take account of improved data and any advances in calculation methodology. The greenhouse gases associated with transport and recorded by GHGI are Carbon Dioxide (CO_2), Nitrous Oxide (N_2O) and Methane (CH_4)[10].

The transport category within the GHGI covers emissions from road, aviation, rail and maritime transport. While domestic aviation and shipping emissions are reported in the GHGI, emissions associated with international aviation and shipping were not originally reported. However, using existing data sources, an indicative assessment of the emissions from international aviation and shipping from each country in the United Kingdom was first published in 2009 and continues to be published as an appendix within the annual GHGI publications, including a breakdown for the four home countries. Consequently, in line with the Scottish Government commitment to include emissions from international aviation and international shipping within the targets set by the Climate Change (Scotland) Act, references to aviation and maritime emissions in this document refer to both domestic and international, unless otherwise stated.

The transport emissions reported in this section only cover emissions at the point of use (tailpipe emissions). Consequently, no lifecycle impacts within the transport infrastructure and no displaced impacts, such as the emissions generated by the electricity used on electrified railways, are included.

[9] Greenhouse Gas Inventory for England, Scotland, Wales and Northern Ireland: 1990-2010 (2012), AEA Technology; http://www.naei.org.uk/reports.php

[10] While not relevant to the transport sector, the full inventory includes the three other greenhouse gases - Hydrofluorocarbons (HFCs) Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).

2.2 Total Emissions Trends

Transport in Scotland produced 13.2 mega-tonnes of carbon dioxide equivalent ($MtCO_2e$) emissions in 2010. This total represents a 0.4 $MtCO_2e$ or 2.9% fall from the equivalent 2009 figure, and is the third consecutive year of annual reduction in transport emissions. 2010 emissions are though still some 1.3% above the 1990 base year emissions total of 13.0 $MtCO_2e$. The uncertain economic conditions clearly continue to play a significant part in the reported transport emissions but movements in transport emissions are in addition affected by car ownership levels, global oil prices, household income, population, land planning and use, public transport provision, culture and lifestyles.

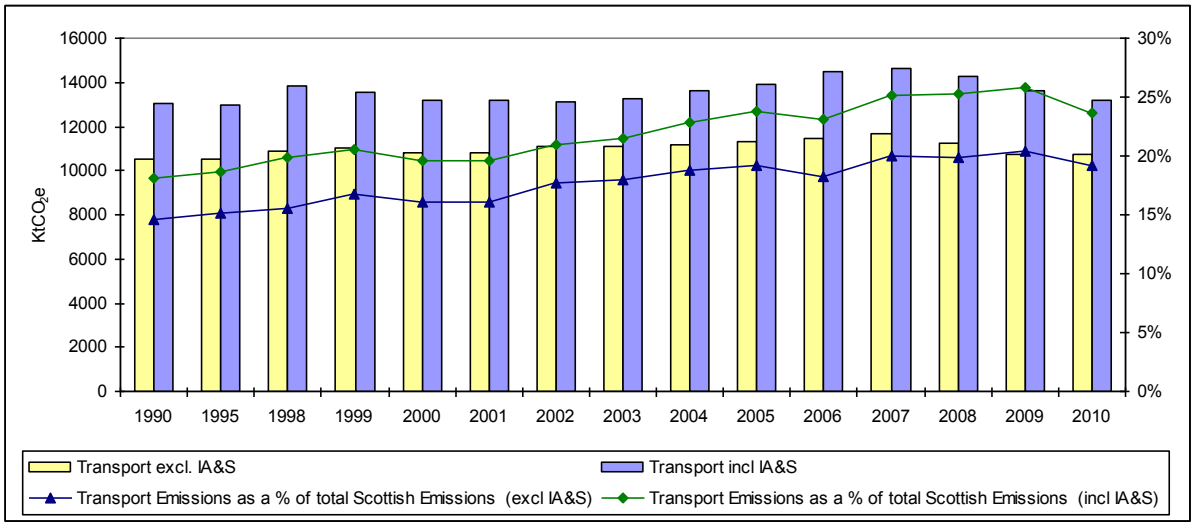
While the uncertainty has also impacted on emissions from all other sectors the 2010 emissions estimate for Scotland shows an increase of 3.1 $MtCO_2e$ between 2009 and 2010.[11] This rise is largely due to an increase in fossil fuels burnt in domestic heating (gas) and in power generation (coal)[12]. Total Scottish emissions are though still 23% below their 1990 level.

The rise in total Scottish emissions coupled with the further decline in transport emissions means that, for the first time since 2006, transport's share of all Scottish emissions has fallen. The transport sector now accounts for 20.1 % of total emissions if International Aviation and Shipping (IAS) emissions are excluded from both transport and the aggregate figure, and 23.7% with the inclusion of IAS emissions. These 2010 proportions are though still considerably above the equivalent 1990 percentages of 15.1% and 18.0% respectively.

[11] This calculation uses the unadjusted Scottish emissions total for 2010 – i.e. excluding the impact of the EU Emissions Trading System (ETS). Including the ETS would lower Scotland's net emissions total and it is this adjusted total that is used in assessing Scotland's performance under the Climate Change (Scotland) Act.

[12] The emissions from power stations will have been offset with the purchase of EU ETS allowances.

Figure 1: Total emissions from transport and transport emissions as a percentage of total Scottish emissions, 1990-2010



Source: Greenhouse Gas Inventory, NAEI, 2012, Transport Scotland. Total emissions calculation excludes the impact of the EU Emissions Trading System

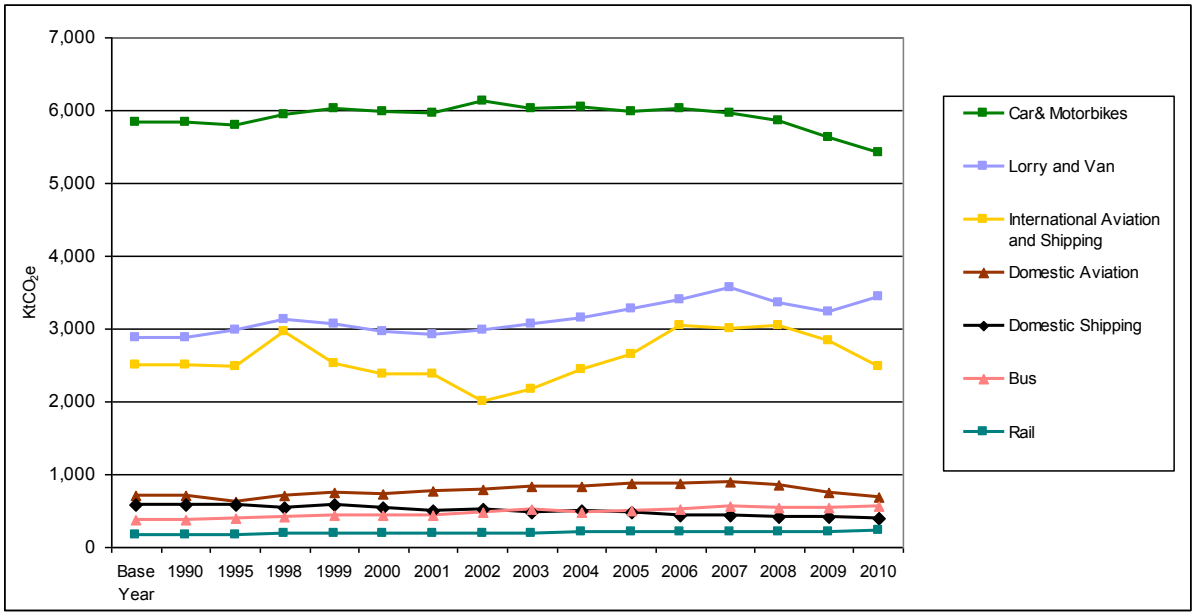
Emissions by mode

The fall in aggregate transport emissions between 2009 and 2010 is largely a result of reduced emissions from international aviation and shipping. Road emissions are broadly unchanged as the significant reduction in emissions from cars is offset by an almost equivalent increase in emissions from lorries and vans. In more detail:

- Emissions from cars and motorbikes fell by 3.6% from 5.6 to 5.4 $MtCO_2e$;
- Emissions from lorries and vans increased by 6.5% from 3.2 to 3.4 $MtCO_2e$;
- Emissions from IAS fell by 12.1% from 2.8 to 2.5 $MtCO_2e$; and
- Combined, the other sectors[13] saw emissions fall by 3.3% from 1.9 to 1.8 $MtCO_2e$.

[13] Domestic aviation and shipping, bus and rail

Figure 2: Transport emissions 1990-2010 broken down by broad transport sector



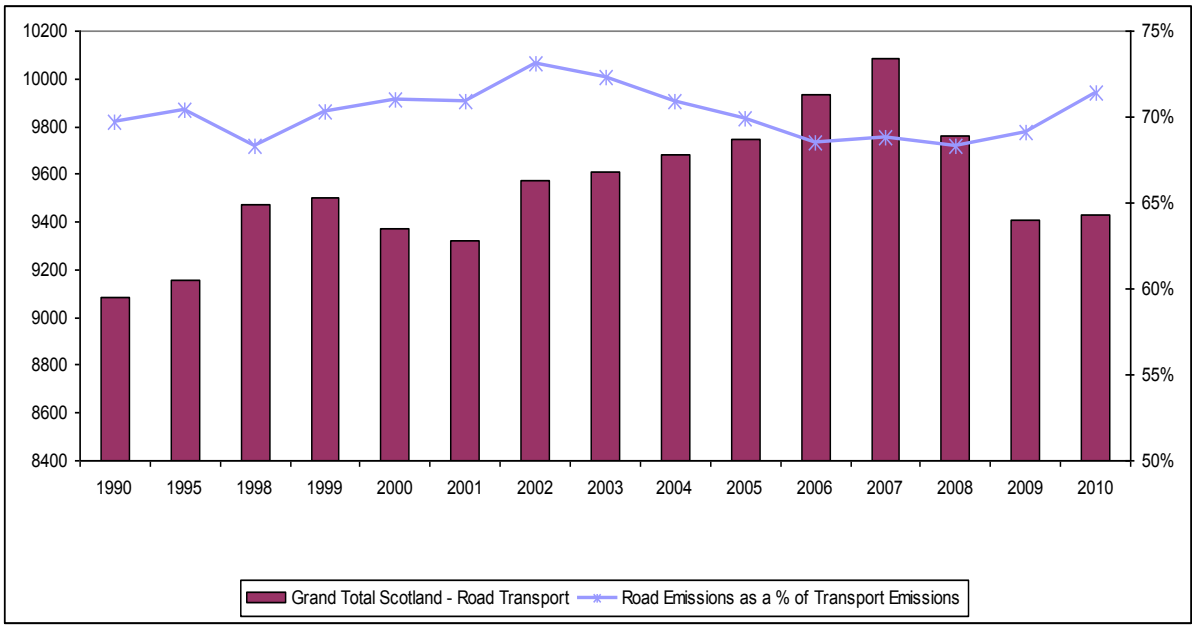
2.3 Emissions analysis by transport sector

Road transport

Road transport emissions cover emissions from all private, public and commercial road vehicles. Together, this category accounts for over 71% of all transport's emissions, with cars alone accounting for 57% of road transport emissions and 41% of all transport emissions.

Emissions from road transport in 2010 saw a marginal increase over the equivalent 2009 figure, but remain at 9.4 $MtCO_2e$. This total is more than 6% below the 2007 road emissions peak of 10.1 $MtCO_2e$. Overall road emissions in 2010 were 3.8% higher than their equivalent 1990 figure. Road emissions as a percentage of total transport emissions rose marginally in 2010.

Figure 3: Road transport emissions 1990-2009 and as a share of total transport emissions



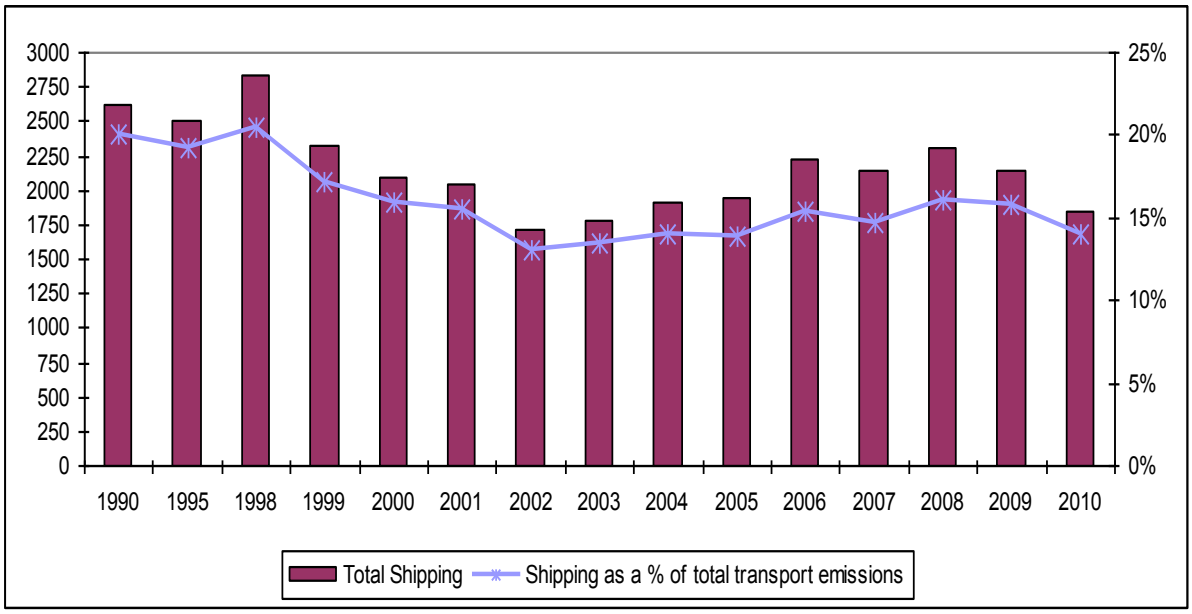
Further detailed analysis of road transport emissions by vehicle type is undertaken in section 2.4.

Maritime transport

Maritime emissions[14] in 2010 are estimated to be 1.9 $MtCO_2e$ or 14% of total transport emissions. As international shipping accounts for between 75% and 85% of the sector's total emissions, so the performance of the maritime category is principally driven by changes in this one activity. Historically, maritime emissions, and international emissions in particular, have been very volatile. Between 1995 and 2002 shipping emissions fell by almost a third to 1.7 $MtCO_2e$ before rising again by a third to 2.3 $MtCO_2e$ by 2008. International shipping emissions fell by almost 16% between 2009 and 2010. Emissions in 2010 are now over 0.7 $MtCO_2e$ below the equivalent 1990 figure.

[14] Includes national navigation and international shipping

Figure 4: Maritime emissions 1990-2010 and as a share of transport emissions

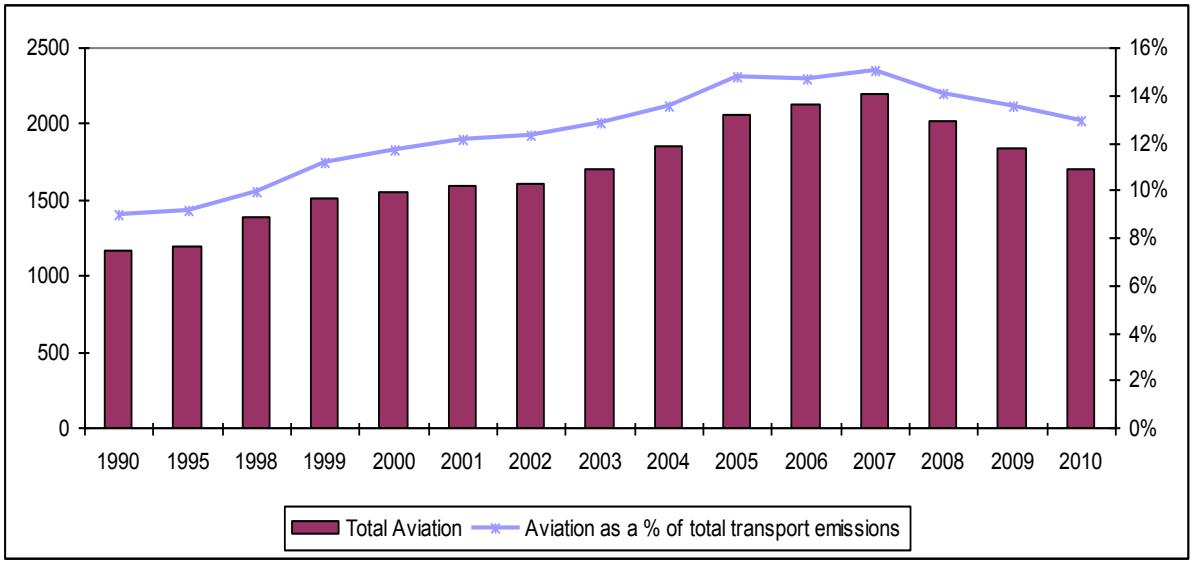


Aviation

Aviation emissions have fallen by 7% continuing a trend begun in 2008. Between 2009 and 2010 emissions fell from 1.8 $MtCO_2e$ to 1.7 $MtCO_2e$, and are now some 0.5 $MtCO_2e$ below the 2007 peak of 2.2 $MtCO_2e$. Current aviation emissions account for 13% of total transport emissions, down from 15% of all transport emissions in 2007. International aviation emissions make up around 60% of total emissions from the sector.

Overall aviation emissions are still over 0.5 $MtCO_2e$ above their equivalent 1990 figure, driven almost exclusively by the increase in international emissions over the period.

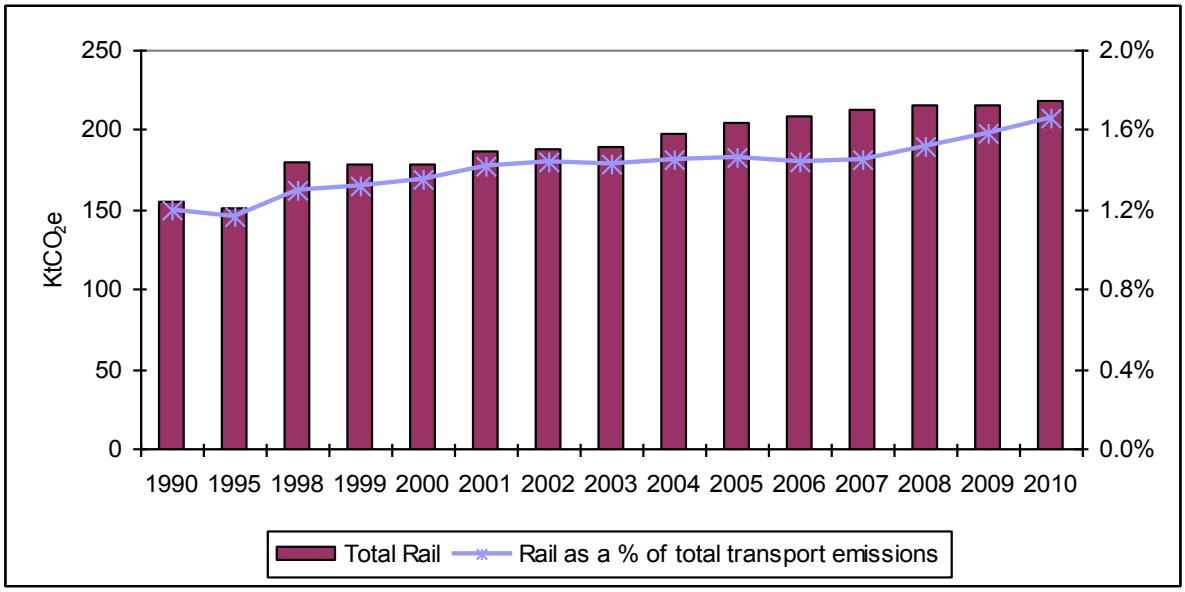
Figure 5: Aviation emissions 1990-2010 and as a share of total transport emissions



Rail

Rail emissions rose by 1.6% between 2009 and 2010 and the 2010 emissions total of 0.2 $MtCO_2e$ is 35% above the equivalent 1990 figure. Despite these shorter and longer term increases in rail emissions the sector still accounts for less that 2% of all Scottish transport emissions.

Figure 6: Rail emissions 1990-2010 and as a share of total transport emissions



2.4 Road Emissions by vehicle type

Cars: At 5.4 $MtCO_2e$ in 2010, emissions from cars account for both the greatest proportion of road emissions as well as all transport emissions; just over 57% and 41% respectively. Emissions from cars have fallen slowly from a peak of 6.1 $MtCO_2e$ in 2002 to their current level. The 2010 emissions level is 11% below that 2002 peak figure and also 0.4 $MtCO_2e$ below the 1990 level.

HGVs: Emissions from HGVs make up the second largest proportion of road emissions. HGV emissions in 2010 were just under 2.1 $MtCO_2e$, a 10% increase over the 2009 figure of 1.9 $MtCO_2e$. This increase marks the end of a short run of declining emissions from HGVs and takes the total marginally above the 1990 baseline figure.

LGVs: LGV emissions increased by 1.1 % between 2009 and 2010 but remain at 1.3 $MtCO_2e$, having previously fallen for 2 years. The latest emissions figure for LGVs is almost 70% above the base year total of just under 0.8 $MtCO_2e$.

Buses and motorcycles: Emissions from buses rose marginally between 2009 and 2010 but remain under 0.6 $MtCO_2e$, while motorcycle emissions fell slightly and now account for less than 0.04 $MtCO_2e$ of total transport emissions.

Figure 7 shows the changes in emissions for road vehicles, broken down by vehicle type while Figure 8 shows the year on year percentage change in emissions in the three largest road emitting categories (Car, HGV and LGV). While the downward trend in emissions from cars continues there has been a return to increasing emissions in both goods vehicle categories after two years of reductions.

Figure 7: Breakdown of Road Emissions by Vehicle Type 1990-2010

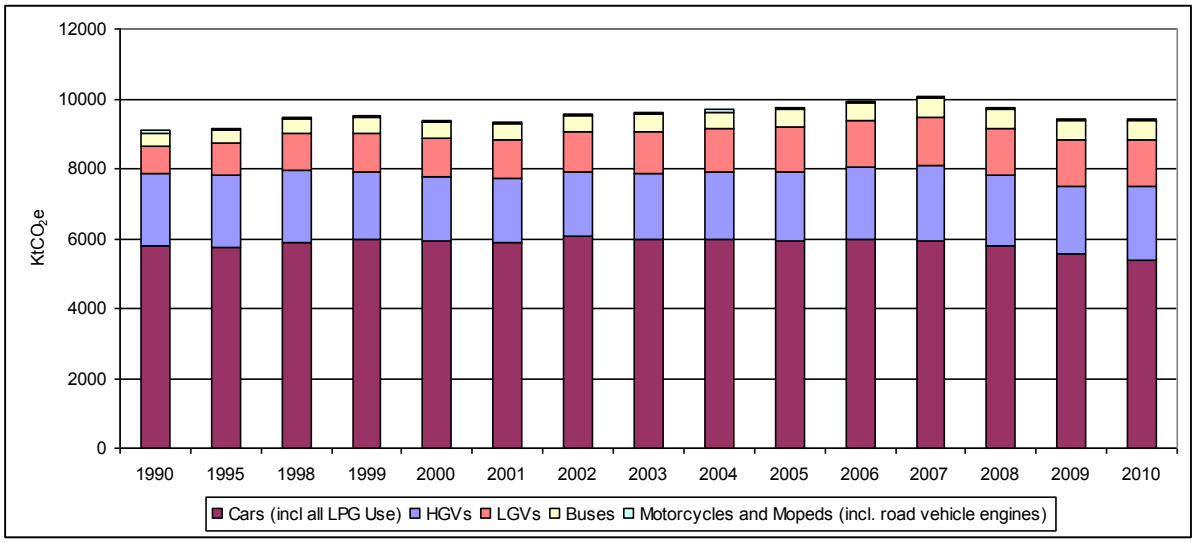
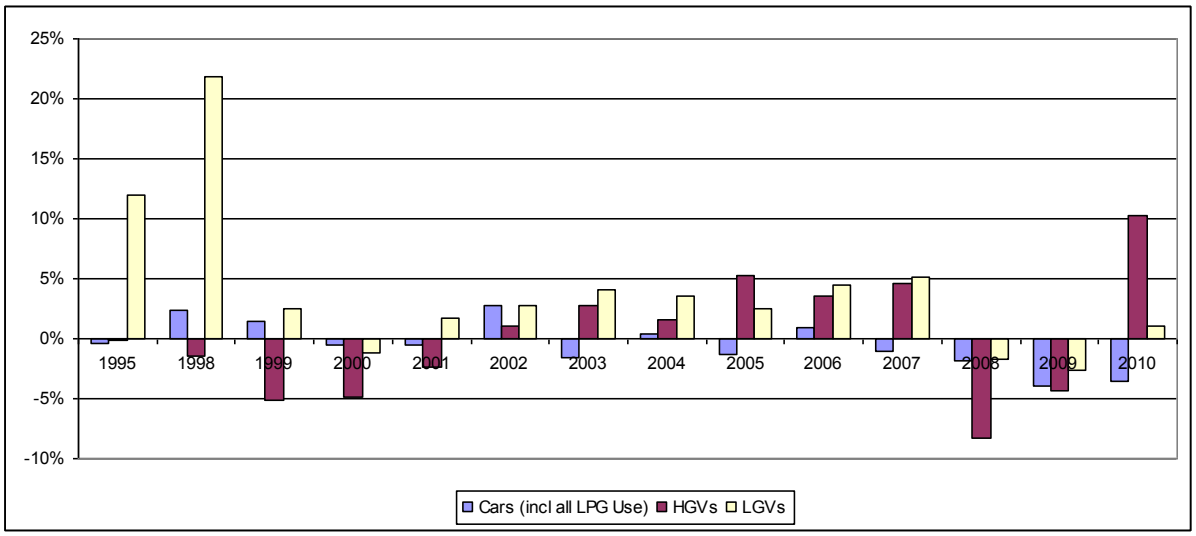


Figure 8: Year on year change in car, HGV and LGV emissions 1995-2010

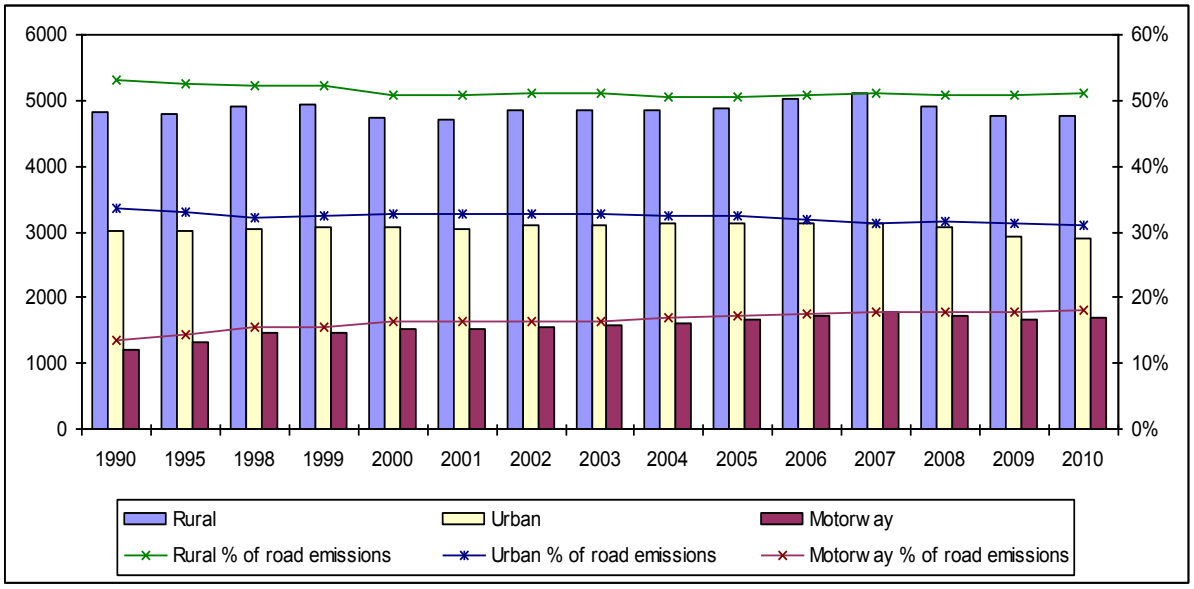


Emissions by road type

The GHGI database also differentiates road transport emissions across three road types: rural, urban and motorway. All three road categories saw virtually no change in emissions between 2009 and 2010. Just over half of Scottish road emissions arose from rural driving in 2010, a small reduction in percentage terms from the position in 1990. Urban emissions have fallen from just over one third of road emissions to just below one third with the increase in emissions from motorway

driving causing these gradual declines on other parts of the road network. Emissions from motorway driving in 2010 are 40% higher than in 1990.

Figure 9: Breakdown of road emissions by road type 1990-2010



2.5 Comparison of key Scottish and UK Transport emission figures and trends

Table 1: Comparison of Scottish and UK GHG emissions

	Scottish emissions 2010	Scottish emissions as a % of UK emissions 2010	Change in Scottish emissions (2009-2010)	Change in UK emissions (2009-2010)	Change in Scottish emissions (1990-2010)	Change in UK emissions (1990-2010)
All Transport	13,204	8.1%	-2.9%	-1.9%	1.3%	11.2%
All Transport (excl. IAS)	10,717	8.8%	-0.5%	-0.2%	1.9%	0.3%
Road Transport	9,427	8.4%	0.2%	0.0%	3.8%	1.6%
of which:						
Cars	5,380	7.9%	-3.6%	-3.3%	-7.3%	-6.3%
HGVs	2,098	9.1%	10.3%	11.0%	0.7%	-3.9%
LGVs	1,346	8.9%	1.1%	0.5%	69.3%	61.2%
Buses	559	11.8%	2.7%	0.7%	46.3%	40.8%
Motorcycles	34	6.0%	-8.7%	-9.3%	10.7%	-9.6%
Rural	4,779	10.8%	0.4%	0.1%	-0.6%	0.2%
Urban	2,900	7.1%	-1.0%	-1.8%	-4.2%	-7.4%
Motorway	1,691	6.5%	1.8%	2.9%	39.6%	22.7%
Rail	219	9.8%	1.6%	1.5%	35.2%	9.2%
Aviation	1,707	4.7%	-7.1%	-4.6%	46.0%	69.9%
Maritime	1,851	15.3%	-13.7%	-10.3%	-29.3%	-3.4%

Scottish transport emissions including IAS currently account for 8.1% of total UK transport emissions and 8.8% of emissions if IAS is excluded. Emissions from road transport in Scotland are in proportion to the overall UK figure although emissions on rural roads are above the UK equivalent percentage with the reverse holding for motorway emissions. The aviation (4.7%) and maritime (15.3%) sectors show the greatest variation from a proportional share.

Historically, all sub categories of Scottish transport emissions have moved broadly in line with the equivalent UK level series. This is to be expected given the similarities in economies, transport networks and levels of interconnectivity.

It is the difference in size and relative importance of the aviation and maritime sectors in the UK and Scotland that have largely driven the change in overall transport emission performance between Scotland and the UK, particularly in respect of the changes seen between 1990 and 2010. Excluding IAS UK emissions in 2010 are only marginally above the 1990 level, with Scotland seeing a greater increase, albeit still below 2%. However, once emissions from IAS are included the position changes significantly. UK emissions in 2010 are just over 11% above their equivalent 1990 figure while in Scotland the rise is just over 1%.

More specifically, while international aviation emissions have increased by almost 70% at the UK level the figure for Scotland is significantly lower at 46%. For the maritime sector emissions have fallen by 3% at the UK level but by 29% in Scotland. This sub-UK level change in maritime emissions is due in significant part to a methodological change and reallocation of emissions between the countries of the UK. With international maritime emissions making up just under 25% of total UK IAS emissions but almost 60% of Scottish IAS emissions the drivers behind the changes in overall transport emissions including IAS are more obvious.

2.6 Efficiency of passenger vehicles

Different modes of transport have the capacity to transport different numbers of passengers. For example the average number of passengers on a bus is higher than the average number of passengers in a car. As such the efficiency of transport modes, in terms of the CO_2 per passenger kilometre transported, varies. Defra's Company Reporting Guidelines[15] allow comparisons to be made between the emissions per passenger kilometre[16] of different modes of travel.

Table 2: **CO_2e emissions per passenger kilometre by mode**

Sector	Mode	gCO_{2e}/pkm
Road[17]	Average petrol car	129
	Average diesel car	119
	Average petrol hybrid car	86
	Average petrol motorbike	119
	Average bus	112
	Average coach	29
Rail	National rail	58
	Light rail and tram	68
Ferry (Large RoPax)	Average foot and car passengers	116
Aviation	Domestic flights	167
	Short haul international	95
	Long haul international	109

Source: 2012 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors May 2012

All values shown in Table 2 are estimated using data for Great Britain so do not specifically relate to Scotland. In general, public passenger transport (rail, coach, and tram) is more efficient in terms of CO_2e/pkm because they transport more people at one time.

2.7 Leading indicators

Data on greenhouse gas emissions tends to lag approximately a year behind other transport data. Consequently, in order to keep the information in the CAT as

[15]Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting (2012), Produced by AEA for the Department of Energy and Climate Change (DECC) and the Department of Environment, Food and Rural Affairs (Defra)

[16]Passenger Kilometres is the product of the distance a vehicle travels multiplied by the number of occupants travelling that distance.

[17] All car figures assume an average car occupancy rate of 1.57 passengers based on the Scottish Household Survey Travel Diary: 2009-10.

relevant as possible, the following indicators provide some insight into likely future trends in GHG emissions:

- **Road vehicle kilometres travelled:** Emissions are directly related to the kilometres travelled. This indicator tracks vehicle kilometres travelled by all vehicle types on all roads.
- **Road transport fuel consumption per vehicle kilometre:** Fuel efficiency in this context relates to reducing fuel consumption in road transport without impinging on our ability to transport ourselves. Holding all else constant, the more fuel efficient we are as we travel the fewer emissions we emit. Improving fuel efficiency can be achieved through a combination of measures to improve the fuel efficiency of vehicles and decreasing the volume of fuel consumed through widening travel choices. This indicator tracks the fuel consumption per vehicle kilometre and per 1000 of population.
- **Proportion of new road vehicles that are alternatively fuelled:** Improving the average efficiency of new vehicles is crucial to reducing emissions from the transport sector. Alternatively fuelled vehicles[18], including electric and hybrid vehicles, have the potential to emit very low levels of tailpipe emissions. This indicator tracks the proportion of vehicles newly registered that are alternatively fuelled.
- **Modal share of public transport and active travel:** Promoting the use of public transport or active travel as an alternative to the private car is an important element of reducing transport emissions. This indicator tracks the proportion of average distance travelled per person per annum by public transport, walking or cycling.
- **Aviation passengers:** Emissions from aviation have grown rapidly over the past 20 years. This indicator tracks the total number of aviation passengers, both terminal and transit.
- **Waterborne freight lifted in Scotland and moved:** Commercial shipping constitutes the greatest element of maritime emissions. This indicator tracks the

[18] Alternatively fuelled vehicles include all vehicles whose primary method of propulsion is neither petrol nor diesel.

total level of waterborne freight lifted in Scotland and moved, measured in million tonne-kilometres.

Table 3: Trends in leading transport indicators[19] Awaiting an update of the table from STS when published for first half of table

Indicator	2011 level	Average growth p.a. (2003-2011)	Growth (2010-2011)
Road vehicle kilometres travelled (million vehicle kilometres)	43,390	0.4%	-0.2%
Proportion of new road vehicles that are alternatively fuelled (%)[20]	2%	27%	0.1%
Modal share of public transport and active travel (distance travelled) (%)[21]	20%	1.7%	-1.2%
Aviation passengers (thousand passengers)	22,111	0.6%	-7%
Waterborne freight lifted in Scotland and moved (million tonne-kilometres)[22]	15,722	-0.8%	-12%
	2010 level	**Average growth p.a. (2005-20010)**	**Growth (2009-2010)**
Road transport fuel consumption[23] (a) tonnes per 1000 vehicle kilometres; (b) tonnes per 1000 population.[24]	(a) 0.07 (b) 569	(a) -1.1% (b) -1.0%.	(a) -1.4% (b) -2.7%

[19] Source: Scottish Transport Statistics, No 31, 2012 Edition. Tables 5.1, 1.1, 11.2, 8.1, 9.1, 5.11.
[20] Definition and series extended to include all vehicles not fuelled entirely by petrol and diesel
[21] Latest available data is up to 2009/10
[22] Latest available data is up to 2010
[23] Own calculation using population data from GROS, kilometres travelled from Scottish Transport Statistics and fuel data from DECC: Road fuel consumption at Local Authority level
[24] GROS population estimates (mid 2011) for Scotland are 5,254,800.

Chapter 3: Future emissions impact of transport interventions

3.1 Background

This chapter lists those transport interventions, whether devolved or reserved to the UK/EU, which are firm commitments and are expected to have a direct and significant impact on Scottish transport emissions after the time period captured by the GHGI (1990–2010). The interventions are separated between infrastructure projects and those that involve fiscal policy or regulation. Emissions impacts are taken from the original appraisal report or subsequent published document, where available and have been rounded to the nearest 1 kilo-tonne of carbon-dioxide equivalent ($ktCO_2e$) where appropriate.

As well as reporting the emissions impacts, where possible the chapter outlines the general methodological approach for estimating the impact of both infrastructure projects and fiscal/regulatory policies. As is apparent, the precise estimation methodology may differ significantly depending upon the type of intervention and the original model used. Emissions estimates are frequently assessed in isolation, and so will not necessarily include the full interactions between measures or take account of the impact of any future measures on the project. Furthermore, for many interventions there are likely to be a number of localised impacts which may not be captured or presented consistently between appraisals. Where possible, the impacts presented here are the net emissions impact at a national level.

As a result of such methodological variation, the emissions estimates and related timescales are to be used as an informative guide to the direction of change and the order of magnitude only. The comparison, addition or netting off of emissions estimates between interventions or against the GHGI data is not statistically valid and may lead to incorrect conclusions being drawn**.**

3.2 Infrastructure projects

Methodology

Environmental impacts of infrastructure projects are taken from the latest published estimates. In most cases this will be the emissions estimate contained in the project specific Environmental Statement. Some recently announced projects will not yet have begun a formal appraisal process. For reference, links to the project home page are also provided where an online assessment is available.

STAG recommends that greenhouse gas emissions from road traffic are calculated according to the methodology in the Design Manual for Roads and Bridges[25] (DMRB). DMRB was first introduced in 1992 in England and Wales, and subsequently in Scotland and Northern Ireland. It provides a comprehensive manual system which accommodates current Standards, Advice Notes and other published documents relating to Trunk Road Works.

For emissions associated with the running of diesel and electric trains, STAG recommends the use of the Rail Emission Model Final Report[26] that was produced for the Strategic Rail Authority. This is published on the Department for Transport website, and provides estimated emission factors and detailed data for individual diesel and electric train types.

There are no such established guidelines for estimating carbon estimates for other travel modes. Where projects do concern other modes, for example the Edinburgh Tram, the methodology used to estimate the carbon impact is tailored specifically to that individual project. Similarly, it is important to note that when considering the predicted emissions impacts of these infrastructure projects, the modelling procedures used to derive these predictions can differ significantly, particularly in the way in which they account for secondary impacts such as land-use changes resulting from the transport project. The Edinburgh tram model is an example where

[25] Design Manual for Roads and Bridges (2009): Highways Agency Design Manual for Roads and Bridges (DMRB)
[26] Rail Emission Model (2001), AEA Technology Environment

the secondary effects are assessed, and this may be one of the reasons why its emissions impacts appear relatively high.

Undertaken by Transport Scotland and announced by The Minister for Transport, Infrastructure and Climate Change in December 2008, the Strategic Transport Projects Review (STPR)[27] sets out the strategic transport investment priorities for the next twenty years and provides the basis on which Ministers can make informed decisions about future transport spending beyond the current programme. The nature of this publication means that many of the projects will be undertaken at a future date and thus lack a designated timetable and a formal appraisal process. Those projects that are being 'fast-tracked' (i.e. the Forth Replacement Crossing and Edinburgh-Glasgow (Rail) Improvements Programme) are assessed and there impacts included in the CAT. Other individual projects from within STPR likely to have a significant emission impact will be included in the CAT commentary as and when they become committed schemes.

Road

M80 Stepps-Haggs

http://www.transportscotland.gov.uk/projects/trunk-road-projects/m80-stepps-to-haggs-project

- Document: Environmental Statement (2004), Babtie
- Construction completed: September 2011
- Estimated emissions impact: +40ktCO_2 p.a. from 2012; +40ktCO_2 p.a. from 2025

This project is to upgrade the A80 between Stepps and Haggs to motorway standard. The change in carbon dioxide emissions results from the predicted increase in traffic volume and an increase in the average vehicle speed on the A80 from 69kph to 88kph.

[27] The final report from the STPR was published in October 2009

M74 Completion

http://www.transportscotland.gov.uk/projects/m74-completion

- Document: Environmental Statement (2003), ERM
- construction completion: 28 June 2011
- Estimated emissions impact: +87ktCO_2 p.a. from 2012; +135ktCO_2 p.a. from 2020

The M74 Completion project completes a vital part of the west of Scotland's motorway network. The new eight kilometres (five miles) stretch of road continues the M74 motorway from Fullarton Road Junction, near Carmyle, to the M8 motorway west of the Kingston Bridge. Construction work on the road began in May 2008 with the road open to traffic on 28 June 2011.

The scheme is predicted to cause an increase in global emissions of CO_2 due to the overall increase in vehicle kilometres travelled on the road network. Note that the construction completion date of June 2011 is a year later than the original 2010 emissions impact estimate as published in the Environmental Statement.

A75 Dunragit Bypass

www.transportscotland.gov.uk/projects/trunk-road-projects/a75-dunragit-bypass-project

- Document: Environmental Statement, Young Associates / Mouchel Parkman
- Anticipated construction completion: 2012/13
- Estimated emissions impact: +4ktCO_2 p.a. from 2022

Drivers currently experience limited overtaking opportunities along much of the A75, which leads to traffic congestion and creates driving conditions which lower average speeds and increase driver frustration and the potential for accidents. The proposed scheme will comprise an off-line road alignment and, in accordance with its stated objective, will provide guaranteed overtaking in both eastbound and westbound directions. The additional CO_2 emissions are expected as a result of the increase in distance that vehicles will travel due to the addition of the bypass.

M8, M74 and M73 Improvements

The current programme for the M8 M73 M74 Motorway Improvements is due for completion in Spring 2017, based on a project commencement in late 2013. This project bundles together three individual projects: M8 Baillieston to Newhouse, M74 Raith Interchange, and M8 M73 M74 Network Improvements.

The project is of a similar scale to the recent M74 Completion which directly supported 900 construction jobs - the large majority of the workers came from the local area - and is expected to reduce the journey time for around 115,000 vehicles per day which use the busiest sections of the M8.

It is predicted that the scheme will lead to a reduction of more than 100 accidents per year and more freely flowing traffic on these strategic routes will reduce the emissions associated with queuing traffic and improving both air quality and health.

M8 Baillieston-Newhouse

http://www.transportscotland.gov.uk/projects/trunk-road-projects/m8-baillieston-to-newhouse

- Document: Environmental Statement (2007), Mouchel Fairhurst JV
- Anticipated construction completion: 2017
- Estimated emissions impact: +30ktCO_2 p.a. from 2020

This project is a proposal to upgrade the existing A8 between Baillieston and Newhouse to dual three-lane motorway standard equivalent.

The DMRB was used to calculate the change in greenhouse gas emissions, therefore the assessment has included all traffic on the entire modelled network, not just links that were explicitly included in the local assessment. The increase in emissions is due to an increase in predicted traffic levels.

M74 Raith Interchange

http://www.transportscotland.gov.uk/projects/trunk-road-projects/m74-raith-interchange

- Document: Environmental Statement (2007), Mouchel Fairhurst JV
- Anticipated construction completion: 2017
- Estimated emissions impact: +10ktCO_2 p.a. from 2020

The scheme is aligned with the M8 Baillieston to Newhouse works and the Associated Network Improvements**.** These are vital links in the trunk road network of Central Scotland and serve substantial existing developments as well as some of the most significant future development sites in Scotland.

Severe traffic problems exist at Raith Junction due to the interaction of heavy turning volumes from the A725 and the M74 at the signalised roundabout. This scheme aims to relieve traffic congestion at the junction.

M8 Associated Network Improvements

http://www.transportscotland.gov.uk/projects/trunk-road-projects/m8-associated-network-improvement-study

- Document: Environmental Statement, 2008 (Mouchel Fairhurst JV)
- Anticipated construction completion: 2017
- Estimated emissions impact: +2ktCO_2 p.a. by 2020

This scheme comprises capacity improvements on sections of the M73, M74 and M8 adjacent to Baillieston and Maryville interchanges as a result of changes to east-west traffic patterns once the extension to the M74 and improvements to the M8 are in place.

A90 Balmedie-Tipperty

http://www.transportscotland.gov.uk/projects/trunk-road-projects/a90-balmedie-to-tipperty-dualling-project

- Document: Environmental Statement (2007), Grontmij / Natural Capital
- Anticipated construction completion: Linked to AWPR
- Estimated emissions impact: +2ktCO_2 p.a. from 2013

This project involves the proposed dualling of the A90 between Balmedie and Tipperty. These improvements will provide continuous dual carriageway between Aberdeen and Ellon, which will remove the bottleneck caused by the existing single carriageway. The local community has been pressing for this upgrade for a number of years.

The increase in emissions is due to the increase in the road sections that make up the total road assessed.

A90 Aberdeen Western Peripheral Route (AWPR)

http://www.awpr.co.uk/

- Document: Assessment of Effects of Updated Traffic Model submitted for PLI (2008), which updates previous source of 2007 Environmental Statement, Jacobs
- Anticipated construction completion: As a result of the delays associated with the protracted public local inquiry and legal challenges the anticipated construction completion is now spring 2018. Estimated emissions impact: +10ktCO_2 p.a. from 2027.

A peripheral route around Aberdeen is proposed to reduce the high volumes of traffic using the A90 in the centre of Aberdeen, and to reduce the traffic congestion that the city experiences as a result of the volume of traffic using the A90 and its associated radial roads. The overall increase in the number of road vehicles, however, is expected to lead to an increase in CO_2 emissions.

The AWPR will provide substantial benefits across the whole of the North East of Scotland and will provide a boost to the economy; increase business and tourism opportunities; improve safety; cut congestion as well as increasing opportunities for improvements in public transport facilities.

Forth Replacement Crossing

http://www.transportscotland.gov.uk/projects/forth-replacement-crossing

- Document: Environmental Statement (2009), Jacobs Arup

- Anticipated construction completion: 2016
- Estimated emissions impact: +20ktCO_2 p.a. in 2032

The Forth Replacement Crossing (FRC) is a major road infrastructure project being delivered by Transport Scotland. The project was driven by uncertainty over the future viability of the existing Forth Road Bridge, and is designed to safeguard this vital connection in Scotland's transport network. It comprises a new cable-stayed bridge across the Firth of Forth, to the west of the existing Forth Road Bridge, and associated new and improved road infrastructure to the north and south of the bridge. The proposed scheme will retain the existing Forth Road Bridge as a public transport corridor for use by buses, taxis and other specified users and for continued use by pedestrians and cyclists. The new bridge will be used by all other traffic including private cars and heavy goods vehicles. Emergency vehicles will be able to use either bridge.

The FRC was identified as a key strategic investment project in Scotland's national transport network in the Strategic Transport Projects Review (STPR) undertaken by Transport Scotland in December 2008, and the National Planning Framework (NPF2) published by the Scottish Government in June 2009. There are eight specific transport planning objectives for the FRC which have underpinned the work on the proposals. These are to:

- maintain cross-Forth transport links for all modes to at least the level of service offered in 2006
- connect to the strategic transport network to aid optimisation of the network as a whole
- improve the reliability of journey times for all modes
- increase travel choices and improve integration across modes to encourage modal shift of people and goods
- improve accessibility and social inclusion
- minimise the impacts of maintenance on the effective operation of the transport network
- support sustainable development and economic growth

- minimise the impact on people, and the natural and cultural heritage of the Forth area.

Construction commenced in 2011 and that the FRC remains on target to open late 2016.

Dualling of A9

- Document: Environmental Statement: not yet available
- Anticipated construction completion: 2025
- Estimated emissions impact: not yet available

This programme will address issues of driver frustration on the A9 caused by the limited guaranteed overtaking opportunities that current exist, resulting in improved connections between Perth and Inverness. Options for the proposed dual carriageway are currently being developed but it is likely that it will largely comprise on-line widening due to the environmental and physical constraints in the corridor.

It is too early to say how CO_2 emissions may change as a result of the scheme. Further work will be undertaken during the design development to understand changes to vehicle speeds and their consequences for emissions before and after the scheme is in place.

Dualling of A96

- Document: Environmental Statement: not yet available
- Anticipated construction completion: 2030
- Estimated emissions impact: not yet available

This programme will address issues of driver frustration on the A96 caused by the limited guaranteed overtaking opportunities that current exist. It will also address issues of community severance by introducing bypasses to communities along the route. Both objectives will serve to improve connectivity between Inverness and Aberdeen. Baseline information and constraints mapping is currently being collated to support future option development for the proposed dual carriageway.

Given the likelihood of extended lengths of dual carriageway to provide bypasses it is likely that CO_2 emissions will increase as a result of the scheme. However further work will be undertaken during the design development to understand changes to vehicle speeds and their consequences for emissions before and after the scheme is in place.

Rail

Stirling-Alloa-Kincardine Railway Line

http://www.transportscotland.gov.uk/projects/SAK-railway-project

- Document: Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study (2002), MVA / David Simmonds Consultancy / Environmental Resources Management
- Construction completion: 2008
- Estimated emissions impact: +2ktCO_2 p.a. from 2009

In May 2008, the Stirling-Alloa-Kincardine railway line re-opened after lying unused for over 40 years. As one of the most important railway infrastructure projects in recent years, the reopening of the Stirling-Alloa-Kincardine line has delivered major social, economic and environmental benefits to the communities directly concerned and also to Scotland as a whole.

The environmental appraisal follows the guidance set out in STAG and the DMRB. Emissions have been calculated on the basis of new railway movements along the Stirling to Kincardine railway as well as changes to movements of freight (and passenger) trains on other sections of the railway network. The railway carries both high volume freight and passenger services.

Borders Railway

http://www.bordersrailway.com

- Document: Borders Railway Design Development Appraisal (2008), Transport Scotland
- Anticipated construction completion: 2015

- Estimated emissions impact: +32ktCO_2 by 2030, +2ktCO_2 by 2050 and -28ktCO_2 by 2070[28].

This project is to reinstate part of the former Waverley rail route from the Scottish Borders to Edinburgh.

The change in CO_2 emissions has been re-calculated in line with STAG guidelines. For road traffic, the calculations are based on changes to the number of car journeys between the different stations, with each journey modelled separately. The emissions from the railway have been calculated in line with the Rail Emissions Model produced by the Strategic Rail Authority.

Overall, the Borders Railway Project will have a small beneficial impact on CO_2 levels although a recent update of the analysis has downgraded the extent of the savings. The most recent assessments suggest that after an initial period of increased emissions there will be reductions in the longer term.

Edinburgh-Glasgow (Rail) Improvements Programme

http://www.transportscotland.gov.uk/strategy-and-research/strategic-transport-projects-review

- Document: Edinburgh Glasgow Improvement Programme (EGIP) Appraisal and Analysis Model (2009), Transport Scotland
- Anticipated construction completion: Phased to 2016
- Embodied carbon emissions: +126ktCO_2 from construction and rolling stock provision
- Operational emissions [29]:
    - Average annual savings of -41ktCO_2 p.a. from 2017
    - Cumulative savings of -2,395ktCO_2 by 2075.

[28] Emissions figures have been updated since 2010 publication from Carbon emissions to CO_2 emissions.

[29] To be consistent with the scope of this document, these figures (both the average annual savings and the cumulative savings) relate to emissions in the transport sector only and *exclude* increased emissions in the electricity production and distribution sector associated with electrification. However, the estimated net impact at the overall Scottish level, even including these emissions, is to lower emissions over the longer term

This intervention was identified early in the STPR and brought forward in a study which considered improvements to the capacity, frequency and journey time of rail services between Edinburgh and Glasgow.

The change in CO_2 emissions has been calculated in line with guidance from the Department for Energy and Climate Change. Previous estimates derived from the Network Modelling Framework (NMF) have been significantly revised to reflect the latest operational assumptions for the programme. There is estimated to be a reduction in road emissions of around -2ktCO_2 p.a. which is included in the overall figures presented.

The Edinburgh Glasgow Improvement Programme is expected to result in a significant reduction in emissions, through the electrification of approximately 350 km of single track and the resulting move from diesel to electric trains. The programme therefore achieves its emissions reductions reported here through transferring emissions from the non-traded sector to the traded sector, as demonstrated in the table below. If electricity emissions and those from embodied carbon are included, the total net impact of EGIP is -1,221 ktCO_2 by 2075, approximately half the level quoted above. Table 4 demonstrates the precise breakdown of the emissions impact across the different sectors.

Table 4: Change in CO_2 emissions from EGIP by sector (ktCO_2)

	Operational		Embodied**
Budget Period	**Transport sector**	**Non-transport sector***	
2008 - 2012	+25	+8	+33
2013 - 2017	-10	+97	+98
2018 - 2022	-208	+177	+0
2023 onwards	-2,203	+846	-5
UK Net	**-2,395**	**+1,048**	**+126**
* Electricity production and distribution sector ** Primarily manufacturing and construction			

Following an announcement by the Transport Minister in July 2012 the scope of the Edinburgh Glasgow Improvement Programme has been updated. The carbon emission impacts of the latest scope have yet to be modelled. The results of this

exercise will be included in next year's CAT. However, it is anticipated that the majority of the benefits shown below from the most recent analysis will remain.

Edinburgh Tram Lines 1a and 1b[30]

http://www.tiedinburgh.co.uk/

- Document: STAG part 2 appraisal (2006), Steer Davies Gleave / Colin Buchanan
- Anticipated construction completion: 2012
- Estimated emissions impact[31]: +90ktCO_2 p.a. from 2011; +167ktCO_2 p.a. from 2031.

The proposed tram lines, Phases 1a and 1b, are covered by the respective Edinburgh Tram (Lines One and Two) Acts of 2006. Both were intended to open in 2011 but contractual disputes have caused severe delays, particularly in terms of certainty for completion and operational dates. Phase 1a runs from Edinburgh Airport to Newhaven via Princes Street and will now be an incremental construction. The first stage from the Airport to St Andrews Square is currently scheduled for operations in 2014. No date has yet been set for the completion of the remaining stage(s) Phase 1b running between Haymarket and Newhaven via the Roseburn corridor has been postponed on affordability grounds.

In the project development stages, an Edinburgh based demand forecasting model was developed to predict use of the tram and the impact on other transport modes. The STAG reports that building the tram network would generate a higher level of development along the tram corridor than not building the network. The effect of this is to increase the overall volume of movements which could potentially include a higher number of car trips. The original modelling work demonstrated that both

[30] The Edinburgh Tram network is the responsibility of the City of Edinburgh Council who are both Statutory Undertaker and operator of the two proposed tram lines under the respective Edinburgh Tram (Lines One and Two) Acts of 2006.

[31] To be consistent with the scope of this document, these figures relate to emissions in the transport sector only and *exclude* increased emissions resulting from power consumption by the tram. If the CO_2 emissions resulting from power consumption by the tram are added to the additional emissions from road traffic, then the net emissions impact of the project increases by 8ktCO_2 and 11ktCO_2 p.a. in 2011 and 2031 respectively.

Phase 1a and 1a+1b would increase the level of CO_2, as a result of traffic re-routing and demand redistribution.[32],[33]

Table 5 summarises the information from the projects listed above. Whilst this may prove a useful reference table, it should be reiterated that these emissions estimates are not produced using a single, consistent methodology and, therefore, are not directly comparable.

Table 5: Emissions impact estimates of transport infrastructure projects

Project title	Published emissions estimate
M80 Stepps-Haggs	+40ktCO_2 p.a. from 2012 +40 ktCO_2 p.a. from 2025
M74 Completion	+87 ktCO_2 from 2012 +135 ktCO_2 from 2020
A75 Dunragit Bypass	+4 ktCO_2 p.a. from 2022
M74 Raith Interchange	+10 ktCO_2 p.a. from 2020
M8 Associated Network Improvements	+2 ktCO_2 p.a. by 2020
M8 Baillieston-Newhouse	+30 ktCO_2 p.a. from 2020
A90 Balmedie-Tipperty	+2 ktCO_2 p.a. from 2013
A90 Aberdeen Western Peripheral Road	+10 ktCO_2 p.a. from 2027
Forth Replacement Crossing	+20 ktCO_2 p.a. in 2032
Stirling-Alloa-Kincardine Railway Line	+2 ktCO_2 p.a. from 2009
Borders Railway	+32 ktCO_2 total savings by 2030 +2 ktCO_2 total savings by 2050 -28 ktCO_2 total savings by 2070
Edinburgh-Glasgow (Rail) Improvements Programme	-41 ktCO_2 average p.a. from 2017 -2,395 ktCO_2 total savings by 2075
Edinburgh Tram Lines 1a and 1b	+90 ktCO_2 p.a. from 2012 +167 ktCO_2 p.a. from 2031

The emission estimates within this table are forecast changes in carbon dioxide emissions with the project compared to without the project in a given future assessment year. These estimates have been calculated using a variety of methodologies and, consequently, it is not statistically valid to aggregate the individual figures or directly compare them with one another.

[32] It is worth noting that without the tram, it is possible that the developments referred to would take place elsewhere, most likely in peripheral locations with a higher proportion of car usage and longer trip lengths. These 'dis-benefits' have not been accounted for. Without the effect of the larger assumed travel market in the 'with-tram' scenario, the increases in emissions would be approximately half of those reported.

[33] All figures and analysis for the Edinburgh Trams Lines 1a and 1b refer to modelling of the original project scope and do not take account of decisions to be made through current contractual discussions.

3.3 Fiscal / regulatory measures

Methodology

The current split between devolved and reserved powers means that the majority of fiscal and regulatory measures are taken at either the UK or EU level.

The aggregate UK impact of these measures are published in Impact Assessments for individual measures and/or documents such as the annual HM Treasury (HMT) Budget and Autumn Statement/Pre-Budget reports and the Report on Proposals and Policies (RPP). For the purpose of the CAT, estimates from these sources are the most reliable available. No attempt is made to identify what proportion of the aggregate UK or European emissions impact is specifically realised in Scotland except where we have direct estimates from sources such as the RPP.

Freight Modal Shift Grants

http://www.transportscotland.gov.uk/road/policy/freight/Freight-Grants

- Document: Internal calculation from commissioned research; RPP
- Implementation date: Ongoing
- Estimated emissions impact: <0.1 $MtCO_2e$ by 2027

The Scottish Government operates 3 freight grant schemes – Freight Facilities Grant (FFG), Mode Shift Revenue Support Scheme (MSRS), and Waterborne Freight Grant (WFG). The aim of these schemes is to generate environmental benefits by encouraging the transfer of freight from road to rail or water where road is the less costly option.

The FFG scheme funds the additional capital costs of inland waterway, rail, coastal & short sea shipping freight facilities. The MSRS scheme funds the additional operating costs of inland waterway and rail freight movements. The WFG scheme, funds the additional operating costs during the start up phase of new coastal and short sea shipping services.

Removal of tolls from Forth and Tay bridges

www.scotland.gov.uk/Resource/Doc/87965/0052406.pdf

- Document: Toll Impact Study (2007), Steer Davies Gleave
- Implementation date: 2008
- Estimated emissions impact: +8KtCO_2 to +9KtCO_2 p.a. from 2008

The Toll Impact Study undertaken by Steer Davies Gleave found that the increase in greenhouse gas emissions, as a result of removing tolls from the Forth and Tay bridges, resulted from an increase in traffic travelling through, in and around Fife only partially offset by a reduction in traffic travelling through Perthshire and Kinross. This trend is a result of the change in route choice between the M90 and the A91/92 once the tolls are removed.

Freight Best Practice Scotland

http://www.transportscotland.gov.uk/road/policy/freight/best-practice

- Document: Freight Best Practice Scotland: 2008-09 (2009), AECOM
- Document: SAFED for Vans: 2009, AEA .
- Implementation date: 2008
- Estimated emissions impact: - 0.3MtCO_2 in 2008-09

In October 2008 the Scottish Government bought into the Freight Best Practice programme originally developed by the Department for Transport (DfT) with the aim of reducing carbon emissions. It has generated a range of free material to help road freight managers and drivers improve the efficiency of their operations. Guides, case studies, software and seminars are available on topics such as saving fuel, developing skills, equipment and systems, operational efficiency and performance management. Buy-in enabled Scottish hauliers to have access to the existing library of materials that DfT developed plus new material specifically targeted at Scottish themes i.e. 8 Scotland-specific case studies, 5 pocket guides, a 'lite' guide and an online safety video have been produced. Since 1 April 2011 FBP Scotland has been delivered online via a website on the Transport Scotland webpage. All of its documents are available to download electronically.

In addition to this, the Scottish Government has established a network of Safe and Fuel Efficient Driving (SAFED) van instructors to enable industry to reduce its CO_2 emissions. In 2009, 50 instructors were trained to deliver SAFED and 100 reference students from a diverse range of operators were trained in SAFED alongside this. The final report concluded that 74 tCO_2e were abated from training the 100 reference students.

Air Passenger Duty (APD)

- http://www.hmrc.gov.uk/ria/apd-reform-ia.pdf
- Documents: Pre-Budget Report (2008), HMT and HMRC Impact Assessment (2009)
- Implementation date: 1st November 2009 and 1st November 2010
- Estimated emissions impact: -0.6$MtCO_2$ in 2011-12 (UK)[34]

Air Passenger Duty (APD) is a duty of Excise which is levied on the carriage, from a UK airport, of chargeable passengers on chargeable aircraft. Following the doubling of APD rates in 2007, reform of APD has meant that since 1 November 2009 APD has been structured around four distance bands, set at intervals of 2,000 miles from London. The intention of the banding is that those flying further will pay more and is expected to deliver estimated savings of 0.4$MtCO_2$ in 2010-11 rising to 0.6 $MtCO_2$ in 2011-12. As part of a UK Government consultation on APD it will now be expanded to cover business jets.

In the 2011 Budget, APD rates were frozen for 2011-12 and an RPI increase deferred to April 2012.

Smarter Choices, Smarter Places

http://www.transportscotland.gov.uk/roads/sustainable-transport/funding-for-projects/smarter-choices-smarter-places

- Document: Strategic Environmental Assessment (2008), The Scottish Government

[34] Figure is based on the impact assessment of the 2009 APD reform.

- Implementation date: 2009
- Estimated emissions impact: -71ktCO_2 p.a. from 2009

Smarter Choices Smarter Places is a Scottish Government partnership project with COSLA. The 3 year pilot is designed to increase active travel and public transport use in 7 project locations:

- Dumfries & Galloway and SWestrans - Dumfries
- Dundee - Dundee Health Central
- East Dunbartonshire - Kirkintilloch and Lenzie (under 'Transport and Development')
- East Renfrewshire - Barrhead
- Falkirk - Larbert and Stenhousemuir
- Glasgow - East End Accessibility (supporting Commonwealth Games)
- Orkney – Kirkwall

Activities in these Local Authorities include: intensive marketing and awareness raising campaigns around travel planning, improving public transport services, and upgrades in walking and cycling infrastructures. Alongside reducing emissions, these initiatives will contribute to a number of objectives in the Scottish Government's National Performance Framework, and Local Authorities' Single Outcome Agreements. Evaluations of these schemes are expected to be pushed in 2013.

Inclusion of aviation in EU ETS

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:008:0003:01:EN:HTML

- Document: http://www.parliament.uk/briefing-papers/SN05533
- Implementation date: 2012
- Estimated emissions impact: up to - 183 MtCO_2 p.a. in 2020 across Europe

The Aviation Greenhouse Gas Emissions Trading Scheme Regulations 2010 came into force in the UK on 31 August 2010. The inclusion of aviation within the

emissions trading system will allow the sector to take responsibility for its carbon emissions in the most cost effective way and will form the basis for wider, global action. While it is difficult to predict the exact impact of the scheme, particularly with the ongoing economic uncertainties, earlier estimates made by the Commission suggest that the cap could reduce emissions in 2020 by up to 183 million tonnes CO_2.

Sustainable transport measures

http://www.transportscotland.gov.uk/roads/sustainable-transport

- Document: N/A
- Implementation date: Ongoing
- Estimated emissions impact: Not quantified

The Scottish Government is committed to reducing emissions from the transport sector and, as well as the specific Smarter Choices, Smarter Places programme, funding is given to public transport provision and promoting more sustainable travel and transport means. These sustainable transport policies include: fuel efficient driving; work with organisations and businesses to encourage low carbon transport choices through travel-planning and fleet management; encouraging use of cleaner vehicles and alternative fuels where these are sustainable; increasing cycling through the Cycling Action Plan for Scotland (CAPS) and completion of the National Cycle Network. Policy delivery initiatives are subject to monitoring to assess impacts and opportunities for further development.

New car CO_2 regulation

http://register.consilium.europa.eu/pdf/en/08/st03/st03741.en08.pdf

- Document: Low Carbon Transport: A Greener Future. DfT, 2009; RPP
- Implementation date: Ongoing
- Estimated emissions impact: -1.0 $MtCO_2$ p.a. in 2022 in Scotland[35]

On 6 April 2009 the EU adopted a regulation setting mandatory CO_2 reduction targets for manufacturers registering vehicles in the EU. It sets an EU average

[35] Estimate of impact reported in RPP

emissions target of 130gCO_2/km by 2015 and a longer-term target of 95gCO_2/km by 2020. This represents a reduction in average new car CO_2 emissions of around 40% on 2007 levels. In late 2010, the EU added regulations on van emissions. The main objective of the vans regulation is to cut CO_2 emissions from vans to 175 grams of CO_2 per kilometre by 2017, phasing in the reduction from 2014, and to reach 147g CO_2/km by 2020. These cuts represent reductions of 14% and 28% respectively compared with the 2007 EU average of 203 g/km.

Fuel duty

http://www.hmrc.gov.uk/budget-updates/march2011/fuel-duty.pdf

Document: Budget Report (2011), HMT

- Implementation date: 23 March 2011 and 1 January 2012
- Estimated emissions impact: +0.4MtCO_2 in 2011 -12.

To support fiscal consolidation and encourage fuel efficient behaviour Budget 2009 announced that fuel duty would increase by one pence per litre in real terms on 1 April each year from 2010 to 2013. Budget 2010 announced that the 2010-11 increase would be staged and that fuel duty will increase by a further penny per litre in real terms in April 2014. These measures were estimated to save 2MtCO_2 per year by 2014-15 compared to inflation only increases.

Due to high oil prices, Budget 2011 cut the fuel duty by 1p per litre and deferred the scheduled 2011 inflation-only increase until 1 January 2012. The fuel duty escalator was replaced by a fair fuel stabiliser. These changes were forecast by HMRC to generate a small increase in emissions of 0.4MtCO_2 in 2011-12

Bio-fuels and the Renewable Transport Fuels Obligation

Impact Assessment: Biofuels and RTFO

- Documents: Pre-Budget Report (2009), HMT; DfT Impact Assessment; RPP
- Implementation date: Ongoing
  Estimated emissions impact: -0.6 MtCO_2e in 2022 (Scotland)

The Renewable Transport Fuels Obligation (RTFO) sets targets for increasing the use of renewable fuels in UK road transport with the aim of reducing carbon emissions. It commenced in April 2008 and places an obligation on fuel suppliers to ensure that a certain percentage of their aggregate sales are made up of bio-fuels. Based on advice from the King Review[36] and Gallagher Review[37], the UK's bio-fuels target for 2009-10 was 3.25% rising to 3.5% in 2010-11[38]. The UK met its 2009-10 target with 3.33% of the UK's total road transport fuel supply being bio-fuels. This has equated to a 2MtCO_2e saving compared to the equivalent fossil fuels. In the twelve months of the 2010/11 obligation period, 1,440 million litres of bio-fuel have been supplied, which is approximately 3.1% of total road transport fuel reported to the RTFO Administrator against an annual target of 3.5%.

The Renewable Energy Directive (RED) requires the UK to source 15% of its overall energy and 10% of energy used in transport from renewable sources by 2020. The majority of the transport target is expected to be met through the use of bio-fuel. The RED introduces a number of sustainability criteria which bio-fuel must meet in order to be counted towards meeting the 10% target.

The Fuel Quality Directive introduces the requirement for transport fuel / energy suppliers to reduce the lifecycle greenhouse gas emissions of the fuel / energy supply by 6% per unity of energy by 2020. Department for Transport analysis suggested the required reduction would come largely from increased supply of bio-fuel although there are concerns to be addressed in the implementation of the directive.

Reform to vehicle excise duty

http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm;
http://www.hmrc.gov.uk/ria/reforms-vehicle.pdf

- Document: Pre-Budget Report (2009), HMT; HMRC Impact Assessment

[36] The King Review of low carbon cars (2007), King, J.
[37] The Gallagher Review of the indirect effects of biofuels production (2008), Renewable Fuels Agency
[38] Budget 2008 announced that from April 2010, the biofuels duty differential will cease and support for biofuels will be provided by the RTFO. The exception to this is biofuels made form used cooking oil. Pre-Budget Report 2009 stated that a 20 pence per litre duty differential will continue on this until 2012.

- Anticipated implementation date: 2010
- Estimated emissions impact: -0.9 $MtCO_2$ by 2020

From April 2010, the Government introduced a new first-year rate of VED. Under this system, all cars emitting up to 130 g CO_2 per km pay no VED in the first year. Cars emitting over 165 g CO_2 per km pay additional VED in the first year. First year rates are used to encourage the purchase of more fuel-efficient cars. Together, these changes are estimated to result in a cumulative UK saving of 0.9 $MtCO_2$ by 2020. However, this assessment only includes impacts in the new car market, and these figures will contribute to the delivery of the savings from the EU regulation on CO_2 from cars, rather than constitute additional savings. Budget 2011 announced that VED rates would increase by RPI indexation in 2011-12 with rates for HGVs frozen over the period.

Company car tax

http://cdn.hm-treasury.gov.uk/budget2012_complete.pdf

- Document: Pre-Budget Report (2009), Budget 2012 HMT
- Anticipated implementation date: Ongoing
- Estimated emissions impact: Not quantified

The Government in its June 2010 budget set out further reform of company car tax to provide an incentive to purchase the lowest emitting vehicles on the market. This has been reinforced in recent budgets.

From April 2011, the basic threshold for the 15 per cent band of company car tax will be reduced by 5 grams of carbon dioxide emitted per kilometre (g CO_2 per km), so that this band applies to cars emitting between 121 and 129g CO_2 per km.

Budget 2012 announced that the appropriate percentage of list price subject to tax will increase by one percentage point for cars emitting more than 75 grams/kilometre of carbon dioxide, to a maximum of 35 per cent in 2014–15, and by two percentage points, to a maximum of 37 per cent in both 2015–16 and 2016–17. From April 2015, the five-year exemption for zero carbon and ultra low carbon emission vehicles will

come to an end as legislated in Finance Act 2010. The appropriate percentage for zero emission and low carbon vehicles will be 13 per cent from April 2015 and will increase by two percentage points in 2016–17.

From April 2016, the Government will remove the three percentage point diesel supplement differential so that diesel cars will be subject to the same level of tax as petrol cars.

Fuel benefit charge (FBC)

http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/budget2010_documents.htm

- Document: Pre-Budget Report (2009), HMT
- Anticipated implementation date: 2010
- Estimated emissions impact: Not quantified

The provision of free fuel to company car drivers provides a perverse environmental incentive. The Government is committed to increasing the fuel benefit charge multiplier – which is used to calculate the tax payable on free fuel – at least in line with inflation each year. The Pre-Budget Report 2009 set out that from 6 April 2010, the multiplier would increase from £16,900 to £18,000. The van fuel benefit charge – on which tax on free van fuel is payable – will also increase from £500 to £550. Budget 2011 announced that the fuel benefit charge multiplier for cars would increase by indexation to £18,800 in 2011.

Budget 2012 introduced a further rise from £18,800 to £20,200, and it will increase by 2 per cent above the RPI in 2013-14. The Government also committed to pre-announcing the FBC multiplier one year in advance. The van FBC multiplier will be frozen at £550 in 2012 but will increase by the RPI in 2013–14.

Low Carbon Vehicles

http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/budget2010_documents.htm

- Document: Pre-Budget Report (2009), HMT; RPP;

- Anticipated implementation date: 2010-11
- Estimated emissions impact: 0.4MtCO_2e by 2022

http://www.transportscotland.gov.uk/roads/sustainable-transport/Alternative-Fuels

http://www.transportscotland.gov.uk/public-transport/Buses/Bus-Fund

- Document: Budget 2010, HMT
- Anticipated implementation date: 2011 onwards
- Estimated emissions impact: Not quantified[39]

Transport Scotland is one of eight consortia involved in the UK Government's £30m Plugged in Places scheme, which supports the installation of charging infrastructure for electric vehicles. This activity will result in the installation of approximately 375 charging points across Scotland and will provide a network of points within Scotland and linked to the North East of England and Northern Ireland.

Over the past 2 years, Transport Scotland has invested over £8m in electric vehicles and infrastructure for the public sector in Scotland. A £4.2m Electric Vehicle Procurement Support Scheme for the public sector in 2011/12 was announced on 24th October 2011.

This extra funding will allow local authorities and their community planning partners to bridge the gap between the cost of petrol or diesel powered vehicles and their electric powered equivalents, and help drive down air-polluting emissions. Funding can also be used to install charging points on public sector owned land to support the vehicles. We estimate this funding will allow some 120 vehicles to be purchased and around 160 charging points installed in 2011/12. This work will pave the way for the future uptake of more electric vehicles amongst the general public.

This builds on work carried out as a direct result of £4.3m funding in 2010/11 which has enabled Scotland's public services to purchase 145 low carbon vehicles, including cars, vans and street sweepers, and install 74 charging points across the country.

[39] A primary outcome of this intervention will be to facilitate the savings attributed to the 'New car CO_2 Regulation'.

In addition, Ministers have announced further investment to support low carbon vehicles from the Future Transport Fund (alongside support active travel and investment in lower-emission hybrid buses). LCV policy will receive £7.75m over this Spending Review period.

Vehicles with zero tailpipe emissions are already exempt from VED. Budget 2009 announced that, from April 2010, electric cars and vans would also be exempt from company car tax and van benefit charge for five years. This will support the purchase of electric cars and vans by employers.

Since 2002, electric cars have been eligible for a 100 per cent first-year allowance, in order to provide businesses with an incentive to buy cars with lower CO_2 emissions. The Pre-Budget Report 2009 announced that a 100 per cent first-year allowance will also be provided for the purchase of electric vans, from April 2010, subject to confirming compatibility with state aid rules. This will help to catalyse the market for electric vans, as manufacturers continue to develop electric vehicle technology.

The UK Government has committed over £450 million to support the manufacture and uptake of ultra-low carbon vehicles. For example, the Plug-In Car Grant has provided up to £5,000 off the price of eligible cars from January 2011. The UK Government announced on 21 February 2012 a new Plug-in Van Grant, which will support van buyers who will be able to receive 20% – up to £8,000 – off the cost of the first wave of 7 plug-in vans.

In November 2010, Transport Scotland announced that 48 new low carbon vehicles will join the Scottish bus fleet as a result of £4.4m in grant funding awarded to six bus operators across Scotland. These operators will also benefit from the Low Carbon Vehicles (LCV) incentive within the Bus Service Operators Grant (BSOG) scheme, which pays out at twice the conventional rate for LCVs. Round 2 (2011/12) of the Scottish Green Bus Fund, with a fixed budget of £2m, has just closed and will result in more new low carbon buses joining the Scottish bus fleet by March 2013.

Table 6 summarises the previous information. As with Table 5, these emissions are not produced using a single, consistent methodology and, therefore, are not directly comparable.

Table 6: Emissions impact estimates of fiscal / regulatory measures

Project title	Published emissions estimate
Freight Facilities Grants	-<0.1 $MtCO_2$ in 2027
Removal of tolls from Forth and Tay bridges	+<0.01$MtCO_2$ from 2008
Freight Best Practice	-0.3 $MtCO_2$ in 2027
Air passenger duty	-0.6$MtCO_2$ in 2011-12 (UK)
Smarter Choices, Smarter Places	-<0.1$MtCO_2$ p.a. from 2009
Inclusion of aviation in EU ETS	-183$MtCO_2$ p.a. in 2020 (Europe)
Sustainable transport measures	Not quantified
New Car CO_2 Regulation	-0.6 $MtCO_2$ p.a. in 2022 (Scotland)
Fuel Duty	+0.4 $MtCO_2$ p.a. by 2011-12 (UK)
Biofuels and the Renewable Transport Fuels Obligation	-0.6 $MtCO_2$ p.a. in 2022 (Scotland)
Reform to vehicle excise duty[40]	-0.9 $MtCO_2$ total savings by 2020 (UK)
Company car tax[20]	Not quantified
Fuel benefit charge	Not quantified
Ultra-low carbon vehicles in the UK	-0.4 $MtCO_2$ p.a. in 2022 (Scotland)

The emission estimates within this table are forecast increases in carbon dioxide emissions with the policy compared to without the policy in a given future assessment year. These estimates have been calculated using a variety of methodologies and, consequently, it is not statistically valid to aggregate the individual figures or directly compare them with one another.

3.4 Net impact of all Scottish measures

The Carbon Account for Transport collates information from a variety of sources, one of the key ones being the findings from the application of the Scottish Transport Appraisal Guidance (STAG) to transport projects. Two key concepts in STAG are:

[40] The impacts from both VED and company car tax contribute to the delivery of the savings from the EU regulation on CO_2 from cars, as opposed to representing additional savings.

- It should be applied proportionately but comprehensively. The whole process should be used and the level of detail required will be determined by the scale of the impacts of the transport issue being addressed.

- It does not prioritise between options. Instead, it is an aid to decision makers to allow them to make informed choices. STAG may provide an initial rationale for investment and it is important that the STAG outcomes are revisited as the Business Case for an intervention develops.

As such, a study undertaken using STAG is not required to provide an absolute prediction of all of the outcomes of an intervention. Instead, it provides sufficient information to understand the relative impacts between different options. With such flexibility it is not, therefore, a key concept of STAG to be able to compare the outcomes of different STAG studies and as such the results in Table 5 cannot simply be summed to produce an aggregate outcome.

While this analysis improves one of the key purposes of the CAT - to improve transparency - something further is needed to monitor progress towards the NTS strategic outcome of reduced transport emissions. In 2010 a single model run of the Land-Use and Transport Integration in Scotland (LATIS) service was commissioned to estimate the net impact of all measures within the CAT that fall under the competence of the Scottish Government or other Scottish public body[41]. LATIS includes a strategic transport and land-use model covering all of Scotland and all motorised modes of transport. The use of LATIS to assess the carbon impacts of Scottish transport schemes ensures consistency and takes full account of the potential displacement of developments between one area and another. The modelling of this set of measures allows a greater understanding of the full impact that Scottish interventions are having, or are expected to have, on underlying emissions from transport. The model run is not a complete assessment of the likely impact as it does not include the impact of those measures taken at a reserved level, for example changes to fuel duty. The full emissions output of this model simulation is demonstrated in Table 7, with the long-run impact estimated at just over 70ktCO_2

[41] Including those measures whose expected emissions impacts has not been quantified on an individual basis, e.g. Freight Facilities Grant.

p.a. by 2022 (around a 0.4% growth in annual transport emissions relative to where they would otherwise have been).

With a number of new transport infrastructure projects recently receiving the go ahead it is our intention to undertake an updated run of LATIS at a point in the near future to generate a revised set of net emissions impacts. The results of this work will be included in a future CAT.

Table 7: Net impact of all Scottish measures[42]

Year	Annual abatement ($ktCO_2e$)
2012	+82
2017	+66
2022	+71

This estimated increase in emissions is largely driven by a net increase in vehicle kilometres, which are anticipated to increase by 1.2% above a business as usual scenario in 2022 as a result of Scottish transport interventions. However, the relatively small net increase in both vehicle kilometres and emissions at a national level masks some more significant regional differences. Specifically, vehicle kilometres in Strathclyde and Aberdeen are predicted to increase the most, predominantly due to the large infrastructure projects that are located within these areas, whilst those in the South West and Perthshire are expected to decrease by the greatest amounts. This demonstrates the importance of fully assessing wider geographic interactions and impacts, including on the population, labour market and economy, when modelling any specific transport intervention.

[42] The reduction in emissions within the non-traded sector that are a result of EGIP have been added to the modelled output, as these benefits sit outside the scope of the modelling framework.

Chapter 4: Summary

The Scottish Government is committed to tackling climate change, and has put in place a framework to deliver greenhouse gas emission reductions of 42% by 2020 and 80% by 2050 (compared to a 1990 baseline).

Transport has a significant role to play in meeting these targets and a wide range of work is underway to slow the increase in transport emissions and, ultimately, to reduce transport's climate change impact. Investments in public transport infrastructure and service delivery, initiatives to encourage active travel, improving the efficiency of freight movements and the use of low carbon vehicles are all decisions being taken at the devolved level with the clear intention of reducing transport emissions. Furthermore, there is strong support from the Scottish Government for those wider measures such as the new car CO_2 regulation, the RTFO and the inclusion of aviation in the EU ETS. Together, all of these will make a long lasting and permanent reduction in Scotland's transport emissions.

Section 2 of the CAT set out the latest outturn emissions data available. It demonstrated that whilst transport continued to make up a quarter of Scotland's total emissions, transport emissions fell for a third year.

Section 2 also demonstrates that a range of key indicators that can be used to monitor public transport use, use of alternatively fuelled vehicles and fuel efficiency in transport are indicating encouraging movements towards more fuel efficient, less emitting transport behaviours.

Section 3 of the CAT explains the likely future impact from the infrastructure projects underway. While the emissions impacts from these projects are not measured on a like for like basis, and consequently cannot be compared against each other, it is clear that some interventions are expected to increase future emissions albeit by relatively small amounts. The STAG process is though about more than emissions so may show that an infrastructure improvement is, on balance, the best way to

achieve the overall Government Purpose. That said, it is still important to quantify and to minimise the emissions impacts of each project.

Section 3 of the CAT sets also out the range of fiscal and regulatory measures, predominantly reserved, that have been committed to usually via the EU or UK Budget process. The intention behind these measures generally is to encourage shifts in travel behaviour towards more fuel efficient options through charging more for inefficient practices or offering reduced rates on efficient transport choices.

Moving forward, Transport Scotland has developed a Climate Change Action Plan for the organisation and is currently exploring a carbon management system (CMS), which will help measure the carbon associated with TS operations and drive continuous improvement. Over time, the application of a CMS to projects should yield better information about the whole life embedded impacts of transport infrastructure projects. It is possible that these lifecycle emissions could eventually be incorporated into the CAT.

The purpose of the CAT is to bring greater transparency to Scotland's transport emissions and, therefore, greater accountability in transport policy. This will mean promoting those measures which reduce emissions, as well as minimising the impact of policies and projects which increase emissions. Whilst the underlying factors set out in Chapter 2 will continue to have a major influence on overall transport emissions, the CAT will continue to report the marginal impact that projects and policies are likely to have upon overall emissions.

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Further copies of this document are available, on request, in audio and large print formats and in community languages (Urdu; Bengali; Gaelic; Hindi; Punjabi; Cantonese; Arabic; Polish).

اس دستاویز کی مزید کاپیاں آڈیو کیسیٹ پر اور بڑے حروف کی چھپائی میں اور کمیونٹی کی زبانوں میں طلب کیے جانے پر دستیاب ہیں، برائے مہربانی اس پتہ پر رابطہ کریں:

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