

Tactran

Transport Carbon Assessment

Stage 2 Report
June 2013

ATKINS

Plan Design Enable

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Table of contents

Chapter	pages
1. Introduction	6
1.1. Mitigating Transport's Impact on Climate Change	6
1.2. Transport Carbon Assessment - Stage 1 Report	6
1.3. Baseline emissions for the Tactran and Tayplan areas	6
1.4. 'Do Minimum' scenario	6
1.5. 'CCC Carbon Budget Recommendations' scenario	9
1.6. Transport Carbon Assessment - Stage 2	12
2. Climate change mitigation	15
2.1. Introduction	15
2.2. Option generation and initial development	15
2.3. Initial assessment and prioritisation of options	15
2.4. Option analysis and modelling	18
2.5. Mitigation – summary of findings	26
3. Climate change adaptation	32
3.1. Statutory duties	32
3.2. Adaptation in Scotland	32
3.3. Outline of an adaptation strategy	32
3.4. Understanding historical trends and establishing baseline vulnerability	32
3.5. Establishing future changes in climate and assessing vulnerability to climate change	35
3.6. Developing an adaptation plan	36
3.7. Implementing an action plan	37
3.8. Monitoring and evaluation	38
3.9. Delivery Plan	38
4. Monitoring framework for carbon abatement	39
4.1. Key indicators	39
4.2. Using the UK Greenhouse Gas Inventory	40
• local and regional CO ₂ emissions (all sectors);	40
• road transport fuel consumption and non-gas; and	40
• non-electricity and non-road transport fuel consumption.	40
4.3. Road vehicle kilometres travelled by vehicle type and road type	41
4.4. Road transport fuel consumption per vehicle kilometre (fuel consumption per vehicle km and per 1,000 of population)	41
4.5. Proportion of new road vehicles that are alternatively fuelled	42
4.6. Modal share of public transport and active travel (average distance travelled per person per annum by public transport, walking or cycling)	43
4.7. Delivery Plan	43
5. Summary and Conclusions	44
5.1. Key findings	44
5.2. Next steps	45

Tables

Table 1.1 – “Do Minimum” assumptions.....	6
Table 1.2 – “Do Minimum” transport carbon emissions estimates – Tactran and Tayplan areas (MtCO ₂ p.a.)	7
Table 1.3 – “CCC Carbon Budget Recommendations” scenario assumptions	9
Table 1.4 – “CCC Carbon Budget Recommendations” scenario transport carbon emissions estimates – Tactran and Tayplan areas (MtCO ₂ p.a.)	9
Table 1.5: RPP2 estimated transport sector abatement (summary)	14
Table 2.1: Stage 2 long list ranking by initial assessment of abatement potential versus cost.....	17
Table 2.2: CCC suggested required electric vehicle take up	18
Table 2.3: Estimated costs for Tactran investment from 2014 to 2030	19
Table 2.4: Modelled reduction in CO ₂ emissions in Tactran and Tayplan areas (tCO ₂ p.a.)	20
Table 2.5: Summary of eco-driving training cost assumptions for Tactran or Tayplan area.....	20
Table 2.6: Modelled reduction in CO ₂ emissions in Tactran and Tayplan areas (MtCO ₂ p.a.)	21
Table 2.7: Summary of travel planning cost assumptions.....	22
Table 2.8: Modelled reduction in CO ₂ emissions in Tactran and Tayplan areas (MtCO ₂ p.a.)	22
Table 2.9: Modelled reduction in CO ₂ emissions in Tactran and Tayplan areas (tCO ₂ p.a.)	23
Table 2.10: Modelled reduction in CO ₂ emissions in Tactran and Tayplan areas (CO ₂ p.a.)	24
Table 2.11: Bus improvement cost assumptions and sources.....	26
Table 2.12: Modelled reduction in CO ₂ emissions in Tactran and Tayplan areas (tCO ₂ p.a.)	26
Table 4.1: Key indicators recommended for Tactran to monitor progress on CO ₂ emissions mitigation.....	39
Table 4.2: Additional indicators which could be included in a monitoring framework	39
Table 4.3: Electric vehicles registered under Plug-In-Places grant (data courtesy of Plug-In-Places programme and Cenex).....	42

Figures

Figure 1.1 - Indicative “Do Minimum” trajectory – Tactran area.....	7
Figure 1.2 - Indicative “Do Minimum” trajectory – Tayplan area	7
Figure 1.3 - Indicative breakdown of “Do Minimum” emissions by District/area – Tactran area.....	8
Figure 1.4 - Indicative breakdown of “Do Minimum” emissions by District/area – Tayplan area	8
Figure 1.5 - Indicative “CCC Carbon Budget Recommendations” scenario trajectory – Tactran area	10
Figure 1.6 - Indicative “CCC Carbon Budget Recommendations” scenario trajectory – Tayplan area	10
Figure 1.7 - Indicative breakdown of “CCC Carbon Budget Recommendations” scenario emissions by District/area – Tactran area	11
Figure 1.8 - Indicative breakdown of “CCC Carbon Budget Recommendations” scenario emissions by District/area – Tayplan area.....	11
Figure 2.9: Extract from draft RPP2 technical annex (page 48).....	20

Appendices

A.	Tactran Board Presentation	49
B.	Option Generation	50
C.	Qualitative Assessment	55
D.	Abatement Modelling Results for Additional Forecast Years	60
E.	Assessment of Delivery Plan for Climate Change Mitigation and Adaptation	62
F.	Support to low carbon vehicles and infrastructure – Supporting Evidence	63

Glossary

BAU	Business as Usual
BSOG	Bus Service Operators' Grant
CAT	Carbon Account for Transport
CCC	Committee on Climate Change
CCRA	Climate Change Risk Assessment
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DfT	Department for Transport
DECC	Department of Energy and Climate Change
DEFRA	Department for Food Environment and Rural Affairs
EU	European Union
EU ETS	EU Emissions Trading System
Euro standard	European emission standards defining the acceptable limits for exhaust emissions of new vehicles sold in EU member states
EV	Electric vehicle
HDV / HGV	Heavy Duty Vehicle / Heavy Goods Vehicle (truck)
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transport System
IWW	Inland waterways
ktCO ₂	Kilotonnes of CO ₂ (1,000 tonnes of CO ₂)
LDV - LGV	Light Duty Vehicle – Light Goods Vehicle (van)
MCA	Multi criteria analysis
MtCO ₂	Mega or million tonnes of CO ₂ (1,000,000 tonnes of CO ₂ – metric tonnes)
MTCCI	Mitigating Transport's Climate Change Impact, Study for Scottish Government
NAEI	National Atmospheric Emissions Inventory
PIP	Plugged-in-Places
PTP	Personalised travel planning
RPP	Report on Proposals and Policies
RTFO	Renewable Transport Fuels Obligation
RTPI	Real Time Passenger Information
RTS	Regional Transport Strategy
SMMT	Society of Motor Manufacturers and Traders
TERS	Tay Estuary Rail Study
TMfS	Transport Model for Scotland
UKCP09	UK Climate Projections
WTP	Workplace Travel Plan

1. Introduction

1.1. Mitigating Transport's Impact on Climate Change

Atkins was commissioned by the Scottish Government in 2008 to undertake an assessment of policy options for mitigating transport's climate change impact in Scotland¹. Since the completion of the national study Atkins has worked with Tactran to help them respond to their statutory duties that are set out within the Climate Change (Scotland) Act.

The first key output from this work was the Transport Carbon Assessment - Stage 1 Report, which was finalised in December 2012.

1.2. Transport Carbon Assessment - Stage 1 Report

The Tactran Carbon Assessment Stage – Stage 1 Report provides:

- The legislative and policy context for climate change in Scotland;
- The results of the baseline surface transport CO₂ emissions analysis (baseline forecasts), covering the;
 - Tactran area (Dundee, Angus, Perth and Kinross and Stirling), and
 - Tayplan area (Dundee, Angus, Perth and Kinross and North Fife).

1.3. Baseline emissions for the Tactran and Tayplan areas

In Stage 1, transport emission levels and trajectories for the Tactran and Tayplan areas were estimated under two scenarios:

- a "Do-Minimum" scenario, assuming no new measures to reduce CO₂ emissions beyond those considered in progress, committed or very likely to 2020, with no further new measures assumed to be implemented beyond 2020; and
- a "CCC Carbon Budget Recommendations" scenario, assuming national action continues at the level suggested by the Committee on Climate Change to be necessary to meet carbon budgets, as described in the Extended Ambition Scenario to 2020 and Medium Abatement Scenario from 2020 to 2030 (as defined in the 2010 fourth carbon budget²).

1.4. 'Do Minimum' scenario

The core assumptions on the ongoing interventions to reduce CO₂ emissions to 2020 included in the "Do Minimum" scenario are presented in Table 1.1. They are based broadly on those elements of the CCC's Extended Ambition Scenario to 2020 that can be considered in progress, committed or very likely with no further interventions assumed beyond 2020.

Table 1.1 – "Do Minimum" assumptions

	Do Minimum Assumptions
New car emissions	Measures to meet EU Framework new car emissions' targets, meeting the 130g CO ₂ /km target in 2015 and making some further progress towards the proposed target 95g CO ₂ /km in 2020 but through power train and non power train improvements only, without the widespread uptake of electric vehicles (therefore achieving 50% of the additional progress required to meet the 95g target)
Biofuel uptake	% of road fuel used by cars, vans and HGVs which comes from biofuels rises to 10% in 2020 by volume, in line with Gallagher Review and remains consistent to 2030
Rail measures	Some cost saving efficiency measures (such as training and improved rolling stock) as estimated by DfT through the Rail Carbon Trajectories Working Group.

Table 1.2 summarises the estimated 'Do Minimum' baseline surface transport related carbon emissions in the Tactran and Tayplan areas respectively in a base year of 2007 and forecast years of 2022 and 2032 by mode.

Table 1.2 – “Do Minimum” transport carbon emissions estimates – Tactran and Tayplan areas (MtCO₂ p.a.)

Mode	Tactran			Tayplan		
	2007	2022	2032	2007	2022	2032
Private vehicle tailpipe (incl. vans and HGVs)	1.36	1.41	1.54	1.20	1.25	1.36
Bus	0.04	0.04	0.04	0.05	0.05	0.05
Rail (excl. electric rail)	0.03	0.03	0.03	0.03	0.03	0.03
Total Point of Use Emissions	1.44	1.48	1.62	1.28	1.33	1.44
<i>Private vehicle electric (current carbon intensity of energy mix)</i>	0.00	0.00	0.00	0.00	0.00	0.00
Total Surface Transport	1.44	1.49	1.62	1.28	1.33	1.44

Figure 1.1 and Figure 1.2 show an indicative trajectory of change in baseline emissions levels between the forecast years for each area.

Figure 1.1 - Indicative “Do Minimum” trajectory – Tactran area

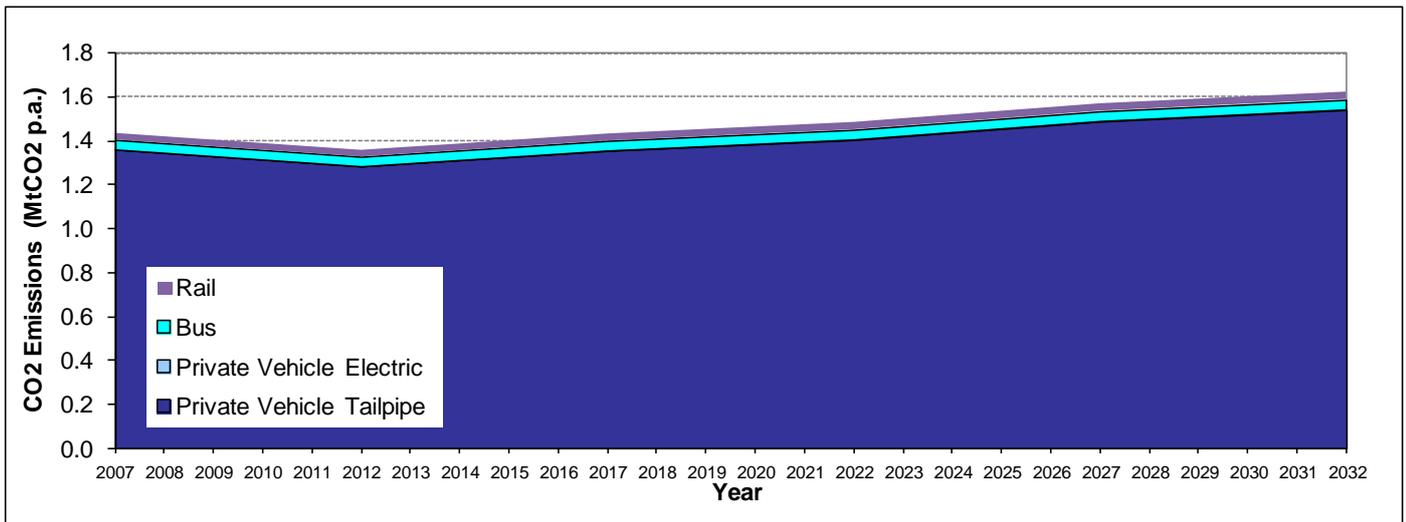


Figure 1.2 - Indicative “Do Minimum” trajectory – Tayplan area

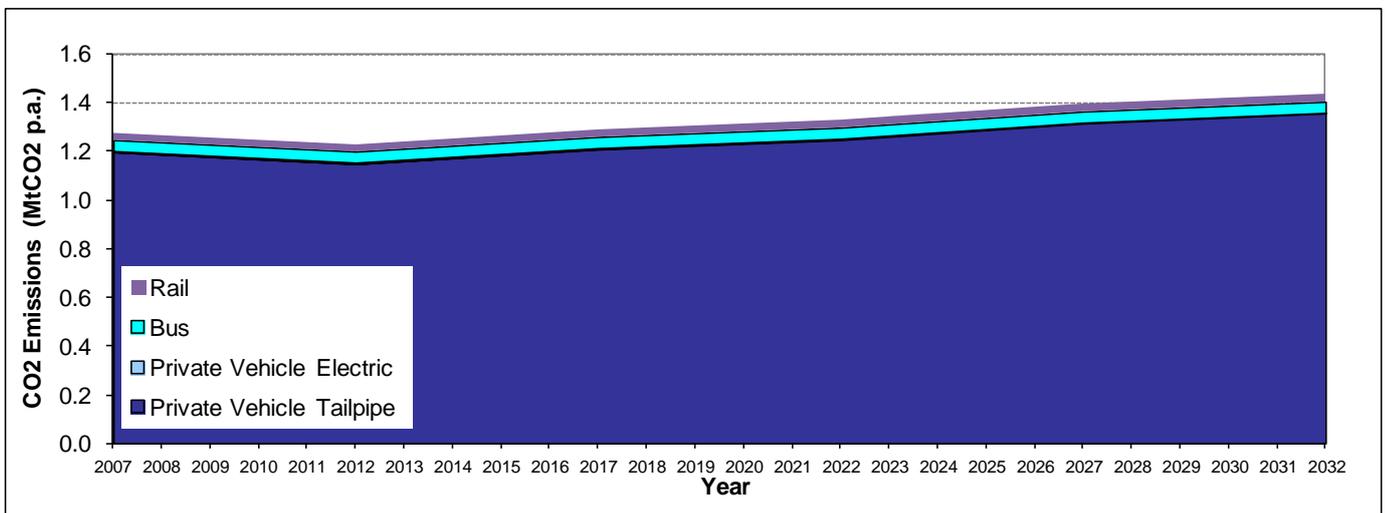


Figure 1.3 and Figure 1.4 provide further detail of the composition of surface transport emissions in the constituent districts within the Tactran and Tayplan areas.

Figure 1.3 - Indicative breakdown of “Do Minimum” emissions by District/area – Tactran area

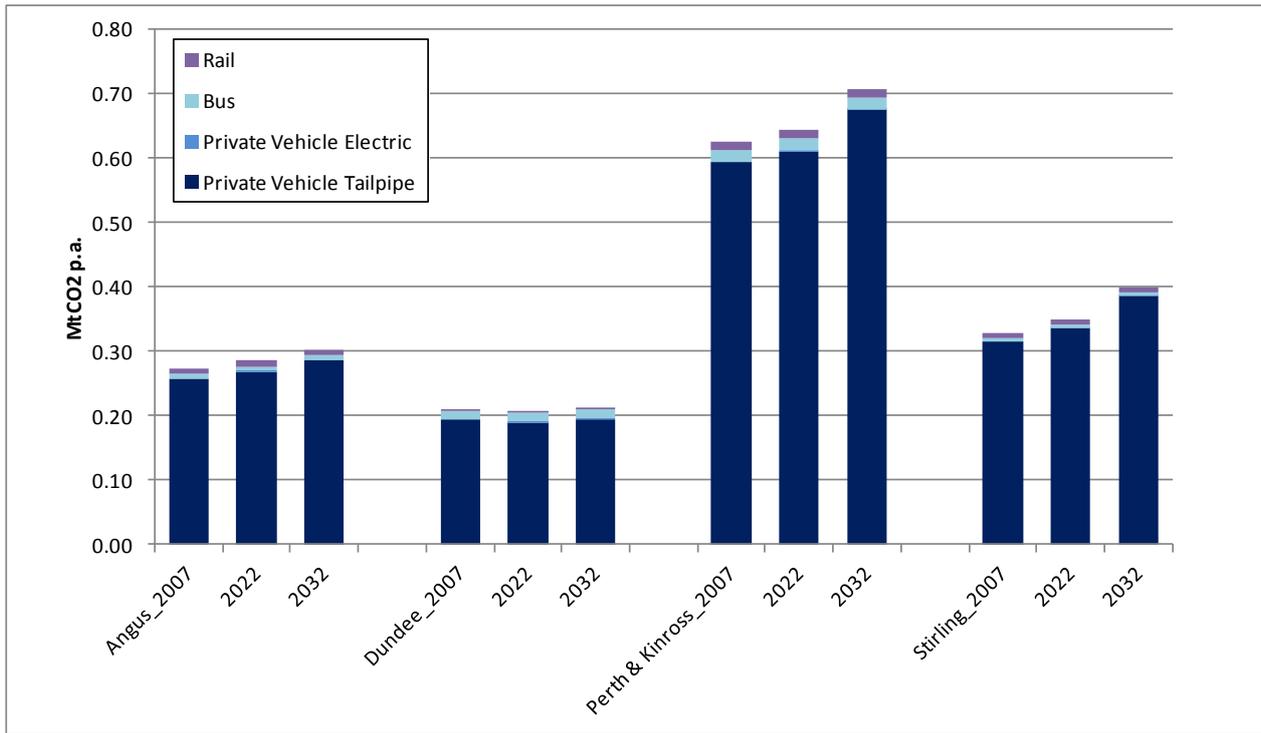
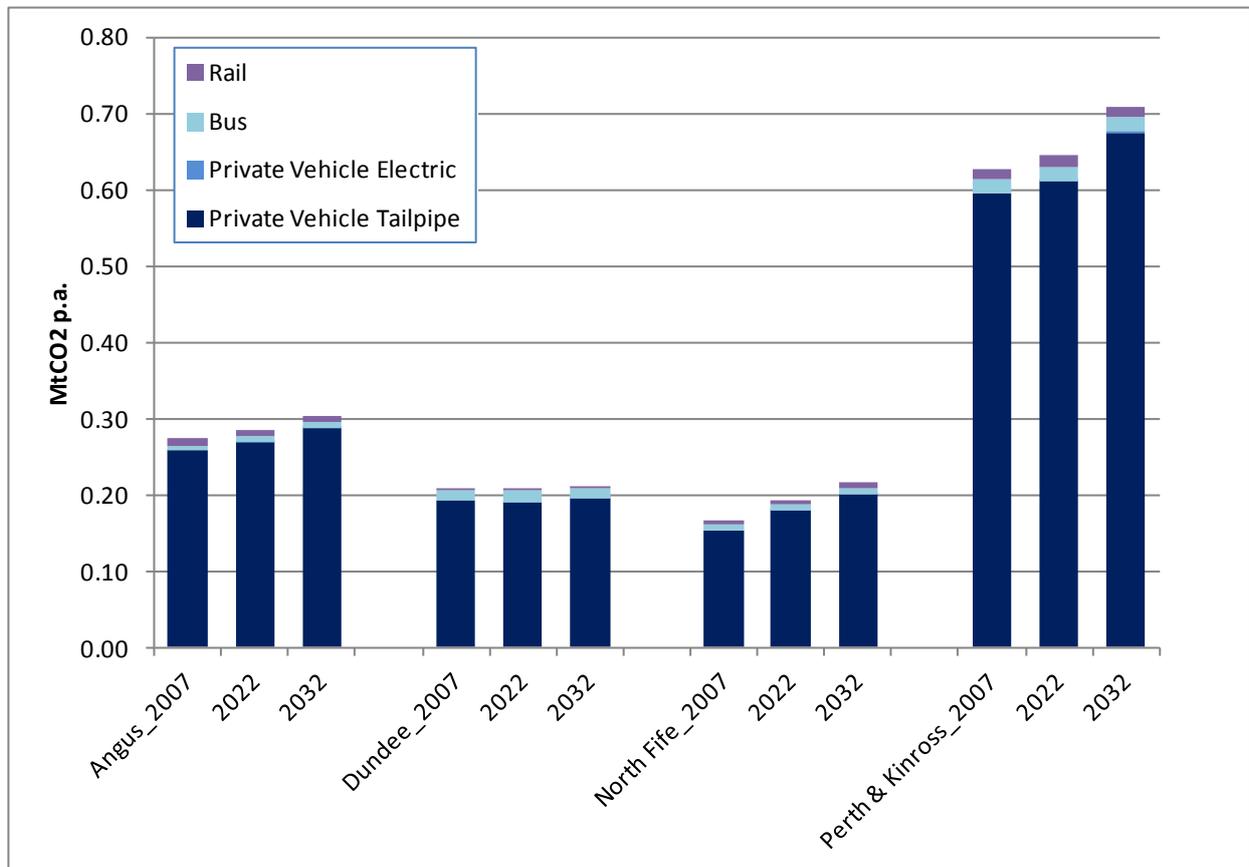


Figure 1.4 - Indicative breakdown of “Do Minimum” emissions by District/area – Tayplan area



1.5. ‘CCC Carbon Budget Recommendations’ scenario

The “CCC Carbon Budget Recommendations” scenario builds on the ‘Do Minimum’ scenario and incorporates current likely levels of national mitigation action required to meet carbon budgets as set out in the Committee on Climate Change reports (specifically using the Extended Ambition scenario to 2020 and Medium Abatement scenario to 2030 as identified in the fourth carbon budget published in 2010³). These CCC scenarios assume extensive improvements in vehicle efficiency and a strong shift towards electric vehicle use. The core assumptions on current and proposed interventions and policies in the CCC Carbon Budget Recommendations scenario are summarised in Table 1.3.

Table 1.3 – “CCC Carbon Budget Recommendations” scenario assumptions

	Extended Ambition and Medium Abatement Scenario
New car emissions	Measures to meet EU Framework on new car emissions achieving 95g CO ₂ /km in 2020 and 80g CO ₂ /km in 2030 through power train improvements, increased uptake of hybrids, plug-in and electric cars and non-power train improvements.
New van emissions	Assumption of progress towards EU framework for van emission reduction and greater uptake of technology which brings financial savings achieving 150g/km in 2020 and 120g/km in 2030 - achieved through power train improvements - increased uptake of stop start vans, hybrids, plug-in and electric cars and non-power train improvements.
New HGV emissions	Limited change to 2020 but greater uptake of non-powertrain improvements after 2020 to achieve a 30% reduction in emissions across all HGV classes by 2030.
Biofuel uptake	% of road fuel used by cars, vans and HGVs which comes from biofuels rises to 10% in 2020 by volume, in line with Gallagher Review and remains consistent to 2030 - as Do Minimum
Rail measures	Efficiency measures (such as training and improved rolling stock) as estimated by DfT through the Rail Carbon Trajectories Working Group, including the assumed 0.03MtCO ₂ saving identified by the CCC in ‘Scotland’s Path to a Low Carbon Economy’ in 2010
Smarter Choices and Eco driving	Savings to 2020 as identified in ‘Scotland’s Path to a Low Carbon Economy’ in 2010 (0.24MtCO ₂ of savings attributable to Smarter Choices by 2020 and 0.11MtCO ₂ savings attributable to eco-driving) with no additional savings beyond 2020. This in line with the UK wide assumption in the CCCs fourth carbon budget, assuming measures to lock in the savings achieved to 2020 but not assuming any further savings are achieved, despite the potential, due to the uncertainties

Table 1.4 summarises the estimated ‘CCC Carbon Budget Recommendations’ scenario surface transport related carbon emissions in the Tactran and Tayplan areas respectively in a base year of 2007 and forecast years of 2022 and 2032 by mode, including an allowance for the fact that any reductions in travel costs are likely to cause a ‘rebound effect’ where people travel further as a result of the reduced costs they face.

Table 1.4 – “CCC Carbon Budget Recommendations” scenario transport carbon emissions estimates – Tactran and Tayplan areas (MtCO₂ p.a.)

Mode	Tactran			Tayplan		
	2007	2022	2032	2007	2022	2032
Private vehicle tailpipe (incl. vans and HGVs)	1.36	1.27	0.94	1.20	1.13	0.82
Bus	0.04	0.04	0.04	0.05	0.05	0.05
Rail (excl. electric rail)	0.03	0.03	0.03	0.03	0.03	0.03
Total Point of Use Emissions	1.44	1.35	1.02	1.28	1.21	0.90
<i>Private vehicle electric (current carbon intensity of energy mix)</i>	0.00	0.06	0.30	0.00	0.05	0.27
Total Surface Transport	1.44	1.40	1.32	1.28	1.26	1.17

Figure 1.5 and Figure 1.6 show an indicative trajectory of change in emissions levels between the forecast years for each area under the ‘CCC Carbon Budget Recommendations’ scenario.

Figure 1.7 and Figure 1.8 provide further detail of the composition of surface transport emissions in the constituent districts within the Tactran and Tayplan areas under this scenario.

Figure 1.5 - Indicative "CCC Carbon Budget Recommendations" scenario trajectory – Tactran area

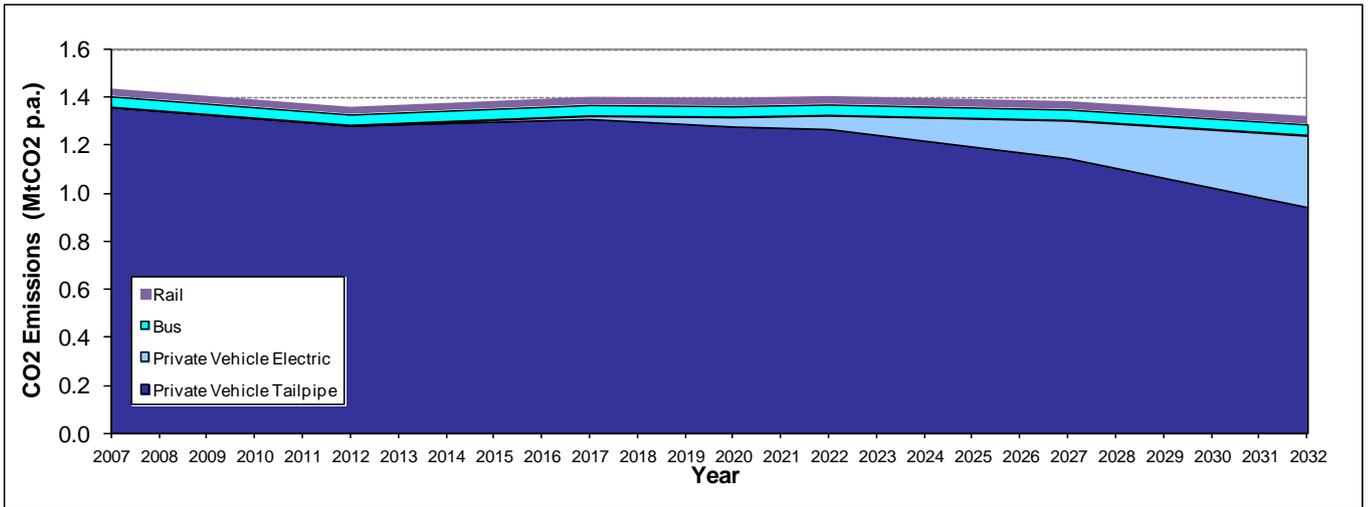


Figure 1.6 - Indicative "CCC Carbon Budget Recommendations" scenario trajectory – Tayplan area

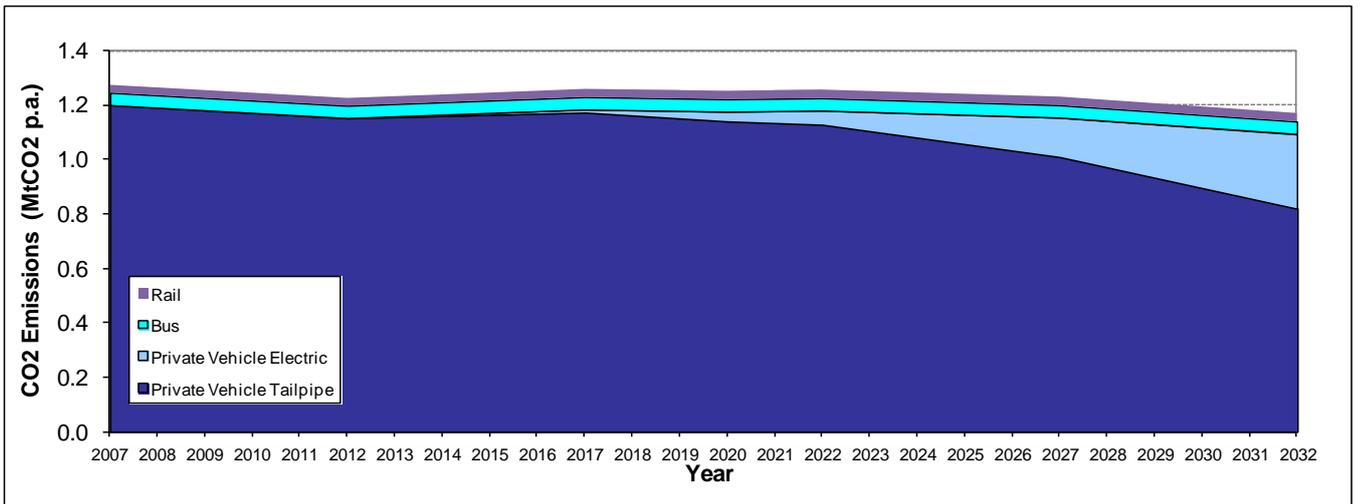


Figure 1.7 - Indicative breakdown of “CCC Carbon Budget Recommendations” scenario emissions by District/area – Tactran area

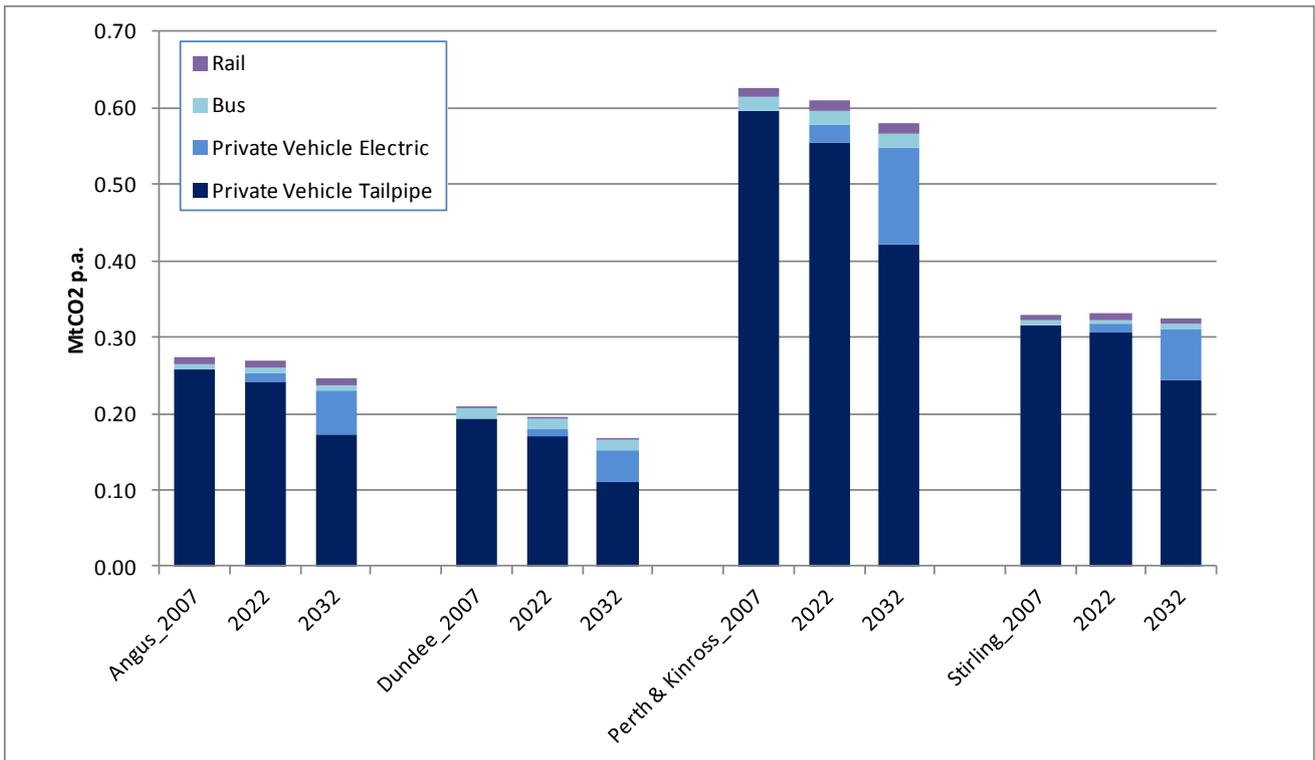
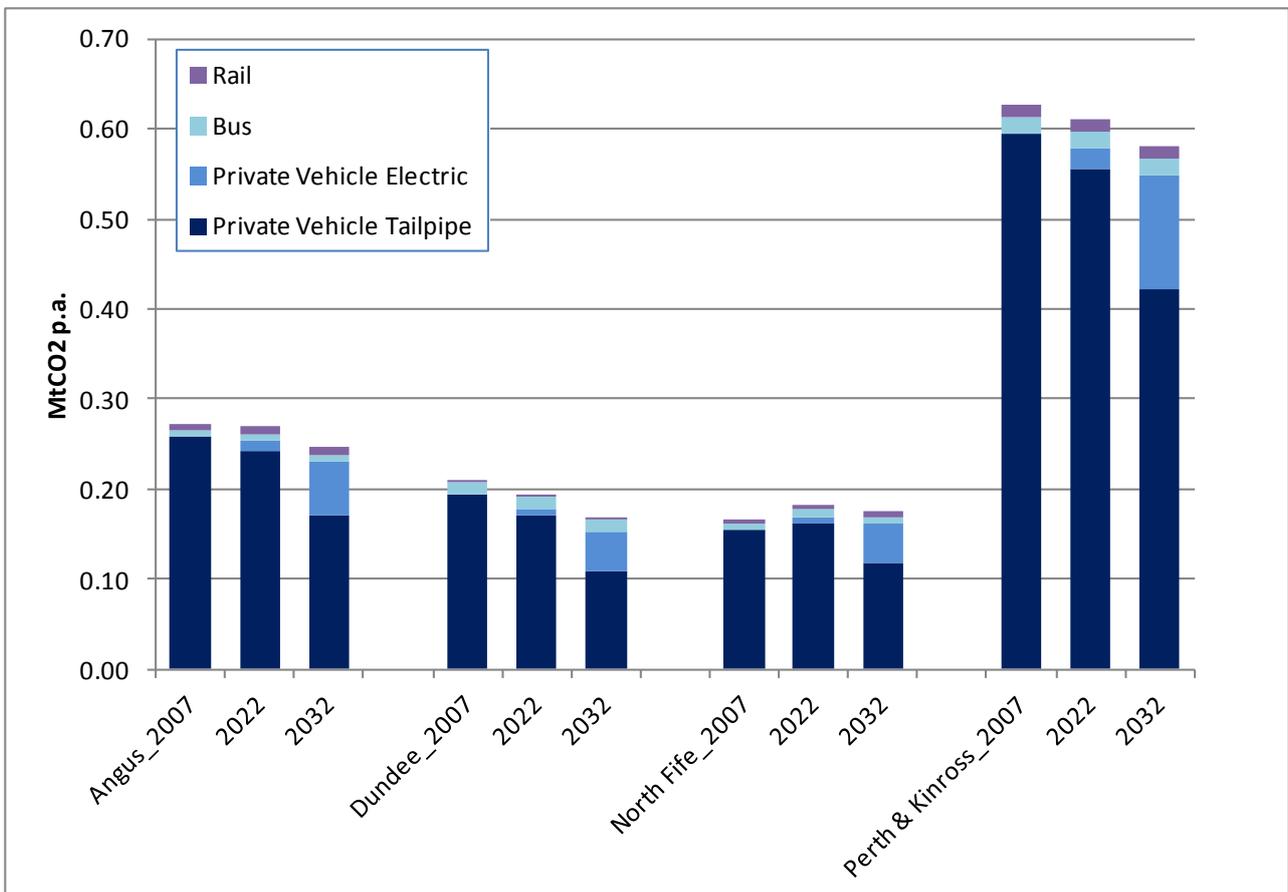


Figure 1.8 - Indicative breakdown of “CCC Carbon Budget Recommendations” scenario emissions by District/area – Tayplan area



1.6. Transport Carbon Assessment - Stage 2

The rest of this report summarises results and recommendations from the second stage of Tactran's transport carbon assessment, which focused on:

Task 1 – Presentation of outputs from Stage 1 to date at Tactran's Board

See Appendix A for the slides that were used during the presentation, which covered the following topics:

- Climate Change (Scotland) Act – duties for Tactran;
- Overview of conclusions from Workshop 1;
- Summary of baseline surface transport CO₂ emissions analysis for Tactran and Tayplan;
- Options for setting targets;
- Options for monitoring; and
- Next steps.

Task 2 – Mitigation options research and prioritisation

Our Stage 1 report provided a list of potential measures to mitigate carbon emissions from land transport, grouped into the six categories and identified in terms of those that have already been implemented to some extent in Scotland and Tactran area and those that are potential future options. We built on this original list to:

- Identify those options that could be delivered by Tactran and its constituent Councils;
- Draw together a more detailed description of relevant mitigation options for the Tactran/Tayplan area;
- Undertake a qualitative assessment of the likely impact (high, medium or low) of each option in terms of abatement potential, deliverability and cost, based on the body of evidence and experience we have accumulated over the last 5 years from our detailed studies of mitigation options for a range of study areas; and
- Prioritise measures most suitable for investment on the basis of cost effectiveness.

Task 3 – RTS Monitoring Framework Guidance and Review of Current Delivery Plan

The impacts of transport measures on CO₂ emissions cannot be measured directly because levels of CO₂ cannot be measured directly as the gas disperses in the atmosphere and has the same impact on the climate change process wherever it is located in the atmosphere. Monitoring of impacts of a strategy such as the RTS on CO₂ emissions therefore requires careful monitoring of changes in transport indicators for which a clear causal link can be identified between the indicator measured (such as vehicle kilometres travelled) and CO₂ emissions levels, with definitions and scopes carefully and narrowly defined to reduce the scope for complicating issues and double counting. Impacts of new schemes are therefore likely to be 'monitored' through an estimate/monitoring of their impact on the identified indicators (like vehicle kilometres and fuel consumption) and therefore the implied impact on emissions. This is the approach adopted for the National Carbon Budget.

We have reviewed existing indicators and identified possible indicators for measuring, relevant approaches for doing so and available data, including the local authority emissions statistics published by DECC, data used for the Scotland Carbon Account for Transport and RPP1/2 monitoring, and monitoring frameworks set out through SOAs.

Finally, using our database of abatement potential for carbon abatement measures we have undertaken a qualitative assessment of all the measures listed in the existing Delivery Plan to establish the relative accumulative abatement potential. We have also repeated this exercise to consider climate change

adaptation and the existing Delivery Plan's potential to contribute towards network / system resilience to climate change impacts.

Task 4 – Detailed Analysis of Prioritised Options

The detailed analysis involved:

- Further research into the prioritised options to estimate costs for implementation in the area;
- Modelling of the estimated abatement potential of each prioritised option in the forecast years of 2017, 2022, 2027 and 2032.
 - Modelling has used the spreadsheet model (based on TMfS outputs) developed for the baseline analysis in the Phase 1 report;
 - Each option has been represented using a bottom up approach, identifying the categories of trips affected by the measure (e.g. commuting trips) and the impact on the number and length of trips and typical fuel efficiency of travel;
 - These inputs have been converted into estimated changes in traffic and fuel consumption and therefore carbon emissions on the basis of national average statistics on trip characteristics by trip type (e.g. average number and length of commuting trips) and using additional information from TMfS on trip characteristics in the Tactran/Tayplan area;
 - The impact of each option has been identified relative to the two baselines presented in the Phase 1 report (i.e. with and without CCC recommended action on electric vehicle uptake); and
- Commentary on the relative abatement and cost performance of the prioritised options and identifying key influences on the variation between them.

Task 5 – Adaptation Strategy Overview

In order to understand potential impacts of climate change on transport in the Tactran / Tayplan areas we have set out guidance on how Tactran and its constituent Councils could determine:

- The nature of historic climate change trends in the Tactran / Tayplan areas;
- Future climate change trends in the Tactran / Tayplan areas;
- The nature of risks likely to be faced by transport assets and services in the Tactran / Tayplan areas as a result of future climate change;
- The types of measure that could be taken to adapt to and mitigate the impacts of the risks faced; and
- Clear guidance on the next steps required to produce a more detailed adaptation strategy for the transport sector in the Tactran / Tayplan areas.

Scottish Government Second Report on Policies and Proposals (RPP2)

Between Stages 1 and 2 of the Tactran/Tayplan transport carbon assessment, the Scottish Government published its Draft Second Report on Policies and Proposals (RPP2), entitled “Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027”, in January 2013.

The package of policies and proposals included in RPP2 are estimated to have the capacity to deliver emission reductions in excess of Committee on Climate Change suggested reductions. This relies on Scotland improving energy efficiency in buildings, supporting the uptake of low carbon vehicles, investing to improve public transport and support sustainable and active travel, reducing waste and making the most of Scotland’s ecosystems and agriculture sector. RPP2 notes that the “*decarbonisation of electricity generation (is) a key driver (to) progress towards a low carbon economy*”.

For the transport sector, RPP2 identifies the following packages.

- **Package 1 – Policies and proposals to decarbonise vehicles.** By 2030, potentially 60% of new vehicles (over 30% of the fleet) will be plug-in hybrid or full electric, supported by the continued installation of charging facilities, increases in vehicle range and reductions in costs.
- **Package 2 – Road network efficiencies.** Using Intelligent Transport System (ITS) and average speed cameras on trunk roads to encourage driving at more efficient speeds.
- **Package 3 – Sustainable communities.** Aiming to encourage people to use more carbon friendly modes of travel through travel planning. This package also includes investment in public transport facilities and services, cycling, walking and car clubs.
- **Package 4 – Business engagement on sustainable transport.** Including the roll-out of fuel efficient driving, workplace travel planning and freight efficiencies.

Table 1.5: RPP2 estimated transport sector abatement (summary)

RPP2 transport sector	Annual abatement in 2020 (ktCO ₂ e)	Annual abatement in 2027 (ktCO ₂ e)
Policies		
Decarbonising vehicles (EU Directives)	1,243	1,727
Proposals		
Decarbonising vehicles	282	798
Sustainable communities	139	277
Business efficiencies	121	462
Network efficiencies	36	32
Lower emission potential in 2027 (against BAU)		750

2. Climate change mitigation

2.1. Introduction

This chapter sets out the findings associated with the assessment of potential climate change mitigation options for land transport in the Tactran / Tayplan areas. Details of the approach adopted and the outputs for the following key stages are provided:

- Option generation;
- Initial option development;
- Prioritisation; and
- Development and analysis of prioritised options.

2.2. Option generation and initial development

A long list of 39 climate change mitigation options for the land transport sector in the Tactran / Tayplan area was generated based on options that emerged whilst working with the Tactran Partnership during the development of the Stage 1 Report. The options in the long list were grouped into the following six categories:

- Low carbon vehicles;
- Low carbon fuels;
- More efficient use of vehicles;
- Shifting to more efficient modes;
- Reducing the need to travel and changing destinations; and
- Avoiding counter-productive investment.

The long list then went through a stage of development where the 39 options were:

- **Merged**, if appropriate, with similar / associated options; or
- **Sifted**, if deemed currently undeliverable,

This process created a short list of 22 options for the initial qualitative assessment and prioritisation. Full details of the long list, their origins, and the results of the merging / sifting exercise are presented in Appendix B.

2.3. Initial assessment and prioritisation of options

In order to prioritise the 22 options it was necessary to undertake a qualitative assessment of the:

- Likely **carbon abatement** of each option – based on % emission reduction for the Tactran / Tayplan areas, with High >20%, Medium >5%, Low >1%;
- Estimated **cost** - overall costs above £50million = High, above £10 million = Medium, above £1 million = Low, below £1 million = Very Low;
- Ratio of **Abatement / Cost (in millions)**; - High > 0.05, Medium > 0.01, Low > 0.005, less than 0.005 Very Low; and
- Anticipated **delivery level** – national, regional, and local.

The assessment was based on the body of evidence and experience Atkins have accumulated over the last 5 years working on similar mitigation studies, including the national study undertaken for the Scottish Government. Full details of the assessment are provided in Appendix C.

Once the options had been assessed they were prioritised for more detailed analysis based on their estimated abatement / cost effectiveness, and the degree to which Tactran could influence the option's implementation, leading to the following initial shortlist (in **bold** in Table 2.1):

- (2) Support/incentives for low carbon vehicles and infrastructure (focusing on electric vehicles including cars, vans and buses);
- (6) Eco driving advice and training (targeting car drivers, taxis, vans, buses);
- (12) Travel planning advice, behaviour change campaigns, Smarter Choices;
- (20) Development planning to support more efficient travel behaviours;
- (16) Rail infrastructure and service improvements and promotion; and
- (15) Public transport infrastructure and service improvements and promotion (excluding rail).

The remaining 16 options were not included on the short list for the following reasons:

- (8) Speed limit enforcement (RPP1 proposal) and reduction (trunk roads), (5) Gas (focusing on HGVs), and (1) Fuel efficiency standards for new vehicles (cars, vans and HGVs), including public sector procurement were ranked as 4, 5, and 6 respectively, however, it is expected that their implementation will be undertaken at an international or national level, with no role for regional or local government.
- (3) Taxis and private hire cars (improved fuel efficiency) was ranked 8th and was considered to be a local licensing issue with little regional influence.
- (19) Use of pricing mechanisms to encourage change to low carbon modes and reduce travel demand – instruments such as fuel prices and road pricing were considered to require a national level lead, and the key local / regional policy, increased parking charge, was considered to involve other significant policy objectives.
- (9) Car sharing schemes to increase car occupancy was ranked 10th, but it was considered best to take this forward as an integral part of (12) Travel planning advice, behaviour change campaigns, Smarter Choices.
- (18) Freight mode shift (road to rail and water) was ranked 13th, but this option was only estimated to provide very low abatement potential, and so, coupled with the significant delivery difficulties, this option was rejected for further development.
- (11) Freight loading improvements (incentives, consolidation centres, etc), (13) Cycling infrastructure and promotion, (10) Support to car clubs, (21) Promotion/support for home/flexible working, (22) Promotion/support for phone/teleconferencing, (17) Public transport fares (lower fares), (4) Biofuels (RTFO, Scottish Biofuel programme, etc), (14) Walking infrastructure and promotion, (7) Intelligent transport system and traffic management to improve efficiency – all the options were estimated to have very low abatement potential and very low cost effectiveness and were therefore not considered in any more detail. In addition it was considered that support to car clubs (10) would be in the form of grants for electric vehicles and therefore the option is included in support for low carbon vehicles and infrastructure (2).

Table 2.1: Stage 2 long list ranking by initial assessment of abatement potential versus cost

Rank ⁴	Option	Abatement	Cost	Abatement / Cost	Tactran role	Delivery (National, Regional, Local)
1	(2) Support to low carbon vehicles and infrastructure	High	Medium	High	Yes	N, R, L
2	(6) Eco driving advice and training	Medium	Low	Medium	Yes	N, R
3	(12) Travel planning advice, behaviour change campaigns	Medium	Medium	Medium	Yes	R,L
4	(8) Speed limit enforcement (RPP1 proposal) and reduction (trunk roads)	Low	Low	Low	No	N
5	(5) Gas (focusing on HGVs)	Very low	Very low	Low	No	N
6	(1) Fuel efficiency standards for new vehicles (cars, vans and HGVs), including public sector procurement	Low	Medium	Low	No	N
7	(20) Development planning	Low	Low	Low	Yes	R, L
8	(3) Taxis and private hire cars (improved fuel efficiency)	Low	Low	Low	No	L
9	(19) Use of pricing mechanisms to encourage change to low carbon modes and reduce travel demand (e.g. fuel prices, road pricing, congestion charging, focussing on car parking charges and management here)	Low	Low	Low	Yes	N, R, L
10	(9) Car sharing schemes to increase car occupancy	Low	Low	Low	Yes	R, L
11	(16) Rail infrastructure and service improvements and promotion	Low	High	Very low	Yes	N, R
12	(18) Freight mode shift (road to rail and water)	Very low	Low	Very low	Yes	N, R, L
13	(15) Public transport infrastructure and service improvements and promotion (excluding heavy rail)	Low	High	Very low	Yes	R, L
14	(11) Freight loading improvements (incentives, consolidation centres, etc)	Very low	Medium	Very low	Yes	N, R, L
15	(13) Cycling infrastructure and promotion	Very low	Medium	Very low	Yes	N, R, L
16	(10) Support to car clubs	Very low	Low	Very low	No	L
17	(21) Promotion/support for home/flexible working	Very low	Low	Very low	No	L
18	(22) Promotion/support for phone/teleconferencing	Very low	Low	Very low	No	L
19	(17) Public transport fares (lower fares)	Very low	High	Very low	No	N
20	(4) Biofuels (RTFO, Scottish Biofuel programme, etc)	Very low	Low	Very low	No	N
21	(14) Walking infrastructure and promotion	Very low	Medium	Very low	Yes	N, R, L
22	(7) Intelligent transport system and traffic management to improve efficiency	Very low	Medium	Very low	Yes	N, R, L

2.4. Option analysis and modelling

This section sets out modelling assumptions and approaches used to represent the impact of the six shortlisted transport carbon mitigation options in the Tactran and Tayplan areas.

The modelled form of each option has been defined in the context of the likely available budget for Tactran and its four local authorities. For four of the options considered below (support/incentives for low carbon vehicles, eco-driving training and advice/behavioural change, travel planning and road based public transport improvements), the potential budget range is reflected through the consideration of Low, Medium and High funding availability scenarios; identified as the implementation of measures costing approximately £100,000 p.a., £300,000 p.a. and £500,000 p.a. respectively, over the period between 2014 and 2030.

This approach is not relevant for the development planning option (for which three different levels of enforcement are tested instead) or for the rail option which involves the representation of a defined proposed measure.

The following paragraphs provide further detail on each mitigation option and its representation within the modelling to estimate the potential carbon savings for the Tactran and Tayplan areas.

2.4.1. Support/incentives for low carbon vehicles and infrastructure⁵

Modelling assumptions

For each modelled scenario, 90% of the funding was assumed to be spent on providing grants to support the purchase of electric vehicles and the remaining 10% on providing additional charging points, focussing particularly on filling gaps in the local charging network left by the nationally funded investment (described in Appendix F). For the Low investment scenario, grants are assumed to be provided to support the purchase of 10 electric cars and 5 electric vans p.a. from 2014 to 2020 and 20 cars and 10 vans p.a. from 2021 to 2030 (assuming that the grants required per vehicle halve after 2020 as vehicle prices reduce). The additional funding was assumed to be spent on providing 2 additional standard charging points p.a. between 2014 and 2020 and 8 every three years between 2021 and 2030 (assuming a 25% reduction in costs per unit after 2020).

In the Medium investment scenario, grants were assumed to support the purchase of 30 electric cars and 15 vans p.a. from 2014 to 2020 (and 60 cars and 30 vans p.a. from 2021 to 2030). Expenditure on charging points was assumed to fund 3 standard points and 1 rapid charger every 2 years between 2014 and 2020 and 6 standard points and 2 rapid chargers every 2 years between 2021 and 2030.

In the High investment scenario, the grants were assumed to fund support for 50 cars and 25 vans p.a. between 2014 and 2020 and 100 cars and 50 vans p.a. between 2020 and 2030. Expenditure on charging points was assumed to fund 1 standard point and 1 rapid charger every year between 2014 and 2020 and 4 standard points and 4 rapid chargers every 3 years between 2021 and 2030.

As an example, the Medium scenario would support the purchase of 315 vehicles between 2014 and 2020 and a further 900 between 2021 and 2030. This level of purchase would lead directly to approximately 0.1% of the car fleet registered in the Tactran area and 0.3% of the van fleet being electric by 2020. By 2030 the equivalent figures would be approaching 0.2% of cars and 0.9% of vans⁶. The existing fleet in the Tayplan area is slightly smaller than that in the Tactran area, so the proportional impacts on fleet are slightly larger, reaching nearly 0.25% of cars and 1% of vans by 2030. Therefore, in each area, the impacts of the investment make a small direct contribution to the required level of electric vehicle take up for Scotland identified by the Draft RPP2 and in the Committee on Climate Change (CCC) Extended Ambition scenario to 2020⁷ and Medium Abatement scenario to 2030⁸, as presented in the table below.

Table 2.2: CCC suggested required electric vehicle take up

Vehicle type	% of electric vehicles in fleet		
	2008	2020	2030
Car	0%	5% ⁹	31%
Van	0%	5%	29%
HGV	0%	0%	0%

Although it is recognised that awareness raising and issues such as confidence in the charging network are an important part of promoting vehicle use, there is no available evidence on the extent to which such

indirect effects impact on uptake. The modelled impacts of this option have therefore been restricted to the direct impact of the electric vehicles purchased with support from the grant scheme.

Costs

Infrastructure costs were based on the assumption that standard charging points cost £5000 per unit on average between 2014 and 2020 and rapid charging points to cost £45,000¹⁰. These costs were assumed to reduce by 25% on average for the period 2020 to 2030, reflecting technological developments and expansion of the market.

Vehicle support costs were based on UK plug-in car and van grants of up to £5,000 for electric cars and £8,000 for electric vans, assumed to halve after 2020 as vehicles become cheaper, allowing the support of additional grants each year.

Table 2.3: Estimated costs for Tactran investment from 2014 to 2030

	Investment Scenario		
	Low	Medium	High
Investment p.a. to support vehicle purchase			
Electric cars	£50,000	£150,000	£250,000
Electric vans	£40,000	£120,000	£200,000
Standard Charging Points	£10,000	£7,500	£5,000
Rapid Charging Points	£0	£22,500	£45,000
Total	£100,000	£ 300,000	£ 500,000
No of units purchase supported p.a. 2015-2020			
Electric cars	10	30	50
Electric vans	5	15	25
Standard Charging Points	2	1.5	1
Rapid Charging Points	0	0.5	1
No of units purchase supported p.a. 2021-2030			
Electric cars	20	60	100
Electric vans	10	30	50
Standard Charging Points	2.67	2.00	1.33
Rapid Charging Points	0.00	0.67	1.33

Abatement impact

The modelled estimated impacts of each scenario on CO₂ emissions in the Tactran and Tayplan areas in 2020 and 2030 are summarised in the table below (Appendix D provides the equivalent information for 2017, 2022, 2027 and 2032). The figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a. and are discussed further in section 2.5. It is noted that these results represent the net effect of the reduction in tailpipe emissions and increase in emissions associated with electricity generation for the vehicles. In line with the baseline forecasts and CCC assumptions, the electricity generation mix is assumed to be equivalent to the current UK wide mix. If alternative assumptions were made, including a higher assumed proportion of generation from renewable sources, the net emissions saving would increase more than two fold on average.

Table 2.4: Modelled reduction in CO₂ emissions in Tactran and Tayplan areas (tCO₂ p.a.)

Scenario	Tactran		Tayplan	
	2020	2030	2020	2030
Low	100	150	50	150
Medium	250	500	200	500
High	400	850	350	800

2.4.2. Eco driving advice and training

Modelling assumptions

For the modelled scenarios, support for eco-driving training is assumed to achieve reductions in fuel use and associated emissions on the basis of the following assumptions:

- Fuel efficiency gain for trained drivers: 7% reduction in fuel use once the driver is trained¹¹, reducing to 5% from 2025 (due to improvements in vehicle efficiency which reduce potential fuel savings from training). Improvements assumed to exclude electric vehicles, new drivers and HGV drivers who are already trained through the driving test/professional training¹²;
- Proportion of drivers trained: 4%, 13%, 22% of existing drivers assumed to be trained between 2015 and 2019 in the Low, Medium and High investment scenarios respectively¹³ (as stated above, this refers to non commercial vehicle types only and assumes new drivers are covered by initial driving training);
- Training assumed to be renewed every 5 years.

Figure 2.9: Extract from draft RPP2 technical annex (page 48)

4.4.23 Commencing in 2012, it is assumed an on-going promotional and awareness raising campaign will eventually reach all driving licence holders. It is assumed that this campaign would result in 85% of the driving population undertaking free face-to-face eco-driving training sessions by 2027 with a refresher update every 5 years.

Costs

Costs were based on the assumption of £50 per training session (based on published evidence)¹⁴ with 100% of costs borne by the public sector and the number of drivers trained estimated based on the number of licence holders registered in the Tactran and Tayplan areas and driving regularly (approximately 230,000 in each case).

Table 2.5: Summary of eco-driving training cost assumptions for Tactran or Tayplan area

Eco driving training cost assumptions			
	Low	Medium	High
Cost per session	£50	£50	£50
% cost covered by public sector	100%	100%	100%
Public sector cost per session (£)	£50	£50	£50
Total licence holders in target group for area	230,000	230,000	230,000
% target group covered by training (total over 5 years)	4%	13%	22%
Total number of sessions	10,000	30,000	50,000
Total public sector costs (£)	£500,000	£1,500,000	£2,500,000
Initial training period (2015 to 2019) (training then repeated on 5 yearly cycle)	5 years	5 years	5 years
Public sector cost per year (£, undiscounted)	£100,000	£300,000	£500,000

Abatement Impact

The modelled estimated impacts of each scenario on CO₂ emissions in the Tactran and Tayplan areas in 2020 and 2030 are summarised in the table below. (Appendix D provides the equivalent information for 2017, 2022, 2027 and 2032). As above, the figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a. and are discussed further in section 2.5.

Table 2.6: Modelled reduction in CO₂ emissions in Tactran and Tayplan areas (MtCO₂ p.a.)

Scenario	Tactran		Tayplan	
	2020	2030	2020	2030
Low	2250	1800	2250	1800
Medium	7350	5800	6800	5350
High	12500	9850	11350	8950

2.4.3. Travel planning training and advice, behaviour change campaigns and Smarter Choices

Modelling assumptions

In each modelled scenario, support is assumed to be aligned to draft RPP2 objectives to “undertake the widespread roll out of travel planning targeting the workplace, schools and households. A full roll out is expected to reduce urban car commuting trips, with a smaller reduction in rural car commuting trips. Business trips, school escort trips and leisure escort trips are also expected to decline”¹⁵.

Modelling assumptions are not detailed in the draft RPP2 documents with regard to the expected coverage of travel plans and personalised journey planning. The assumptions below for this study are therefore derived from RPP1 travel planning assumptions, adjusted on the basis of household and workplace numbers to match the annual total funding available for the specified Low, Medium and High investment scenarios:

- personalised travel planning (PTP) offered to a target group of 8%, 24% and 40% households by 2019 in the Low, Medium and High investment scenarios respectively (with implementation starting in 2014);
- an additional 8%, 24% and 40% of large workplaces (above 30 staff) assumed to implement an effective travel plan by 2019 in the Low, Medium and High investment scenarios respectively (continuing implementation from current levels, with all Local Authority staff/locations assumed to be covered by travel plans already).

The following assumptions were made with regard to the impact of PTP and travel planning at workplaces, based on published evidence:

- PTP take up rate (programme participants as a proportion of target population) of 30%¹⁶;
- PTP impact: 5% reduction in distances driven by car for trips of 50km or less¹⁷ for all trip purposes (except for trips covered by workplace travel planning – see below)¹⁸;
- Workplace travel planning impact: reduction in car travel of 15% across all sites targeted¹⁹ for commuting and business trip purposes;
- Reduction in car travel assumed to reflect transfer to existing public transport services, walking, cycling, changes in destination and or decision not to travel²⁰.

PTP assumed to be renewed every five years and WTPs assumed to have ongoing annual costs.

Costs

Total costs were derived based on the following unit costs derived from published evidence:

- PTP costs: assumed to be £80 per participating household²¹, fully supported by the public sector (Tactran); and
- Workplace travel planning costs: assumed to be £3 per employee targeted²²

Table 2.7: Summary of travel planning cost assumptions

	Tactran			Tayplan		
	Low	Medium	High	Low	Medium	High
Personal Travel Planning						
Public sector cost per household	£80	£80	£80	£80	£80	£80
Total households	247,000 ^[i]	247,000	247,000	248,500 ^[ii]	248,500	248,500
%age targeted (total over 5 years)	8%	24%	40%	8%	24%	40%
% take-up (amongst target group)	30%	30%	30%	30%	30%	30%
Total number of training sessions	6,000	18,000	29,500	6,000	18,000	30,000
Total public sector costs (£)	£480,000	£1,335,000	£2,220,000	£480,000	£1,335,000	£2,220,000
Initial training period (2015 to 2019) (training then repeated on 5 year cycles)	5 years	5 years	5 years	5 years	5 years	5 years
Public sector cost per year (£, undiscounted)	£96,000	£288,000	£472,000	£96,000	£288,000	£472,000
Workplace Travel Planning						
Public sector cost per employee	£3	£3	£3	£3	£3	£3
Total employees in firms > 30 employees	100,000 ^[iii]	100,000	100,000	90,000 ^[iv]	90,000	90,000
%age targeted (total over 5 years)	8%	24%	40%	8%	24%	40%
% take-up (amongst target group)	100%	100%	100%	100%	100%	100%
Total number of training sessions	8,000	24,000	40,000	7,000	21,500	36,000
Total public sector costs (£)	£60,000	£180,000	£300,000	£60,000	£180,000	£300,000
Initial training period (2015 to 2019) (training then repeated on 5 year cycles)	5 years	5 years	5 years	5 years	5 years	5 years
Public sector cost per year (£, undiscounted)	£4,800	£14,400	£24,000	£4,200	£12,900	£21,600
Total public sector cost per year (£, undiscounted)	£100,800	£302,400	£496,000	£100,200	£300,900	£493,600

Abatement impact

The modelled estimated impacts of each scenario on CO₂ emissions in the Tactran and Tayplan areas in 2020 and 2030 are summarised in the table below. (Appendix D provides the equivalent information for 2017, 2022, 2027 and 2032). As above, the figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a. and are discussed further in section 2.5.

Table 2.8: Modelled reduction in CO₂ emissions in Tactran and Tayplan areas (MtCO₂ p.a.)

Scenario	Tactran		Tayplan	
	2020	2030	2020	2030
Low	3150	3550	2700	3000
Medium	9250	10500	7950	8900
High	15100	17200	13000	14600

2.4.4. Development planning

Modelling assumptions

In the modelled scenarios, support is assumed to influence planning decisions that lead to a change in travel behaviour for a percentage of the trips associated with new developments in the main urban areas (particularly Dundee and Perth, along with Stirling in the Tactran option) between 2014 and 2030; meaning that mode share for trips to and from the developments achieves the proportions achieved in exemplar towns, quoted in the DfT's Eco-town guidance²³, cited as 23% walking, 27% cycling, 18% PT, 6% car passenger, 26% car drivers.

The change in trip numbers between 2014 and 2030 was identified on the basis TMfS input planning data.

The proportion of new development trips affected is assumed to build up to 10%, 15% and 20% by 2020 in the Low, Medium and High intensity of implementation scenarios. (NB these are not Low, Medium and High investment scenarios as implementation costs are likely to be similar at each level of intensity, based on staff training and costs only).

The Scottish Government's SPACE spreadsheet tool²⁴ could potentially have provided an alternative approach. However, it was judged disproportionately detailed for the purposes of this study as it requires inputs for each development area (e.g. residential, commercial etc) with details such as area, density of development etc. The approach to calculating transport carbon used within SPACE is relatively simple (using average trip lengths, mode shares and WebTAG calculations of carbon per kilometre) and should produce results consistent with those produced through the TMfS based spreadsheet tool developed for this study if a comparable analysis is done at a later date.

Costs

Costs were assumed to be limited to be supporting training and salary costs for planning staff in the four districts required to establish and implement the measures, estimated to be in the order of £50,000 throughout for either the Tactran or Tayplan area.

Abatement impact

The modelled estimated impacts of each scenario on CO₂ emissions in the Tactran and Tayplan areas in 2020 and 2030 are summarised in the table below. (Appendix D provides the equivalent information for 2017, 2022, 2027 and 2032). As above, the figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a. and are discussed further in section 2.5.

Table 2.9: Modelled reduction in CO₂ emissions in Tactran and Tayplan areas (tCO₂ p.a.)

Scenario	Tactran		Tayplan	
	2020	2030	2020	2030
Low	1650	3700	1750	3700
Medium	2500	5650	2600	5650
High	3350	7600	3450	7650

2.4.5. Rail infrastructure and service improvements and promotion

Modelling assumptions

The TERS (Tay Estuary Rail Study) preferred option for delivering a generally hourly service between Glasgow and Arbroath (with interchange for some services at Perth)²⁵ is assumed to be implemented using public sector funding. Note that this option differs from the other five, as the funding would be provided by Transport Scotland and the rail industry via the ScotRail Franchise rather than by Tactran, Tayplan or constituent authorities, although they would play a role in supporting the investment.

The impacts of the option on emissions were estimated through estimates of the impacts on the number of train and car kilometres travelled.

Train kilometre estimates were based on details of the frequency and length of the service and the type of train to be operated (provided from the business case for the scheme).

Impacts on car emissions were estimated through the TERS representation of the impacts of the service on demand and the carbon modelling process applied for the rest of the options

Costs

The scheme has an estimated present value of cost £60 to £65 million (depending on start up option selected) over a 60 year appraisal period after opening (in 2002 prices and values)²⁶.

Abatement impact

The modelled estimated impacts of TERS on CO₂ emissions in the Tactran and Tayplan areas in 2020 and 2030 are summarised in the table below, based on the results from the business case for the scheme produced in 2011²⁷. (Appendix D provides the equivalent information for 2017, 2022, 2027 and 2032). The figures show a net increase in emissions, taking account of the net effect of increased emissions due to increased rail operations, offset by reduced emissions associated with mode switch from car to rail. As above, the figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only¹, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a. and are discussed further in section 2.5.

Table 2.10: Modelled reduction in CO₂ emissions in Tactran and Tayplan areas (CO₂ p.a.)

Scenario	Tactran		Tayplan	
	2020	2030	2020	2030
	-1700	-1700	-1300	-1300

2.4.6. Road based public transport infrastructure and service improvements and promotion

Modelling assumptions

The model scenarios assume that funding supports measures to improve the quality of passengers' journeys on key routes in the area and to reduce the carbon emissions generated by the bus fleet; building on the measures implemented within the Tactran/Tayplan area, such as Smartbus in the Dundee area. Modelled improvements are assumed to start in 2014, with renewal undertaken on a 5 to 10 year cycle, varying by measure.

The package of measures assumed to be implemented varies with the three scenarios of investment level, follows. Assumptions are common to both the Tactran and Tayplan areas unless otherwise stated:

- Low:
 - The Tactran scenario, assumes introduction of RTPi in Perth and Kinross and then Stirling (building on the systems already in place within Dundee and Angus). The Perth and Kinross system is assumed to be established over the first 2 years and then operated during the establishment of the Stirling system (assumed to share the same server and system) over the subsequent 2 years. Both assumed to be established with limited on street infrastructure initially, focussed on the key hubs, with reliance on passengers using mobile phones to access data elsewhere. Ongoing software and GPRS costs are assumed to be met by Tactran and the additional budget (£30,000 p.a. from year 5 to 10) assumed to be invested in additional street infrastructure as suggested in the feasibility study. Infrastructure is assumed to be renewed on 10 year cycle.
 - The Tayplan scenario follows the same pattern but assumes introduction of an RTPi system in Fife rather than Stirling (recognising that, as well as influencing trips to/from and within the Tayplan, North East Fife area, the system will generate significant benefits that will be experienced in the area of Fife that lies outside of the Tayplan boundaries).

¹ The proportion of total TERS emissions impact allocated to each area was identified on the basis of the proportion of rail length between Glasgow and Arbroath falling in the area in the absence of more detailed information. Approximately 2/3 falls within Tactran and 50% within Tayplan area.

- Medium: As Low plus
 - Provision of wifi on 20 buses per year, focussing on longer routes (renewed on a 5 yearly cycle with operating and maintenance costs between renewals assumed to be covered by operators). (Building on the recent introduction of wifi to the Stagecoach Tayway Service 73 from Arbroath to Dundee and the Coastway coach service X7 from Aberdeen to Dundee). For the Tactran scenario, routes served include those within and on corridors to Stirling. For the Tayplan scenario, these routes are replaced with those from the more urban areas of North East Fife (including St Andrews to Dundee) as well as some additional, relatively populated routes from Angus.
 - Provision of on-bus GPS based audio visual passenger information provided on 20 vehicles per year (building on provision in Dundee and renewed on a 5 yearly cycle, maintenance between renewals assumed to be covered by operators). As for wifi installation, for the Tactran scenario, routes served include those within and on corridors to Stirling. For the Tayplan scenario, these routes are replaced with those from the more urban areas of North East Fife (including St Andrews to Dundee) as well as some additional, relatively urban routes from Angus ;
 - Provision and maintenance of 10 smart ticket vending machines and 20 points of presence (in shops and other location) per year along the corridors from Dundee to Arbroath, Forfar and Perth to extend the reach of the smart ticketing system currently being piloted in Dundee (renewed on a 10 yearly cycle).
- High: As Medium plus
 - Funding of grants to support the purchase of low carbon buses during fleet renewal, by funding the majority of the cost differential between low carbon vehicles and their diesel equivalent (in line with the approach taken by the Scottish Green Bus Fund). Grants to support the purchase of 5 vehicles every 2 years.

The bus quality measures are all assumed to improve bus quality without negative impact on journey times for other modes.

The key influence on the scale of impact of bus quality measures on carbon abatement is the potential to achieve large scale mode switch from car driver trips. The routes selected were therefore those that have high volumes of demand and reasonably long journey lengths (and therefore significant potential for a reduction in car trips due to mode-switch). This reflects the focus on reducing carbon emissions rather than meeting other objectives such as accessibility.

Census journey to work data²⁸, suggests movements between Dundee and Angus, Fife and Perth, have the highest trip volumes within the Tactran area, along with movements within Dundee, between Clackmannshire and Stirling, Falkirk and Stirling and within Perth. However, the Dundee and Angus routes have benefitted significantly recently from quality infrastructure improvements and measures to improve the bus fleet. Therefore, for the measures identified above, where the measure is already in place for some of the corridors, the expenditure was assumed to be made only on other routes.

Impacts of bus quality measures on emissions were estimated through estimates of forecast impacts of the improvements on the number of car kilometres travelled (assuming that bus kilometres remain unchanged as there is no change in service frequency and length and that any changes in emissions due to changed bus speed balance out on average²⁹).

Impacts on car travel were estimated through forecasts of Reference Case patronage (from TMfS) and guidance in terms of:

- the 'value' of improvements in bus quality to passengers in terms of equivalent minutes of in-vehicle time saved;³⁰
- elasticities of change in travel demand to change in travel cost (from the costs represented in TMfS, which account for Reference Case changes in transport supply and congestion); and
- the proportion of any increase in bus patronage assumed to be drawn from previous car driver trips.

Impacts of grants for low carbon buses were estimated on the basis of the number of vehicle kilometres travelled per bus p.a. and the emissions differential between the low carbon vehicle and its diesel equivalent.

Costs

The cost assumptions used were drawn from a number of sources, particularly recent submissions to DfT for funding for Better Bus Area Bids and Major Scheme bids as set out below.

Table 2.11: Bus improvement cost assumptions and sources

Improvement	Price per unit	Source	Renewal frequency (years)
RTPI system set up and ongoing costs	Set up costs: £320,000 (covering both districts) Ongoing costs £70,000 p.a. (when both districts implemented)	2011 feasibility study for RTPI for Perth and Kinross (assuming costs for Stirling and Fife are equivalent but server and software and links to other systems do not need duplication) ³¹	10 (for street equipment)
Audio-visual passenger information	£2,500	South Hampshire Better Bus Area Fund Bid, 2012 ³² , 2012 TAS Report for Guide Dogs ³³ , Announce System Brochure, 2004 ³⁴	5
On bus wifi provision	£2,500	South Hampshire Better Bus Area Fund Bid ³² and internet newspaper articles	5
Smart ticket points of presence	£3,000	Cost of on bus machine 2012 Better Bus Area Fund Bids including Luton ³⁵ and York ³⁶	10
Smart ticket vending kiosks	£4,000	Cost of on bus machine 2012 Better Bus Area Fund Bids including Luton ³⁵ and York ³⁶	10
Grant to cover the cost differential between low carbon buses and their diesel equivalents	£80,000	Based on values of grants provided in Tranches 1 and 2 of the Scottish Green Bus Funding ³⁷	n/a

Abatement impact

The modelled estimated impacts of each scenario on CO₂ emissions in the Tactran and Tayplan areas in 2020 and 2030 are summarised in the table below. (Appendix D provides the equivalent information for 2017, 2022, 2027 and 2032). As above, the figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a. and are discussed further in section 2.5.

Table 2.12: Modelled reduction in CO₂ emissions in Tactran and Tayplan areas (tCO₂ p.a.)

Scenario	Tactran		Tayplan	
	2020	2030	2020	2030
Low	50	50	50	50
Medium	100	100	100	100
High	1100	1500	1150	1550

2.5. Mitigation – summary of findings

This section summarises the estimated impact of each of the modelled options described above on transport carbon emissions in the Tactran and Tayplan areas.

The estimated annual abatement in the Tactran area achieved by four of the options is presented graphically in Figures 2.1 and 2.2 below for 2020 and 2030 respectively. The equivalent information for the Tayplan area is provided in Figures 2.3 and 2.4. A number of key points are relevant in the consideration of the results presented.

- The figures shown represent estimates of direct reduction in CO₂ emissions from travel in the Tactran or Tayplan area only³⁸. For some of the measures shown there will also be further emissions reductions benefits associated with:

- indirect impacts on abatement caused by the measure (for instance increased propensity to buy electric vehicles amongst the wider population caused by increased awareness of and confidence in electric vehicles caused by the presence and awareness of electric taxis and charge points); and
 - impacts outside the Tactran or Tayplan area (e.g. emissions savings achieved by electric vehicles registered in Tactran/Tayplan areas on the element of travel undertaken outside of the boundaries of the Tactran/Tayplan area).
- The graphs only consider impact on CO₂ emissions and do not account for the varying wider impacts. For instance, the bus measures would generate accessibility/social inclusion impacts and eco driving would generate fuel savings.
 - The results are presented for the ‘support for low carbon vehicles’, ‘eco-driving’, ‘travel planning’ and ‘road based public transport’ measures as they are directly comparable, each presenting the annual emissions abatement achieved in the Tactran/Tayplan area by the intensity of implementation achieved through Low, Medium and High levels of annual investment (£100,000, £300,000 and £500,000 p.a. respectively). Comparing the heights of the bars for the equivalent scenario (Low, Medium or High) for each option therefore provides a sense of cost effectiveness of each measure (identifying the amount of abatement assumed to be achieved for that level of investment).
 - Results for the Tactran and Tayplan areas follow a very similar pattern, reflecting the fact that baseline emissions, traffic and population levels are similar in the two areas, for instance baseline emissions in the Tayplan area are approximately 90% of those in the Tactran area. The minor differences evident reflect factors such as the slightly lower fleet size in the Tayplan area, varying relative contribution of different vehicle types (such as car and HGV) to emissions and varying average level of through traffic in the areas.
 - The results for the other two options are not included on the graphs as they are not directly comparable:
 - The development planning option scenarios considered different levels of intensity of implementation of planning measures in urban areas, rather than different levels of investment (each level of intensity scenario was assumed to cost £50,000 p.a. to implement)
 - The rail option is quite distinct from the other five as it represents the net emissions impact from the TERS hourly rail service between Glasgow and Arbroath. Although the scheme is within the Tactran/Tayplan areas, unlike the other measures, this option would be funded through investment from other public sources, the role of Tactran, Tayplan and their constituent authorities would be to support the scheme.

Figure 2.2: Estimated Annual CO₂ Tactran Emissions Reductions for Each Measure and Scenario in 2020 (t CO₂ p.a.,)

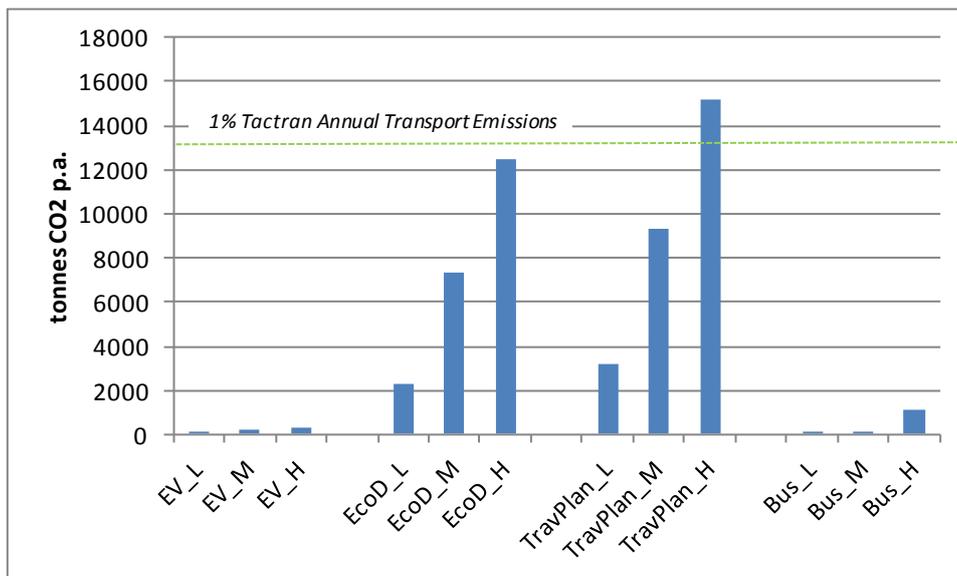


Figure 2.3: Estimated Annual CO₂ Tactran Emissions Reductions for Each Measure and Scenario in 2030 (t CO₂ p.a.,)

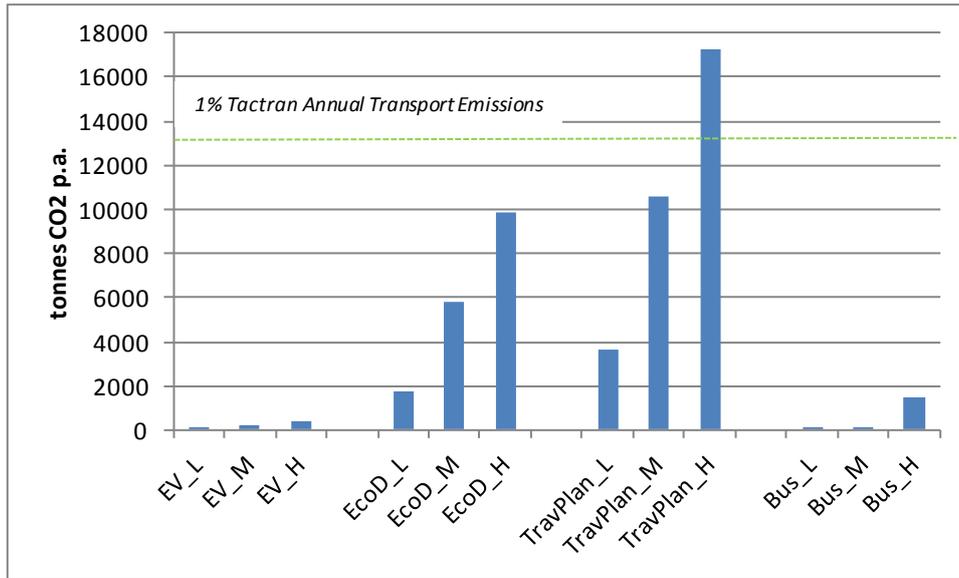


Figure 2.2: Estimated Annual CO₂ Tayplan Emissions Reductions for Each Measure and Scenario in 2020 (t CO₂ p.a.,)

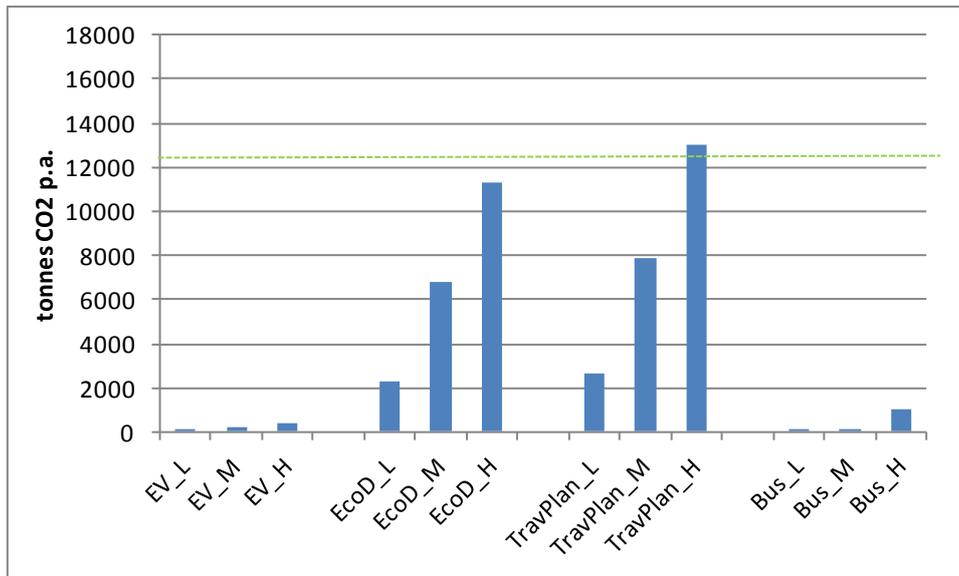
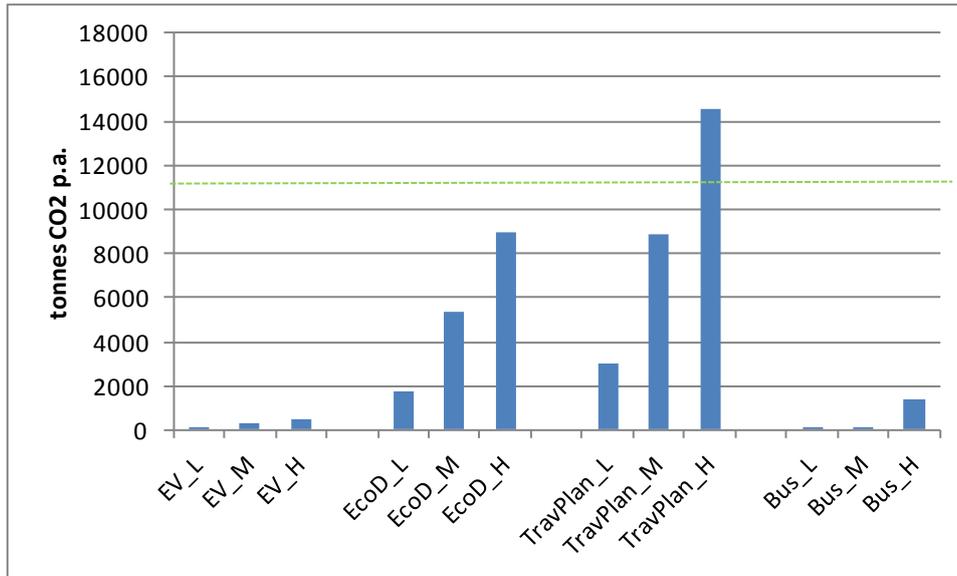


Figure 2.3: Estimated Annual CO₂ Tayplan Emissions Reductions for Each Measure and Scenario in 2030 (t CO₂ p.a.,)



Travel Planning

The model results suggest that the pattern of results for the Tactran and Tayplan areas is very similar and that, when considering direct CO₂ emissions reductions in either area in isolation, investment in travel planning is the most effective form of expenditure, particularly in later years. The modelled measure is forecast to achieve emissions reductions of between 3,500 and over 17,000 tonnes p.a. within the Tactran area in 2030 in the Low and High investment scenarios respectively. The equivalent figures for the Tayplan area are savings of between 3,000 and over 14,500 tonnes p.a. within the area in 2030 in the Low and High investment scenarios respectively. The impact of the High scenario is equivalent to nearly 1.3% of the total Tactran land transport emissions and over 1.2% of the total for the Tayplan area.

It is also important to note that the national effect of the measure will be around 50% greater than the effect within the Tactran/Tayplan areas when the impact on travel by drivers from the Tactran/Tayplan area on roads beyond the Tactran/Tayplan boundaries are taken into account.

Eco Driving

Investments in eco-driving measures are estimated to achieve emissions reductions of nearly 10,000 tonnes p.a. in the Tactran area and nearly 9,000 tonnes p.a. in the Tayplan area in the High scenario in 2030 and (equating to over 0.7% of annual land transport emissions in each case). Again the full national abatement impact of the measures would be approximately 50% greater, reflecting the impact on those elements of trips that start or end in the Tactran/Tayplan area but occur partially outside.

Quality Bus Measures

The direct impact of the bus quality measures is more limited. The Low and Medium scenarios consist of bus quality measures only and achieve emissions reductions of less than 200 tonnes p.a. by 2030 in both areas. This reflects the relatively small proportion of trips carried by bus in the region and the fact that CO₂ reductions rely on mode switch from car to bus, which only occurs in relatively low volumes.

The High investment bus scenario also includes investment in supporting the purchase of more efficient buses and achieves significantly larger emissions savings in both areas (approximately 1,500 tonnes p.a. in both areas), suggesting that, when considering CO₂ abatement impacts in isolation, measures to upgrade the bus fleet are a more effective investment than measures to encourage mode switch through bus quality improvements.

Support for Low Carbon Vehicles

The direct emissions impacts of the measure to support low carbon vehicles in the Tactran and Tayplan area are limited (reaching a maximum of over 800 tonnes p.a. in the High scenario in 2030 in all both areas). This is due to the limited scale of investment considered in the modelling (restricted to Tactran's sphere of influence and budgetary constraints) and contrasts with the much larger scale of investment considered in the initial assessment to identify the short list of options which incorporated UK and Scottish Government initiatives and resulted in the measure being identified as "high abatement potential".

This difference highlights the significance of scale of investment for this measure. As shown by UK and Scottish Government initiatives in this area (summarised in Appendix F), the development of a significant

market for electric vehicles requires considerable financial support in the early years. Large scale investment is important to generate the scale of activity and awareness needed to drive the change in behaviour required for widespread uptake of vehicles. Isolated investment at a small scale (such as the option tested) is likely to lead to limited direct effects, as identified in the modelling and, whilst indirect wider impacts such as improved awareness and confidence in electric vehicles would occur, their scale would be highly dependent on the level of investment and activity in the sector by other bodies and cannot readily be quantified. It is also important to note that the benefits of widespread uptake of electric vehicles would continue to build up beyond the timescales considered in this study, as the cost of electric vehicles would decrease, the need for purchase grants would be removed and the proportion of electric vehicles in the fleet would continue to rise.

The results of this option therefore suggest that, although Tactran could have a role in supporting electric vehicles take up for a small proportion of the fleet in the region, national initiatives are required to support take up across Scotland/the UK, provide appropriate charging infrastructure and achieve the large scale uptake of electric vehicles required for large scale emissions reductions.

In this regard, although the absolute number of vehicles purchased through this measure would represent a limited proportion of the total private vehicles in the Tactran and Tayplan areas, the impact would be accentuated if the car investment was targeted at specific high impact areas such as car clubs, council fleet vehicles and the taxi/private hire fleet. The vehicles purchased through the support would account for a significant proportion of the fleet (for instance the Tactran taxi fleet is currently approximately 1400 vehicles³⁹). The approach would also have the benefit of targeting vehicles that travel above average distances, largely within the urban areas and are particularly visible to the public, increasing their awareness, experience and confidence in electric vehicle operation, helping to promote further uptake.

Development Planning

As noted above, the development planning option is not included on the graphs presented above as it takes a different form to the other options tested (with scenarios varying by intensity rather than investment level). By 2030, it is forecast to have a broadly similar scale of impact to the eco-driving option in both the Tactran and Tayplan areas, estimated to achieve emissions reductions of approximately 7,600 tonnes p.a. in both areas in the High scenario in 2030 (equating to approximately 0.6% of annual land transport emissions in each case). The higher levels of impact in the Tayplan reflect greater forecast development levels in the Tayplan area than Tactran and the higher average car mode share (leading to greater savings when the target is achieved). Again the full national abatement impact of the measures would be approximately 50% greater, reflecting the impact on those elements of trips that start or end in the Tactran/Tayplan area but occur partially outside.

Rail Service Improvements

The TERS rail option discussed above is also not included in the graph as it differs from the other options. As described, the role of Tactran, Tayplan and constituent authorities would be to provide support rather than funding for this scheme, with other public sector bodies providing the investment through the ScotRail Franchise. Forecasts suggest that the scheme would cause a net increase in CO₂ of approximately 1,700 tonnes p.a. in the Tactran area and 1,300 tonnes p.a. in the Tayplan area⁴⁰. The scheme would encourage mode shift away from car, thereby reducing emissions. However, the forecast composition of the rail rolling stock within TERS suggests that the CO₂ savings achieved by the mode switch (approximately 450 tonnes p.a. in Tactran and 350 tonnes p.a. in Tayplan) would be more than offset by the increase in CO₂ associated with the additional rail services (approximately 2,200 tonnes p.a. and 1,600 tonnes p.a. for the Tactran and Tayplan areas respectively).

There are a number of issues that could mitigate against this predicted increase in CO₂. Firstly, since the TERS study reported, nationally there has been a stronger than predicted growth in rail passenger use suggesting there might be a greater than predicted mode shift from car to rail. Secondly, it should be noted that TERS aimed to “fit” additional services around existing rolling stock and timetables and more efficient use of rolling stock could be achieved as part of recasting the timetable during the ScotRail refranchising in 2015, potentially achieving the TERS option and national rail aims and objectives and reduce overall train mileage. Thirdly, the emissions increase would be ameliorated or reversed if the service used more efficient rolling stock or the line was electrified, particularly if the electricity was derived from low carbon sources. If the line was electrified and powered with zero carbon renewable energy, the net impact of the TERS option would be the 350 tonne to 450 tonne saving in CO₂ p.a. due to mode switch from car.

Across all options tested, a further relevant factor to inform decision making is the relative performance of the options through time. Most notably, the impacts of the development and travel planning options and support to low carbon vehicles build up as the number of trips affected cumulatively increases, whilst eco-driving’s impact decreases as cars become more efficient.

Finally it should be noted that while all options within this report have been assessed for their potential for CO₂ emissions mitigation, this is only one consideration and these options also have a role to play in assisting Tactran in meeting its overarching objectives for economy, accessibility, environment, health and well-being, safety and integration.

3. Climate change adaptation

3.1. Statutory duties

The Climate Change (Scotland) Act 2009⁴¹ includes duties for public bodies in relation to climate change in Scotland. Section 44 of the Climate Change (Scotland) Act 2009 requires:

‘that public bodies must act in the way best calculated to help deliver any such statutory adaptation programme.’

In February 2011 the Scottish Government published “Public Bodies Climate Change Duties: Putting Them Into Practice”⁴², which provides guidance for public bodies on how they should deliver their legal obligation within the Climate Change (Scotland) Act 2009.

3.2. Adaptation in Scotland

Scotland's Climate Change Adaptation Framework⁴³ was published by the Scottish Government in December 2009. It provides details on the Government's strategic direction for climate change adaptation, and recognises the importance of action at a local level by individual organisations. The framework is accompanied by 12 sector specific action plans, including one for transport that sets out key issues and actions.

The UK Government published the UK Climate Change Risk Assessment (CCRA)⁴⁴ in January 2012. This document contains the results of the first UK wide climate change risk assessment. The report provides information on the threats and opportunities that the UK will face over the coming century. The assessment is disaggregated by 11 different sectors, including transport, and also provides outputs specific to Scotland.

During 2013 the Scottish Government anticipates that it will publish The Climate Change Adaptation Programme, which will set out how it intends to address the risk identified for Scotland in the CCRA.

3.3. Outline of an adaptation strategy

International best practice in climate adaptation is still evolving, however, a number of bodies, including Adaptation Scotland, have set out the key elements to developing and implementing a robust climate change adaptation action plan. The key steps are set out below and discussed further on the following pages:

- Understand historical trends and baseline vulnerability;
- Establish future changes in climate and assess vulnerability to climate change;
- Develop an adaptation plan;
- Implement actions; and
- Monitor and evaluate.



3.4. Understanding historical trends and establishing baseline vulnerability

Considering the current vulnerability of assets and services is the first key stage to a climate change vulnerability assessment and the development of an adaptation strategy⁴⁵.

Understanding historic trends

The current weather and climate variables to be considered as part of the assessment need to be identified, and this should be informed by a review of **historical weather trends**. Variables could include:

- Annual average precipitation / temperature;
- Seasonal average precipitation / temperature;
- Precipitation / temperature extremes;
- Ice and snow;
- Fog;
- Wind speed and direction;
- Sunshine hours; and
- Humidity.

It is important to make a distinction between weather and climate variables, and secondary effects. For example, high levels of rainfall can be associated with flooding, and extended periods of dry conditions could lead to drought. It is therefore important to record any assumptions made about the relationship between climate variables and secondary effects.

Database of recent weather events & consequences

Once the review of historical weather trends has been undertaken, then it is recommended that a database of recent weather events and the consequences is created using data sources for the last 5 to 10 years. The database should focus on identifying the consequences of past weather events on assets and services⁴⁶. Information collated should include the following:

- Damage costs;
- Number of people affected;
- Impact on service operation; and
- Remedial action necessary.

There are a number of potential data sources available:

- National or local government departmental records;
- National or local media reports (whilst the media may not provide a authoritative source of weather and

Historic Trends in Scotland (1961 to 2004)

The SNIFFER Handbook of Climate Trends Across Scotland provides data on the observed historical trends in Scotland between 1961 to 2004. The keys trends are presented below:

- Temperatures have risen in every season in Scotland.
- Scotland had become 20% wetter by 2004, with an increase of almost 70% in precipitation in northern Scotland. Heavy rainfall events have increased significantly in winter, particularly in northern and western regions.
- The snow season has shortened across the country, with the season starting later and finishing earlier in the year. The greatest reductions have occurred in northern and western Scotland.
- The growing season has increased significantly, with the greatest change occurring at the beginning of the season.
- There has been more than a 25% reduction in the number of days of frost (both air and ground frost) across the country.
- Changes in sea levels around Scotland vary. All mainland gauges have recorded a rise over the last 100 years but in Shetland there has been a decrease since 1957.

Source: SNIFFER Handbook of Climate Trends Across Scotland *SNIFFER (2006)*

Case study: Assessing the impact of weather and climate on Dorset's (UK) roads

In order to ensure future resilience and efficient investment in the road network, Dorset County Council's Highways team required an assessment of the risk associated with climate change. The UK Met Office was commissioned to undertake a study to assess the impact of climate change on the county's road network.

The study started with a review of recent weather events and associated impact on the highway network, drawing on the expert knowledge of Council staff. The relationship between weather events, reactive maintenance and emergency response, as well as changes to design and regular maintenance was documented. This allowed the study team to gain insight into the types of weather event, such as heavy rainfall or heatwaves that cause the greatest problems for the Council's Highways team.

The initial phase of the study helped Dorset County Council's Highways team agree priorities for adaptation to the impacts of climate change. The output of the study was used to inform the Council's short, medium and long term highways asset management strategies.

Met Office (2011)

http://www.metoffice.gov.uk/media/pdf/r/f/Dorset_CC_CS.pdf

climate information, it does report the consequences of weather events⁴⁷);

- Industry press;
- Insurance claims records;
- Emergency services records; and
- Public and private sector annual reports.

Establishing baseline vulnerability

Establishing an understanding of the vulnerability of the transport system to current weather will require an assessment of:

- The sensitivity and exposure of the system's assets and services to weather risks; and
- The system's adaptive capacity.

The database of recent weather events and their consequences can be used to help with this assessment.

It is useful to develop a list of prompts to consider when assessing the sensitivity of the transport system to current weather and climate variables.

Prompts for considering **sensitivity** of assets and services in the transport sector at a national scale include:

- Age of assets;
- Construction materials e.g. asphalt, concrete;
- Broad design and construction techniques, e.g. is the asset embanked or not?
- Usage profile e.g. traffic levels, passenger numbers, diurnal/seasonal timing of journeys etc;
- Ground conditions e.g. broad soil type and geology underlying assets;
- Susceptibility to landslides, rockfalls and erosion.

It is also useful to think about sensitivity in terms of specific thresholds beyond which sensitivity significantly changes. For example, the melting point of bitumen road surfaces could be a threshold that determines the sensitivity of a road pavement to higher temperatures. Thresholds can often be quantified e.g. the temperature at which speed restrictions are applied on the railway due to the risk of buckling.

The **exposure** of assets and services to weather and climate variables will depend on their location and geographical characteristics, for example assets at higher elevations are more likely to be exposed to snow and ice than those in lowland areas. Prompts for considering exposure of transport assets and services to weather and climate variables include:

- Regional/local temperature and precipitation trends;
- Elevation;
- Thunderstorm areas;
- Slope aspect; and
- Proximity of assets to rivers/sea and steep slopes.

Exposure can also be considered in terms of historical incidence of exceeding sensitivity thresholds. For example, the average number of days per year that speed restrictions are applied as a result of weather conditions.

Adaptive capacity depends on factors which affect the ability of the asset or service to adjust to weather or climate variables, this is often linked to organisational factors that provide information and processes for dealing with extreme weather events. In general these systems are well developed in Scotland.

Prompts to consider when assessing adaptive capacity of transport assets and services include:

- Funding and investment;

- Condition of assets;
- Maintenance regime e.g. ditch clearance, verge cutting;
- Weather monitoring and forecasting;
- Early warning systems e.g. flood, landslide; and
- Institutional cooperation e.g. government departments, asset owners, service operators, emergency services etc.

Based on the assessment of sensitivity, exposure and adaptive capacity, **a relative vulnerability classification** should be assigned to each asset or service using a qualitative scale, such as:

- Very high
- High
- Medium
- Low
- Very low.

Such a classification will highlight the relative vulnerability of assets and services rather than describing the absolute vulnerability of a particular asset in isolation.

Vulnerability classification is a subjective process, informed by judgment and based on the information provided in terms of sensitivity, exposure and adaptive capacity. It is important that the assessment of sensitivity, exposure and adaptive capacity is clearly set out in order to make the justification for vulnerability classification as logical and transparent as possible.

3.5. Establishing future changes in climate and assessing vulnerability to climate change

Once baseline vulnerability to current weather and climate is understood, the next stage in the process should focus on identifying the future impacts of climate change. Assessing the vulnerability of systems to climate change follows similar steps to the assessment of baseline vulnerability but the focus is on changing exposure rather than sensitivity and adaptive capacity.

Changes in climate variables to be considered as part of the assessment should be identified. Changes in the selected variables should be identified using climate change projections that are available from DEFRA (UKCP09), supported by additional information where required, such as data from the UK Met Office.

The sensitivity and adaptive capacity of assets and services should not change as a result of changing climate variables. However, exposure is likely to change and could alter vulnerability.

The anticipated magnitude of the costs associated with the risks identified through the climate change vulnerability assessment should then be considered. Depending on the nature and scale of the assessment and the availability of data, costs can be expressed quantitatively or qualitatively.

Undertaking a quantitative assessment of costs involves identifying and measuring climate impacts in physical, quantifiable units and converting these impacts into monetary values. There are various techniques for quantifying impacts, including:

Climate change - projected trends in Scotland

Key trends:

- Hotter, drier summers
- Milder, wetter winters

Also expect to see:

- Extreme temperatures
- Intensity of extreme precipitation events
- Sea level rise

Source:

<http://ukclimateprojections.defra.gov.uk/21678>

- Measuring change in inputs or outputs (change in productivity) and user costs (for example longer journey times);
- Replacement cost - particularly appropriate for quantifying impacts on assets;
- Averted expenditure - more appropriate for costing adaptation actions;
- Primary valuation of assets which are not normally quantified in monetary terms e.g. biodiversity, health and amenity.

When undertaking such an assessment, the following principles apply:

- Many impacts will be felt over a long time period, as such, discounting needs to be applied when costing future impacts.
- Impacts in one sector or region may have knock-on effects elsewhere which should be identified and included in the cost calculation where possible.
- Climate change impacts can result in “non-marginal impacts”, which can affect the relative price of goods or services or even the underlying growth rate of the economy. This should be incorporated into valuations where possible.

Qualitative methods may be more appropriate for high level studies or in situations where data is unavailable to quantify impacts. Costs can be expressed using a high, medium or low scale (e.g. £ for low cost, ££ for medium cost and £££ for high cost).

Potential impacts and opportunities from climate change on the transport system in Scotland

Impacts:

- Infrastructure damage and closure caused by local flooding.
- Landslides and flooding of roads and railway tracks.
- Potential damage to earthworks for embankments and bridges.
- Excess water on roads creating road hazards.
- Damage to rail tracks and road surfaces in extreme weather.
- High temperatures – damage road surfaces and railway tracks.
- Increased growth of vegetation increased requirements maintenance.
- Coastal erosion may result in rerouting of coastal routes.
- Rising sea levels may reduce usefulness of existing harbour infrastructure.

Opportunities:

- Less snow and ice in winter.
- Use of alternatives to transport which will increase resilience and in many cases may also reduce carbon emissions.

Source: <http://www.adaptationscotland.org.uk/2/55/0/Transport.aspx>

3.6. Developing an adaptation plan

An adaptation plan should then be developed to set out prioritised measures for responding to the impacts of climate change. Measures should aim to either reduce vulnerability or maximise opportunities associated with climate change. This section sets out guidance for developing and implementing robust adaptation plans, based on good practice from across Europe.

Planned adaptation measures can be defined as either:

- Building Adaptive Capacity (BAC); or
- Delivering Adaptation Action (DAA).

BAC measures involve developing institutional capacity to successfully adapt to climate change. Institutional capacity to adapt involves having the right information, regulation, management, expertise and frameworks in place to respond to climate risks and opportunities. BAC measures seek to increase this capacity through activities such as: monitoring risks and opportunities; information sharing; developing relationships with stakeholders; and developing adaptation legislation.

DAA measures are practical actions to reduce vulnerability or maximize opportunities associated with the impacts of climate change. In the context of the transport sector, DAA measures might include: building flood defences along a road; altering the choice of construction materials; or changing timetables to reflect changes in diurnal or seasonal temperature.

An adaptation plan is likely to include both BAC and DAA measures.

An adaptation plan should include a list of prioritised and appropriate adaptation measures. At an early stage in development of an adaptation plan, a long list of potential adaptation measures is likely to exist. It is important that the final adaptation plan contains measures which target areas of high vulnerability (or opportunity) and fulfil the criteria of ‘good adaptation’.

The choice of criteria for selecting adaptation measures will depend on the context of the adaptation plan i.e. location, scale, sector, data availability and the nature of vulnerabilities and opportunities. However, there are some features of ‘good adaptation’ that are common across contexts:

- Managing climate and non-climate risks (delivering multiple benefits) – climate change is not the only challenge and adaptation should be delivered in the context of overall economic and sustainability and other objectives. Successful adaptation measures therefore often deliver multiple benefits (win-win). Addressing non-climate risks is also likely to increase support and buy-in for adaptation measures.
- Managing priority climate risks – the results of the vulnerability assessment should help to identify priority areas for adaptation. Successful adaptation measures should address these priority areas, reducing vulnerability or maximising opportunities.
- Addressing today’s climate variability and extremes – successful adaptation starts by addressing vulnerability to current weather and climate. The results of the baseline vulnerability assessment should help to identify current vulnerability. Addressing vulnerability to today’s climate is also likely to increase support and buy-in for adaptation measures.
- Managing uncertainty – uncertainty is inherent in climate change projections and vulnerability assessments, but it can be managed through flexible adaptation measures (no- and low-regrets measures) and adaptive management. No-regrets measures are worthwhile (i.e. they deliver net socio-economic benefits) whatever the extent of future climate change. Low-regrets measures are measures for which the associated costs are relatively low and for which the benefits, although primarily realised under projected future climate change, may be relatively large. Adaptive management deals with uncertainty by responding with incremental adaptation measures accompanied by monitoring of impacts and outcomes of measures to assess effectiveness and to set further adaptation as required.
- Not limiting adaptation efforts of other sectors/organisations – it is important that action taken in one sector or organisation does not have negative consequences on the ability of others to adapt. Good adaptation measures should not conflict or restrict adaptation efforts elsewhere. The impacts of potential adaptation measures on other sectors should therefore be considered.
- Delivering adaptation and not conflicting with mitigation efforts or using resources unsustainably – mal-adaptation must be avoided. Maladaptive actions do not succeed in reducing vulnerability to climate change but increase it and/or reduce the capacity to cope with the negative effects of climate change. Good adaptation measures should not be associated with an increase in greenhouse gas emissions or unsustainable resource use.
- Integration with existing policies and processes - adaptation should not be undertaken in isolation from existing policies and processes. Good adaptation measures therefore, should align with existing policies and be integrated with existing instruments (in the environmental sector and beyond) where possible. However, where modification of existing policies, structures and processes is insufficient to handle adaptation needs, new instruments may be required.

Successful adaptation often requires cooperation between sectors. Partnership working can engender broad support for adaptation measures and allow synergies to be exploited and conflicts to be minimised; although some measures may be delivered by a single organisation e.g. rail maintenance. However, it is important that all relevant stakeholders are involved in the development of the long-list of adaptation measures and the MCA.

3.7. Implementing an action plan

Once adaptation measures have been selected, an implementation plan is required. An implementation plan sets out:

- The objective of each measure;
- How adaptation measures will be implemented e.g. through new or existing processes, policies and procedures;

- The roles and responsibilities of organizations and individuals involved in implementing adaptation actions;
- Links to other activities within the organization – opportunities for synergies and mainstreaming of adaptation measures;
- Approximate resource requirements e.g. cost, staff, equipment;
- How adaptation measures will be communicated;
- Potential barriers to implementation and strategies to overcome them;
- The timetable for implementation; and
- How the measure will be monitored and evaluated.

3.8. Monitoring and evaluation

Once adaptation plans have reached the implementation stage, it is important that measures are monitored and evaluated to assess how they are meeting the objectives of the plan and delivering adaptation.

There is no single framework for evaluating adaptation measures as the challenges encountered will be different for each organisation, sector and adaptation plan. However, there is guidance for organisations wishing to design a monitoring and evaluation programme to measure the success of adaptation plans:

Key steps in developing an adaptation monitoring and evaluation plan include:

- Define the purpose of monitoring and evaluation;
- Establish indicators; and
- Undertake evaluation.

In order to provide meaningful results, the purpose of monitoring and evaluation should be defined at the outset. The purpose of monitoring and evaluation may be to:

- Evaluate effectiveness – have adaptation measures achieved what they were intended to do?
- Assess efficiency – what are the costs and benefits associated with adaptation measures?
- Understand equity – how have adaptation measures affected communities and individuals differently and are these consistent with intended effects?
- Provide accountability – are commitments and expectations being met by adaptation measures?
- Assess outcomes – what are the outcomes and impacts of adaptation measures?
- Improve learning – what works (and what did not) and why?
- Improve future interventions – how should future adaptation measures be implemented?
- Compare with other places, sectors, organisations etc.

The purpose of evaluation will depend on the objectives of the adaptation plan and requirements of the body responsible for its delivery. The purposes of evaluating a transport sector adaptation plan are likely to be understanding effectiveness, assessing efficiency and outcomes and providing accountability, particularly where external funding is involved. All evaluations should include a degree of learning as this is an important aspect of adaptive management.

3.9. Delivery Plan

An initial assessment has been undertaken to assess projects within Tactran's existing delivery plan that could offer a significant enhancement or reduction to the transport systems resilience to climate change. See Appendix E.

4. Monitoring framework for carbon abatement

This section introduces indicators which could be used by Tactran/Tayplan to monitor progress with regard to CO₂ emission reduction in the transport sector. The key indicators selected aim to be consistent with indicators currently used by the Scottish Government where possible.

4.1. Key indicators

Table 4.1 presents the four indicators identified as possible key indicators to measuring progress on CO₂ emission reduction for the Tactran/Tayplan area. These outcome indicators are similar to those used by Transport Scotland in the national Carbon Account for Transport (CAT).

Table 4.2 introduces some additional indicators which could be used to monitor outputs and outcomes of the six selected mitigation measures.

Table 4.1: Key indicators recommended for Tactran to monitor progress on CO₂ emissions mitigation

Key indicator	What is it measuring?	Notes
Road vehicle kilometres travelled by vehicle type and road type	Any decrease in vehicle km for example through reduced number of trips, change of destination or transfer to other modes	Link to CAT, should be possible to disaggregate data, issues with time lag and top down data to be considered
Road transport fuel consumption per vehicle kilometre (fuel consumption per vehicle km and per 1,000 of population)	Vehicle efficiency	Link to CAT, issues with time lag and top down data to be considered
Proportion of new road vehicles that are alternatively fuelled (primary method of propulsion is neither petrol nor diesel)	Vehicle efficiency, share of low carbon vehicles, linked to CCC assessment of required levels of take-up	Link to CAT, data currently available for new registrations of EVs for Plugged-in-Places project
Modal share of public transport and active travel (tracking average distance travelled per person per annum by public transport, walking or cycling)	Any increase in the use of public transport, walking and cycling	Link to CAT, similar to indicator 14 in Current indicators in Regional Transport Strategy, would need to include freight mode share data as well (19), issues with time lag and top down data to be considered

Table 4.2: Additional indicators which could be included in a monitoring framework

Additional indicator	What is it measuring?	Notes
Fuel efficiency of newly registered vehicles in the area	Vehicle efficiency	DVLA data, Plugged-In-Places monitoring data, SMMT data
Number/proportion of drivers trained in eco-driving	Driver training take-up	To be monitored through training programme against number of driving licence holders in the area
Number/proportion of households having been offered personalised travel planning / Proportion of households actively engaged in PTP	Travel planning/PTP take-up	To be monitored through PTP programme against number of households in the area

Additional indicator	What is it measuring?	Notes
Number of employees/proportion of all employees/employers (>30 staff) covered by "effective" travel plans	Travel planning take-up	To be monitored through travel planning programme against business statistics for the area Close to Indicator 6 in Regional Transport Strategy, although currently limited to Council and Health Board employees
Bus/rail patronage and distance per passenger	Any increase in the use of public transport	To be monitored through patronage figures provided by operators, Transport Scotland, the DfT, the Office for Rail Regulation, etc.
Population density in newly developed areas/infill areas	Impact of development planning policy	Based on estimated existing densities and new densities following land use development in selected areas Could be difficult to assess accurately Alternative would be to undertake monitoring surveys (travel patterns) for newly developed areas (once occupied)

4.2. Using the UK Greenhouse Gas Inventory

A number of greenhouse gas and energy datasets are produced under the National Atmospheric Emissions Inventory (NAEI)⁴⁸, which are useful to better understand emissions at the local level. These datasets include:

- local and regional CO₂ emissions (all sectors);
- road transport fuel consumption and non-gas; and
- non-electricity and non-road transport fuel consumption.

The road transport dataset is calculated using a bottom-up approach by combining:

- fleet-weighted fuel consumption factors (in g fuel/km) for each main vehicle type (more precise for cars and vans than for HGVs and buses due to data limitations),
 - vehicle fleet composition data based on licensing statistics and evidence from Automatic Number Plate Recognition (ANPR) data from DfT, providing an indication of the vehicle mix by engine size, vehicle size, age, engine and exhaust treatment technology, Euro emission standards, and fuel type as observed on different road types⁴⁹; and
 - fuel consumption factors based on a combination of surveys on average fuel efficiencies of the vehicle fleet and published compilations of factors derived from vehicle emission test data from various UK and European sources⁴⁹;
- traffic activity data provided by the Department for Transport (DfT);
- normalisation process to make these estimates add up to the amounts of petrol and diesel fuel sales reported in the Digest of UK Energy Statistics (DUKES)

This dataset can provide a useful source of information for the Tactran/Tayplan area but it will need to be used with caution due to the following factors:

- the data is not made available on a regular basis and is usually published with at least a year's delay which means that it is not always appropriate to monitor trends in emissions against policies which have been implemented;

- the dataset does not reflect local measures to reduce transport emissions (for example, low carbon buses introduced) and therefore is not a reliable source of information to monitor the impact of all transport sector abatement options proposed in this document;
- there is a higher level of uncertainty for fuel consumption estimates when considered at the local level (compared to national level). This is due to a range of factors including local variations in the fleet (vehicle age and fuel mix, for example the traffic in some areas might be made up of a higher proportion of diesel cars or older cars), road and driving conditions (variations in average speeds⁵⁰, congestion, road gradient, driving style and vehicle maintenance) which are not factored in this dataset.

4.3. Road vehicle kilometres travelled by vehicle type and road type

This indicator aims to monitor trends in road vehicle usage in the Tactran/Tayplan area. Decreases or increases in total vehicle kilometres can be linked to reductions or increases in resulting tailpipe emissions (also depending on vehicle efficiency – see below).

Decreases in total vehicle kilometres are likely to result from reductions in the number of motorised trips undertaken in the area (transfer to other mode or trip reduction), reductions in the distance covered by motorised trips (partial transfer to other mode or change in destination/origin resulting in shorter trip).

Data on road traffic by region and local authority for Great Britain (motor vehicles/car traffic and including or excluding trunk roads) is available from the UK Department for Transport (DfT) statistics. This is released annually by the DfT and available here: <https://www.gov.uk/government/organisations/department-for-transport/series/road-traffic-statistics>

Transport Scotland also publishes data on road traffic by local authority in Scotland, based on DfT data, including:

- Traffic on major roads (by class / type) and on minor roads, by Council, available here: <http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j251205-070.htm>, and
- Traffic on trunk roads and on local authority roads, by Council area, available here: <http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j251205-071.htm>.

4.4. Road transport fuel consumption per vehicle kilometre (fuel consumption per vehicle km and per 1,000 of population)

The national Carbon Account for Transport (CAT) published by Transport Scotland uses data on “petrol and diesel consumption of road vehicles” from the Scottish Transport Statistics⁵¹ to monitor fuel consumption per vehicle kilometre in Scotland. This data is also available from the Scottish Transport Statistics at the local authority level and could therefore be used to monitor trends in the Tactran/Tayplan area.

This data is however based on DECC data⁵² from the National Atmospheric Emissions Inventory (NAEI). As such, it is subject to limitations similar to those described above for the UK Greenhouse Gas Inventory. In particular, the dataset is unlikely to reflect the impact of local measures to reduce transport sector emissions and is therefore not a reliable source of information to monitor trends at the Tactran/Tayplan level.

Local fuel sales data might provide an alternative to Scottish Transport Statistics/DECC data which would potentially better reflect local changes in fuel consumption. This would need to be collected from local stations (excluding the motorway network) and should reflect changes in local transport fuel use. This data would however need to be treated with caution as increases/decreases in fuel use could be linked to changes in overall vehicle kilometres rather than to vehicle efficiency.

As an alternative to this indicator, Tactran could use the following data which should reflect changes due to local initiatives more closely:

- fuel efficiency of newly registered vehicles in the area (from the DVLA and/or SMMT – see below); and

- driver training uptake in the area, as a proportion of the total number of driving licence holders in the area, and potentially supported by more detailed monitoring data from the training programme (driver monitoring and survey for pre-training and post-training fuel efficiency).

4.5. Proportion of new road vehicles that are alternatively fuelled

The national Carbon Account for Transport (CAT) published by Transport Scotland uses data on “new registrations by taxation group, body type and method of propulsion” from the Scottish Transport Statistics⁵³ to monitor the take-up of alternative fuel vehicles.

This data set, as published in the Scottish Transport Statistics, is however not disaggregated to local authority level so Tactran/Tayplan would need to use alternative data sources to monitor progress in the area. Potential sources include:

- DVLA data (quarterly or annual)⁵⁴, not currently published at regional/local authority level with regard to alternative fuel/electric vehicles but potentially available on request;
- Plugged-In-Places monitoring data, available at local authority level for Scotland and for projects related to Plugged-In-Places – vehicles benefitting from the grants only (see Table 4.3); and
- SMMT data, including breakdown of new registrations on a monthly basis with regional/postcode information, sales type (private/fleet/business) and CO₂ emissions⁵⁵ (data would need to be purchased, cost unknown).

Table 4.3: Electric vehicles registered under Plug-In-Places grant (data courtesy of Plug-In-Places programme and Cenex)

Area ⁵⁶	Electric vehicles registered using Plug-In-Places grants between 2010 and November 2012		
	Electric cars	Electric vans	Total
Angus	0	0	0
Dundee	39	7	46
Perth and Kinross	6	0	6
Stirling	10	0	10
Tactran area total	55	7	62
Fife (partially within Tayplan area)	18	10	28
Rest of Scotland	115	20	135
Tactran area in % of Scotland	29%	19%	28%

4.6. Modal share of public transport and active travel (average distance travelled per person per annum by public transport, walking or cycling)

Data from the DfT, Scottish Transport Statistics is relevant to monitor mode share for the whole of Scotland but is not currently available at the local authority level. An initial step could be to check availability with the Scottish Government (although sample sizes and resulting confidence intervals are probably the limiting factor in disaggregating this data to the local authority level).

Scottish Household Survey (SHS) data includes Travel Diaries and questions on travel habits⁵⁷ and some data is available at the local authority level⁵⁸. The SHS aims to support the National Performance Framework by measuring five National Indicators including “*increase the proportion of journeys to work made by public or active transport*”⁵⁹. Data releases might however not be frequent enough to support regular monitoring activities for the Tactran/Tayplan area (the latest local authority data release available on the internet is 2007/08).

Local authority household surveys could constitute a more regular source of information on resident mode share.

Personalised Travel Planning (PTP) and travel plan monitoring data could also provide information on mode share (although only for groups taking part in these initiatives rather than for the whole Tactran/Tayplan area)

4.7. Delivery Plan

An initial assessment has been undertaken to assess projects within Tactran’s existing delivery plan that could offer a significant contribution towards carbon abatement. See Appendix E.

5. Summary and Conclusions

5.1. Key findings

5.1.1. Mitigation

Potential CO₂ mitigation options for the Tactran and Tayplan areas were considered against **baseline** surface transport CO₂ emissions forecasts derived for both areas in Stage 1 of this study (finalised in December 2012).

The baseline 'Do Minimum' forecasts were based broadly on those elements of the CCC's Extended Ambition Scenario to 2020 (as defined in their 2010 fourth carbon budget report) that can be considered in progress, committed or very likely, with no further interventions assumed beyond 2020. Increases in emissions of approximately 4% between 2007 and 2022 and over 12% between 2007 and 2032 were forecast for both the Tactran and Tayplan areas, driven largely by growth in private road vehicles emissions.

Six **mitigation options** were prioritised for detailed analysis for the Tactran and Tayplan areas:

- Support/incentives for low carbon vehicles and infrastructure (focusing on electric vehicles including cars, vans and buses);
- Eco driving advice and training (targeting car drivers, taxis, vans, buses);
- Travel planning advice, behaviour change campaigns, Smarter Choices;
- Development planning to support more efficient travel behaviours;
- Public transport infrastructure and service improvements and promotion (excluding rail); and
- Rail infrastructure and service improvements and promotion.

The model results suggest that, when considering direct CO₂ emissions reductions in the Tactran/Tayplan areas in isolation, investment in travel planning is the most effective form of expenditure, particularly in later years. The modelled measure is forecast to achieve emissions reductions of between 3,500 and over 17,000 tonnes p.a. within the Tactran area in 2030 in the Low and High investment scenarios respectively. The impact of the High scenario is equivalent to nearly 1.3% of the total Tactran land transport emissions. The equivalent values for the Tayplan area (3,000 tonnes to over 14,500 tonnes in 2030) equate to over 1.2% of the total land transport emissions in 2030 in the High scenario.

It is also important to note that the national effect of the measures will be approximately 50% greater than the effect within Tactran/Tayplan, when the impact on travel by drivers from the Tactran/Tayplan areas on roads beyond Tactran's/Tayplan's boundaries are taken into account.

The eco-driving and development planning measures also achieve emissions reductions equivalent to more than 0.5% of total land transport emissions by 2030 in the High scenarios in both areas. However, the impacts of the other measures are more limited, (equivalent to 0.1% of land transport emissions or less in the High scenario in 2030). This reflects the relatively limited number of trips affected by the measures for the bus quality and low carbon vehicles. However, as discussed a targeted approach to supporting low carbon vehicles such as focussing support on vehicles in car clubs and council and taxi vehicle fleets is considered more appropriate and would be likely to influence behaviour, leading to greater emissions savings than the direct emissions modelled above. For the TERS rail option, under current forecast operating conditions, the carbon emissions associated with the improved service provision would more than offset the savings associated with the mode switch from car to rail generated.

5.1.2. Adaptation

There are five key stages that would need to be undertaken to develop a **climate adaptation plan** for transport within the Tactran area:

- Understanding historical trends and baseline vulnerability;
- Establish future changes in climate and assess vulnerability to climate change;

- Develop an adaptation plan;
- Implement actions; and
- Monitor and evaluate.

5.1.3. Monitoring framework for carbon abatement

Given the nature of the measures that emerged from this work as being the most cost effective carbon abatement measures, and having regard to priorities in RPP1 and expected to be continued in RPP2, it is recommended that Tactran consider using the following as indicators:

- Number/proportion of households having been offered personalised travel planning/proportion of households actively engaged in PTP;
- Number of employees/proportion of all employees/employers (>30 staff) covered by "effective" travel plans;
- Number/proportion of drivers trained in eco-driving; and
- Modal share of public transport and active travel (tracking average distance travelled per person per annum by public transport, walking or cycling).

5.2. Next steps

The findings have reinforced that travel planning and behavioural change aspects of the RTS are the most cost-effective in terms of carbon abatement. Continuing with the implementation of these measures and targeting expenditure in these areas should be considered a priority for Tactran within the context of its climate change statutory duties.

There is also an opportunity for Tactran to explore a role for the RTP to partner with other public/private sector agencies to help implement eco-driving.

The findings suggest that there is a positive role for Development Planning to play in supporting behavioural change in the longer term.

The widespread implementation of electric vehicles will need national leadership to facilitate the fundamental shift in car ownership required. Although this work suggests that Tactran's ability to influence the use of electric vehicles in a cost effective manner is limited, there will continue to be a targeted role for the RTP to support this transition.

In order to fully fulfil their statutory duties that were established in the Climate Change (Scotland) and to help ensure that the transport system in the Tactran / Tayplan areas adapts to the forecast impacts of climate change Tactran and its constituent Councils should consider how to best develop a Transport Climate Adaptation Plan.

Footnotes

- ¹ Mitigating Transport's Climate Change Impact in Scotland: Assessment of Policy Options, Scottish Government, 2009
- ² The Fourth Carbon Budget - Reducing emissions through the 2020s – CCC - 7 December 2010
- ³ The Fourth Carbon Budget - Reducing emissions through the 2020s – CCC - 7 December 2010
- ⁴ Initial ranking based on high level assessment of potential emission abatement and public sector costs for individual measures, based on published evidence and high level assumptions.
- ⁵ More information on UK and Scottish Context is provided in Appendix F
- ⁶ The model calculation of the cumulative impact on the fleet takes account of typical rates of vehicle failure and life spans, based on the approach adopted in the CCC technical model underpinning the 2008 report (referenced in the next footnote) and subsequent work.
- ⁷ Building a low-carbon economy – the UK's contribution to tackling climate change – CCC - December 2008 <http://www.theccc.org.uk/reports>
- ⁸ The Fourth Carbon Budget - Reducing emissions through the 2020s – CCC - 7 December 2010
- ⁹ 120,000 vehicles in Scotland: Source: estimate quoted in Draft RPP2, page 124
- ¹⁰ Costs derived from following sources: "the unit cost per smart private charging point can be estimated to be around €520 (£433); while for a publicly accessible charging point it is approximately €5,280 (£4,400). Source: [http://ec.europa.eu/transport/themes/urban/cpt/doc/swd\(2013\)5-2-impact-assessment-part1.pdf](http://ec.europa.eu/transport/themes/urban/cpt/doc/swd(2013)5-2-impact-assessment-part1.pdf), page 43 : rapid charging points cost £45,000 to install <http://www.bbc.co.uk/news/uk-politics-21503532>, Feb 2013 and publicly available charging points cost £3-£7,000, rapid chargers cost £50,000 to £150,000 www.transportscotland.gov.uk/files/documents/roads/letter_to_cpss.pdf dated 2010 (costs have reduced over the last few years)
- ¹¹ "In individual cases, e.g. depending on the initial driving style of the driver, and directly after receiving training the fuel economy benefits of eco-driving may be as high as 20-25%. **On average, however, eco-driving training leads to fuel economy improvements with a significant long-term effect of 5-10% under everyday driving conditions.** (...) Research clearly indicates that eco-driving is highly cost-effective with estimated cost savings of up to €128 per tonne CO₂ saved". Source: Sharpe, R.B.A. (2009) Technical options for fossil fuel based road transport Paper produced as part of contract ENV.C.3/SER/2008/0053 between European Commission Directorate-General Environment and AEA Technology plc
- ¹² The EU driver education, including a module on eco-driving, is required for all truck drivers in Europe. All truck drivers, both new and experienced, are required to take part in follow up courses every five years. Source: FreightVision, Freight Transport Foresight 2050, Management Summary IV, Vision and Action Plan, Feb 2012
- ¹³ These proportions apply in both the Tactran and Tayplan areas as the numbers of licence holders are very similar in the two areas
- ¹⁴ "To estimate the cost effectiveness of eco-driving, TNO et al. (2006) used a lot of assumptions. (...) The costs of lessons are assumed to be € 50 - €100 for existing drivers". Source: Schroten, A., Essen, H, Smokers, Warringa, G., Bolech, M. and Fraga, F. (2011) Cost effectiveness of policies and options for decarbonising transport. Task 8 paper produced as part of a contract between European Commission Directorate-General Climate Action and AEA Technology plc, quoting TNO et al 2006
- ¹⁵ Source: Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027, The Draft Second Report on Proposals and Policies, Technical Annex (page 49)
- ¹⁶ Based on evidence from 14 personalised travel planning pilots funded by the Department for Transport, showing the following take-up rates: Bracknell – 1%, Bristol - 45%, Cramlington – 42%, Nottingham – 30%, Quedgeley – 49%, Sheffield – 46%, York – 8%. Source: Personalised travel planning: evaluation of 14 pilots part funded by DfT
- ¹⁷ Based on "The evaluation of the results of the three Sustainable Towns projects show that car driver trips per resident of the three towns taken together fell by 9% between 2004 and 2008, whilst car driver distance per resident fell by 5%~7% (trips of 50km or less). Car use per head also fell nationally in comparable (medium-sized) urban areas during this period, but by a much smaller amount: a change of -1.2% for car driver trips and -0.9% for car driver distance (NTS all trip lengths)". Source: The Effects of Smarter Choice Programmes in the Sustainable Travel Towns, Summary Report, Sloman et al. for DfT, 2010
- ¹⁸ Both personalised travel planning and workplace travel planning were assumed to be focussed on the main urban areas and, for each programme, each household was assumed to have equal probability of being affected. Consequently a small overlap was assumed (based on the relevant probabilities). For households affected by both programmes it was assumed that commuting and business trips were affected by the impacts suggested for the workplace travel planning programme and trips for other purposes were assumed to be affected by the impacts suggested for personalised travel planning.
- ¹⁹ Based on "fully fledged travel plans typically reduce car driving by an average of 15-20% at individual sites". Source: Smarter Choices – Changing the Way We Travel', Workplace Travel Plans, Cairns S et al. 2004
- ²⁰ Based on "The travel behaviour change in the towns involved a combination of mode shift (with unchanged destination); switch of destination and mode (e.g. replacing a medium-length car trip with a shorter journey by foot, bike or bus); and trip evaporation (not making a trip at all). At the aggregate level, roughly 7% of the reduction in car use (including car driver and car passenger trips) was from a net reduction in trips". Source: The Effects of Smarter Choice Programmes in the Sustainable Travel Towns, Summary Report, Sloman et al. for DfT, 2010
- ²¹ Based on the costs of the recent travel planning in Dundee city (cost £20 per household and £77 per engaged household)
- ²² Based on UK data showing workplace travel planning public sector (local authority, capital and revenue) costs per employee targeted in different locations: Birmingham – £0.7, Bristol - £4.3, Buckinghamshire - £5, Cambridgeshire - £1.7,

Merseyside - £1.8, Nottingham – £3.8, York - £2. Source: Smarter Choices – Changing the Way We Travel, Workplace Travel Plans, Cairns S et al. 2004

²³ DfT Eco-Town Guidance, 2008

²⁴ <http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/themes/sus-dev/SPACE/Tool>

²⁵ In the long term from December 2017 as set out in Extended Tay Estuary Rail Study, Updated Business Case, Steer Davies Gleave, March 2011 for Tactran

²⁶ Extended Tay Estuary Rail Study, Updated Business Case, Steer Davies Gleave, March 2011 for Tactran

²⁷ Extended Tay Estuary Rail Study, Updated Business Case, Steer Davies Gleave, March 2011 for Tactran

²⁸ Census 2001 data was used as 2011 data is not yet available

²⁹ Optimum, lowest emission bus speeds occur at about 50kph with emissions per km rising with increases and reductions in speeds from this point – therefore increases in speed will cause increases in emissions at some speeds and decreases at others.

³⁰ Draw from 'The Role of Soft Measures in Influencing Patronage Growth and Modal Split in the Bus Market in England' AECOM for DfT, October 2009

³¹ Real Time Passenger Information and Urban Traffic Management & Control, Halcrow and JMP for Perth & Kinross.

³² <http://www3.hants.gov.uk/2012-tfsh-better-bus-area-fund-application.pdf>

³³ <http://www.guidedogs.org.uk/news/new-tas-research-uncovers-the-true-cost-of-audio-visual-systems/>

³⁴

<http://webarchive.nationalarchives.gov.uk/http://www.dft.gov.uk/transportforyou/access/buses/pubs/research/as/eannouncesystemssummaryreport.pdf>

³⁵

http://www.luton.gov.uk/Transport_and_streets/Lists/LutonDocuments/PDF/Engineering%20and%20Transportation/BBF%20Application%20February%202012.pdf

³⁶ <http://www.york.gov.uk/info/200206/buses/382/buses/4>

³⁷ <http://www.transportscotland.gov.uk/public-transport/Buses/Bus-Fund/background>

³⁸ The focus on emissions generated by activity within the Tactran area is consistent with the calculation of the baseline forecasts of land transport emissions (Tactran Transport Carbon Assessment, Stage 1 Report, November 2012), the approach taken in the Scottish Government's MTCCI study and international reporting conventions, adopted by inventories such as the National Atmospheric Emissions Inventory

³⁹ Transport Scotland Vehicle Statistics, 2010, Table 1.4

⁴⁰ Assuming approximately 67% of TERS rail emissions and emissions savings due to mode switch occur within the Tactran area and 50% in the Tayplan area (based on rail length in each area), the operating fleet is approximately 40% Class 158s and 60% Class 170s (based on information from the business case from SDG) and rail diesel emits 2695g CO₂/litre – based on Baseline energy statement – energy consumption and carbon dioxide emissions on the railway, ATOC, March 2007

⁴¹ <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact>

⁴² <http://www.scotland.gov.uk/Publications/2011/02/04093254/0>

⁴³ <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/adaptation/AdaptationFramework/TheFramework>

⁴⁴ <http://www.defra.gov.uk/environment/climate/government/risk-assessment/>

⁴⁵ UKCIP, undated. Identifying adaptation options. UKCIP, Oxford

⁴⁶ Angus, Perth & Kinross and Stirling have taken part to the Local Climate Impacts Profile project and have logged some events and their impacts already – see <http://www.adaptationscotland.org.uk/11/96/0/Local-Climate-Impacts-Profile-project-findings.aspx>

⁴⁷ UKCIP, 2009. A local climate impact profile: how to do an LCLIP. UKCIP, Oxford

⁴⁸ See <http://naei.defra.gov.uk/data/local-authority>

⁴⁹ Source: Changes made in the 2010 NAEI Road Transport Inventory: A Briefing Note Produced for DECC on Changes in Fuel Consumption, April 2012

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66001/2097-changes-2009-naei-road-transport-invent.pdf

⁵⁰ The model currently assumes the same average speed for vehicles on the same type of road across the country

⁵¹ See <http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j205779-77.htm>

⁵² See <https://www.gov.uk/government/statistical-data-sets/road-transport-energy-consumption-at-regional-and-local-authority-level>

⁵³ See <http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j205779-16.htm>

⁵⁴ See <https://www.gov.uk/government/organisations/department-for-transport/series/vehicle-licensing-statistics>

⁵⁵ See <https://www.smmmt.co.uk/members-lounge/member-services/market-intelligence/vehicle-data/mvris-new-vehicle-registrations-uk/>

⁵⁶ A vehicle registered to one area does not necessarily operate in that area

⁵⁷ See <http://www.scotland.gov.uk/Topics/Statistics/16002/FAQAccess>

⁵⁸ See <http://www.scotland.gov.uk/Topics/Statistics/16002/LA0708Excel>

⁵⁹ Source: <http://www.scotland.gov.uk/Resource/Doc/933/0101727.pdf>

Appendices

A. Tactran Board Presentation

Climate Change & Transport

Steven Fraser

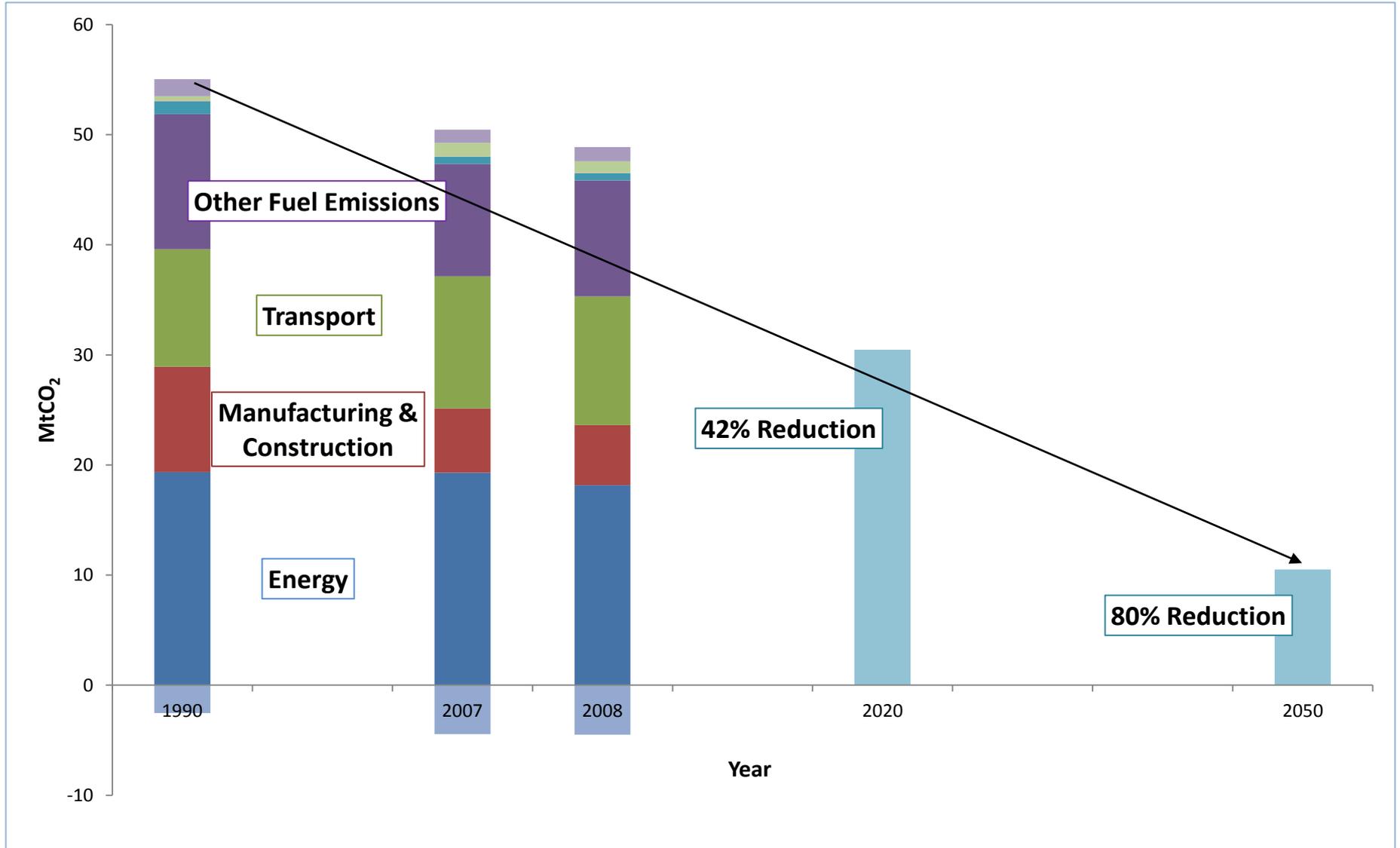


Agenda

- Climate Change (Scotland) Act
- Overview of conclusions from Workshop 1
- Summary of baseline analysis for Tactran
- Options for setting targets
- Options for monitoring
- Current abatement measures
- Next steps

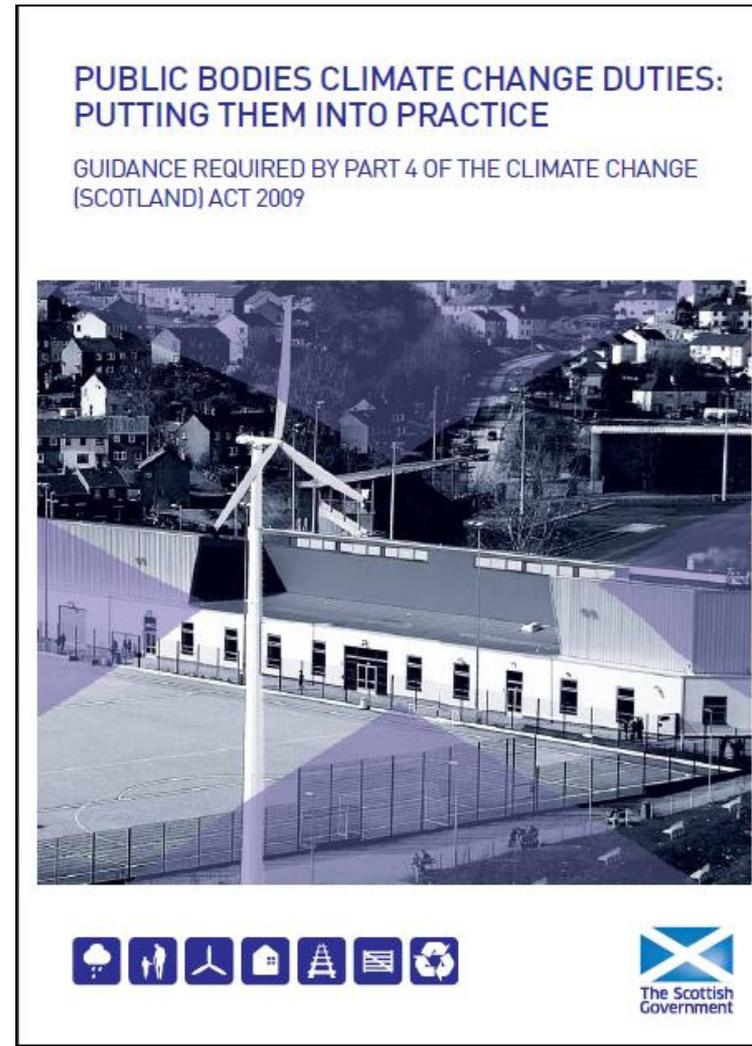


Climate Change (Scotland) Act 2009



Public Body Duties

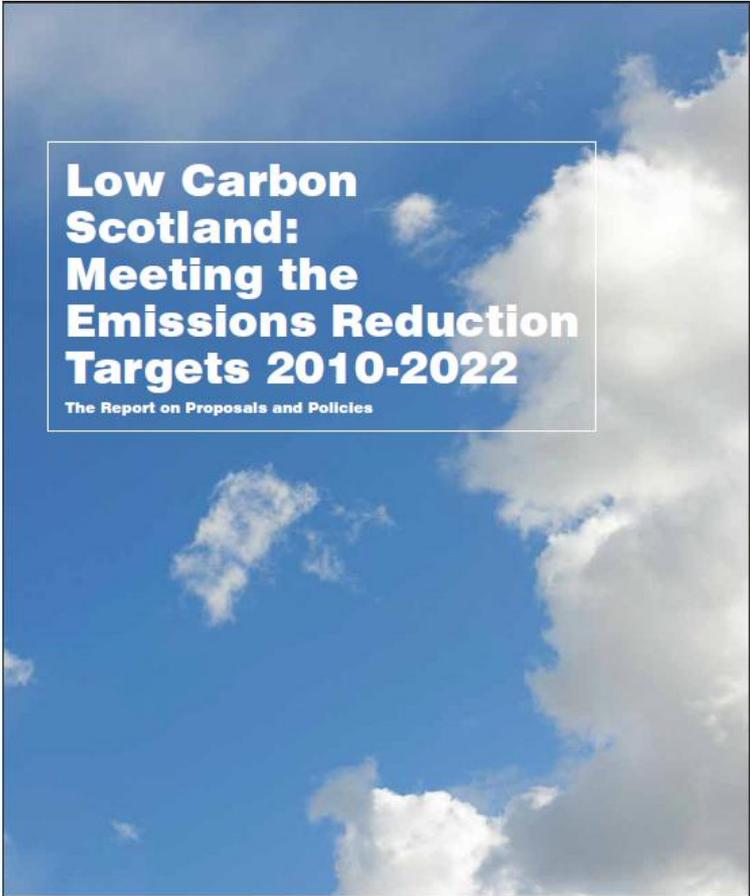
- Mitigation
- Adaptation
- Acting Sustainably



Low Carbon Scotland

– Meeting the Emission Reduction Targets 2010-2022

1. Sets out policies already in place
2. Further proposals to meet the annual emissions
3. “The Atkins Study”



**Low Carbon
Scotland:
Meeting the
Emissions Reduction
Targets 2010-2022**

The Report on Proposals and Policies

Workshop 1

- 20th September 2011
- What action is Tactran currently taking to address transport CO2 emissions?
- What should Tactran do to address transport CO2 emissions moving forward?



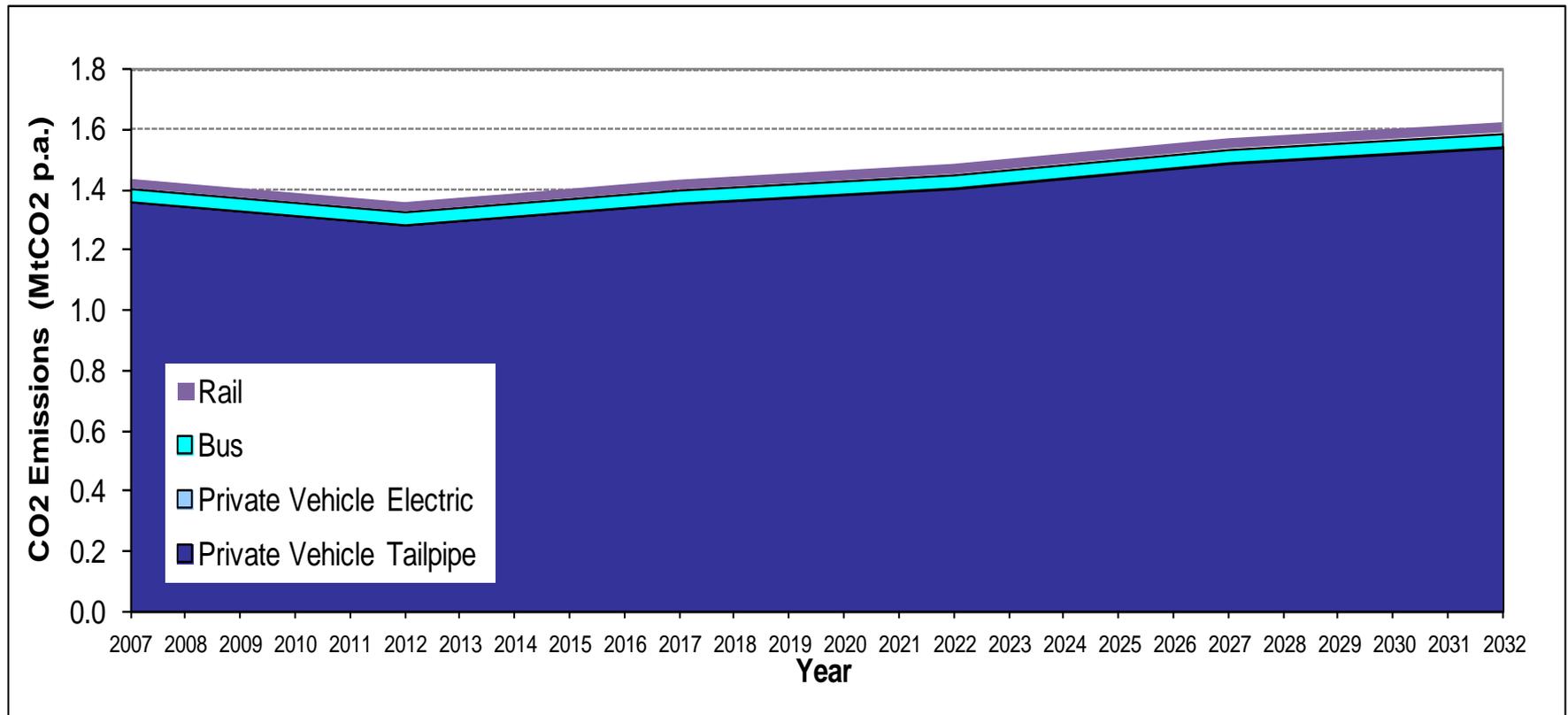
Baseline Carbon Forecasts

- Do-Minimum scenario
- CCC Carbon Budget Recommendations scenario,



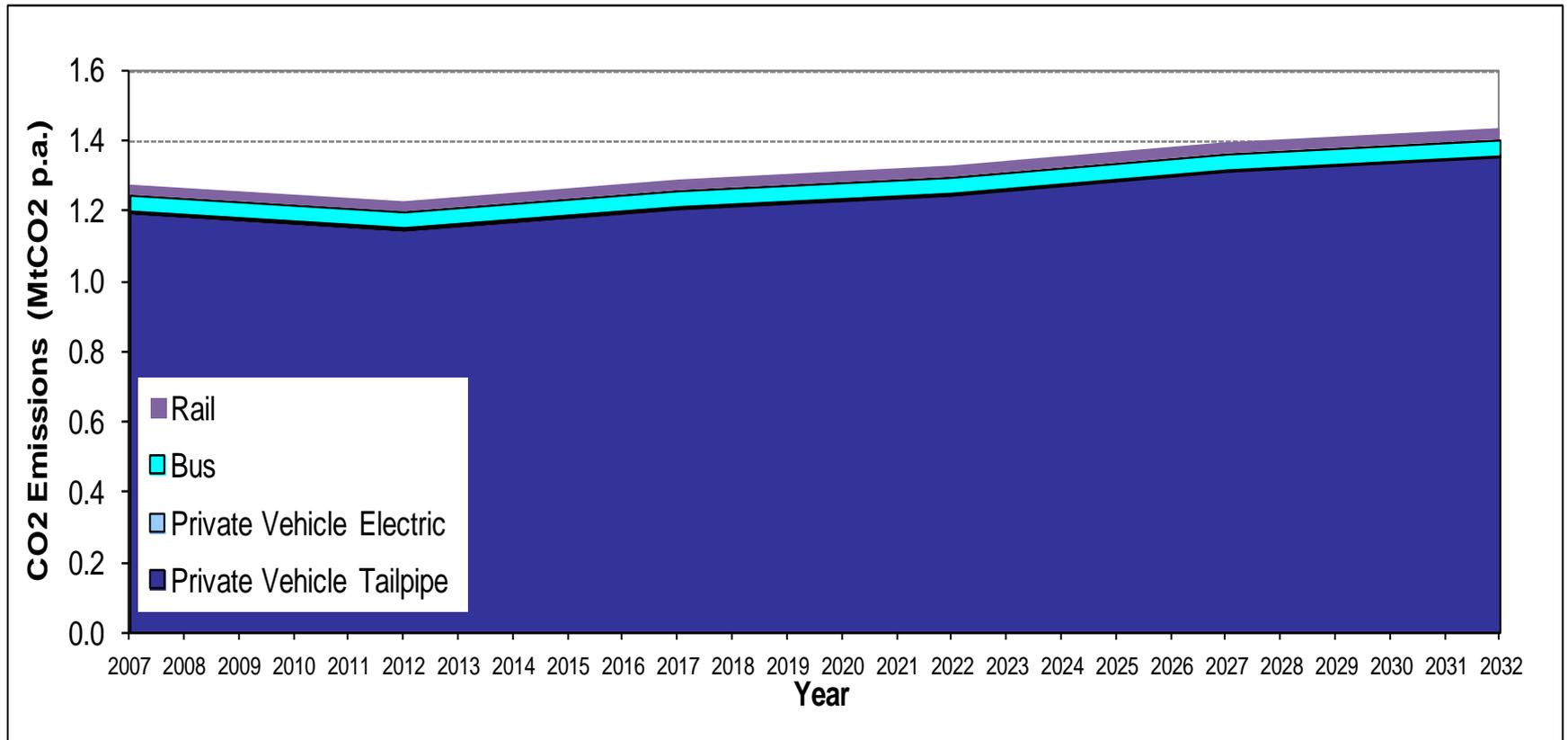
Do-Minimum Scenario

- Tactran area



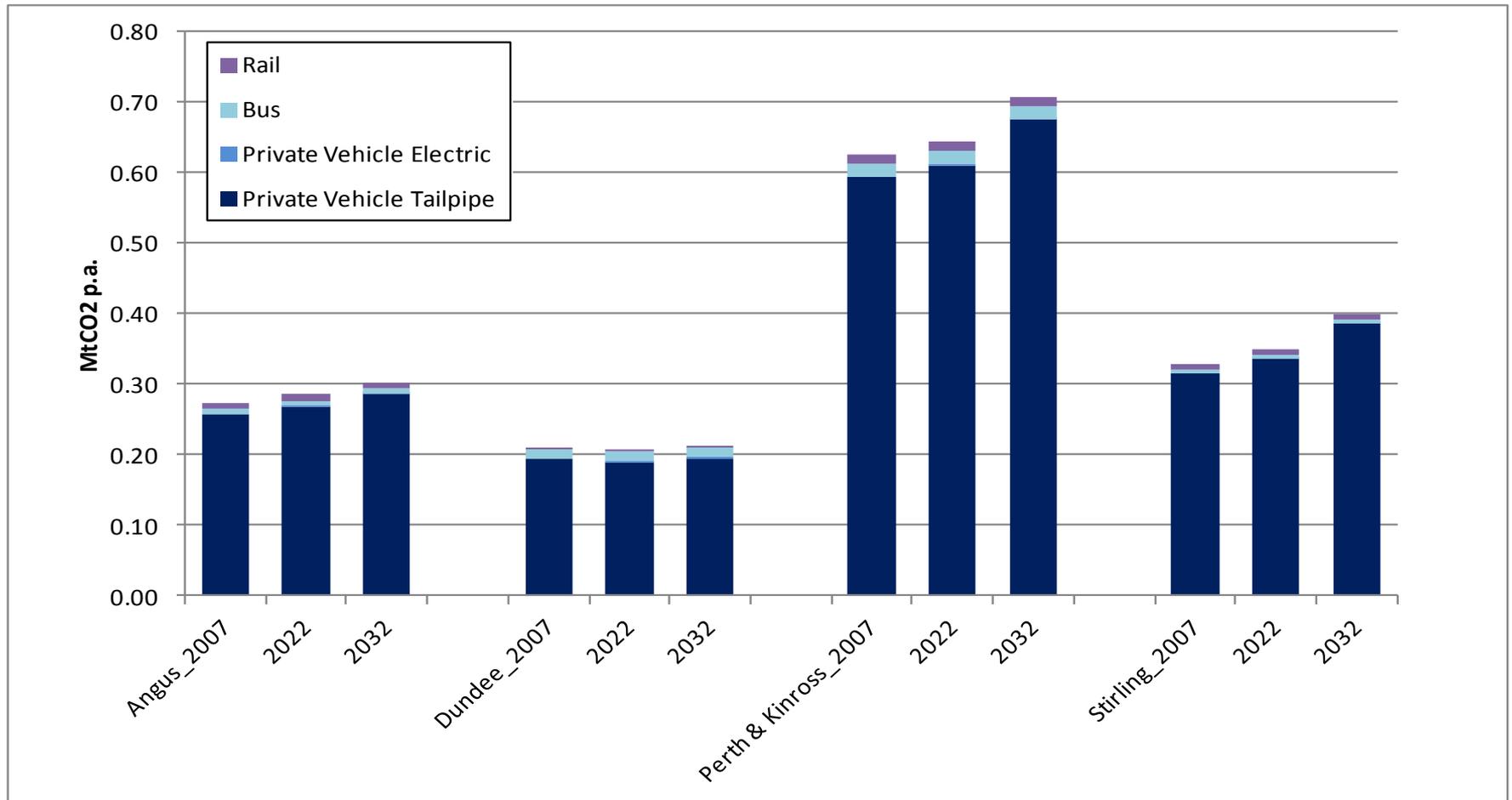
Do-Minimum Scenario

- Tayplan area



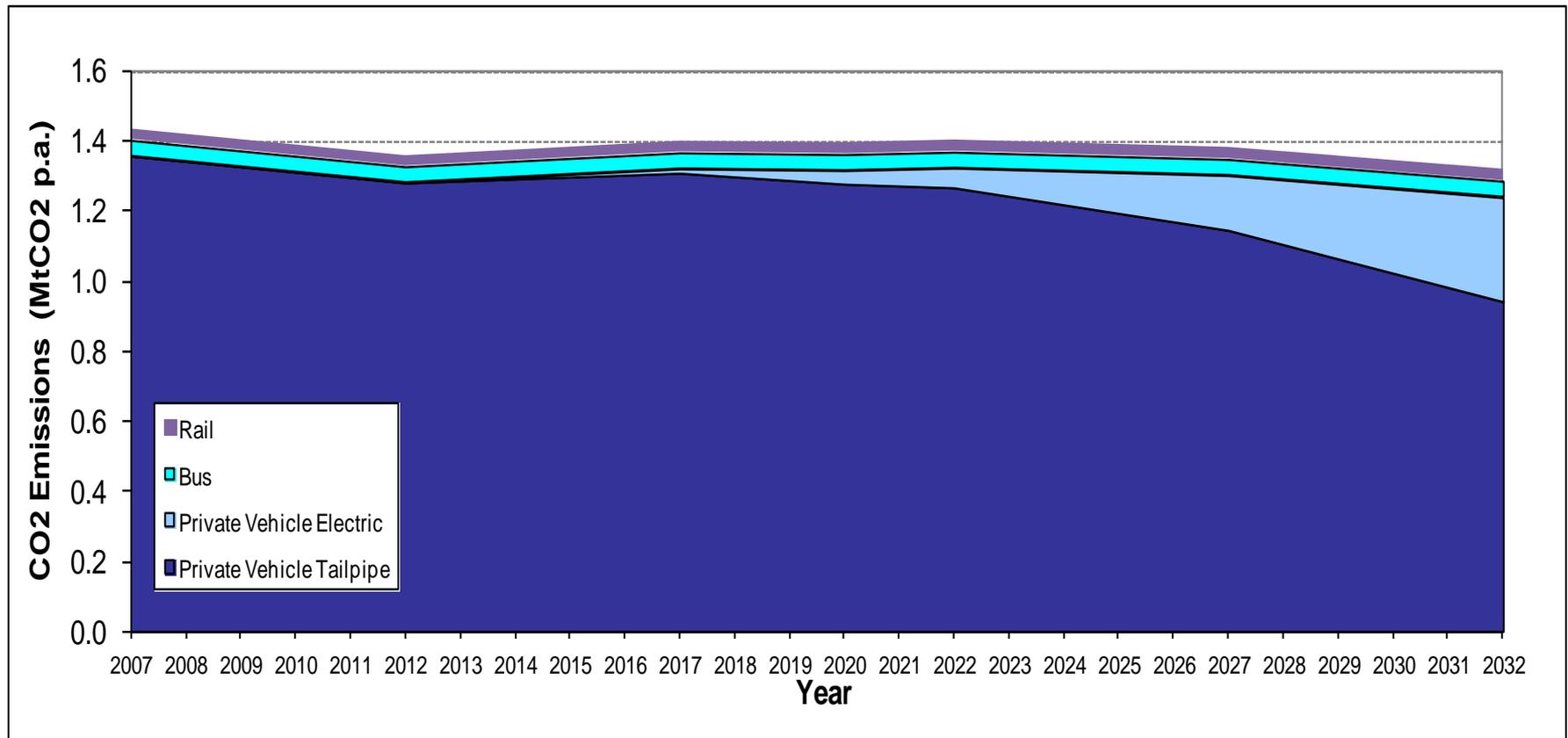
Do-Minimum Scenario

- Disaggregated by LA



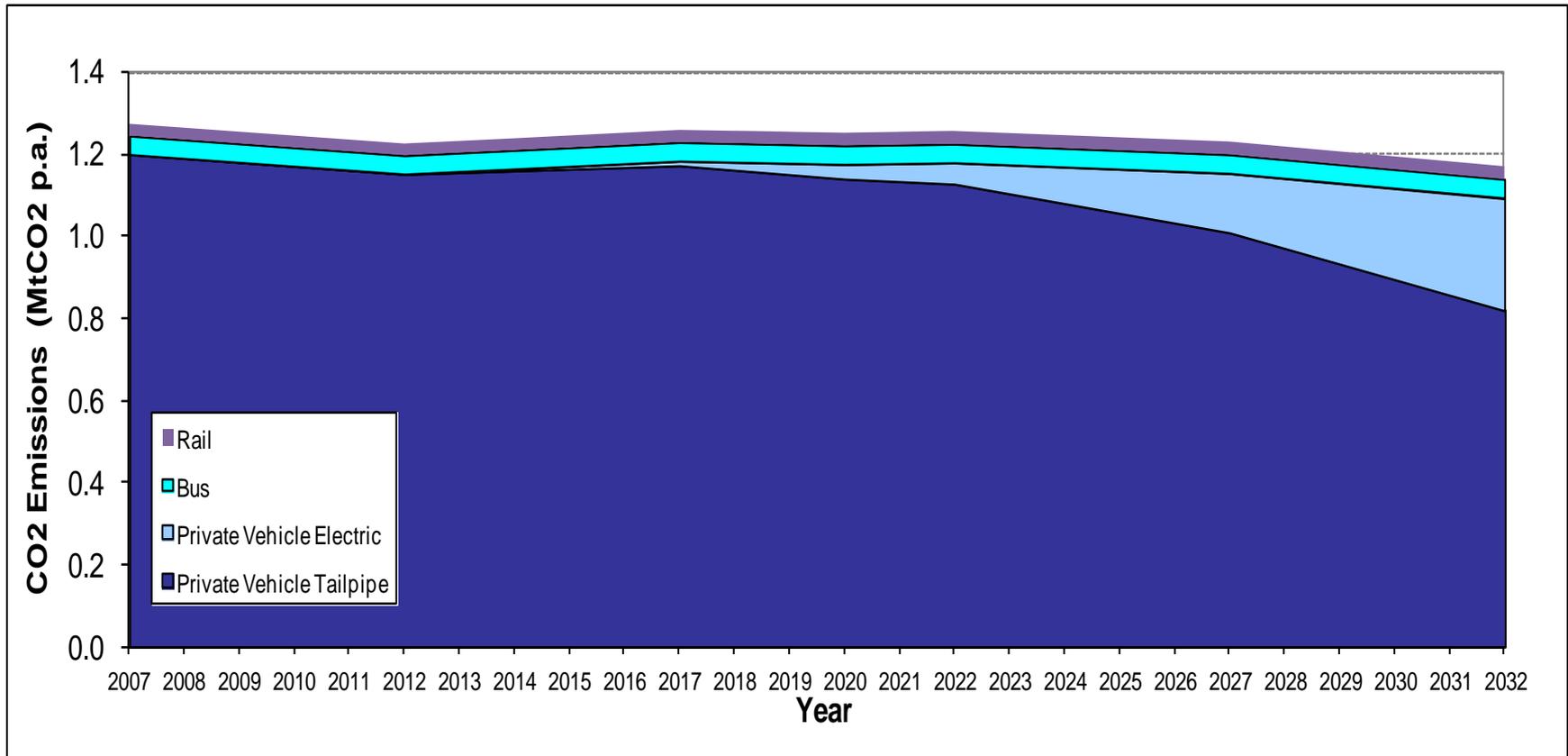
CCC Carbon Budget scenario

- Tactran area



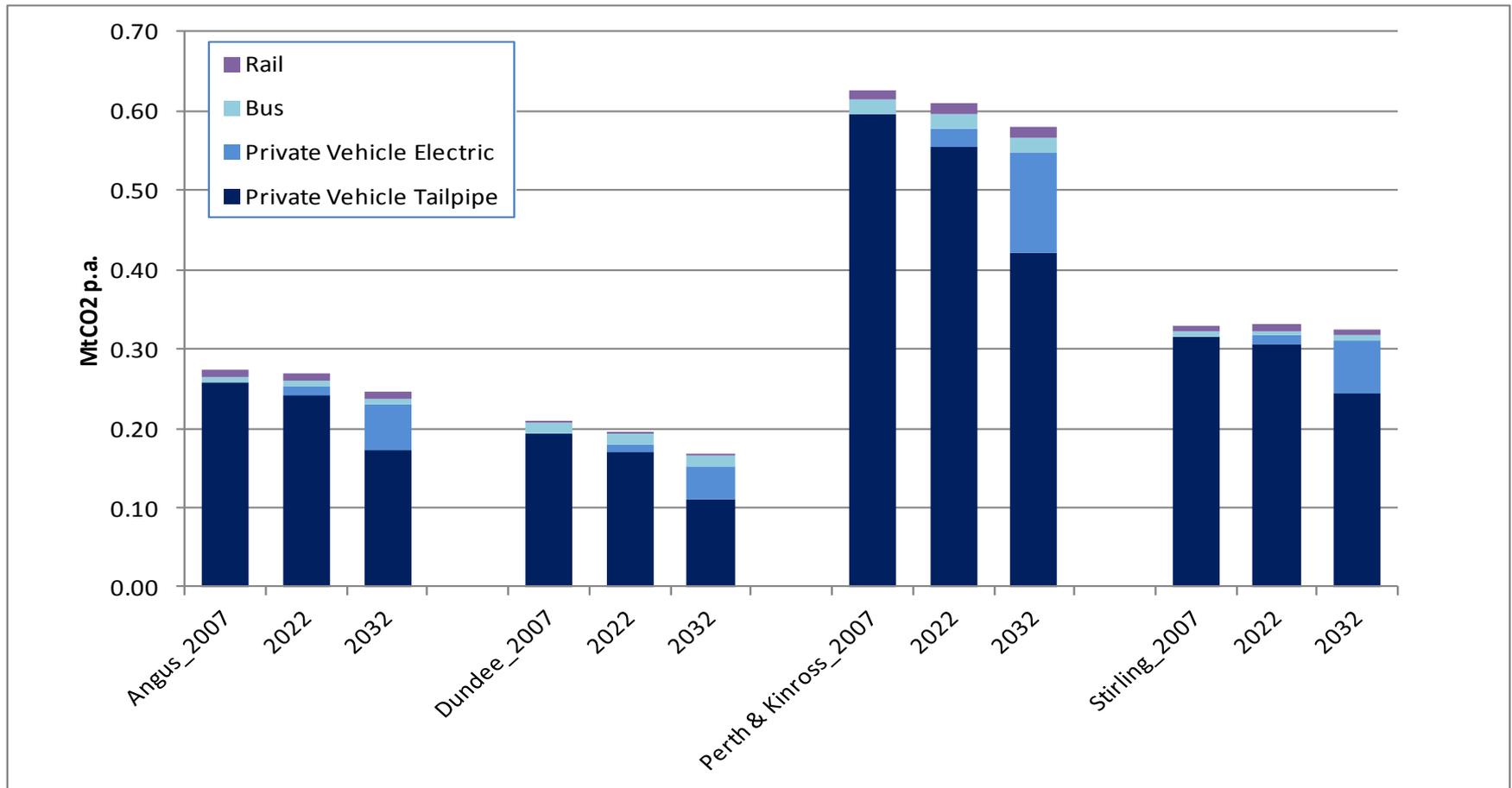
CCC Carbon Budget Scenario

- Tayplan area



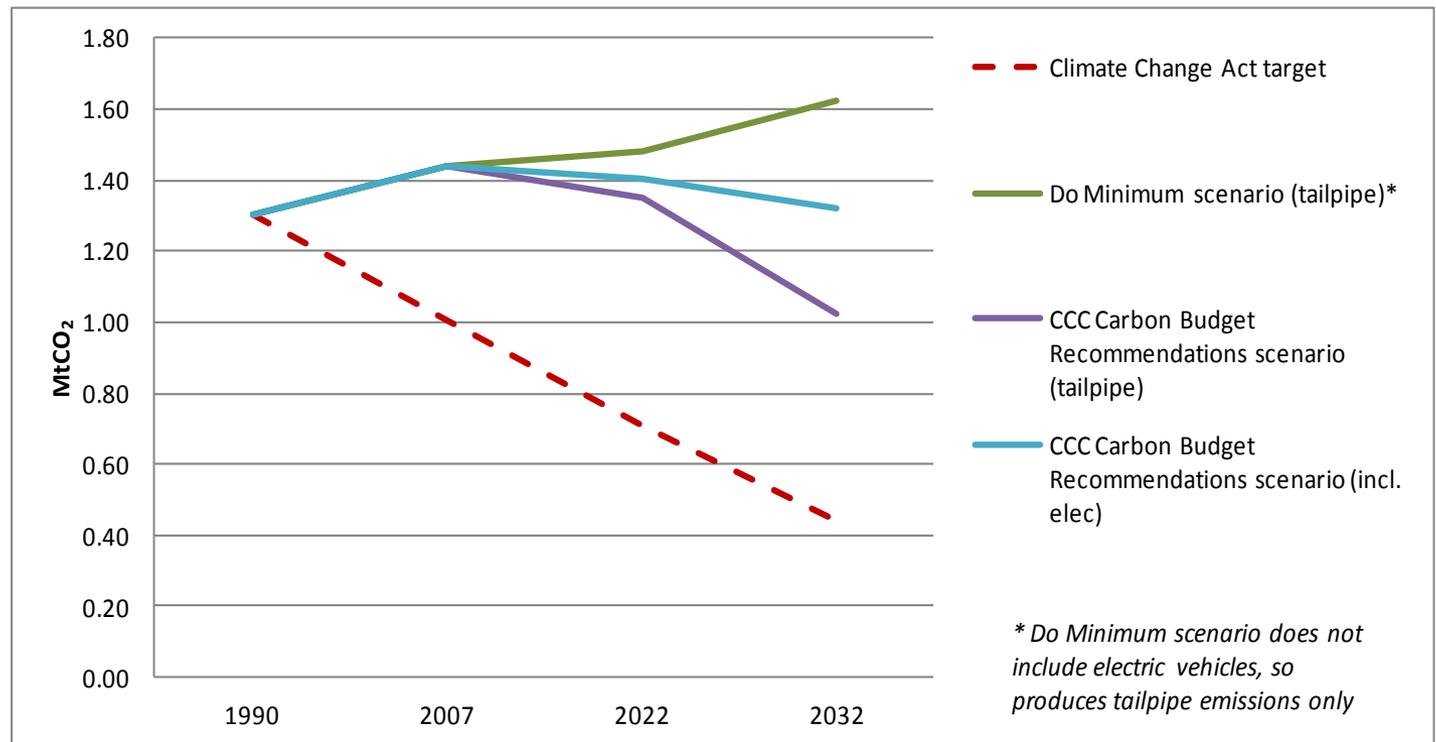
CCC Carbon Budget Scenario

- Disaggregated by LA



Options for Setting Targets

- Top-down, “fair share” approach
- Bottom-up, “cost effectiveness” approach



Options for Monitoring

- Use of existing RTS indicators
- Consider using:
 - Low carbon vehicles – take-up of low carbon vehicles in the Tactran and Tayplan areas (including vans and HGVs);
 - More efficient use of vehicles – fuel consumption per vehicle kilometre in the area
 - Shift towards more efficient modes – mode share
 - Reduction of travel need and destination shift – vehicle kilometres travelled in the Tactran and Tayplan areas.

Current Abatement Measures

- Measures designed to change attitudes and behaviour
- Information based measures
- Walking & cycling measures
- Bus based measures
- Rail based measures
- Measures associated with improving multi modal interchange
- Community & DRT
- Freight specific measures
- Land Use and Planning related measures

Next Steps

- Mitigation options prioritisation
- Analysis of prioritised options
- RTS Monitoring Framework & review of current Delivery Plan
- Adaptation strategy overview

SCOTLAND'S CLIMATE
CHANGE ADAPTATION
FRAMEWORK



Climate Change & Transport

Questions



B. Option Generation

Transport mitigation options – Long List	Identified/included in			Transport mitigation options – Short List
	Stage 1 report	Tactran Board workshop – Sept 2011	Stage 2 long list	
Low carbon vehicles				
EU targets for new cars and vans fuel efficiency	Existing policy		Yes	Merged in Stage 2 to become - (1) Fuel Efficiency Standards.
Clean Vehicle Directive	Existing policy			
Support to low carbon vehicles and infrastructure	RPP1 policy Additional option	Yes ⁶⁰	Yes	Merged in Stage 2 to become – (2) Support/incentives for low carbon vehicles and infrastructure (focusing on electric vehicles including cars, vans, and buses).
Public sector vehicle procurement applying strict efficiency criteria	Additional option			
Scottish Green Bus Fund	Existing policy			
Changes to BSOG to encourage low carbon buses	RPP1 proposal			
Improve efficiency of taxis and private hire cars	RPP1 proposal		Yes	(3) Taxis and private hire cars fuel efficiency support.
Low carbon fuels				
Renewable Transport Fuel Obligation	Existing policy		Yes	Merged in Stage 2 to become – (4) Biofuels.
Further support to development of sustainable biofuels (incl. Scottish Biofuels, Biofuels Business Programme)	Existing policy Additional option			
Support production of low carbon electricity (EVs)	Additional option		Yes	Merged in Stage 2, then sifted from the short list on the basis that there was a significant degree of ambiguity relating to Tactran's role in implementation.
Development of hydrogen facilities		Yes ⁶¹	No	
Using gas (CNG/LNG including biomethane for transportation, e.g UK Low Carbon Trucks Trial)			Yes	Identified as a separate option in Stage 2 to become (5) Gas (including biomethane - focusing on HGVs).
More efficient use of vehicles				
Eco-driving advice	RPP1 policy Additional option ⁶²		Yes	Evolved in Stage 2 to become – (6) Eco driving advice and training (targeting all categories of drivers: car driver, taxis, vans, HGVs, and buses).
Intelligent Transport System Action Plan	RPP1 policy Additional option		Yes	Evolved in Stage 2 to become – (7) Intelligent transport system and traffic management to improve efficiency.
Speed limit enforcement and lower speed limits on trunk roads	RPP1 proposal / Additional option		Yes	(8) Speed limit enforcement (RPP1 proposal) and reduction (trunk roads).

Transport mitigation options – Long List	Identified/included in			Transport mitigation options – Short List
	Stage 1 report	Tactran Board workshop – Sept 2011	Stage 2 long list	
Liftshare schemes	Existing policy Additional option	Yes ⁶³	Yes	Evolved in Stage 2 to become – (9) Car sharing schemes to increase car occupancy.
Further support to increase freight loading (consolidation centres)	Additional option		Yes	Evolved in Stage 2 to become – (11) Freight loading improvements (incentives, consolidation centres etc).
Shifting to more efficient modes				
Travel planning advice, Smarter Choices Smarter Places	RPP1 policy Additional option	Yes ⁶⁴	Yes	Merged in Stage 2 to become – (12) Travel planning advice, behaviour change campaigns.
Personalised travel planning, all households by 2022	RPP1 proposal			
All workplaces with effective travel plan by 2022	RPP1 proposal			
Cycling Action Plan	RPP1 policy	Yes ⁶⁵	Yes	Evolved in Stage 2 to become – (13) Cycling infrastructure and promotion, and (14) Walking infrastructure and promotion.
Cycling and walking infrastructure (as in Sweden)	RPP1 proposal			
Support to car clubs	Existing policy	Yes ⁶⁶	Yes	(10) Support to car clubs.
Freight mode shift (road to rail or water)	Existing policy		Yes	(18) Freight mode shift (road to rail or water).
Rail improvements (heavy rail)	Existing policy		Yes	Evolved in Stage 2 to become – (16) Rail infrastructure and service improvements and promotions.
Stronger investment in public transport, walking and cycling infrastructure	Additional option		Yes	Evolved in Stage 2 to become – (13) Cycling infrastructure and promotion, (14) Walking infrastructure and promotion, and (15) Public transport infrastructure and service improvements and promotion (excluding heavy rail).
Improvements to delivery of PT services (bus quality partnerships, quality contracts)	Additional option			
Promoting the use of public transport		Yes		
Reducing bus fares		Yes ⁶⁷	Yes	Evolved in Stage 2 to become – (17) Public transport fares (lower fares).

Transport mitigation options – Long List	Identified/included in			Transport mitigation options – Short List
	Stage 1 report	Tactran Board workshop – Sept 2011	Stage 2 long list	
Use of pricing mechanisms: road user charging, car parking charges, etc / PT fare reduction, reward schemes	Additional option	Yes, parking charges	Yes	Evolved in Stage 2 to become – (19) Use of pricing mechanisms to encourage change to low carbon modes and reduce travel demand (e.g. fuel prices, road pricing, congestion charging, focussing on car parking charges and management)
Reducing the need to travel and changing destinations				
Development planning ⁶⁸	Existing policy Additional option			Merged in Stage 2 to become – (20) Development Planning.
Community hubs	RPP1 proposal ⁶⁹ Additional option		Yes	
Review of service delivery to reduce need to travel (education, health, public services, shopping, leisure)	Additional option			
Home/flexible working	Existing policy Additional option	Yes	Yes	Evolved in Stage 2 to become – (21) Promotion / support for home / flexible working.
Encourage use of virtual meetings (video-conferencing, Skype, etc)		Yes	Yes	Evolved in Stage 2 to become – (22) Promotion / support for phone / teleconferencing.
Tactranconnect - investigate facility for optimum meeting scheduling to encourage public transport use		Yes	Yes	Merged in Stage 2 to support – (12) Travel planning advice, behaviour change campaigns.
Avoiding counter-productive investment				
Proposal to increase speed limits in the UK to 80mph on motorways (decision to be devolved in Scotland)	Yes		No	
Transport investment and scheme design	Yes		Yes ⁷⁰	
Changes to financial incentives and disincentives (for example fuel tax, vehicle tax, etc)	Yes		No	

⁶⁰ Workshop participants noted the need for the Scottish Government to extend the Plugged In Places programme across Scotland

⁶¹ Workshop participants referred to the M4 hydrogen corridor (see: www.bristol.gov.uk/press/business-bristol/m4-hydrogen-corridor)

⁶² Including “National Motoring Package” from MTCCI (covering initiatives designed to reduce fuel used by cars and motorcycles during driving, including information campaigns and courses on driving style)

⁶³ Promotion of car sharing for meetings identified at Tactran Board workshop

⁶⁴ Workshop participants noted that the Scottish Government promotes travel planning but removed dedicated Regional Transport Partnership (RTP) funding for travel plan implementation

⁶⁵ Workshop identified the need for Bike facilities at Broxden and existing measures such as cycle training and Safe Routes to School

⁶⁶ Workshop participants noted the launch of the Glasgow Peugeot car club (“Mu” – see <http://dealer.peugeot.co.uk/robins-and-day-glasgow/new-vehicles/new-car-offers/dealer-Mu%20by%20Peugeot>)

⁶⁷ The issue of the sustainability of National Concessionary Travel Scheme was discussed at the workshop

⁶⁸ Described as “Scottish Planning Policy” in Stage 1

⁶⁹ RPP1 recommends further analysis of this option

⁷⁰ Considered in Stage 2 through qualitative assessment of Tactran Delivery Plan

C. Qualitative Assessment

Option category	Option	Current level of implementation	Opportunities to do more for Tactran & partners	Carbon abatement ⁷¹	Cost banding ⁷²
Low carbon vehicles	(1) Fuel efficiency standards for new vehicles (cars, vans and HGVs), including public sector procurement (Clean Vehicle Directive)	Already in place with standards being strengthened	- Potential for stricter procurement criteria across public sector incl. Tactran	Low	Medium
	(2) Support/incentives for low carbon vehicles and infrastructure (focusing on electric vehicles including cars, vans and buses)	- Charging points for electric cars - Transport Scotland through its “Plugged in Places” initiative has awarded funding to CPPs including within Tactran area. - Dundee City Council electric vehicles, funding contribution through Tactran Capital Programme	- Potential for further take-up and higher levels of investment - more charging points, more support to buy LCVs - Further changes to BSOG - Scottish Government (RPP1 proposal) - Further pricing signals - car parking charges lower for LCVs - LAs	High	Medium
	(3) Taxis and private hire cars fuel efficiency - supporting improvements in efficiency	No current action identified	- Local Licensing criteria - LAs - Potential Tactran role through support/incentives for low carbon vehicles and infrastructure	Low	Low
Low carbon fuels	(4) Biofuels (RTFO, Scottish Biofuel programme, etc)	- RTFO and obligations on fuel suppliers already in place at EU level - Scottish biofuel programme		Very low	Very low
	(5) Gas (including biomethane – focusing on HGVs)	- UK Low carbon Truck trial includes trucks and refuelling stations in Scotland (not Tactran area) - Low take-up at present	- Assumed to develop through private investment in future	Very low	Very low

Option category	Option	Current level of implementation	Opportunities to do more for Tactran & partners	Carbon abatement ⁷¹	Cost banding ⁷²
More efficient use of vehicles	(6) Eco driving advice and training (targeting all categories of drivers: car drivers, taxis, vans, HGVs, buses)	- Transport Scotland subsidised driver training sessions available through Energy Saving Trust	- Financial support to deliver eco-driving training to large proportions of drivers (possible to target high mileage groups) - Tactran and LAs to provide advice as part of Travel Planning, Liftshare, travelknowhow	Low	Low
	(7) Intelligent transport system and traffic management to improve efficiency (Intelligent Transport System Action Plan in RPP1)	- ITS (real time information for road users) for journey time information on trunk and strategic roads and UTMC in cities.	- Potential to use ITS more to manage traffic	Very low	Medium
	(8) Speed limit enforcement (RPP1 proposal) and reduction (trunk roads)	- No specific additional action taken		Low	Low
	(9) Car sharing schemes to increase car occupancy	- Liftshare schemes already in place in area	- Potential to further promote use	Low	Low
	(10) Support to car clubs	- Dundee car club	- Potential Tactran role through support/incentives for low carbon vehicles and infrastructure	Very low	Low
	(11) Freight loading improvements (incentives, consolidation centres, etc)	- Dundee partner in ENCLOSE (ENergy efficiency in City LOGistics SErvices for small and mid-sized European Historic Towns) European project - Tactran and Perth & Kinross Council part of LaMilo (Last Mile Logistics), Interreg IVB North West Europe project starting in 2013, to 2015, to introduce a trial freight consolidation centre for Perth - Regional Freight Quality Partnership (FQP)	- Further development of consolidation centres - Tactran and LAs - Urban access restrictions for LGVs (LEZs) - Tactran and LAs (might be more for air quality issues than for CO ₂)	Very low	Medium

Option category	Option	Current level of implementation	Opportunities to do more for Tactran & partners	Carbon abatement ⁷¹	Cost banding ⁷²
Shifting to more efficient modes	(12) Travel planning advice, behaviour change campaigns, Smarter Choices - Smarter Places - personalised travel planning to all households by 2022 (RPP1 proposal) - all workplaces (above 30 staff) with effective travel plan by 2022 (RPP1 proposal)	<ul style="list-style-type: none"> - Tactran Travel Planning Officer - Travel Know How - Sustainable Travel Grant Scheme (for public sector and non-for-profit employers) - Council employees covered by Travel Plans in 2012: 94% - Liftshare - use of various media and publicity campaigns - Central Dundee part of the Smarter Choices, Smarter Places programme - Tactranconnect website 	<ul style="list-style-type: none"> - Tactran and LAs in area could assist to deliver targets from RPP1 proposals 	Low	Medium
	(13) Cycling infrastructure and promotion - cycling action plan (RPP1) - cycling infrastructure similar to Swedish infrastructure (RPP1 proposal)	<ul style="list-style-type: none"> - Cycle training for school children - Safe Routes to Schools - Cycling infrastructure - Scottish Government grant funding to Angus, Dundee City and Perth & Kinross Councils to implement Cycling, Walking and Safer Streets (CWSS) projects - Regional Walking & Cycling Strategy approved October 2008 - Dundee Cycle Way / Green Circular - Dundee travel active - Gap filling in National Cycle Network - Tactranconnect cycle page 	<ul style="list-style-type: none"> - Continue to assist in delivering infrastructure and promotion of cycling 	Very low	Medium
	(14) Walking infrastructure and promotion	<ul style="list-style-type: none"> - Safe Routes to Schools - Scottish Government grant funding to Angus, Dundee City and Perth & Kinross Councils to implement Cycling, Walking and Safer Streets (CWSS) projects - Regional Walking & Cycling Strategy approved October 2008 - Dundee travel active - Tactranconnect walk page 	<ul style="list-style-type: none"> - Continue to assist in delivering infrastructure and promotion of walking 	Very low	Medium

Option category	Option	Current level of implementation	Opportunities to do more for Tactran & partners	Carbon abatement ⁷¹	Cost banding ⁷²
	(15) Public transport infrastructure and service improvements and promotion (excluding rail)	<ul style="list-style-type: none"> - TactranConnect (information) - Tactran Bus Strategy - Tactran P&R Strategy - Feasibility and infrastructure improvements including Quality Bus Corridors and interchange facilities - Bus Punctuality Improvement Partnerships (BPIPS) and Quality Partnerships 	<ul style="list-style-type: none"> - Support for service and facilities improvements 	Low	High
	(16) Rail infrastructure and service improvements and promotion	<p>TERS proposals to improve services and facilities, such as</p> <ul style="list-style-type: none"> - Gleneagles Station Enhancement - Broughty Ferry and Invergowrie service improvements 	<ul style="list-style-type: none"> - Continued engagement with rail industry to further improve services and facilities through promotion of TERS Strategy - Ensure regional aspirations developed within HLOS, NR Business Plan and ScotRail refranchise 	Low	High
	(17) Public transport fares (lower fares)	<ul style="list-style-type: none"> - National Concessionary Travel scheme 	<ul style="list-style-type: none"> - Fares are considered a matter for National Concessionary Schemes and individual bus operating companies 	Very low	High
	(18) Freight mode shift (road to rail and water)	<ul style="list-style-type: none"> - Scottish Government operates freight grant schemes⁷³ - Regional Freight Quality Partnership (FQP) - Feasibility study into potential for Port of Dundee freight railhead completed in 2008 - Funding contributions to Highland Spring to develop feasibility of rail freight terminal at Blackford 	<ul style="list-style-type: none"> - Working in partnership with FQP to address barriers 	Very low	Low

Option category	Option	Current level of implementation	Opportunities to do more for Tactran & partners	Carbon abatement ⁷¹	Cost banding ⁷²
	(19) Use of pricing mechanisms to encourage change to low carbon modes (and reduce travel demand) - fuel prices (taxes) - car parking charges , reduction in car parking availability, - road pricing/ tolling/ congestion charging - financial incentives and reward schemes	- Car parking generally managed (charges, duration of stay) in urban areas. - Development of Park & Ride schemes	- Ensure new Park & Ride facilities are part of cohesive city centre parking policy - Further real time information for parking availability	Low	Low
Reducing the need to travel and changing destinations	(20) Development planning to support more efficient travel behaviours - higher density - mixed use developments - provision of public transport, walking and cycling infrastructure - review of service delivery to reduce the need to travel (education, health, public services, shopping, leisure) - community hubs (RPP1 proposal)	- Community planning - Tactran input into action plans and comments on planning applications with significant impacts - Tactran has a key agency status for SDP and LDP and provides advice to ensure consistency with RTS policies and programmes	- Influencing planning authorities - Embedding RTS within SDP and LDP and their action plans	Low	Low
	(21) Promotion/support for home/flexible working		- Information and promotion through travel planning activities	Very low	Low
	(22) Promotion/support for phone/teleconferencing		- Information and promotion through travel planning activities	Very low	Low

⁷¹ Overall impact of option (High, Medium, Low, Very low) – initial assessment

⁷² Cost to Tactran or public sector partners only (High, Medium, Low, Very low) – initial assessment

⁷³ Freight Facilities Grant (FFG), Mode Shift Revenue Support Scheme (MSRS) and Waterborne Freight Grant (WFG)

D. Abatement Modelling Results for Additional Forecast Years

The following tables provide modelled estimated impacts of each scenario on CO₂ emissions in the Tactran and Tayplan areas in 2017, 2022, 2027 and 2032. The figures show direct impacts only and are limited to impacts on emissions originating within the Tactran/Tayplan boundaries only, for consistency with the Baseline forecasts. The results are rounded to the nearest 50 tonnes p.a.

Table D1: Modelled reduction in CO₂ emissions in Tactran area (tCO₂ p.a.)

Measure	Scenario	2017	2022	2027	2032
Low Carbon Vehicles	Low	50	100	150	200
	Medium	150	300	500	550
	High	200	500	800	900
Eco Driving	Low	1350	2000	1750	1800
	Medium	4350	6550	5700	5900
	High	7300	11050	9650	10000
Travel Planning	Low	1850	3200	3450	3600
	Medium	5400	9400	10200	10650
	High	8800	15400	16650	17400
Bus Measures	Low	50	50	100	100
	Medium	50	100	100	100
	High	700	1300	1500	100
Development Planning	Low*	1350	1950	2950	3750
	Medium*	2000	2950	4450	5700
	High*	2600	3900	6000	7700
TERS Scheme		-1750	-1700	-1700	-1700

Table D2: Modelled reduction in CO₂ emissions in Tayplan area (tCO₂ p.a.)

Measure	Scenario	2017	2022	2027	2032
Low Carbon Vehicles	Low	50	100	150	150
	Medium	100	300	450	500
	High	200	450	800	850
Eco Driving	Low	1350	2000	1750	1800
	Medium	4000	6050	5250	5450
	High	6650	10050	8750	9050
Travel Planning	Low	1550	2750	2950	3050
	Medium	4650	8050	8650	9000
	High	7600	13250	14200	14750
Bus Measures	Low	50	50	50	50
	Medium	50	100	100	100
	High	700	1350	1600	1550
Development Planning	Low*	750	4100	5000	5600
	Medium*	1100	6150	7500	8450
	High*	1450	8250	10050	11250
TERS Scheme		-1350	-1300	-1300	-1300

E. Assessment of Delivery Plan for Climate Change Mitigation and Adaptation

TACTRAN Delivery Plan

Delivery Plan Ref No.	Project	Description	Relevant Strategy	Indicative Objective Benefit						Relationship with SOA's		Climate Change Act		Financial Estimate		Notes
				ACCESSIBILITY	ECONOMY	ENVIRONMENT	HEALTH & WELL BEING	SAFETY & SECURITY	INTEGRATION	SOA Named	SOA General	Mitigation	Adaptation	Project Cost	General Capital Allowance for Delivery per annum	
														Capital Cost £000's	Annual Capital Costs	
Land Use and Planning related measures (including Parking Strategy)																
A1	Regional Transport Model for scheme appraisal, design and congestion monitoring	Liaise with Transport Scotland and others to develop suitably-robust models that are available for any forthcoming scheme design and appraisal work and to help monitor congestion.	RTS	↑	↑	↔	↑	↔	↑		All	↔	↑	800		Purchase of Models Year 4 - ongoing maintenance circa £60k years 4 onwards
A2	Work closely with National Parks, Visit Scotland and others as appropriate to identify, promote and deliver a range of sustainable transport options and to improve safety and quality of the experience of car and coach visitors to the National Parks and the region generally	Ongoing package of capital measures to support liaison aimed at improving visitor access and travel experience. Examples may include cycle parking, coach parking.	RTS	↔	↑	↑	↔	↔	↑		All	↔	↔	1400	100	Ongoing annual programme of promotion and implementation of a range of measures. £50k Years 1and 2. £100k per annum thereafter.
A3	Dundee West Land Use & Transport Integration	Integration of Transport Infrastructure requirements to facilitate Dundee Western Gateway development aspirations including options for sustainable transport measures.	RTS	↑	↑	↔	↔	↔	↑		DCC	↑	↔	50		
Information-based measures																
B1	Regional Travel Information database, web interface and journey planner.	Implementation of Travel Information Strategy Actions A01, A02 and A03. This will include purchase of hardware, software and initial population of travel information system, building on best practice and in partnership with Traveline. Further feasibility work also required from revenue budget to identify best options to take forward.	TIS	↑	↑	↑	↑	↔	↑		All	↑	↑	240		Yr1 £40k feasibility and £120k purchase of equipment towards end of yr. Yr 2 120k capital purchase/implementation of equipment and £40k revenue for maintenance/development. Yr 3 onwards £60k revenue for maintenance/development.
B2	Work in Partnership to integrate NHS appointment process with Travel Options	Implementation of Travel Information Strategy Action A26. SPT/Traveline pilot linking Outpatient appointment data with public transport personalised travel journey information is currently ongoing. This project will use outcome of pilot in partnership with NHS in TACTRAN	TIS	↑	↑	↑	↑	↔	↔		All	↑	↔	60		SPT/Traveline pilot underway. Yr 1 implement in TACTRAN area. Match funding from NHS possible. Currently total cost included.
B3	Urban Traffic Management & Control, Dundee	Implementation of Travel Information Strategy Action A32. Upgrade of UTMC system including Traffic Signal Control, VMS, CCTV and RTP1 to improve operability, efficiency and potential for expansion.	RTS	↑	↑	↑	↔	↔	↑		DCC	↑	↑	150		
B4	Intelligent Transport Systems, Dundee	Implementation of Travel Information Strategy Actions A6, A27 and A32. ITS Dundee aims to provide real time traffic information on the strategic road network and will be co-ordinated with Transport Scotland's ITS trunk road programme.	TIS	↑	↑	↑	↔	↔	↔		DCC	↑	↑	20		
Measures designed to change attitudes and behaviours																
C1	Travel Plan - Provision of Bus Shelter at Pitheavlis, Perth	Provision of high quality bus infrastructure at Pitheavlis, Perth in support of ongoing workplace travel plan in conjunction with AVIVA.	RTS	↔	↑	↑	↑	↔	↑		PKC	↔	↔	20		
C2	Awareness Campaigns including Smarter Choices, Salary Sacrifice, Travel Discount Schemes, Workplace Travel Planning, promotion of Active Travel and marketing of Walking and Cycling	Implementation of Bus Strategy Actions NP6, NP8 and Walking and Cycling Strategy Actions E1 and E3. Investment in infrastructure to support Hearts and Minds campaigns which have been shown to be effective in delivering Dundee Health Central Smarter Choices	RTS	↔	↑	↑	↑	↔	↑	AC, DCC	PKC, SC	↑	↔	1275	100	Awaiting outcome of Dundee Health Central. £75k year 3, thereafter £100k p.a.
C3	Dundee Travel Active Smarter Choice Smarter Places Project	Implementation of Walking and Cycling Strategy Actions E2 and E3. Measures to support aims of Scottish Government Smarter Choices, Smarter Places pilot, now being expanded to other areas of Dundee. With funding from SCSP fund and Tactran/DCC Capital programme.	WC	↑	↑	↑	↑	↑	↑		DCC	↑	↔	2710		Dundee Health Central £200k per annum years 1 & 2. Revenue for maintenance ?
C4	Low Carbon Transport & Infrastructure - Dundee	Implementation of Low Carbon Transport and Infrastructure measures aimed at decarbonising road transport.	RTS	↔	↑	↑	↑	↔	↔		DCC	↑	↔	110		
Walking and cycling measures																
D1	Stirling University Cycle/Walk Link	Implementation of Walking and Cycling Strategy Action B2 . Development of an approximately 2km cycle facility connecting Stirling University to local and NCN route.	WC	↑	↑	↑	↑	↑	↑		SC	↑	↔	200		Yr1 £75k, Yr 2 £25
D2	Ninewells Hospital - NCN Cycle/Walk Link	Implementation of Walking and Cycling Strategy Action B1. Development of an approximately 2km cycle facility connecting Ninewells Hospital to local and NCN route.	WC	↑	↑	↑	↑	↑	↑		DCC	↑	↔	80		Yr1 £80k
D3	Walk/Cycle links from Hospitals, Employment Centres, Education to nearest National Cycle Network Route.	Continued support for Walking and Cycling Strategy Action B1 and B2. Development of walking and cycling links to and within town and city centres and to education and health services and employment, leisure and tourism activities in conjunction with Travel Plans.	WC	↑	↑	↑	↑	↑	↑		All	↑	↔	3000	250	Yr4 onwards assume 5km per annum at cost of £50k per km. Therefore £250k per annum yr 2 onwards.

TACTRAN Delivery Plan

Delivery Plan Ref No.	Project	Description	Relevant Strategy	Indicative Objective Benefit						Relationship with SOA's		Climate Change Act		Financial Estimate		Notes
				ACCESSIBILITY	ECONOMY	ENVIRONMENT	HEALTH & WELL BEING	SAFETY & SECURITY	INTEGRATION	SOA Named	SOA General	Mitigation	Adaptation	Project Cost	General Capital Allowance for Delivery per annum	
D4	Doune - Callander Cycle/Walk Link	Implementation of Walking and Cycling Strategy Action B1. supporting development of the National Cycle Network and a complementary regional network by connecting key settlements, and provide local links to the NCN in cooperation with Sustrans.	WC	↑	↑	↑	↑	↑	↑		SC	↑	↔	600		12km at £50k per km from Yr4,5 & 6 at 4km per yr. Possible match funding from Sustrans
D5	Perth - New Scone Connect 2 Bridge over Tay	Implementation of Walking and Cycling Strategy Action B1. Perth to New Scone has been identified as the top priority cycle/walk regional link in work undertaken for the Walking and Cycling Strategy. Delivery Plan funding is a contribution to a scheme that has also secured lottery funding.	WC	↑	↑	↑	↑	↑	↑		PKC	↑	↔	3800		Contribution towards total Connect 2 Tay Bridge project total of £7m total. Lottery funding is £1.25m
D6	Walk/Cycle links completing gaps in National Cycle Network	Continued support for Walking and Cycling Strategy Action B1. Development of the National Cycle Network and a complementary regional network connecting key settlements, and provide local links to the NCN in cooperation with Sustrans.	WC	↑	↑	↑	↑	↑	↑		All	↑	↔	3000	250	Yr 4 onwards assume 5km per annum at cost of £50k per km. Therefore £250k per annum yr 4 onwards.
D7	Secure cycle parking at key trip destinations in Dundee	Implementation of Walking and Cycling Strategy Action B3. Location of cycle parking yet to be identified and prioritised.	WC	↑	↑	↑	↑	↑	↔		DCC	↑	↔	6		
D8	Secure cycle parking at key trip destinations.	Implementation of Walking and Cycling Strategy Action B3. Location of cycle parking yet to be identified and prioritised.	WC	↑	↑	↑	↑	↑	↔		All	↑	↔	274	20	£20k per annum for implementation Yr 2 onwards. Possible match funding for some locations.
D9	Stirling City Cycle/Walk Signage	Implementation of Walking and Cycling Strategy Action B1 and B2. Signage enhancement of walking and cycling links to and within Stirling .	WC	↑	↑	↑	↑	↑	↑		SC	↑	↔	25		
D10	Walk/Cycle links - A81 Bridge-end to Callander	Implementation of Walking and Cycling Strategy Action B1 and B2. Development of walking and cycling links to and within town and city centres and to education and health services and employment, leisure and tourism activities in conjunction with Travel Plans.	WC	↑	↑	↑	↑	↑	↑		SC	↑	↔	48		
D11	Walk/Cycle links - A905 Main Street Fallin - Puffin Crossing	Implementation of Walking and Cycling Strategy Action B1 and B2. Development of walking and cycling links to and within town and city centres and to education and health services and employment, leisure and tourism activities in conjunction with Travel Plans.	WC	↑	↑	↑	↑	↑	↑		SC	↔	↔	30		
D12	Doune to Dunblane Argaty Crossing	Implementation of Walking and Cycling Strategy Action B1. supporting development of the National Cycle Network and a complementary regional network by connecting key settlements, and provide local links to the NCN in cooperation with Sustrans.	WC	↑	↑	↑	↑	↑	↑		SC	↔	↔	50		
D13	A905 Kerse Road Toucan Crossing	Implementation of Walking and Cycling Strategy Action B1. supporting development of the National Cycle Network and a complementary regional network by connecting key settlements, and provide local links to the NCN in cooperation with Sustrans.	WC	↑	↑	↑	↑	↑	↑		SC	↔	↔	60		
Bus-based measures																
E1	Blaigowrie - Perth Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main actions for this project is to implement bus stop infrastructure, lighting and mobility improvements (IV3, IV6, IV7).	BUS	↑	↔	↑	↑	↑	↔		PKC	↑	↔	115		Includes bus infrastructure, lighting, mobility measures
E2	Dundee - Perth Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main actions for this project is to implement bus stop infrastructure, lighting and mobility improvements (IV3, IV6, IV7).	BUS	↑	↔	↑	↑	↑	↔		PKC, DCC	↑	↔	95		
E3	Dundee - Blairgowrie Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main action for this project is to implement bus priority/punctuality improvements (IV3).	BUS	↔	↑	↑	↔	↔	↑		DCC, PKC	↑	↔	210		Bus Priority - Lochee Bypass
E4	Alloa - Stirling - Larbert Hospital Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main action for this project is to implement bus priority/punctuality improvements (IV3).	BUS	↔	↑	↑	↔	↔	↑		SC	↑	↔	300		Includes bus infrastructure, lighting, mobility measures and bus priority
E5	Arbroath - Montrose - Brechin - Stracathro Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main actions for this project is to implement bus stop infrastructure, lighting and mobility improvements (IV3, IV6, IV7).	BUS	↑	↔	↑	↑	↑	↔		AC	↑	↔	100		Yr 1 bus infrastructure, lighting, mobility measures

TACTRAN Delivery Plan

Delivery Plan Ref No.	Project	Description	Relevant Strategy	Indicative Objective Benefit						Relationship with SOA's		Climate Change Act		Financial Estimate		Notes
				ACCESSIBILITY	ECONOMY	ENVIRONMENT	HEALTH & WELL BEING	SAFETY & SECURITY	INTEGRATION	SOA Named	SOA General	Mitigation	Adaptation	Project Cost	General Capital Allowance for Delivery per annum	
														Capital Cost £000's	Annual Capital Costs	
E6	Brechin - Forfar Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main actions for this project is to implement bus stop infrastructure, lighting and mobility improvements (IV3, IV6, IV7).	BUS	↑	↔	↑	↑	↑	↔		AC	↑	↔	100		Yr1/Yr2 bus infrastructure, lighting, mobility measures
E7	Forfar - Arbroath Quality Bus Corridor	Implementation of measures to support a raft of Bus Strategy Actions NP3, NP4, IV3, IV5, IV6, IV7. Although incorporating a number of elements, the main actions for this project is to implement bus stop infrastructure, lighting and mobility improvements (IV3, IV6, IV7).	BUS	↑	↔	↑	↑	↑	↔		AC	↑	↔	100		Yr4 bus infrastructure, lighting, mobility measures
E8	Mobility Access at Key Bus Stops in Angus	Bus Boarders to provide easy access to buses for those with mobility impairments	BUS	↑	↔	↔	↑	↑	↑		AC	↑	↔	54		
E9	Bus Priority Measures on Key Quality Corridors	Continued support for Bus Strategy Action NP3 to identify and prioritise key strategic corridors for bus priority measures and, in partnership with key stakeholders, explore the potential for introduction of Punctuality Improvement Partnerships (PIPs).	BUS	↔	↑	↑	↔	↔	↑		All	↑	↔	4000	330	Feasibility/Design Yr 4, 4 smaller Bus Priority schemes at £250k each per annum beginning Yr 4 (i.e. assume 1 bus priority measure for 2 corridors) 3 No Larger bus priority schemes £1m each in Later Years. Assume 1 per 2 corridors. Years 1-3 moved to
E10	Bus bay markings, signing and traffic regulation orders	Continued support for Bus Strategy Action NP4 to ensure traffic regulations that facilitate efficient bus service provision are enforced.	BUS	↔	↑	↑	↔	↔	↔		All	↑	↔	180	15	Bus bay markings /enforcement plates/tro say £150 each @ 100 per annum (i.e. 50 per corridor) Yr 4 Onwards
E11	Bus Stop Infrastructure Improvements on Quality Corridors (including lighting and mobility access)	Continue support for Bus Strategy Action IV3, IV6 and IV7 to prioritise corridors and individual sites for improvement to bus stop infrastructure, including lighting and mobility access.	BUS	↑	↔	↑	↑	↑	↔		All	↑	↔	4200	350	Quality corridors at £175k per corridor. Assume 2 corridors per annum from Yr 4 Onwards
E12	CCTV on Quality Corridors	Continued support for Bus Strategy Action IV5 to identify and prioritise opportunities for enhanced provision of CCTV on vehicles and at key interchanges.	BUS	↔	↔	↑	↑	↑	↔		All	↑	↔	480	40	Assume 1 per annum at £40k Yr 4 onwards. (i.e. assume 1 per 2 corridors) Assumed CCTV at Interchanges included in interchange costs (See Interchange category). CCTV on bus assumed to be Bus Operators expense.
E13	Real Time Information Corridor signs and on bus facilities	Implementation of Travel Information Strategy Action A22. Extending Real Time Passenger Information on next available services into Perth & Kinross and Stirling Council Areas.	TIS	↑	↑	↑	↔	↑	↑		All	↑	↔	3600		PKC and SC - Assume 2 corridors installed to require 50 RTPi signs and 25 on bus equipment per annum. Cost £300k per annum from yr 4 onwards
E14	Real Time Information Central System (inc comms) - SC	Implementation of Travel Information Strategy Action A22. Extending Real Time Passenger Information on next available services into Stirling Council Area.	TIS	↑	↑	↑	↔	↑	↑		SC	↑	↔	160		Yr 4 Central and Comms system - SC - need to tie in to SESTRAN RTIS
E15	Real Time Information Central System (inc comms) - PKC	Implementation of Travel Information Strategy Action A22. Extending Real Time Passenger Information on next available services into Perth & Kinross Council Area.	TIS	↑	↑	↑	↔	↑	↑		PKC	↑	↔	160		Yr 4 Central & comms system - PKC
E16	Killin Bus Turning Circle	Implementation of improvements to bus infrastructure and facilities	BUS	↑	↔	↑	↑	↑	↔		SC	↔	↔	131		
E17	Real Time Passenger Information Upgrade - Dundee City Centre and Ninewells Hospital	Implementation of Travel Information Strategy Action A22. Upgrade of RTPi signs at Dundee City Centre and Ninewells to provide better and more flexible display options and information provision	TIS	↑	↑	↑	↔	↑	↑		DCC	↑	↔	75		
Rail-based Measures																
F1	TERS plus Rail Service from Arbroath to Glasgow	Feasibility Study involving Transport Scotland, First ScotRail and Network Rail to update the Business Case for the proposed TERS Rail service from Arbroath - Glasgow, including rail infrastructure requirements has been completed. Incremental improvements being	PR	↑	↑	↑	↔	↔	↔		All	↑	↔	240		Assume net operating cost circa £900k pa. Assume service begins yr3/Yr4 at £450 per annum. Thereafter £900k pa.
F2	TERS plus Station enhancements	Station enhancements recommended from TERS study and other station improvements on Aberdeen to Glasgow corridor between Montrose and Stirling.	PR	↑	↑	↔	↔	↔	↑		All	↑	↑	5500		Costs as per existing STAG 2 with £6m added for 2 extra new stations and all infrastructure moved back to Yr 4 - 9 at earliest
F3	TERS - Gleneagles Station Enhancement	TERS recommendation to enhance Gleneagles Station including new road access, expanded car park, customer information, safety, accessibility and station building upgrades being progressed with Perth & Kinross Council, Transport Scotland and rail industry with aim of completion by September 2014. Ryder Cup.	PR	↑	↑	↔	↔	↑	↑		PKC	↑	↑	hr		
F4	Edinburgh Glasgow Improvement Programme (EGIP) - Enabling Works - Carseview Rail Bridge replacement and realignment	EGIP is aimed at reducing Journey times between Glasgow and Edinburgh and other Central Scotland locations. Carseview Rail Bridge replacement and realignment is part of enabling works to extend EGIP to	RTS	↑	↑	↑	↔	↔	↑		SC	↔	↔	300		
Measures associated with improving multi-modal interchange																
G1	Significant improvements to Dundee railway station	Significant improvement in function and form of Dundee railway station to provide a suitable gateway to the city.	RTS	↑	↑	↑	↑	↔	↑		DCC	↑	↑	9000		Estimated cost as per RTS 2007 for Yr 4 - 9. Ties in with programmed completion of Central Waterfront infrastructure completion in year 9.

TACTRAN Delivery Plan

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				ACCESSIBILITY	ECONOMY	ENVIRONMENT	HEALTH & WELL BEING	SAFETY & SECURITY	INTEGRATION	SOA Named	SOA General	Mitigation	Adaptation	Project Cost	General Capital Allowance for Delivery per annum	
														Capital Cost £000's	Annual Capital Costs	
G2	Significant improvements to Perth's rail and bus stations and associated links to the city centre.	Co-location of Perth's bus station with the railway station and improved links to city centre.	RTS	↑	↑	↑	↑	↔	↑	PKC		↑	↑	25000		Estimate from RTS 2007 still valid. Total cost likely to be around £25m but need to allocate between Network Rail and PKC/TACTRAN. Share thought to be £5m approx.
G3	Significant integration improvements at Stirling's bus and rail station.	Upgrading of Stirling bus station to provide full integration with the railway station.	RTS	↑	↑	↑	↔	↔	↑		SC	↑	↑	5000		RTS 2007 had included total of £5m in yrs 4 - 9. Is this still required?
G4	Stirling's bus and rail station - canopy and station forecourt improvements..	To help deliver integration improvements at Stirling's bus and rail station.	RTS	↑	↑	↑	↔	↔	↑		SC	↑	↔	250		extension to the canopy and improvements to area in front of rail station.
G5	New Rail Station at Bridge of Earn	Implementation of Park and Ride Strategy Action NPR 11 supporting the development of a new rail station at Bridge of Earn and ensuring the provision of parking space is sufficient to match the anticipated parking demand.	PR	↑	↔	↔	↔	↑	↑		PKC	↑	↔	3000		Assume £3m in Years 4 - 9
G6	Additional Car Parking at Bridge of Allan/Dunblane Rail Stations	Implementation of Park and Ride Strategy Action EPR5, supporting the provision of additional car parking at Dunblane and / or Bridge of Allan. Extension of existing car park in early years and further investigation for significant upgrade ongoing with Network Rail.	PR	↑	↑	↑	↑	↑	↑		SC	↑	↔	340		Based on 100spaces and 10% annual Revenue costs. Discussions re Network Rail funding ongoing
G7	Bus CT DRT Spoke and Hub Interchange	Implementation of Bus Strategy Action IV2 to assess the opportunities for new bus interchange facilities and provide interchanges between CT/DRT and bus services.	BUS	↑	↑	↑	↑	↑	↑	SC	AC, DCC, PKC	↑	↔	4000	330	implement over Yrs 4-9 and Yr 10 - 15
G8	Crianlarich/Tyndrum Interchange	Implementation of Bus Strategy Action IV2. The need and opportunity for new bus/coach interchange facility has been identified at Crianlarich/Tyndrum.	BUS	↑	↑	↑	↑	↑	↑		SC	↑	↔	250		Design, land and implementation split over yrs 1 and 2
G9	Arbroath Bus Station Improvements	Implementation of Bus Strategy Action IV1 to deliver improvements to regionally significant interchanges.	BUS	↑	↑	↑	↔	↑	↑		AC	↑	↔	420		Updated as per Angus Council Committee Report
G10	Blairgowrie Bus Stance Improvements	Implementation of Bus Strategy Action IV1 to deliver improvements to regionally significant interchanges.	BUS	↑	↑	↑	↑	↑	↔		PKC	↑	↔	600		Blairgowrie Bus Stance identified as requiring upgrading, but moved back to yr 4 onwards
G11	Upgrade Existing interchanges to a quality standard.	Continued support of Bus Strategy Action IV1 to establish minimum standards for regionally significant interchanges and deliver improvements.	BUS	↑	↑	↑	↑	↑	↔		All	↑	↔	6000	500	Yr 4 onwards one Station per annum at £1m to max of 6 stations
G12	New Park & Ride facility - south of the Tay Bridge	Implementation of Park and Ride Strategy Action NPR2 and STPR Project 8. Implement proposals for a new bus Park & Ride south of the Tay Bridge, incorporating multi-modal and other best practice.	PR	↑	↑	↑	↑	↑	↑	DCC		↔	↔	3670		Yr 2 300spaces, 100 more spaces yr 7. Maybe 50% shared with SESTRAN. Assume existing bus service.
G13	New Park & Ride facility - A90 West of Dundee	Implementation of Park and Ride Strategy Action NPR3. and STPR Project 8. Implement proposals for a new bus Park & Ride site west of Dundee near the A90, incorporating multi-modal and other best practice.	PR	↑	↑	↑	↑	↑	↑	DCC	PKC, AC	↔	↔	3030		Y4 250 Spaces. Assume existing bus service.
G14	New Park & Ride facility - A92 East of Dundee, near Monifieth	Implementation of Park and Ride Strategy Action NPR5 and STPR Project 8. Implement proposals for a new bus Park & Ride site east of Dundee near the A92, incorporating multi-modal and other best practice.	PR	↑	↑	↑	↑	↑	↑	DCC	AC	↔	↔	1350		Yr 8 250 Spaces. Assume existing bus service.
G15	New Park & Ride facility - A90 Dundee North, near Fintry	Implementation of Park and Ride Strategy Action NPR6 and STPR Project 8. Implement proposals for a new bus Park & Ride site on the north side of Dundee near the A90, incorporating multi-modal and other best practice.	PR	↑	↔	↔	↔	↑	↔	DCC	AC	↔	↔	1350		Yr 10 250 Spaces. Assume existing bus service.
G16	New Park & Ride facility - A90 East of Perth, near Walnut Grove	Implementation of Park and Ride Strategy Action NPR8. Implement proposals for a new bus Park & Ride site east of Perth near the A90, incorporating multi-modal and other best practice.	PR	↑	↑	↑	↑	↑	↑	PKC	DCC	↔	↔	1600		Yr 3 250 Spaces - Priority Swapped. Assume existing bus service.
G17	New Park & Ride facility - A9 North of Perth	Implementation of Park and Ride Strategy Action NPR7. Implement proposals for a new bus Park & Ride site North of Perth near the A9, incorporating multi-modal and other best practice.	PR	↑	↑	↑	↑	↑	↑	PKC		↔	↔	1350		Yr 6 250 Spaces - Priority Swapped. Assume existing bus service.
G18	New Park & Ride facility - South of Stirling	Implementation of Park and Ride Strategy Action NPR9. Implement proposals for a new bus Park & Ride site south of Stirling, incorporating multi-modal and other best practice.	PR	↑	↔	↔	↔	↑	↑		SC	↔	↔	1350		Yr 5 250 Spaces. Assume existing bus service.
G19	Improved waiting facilities at Broxden, Perth	Implementation of Park and Ride Strategy Action EPR2 to provide improved waiting facilities at Broxden, Perth to accommodate the passenger demand at the site.	PR	↑	↑	↑	↑	↑	↔	PKC	SC	↑	↔	225		

TACTRAN Delivery Plan

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														Capital Cost £000's	Annual Capital Costs	
G20	Improved waiting facilities at Springkerse, Stirling	Implementation of Park and Ride Strategy Action EPR2 to provide improved waiting facilities at Springkerse, Stirling to accommodate the passenger demand at the site.	PR	↑	↑	↑	↑	↑	↔		SC	↑	↔	100		Yr 1 in PR strategy
G21	Expansion of Car Parking at Castlevie P&R, Stirling	Implementation of Park and Ride Strategy Action EPR3 to expand existing P&R where there is demand. The Castlevie Park and Ride Site with 250 parking spaces was opened recently. The demand is forecast to increase and there is land for expansion to 400 spaces	PR	↑	↑	↑	↑	↑	↔		SC, PKC	↑	↔	500		Yr 3 and 4 Implement
G22	A90 Forfar multi-modal Interchange	Implementation of Park and Ride Strategy Action NPR 12 to facilitate essential interchange at long distance bus stops	PR	↑	↔	↔	↔	↑	↔		AC, DCC	↑	↔	75		Provide a link to strategic PT travel end yr 1 and Yr 2
G23	A90 Brechin multi-modal Interchange	Implementation of Park and Ride Strategy Action NPR 12 to facilitate essential interchange at long distance bus stops	PR	↑	↔	↔	↔	↑	↔		AC,DCC	↑	↔	75		Provide a link to strategic PT travel Yr 4
G24	New Interchanges	Continued support for Bus Strategy Action IV2 to assess opportunities for new interchanges.	BUS	↑	↑	↑	↔	↑	↑		All	↑	↔	200		
Community and Demand Responsive Transport																
H1	Demand Responsive Transport Urban Pilot - Dundee	Assist with the implementation of Bus Strategy Actions NC3, IV7, IV9, NP9 and NP11. Pilot to assist in determining the potential for expansion of Demand Responsive Transport provision in urban areas across TACTRAN.	BUS	↑	↑	↔	↔	↔	↔		DCC	↑	↔	125		Pilot £250k year one
H2	Demand Responsive Transport Rural Pilot	Assist with the implementation of Bus Strategy Actions NC3, IV7, IV9, NP9 and NP11. Pilot to assist in determining the potential for expansion of Demand Responsive Transport provision in rural areas across TACTRAN.	BUS	↑	↑	↔	↔	↔	↔	SC	AC, PKC	↑	↔	250		Pilot £250k year one
H3	CT/DRT Booking system	Implementation of Bus Strategy Action NP9. Building on the outcomes of the DRT pilot schemes this action will facilitate a co-ordinated information and booking service for CT/DRT services.	BUS	↑	↑	↑	↑	↑	↔	SC	AC, DCC, PKC	↑	↔	500		Purchase TDC system / software and tailor to TACTRAN requirements 3/Yr4 maintenance costs circa £100k per annum thereafter.
Road Infrastructure																
I1	A90 through/around Dundee and an associated package of pedestrian, cycling and bus priority measures.	Design, development and implementation of A90 through/around Dundee and an associated package of pedestrian, cycling and bus priority measures. Consideration of all options in conjunction with Transport Scotland through the STPR, Project 29.	RTS	↑	↑	↔	↑	↑	↑		DCC	↔	↑	175000		As per RTS 2007
I2	A9/A94 link-road and an associated package of pedestrian, cycling and bus priority measures in Perth.	Design, development and implementation of a new A9/A94 link-road and an associated package of pedestrian, cycling and bus priority measures in Perth.	RTS	↑	↑	↔	↑	↑	↑	PKC		↔	↑	62500		Yr 1 Design completed. Yr 4 - 6 implement at estimate of £35m. Funding mechanism to be identified.
I3	A9/A94 link road - Perth Western Edge Transport Solutions	Design, development and implementation of junction/road improvements, pedestrian overbridge and public transport enhancements in the western edge area of Perth. Detailed design in year 1 for implementation in future years.	RTS	↑	↑	↔	↑	↑	↑	PKC		↔	↑	17000		
I4	A84/A9 link-road to the west of Stirling and associated package of pedestrian, cycling and bus priority measures in Stirling City centre.	Design, development and implementation of the A84/A9 link-road to the west of Stirling and associated package of pedestrian, cycling and bus priority measures in Stirling City centre.	RTS	↑	↑	↔	↑	↑	↑		SC	↔	↑	57000		All moved to later years
I5	M9/A811 interchange.	Design, development and implementation of M9/A811 interchange in conjunction with A84/A9 link road to complete Stirling's Outer Ring Road	RTS	↔	↑	↔	↔	↔	↑		SC	↔	↑	11000		As per RTS 2007
I6	Programme of road safety measures for the A9 between Stirling and Perth and Perth and Inverness.	Programme of road safety measures for the A9 between Stirling and Perth and Perth and Inverness included in STPR. Work closely with Transport Scotland through the STPR and the relevant Councils and HITRANS to support	RTS	↑	↑	↔	↔	↑	↔	PKC	SC	↔	↑	500000		As Per RTS 2007, TS to deliver therefore will be removed
I7	Programme of road safety measures for the A85/A84/A82 between Callendar and the regional boundary.	Work closely with Transport Scotland and Stirling Council to support a programme of road safety measures for the A85/A84/A82 between Callendar and the regional boundary.	RTS	↔	↑	↔	↔	↑	↔		SC	↔	↔	11750		As per RTS 2007, but likely to be lobbying role therefore remove
I8	Programme of road safety measures for the A90.	Work closely with Transport Scotland, the relevant Councils and NESTRANS to support a programme of road safety measures for the A90.	RTS	↔	↔	↔	↔	↑	↔		AC, DCC, PKC	↔	↔	24000		As per RTS 2007, but likely to be lobbying role therefore remove

TACTRAN Delivery Plan

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														Capital Cost £000's	Annual Capital Costs	
I9	Programme of road safety measures for the A977	Work closely with Transport Scotland, Perth and Kinross Council, SESTRAN and FETA to support a programme of road safety measures for the A977	RTS	↔	↔	↔	↔	↑	↔		PKC	↔	↔	1000		PKC lobbying for route to be re-trunked as result of new Kincardine Bridge. £1m moved to later years
I10	Programme of road safety measures for the A811	Work closely with Stirling Council and SPT to support a programme of road safety measures for the A811	RTS	↔	↔	↔	↔	↑	↔		SC	↔	↔	500		All moved to later years
I11	Road safety concerns on the strategic road network	Work closely with Transport Scotland, constituent Councils and neighbouring Regional Transport Partnerships to address road safety concerns on the strategic road network	RTS	↔	↑	↔	↔	↑	↔		All	↔	↔	3000	750	All moved to later years
Freight Specific measures																
J1	Inter-modal Regional Rail Freight Facilities at Dundee	Development of freight facilities, building on existing proposals at Dundee Port for inter-modal transfer between road, rail and sea-borne freight.	RTS	↔	↑	↑	↔	↔	↑		DCC	↑	↔	5000		Awaiting outcome of Scottish Enterprise Study. Earliest Likely start date Yr 4
J2	Inter-modal Regional Rail Freight Facilities at Perth	Development of freight facilities, building on existing proposals at Perth Harbour for inter-modal transfer between road, rail and sea-borne freight.	RTS	↔	↑	↑	↔	↔	↑		PKC	↑	↔	1500		Design/Consultation Yr 1/2. Yr 3 Start Date. Total for Hardstanding and Crane estimated at £1.5m
J3	Inter-modal Regional Rail Freight Facilities at Montrose	Development of regional facilities, building on existing proposals at Montrose Port for inter-modal transfer between road, rail and sea-borne freight.	RTS	↔	↑	↑	↔	↔	↑		AC	↑	↔	1500		Assumed £1.5m total capital cost and delivery in Yrs 4-9. Finding of Deltix Study Required
J4	Improved Road Links to Dundee Port	The rail line creates a barrier with few accessible road links to Dundee Port. This action will assist with design and development work on a new bridge over the rail line at Stannergate, Dundee and associated road and	RTS	↔	↑	↑	↓	↔	↑		DCC	↔	↑	2300		Design/Feasibility Year 1. Implementation Year 4 onwards. Bridge £2m, Stannergate Jcn £2.5m, Greendykes £0.5m
J5	Improved Road Links to Perth Harbour	Investigation, development and implementation of a road link extending to Perth Harbour to facilitate road/rail interchange.	RTS	↔	↑	↑	↓	↔	↑	PKC		↔	↑	3000		Moved to backwards to begin Year 4. £3m total
J6	Improved Road Links to Montrose Port - A92 north of Arbroath Route Action Plan	Improvements to the A92 north of Arbroath to Montrose and its Port through a series of targeted road improvements.	RTS	↔	↑	↑	↓	↔	↑		AC	↔	↑	2880		Updated as per Angus Council Capital Plan
J7	Improved Road Links to Montrose Port - A935 Montrose to Brechin Route Action Plan	Improvements to A935 road link between Brechin and Montrose and its Port through a series of targeted road improvements.	RTS	↔	↑	↑	↓	↔	↑		AC	↔	↑	1459		Updated as per Angus Council Capital Plan
J8	Improved Road Links to Montrose Port - A90(T) to A935 East of Brechin Link Road.	Investigation, development and implementation of a link road between A90 and A935 to provide improved access to Montrose and its Port.	RTS	↔	↑	↑	↓	↔	↑		AC	↔	↑	4700		Updated as per Angus Council Capital Plan
J9	Freight Quality Partnership and Action Plan - cost-effective packages of freight-related interventions across the region.	Capital funding provision to assist in delivering cost-effective packages of freight-related interventions across the region. identified through a Freight Quality Partnership	RTS	↔	↑	↔	↑	↔	↑		All	↔	↔	3000	250	All moved to later years except £250 in Yr 3.
												TACTRAN RTS		311407		
												Strategic Transport Projects Review		684400		
												Total		995807		

F. Support to low carbon vehicles and infrastructure – Supporting Evidence

Supporting evidence – UK context

The UK Committee on Climate Change (CCC) recommends that, in order to achieve the required levels of electric vehicle take-up (plug-in hybrid and full electric), *“the Government should commit to funding both to offset a transitional cost premium and to develop a national battery charging network”*⁷⁴.

Considering existing price support mechanisms (plug-in car and van grant⁷⁵), the CCC notes that *“more resource is likely to be required to deliver the penetration of electric vehicles set out in our scenarios”*.

Considering the need for charging infrastructure and the existing Plugged-in-Places (PiP) programme⁷⁶, the CCC notes that

- *“charging infrastructure to support 1.7 million cars in 2020 could be achieved at a cost of a few hundred million pounds, rising to around £1.4 billion depending on the level of sophistication of charging meters. This would have to be funded at least in part by Government”*; and
- *“Plugged-In Places delivered a total of around 2,000 charge points in the period to the end of March 2012. This period has also seen significant investment in privately delivered charge points, with a total of around 4,000 delivered to the end of March 2012. It is likely that the Plugged-In Places programme has facilitated investment in privately delivered charge points by providing the private sector with confidence in the existence of a market for electric vehicles and the viability of battery-charging business models”*.

The requirement to provide adequate charging infrastructure is likely to be supported by future EU regulation through the implementation of the EU Clean Fuel Strategy⁷⁷. Based on EU member states’ targets for the number of electric vehicles on their roads by 2020, the EU is proposing to establish a minimum number of publicly accessible charging points for each country⁷⁸.

DVLA data shows that, during the third quarter of 2012, a total of 987 new ultra-low emission vehicles⁷⁹ were registered for the first time in the UK. This was an increase of 91% from 516 in 2011 Q3. *“The Plug-In Car Grant, which started in January 2011, is likely to have made a major contribution to this increase. An increase in supply of electric cars to the UK market will have also played a part”*⁸⁰.

Supporting evidence – Scottish context

Scotland is already very active in the promotion of electric vehicle uptake. This reflects an ambition to play a leading role in the field and the key role attributed to low carbon vehicles in the plan to meet the challenge in reducing transport emissions by the amount identified by the CCC, also reflected in the Scottish government’s stated ambition of complete decarbonisation of road transport by 2050, re-emphasised in the draft RPP2⁸¹ published in February 2013.

The most recent development in the field was the Scottish government’s February 2013 announcement of £2.6 million intended investment⁸² in a large scale expansion of the charging point network, to be called ‘Charge Place Scotland’. Planned new points are intended to provide public points at least every 50 miles on the trunk road network and provision at leisure facilities, local authority public car parks and ferry terminals, along with free installation in homes and funding for workplace points. Funding will initially focus on expanding provision in Glasgow in time for the Commonwealth Games. The announcement was further supported by the launch of a website to raise awareness of electric vehicles and their potential amongst the public; including details of charging point locations and available grants for vehicle purchase.⁸³

This funding follows on from significant investment over the last three years to support vehicle purchase and infrastructure in Scotland, including two phases of the Plugged in Places scheme, bringing charging facilities to the seven cities and trunk roads as well as homes and work places.

Total investment in vehicles and infrastructure in Scotland is set to have reached £9 million by the end of the 2012/13 financial year and will have funded the purchase of a substantial number of vehicles (270 by

February 2013) and the implementation of an extensive network of charging points, totalling 280 in February (with 80 public points) and forecast to increase to more than 500 (with over 300 public points) by the end of summer 2013.

The number of Plug-In Car/Van Grant vehicles registered in the Tactran area in 2012 is 55 cars and 7 vans, representing 28% of total number of vehicles registered through Plug-In Car/Van programme in Scotland. The majority of these vehicles are registered in Dundee (39 cars and 7 vans)⁸⁴, of which several are associated with Dundee City Council in line with its announcement in October 2012 that it was investing £162,000 (Tactran contributed £30K) in expanding its pool of eight electric cars to twenty-four. Perth and Kinross has a further 6 cars registered and Stirling a further 10.

Beyond the direct public sector interventions, expansion of electric vehicle use in Scotland is also being supported by the E-cosse partnership. E-cosse was initiated by Transport Scotland and WWF Scotland and involves collaboration between industry, government and stakeholders, recognising the importance of each in successful take up of electric vehicles.

Despite the existing activity in the field, it is recognised that further support, particularly for vehicle purchase, is needed to encourage sufficient electric vehicle take up to meet the challenging ambitions identified. The scale of the challenge is highlighted by the Draft RPP2 which identifies similar uptake targets to the CCC, suggesting that that in order to meet the decarbonisation aim, potentially 60% of new cars and 30% of the total car fleet will need to be electric by 2030 (equating to approximately 100,000 and 720,000 vehicles respectively for Scotland).

⁷⁴ Source: UK Committee on Climate Change (www.theccc.org.uk/sectors/surface-transport/electric-cars)

⁷⁵ Up to £5,000 towards the purchase of an eligible electric car and £8,000 for each eligible electric van

⁷⁶ Currently funded in the East of England, Greater Manchester, London, the Midlands, Milton Keynes, the North East, Northern Ireland and Scotland

⁷⁷ See http://europa.eu/rapid/press-release_IP-13-40_en.htm?locale=en

⁷⁸ http://ec.europa.eu/transport/themes/urban/cpt/index_en.htm

⁷⁹ With tailpipe emissions below 75 g/km of CO₂. Of which 736 ultra-low emission cars and quadricycles

⁸⁰ Source: Vehicle licensing statistics, 2012 (www.gov.uk/government/uploads/system/uploads/attachment_data/file/35995/vls-quarter-3-2012.pdf)

⁸¹ Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027: The Draft Second Report on Proposals <http://www.scotland.gov.uk/Resource/0041/00413150.pdf>

⁸² including £0.75 million from Transport Scotland

⁸³ <http://www.greenerscotland.org/travel/electric-vehicles>

⁸⁴ Source: Cenex

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