CARBON ACCOUNT FOR TRANSPORT

No. 3: 2011/12 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 recently updated Government Economic Strategy[1] re-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 Act, the next batch of annual targets covering the period 2023-27 were agreed in October 2011[6].

[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

Meeting these ambitious targets will be challenging, and all sectors will need to play their part. Tackling emissions from transport will require a combination of both reserved and devolved policies to make the necessary difference.

1.2 Purpose of the Carbon Account for Transport

The National Transport Strategy (NTS)[7] published in 2006 and endorsed by Scottish Ministers, outlined 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 up to 2009;
- The efficiency of passenger vehicles;
- Key transport indicators;
- Emissions impacts of Scottish transport infrastructure projects; and
- Emissions impacts 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 an individual project or policy level. Nor is it intended to offer rejection to projects or policies that have a negative impact on emissions. 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 the emissions impact of 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.

Showing the level of greenhouse gas emissions of the Scottish transport sector over time, measured in carbon dioxide equivalents (CO_2e), the CAT helps explain which transport policies and projects are forecast to have the most significant influence on emission levels. These interventions are split between those that are infrastructure projects and those that are fiscal policies or regulatory measures.

To avoid misrepresentation of the data, the CAT does not attempt to aggregate the impacts of these individual measures or to compare them to a business as usual baseline. The comparison, addition or netting off of emissions estimates between interventions or against a baseline may lead to incorrect conclusions being drawn. 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 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: Background 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: 1990-2009'[9] (GHGI) unless stated otherwise. 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 are not. 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 publication. 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 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: 1990-2009 (2011), AEA Technology; http://www.naei.org.uk/reports.php

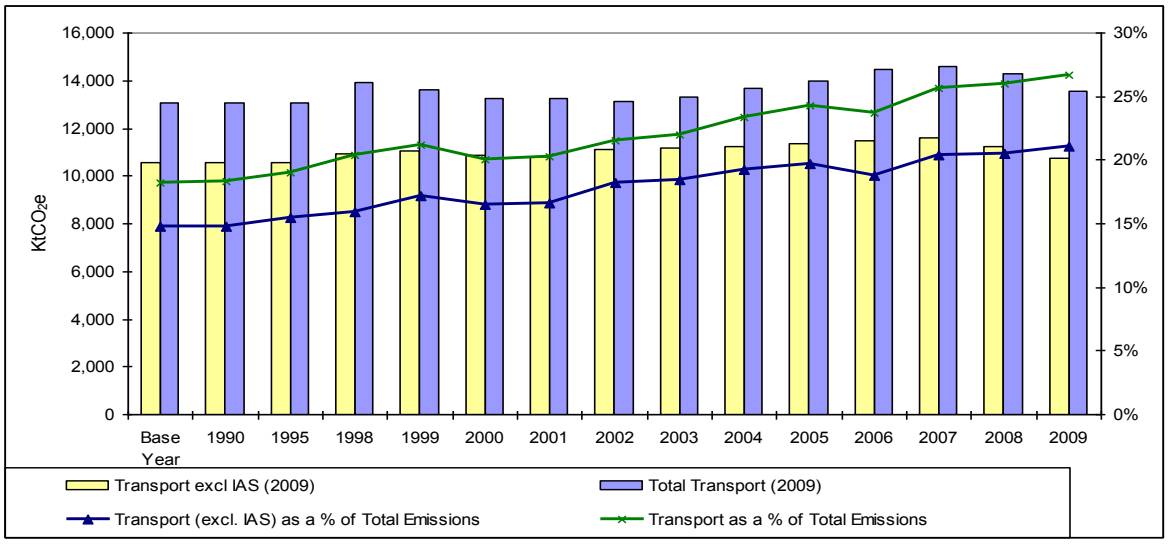
[10] While not relevant to the transport sector, the full inventory includes the three other greenhouse gases - Hydrofluorocarbons (HFCs) Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).

2.2 Historic Emissions Trends

Transport in Scotland produced 13.6 mega-tonnes of carbon dioxide equivalent ($MtCO_2e$) emissions in 2009. This total represents a 0.7 $MtCO_2e$ or 4.8% fall from the equivalent 2008 figure, and the second consecutive year of annual reduction in transport emissions. 2009 emissions are though still some 3.7% above the 1990 base year emissions total of 13.1 $MtCO_2e$. The global recession has clearly played a significant part in the recent reduction in reported 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 and culture and lifestyles.

The recession has also affected emissions from all other sectors. The falls seen elsewhere have, in proportionate terms, been greater than in transport so the percentage of Scottish emissions accounted for by the transport sector increased between 2008 and 2009. This continues the trend of transport contributing an increasing proportion of annual Scottish emissions: the sector now accounts for over 21% of total emissions if International Aviation and Shipping (IAS) emissions are excluded, and just below 26% with the inclusion of IAS emissions.

Figure 1: Total emissions from transport and transport emissions as a percentage of total Scottish emissions, 1990-2009



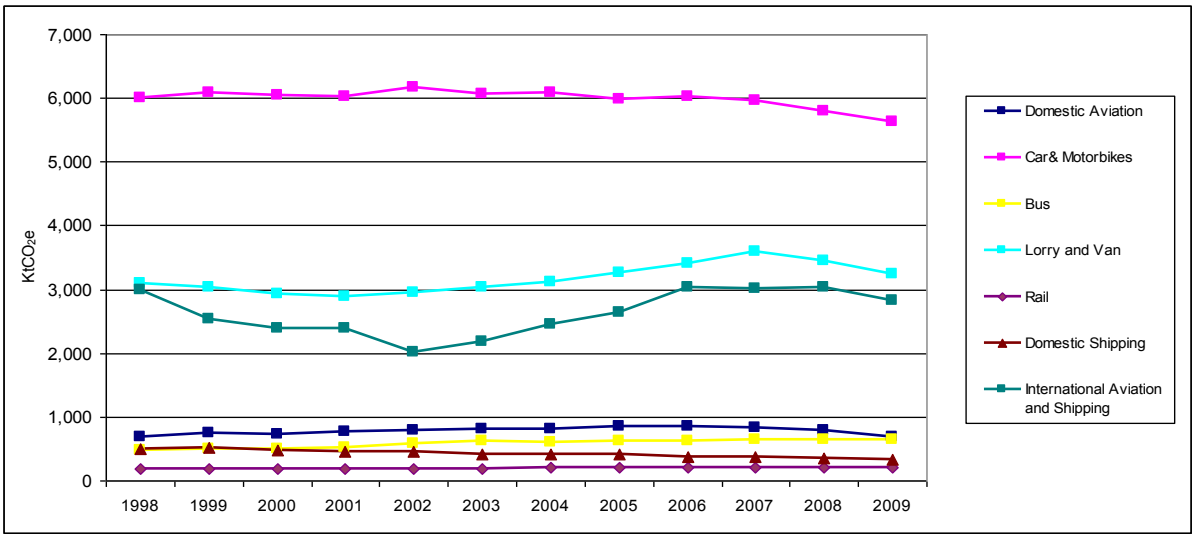
Source: Greenhouse Gas Inventory, NAEI, 2011, Transport Scotland. Total emissions exclude the impact of the EU Emissions Trading System

Emissions by mode

With the exception of a marginal increase in rail emissions, all broad modes of transport saw emissions reductions between 2008 and 2009:

- Emissions from cars and motorbikes fell by 0.15 $MtCO_2e$;
- Emissions from lorries and vans fell by 0.22 $MtCO_2e$;
- Emissions from IAS fell by 0.20 $MtCO_2e$; and
- The other sectors combined provided the remaining 0.11 $MtCO_2e$ of emissions reductions.

Figure 2: Transport emissions 1990-2009 broken down by broad transport sector



2.3 Analysis by transport sector

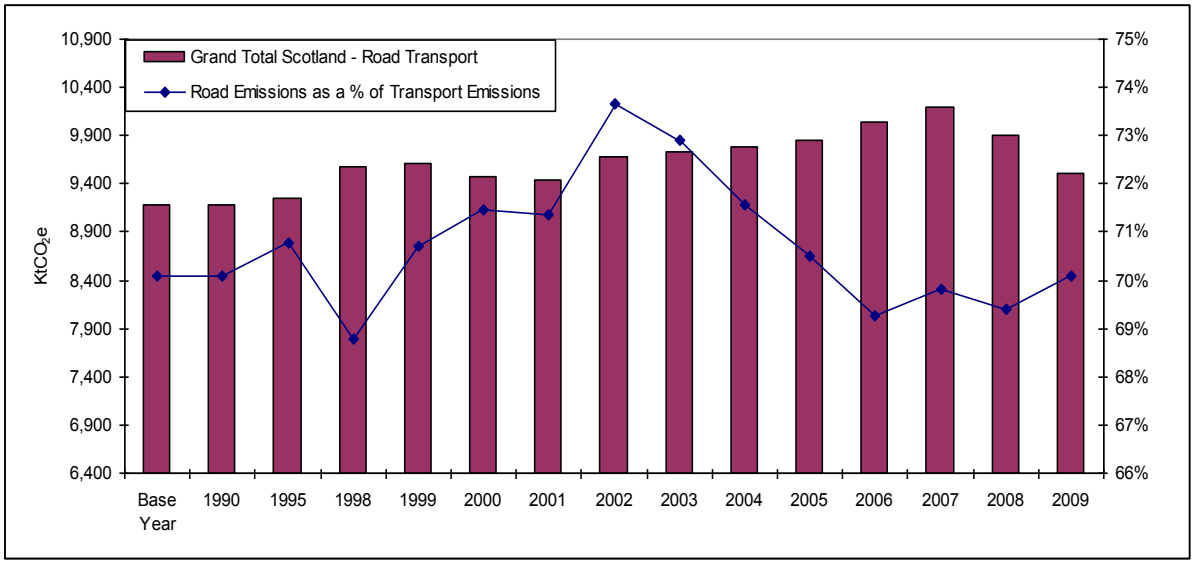
Road transport

Road transport emissions cover emissions from all private, public and commercial road vehicles. Together, this category accounts for around 70% of all transport's emissions, with cars alone accounting for 60% of road transport emissions.

Emissions from road transport fell by just under 4% between 2008 and 2009, from 9.9 $MtCO_2e$ to 9.5 $MtCO_2e$. They are now more than 6% below their 2007 emissions peak of 10.2 $MtCO_2e$. Overall, road emissions in 2009 were just over 3% higher

than their equivalent 1990 figure. Road emissions as a percentage of total transport emissions rose slightly in 2009. Within the road transport sector HGV emissions fell at a rate greater than the overall rate of reduction in road emissions (falling by 9%) while car and LGV emissions, the two other significant components of road transport emissions, each fell by between 2% and 3%.

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



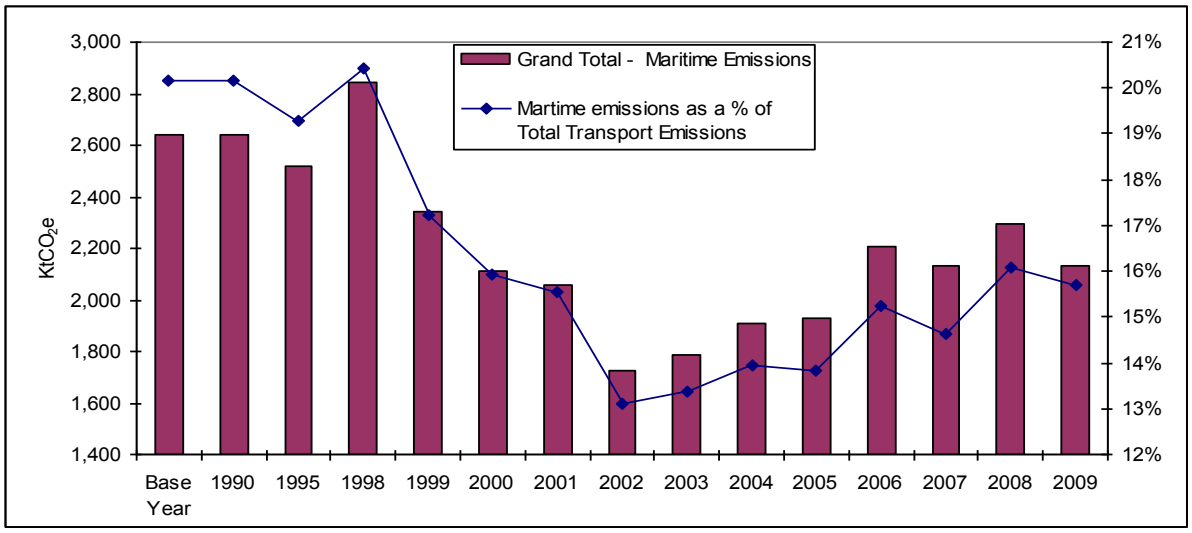
Further analysis of road transport emissions is undertaken in section 2.4.

Maritime transport

Maritime emissions[11] in 2009 are estimated to be 2.1 $MtCO_2e$, just less than 16% of total transport emissions in that year. 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 40% to 1.7 $MtCO_2e$ before rising again by over 30% to 2.3 $MtCO_2e$ by 2008. International shipping emissions fell by over 7% between 2008 and 2009 which, when coupled with smaller falls in emissions from the other components of maritime transport, lead to an overall fall in maritime emissions of 7%.

[11] Includes national navigation and international shipping

Figure 4: Maritime emissions 1990-2009 and as a share of transport emissions

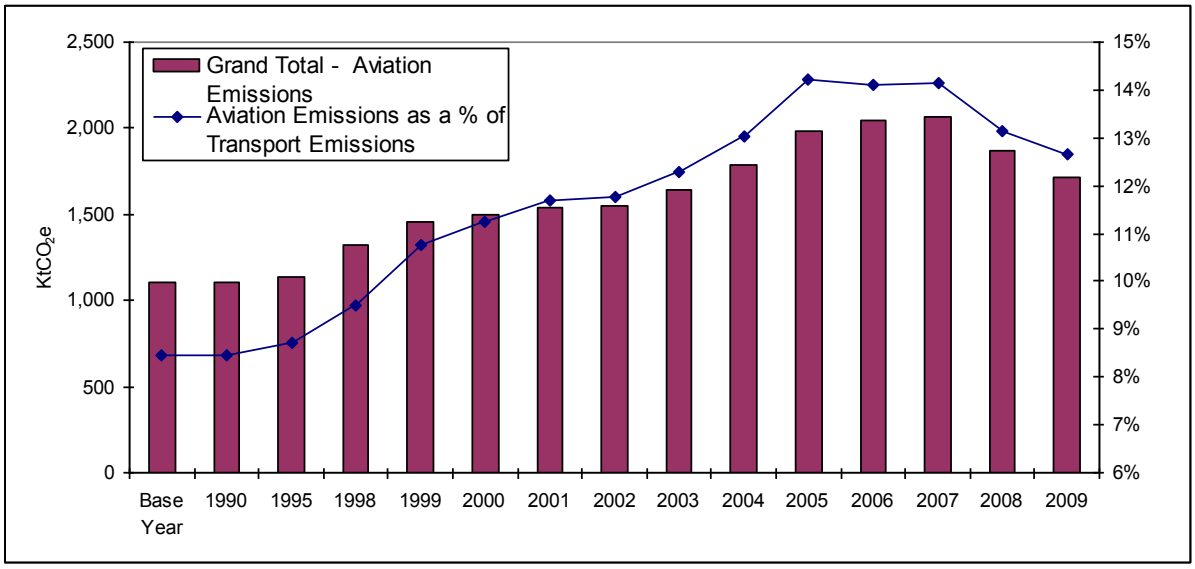


Aviation

Aviation emissions in 2009 are estimated to be 1.7 $MtCO_2e$ and account for just under 13% of total transport emissions. At their peak in 2007 emissions from this category accounted for over 14% of all transport emissions. International aviation emissions make up the majority of this category's emissions (60%).

Overall aviation emissions fell by over 8% between 2008 and 2009 but remain some 0.6 $MtCO_2e$ above their 1990 figure, driven almost exclusively by an increase in international emissions over the period. The reduction in recorded aviation emissions between 2008 and 2009 has been driven by large falls in the domestic and military aviation emissions (12% cruise, 13% take off and landing, 14% military) while international emissions have fallen by 5% over the same period.

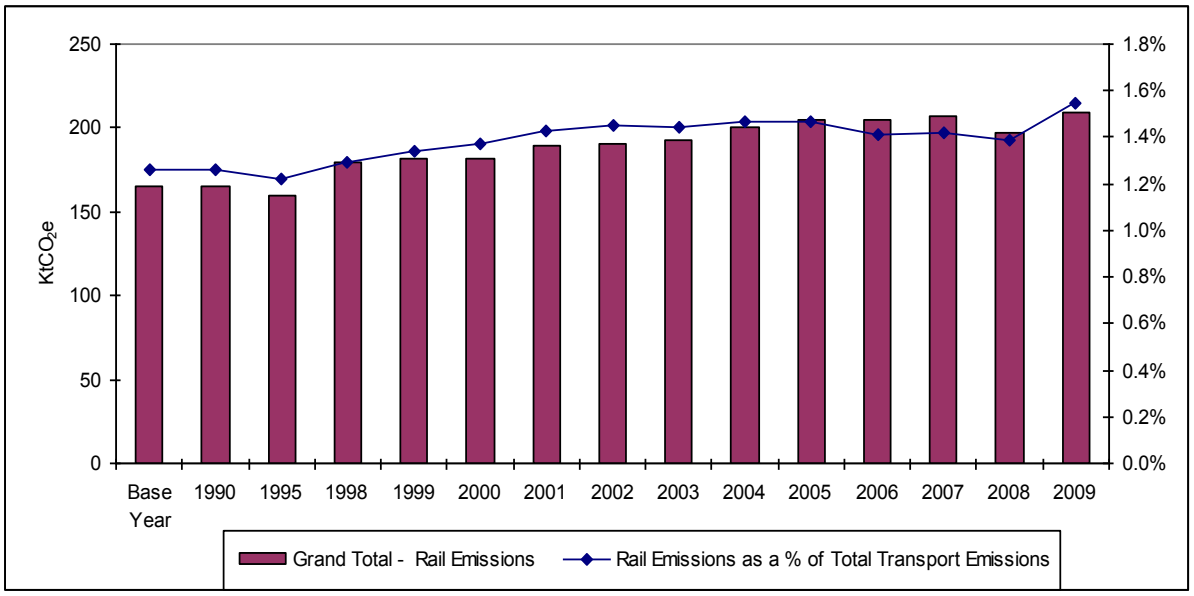
Figure 5: Aviation emissions 1990-2009 and as a share of total transport emissions



Rail

Rail emissions rose by 6% between 2008 and 2009 and the 2009 emissions total of 0.2 $MtCO_2e$ is 27% 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 1990-2009 and as a share of total transport emissions



2.4 Road Emissions by vehicle type

Cars: At 5.6 $MtCO_2e$ in 2009, emissions from cars account for both the greatest proportion of road emissions as well as all transport emissions; 60% and 41% respectively. Emissions from cars have fallen slowly from a peak of 6.2 $MtCO_2e$ in 2002 to their current level so that they are now 9% below that peak figure and also 0.2 $MtCO_2e$ below their 1990 level.

HGVs: Emissions from HGVs make up the second largest proportion of road emissions. HGV emissions in 2009 were just under 1.9 $MtCO_2e$, a 9% reduction on the 2008 figure of 2.1 $MtCO_2e$. After a run of six years of continuous years of emissions growth between 2002 and 2007 falls in both 2008 and 2009 mean emissions from this vehicle type are at their lowest annual level since 2004, and are now below the 1990 base year level of 2.1 $MtCO_2e$.

LGVs: LGV emissions fell by 2.6% between 2008 and 2009 from 1.4 $MtCO_2e$ to 1.3 $MtCO_2e$. Emissions have now fallen for the last two years having risen steadily between 2001 and 2007. Despite this fall, the latest emissions figure for LGVs is 70% above the base year total of just under 0.8 $MtCO_2e$.

Buses and motorcycles: Emissions from buses fell marginally between 2008 and 2009 (<0.01 $MtCO_2e$) and remain just over 0.6 $MtCO_2e$, while motorcycle emissions remain stable at just under 0.05 $MtCO_2e$.

Figure 8 shows the year on year percentage change in the three largest road emitting categories. All three categories have seen recent reductions in emissions and, in the case of commercial vehicles this has reversed a trend of increasing emissions in at least the preceding six years. The sharp reversal in trend is undoubtedly in part a consequence of the economic recession.

Figure 7: Breakdown of Road Emissions by Vehicle Type 1990-2009

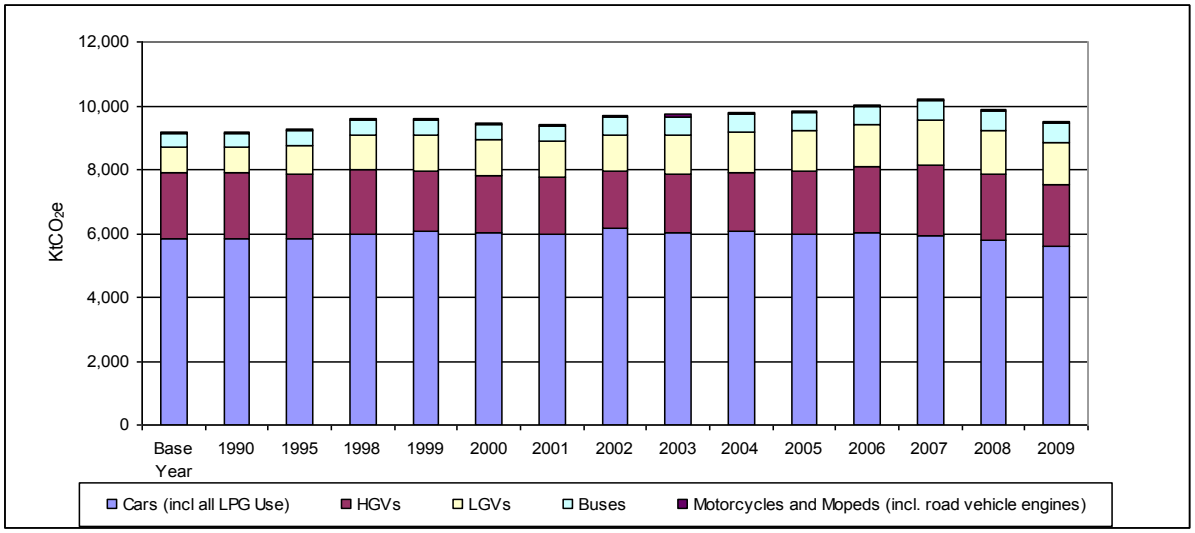
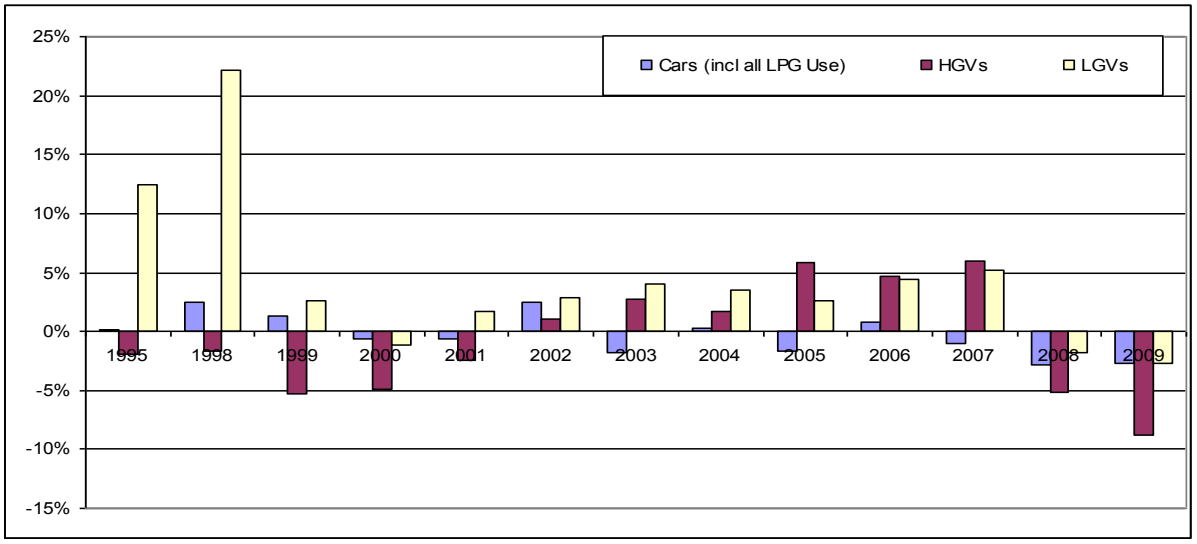


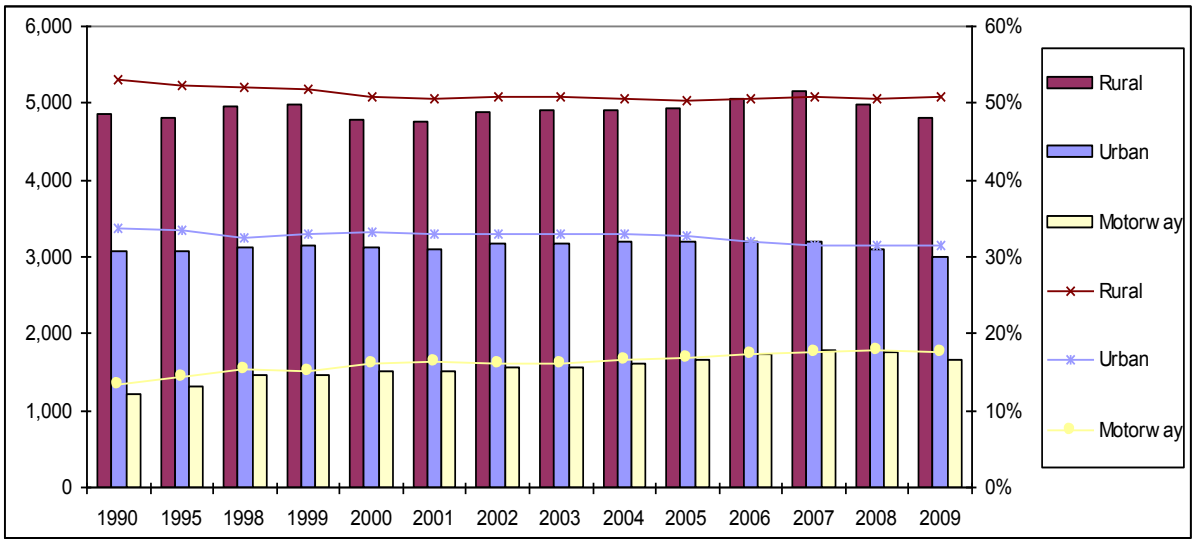
Figure 8: Year on year change in car, HGV and LGV emissions 1995-2009



Emissions by road type

The GHGI database also differentiates road transport emissions across three road types: rural, urban and motorway. Just over half of Scottish road emissions arose from rural driving in 2009, a small reduction in percentage terms from the position in 1990. Urban emissions have remained at or just under one third of emissions and it is only emissions from motorway driving that have shown any real change over the period. Emissions from motorway driving in 2009 are some 38% higher than in 1990. All three categories registered slight falls in emissions between 2008 and 2009.

Figure 9: Breakdown of road emissions by road type 1990-2009



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

Table 1: Comparison of Scottish and UK GHG emissions

	Scottish Emissions 2009	Scottish Emissions 2009 as a % of UK emissions	Change in Scottish Emissions (2008-9)	Change in UK Emissions (2008-9)	Change in Scottish Emissions (1990-2009)	Change in UK Emissions (1990-2009)
All Transport	13,577	8.2%	-4.8%	-4.4%	3.7%	12.8%
All Transport (excl.IAS)	10,742	8.8%	-4.3%	-4.2%	1.7%	0.0%
Road Transport	9,515	8.4%	-3.8%	-4.0%	3.7%	2.2%
of which:						
Cars	5,620	8.0%	-2.8%	-2.8%	-3.3%	-3.0%
HGVs	1,896	9.1%	-8.7%	-9.1%	-9.1%	-12.8%
LGVs	1,342	8.8%	-2.6%	-3.2%	69.1%	61.8%
Buses	610	11.5%	-0.4%	-1.1%	41.2%	38.8%
Motorcycles	47	7.4%	1.6%	1.6%	-8.4%	1.7%
Rural	4,801	10.7%	-3.6%	-4.4%	-1.0%	0.4%
Urban	2,991	7.0%	-3.7%	-3.3%	-2.9%	-5.2%
Motorway	1,673	6.6%	-4.6%	-4.5%	37.6%	19.8%
Rail	210	9.6%	6.1%	1.8%	27.2%	4.9%
Aviation	1,719	4.7%	-8.2%	-5.2%	55.0%	75.1%
Maritime	2,132	16.6%	-7.1%	-6.8%	-19.3%	4.7%

Scottish transport emissions including IAS currently account for 8.2% 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 while the aviation (4.7%) and maritime (16.6%) sectors show the greatest variation from the equivalent UK figure.

Within the category of road transport it is only for buses and motorcycles, the smallest sub-categories in respect of emissions, where the Scottish share of emissions varies significantly from the overall percentage. Historically, all sub categories of Scottish road transport emissions have move in line with the equivalent UK level series. By road type, there are proportionally more emissions derived from rural roads in Scotland and proportionally fewer from both urban roads and motorways.

It is the difference in size and change in emissions from the aviation and maritime sectors that have driven the change in overall transport emission performance between Scotland and the UK, particularly in respect of the changes seen between 1990 and 2009. Excluding IAS UK emissions in 2009 are at the same level as 1990, with Scotland seeing a small increase of less than 2%. However, once emissions from IAS are included the position changes significantly. UK emissions in 2009 are 19 $MtCO_2e$ above their 1990 level, an increase of just under 13%. In Scotland the rise is only 0.5 $MtCO_2e$, an increase of less than 4%. More specifically, while international aviation emissions have more than doubled at the UK and Scottish level, international shipping emissions have risen by 16% at the UK level but fallen by 14% in Scotland. This sub-UK level change is due in significant part to a reallocation of emissions between UK countries. With international aviation emissions making up around three-quarters of total UK IAS emissions but only just over a third of Scottish IAS emissions (with maritime consequently being far more important to the Scottish IAS figure) the drivers behind the changes in 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[12] allow comparisons to be made between the emissions per passenger kilometre[13] of different modes of travel.

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

Sector	Mode	gCO_{2e}/pkm
Road[14]	Average petrol car	113
	Average diesel car	104
	Average petrol hybrid car	87
	Average petrol motorbike	116
	Average bus	149
	Average coach	31
Rail	National rail	57
	Light rail and tram	69
Ferry (Large RoPax)	Average foot and car passengers	116
Aviation	Domestic flights	163
	Short haul international	96
	Long haul international	110

Source: 2010 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors.

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, tram) are more efficient in terms of CO_2e/pkm because they transport more people at one time.

[12]Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting (2011), Produced by AEA for the Department of Energy and Climate Change (DECC) and the Department of Environment, Food and Rural Affairs (Defra)

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

[14] All car figures assume an average car occupancy rate of 1.6 passengers based on the Scottish Household Survey Travel Diary: 2007-8.

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 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[15], 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.

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

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

Table 3: Trends in leading transport indicators[16]

Indicator	2010 level	Average growth p.a. (2003-2010)	Growth (2009-2010)
Road vehicle kilometres travelled (million vehicle kilometres)	43,488	+0.5%	-1.7%
Proportion of new road vehicles that are alternatively fuelled (%)	0.6%	+80%	+71%
Modal share of public transport and active travel (distance travelled) (%)	20%	0%	0%
Aviation passengers (thousand passengers)	20,957	-0.1%	-7%
Waterborne freight lifted in Scotland and moved (million tonne-kilometres)	15,722	-1%	-12%
	2009 level	**Average growth p.a. (2005-2009)**	**Growth (2008-2009)**
Road transport fuel consumption[17] (a) tonnes per 1000 vehicle kilometres; (b) tonnes per 1000 population.[18]	(a) 0.1 (b) 594	(a) -2% (b) -0.3%.	(a) -3% (b) -3%

[16] Source: Scottish Transport Statistics, No 30, 2011 Edition. Tables 5.3, 1.1, 11.2, 8.1, 9.1, 5.11.
[17] Road transport fuel consumption indicator is referred to in 'Conserve and Save: The Energy Efficiency Action Plan for Scotland' published in October 2010.

Chapter 3: 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 (1990–2009). 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, 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. 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**.**

[18] GROS population estimates (mid 2009) for Scotland are 5,194,000.

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 specific Environmental Statement. Some projects may not yet have undergone a formal Environmental Statement; where this is the case the emissions estimate is taken from the environmental chapter of the STAG Appraisal report. In general, where more than one set of figures exist, the most recent data takes precedence. For reference, links to the project home page are also provided where an online version 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[19] (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[20] 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

[19] Design Manual for Roads and Bridges (2009), Highways Agency
[20] Rail Emission Model (2001), AEA Technology Environment

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

Excluded from this analysis is the Strategic Transport Projects Review (STPR), with the exception of those projects that are to be 'fast-tracked' (i.e. the Forth Replacement Crossing and Edinburgh-Glasgow (Rail) Improvements Programme). Undertaken by Transport Scotland and announced by The Minister for Transport, Infrastructure and Climate Change in December 2008, the STPR 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. Individual projects from within STPR will be included as and when they become committed schemes with a designated timescale for implementation.

Road

A876 Upper Forth Crossing at Kincardine

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

- Document: Environmental Statement (2003), Babtie
- Construction completion: 2008
- Estimated emissions impact: +5ktCO_2 p.a. in 2009; +8ktCO_2 p.a. in 2021

The £120 million Clackmannanshire Bridge over the Firth of Forth was officially opened on the 19th November 2008. This project is designed to improve the road network within and around the village of Kincardine. The existing Kincardine Bridge requires substantial refurbishment. Without the new bridge, traffic would otherwise have to divert to Stirling or the Forth Road Bridge in order to cross the Forth, resulting in major disruption to the wider road network.

It is estimated that CO_2 emissions increase with time due to the predicted increase in traffic as a result of the new crossing; an estimated 8,000 additional vehicles a day would be attracted to the area.

Note that the final construction completion date of 2008/09, as specified in Transport Scotland's Scottish Motorway and Trunk Road Programme (SMTRP), is later than the original 2006 emissions impact estimate as published in the Environmental Statement.

M80 Stepps-Haggs

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

- Document: Environmental Statement (2004), Babtie
- Anticipated construction completion: 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.

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 carbon dioxide 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.

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: 2012/13
- Estimated emissions impact: +10ktCO_2 p.a. from 2013; +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: 2012/13
- Estimated emissions impact: +0ktCO_2 by 2013; +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. The scheme will be procured as a package with the M8 Baillieston to Newhouse Scheme and M74 Raith Junction.

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: Anticipated construction completion: It had been hoped to start construction of the AWPR in 2011 however, legal challenges submitted to the Court of Session challenging the decision to proceed with the project will delay construction until resolution of the challenges. Assuming a successful outcome to the challenges, a thorough review of the remaining stages of the project will be required before issuing a definitive timetable to construction.
- Estimated emissions impact: +8ktCO_2 p.a. from 2012; +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 carbon dioxide 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.

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: 2013/14
- Estimated emissions impact: +30ktCO_2 p.a. from 2014; +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.

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 cablestayed 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.

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: 2014
- Estimated emissions impact: Cumulative decreases of -26ktCO_2 by 2030, -132ktCO_2 by 2050 and -248ktCO_2 by 2070[21].

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 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 beneficial impact on CO_2 levels. The most recent assessments suggest that it will save emissions from the opening year,

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

and deliver significant long-term benefits, removing approximately 248ktCO_2 over the appraisal period to 2070.

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 [22]:
    - Average annual savings of -41ktCO_2 p.a. from 2017
    - Cumulative savings of -2,395ktCO_2 by 2075.

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

[22] 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

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 ($ktCO_2$)

Budget Period	Operational		Embodied**
	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			

Edinburgh Tram Lines 1a and 1b[23]

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

- Document: STAG part 2 appraisal (2006), Steer Davies Gleave / Colin Buchanan
- Anticipated construction completion: 2012
- Estimated emissions impact[24]: +90$ktCO_2$ p.a. from 2011; +167$ktCO_2$ 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.

[23] 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.

[24] 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 8$ktCO_2$ and 11$ktCO_2$ p.a. in 2011 and 2031 respectively.

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 Phase 1a and 1a+1b would increase the level of CO_2, as a result of traffic re-routing and demand redistribution.[25],[26]

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
A876 Upper Forth Crossing at Kincardine	+5ktCO_2 p.a. from 2009 +8ktCO_2 p.a. from 2021
M80 Stepps-Haggs	+40ktCO_2 p.a. from 2012 +40ktCO_2 p.a. from 2025
M74 Completion	+87ktCO_2 from 2012 +135ktCO_2 from 2020
A75 Dunragit Bypass	+4ktCO_2 p.a. from 2022
M74 Raith Interchange	+10ktCO_2 p.a. from 2013 +10ktCO_2 p.a. from 2020
M8 Associated Network Improvements	+0ktCO_2 p.a. by 2013 +2ktCO_2 p.a. by 2020

[25] 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 'disbenefits' 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.

[26] 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.

A90 Balmedie-Tipperty	+2ktCO_2 p.a. from 2013
A90 Aberdeen Western Peripheral Road	+8ktCO_2 p.a. from 2012 +10ktCO_2 p.a. from 2027
M8 Baillieston-Newhouse	+30ktCO_2 p.a. from 2014 +30ktCO_2 p.a. from 2020
Forth Replacement Crossing	+20ktCO_2 p.a. in 2032
Stirling-Alloa-Kincardine Railway Line	+2ktCO_2 p.a. from 2009
Borders Railway	-26ktCO_2 total savings by 2030 -132ktCO_2 total savings by 2050 -248ktCO_2 total savings by 2070
Edinburgh-Glasgow (Rail) Improvements Programme	-41ktCO_2 average p.a. from 2017 -2,395kt CO_2 total savings by 2075
Edinburgh Tram Lines 1a and 1b	+90ktCO_2 p.a. from 2012 +167ktCO_2 p.a. from 2031

The emission estimates within this table are forecast increases 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.

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 'Climate Change: The UK Programme 2006'[27], 'Meeting the Energy Challenge: A White Paper on Energy'[28], and the annual HM Treasury (HMT) Budget and Pre-Budget reports. 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.

[27] Climate Change: The UK Programme (2006), Presented to Parliament by the Secretary of State for the Environment, Food and Rural Affairs by Command of Her Majesty

[28] Meeting the Energy Challenge: A White Paper on Energy (2007, Department of Trade and Industry

Freight Modal Shift Grants

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

- Document: Internal calculation (2008)
- Implementation date: Ongoing
- Estimated emissions impact: Not quantified

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.

Under the FFG Scheme, grants are available towards the capital costs of inland waterway, rail, coastal & short sea shipping freight equipment in cases where the traffic would otherwise move by road. There are two elements to the MSRS scheme: MSRS (Intermodal) can subsidise the ongoing costs of intermodal container movements by rail; MSRS (Bulk and Waterways) can subsidise the ongoing costs of bulk rail freight traffic movements and inland waterway movements. Under the WFG scheme, operating subsidy is available to support the start up phase of new coastal and short sea shipping routes where road is the less costly option.

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: -4KtCO_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 and a 'lite' guide 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. Projecting forward, it proposes that there is demand for 15,000 van drivers to be trained in SAFED in 2010-11, which has the potential to abate 11.1 ktCO_2 per annum.

Air Passenger Duty (APD)[29]

http://webarchive.nationalarchives.gov.uk/20100407010852/http://www.hm-treasury.gov.uk/prebud_pbr08_repindex.htm

- Document: Pre-Budget Report (2008), HMT
- Implementation date: 1st November 2009 and 1st November 2010
- Estimated emissions impact: -0.6MtCO_2 in 2011-12 (UK)[30]

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 0.4MtCO_2 in 2010-11 rising to 0.6 MtCO_2 in 2011-12.

In the 2011 Budget, APD rates were frozen for 2011-12 and an RPI increase deferred to April 2012. In addition to this, the UK Government launched a consultation on reform of APD as a means of developing different options for simplifying the tax system for air transport to support a number of objectives including the reduction of global emissions.

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

29 http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageExcise_ShowContent&propertyType=document&id=HMCE_CL_000505

30 Figure is based on the impact assessment of the 2009 APD reform.

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.

Inclusion of aviation in EU ETS

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

- Document: Pre-Budget Report (2008), HMT
- Implementation date: 2012
- Estimated emissions impact: -133MtCO_2 p.a. in 2015 and 194MtCO_2 p.a. in 2020 across Europe

A Directive to include aviation into the EU Emissions Trading Scheme (ETS) was published in the Official Journal of the European Union on 13 January 2009. The Aviation Greenhouse Gas Emissions Trading Scheme Regulations 2010 came into force in the UK on 31 August 2010. The inclusion of aviation in the EU ETS 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.

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, substantial funding is given to public transport provision and promoting more sustainable travel and transport means. These sustainable transport policies include: fuel efficient driving; 'Smarter Choices' including travel plans using more sustainable transport, information and marketing; encouraging use of cleaner vehicles and alternative fuels where these are sustainable; increasing cycling through the Cycling Action Plan and completion of the National Cycle Network. Monitoring programmes are being put in place for all of these measures to assess their impacts.

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
- Implementation date: Ongoing
- Estimated emissions impact: -7 $MtCO_2$ p.a. in 2020 across the UK

On 6 April 2009 the EU Council of Ministers formally adopted a regulation setting mandatory CO_2 reduction targets for manufacturers registering vehicles in the EU. It sets an EU average 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.[31]

[31] On 28 October 2009 the European Commission also adopted a new legislative proposal to reduce CO_2 emissions from light commercial vehicles. In December 2010, the European Parliament and the

Fuel duty

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

- Document: Budget Report (2010), HMT
- Implementation date: Ongoing
- Estimated emissions impact: -2 $MtCO_2$ p.a. by 2014-15 across the UK compared to inflation only increases.

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 will 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 impact of such changes on CO_2 emissions has not been derived, but is likely to reduce the likely hood of achieving the $2MtCO_2$ per year saving by 2014-15.

Bio-fuels and the Renewable Transport Fuels Obligation

http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm

- Document: Pre-Budget Report (2009), HMT
- Implementation date: Ongoing
- Estimated emissions impact: -2.6 to -3$MtCO_2$ in 2010-11 from RTFO (UK) -0.3$MtCO_2$ in 2012-13 from abolition of the biofuels duty differential (UK) based on Budget 2008 figures.

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

---

Council reached agreement on the final text of the vans Regulation. The main objective of the vans Regulation is to cut CO_2 emissions from vans to 175 grams of CO_2 per kilometer 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.

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[32] and Gallagher Review[33], the UK's bio-fuels target for 2009-10 was 3.25% rising to 3.5% in 2010-11[34]. 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 suggests the required reduction will come largely from increased supply of bio-fuel.

Reform to vehicle excise duty

http://www.hm-treasury.gov.uk/prebud_pbr09_repindex.htm

- Document: Pre-Budget Report (2009), HMT
- Anticipated implementation date: 2010
- Estimated emissions impact: Cumulative UK saving of 1.0 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.

[32] The King Review of low carbon cars (2007), King, J.

[33] The Gallagher Review of the indirect effects of biofuels production (2008), Renewable Fuels Agency

[34] 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.

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 1.0MtCO_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://www.hm-treasury.gov.uk/2010_june_budget.htm

- Document: Pre-Budget Report (2009), HMT
- Anticipated implementation date: 2011
- Estimated emissions impact: Not quantified

Building on reforms made to company car tax in 2008 and 2009, the Government in its June 2010 budget set out further reform of company car tax so that it continues to provide an incentive to purchase the lowest emitting vehicles on the market.

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.

The percentage of list price subject to tax will continue to increase by one percentage point with every 5g CO_2 per km increase in emissions, to a maximum of 35 per cent. The cap on car list prices used to calculate the taxable benefit arising from company cars will also be abolished on in April 2011 as will discounts for early uptake Euro 4-standard diesel cars, higher-emitting hybrid cars and alternative fuel company cars.

From April 2012, the 10 per cent band for cars emitting 120g CO_2 per km or less will be removed, and the system of bands will be extended so that they increase by one

percentage point with every 5g CO_2 per km increase in emissions, from 10 per cent. This 10 per cent band will apply to cars that emit 99g of CO_2 per km or less.

Budget 2011 announced that from April 2013, Company Car Tax will be frozen for cars emitting less than 95g/km and will increase by 1 percentage point for vehicles with CO_2 emissions between 95g/km and 219g/km.

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.

Low Carbon Vehicles

http://www.hm-treasury.gov.uk/d/pbr09_chapter7.pdf

- Document: Pre-Budget Report (2009), HMT
- Anticipated implementation date: 2010-11
- Estimated emissions impact: Not quantified

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

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[35]

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.

In addition, Ministers have announced an additional £5m to support low carbon vehicles in 2014/15 through our Future Transport Fund, this is on top of £11m already announced through the fund to cover the next 2 years to support LCVs, walking, cycling and green buses

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

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. It is anticipated that the new buses will deliver an average reduction of 21 t CO_2 p.a. 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	Not quantified
Removal of tolls from Forth and Tay bridges	+8ktCO_2 to +9ktCO_2 p.a. from 2008
Freight Best Practice	-4KtCO_2 in 2008-09
Air passenger duty	-0.6MtCO_2 in 2011-12 (UK)
Smarter Choices, Smarter Places	-71ktCO_2 p.a. from 2009
Inclusion of aviation in EU ETS	-133MtCO_2 p.a. in 2015 -194MtCO_2 p.a. in 2020 (Europe)
Sustainable transport measures	Not quantified
New Car CO_2 Regulation	-7 MtCO_2 p.a. in 2020 (UK)
Fuel Duty	-2MtCO_2 p.a. by 2014-15 (UK)
Biofuels and the Renewable Transport Fuels Obligation	-2.6 to -3MtCO_2 in 2010-11 from RTFO -0.3MtCO_2 in 2012-13 from abolition of the biofuels duty differential (UK)
Reform to vehicle excise duty[36]	-1.0MtCO_2 total savings by 2020 (UK)
Company car tax[20]	Not quantified
Fuel benefit charge	Not quantified
Electric van benefit charge	Not quantified
Ultra-low carbon vehicles in the UK	Not quantified

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 Scottish Transport Appraisal Guidance (STAG). Two key concepts in STAG are:

- 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.

[36] 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 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; it provides sufficient information to understand the relative impacts between different options. It is not, therefore, a key concept of STAG to be able to compare the outcomes of different STAG studies.

Following this approach, the totals highlighted in Tables 5 and 6 detail the estimated impact of each individual intervention in isolation. As stated, these emissions estimates are frequently based upon models that are tailored specifically to a particular intervention and as such it is not statistically valid to aggregate the individual totals or directly compare them with one another.

The purpose of the CAT, however, is to improve transparency and to monitor progress towards achievement of 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[37]. 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. 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,

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

with the long-run impact being estimated at +71ktCO_2 p.a. by 2022 (around a 0.4% growth in annual transport emissions).

Table 7: Net impact of all Scottish measures[38]

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.

[38] 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 intended 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 wider measures such as the New Car CO_2 Regulation, the Renewable Transport Fuels Obligation and the inclusion of aviation in the EU ETS. 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 second 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 demonstrates that there are several infrastructure projects where construction is underway or planned over the next few years. Whilst their GHG impacts are not measured on a like for like basis, and consequently cannot be compared against each other, it is clear that several of these are anticipated to increase emissions in the future. This reflects the fact that, in order to deliver the Scottish Government's Purpose and to work towards the strategic outcomes in the

NTS, STAG is used to evaluate the performance of proposed transport schemes against five equally-weighted criteria, including Environment. This process may sometimes show that an infrastructure improvement is, on balance, the best way to achieve our objectives; nonetheless, it is still important to quantify and to minimise its emissions impacts.

Section 3 of the CAT also sets out the range of fiscal and regulatory measures, predominantly reserved, that have been committed to via the 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 (TS) have developed a Climate Change Action Plan for the organisation and are currently developing a carbon management system (CMS), which will help measure the carbon associated with TS operations and drive continuous improvement. Over time, application of the CMS to projects will yield better information about the whole life embedded impacts of transport infrastructure projects. It is possible that these lifecycle emissions could be incorporated into the CAT once the CMS is fully established.

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 underlying factors will continue to have a significant influence on transport emissions, as specified in Chapter 2, the CAT will continue to report the marginal impact that projects and policies have upon these background emissions.

References

AEA for the Department of Energy and Climate Change (DECC) and the Department of Environment, Food and Rural Affairs (Defra) (2011): 2011 *Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting,*

AEA Technology (2011): *Greenhouse Gas Inventory for England, Scotland, Wales and Northern Ireland: 1990-2009*

AEA Technology Environment (2001): *Rail Emission Model*

Department of Trade and Industry (2007): *Meeting the Energy Challenge: A White Paper on Energy*

Department for Transport (2008): *Carbon Pathways Analysis: Informing Development of a Carbon Reduction Strategy for the Transport Sector*

Department for Transport (2009): *Low Carbon Transport: A Greener Future*

Gallagher, E. (2008): *The Gallagher Review of the indirect effects of biofuels production* Renewable Fuels Agency

Highways Agency (2009): *Design Manual for Roads and Bridges*

King, J. (2007): *The King Review of low carbon cars*

Secretary of State for the Environment, Food and Rural Affairs (2006): *Climate Change: The UK Programme*

The Scottish Executive (2006): *Scotland's National Transport Strategy*

The Scottish Government (2011): *The Government Economic Strategy,*

The Scottish Government (2009): *Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets*

The Scottish Government (2009): *Consultation on Low Carbon Vehicles*

The Scottish Government (2009): *Cycling Action Plan for Scotland*

The Scottish Government (2010): *Conserve and Save. The Energy Efficiency Action Plan for Scotland.*

The Scottish Government (2010): *Scottish Transport Statistics.*

The Scottish Government (2011): *Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022: The Report on Proposals and Policies.*

Transport Scotland (2008): *Strategic Transport Project's Review*

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:

এই ডকুমেন্ট-এর (দলিল) অতিরিক্ত কপি, অডিও এবং বড়ো ছাপার অক্ষর আকারে এবং সম্প্রদায়ভুক্ত লোর ভাষায় অনুরোধের মাধ্যমে পাওয়া যাবে, অনুগ্রহ করে যোগাযোগ করুন:

Gheibhear lethbhreacan a bharrachd ann an cruth ris an èistear, ann an clò mòr agus ann an cànain coimhearsnachd. Cuir fios gu:

इस दस्तावेज़/काग़ज़ात की और प्रतियाँ, माँगे जाने पर, ऑडियो टैप पर और बड़े अक्षरों में तथा कम्यूनिटी भाषाओं में मिल सकती हैं, कृपया संपर्क करें:

ਇਸ ਦਸਤਾਵੇਜ਼/ਕਾਗ਼ਜ਼ਾਤ ਦੀਆਂ ਹੋਰ ਕਾਪੀਆਂ, ਮੰਗੇ ਜਾਣ 'ਤੇ, ਆੱਡਿਓ ਟੇਪ ਉੱਪਰ ਅਤੇ ਵੱਡੇ ਅੱਖਰਾਂ ਵਿਚ ਅਤੇ ਕੰਮਿਉਨਿਟੀ ਭਾਸ਼ਾਵਾਂ ਦੇ ਵਿਚ ਮਿਲ ਸਕਦੀਆਂ ਹਨ, ਕ੍ਰਿਪਾ ਕਰਕੇ ਸੰਪਰਕ ਕਰੋ:

此文件有更多備份，如果需要，語音版本和大字體版本及少數種族語言版本也可提供，請聯絡：

يمكن أن تطلب النسخ الأخرى من هذا المستند كالتسجيل الصوتي والخط المكبر ونسخ بلغات أخرى، يرجى الإتصال على:

Aby otrzymać niniejszy dokument w innej wersji językowej, na kasecie lub w wersji z powiększonym drukiem, prosimy o kontakt:

Transport Scotland, Buchanan House,
58 Port Dundas Road, Glasgow, G4 0HF
0141 272 7100
info@transportscotland.gsi.gov.uk
www.transportscotland.gov.uk

ISBN: 978-1-908181-31-2

Any enquiries regarding this document/ publication should be sent to us at info@transportscotland.gsi.gov.uk

This document is also available on the Transport Scotland website: www.transportscotland.gov.uk