Transport Technical Annex

This is an annex to the CCC advice on Scottish climate change targets, covering detailed technical considerations for the transport sector analysis.

Forecasts of travel demand

Forecasts of travel demand in Scotland are available from Transport Scotland's 'Transport Model for Scotland' (TMfS) and the UK Department for Transport's 'National Transport Model' (NTM). As the overall difference in traffic growth projected by the two models is relatively small, we have opted to use the NTM for our baseline projection as it is better suited to our analysis of emissions reduction:

- The most recent run of TMfS and an equivalent run of the NTM both predict a 35% increase in overall traffic between 2010 and 2035.
- The CCC baseline run was commissioned from DfT in 2015 and uses the most up to date Government fuel price projections. No such run of TMfS was available at that time.
- The NTM van and HGV models are more detailed than those in TMfS. In addition, the NTM van model has been recently updated to account for recent rapid rises in van traffic.
- As we used the NTM for our analysis for the UK's fifth carbon budget, this maintains consistency between the Committee's UK advice and our Scottish advice.

We now turn to look at how patterns of travel demand are important for determining the extent of potential emissions reduction, and consider the differences in travel patterns between Scotland and Great Britain[1] as a whole.

Patterns of travel demand

Patterns of travel demand can influence the scope for reducing emissions in a number of ways. Two key examples are reducing demand for car travel and uptake and usage of electric vehicles (EVs):

- Demand for car travel can be reduced by measures such as shifting trips to lower carbon modes like walking, cycling or public transport. We have developed scenarios for reducing demand for car travel based on analysis of data from the National Travel Survey (NTS), which depend on existing travel patterns.
  - The NTS provides a representative picture of trips taken across Great Britain (data is available for the whole of Great Britain up to 2012 but the NTS was discontinued in Wales and Scotland from 2013).
  - Using this data, we identified a set of car trips that might be amenable to switch to a lower carbon mode, using a number of criteria including distance, time of day, purpose, age of traveller and an urban/rural identifier. For example, shorter, daytime trips undertaken by younger people in urban areas are assumed to be more amenable to mode switching.
  - Overall, this analysis suggests that 24% of car trips with the shortest length, representing 5% of car kilometres, could be switched to bus, cycling or walking given the appropriate policy support and investment.

[1] We focus on Great Britain, rather than the UK, as data for Northern Ireland is limited.

- Our analysis of uptake and usage of electric vehicles (EV) suggests that car drivers' range requirements and trip patterns will influence whether the purchase an EV and the extent to which plug-in hybrid EVs (PHEVs) will be driven in electric mode.
  - Our modelling of EV uptake[2] suggests that 25% of new cars could be fully electric by 2030 provided available vehicles have an average real-world electric range of 175-300km (depending on the size of the car) and a national network of rapid charging infrastructure.
  - Car drivers not able to accept a limited range could opt for PHEVs, which make up 35% of new car sales by 2030 in our Central scenario. We also carried out an analysis of the NTS data to estimate the percentage of kilometres that could be driven in electric mode. For a PHEV with a 30 km real-world electric range we estimate that around 50% of kilometres could be driven in electric mode.

Given the dependence of emissions reduction potential on patterns of travel demand, it is important to look at differences in these patterns between Scotland and the UK as a whole when providing advice to the Scottish Government on future climate change targets. We now consider these differences and set out implications for emissions reduction potential at the end of the document.

Urban and rural populations

The relative size of urban and rural populations within a country can influence the overall potential to reduce emissions. For example, cycling and public transport schemes are often found to be more cost-effective in urban areas with higher population densities. Overall, the split between urban and rural populations in Scotland is very similar to that in the rest of Great Britain but there are differences within the rural populations of the different nations.

- Around 80% of the Scottish population lives in urban areas, broadly the same percentage as in England and Wales[3].
- Within the rural populations, around 6% of Scottish residents live in the most remote areas compared to around 4% of English and Welsh residents.
- There are differences in the area classification methodology between Scotland and the rest of Great Britain, which means that these comparisons should be treated with caution[4].

Travel pattern data

Whilst data on urban and rural populations can be helpful in understanding broad similarities and differences in travel behaviour between nations, it is more illustrative to look at survey data on travel patterns. Overall travel patterns in Scotland and Great Britain are found to be very similar, although issues with the data mean these comparisons need to be treated with caution.

- There are two sources of data available on travel patterns within Scotland:
  - The National Travel Survey (NTS) collects trip information from respondents over the course of a week. As the survey was designed to provide information for all of Great Britain, the sample sizes are relatively small for Scotland at around 1,500 individuals per survey

2 CCC (2015) *Sectoral scenarios for the Fifth Carbon Budget*

3 National Records of Scotland (2012) *Scotland Urban Rural Population Data*; ONS (2011) *Census Analysis – Comparing Rural and Urban Areas of England and Wales*. Data aggregated according to national urban/rural classification.

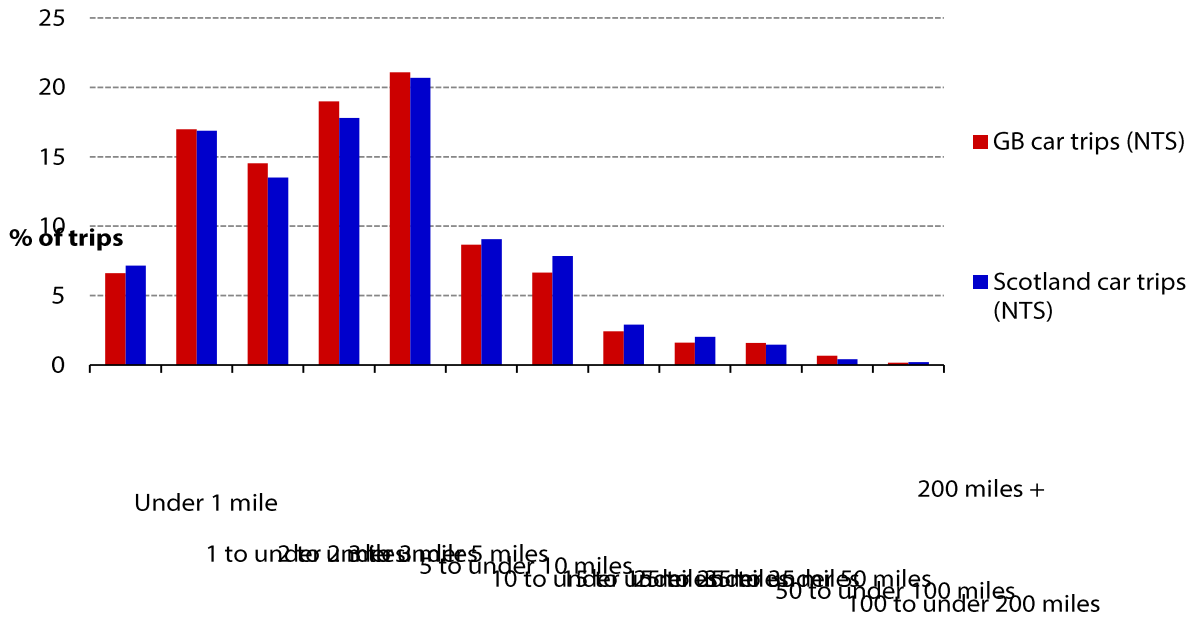
4 http://www.gov.scot/Resource/0046/00464780.pdf

year. The sample size can be boosted by including data from multiple survey years. The survey finished in Scotland in 2012.

  - The Scottish Household Survey (SHS) Travel Diaries collect trip information over the course of a day. The sample sizes are much bigger at around 10,000 individuals per survey year. The survey is ongoing.

- The weekly nature of the NTS may capture some travel patterns more accurately than the SHS (e.g. commuting vs leisure trips) but the large sample size of the SHS is likely to make it more representative of Scottish residents. As there are advantages and disadvantages to using either survey, we have undertaken comparisons using both surveys.
  - Comparisons of the trip distance distribution for Scotland and Great Britain using the NTS data show only small differences across all distances (Figure 1). At an aggregate level, the National Travel Survey shows that the average car trip length in Scotland and Great Britain were very similar at 8.4 miles and 8.5 miles[5].
  - We also find relatively little difference in the Scottish and Great British trip distance distributions, using SHS for Scotland and NTS for Great Britain (Figure 2). However, this data suggests that the share of very short trips (<2km) is higher in Scotland than in Great Britain.
  - As mentioned above, we assume the plug-in hybrid EV (PHEV) cars will have a battery allowing them to travel up to 30 km in electric mode. The National Travel Survey data for Scotland shows that the percentage of distance due to trips under 30 km is around 52%, broadly in line with 50% for Great Britain, meaning that PHEVs are expected to have a similar emissions reduction potential in Scotland.

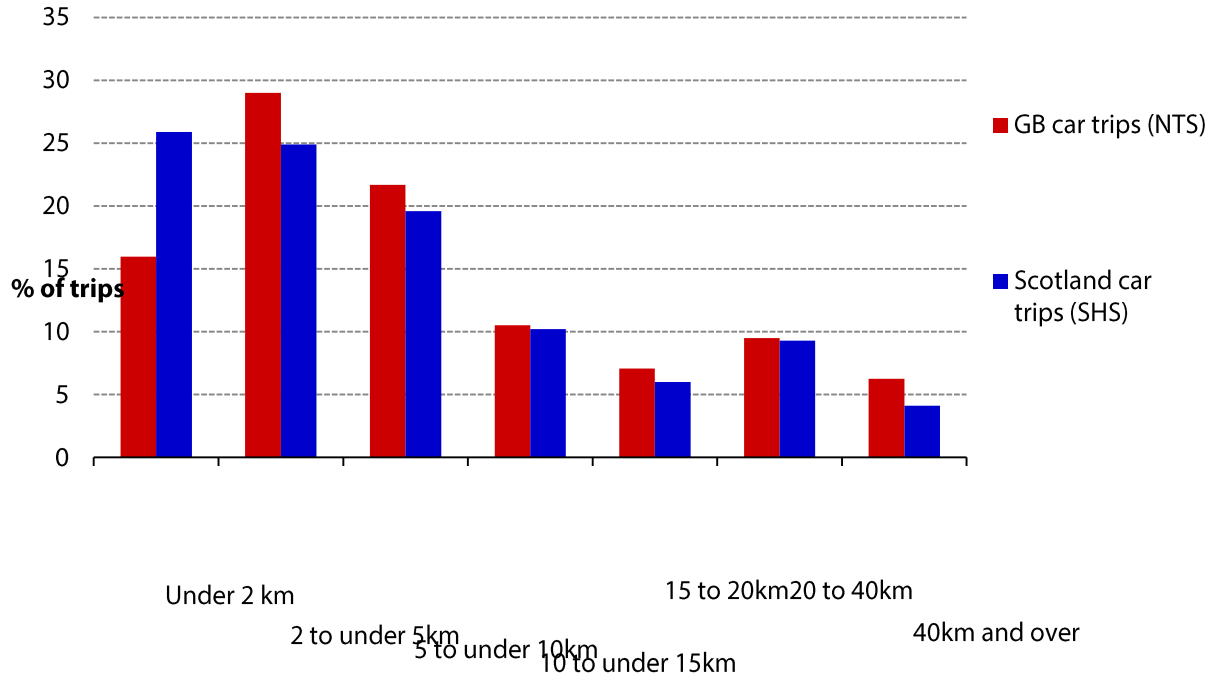
Figure 1: Average trip distance distribution 2002-2012 for Great Britain and Scotland



Source: NTS (2002-2012)
Notes: CCC analysis of raw NTS data. Data aggregated 2002-2012 to increase sample size for Scotland.

[5] NTS (2012) Using data from 2011 and 2012 to increase the sample size.

Figure 2: Average trip distance distribution for Great Britain (2012) and Scotland (2014)



Source: NTS (2002-2012); Transport Scotland (2015) *Scottish Household Survey Travel Diary results.*
Notes: CCC analysis of raw NTS data. Data aggregated 2002-2012 to increase sample size for Scotland.

Implications for emission reduction scenarios

Overall, the analysis of demographic and survey data suggests that differences in travel patterns between Scotland and Great Britain as a whole are relatively small despite differences in the remoteness of rural populations. This means that the potential for reducing emissions through reducing car travel and switching to EVs is similar in Scotland and Great Britain.

- We have carried out further analysis of the NTS to update our scenario for car travel demand reduction, but the scenarios remain broadly unchanged due to the similarities in trip patterns.
  - We developed scenarios for car travel demand reduction using NTS data, similar to those developed for our UK analysis. As the urban/rural identifier was not available for the Scottish respondents, we adjusted the criteria and used more conservative assumptions on the percentage of eligible journeys that would be able to switch.
  - We found that 5% of car kilometres could be switched to walking, cycling or bus. In a low scenario this was reduced to 3% and in a high scenario it was increased to 12%. This is in line with the findings at a UK level, the only difference being that the high Scottish scenario is slightly higher than the UK high scenario (a 10% reduction).
- For the Scottish analysis, we have used the EV uptake and usage scenarios originally developed for the UK as the trip patterns affecting these scenarios are very similar.

Implications for policy

Whilst our analysis suggests that differences in national circumstances should not have

a significant impact on the potential to roll out emissions reduction measures, different approaches may be needed to reduce transport emissions in very remote areas. For example, the balance of walking, cycling, public transport, car clubs and lift sharing schemes might need to be different in very remote locations compared to less remote rural settings in England.