Department
for Transport

National Road Traffic Projections 2022

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Foreword

It is critical to understand future road traffic demand and the uncertainty around it to provide the basis for informed and resilient transport policy. I am therefore pleased to share this report which includes the Department for Transport's latest projections of road traffic, congestion and emissions in England and Wales up to the year 2060, using the DfT's National Transport Model (NTM).

There is considerable uncertainty around future travel demand, including the extent to which social and behavioural change, emerging technologies, decarbonisation, demographic change and growth in the economy will influence how, when and where we travel. The COVID-19 pandemic has highlighted the need for robust approaches for analysing and presenting uncertainty and this report pioneers the use of DfT's Common Analytical Scenarios, which are a set of seven scenarios exploring national level uncertainties which have been developed for use in modelling and appraisal. These scenarios provide a framework for considering the evolution of key drivers of demand and their use provides valuable insight into the impacts of national level uncertainties on traffic levels, congestion, and emissions.

Since we last published forecasts in 2018, we have developed and updated our modelling suite and thoroughly reviewed all our inputs and assumptions. The projections illustrate that a wide range of traffic growth is possible in the long term, with the scenarios suggesting an 8% to 54% increase in distance driven between 2025 and 2060. Whilst traffic is projected to grow in all of our scenarios, this illustrates that the rate of growth is sensitive to assumptions about how the key drivers of demand evolve over time.

Our aim is that these projections will be used to inform and shape debate in the transport sector, provide a common and consistent basis for analysis, and support strategic policy development that is resilient to future uncertainty. Alongside this, we will continue to monitor travel trends and develop the analytical evidence base, working closely with our stakeholders.

Amanda Rowlett

Chief Analyst

Executive Summary

Introduction

1.1 This report presents the Department for Transport's (DfT's) latest projections of road traffic, congestion and emissions for England and Wales. These are long term, strategic projections of future road travel demand under a range of different plausible future scenarios.

1.2 The projections have been produced using the Department's national transport modelling framework which consists of a series of sub-models each representing a different aspect of travel demand or vehicle type. The modelling suite is based on many years of data and evidence on why, when, and how people travel and, since our last road traffic projections were published in 2018, it has been developed and updated to reflect more recent data and evidence.

1.3 Projecting travel demand over the long term is inherently uncertain and the Department has developed a set of analytical scenarios to explore the uncertainties around key national level drivers of travel demand. The Common Analytical Scenarios (CAS) are a set of seven standardised, off-the-shelf, cross-modal scenarios exploring national level uncertainties for use in transport forecasting and appraisal. The scenarios explore uncertainties in demography, economic growth, regional redistribution, behavioural change, emerging technologies, and decarbonisation.

1.4 The projections are not definitive predictions of what will happen in the future and the outcomes are not necessarily desirable. Their purpose is to inform and shape strategic policy development, to provide a common and consistent basis against which policy options can be compared, and to further our understanding of the drivers of travel demand and how they impact on traffic levels, congestion and emissions in different plausible scenarios.

Improvements to the projections

1.5 Since 2018, our modelling suite has been developed and updated to reflect more recent data and evidence. This includes the 2022 update to the National Trip End Model (NTEM), our model of personal travel growth, which incorporated updated projections of population, GDP, employment and housing stock, which are key factors in travel demand. It also extended the projection window to 2060. For non-person travel, updates to both the Light Goods Vehicle (LGV) model and the Great Britain Freight Model (GBFM) have been undertaken. In addition, GBFM has been revalidated to 2018 from a base year of 2004.

1.6 We have also reviewed and updated the full range of modelling assumptions, including the costs of travel. This includes a series of assumptions on the price of fuel, the fuel efficiency of different types of vehicles and the value of time spent travelling. Together, travel costs, population, and economic growth account for around 90% of overall projected traffic growth between 2025 and 2060.

1.7 The CAS are used to explore the uncertainties around key drivers of travel demand. These scenarios were published at a high level in DfT's Uncertainty Toolkit in 2021 and have been refined over the past year following extensive engagement with stakeholders, including DfT's academic and practitioner panel, the Joint Analysis Development Panel (JADP).

1.8 The coronavirus (COVID-19) pandemic has had a significant impact on travel patterns. Road demand has been affected less than other modes of transport, however, car use, which accounted for around 78% of all traffic in 2019, is still below pre-pandemic levels. In contrast, both van and heavy goods vehicle (HGV) traffic are higher than pre-pandemic levels, with July 2022 levels 24% and 15% above February 2020 levels, respectively. The extent to which these patterns will be sustained long term is unclear, however, having reviewed the available survey evidence and traffic data, we have made a high-level assumption that, in the long term, car traffic will be 5% lower than it would have been without COVID-19.

What the projections show

1.9 There is significant uncertainty in long term travel demand and the full range of CAS should be considered to understand how sensitive the projections are to different drivers of travel demand. The analysis presented here is for national road traffic projections and focused on highway-based private motorised transport and freight movements. The NTM is a strategic highway model that is designed primarily for this purpose and is not used to make detailed projections for other individual surface transport modes.

1.10 The National Road Traffic Projections (NRTP 22) illustrate that a wide range of future traffic growth is possible, projecting traffic levels at 5-year intervals between 2025 and 2060. Road traffic is projected to increase in all the scenarios modelled though there is significant variation across the scenarios.

1.11 The Core Scenario includes 'firm and funded' government policy, for example, where ambitions are supported by published plans or funded policies. Relationships between the key drivers of demand and road traffic are broadly assumed to continue in line with historical trends and evidence, for example, how drivers respond to changes in fuel costs or how changes in income influence people's travel choices. The Core Scenario projects a 22% increase in traffic between 2025 and 2060. It uses the latest government projections of the main drivers of road traffic demand including population, economic growth, employment, households, fuel prices and fuel efficiency.

1.12 The lowest levels of traffic are seen in the Behavioural Change Scenario which assumes increased flexible working, online shopping and reduced rates of driving licence holding among younger cohorts. In this scenario, traffic is projected to grow by 8% between 2025 and 2060. The highest growth is seen in the Technology Scenario which assumes high and fast uptake of connected and autonomous vehicles (AVs) and high and fast uptake of electric vehicles (EVs) which are assumed to maintain their current cost advantage over petrol and diesel vehicles. This is just one potential future with AVs which assumes increased trip making for the elderly and increased driving licence holding for all. In this scenario, traffic is projected to grow by 54% between 2025 and 2060.

1.13 Traffic growth varies not only by scenario, but also by road type. The projections consider traffic growth for motorways, A-roads, and minor roads. In the Core Scenario, traffic on minor roads and A-roads is expected to grow by 21% and 20% respectively, while motorway traffic is projected to increase by 27% between 2025 and 2060. Congestion (measured in delay per mile) is also projected to increase, with the average delay per mile projected to increase around 27% between 2025 and 2060. Motorways have the least delay, which rises from 4 seconds in 2025 to 10 seconds in 2060. The average delay on A-roads and minor roads is longer but rises by a smaller proportion (21 seconds to 29 seconds on A-roads, 30 seconds to 33 seconds on minor roads).

1.14 Carbon Dioxide equivalent (CO_2e) emissions are projected to fall significantly in all scenarios. This is largely driven by the anticipated uptake of EVs. The three ambitious EV uptake scenarios are the Technology, Mode-balanced Decarbonisation and Vehicle-led Decarbonisation scenarios. They all assume delivery of the ambition to phase out petrol and diesel cars and van sales by 2035, and the implementation of vehicle decarbonisation policies such as zero emission vehicle mandates. The Core, Low Economy, High Economy, Behavioural Change and Regional Scenarios are based on existing firm and funded policies only. The Core, Low Economy, High Economy, Behavioural Change and Regional Scenarios are based on firm and funded policies. The smallest reduction in CO_2e emissions is a reduction of 38% in the High Economy Scenario, which assumes high rates of growth in population, GDP and employment levels. The largest reduction is 98% in the Mode-balanced Decarbonisation Scenario, which assumes a high and fast uptake of EVs and an increased share of public transport relative to the Core Scenario.

1.15 Nitrogen Oxides (NO_x) and particulate (PM_{10}) emissions follow broadly similar trends with NO_x reducing by between 61% (in the High Economy Scenario) and 98% (in the Mode-balanced Decarbonisation Scenario) between 2025 and 2060. For PM_{10}, the range is a reduction of between 49% (in the High Economy Scenario) and 98% (in the Mode-balanced Decarbonisation Scenario) over the same period.

Next steps

1.16 The projections provide a strong analytical basis for understanding the potential evolution of traffic growth, congestion, and emissions under a wide range of plausible future scenarios. We will, however, continue to monitor data and events and are undertaking further analysis and research to better understand changes in travel behaviour. This work will consider issues such as working from home, changing patterns of land use and the distribution of travel across time periods, days of the week and journey purposes.

2. Introduction and use of projections

This chapter introduces the uses of the National Road Traffic Projections, gives a brief overview of the modelling framework, and sets out the structure of the document. Further detail on the modelling can be found in Annex B:.

Introduction

2.1 The NRTP 22 presents DfT's latest projections of traffic demand, congestion and emissions in England and Wales produced using the National Transport Model (NTM). The projections support the development of strategic policies to meet DfT's priority outcomes to:

- Improve connectivity across the UK and grow the economy by enhancing the transport network, on time and on budget;
- Build confidence in the transport network as the country recovers from COVID-19 and improve transport users' experience, ensuring that the network is safe, reliable, and inclusive;
- Tackle climate change and improve air quality by decarbonising transport, reflecting DfT's contribution to the cross-cutting net zero outcome led by Department for Business, Energy & Industrial Strategy (BEIS).

2.2 Since our last forecasts were published in 2018 (the GOV.UK publication, Road Traffic Forecasts 2018) (, we have updated our modelling suite and reviewed the key drivers of travel demand, including assumptions about their future evolution. In particular, the Department has developed the Common Analytical Scenarios (CAS). These are a set of seven scenarios which are central to DfT's approach to uncertainty in transport analysis. These scenarios explore national level uncertainties including:

- Growth in the population and the economy;
- Distribution of economic activity across the regions;
- Technological advances and uptake;
- Social and behavioural change;
- Level of decarbonisation and proportion of distance travelled by fuel type.

2.3 The use of these scenarios provides greater insight into the impacts of changes in key drivers of travel demand and increases the transparency of our projections.

Further details of DfT's approach to uncertainty can be found in the GOV.UK publication, the DfT Uncertainty Toolkit.

Use of the projections

2.4 The NRTP 22 will be used to:

- provide an evidence base for strategic policy development. This includes exploring the uncertainties through effective application of the CAS.
- provide a consistent baseline for transport business cases. Especially for freight and LGV projections and for smaller projects that don't require a strategic transport model. In addition to transport investment for national, subnational and local transport authorities, NRTP is also used in wider system planning, such as land use, electrical grid and other infrastructure developments that will have an impact on traffic.
- provide further insight into transport, such as projections of Light Goods Vehicle (LGV) and Heavy Goods Vehicle (HGV) traffic that are not produced elsewhere.

2.5 Given the strategic, high-level nature of the NTM, the projections are not anticipated to be directly used to appraise individual road schemes, nor are they intended to be used to consider capacity changes on a specific road or solutions to specific local issues. The additional detail needed for this kind of policy usually requires a bespoke scheme model which uses the growth rates from the projections, the Department's Transport Analysis Guidance (TAG), and more local information.

Modelling framework and developments

2.6 Our national transport modelling framework consists of a series of sub-models each representing a different aspect of travel demand or vehicle type. Drawing on extensive data sources from across government, we seek to take account of a wide range of social and economic factors affecting businesses, individuals, and households to understand why people travel, when and how. The relationships in the modelling capture how people respond to changes in drivers of travel demand and are based on many years of observed data and research. Key relationships include how people respond to changes in fuel costs and income and how population influences demand. We also make several informed assumptions about how key variables will evolve in the future.

2.7 The NTM is a complex, national-level model that produces projections of travel demand for specific years. The NRTP 22 projects traffic every 5 years from 2025 to 2060 inclusively. Transport is a derived demand based on the journeys that people need and want to make, and travel choices are based on the cost of different options (monetary costs are combined with other costs, such as time).

The modelling can be simplified as representing four key decisions following the classic 4-stage transport model approach:

1. **Whether to travel (trip generation)** - whether a trip needs to be made (e.g. to work, the shops or to visit friends). The National Trip End Model (NTEM) provides an initial forecast of travel demand based on population by gender and age, households by size, employment (jobs) by industry, gender and working status and car ownership by

household type based on licence holding, income, population, car costs and employment.

2. **Where to travel to (trip distribution)** - based on the reasons for travel and the geographical distribution of journeys.

3. **Which mode of transport to use (mode choice)** - based on what people would choose, considering the costs of the different options for travel between the given origins and destinations. The costs of travel include both the monetary cost and the value of time spent travelling.

4. **Which route to use (highway assignment)** - based on the time and cost of the routes available.

2.8 Figure 1 shows a simplified diagram of the NTM, in terms of these steps. It is important to note that steps 2, 3 and 4 are iterative so that changes in congestion, and therefore the time element of the costs of travel estimated in step 4 feed back into the decisions made in steps 2 and 3 about where to travel and by which mode. A more detailed diagram is shown in Figure 58 in Annex B:.

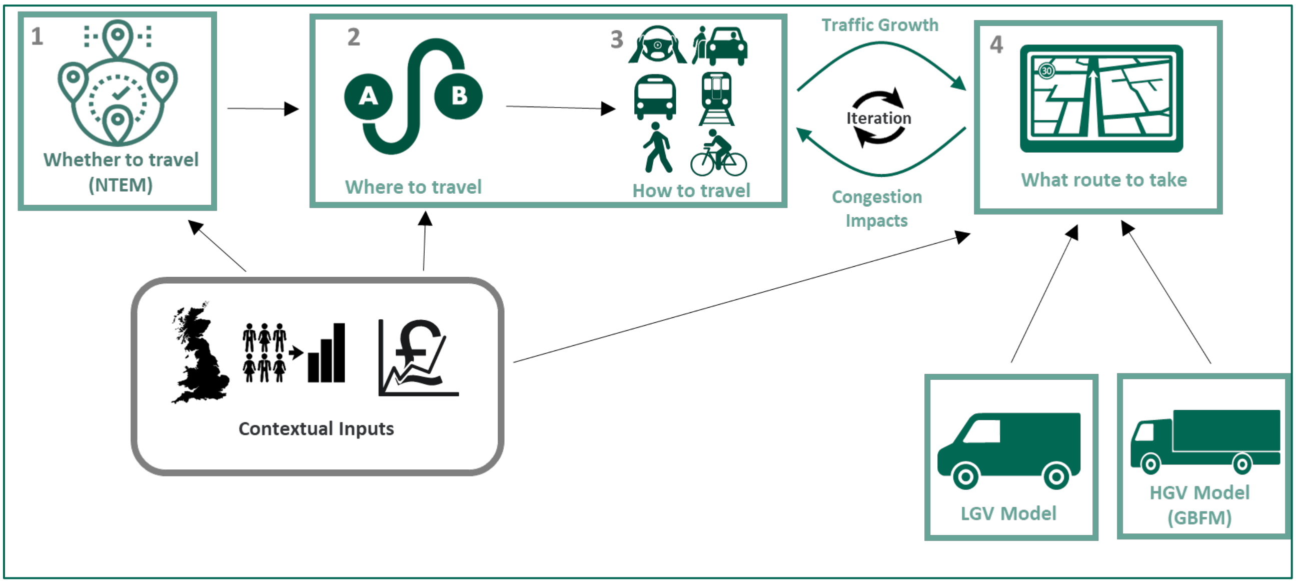

Figure 1 Simplified NTM diagram

2.9 HGV and LGV traffic is generated by two separate sub-models. These take into account the key drivers of demand that affect these vehicle types. Traffic growth from these models is fed into the NTM at step 4, the highway assignment stage, to assess the impact of these vehicles on congestion.

2.10 Our modelling framework has been developed and updated to reflect the latest data and evidence. The 2022 published update to NTEM includes updated projections to population, GDP, employment, and housing stock. It also produces estimates of trips for most scenarios included in the CAS. Our LGV model and HGV model (GBFM) have been updated, and the GBFM has been revalidated to 2018 from a base year of 2004.

2.11 Since we last published road traffic forecasts in 2018, we have undertaken and published a set of stretching and innovative model tests and a peer review confirming that the model is fit for purpose. The tests include a backcast where historical data was input to the model to see if it could predict (backcast) 2003 traffic. The high-level analysis showed that the model is able to project the total traffic distance travelled for 2003 with a 3.7% difference compared to the actual 2003 traffic levels.

2.12 One of the findings of the review suggested that exogenous input data had contributed to over-forecasting in the past. Since then the OBR have reduced their forecasts of long-term economic growth and the ONS have lowered their population projections. They are two key input assumptions and drivers of travel demand that have been revised in way that would reduce traffic.

2.13 Further details on our modelling framework can be found in Annex B:.

Structure of this document

2.14 This document explains the inputs and results from the projections. This is for all scenarios, both the Core Scenario and the CAS. The document is structured as follows:

- Chapter 3 explains the key drivers of growth and the inputs used for the modelling.
- Chapter 4 presents the results of the modelling. The range of outputs from all scenarios is shown. This is then followed by specific scenario results for relevant disaggregations. The Core Scenario is described first, with significant differences in other scenarios presented as well.
- Chapter 5 evaluates the performance of past and present projections.
- Chapter 6 lays out the conclusions of the modelling and the next steps.
- Further technical details are contained in the annexes.

3. Modelling inputs and assumptions for each scenario

Our modelling framework is based on many years of data and evidence on why, when, and how people travel. This chapter describes the key drivers of demand and the inputs and assumptions made in the Core Scenario and Common Analytical Scenarios.

Core Scenario input assumptions

3.1 The Core Scenario is based on the latest government projections of the main drivers of road traffic demand, for example population, GDP, employment, households, fuel prices and fuel efficiency. The core also includes 'firm and funded' government policy, for example, where ambitions are supported by published plans or funded policies. Relationships between the key drivers of demand and road traffic are broadly assumed to continue in line with historical trends and evidence, for example, how drivers respond to changes in fuel costs or how changes in GDP influence people's travel choices.

3.2 The Core Scenario is the starting point for most of the Common Analytical Scenarios except for the Behavioural Change Scenario. The rest of the scenarios are created by changing some of the Core Scenario inputs. The base year for the NTM v2R is 2015 which pre-dates the COVID-19 pandemic. The "Common Analytical Scenarios inputs" section from paragraph 3.24 onwards explains the assumptions behind the scenarios in more detail.

Adjusting for coronavirus (COVID-19)

3.3 The COVID-19 adjustment method described below and in Annex C shows the department’s approach strictly for the purpose of producing national road traffic projections. Other model owners should use knowledge of their model, local data and evidence to interpret TAG guidance to line up with their circumstances and specific needs.

3.4 We have been through an unprecedented period in modern history, with the COVID-19 pandemic leading to travel being significantly restricted by law during much of 2020 and 2021. During the pandemic people changed their travel behaviour with frequency of travel, trip lengths, time of travel, journey purpose and mode choice all impacted by different COVID-19 restrictions. Considerable uncertainty remains over the extent to which current travel patterns will be sustained. The NRTP's results start from 2025 and is developed from a 2015 base year model which is adjusted for COVID-19 as described below and in Annex C.

3.5 Published data on GOV.UK on transport use during the coronavirus (COVID-19) pandemic tells us at an aggregate level how much road traffic there is by different vehicle types, and how it compares to pre-pandemic levels, as shown in Figure 2. It shows that car traffic remains below pre-pandemic levels while HGV, and particularly LGV traffic, is above.

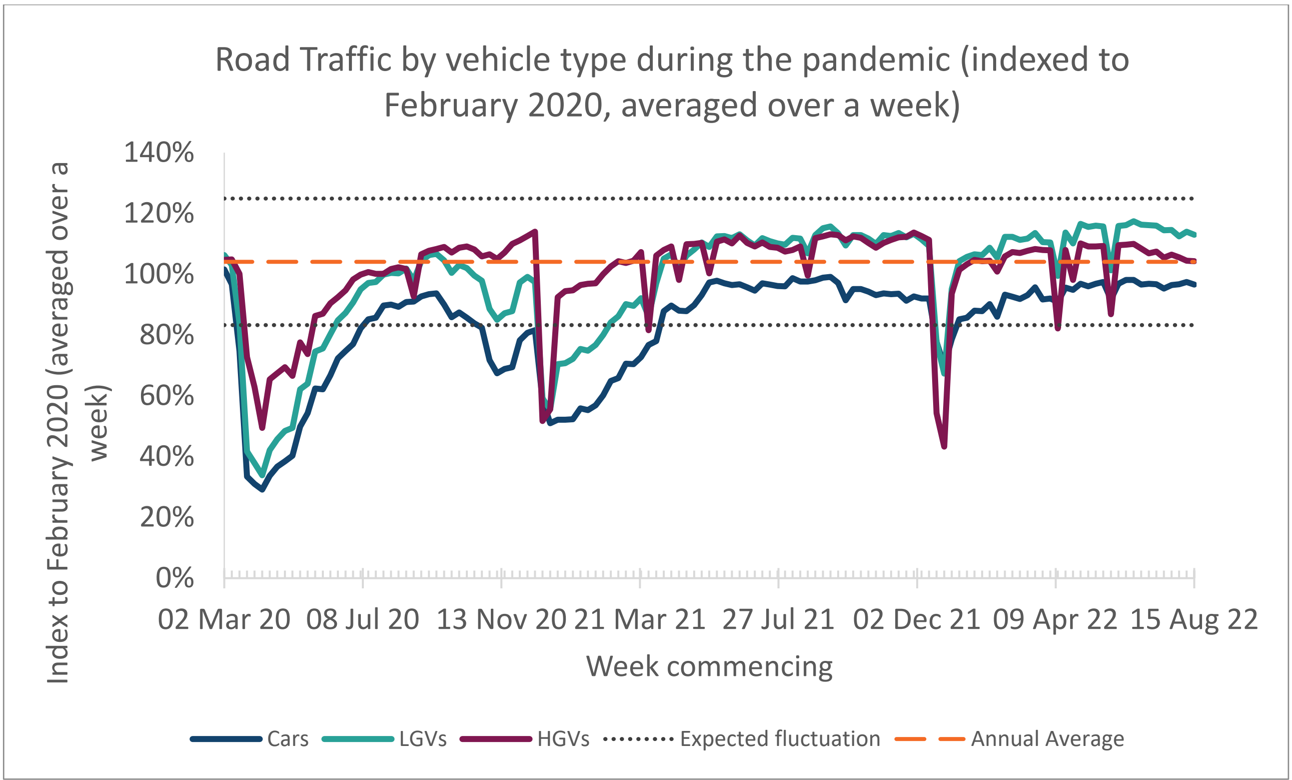

Figure 2 Road traffic by vehicle type during the pandemic

3.6 There is currently insufficient evidence to support a robust projection of the long-run impacts of COVID-19. In February 2022 (the latest data point when our assumptions were finalised), traffic was 8% lower than 2019 levels. Typically, traffic growth for 2 years is around 3%. Thus, traffic in February 2022 was approximately 11% lower than might have been expected without the impact of COVID-19 and government restrictions on travel. This forms a lower bound estimate for the impact of COVID-19 on road traffic. An upper bound can be formed by assuming the COVID-19 pandemic hasn't happened.

3.7 To develop an informed assumption on the long run impacts of COVID-19, we have undertaken a thorough review of the evidence (described in more detail in Annex C) available in March 2022 when our assumptions were finalised. This suggests that people have formed new habits and expectations over the past two and a half years, particularly around working from home and online shopping. Using this evidence alongside the upper and lower bound estimates detailed in Annex C, the Department has applied a net reduction of 5% in car vehicle miles compared to a projection without COVID-19. This reflects evidence around journey purpose especially for people who are able to work from home. The applied split by journey purpose for car traffic is a 6% reduction in commuting trips, a 9% reduction for business trips and 4% reduction for all other trip purposes.

3.8 No such adjustment has been made to LGV or HGV traffic. LGV traffic projections in the NRTP take the March 2022 LGV levels and then extrapolate forward using GDP. The long run HGV projections are driven by GDP and population as detailed in the GBFM report. Annex C: explains in more detail how the NRTP 22 has taken account of the potential long run impacts of COVID-19.

Income (Gross Domestic Product (GDP))

3.9 One of the key drivers of road traffic demand is income. There are two principal mechanisms through which higher incomes lead to increased traffic in the NTM. The higher the income of an individual the more likely they are to own a car, which enables more trips and longer trips. Secondly, income affects how people perceive time with those on higher incomes willing to pay more to travel in comfort and get to a destination more quickly.

3.10 Within the NTM, income growth is represented by growth in GDP per capita. GDP per capita is a measure of average income per person which is directly proportional to people's value of their own time and their propensity to own cars and hence travel by car. The LGV model also uses GDP projections as its main driver of LGV demand.

3.11 We have updated our projections of GDP using forecasts from the Office for Budget Responsibility (OBR), specifically the OBR Economic and Fiscal Outlook (March 2022) forecast up to and including 2026 and the OBR Economic and Fiscal Outlook (March 2021) long-run economic determinants forecasts thereafter. In addition to the updates to long-run data, the OBR forecasts also include revisions to historical GDP and an update for the financial impacts of COVID-19.

3.12 In the Core Scenario GDP is projected to increase by 69% between 2025 and 2060.

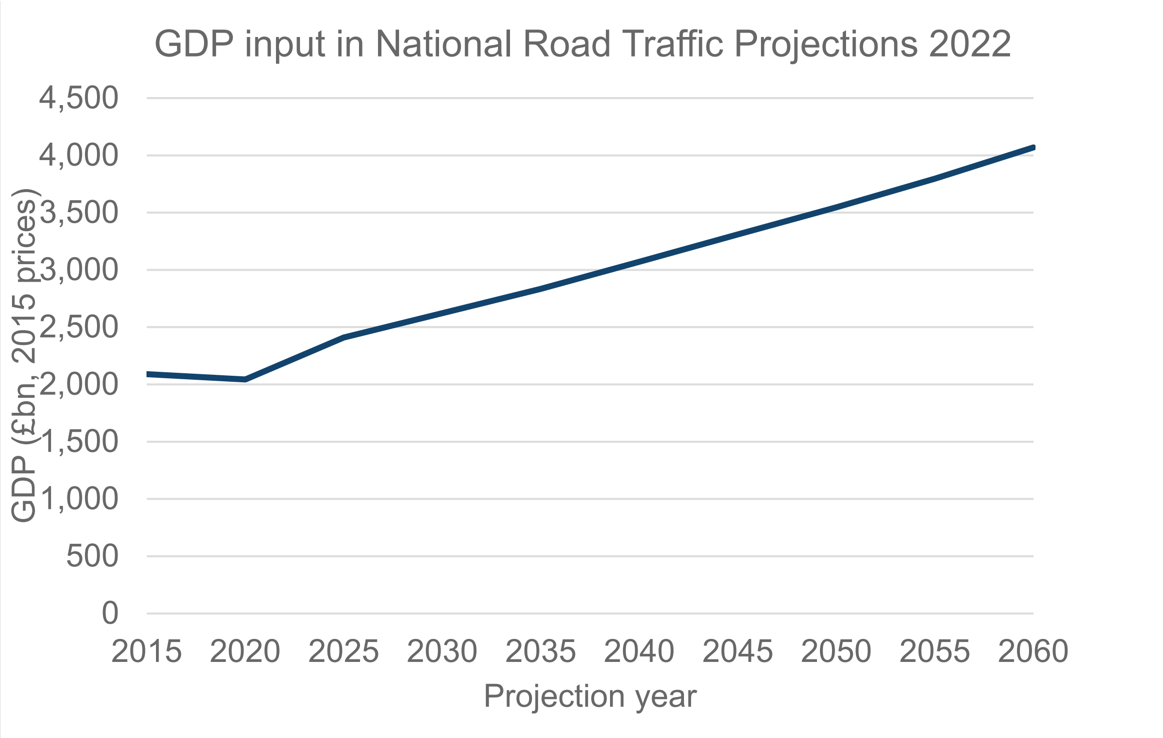

Figure 3 GDP (levels) in National Road Traffic Projections 2022

Vehicle Operating Costs (VOC)

3.13 The cost of making a trip influences an individual's choice of whether to make a trip, how far they are willing to travel, their mode of travel and the route they take. Car driver costs include both fuel and non-fuel costs which include oil, tyres, maintenance, and depreciation. Fuel costs change over time due to assumed improvements in fuel efficiency and forecast changes in fuel prices. The projected uptake of EVs, including self-driving cars, has a significant impact on future fuel costs due to their comparatively cheaper running costs.

3.14 We have updated our assumptions on EV uptake to reflect recent developments in the electric car and van market, in particular lower battery prices and a recent acceleration in sales. As part of the Net Zero Strategy: Build Back Greener the Government announced that it will introduce a zero emission vehicle (ZEV) mandate setting targets requiring a percentage of manufacturers' new car and van sales to be ZEVs each year from 2024 to 2035. This has not been included in the projections of fuel efficiency and therefore cost assumed in the Core Scenario because the details have yet to be announced, including the trajectory. The public consultation on the ZEV mandate is due to start by the end of 2022. In the meantime, the impact of higher EV uptake consistent with our stated ambitions to phase out the sale of petrol/diesel vehicles is explored in three of the common analytical scenarios, namely the Technology Scenario, Vehicle-led Decarbonisation Scenario and the Mode-balanced Decarbonisation Scenario.

3.15 Fuel and non-fuel costs are based on assumptions in the Transport Analysis Guidance (TAG) databook which provides a set of consistent assumptions and inputs for use in modelling and appraisal. These suggest that between 2025 and 2060 the cost of driving is projected to fall by 30%.

3.16 Vehicle operating costs (VOC) in the NTM are disaggregated by vehicle type and whether the activity is working or non-working to reflect the different perceptions of taxation. Travel by workers on employer's business is not subject to VAT whereas personal travel, including commuting costs, is. VOC are a function of:

- Non-fuel VOC (per distance travelled) – the elements making up non-fuel vehicle operating costs include oil, tyres, maintenance, depreciation, and vehicle capital saving (the latter only for vehicles in working time)
- Fuel costs (per litre or per kilowatt hour)
- Fuel consumption parameters (litre per km)
- Fuel efficiencies including biofuels (litre per km)
- Mileage splits by vehicle and fuel type (proportion of distance travelled)

3.17 The first three are taken from TAG Databook v1.17 and the latter two are published in the TAG Databook v1.19 as a forthcoming change. These inputs are taken together to calculate coefficients in a function to provide operating costs for a given speed.

3.18 The modelling uses long run estimates from BEIS for fuel prices. The source is the valuation of energy use figures for petrol, diesel and electricity prices. This data is shown in Figure 4 and Figure 5, respectively. Petrol and diesel prices increase in the long run, though this increase is assumed to slow from 2035. Electricity, however, is assumed to decrease in price (pence per kilowatt hour) until 2040, and then levels off. These costs will affect the attractiveness of driving compared to other modes, as well as routes taken. The fuel prices used in the NRTP are the data available in March 2022. This does not account for recent energy price changes. However, the Vehicle-led Decarbonisation Scenario and the Mode-balanced Decarbonisation Scenario can be used to look at the impact of fuel price on traffic levels.

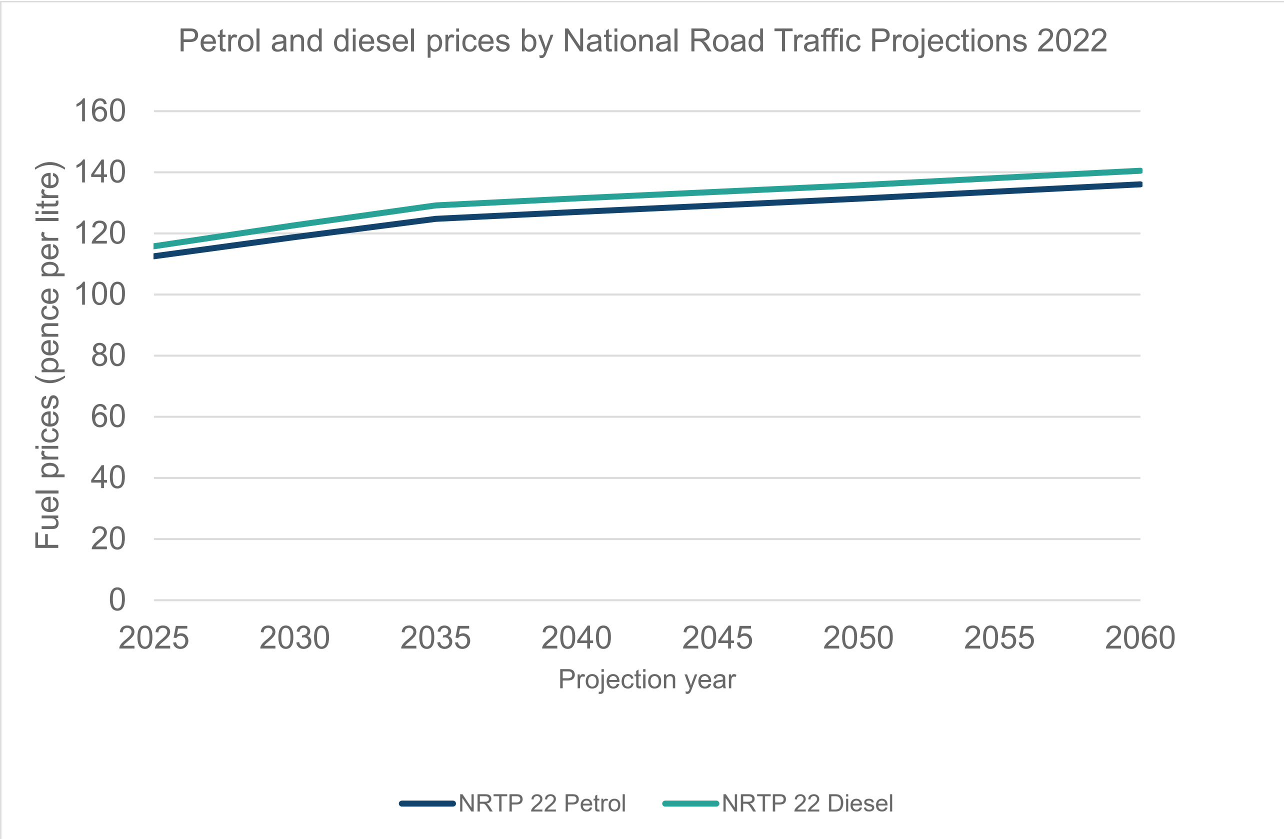

Figure 4 Petrol and diesel prices in National Road Traffic Projections 2022

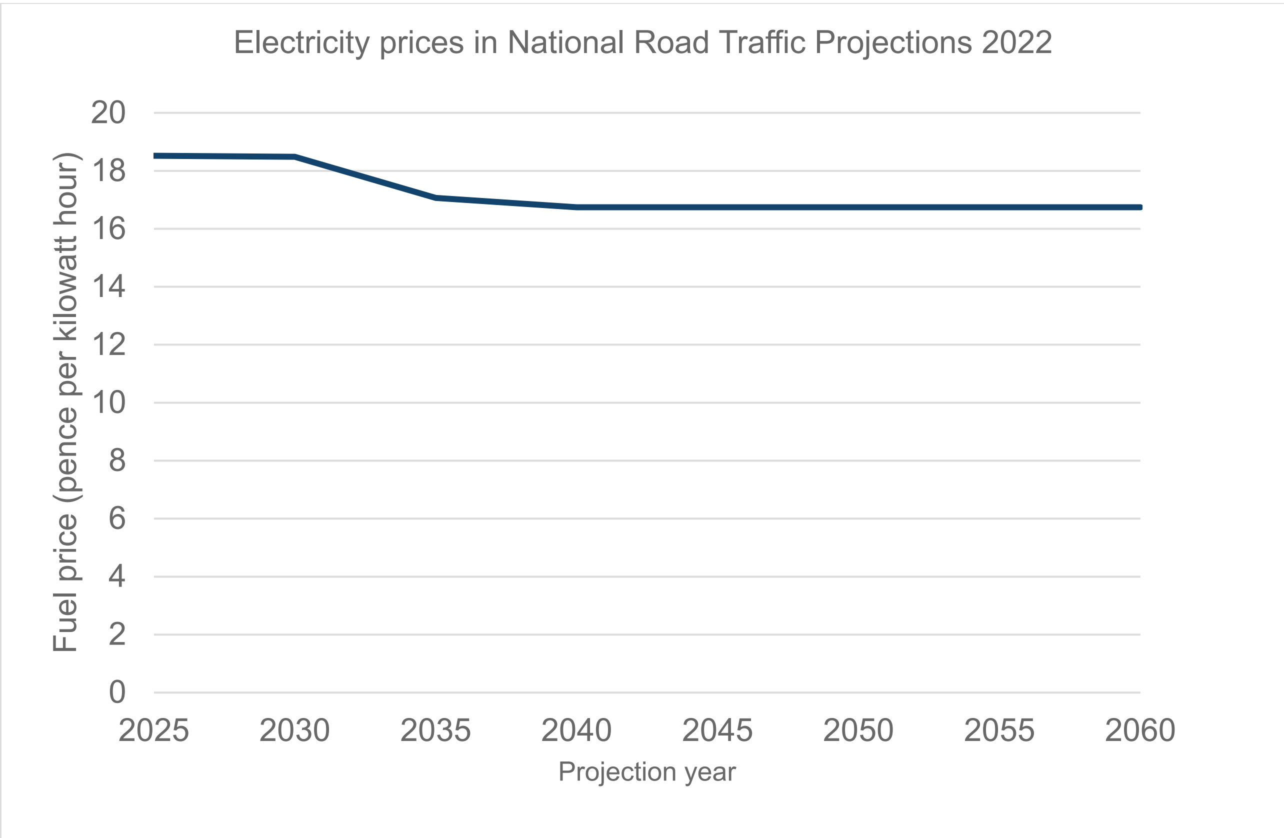

Figure 5 Electricity prices in National Road Traffic Projections 2022

Population

3.19 Population is the driver of demand that traffic is most sensitive to. As the population increases, there are more people who travel, which leads to higher traffic. Population growth also leads to increased consumer demand for goods and therefore freight traffic. Furthermore, travel is influenced by the age and gender distribution of the population, for example, the number of children feeds directly into the number of education trips.

3.20 Over the next 10 years, 27% of UK population growth is projected to result from more births than deaths, with 73% resulting from net international migration; although net migration falls during this period. The number of deaths rises as those born in the baby boom after World War Two reach older ages. There will be an increasing number of older people; the proportion aged 85 years and over is projected to almost double over the next 25 years. England's population is projected to grow more quickly than the other UK nations: 5.0% between mid-2018 and mid-2028, compared with 2.7% for Wales.

3.21 There has been a steady growth in the GB population over the last 20 years which has increased the overall demand for travel. Up from 57 million people in 2000 to 65 million in 2020.

3.22 The Core Scenario, uses ONS 2018-based 0% future EU migration variant projections. This aligns with the assumptions currently used by the OBR and those published in the May 2022 TAG Databook. As shown in Figure 6, UK population is projected to increase by 4% between 2025 and 2060.

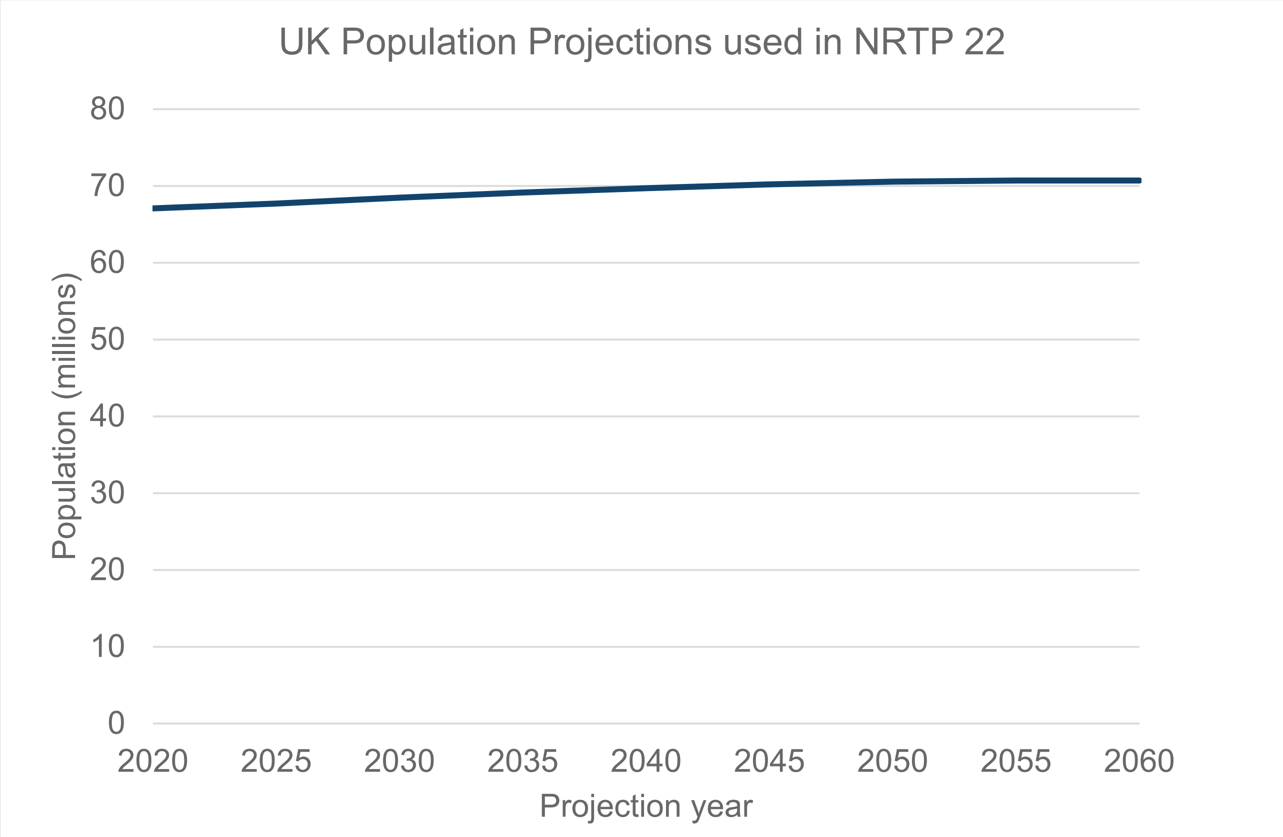

Figure 6 UK Population Projections used in NRTP 22

The number of trips made by individuals each week (Trip rates)

3.23 The National Trip End Model estimates how many trips an individual will make each week for different journey purposes including work, shopping, employer's business and education (known as trip rates). Figure 7 shows trip rates per person by journey purpose from the National Travel Survey between 2009 and 2019. Following a long period of slow but steady decline, the most recent 5-year period suggests the decline may have levelled off hence we have assumed that trip rates remain constant at 2016 levels throughout the projection period. As described above, there is of course considerable uncertainty over the extent to which changes to travel patterns induced by the COVID-19 pandemic will persist, as well as uncertainty over changes in behaviour that were seen prior to the pandemic. These uncertainties are explored further in the behavioural change CAS.

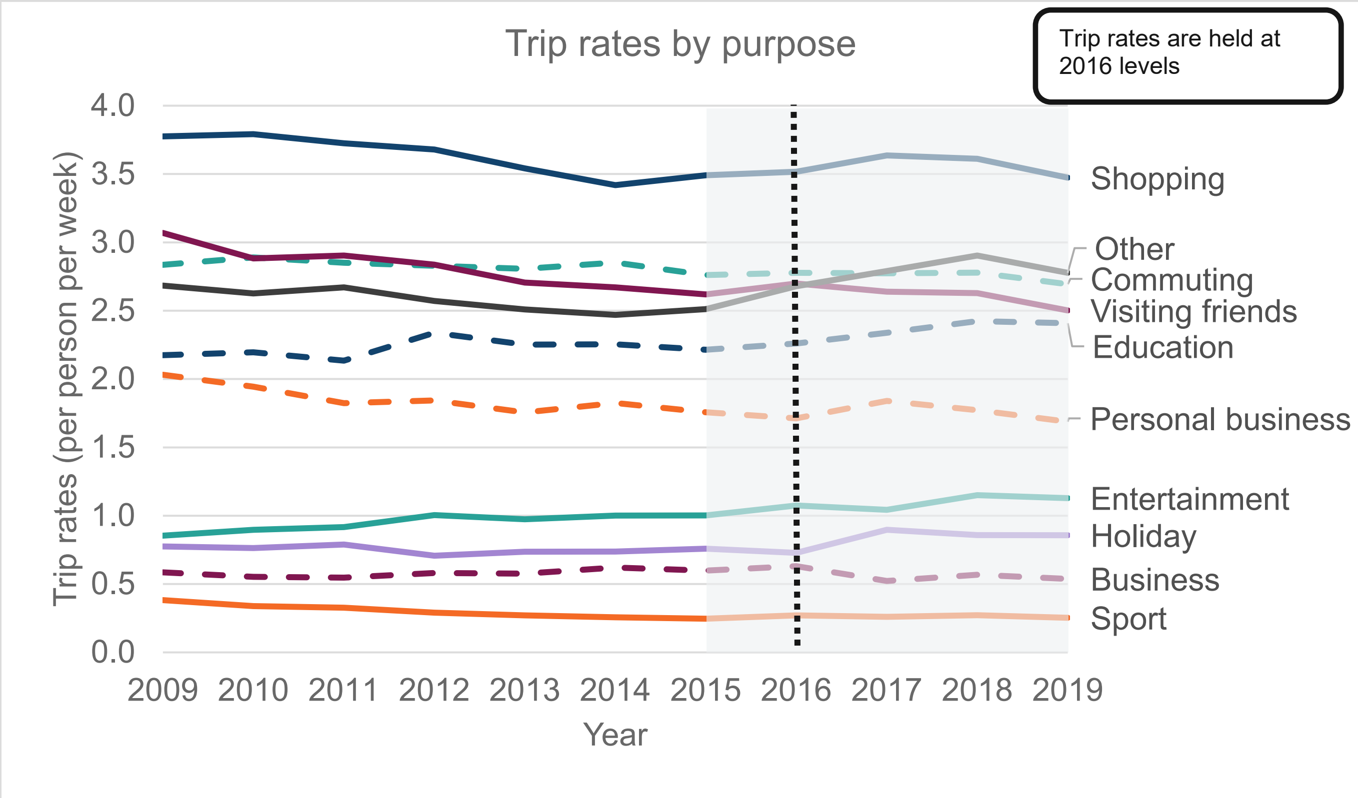

Figure 7 Trip rates (trips per week per person) broken down by purpose of trip, taken from the National Travel Survey

Network assumptions

3.24 The road network has been updated to reflect firm and funded elements of the Road Investment Strategy 2 (RIS2), Roads Investment Strategy 1 (RIS1), and local major roads programme. These add 1,400 additional lane miles in England by 2035.

Common Analytical Scenarios Inputs

3.25 The CAS are a set of seven standardised, off-the-shelf, cross-modal scenarios exploring national level uncertainties for use in transport forecasting and appraisal. They have been developed by thoroughly examining key drivers of travel demand and engaging extensively with stakeholders including DfT's academic and practitioner panel, the Joint Analysis Development Panel. The scenarios explore uncertainties in demography, economic growth, regional redistribution, behavioural change, emerging technologies and decarbonisation.

3.26 Using the CAS allows us to consider a range of potential travel demand futures and facilitates a consistent, transparent, reproducible approach to looking at the significant levels of uncertainty in travel demand projections, especially in the long run. Their use ensures there is not undue focus on one scenario, but instead a range of futures. It is worth noting they do not account for the additional layers of uncertainty created through the assumptions and model specifications used.

3.27 The scenarios used in NRTP 22 are different to those used in RTF 18. The scenarios in RTF 18 were highly focused, with only a couple of parameters changing to create the differences. In the CAS, more assumptions are flexed in each scenario, based on the drivers of demand. However, we attempt to maintain the ability to identify how assumptions change outputs, which is derived from relative simplicity (the number of inputs changing in any one of the individual scenarios), as well as the depth of narrative behind the scenario generation. There are also new contextual priorities considered in the CAS, such as behavioural changes following the COVID-19 pandemic.

3.28 For more details on the CAS, see the GOV.UK report on NTEM Data which can be downloaded along with the NTEM setup data and the GOV.UK guidance DfT Uncertainty Toolkit.

Exploring economic growth - High Economy Scenario and Low Economy Scenario

3.29 The High Economy Scenario and Low Economy Scenario consider opposing futures of economic and demographic change. In the High Economy Scenario, people become richer than we currently expect alongside upper forecasts of inwards migration, and population in general. The Low Economy Scenario considers a future where inwards migration is subdued, causing low levels of total population growth, income and employment levels are also lower.

3.30 The 2018-based High and Low population variant projections from the ONS are used to reflect the High Economy Scenario and Low Economy Scenario. In the High Economy Scenario, the population of England and Wales reaches 75.6 million (72 million in England, 3.6 million in Wales) in 2060. By contrast, in the Low Economy Scenario, population peaks around the early 2030s and then falls. This results in population of England and Wales of 57.5 million in 2060 (54.7 million in England and 2.8 million in Wales).

3.31 To create GDP projections for the High and Low Economy Scenarios, we have modified the Core Scenario GDP per capita growth rates by +/- 0.5 percentage points per annum. In the High Economy Scenario, GDP is 43.0% higher relative to the Core Scenario assumptions in 2060. Whereas, in the Low Economy Scenario, GDP is 25.5% lower relative to the Core Scenario assumptions in 2060. In total, GDP per capita is projected to grow by between 28% (Low Economy Scenario) and 131% (High Economy Scenario) from 2025 to 2060.

Exploring regional redistribution - Regional Scenario

3.32 The Regional Scenario considers a future in which people leave the Wider South East (London, the South East and East of England) and move to the rest of Great Britain. As a result, employment and population growth in the Wider South East is capped at national average rates with the extra jobs and population redistributed to areas of the country that are projected to grow at below national average rates in the Core Scenario. Hence, areas outside of the Wider South East increase their relative level of competitiveness.

3.33 This is achieved by adjusting the population growth inputs for regions in NTEM which are used for projecting the number of trips in the future. The growth rate in trips is used to develop unconstrained travel demand estimates in the NTM. All other inputs to the NTM are consistent with the Core Scenario.

3.34 The population growth in areas outside the Wider South East are adjusted up to the national average. Areas outside the Wider South East with population growth at or above the national average maintain their existing projected growth rates. Growth rates in areas inside the Wider South East are adjusted down so that the projected national population growth rate is maintained. This produces factors which are applied by region to employment and household projections.

Exploring travel behaviour and pandemic impacts - Behavioural Change Scenario

3.35 The Behavioural Change Scenario considers a future wherein people embrace new ways of working, shopping and travelling. Some important behavioural trends that were emerging prior to COVID-19 have been accelerated, in part by the COVID-19 pandemic. These include changes in the travel behaviour of young people, increased flexible working and increased online shopping.

3.36 The Behavioural Change Scenario reduces trip rates with car and LGV trips being adjusted to reflect trends in flexible and remote working, online shopping, and reduced driving licence uptake by young people. These trends are adjusted to reflect an acceleration caused by the COVID-19 pandemic. All other values are consistent with the Core Scenario.

3.37 In NTEM, driving licence holding and trip rates are adjusted to reflect the decreased uptake of driving licences by younger populations and the mostly downward trends in trip-making (some trip purposes see an increase, namely home-based holiday and day trips and, to a slight degree, home-based employer’s business trips). There is also a downward adjustment for trip-making in 2020, 2021 and 2022. 2022 being 90% of 2019 person trip rates to account for the COVID-19 pandemic. The table below shows the cumulative adjustment to person trips rates by 2041. Note the increase in Holiday and Day Trip rates. The 2041 trip rates are then held constant until 2060.

Journey purpose (trips starting at home)	Percentage change to the person trip rate by 2041
Commute	-39%
Employers Business	-8%
Education	-40%
Shopping	-30%
Personal Business	-41%
Recreation / Social	-20%
Visiting friends and relatives	-55%
Holiday / Day trip	19%

Figure 8 Table of Behavioural Change Scenario person trip rate changes in 2041

3.38 In addition to these input changes, LGV trips are factored upwards to reflect the replacement of high-street shopping trips with deliveries from online shopping. This is calculated using trends in LGV growth and shopping trips between 2000 and 2019. The result is by 2060, LGV trips are 7% higher than in the Core Scenario.

Exploring the shift to Zero Emission Vehicles (ZEVs) - Vehicle-led Decarbonisation Scenario, Mode-balanced Decarbonisation Scenario and Technology Scenario

3.39 Three of the Common Analytical Scenarios explore how the shift towards ZEVs, self-driving cars and achieving decarbonisation in the transport sector could change travel.

3.40 The Vehicle-led Decarbonisation Scenario and Mode-balanced Decarbonisation Scenario both assume a high and fast uptake of EVs and ZEVs, in line with stated ambitions to end the sale of diesel and petrol cars, vans, HGVs and buses/coaches. In both scenarios, vehicle fleet electrification approaches 99% by 2050. We do not project 100% EVs as specialist vehicles such as classic cars and other legacy uses of Internal Combustion Engine (ICE) vehicles are expected to remain.

3.41 In the Vehicle-led Decarbonisation Scenario, no other adjustments are made compared to the Core Scenario. The current cost regimes for EVs is maintained. Making the use of cars cheaper over time, as the fleet electrifies, leads to higher car use, more congestion and reductions in the use of other modes including public transport.

3.42 The Mode-balanced Decarbonisation Scenario represents a world where the assumed increase in EVs does not result in a decline in public transport use. There are many policy options that could deliver this outcome and, consequently, several ways to model it. For the purposes of modelling simplicity, we have taken the straightforward approach to equalise the perceived costs of EVs with those of petrol and diesel. This removes the cost advantage of EVs and creates a slight cost disadvantage compared to current conditions making the usage of public transport, walking and cycling more attractive.

3.43 The Technology Scenario supposes a future wherein road travel becomes far more attractive and accessible. The same high and fast uptake of EVs and ZEVs is assumed as in the Vehicle-led and Mode-balanced Decarbonisation Scenarios. In addition, a high take-up of autonomous vehicles (AVs) is assumed which enter the fleet in the 2020s and make up 50% of it by 2047.

3.44 As a result of the introduction of AVs, the Technology Scenario includes changes to driving licence holding, trip rates and car occupancy which all increase car use. The value of time is adjusted downwards to account for the ability to work or relax whilst travelling in a self-driving vehicle, as a result it is assumed that people are more willing to undertake a longer journey because of this. Car occupancy is also adjusted downwards to reflect zero-occupancy trips (trips with no passengers or drivers). The Technology Scenario does not adjust for potential capacity improvements from AVs being able to communicate with each other, reducing the gap needed between cars. This represents one potential autonomous vehicle future of many as uptake rates and timescales, the balance between private ownership and rental, shared versus individual usage, the impact on capacity and use of road space are all uncertainties at this stage.

4. National Road Traffic Projections 2022 Results

This section summarises the results and presents projected traffic growth, congestion and emissions for all the scenarios.

Summary of results

4.1 There is considerable uncertainty over future travel demand, especially in the long run. The projections presented here are not definitive predictions of what will happen in the future and the outcomes are not necessarily desirable. Their purpose is to inform and shape strategic policy development, provide a common and consistent basis for analysis and to further our understanding of the drivers of travel demand and how they may affect traffic levels, congestion and emissions in different plausible scenarios.

4.2 Traffic levels in England and Wales are projected to grow in all our scenarios, but with large variation around the size and trend of that growth. From 2025, traffic is projected to grow between 8% and 54% by 2060 (Figure 9). Consequently, delay is projected to increase by between 6% and 85% from 2025 to 2060. This is measured as average delay per vehicle per mile in seconds. Despite this, tailpipe CO2e emissions from road transport are projected to fall by between 34% and 98% by 2060 (Figure 11).

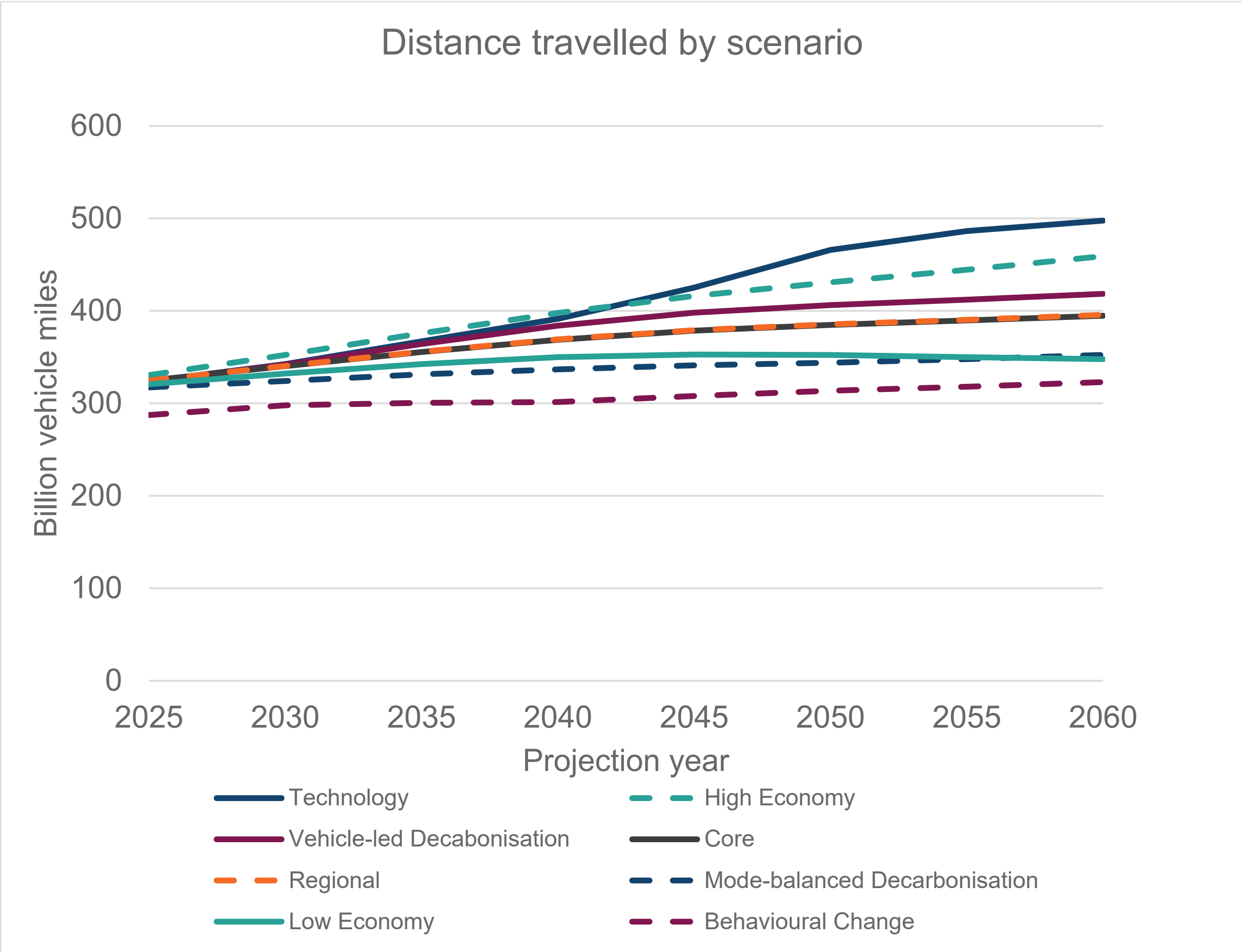

Figure 9 Projected total vehicle miles by scenario and year

4.3 By 2060 the CAS show a range of results in terms of total billion vehicle miles (bvm) travelled: 323 bvm in the Behavioural Scenario to 498 bvm in the Technology Scenario. Figure 9 shows the variation in miles travelled by scenario. The largest component of vehicle miles driven is by car, followed by LGVs and the HGVs. Figure 10 below shows how the traffic growth not only varies by scenario but also summarises projected distance travelled by vehicle type in 2060. When compared to total miles travelled HGV mileage is relatively consistent across the scenarios. Looking at the High and Low Economy Scenarios shows the potential variation in LGV mileage across scenarios is approximately double. The Behavioural Change Scenario and Technology Scenario car mileage projections vary by approximately 130% due to the reduced trip making in the Behavioural Change Scenario and the increased license holding and reduced operating costs in the Technology Scenario.

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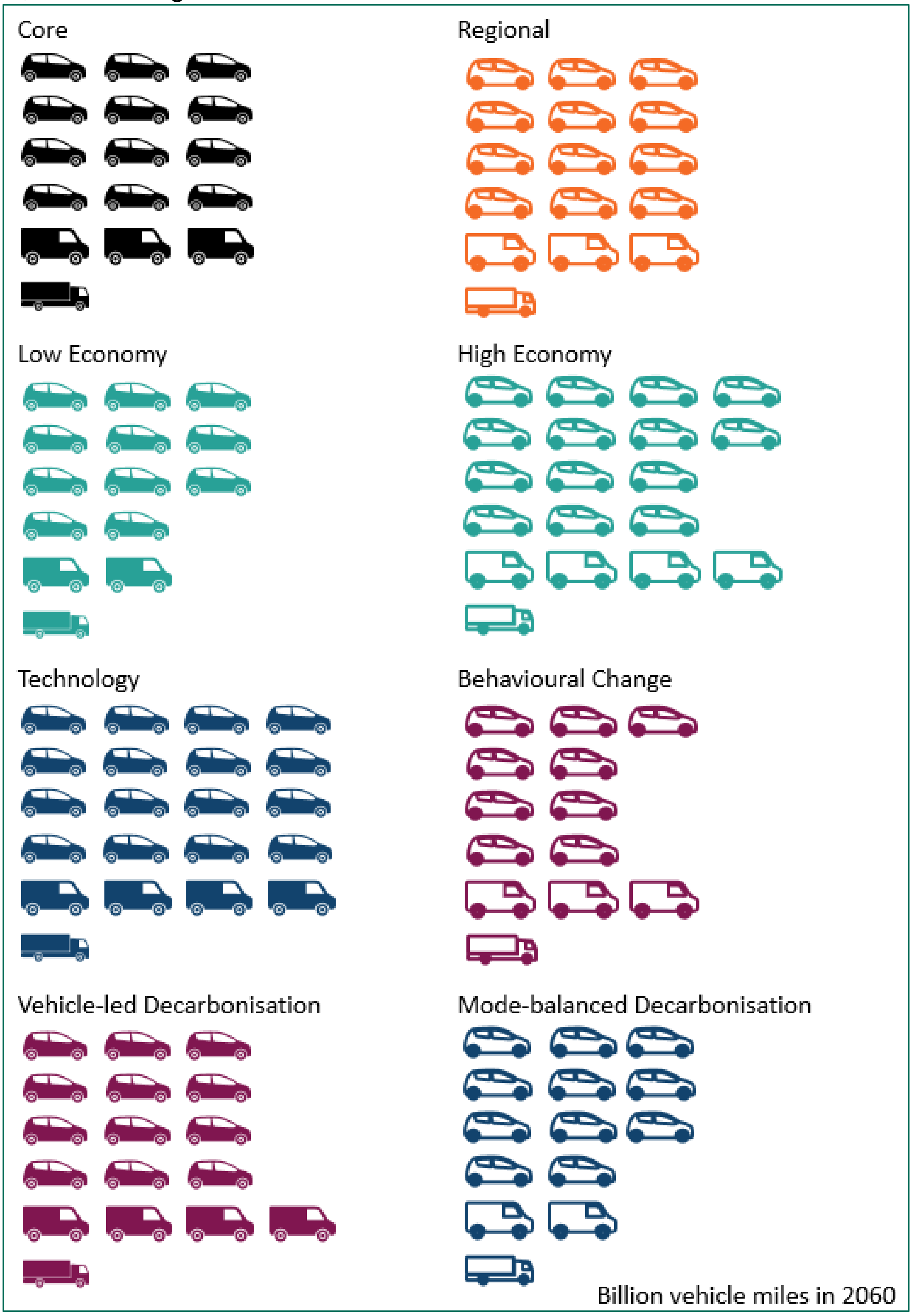

Figure 10 Infographic of projected vehicle miles by scenario and vehicle type in 2060

4.4 The projected tail pipe emissions of CO2e, NOx and PM10s are projected to fall in all scenarios. The reduction in tailpipe CO2e emissions is driven by increasing uptake of EVs and more efficient engines in the Core, Low Economy, High Economy, Behavioural Change and Regional Scenarios. In the Technology, Mode-balanced Decarbonisation and Vehicle-led Decarbonisation Scenarios, the reduction in tailpipe

CO2e emissions is driven by the more ambitious input assumptions on EV uptake. Namely that by 2050, 99% of vehicle miles driven are by electric vehicles. Figure 11 below shows tailpipe CO2e emissions by year. The megatons of CO2e range from around 80 to 90 in 2025 down to a range of approximately 60 to 5 megatons of CO2e in 2060.

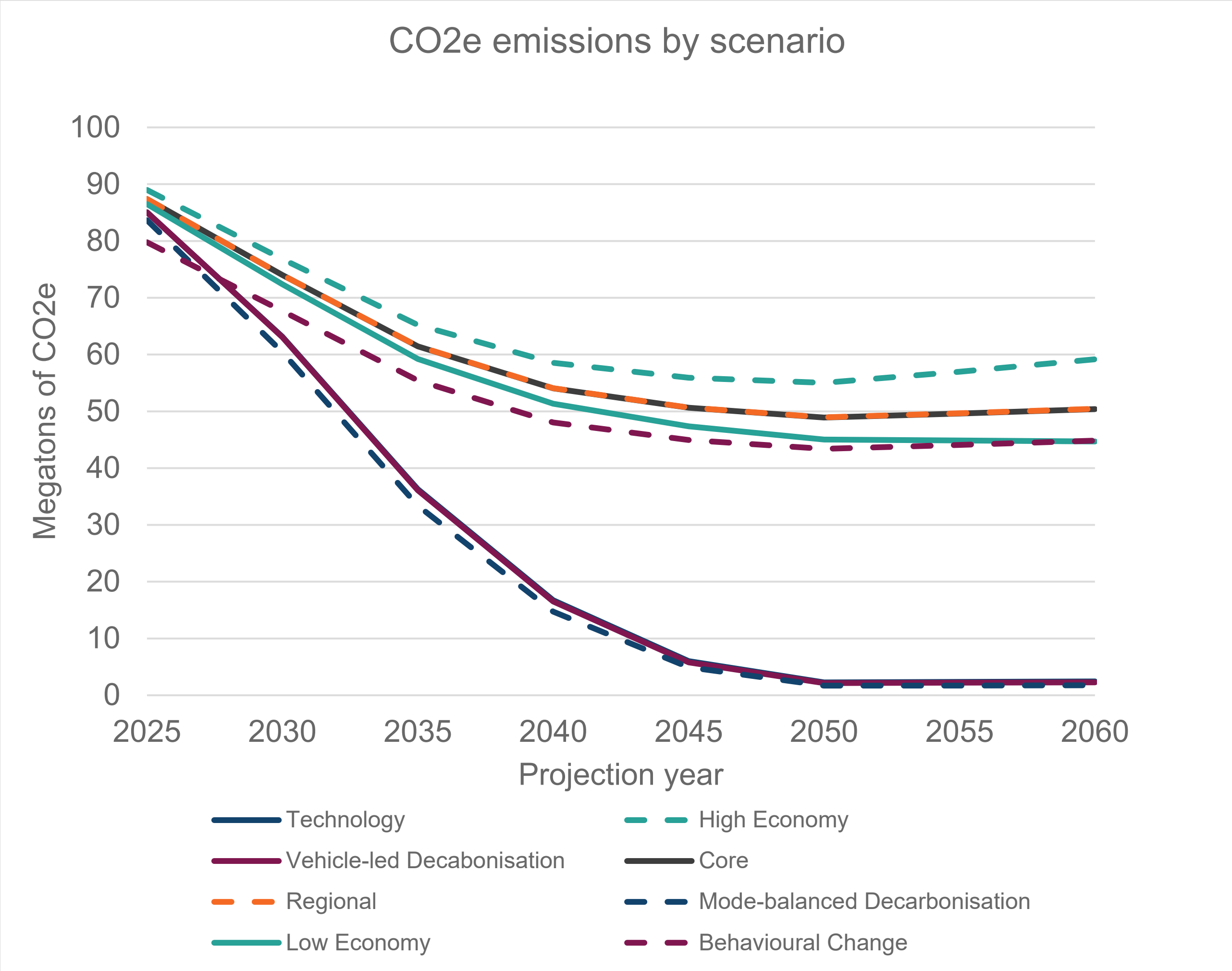

Figure 11 Projected total CO2e emissions by scenario and year

4.5 Between 2025 and 2050 NOx are projected to reduce by 65%, driven by the uptake of Euro 6 engines. However, as the uptake of Euro 6 engines flattens off the impact of greater travel increases the NOx by 1% between 2050 and 2060. Figure 12 shows the downward trajectory of tailpipe NOx emissions across all the scenarios. The high EV uptake scenarios reduce to almost zero by 2050 due to the electrification of the vehicle fleet.

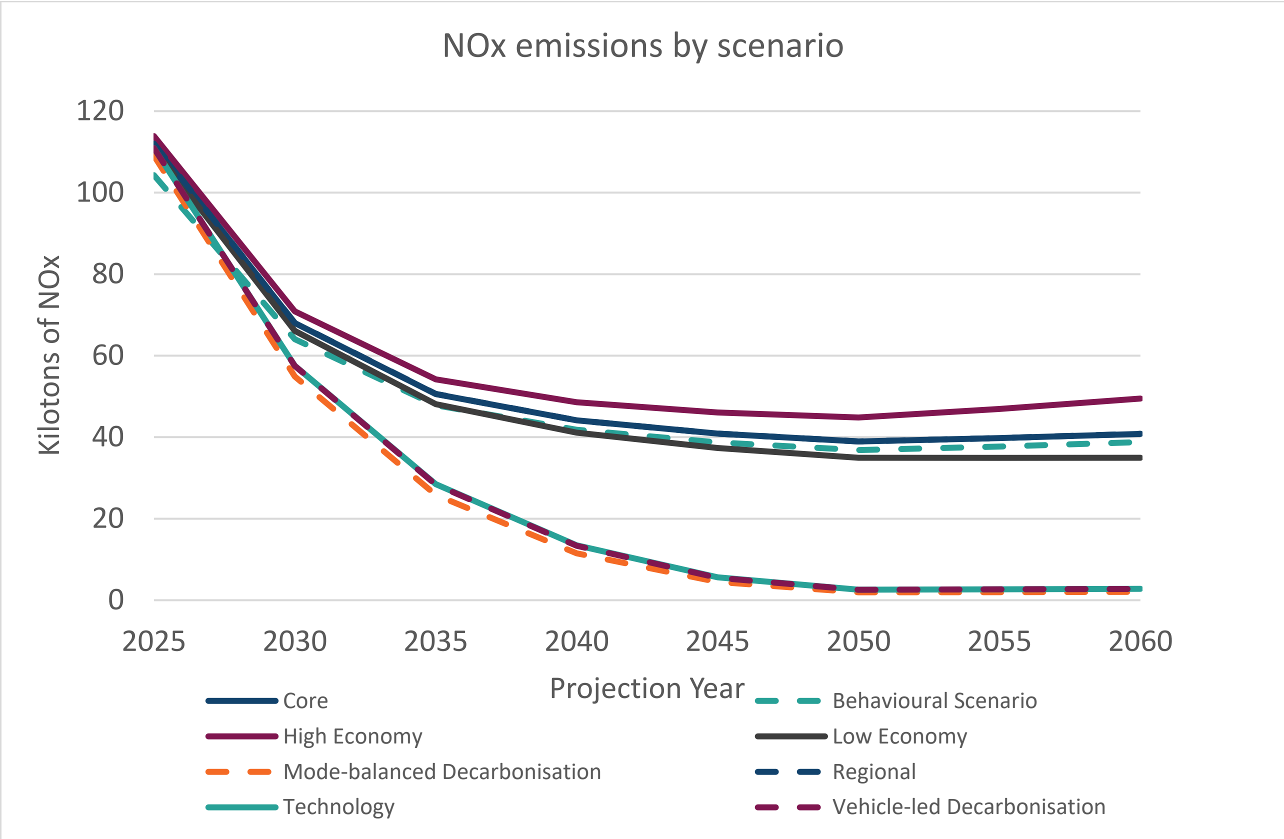

Figure 12 Projected total NOx emissions by scenario and year

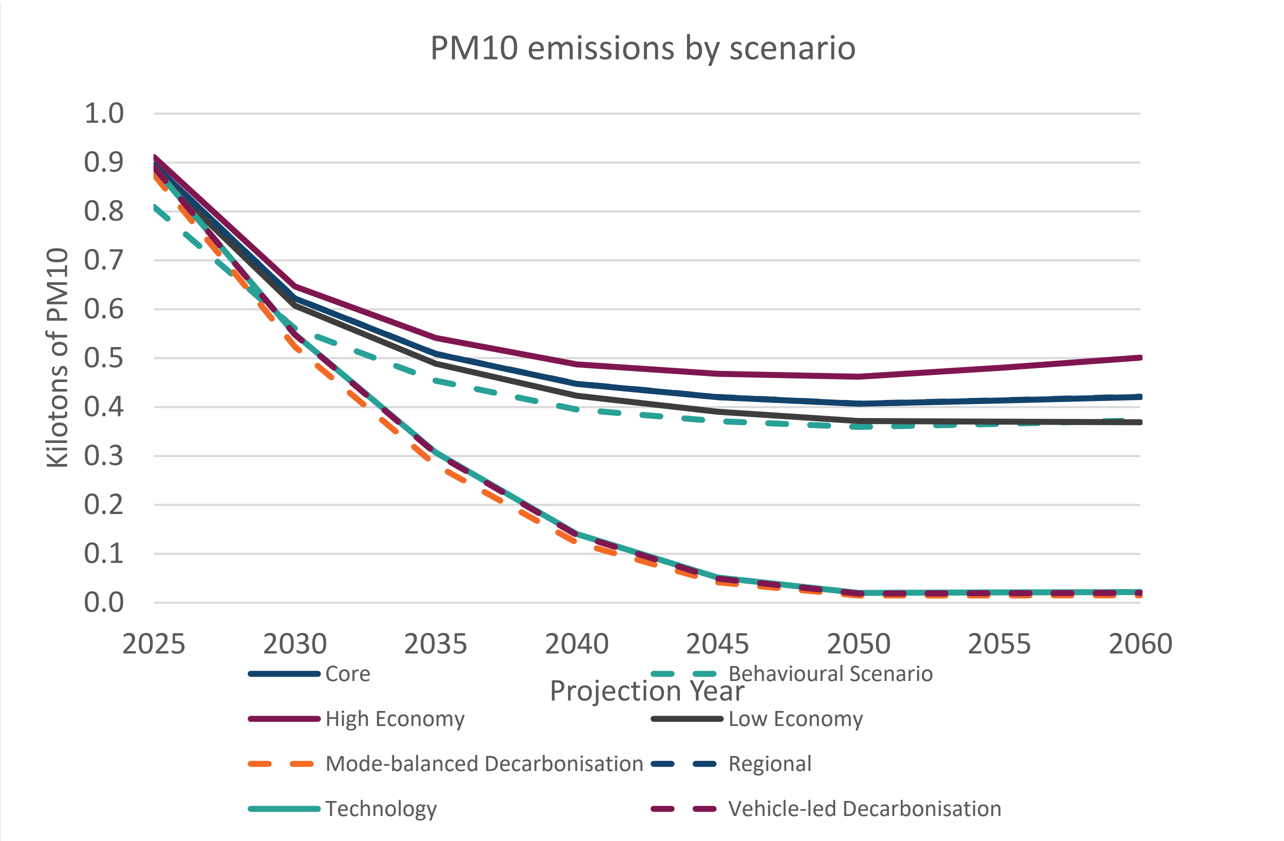

Figure 13 Projected total PM10 emissions by scenario and year

Core Scenario results

4.6 As described in Chapter 3, the Core Scenario is based on the latest government projections, for example of population, GDP, fuel prices and engine efficiencies, which are the main drivers of road traffic demand. The Core Scenario also includes 'firm and funded' government policy, for example, where stated ambitions are supported by published plans or funded policies. Relationships between the key drivers of demand and road traffic are broadly assumed to continue in line with historical trends and evidence, for example, how drivers respond to changes in fuel costs or how changes in GDP influence people's travel choices. The Core Scenario is presented here first as it is the starting point for the Common Analytical Scenarios.

Traffic – distance

4.7 The three main drivers of travel demand are increases in GDP, the reduction in the cost of driving and population growth. In the Core Scenario GDP increases by 69% between 2025 and 2060, over the same period the cost of driving decreases by 30% and population increases by 4%. Figure 14 shows that total traffic is projected to increase by 22% between 2025 and 2060, with the traffic growth between each forecast year declining over time. Modelling results show that approximately 90% of the growth is driven by the three main drivers of travel demand. Namely increases in GDP (50%), the reduced cost of driving (25%) and population increases (15%). HGV traffic is projected to have a moderate increase from 16 Bn vehicle miles in 2025 to 18 Bn vehicle miles in 2060. LGV growth is stronger starting at 57 Bn vehicle miles in 2025 rising to 77 Bn by 2060. The LGV growth follows the projected growth in income (GDP).

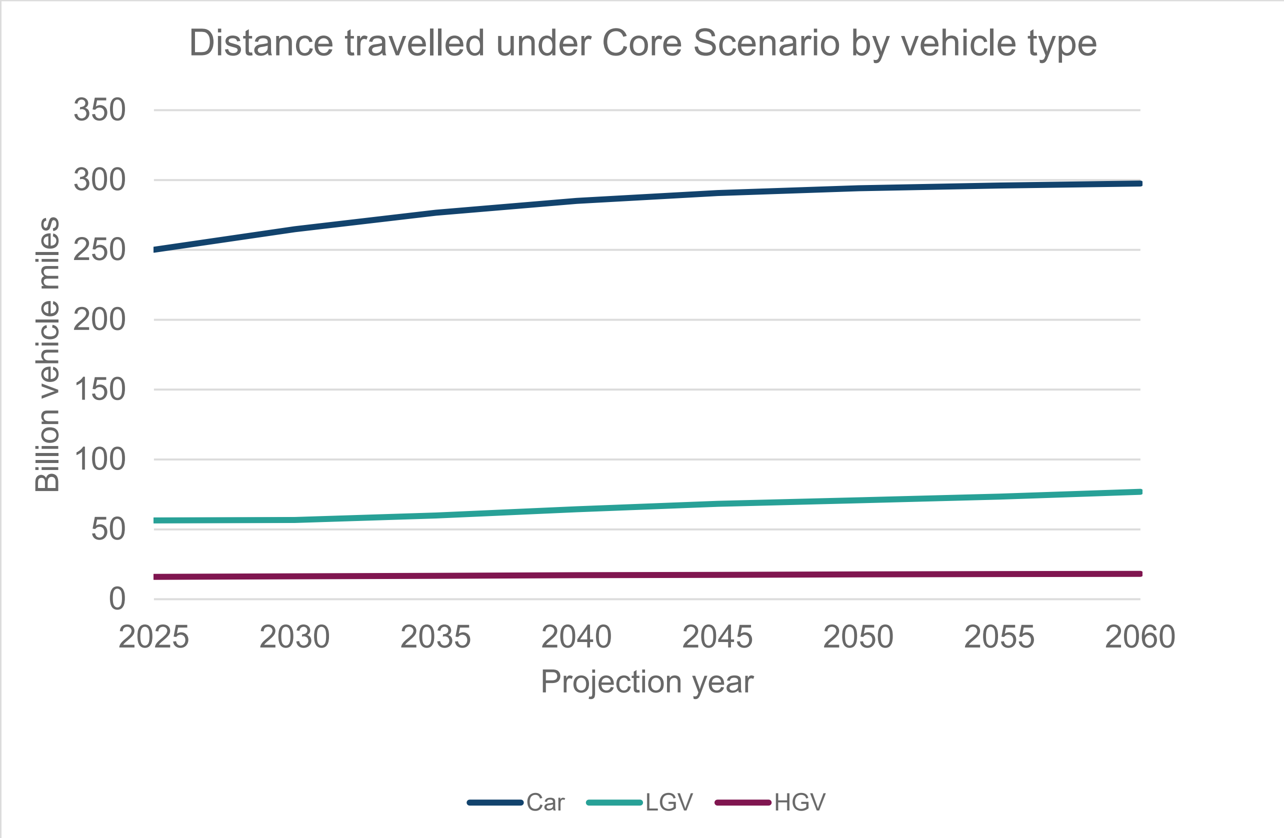

Figure 14 Core Scenario, distance by vehicle type

4.8 The relative distance travelled by region remains mostly consistent throughout the projection. This is shown in Figure 15, where distance travelled by region varies between 20% and 22% between 2025 and 2060. The North East, Wales and London are consistently the regions with the fewest miles travelled, while the opposite is true for the South East, Eastern England, and the North West. Note that regions are not equal in geographic size or population and therefore relative distance is not representative of an average household or individual from a region.

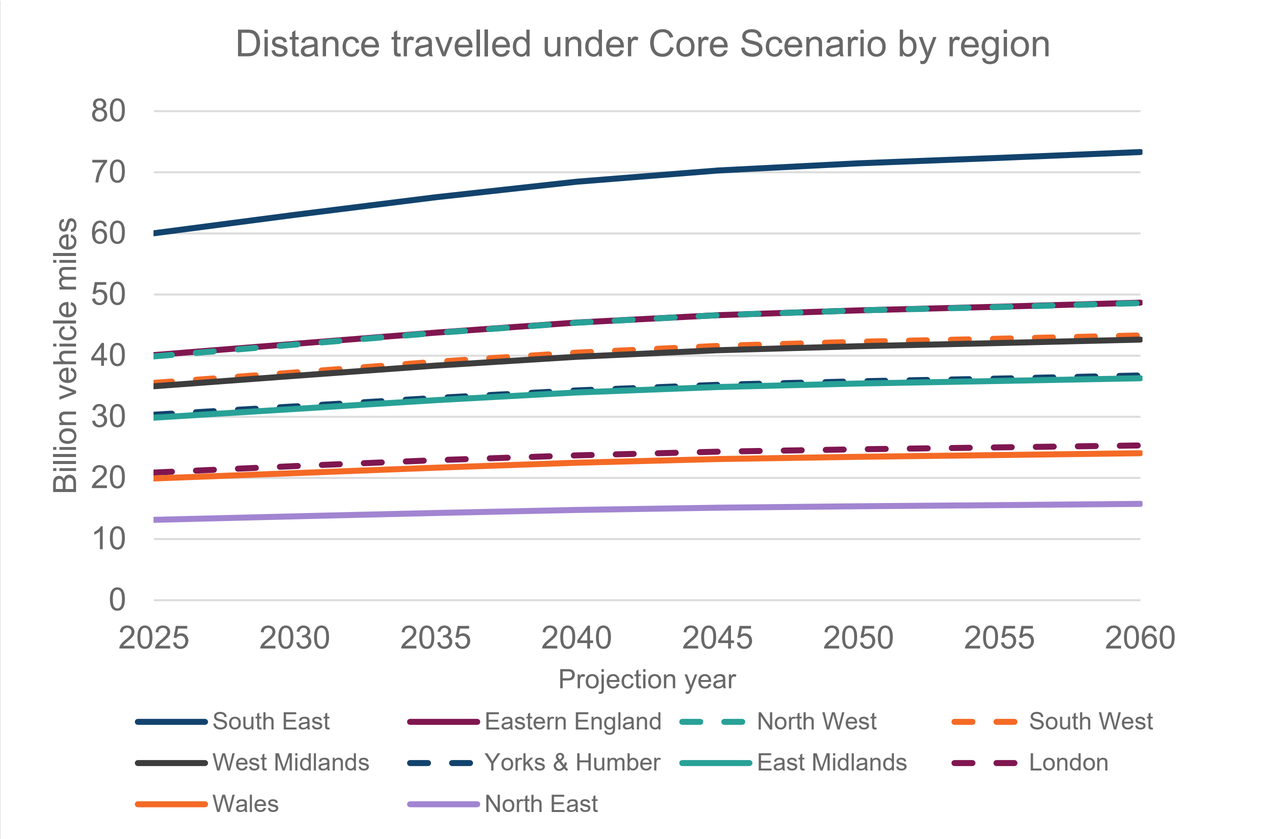

Figure 15: Core Scenario, distance travelled by region

4.9 Figure 16 shows the Core Scenario distance travelled projections by road type. Distance travelled on each road type increases over time, but the magnitude of the increase gradually declines. This growth is not spread evenly however, with vehicle miles on motorways increasing by 27% between 2025 and 2060 (compared to 20% and 21% on minor roads and A roads respectively), leading to a rise in the proportion of distance travelled by motorway. This is in part down to the relatively low levels of congestion on the motorway network compared to local roads and A roads. Hence there is more scope for increased vehicle miles. It is intuitive that local urban roads see less traffic growth as congestion in these areas is already higher than motorways.

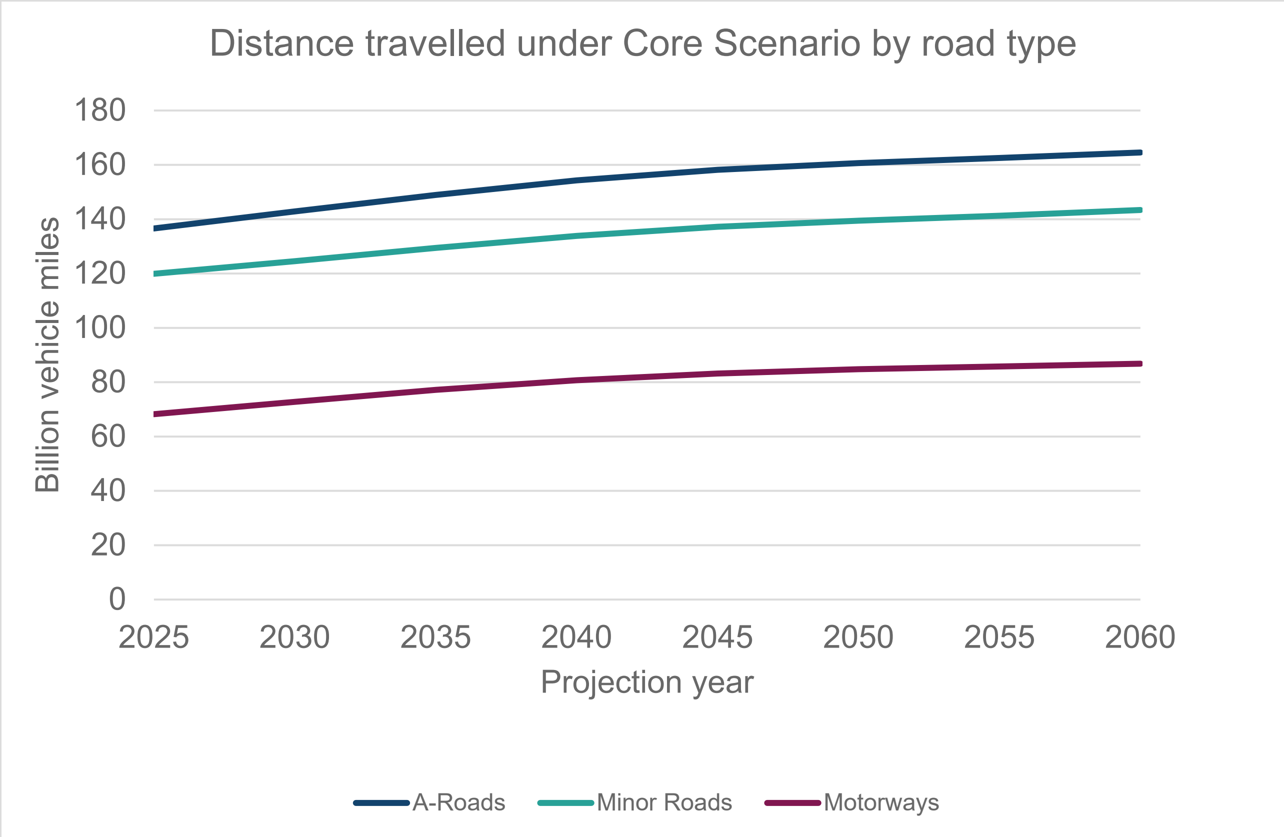

Figure 16: Core Scenario, Distance by Road type

Congestion

4.10 Congestion is dependent on the overall level of traffic relative to road capacity and should be expected to increase as traffic grows, provided capacity does not increase to match it. Growth in congestion varies depending on where and when traffic growth occurs. Traffic growth concentrated in already congested areas and times of day will naturally have a greater impact than growth that is in relatively uncongested locations or quiet times of day.

4.11 The average time lost per vehicle mile (Figure 17) during all time periods is projected to increase by approximately six seconds (27%) between 2025 and 2060.

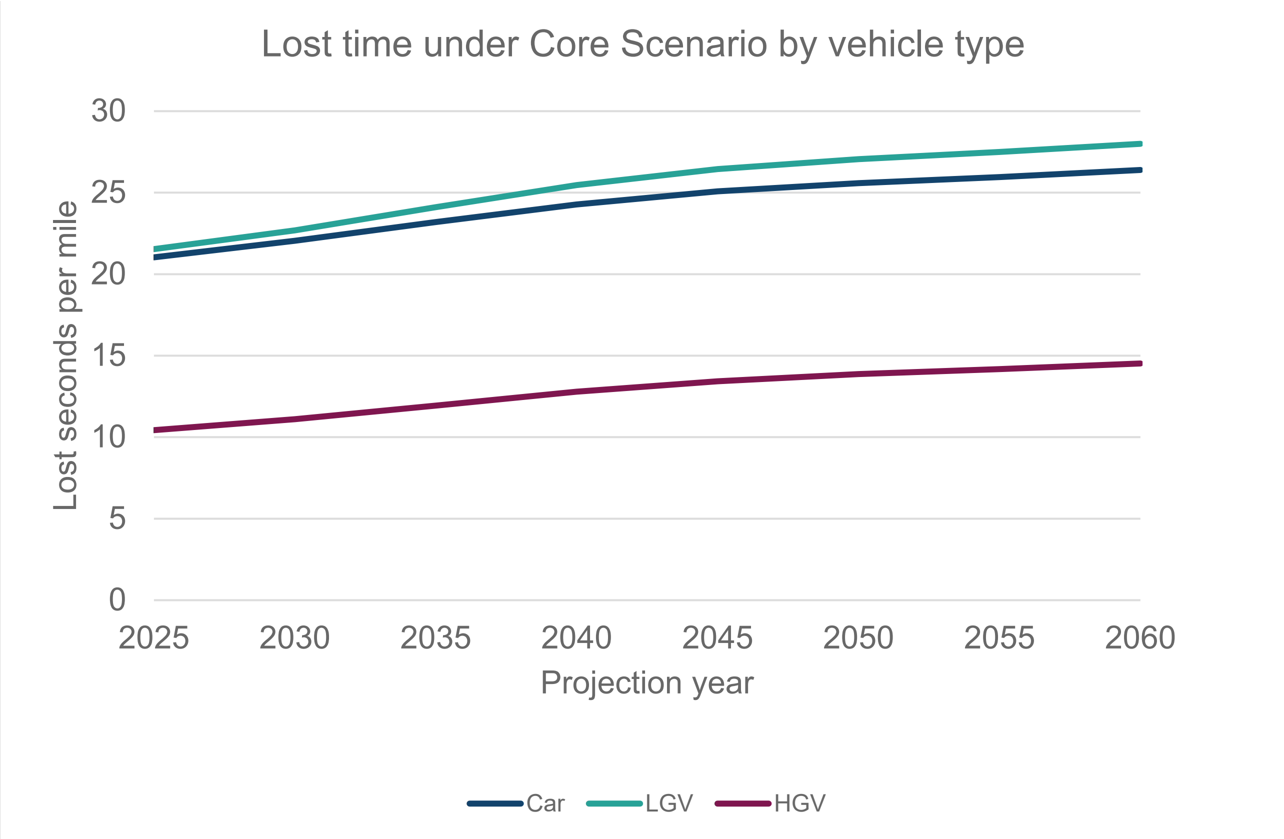

Figure 17: Core Scenario, lost seconds per vehicle mile

Emissions – CO2e, NOx and PM10s

4.12 The NTM produces projections of tailpipe emissions of CO2e, NOx and PM10. The projections do not include emissions from tyre wear, brake dust and road abrasion particles. The model calculates an estimate of aggregate emissions from the volume of traffic, the speed of the traffic and assumptions of improved fuel efficiency in the vehicle fleet that reduce emissions for a given speed. Speed emissions curves are applied to the traffic forecasts from the NTM, and the results aggregated to give emissions at the national level.

4.13 The estimates of emissions produced here are mainly driven by input assumptions around electric vehicle uptake.

4.14 Under the Core Scenario, which is based on firm and funded policies, CO2e tailpipe emissions are projected to fall from 87 MtCO2e (megatons of CO2e) to 50 MtCO2e. A decrease of 42% between 2025 and 2060 (Figure 18).

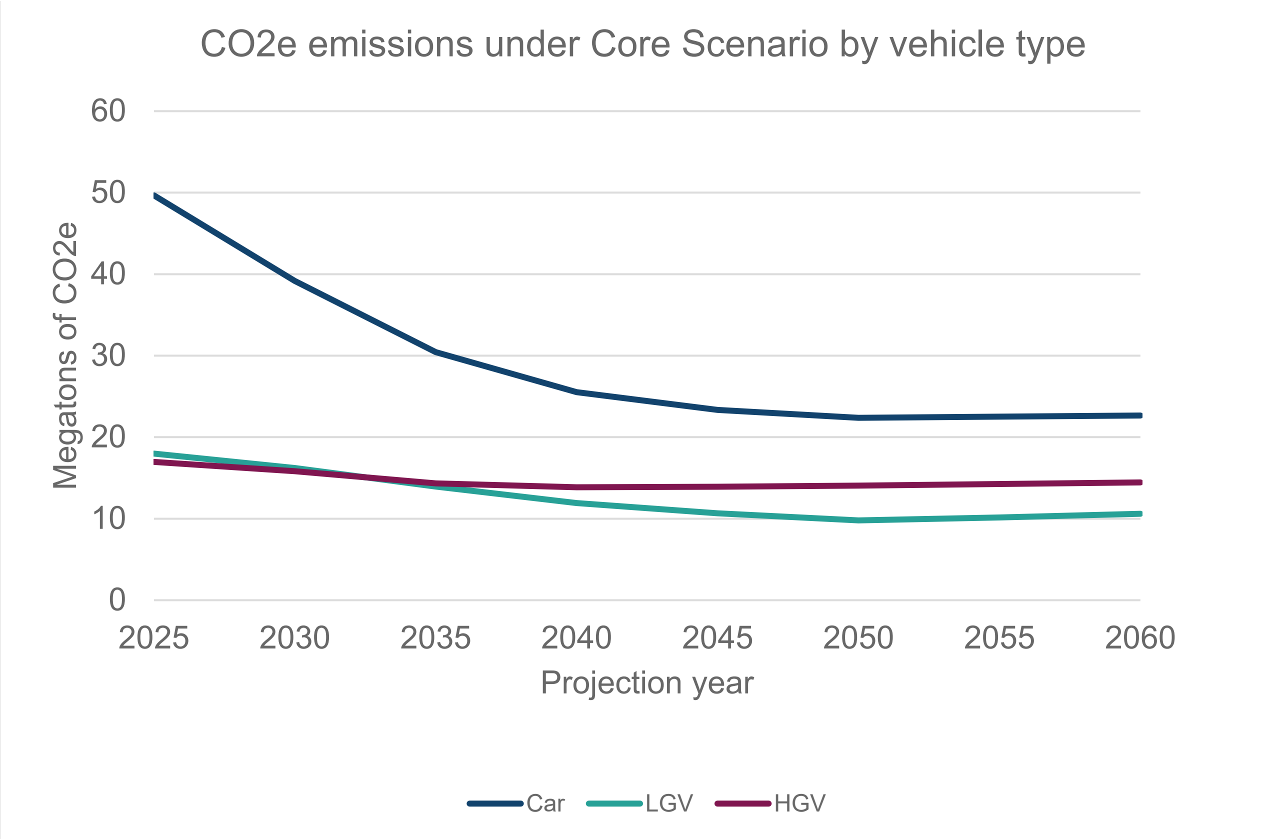

Figure 18 Core Scenario, CO2e emissions by vehicle type

4.15 After initial falls, emissions largely level off after 2030 as the details of future car and LGV regulations to reduce CO2e emissions beyond this point have yet to be finalised. After 2030 the impact of rising traffic is offset by the increasing numbers of electric vehicles in the fleet.

4.16 The projection for NOx emissions shows a decline of 64% from 2025 to 2060 to just less than 41 ktNOx (kilotons of NOx) (Figure 19).

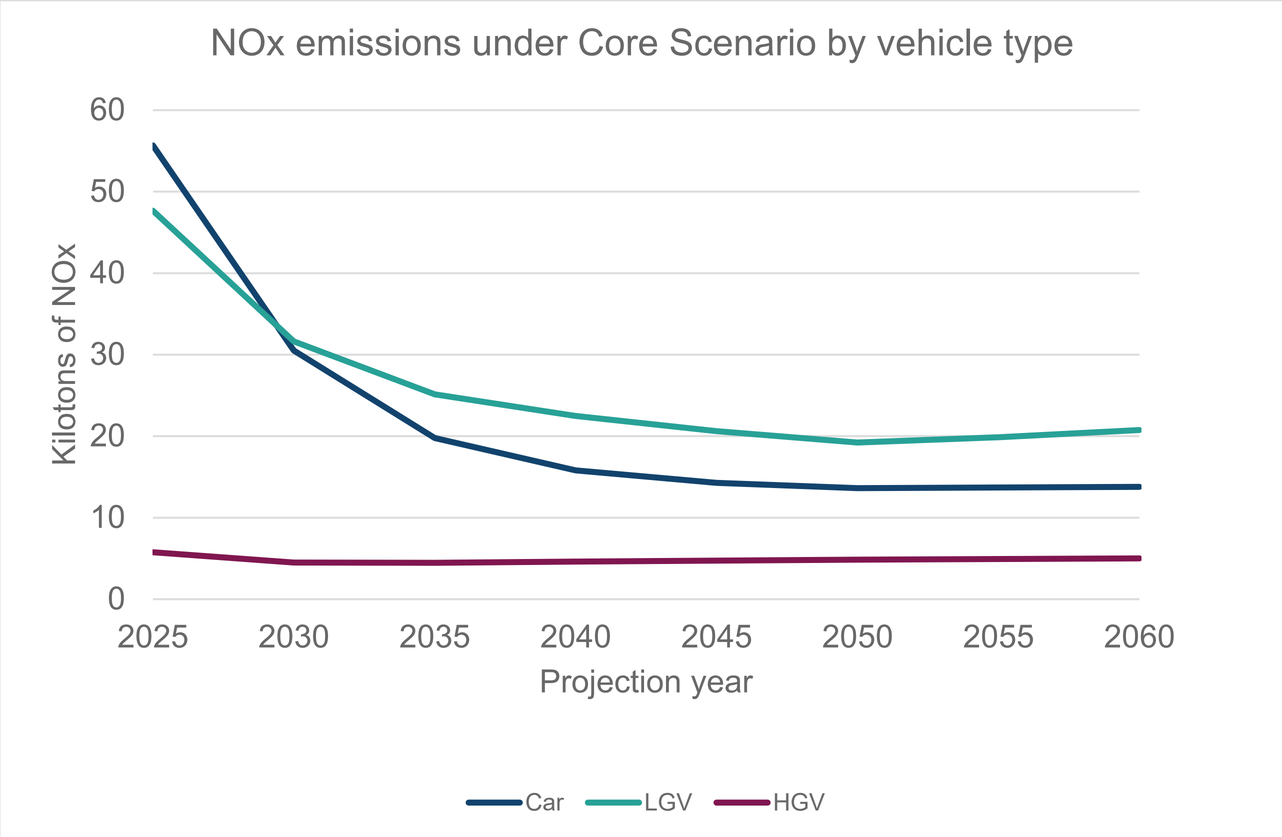

Figure 19: Core Scenario, NOx emissions by vehicle type

4.17 A similar story is told for tailpipe PM10 emissions, Figure 20 shows PM10 emissions projected to decline to 0.4 ktPM10 (kilotons of PM10), a decrease of 53% from 2025 to 2060. Again, this is largely driven by the uptake of cleaner ICEs and EVs.

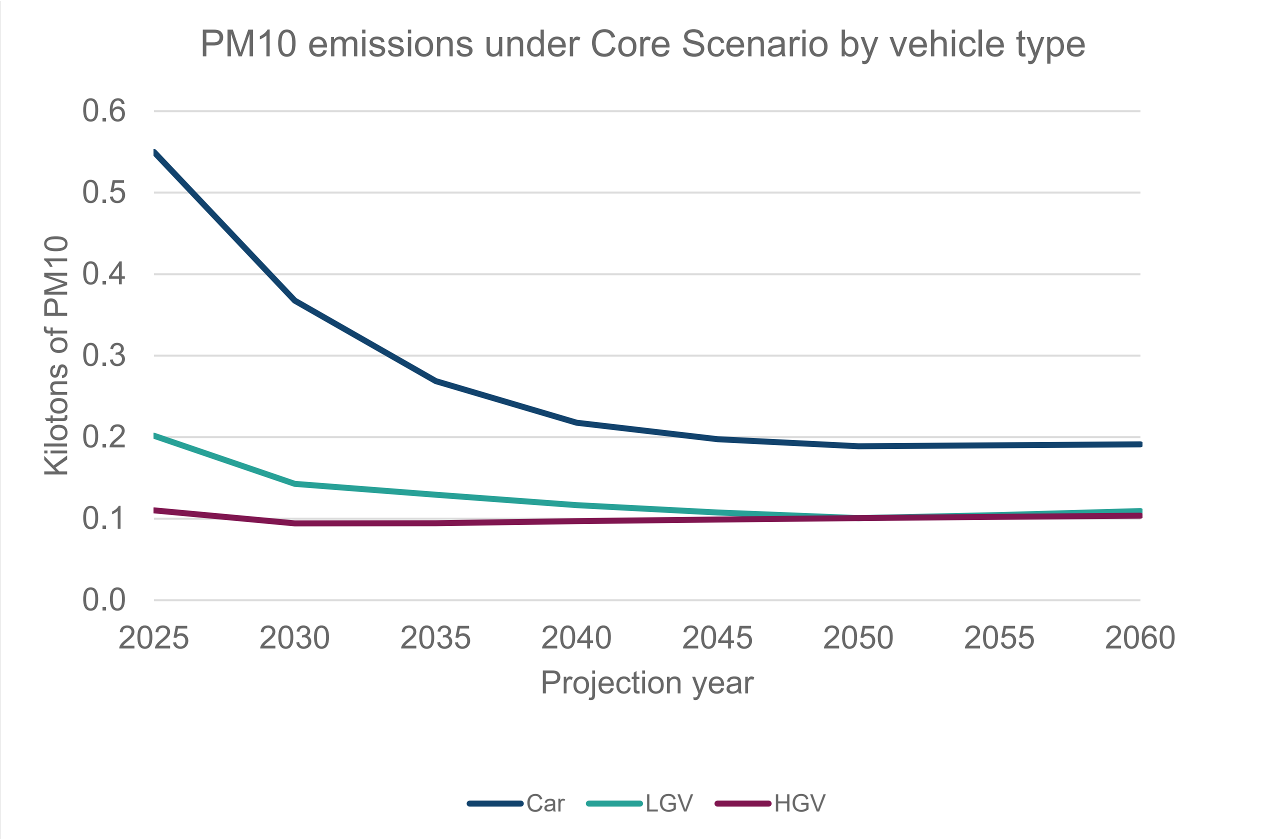

Figure 20: Core Scenario, PM10 emission by vehicle type

High Economy Scenario and Low Economy Scenario results

4.18 These scenarios produce projections in a world where the drivers of demand remain the same but consider how traffic could vary with economic and demographic uncertainty. Consequently, distance travelled, congestion and emissions all rise with GDP and population under the High Economy Scenario, while the opposite is true for the Low Economy Scenario.

Traffic – distance

4.19 Distance travelled under the two scenarios diverge over time in line with GDP and population. The divergence is shown in Figure 21. Under the High Economy Scenario, distance travelled grows by 39% between 2025 and 2060. Conversely, in the Low Economy Scenario distance travelled grows by 8%. This is the only scenario to project distance travelled rising and then declining, growth in distance travelled from 2025 under the Low Economy Scenario reaches 10% by 2045 but falls back to 8% in 2060.

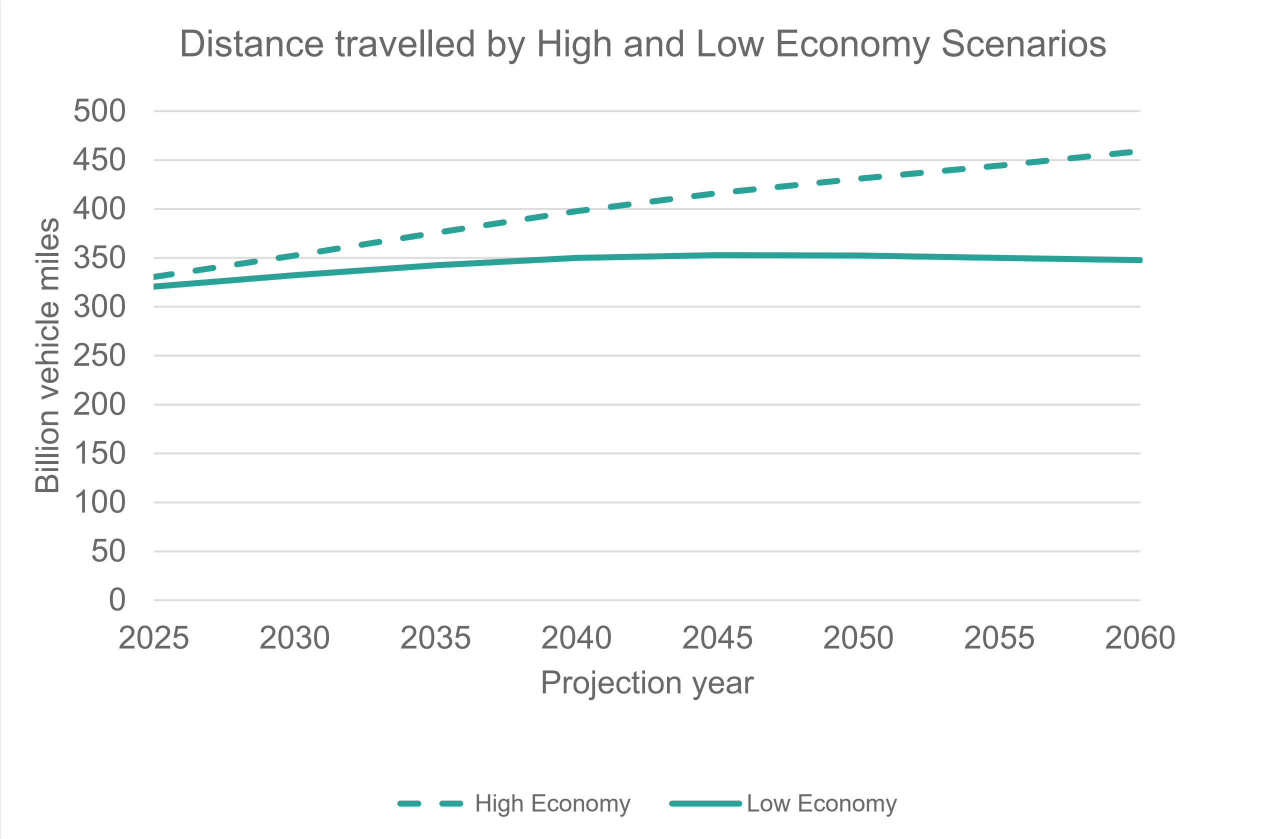

Figure 21: High Economy Scenario and Low Economy Scenario, distance by scenario

Trips

4.20 In the High Economy Scenario, car trips increase over time. In contrast in the Low Economy Scenario, car trips remain relatively stable until the 2040s, from which point they begin to decrease.

4.21 In the High Economy Scenario, due to higher incomes increasing car ownership, the number of car drivers increase, and car passengers decrease. This causes vehicle occupancy to fall, as it does in the Core Scenario, but to a slightly higher degree.

4.22 Meanwhile, in the Low Economy Scenario, the declining population and lower economic growth results in more people switching to be car passengers instead of car drivers. Vehicle occupancy falls faster than in the Core Scenario and High Economy Scenario, but then increases in the 2040s, before declining again, resulting in a level in 2060 higher than in both the Core Scenario and High Economy Scenario.

Congestion – Lost Time per mile

4.23 As stated above, congestion is dependent on the overall level of traffic relative to road capacity and, other things being equal, should be expected to correlate with distance travelled. Figure 22 shows this relationship for the High Economy Scenario and Low Economy Scenario.

4.24 The High Economy Scenario shows lost time increasing throughout the projection period. The average delay per vehicle mile during all periods is projected to increase by approximately 12.5 seconds (59%) between 2025 and 2060.

4.25 Meanwhile the Low Economy Scenario shows a slower increase in lost time out to 2045 before declining again, following the pattern of distance travelled. The average delay per vehicle mile for the Low Economy Scenario is projected to increase by approximately 1.4 seconds (7%) between 2025 and 2060.

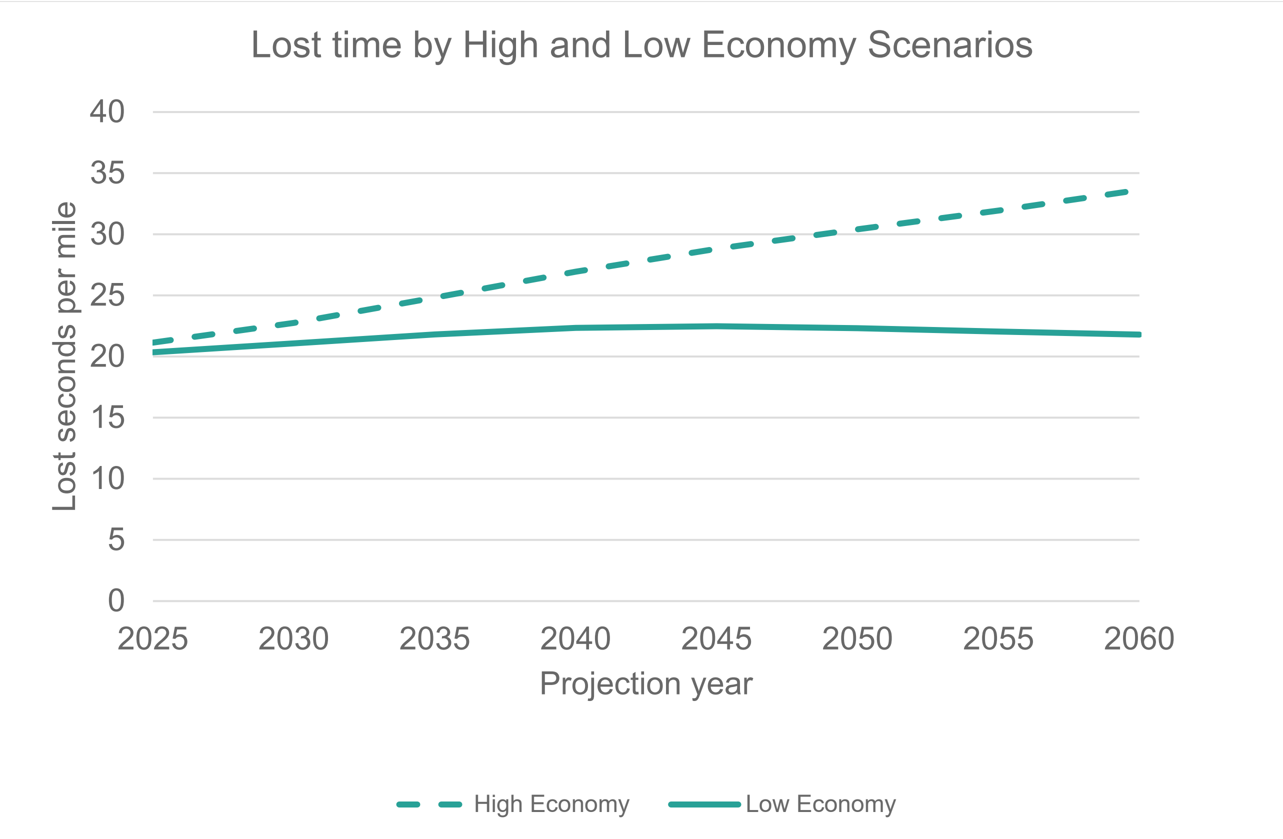

Figure 22: High Economy Scenario and Low Economy Scenario, lost time in seconds per vehicle mile

Emissions – CO2e, NOx and PM10s

4.26 As seen in the other scenarios which use the Core Scenario mileage split and fuel efficiency assumptions, emissions fall over time. The rate of CO2e emissions per mile declines out to 2060 however the increase in distance travelled after 2050 brings this improvement to almost level in the Low Economy Scenario and leads to an increase in tailpipe CO2e emissions in the High Economy Scenario. This is seen in Figure 23, where the High Economy Scenario sees CO2e emissions fall more slowly than the Low Economy Scenario.

4.27 In the High Economy Scenario, the CO2e emissions fall by 34% between 2025 and 2060. In the Low Economy Scenario, CO2e emissions fall by 48% between 2025 and 2060. As a result, the divergence between the scenarios increases over time and the High Economy Scenario sees emissions growth post-2050 (returning to pre-2040 projections by 2060). This is because mileage split assumptions are held constant from 2050 which is the target Year for net zero policies.

4.28 Figure 24 and Figure 25, show that this relationship between the two scenarios also holds for NOx and PM10 emissions.

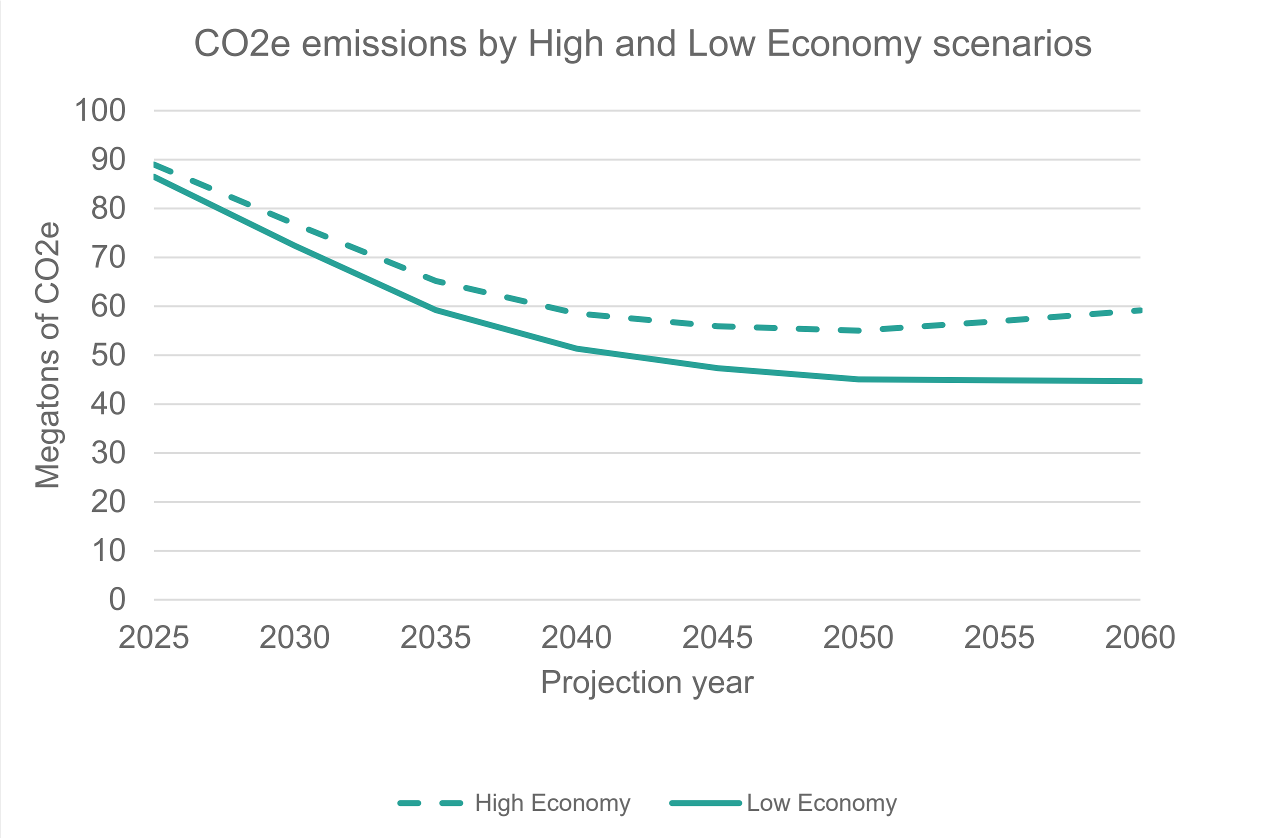

Figure 23: High Economy Scenario and Low Economy Scenario, CO2e emissions

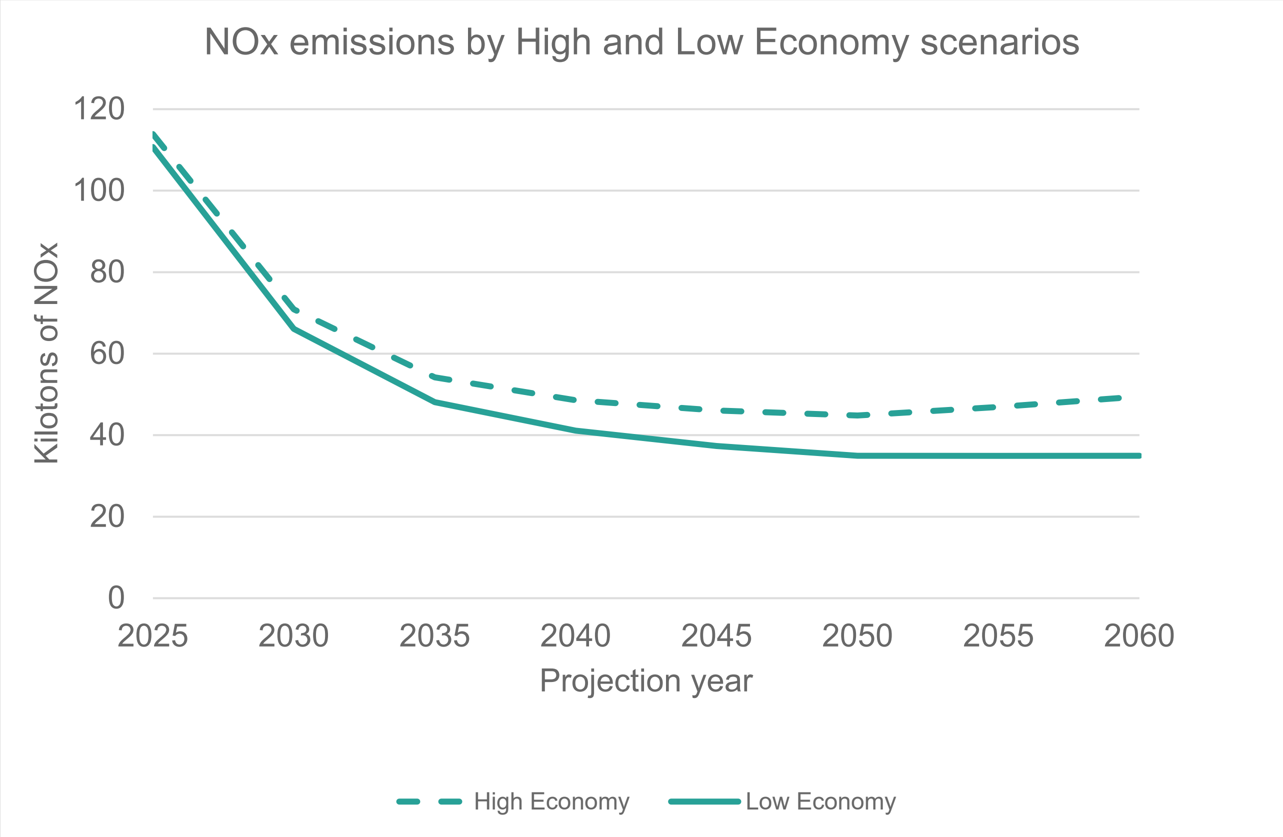

Figure 24: High Economy Scenario and Low Economy Scenario, NOx emissions

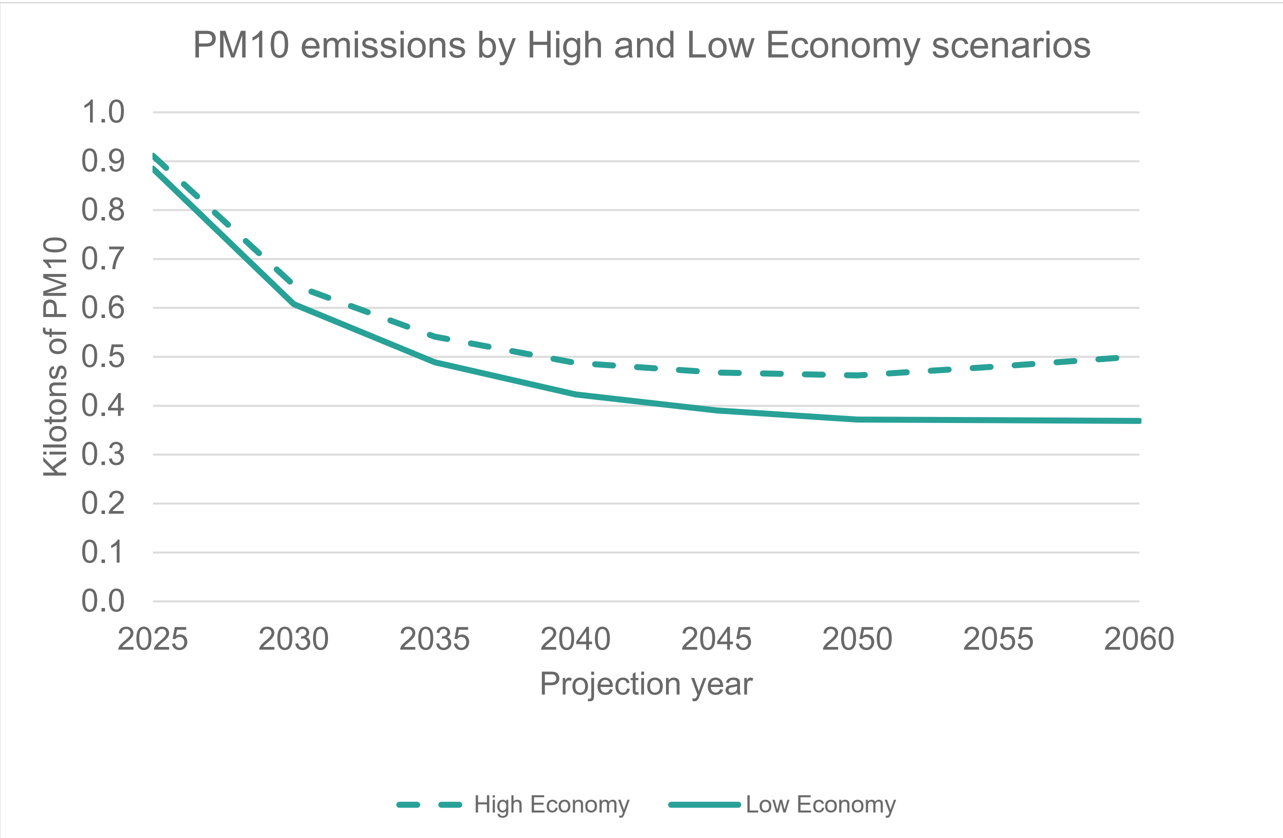

Figure 25: High Economy Scenario and Low Economy Scenario, PM10 emissions

Regional Scenario results

4.29 In terms of total bvm, the Regional Scenario is similar to the Core Scenario, but slightly higher. The similarity derives from the adjustments being controlled to the same national level. However, the slight increase (0.25%) in total billion vehicle miles by 2060, can be explained by the difference in mode choice across the regions. The Regional Scenario shifts population and therefore traffic away from the Wider South East (London, the South East and East of England), which feature a greater prominence of non-car modes (particularly rail). As people move to regions with more rural areas, car miles increase. The similarity is also apparent when comparing emissions and distance travelled by vehicle type.

Traffic – distance

4.30 The distribution of road vehicle miles by vehicle type is typical for the Regional Scenario compared to the other scenarios. Cars travel the most distance, at about 75% of the total bvm travelled.

4.31 However, when the distribution of vehicle miles by region is considered in Figure 26, the effect of the regional redistribution methodology is seen. London sees the biggest reduction out of the Wider South East regions, whereas Yorkshire & the Humber and the North East see the biggest increase, when compared to growth in the Core Scenario.

4.32 It is worth noting that the impact of the adjustment is moderate. This is down to the methodology, which only increases population in regions that were growing slower than the national average. It was found that many regions, particularly those in the Midlands, were already growing faster than the national average so they received no additional population growth from the redistribution. London sees a smaller increase in delay compared to the Core Scenario due to the redistribution of traffic away from the wider south east.

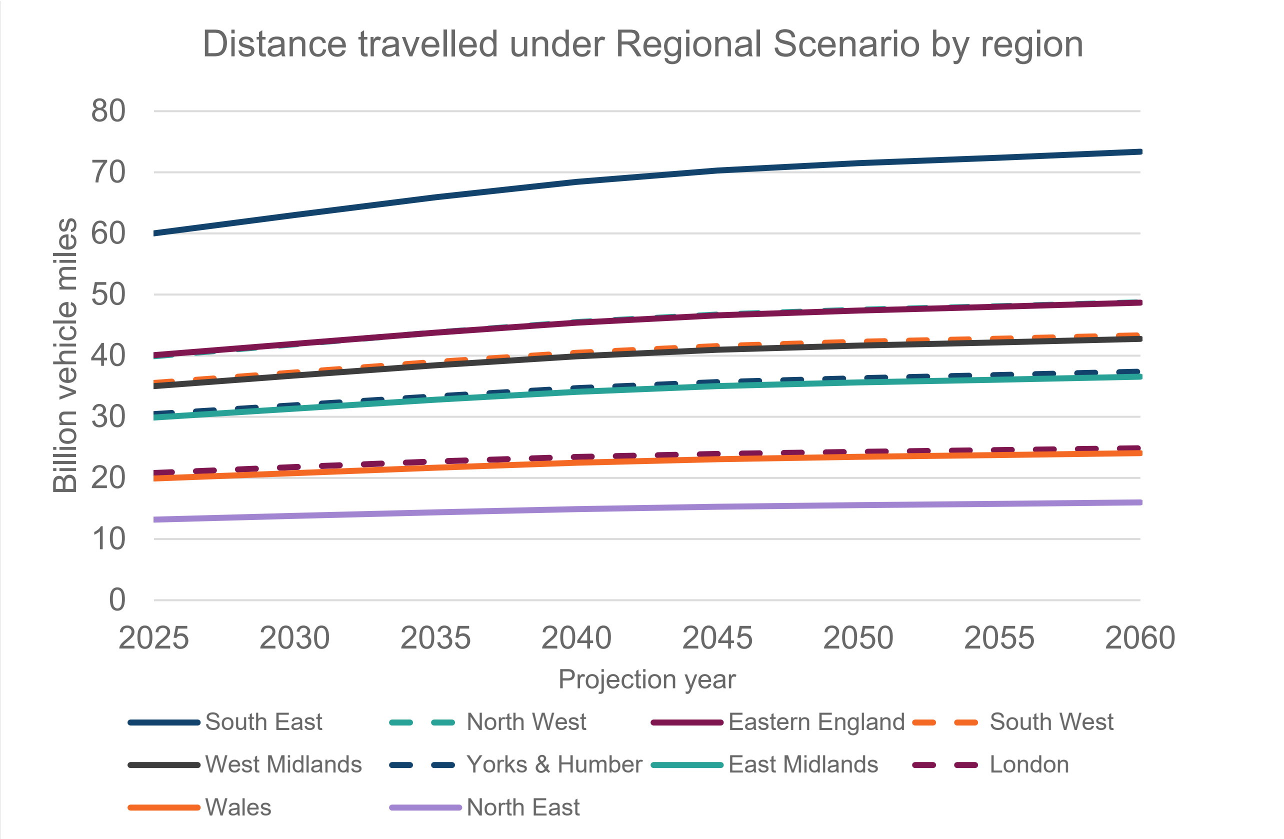

Figure 26 Regional Scenario, distance by region

4.33 When looking at bvm by road type in Figure 27, traffic on all road types increases in the Regional Scenario, when compared to the Core Scenario. The biggest change in bvm is seen by minor roads, which reflects the more rural make-up of regions outside of the Wider South East. However, motorways grow the fastest across the period of 2025 to 2060, being 28% higher in 2060 compared to 2025. However, they still represent a minority of travel in terms of distance.

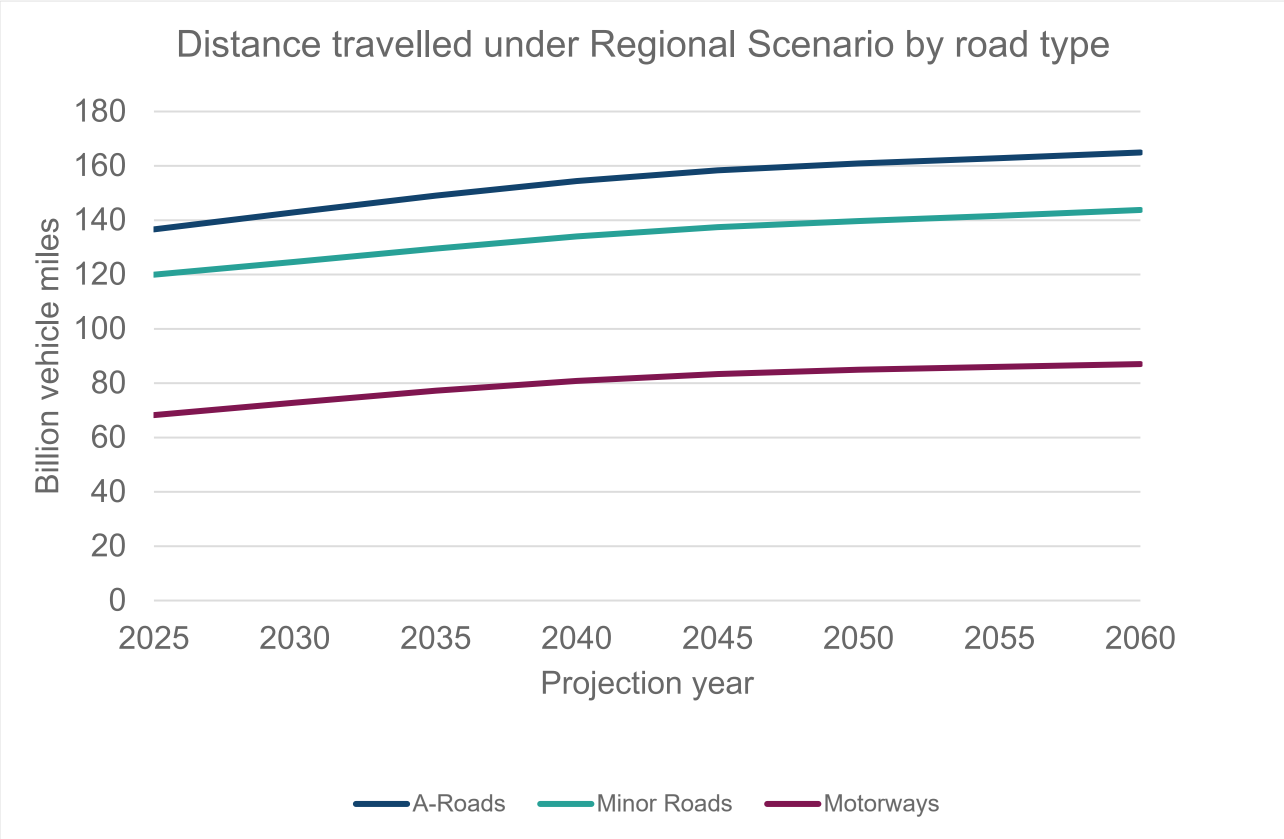

Figure 27 Regional Scenario, distance by road type

Congestion – Lost Time per mile

4.34 Figure 28 shows the lost seconds per mile by region for the Regional Scenario. Although congestion in other regions is dwarfed by that in London, all regions experience an increase in congestion, ranging from 15% (South West) to 37% (Yorkshire and the Humber) between 2025 and 2060. London starts with a lost time of 87 seconds or 1 minute and 27 seconds per mile in 2025 and reaches 110 seconds (1 minute 50 seconds) in 2060. All other regions start from a much lower lost time per mile, ranging between 10 and 22 seconds in 2025, and reach between 12 seconds and 28 seconds in 2060. The distribution across the regions is changed from the Core Scenario, with the Northern regions experiencing more congestion relative to the Core Scenario, as people and traffic move there.

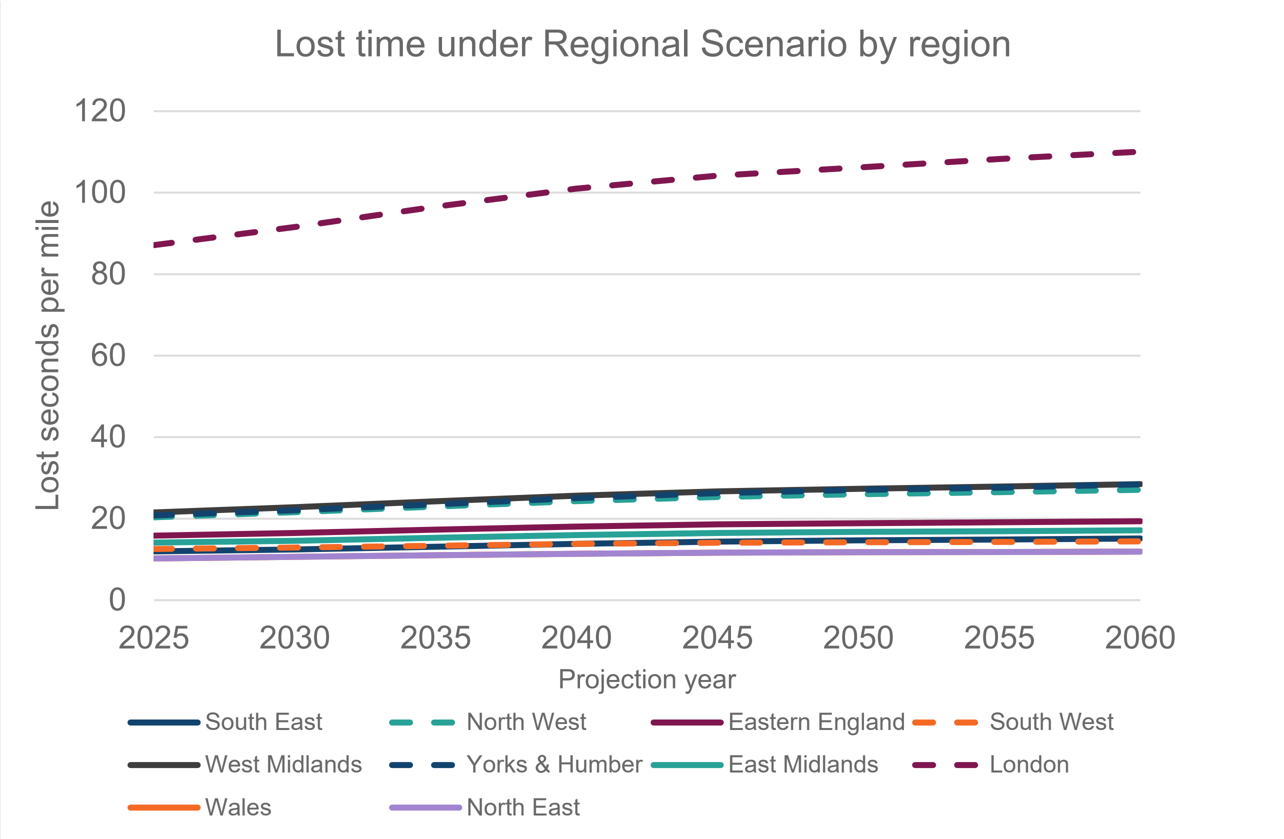

Figure 28 Regional Scenario, lost seconds by region

Emissions – CO2e, NOx and PM10s

4.35 As seen in the other scenarios which use the Core Scenario mileage split and fuel efficiency assumptions, CO2e emissions fall over time most dramatically for cars. This is shown in Figure 29. Whilst other vehicle types see decreases in CO2e emissions derived from fuel efficiency improvements, they are not on the scale as the decrease for cars, which benefits from a sizable electrification of the fleet (68% by 2050).

4.36 However, when compared in megatons, cars still emit the most CO2e, even in later forecast years, due to the sheer quantity of vehicle miles driven. Similar patterns to the Core Scenario are evident in NOx and PM10 emissions as well.

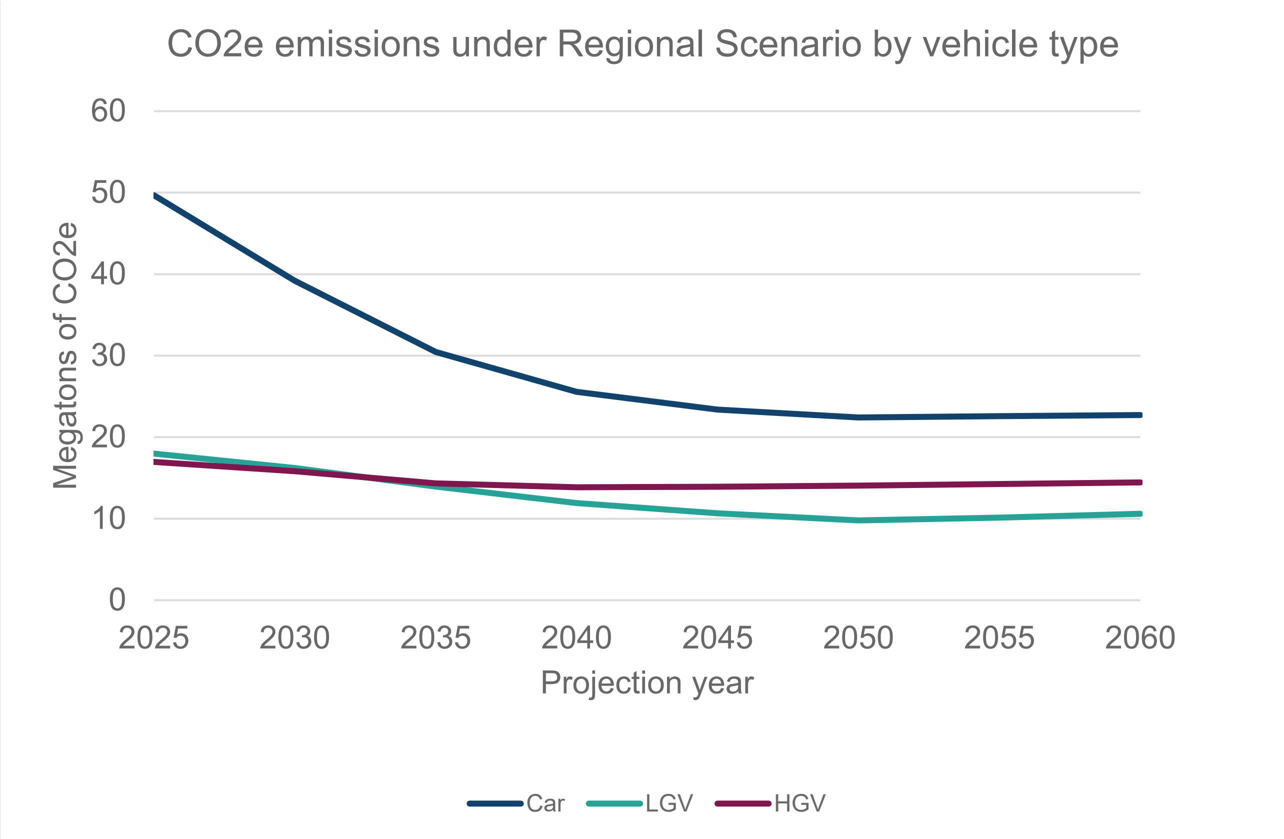

Figure 29 Regional Scenario, CO2e emissions by vehicle type

4.37 When compared across regions in Figure 30, CO2e emissions fall broadly across the board. From 2050, as electrification of the fleet is held constant, emissions begin to increase in line with traffic growth. Wales and the South West see the biggest falls in CO2e emissions, perhaps linked to the slower traffic growth in those regions. NOx and PM10 emissions show a similar pattern, falling across all regions and picking up again in the later forecast years.

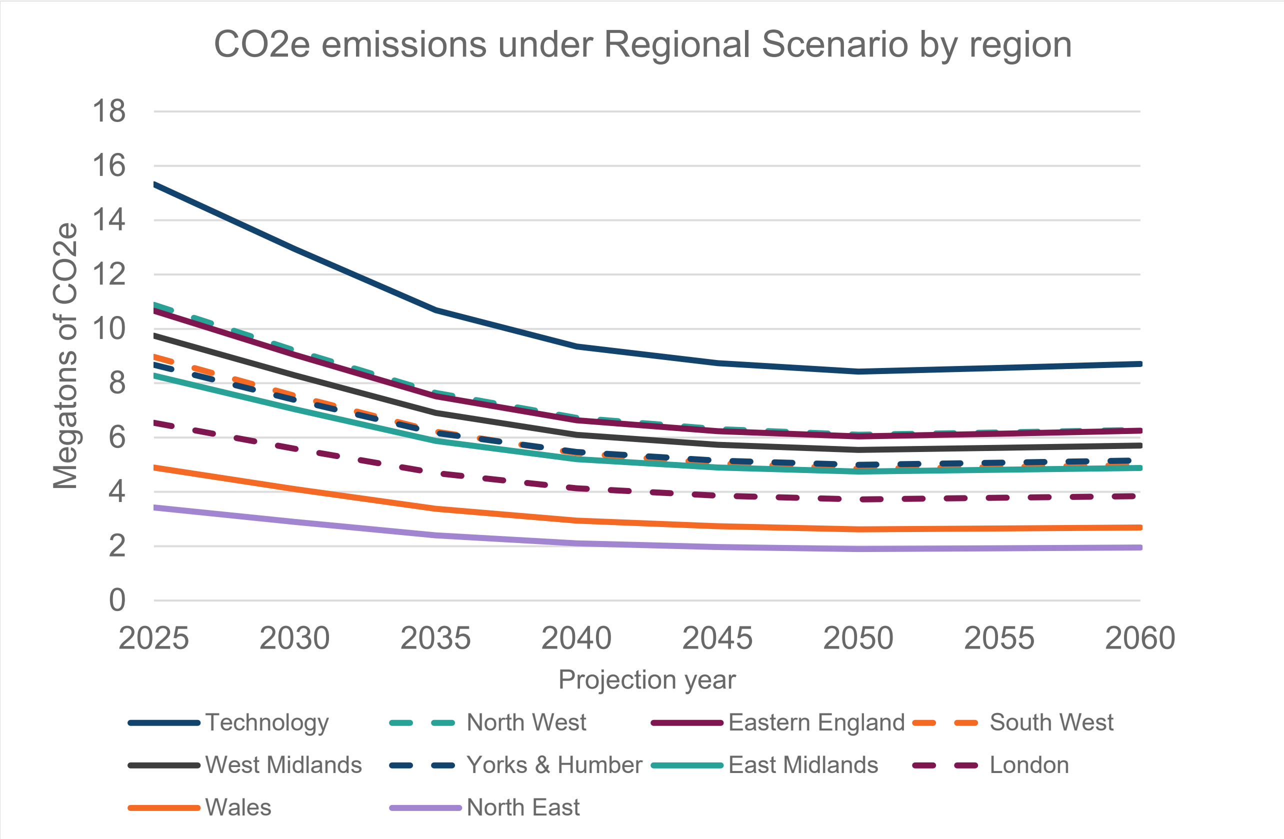

Figure 30 Regional Scenario, CO2e emissions by region

Behavioural Change Scenario results

4.38 The Behavioural Change Scenario provides the lower bound on traffic demand for the NRTP 22. Traffic growth stagnates due to declining trip rates and driving licence holding. However, the shape of the curves is similar to the Core Scenario, particularly from 2040 onwards. This is because the trip rate adjustments are held constant from that point, meaning growth begins to follow the Core Scenario profile again. LGV miles travelled increase over the projection period, as they have been adjusted upward to account for increased home deliveries due to the shift away from high-street shopping to online shopping.

Traffic – distance

4.39 Figure 31 shows that total distance travelled broadly levels off for cars and freight. However, LGVs see an increase of 45% between 2025 and 2060. This compares to 12% growth overall for the same period.

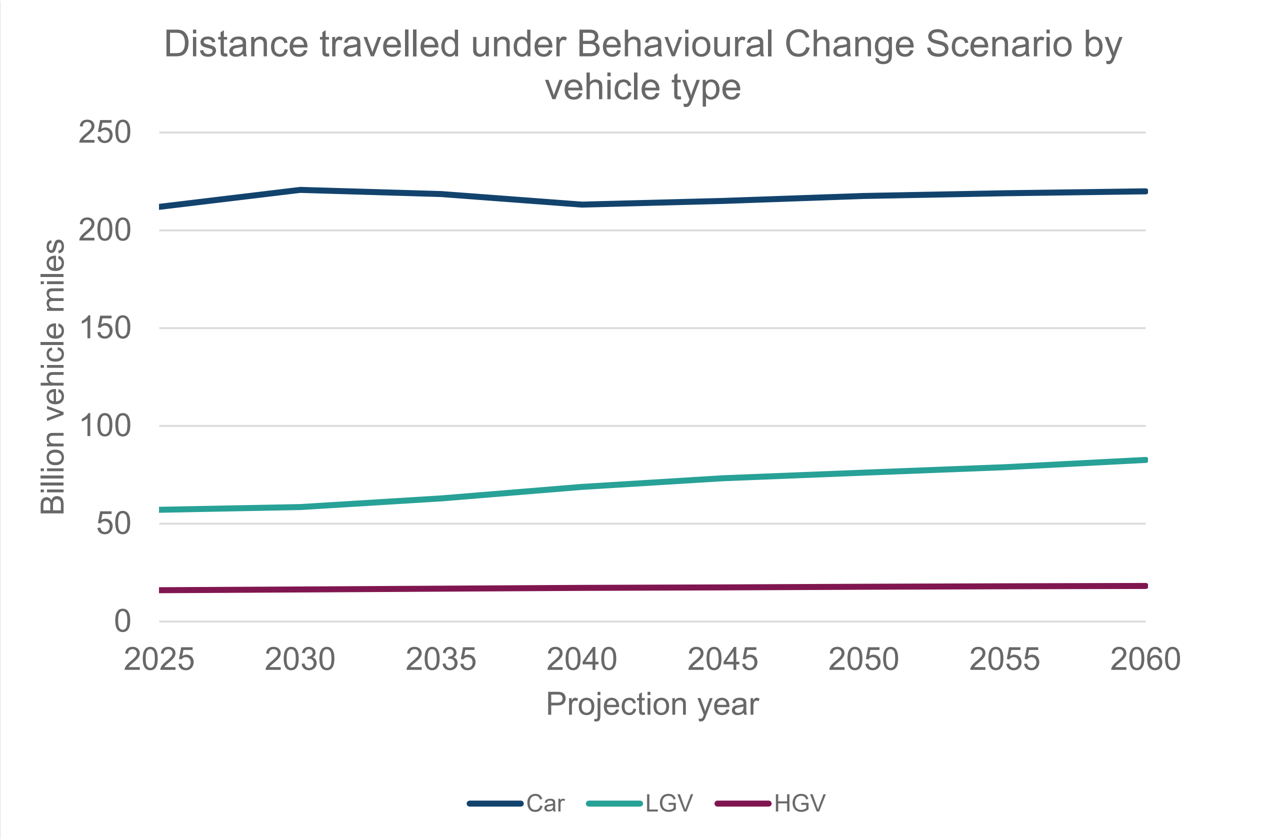

Figure 31 Behavioural Change Scenario, distance by vehicle type

4.40 The biggest decline in distance travelled is seen in the North East, with a 20% decline from 2025 to 2060, which compares to the national average of an 18% decline. Meanwhile, London only sees a 16% decline from 2025 to 2060. This is likely due to the distribution of the population across England and Wales.

4.41 Motorways see distance travelled increasing by 23% over the projected period which is 4% lower than in the Core Scenario. There is projected to be 10% growth on A-roads and 7% on Minor roads over the same period. In this scenario, people are travelling less often and are not taking shorter distance trips. Visiting friends and family, home based personal business and education trips see the greatest reduction and these trips have lower trip lengths than work trips and holidays. Hence, the trips that remain have on average longer trip lengths, thus the average trip length increases.

Congestion – Lost Time per mile

4.42 Congestion broadly remains the same across the projection period in the Behavioural Change Scenario, although all vehicle types see some increases, as shown in Figure 32. For cars, lost time per mile increases by 1% between 2025 and 2050, and by 4% between 2025 and 2060. The increase in later years happens as the reductions in trip rates ends in the 2040s, and by the 2050s traffic and associated congestion begins to increase. LGVs and HGVs see larger increases, of 5% and 9% respectively between 2025 and 2050, and of 10% and 15% respectively between 2025 and 2060.

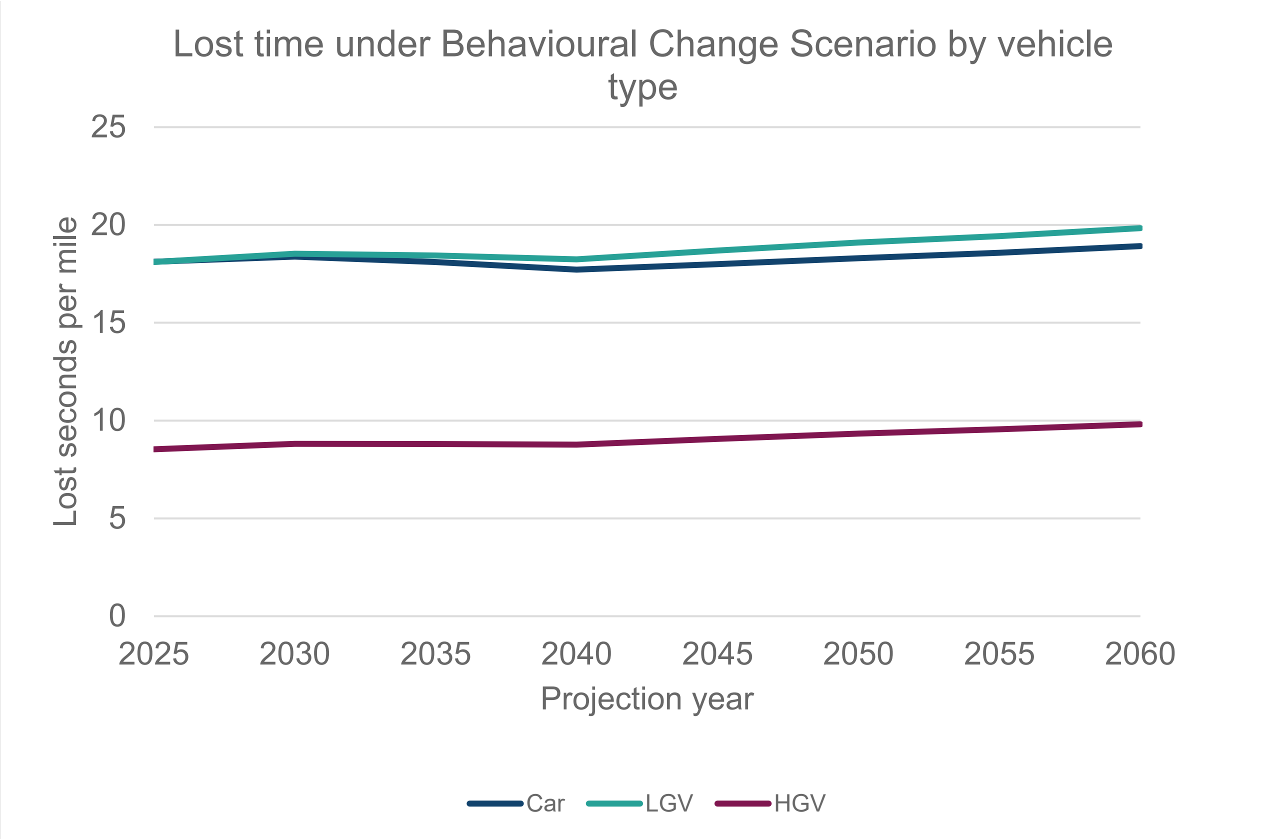

Figure 32 Behavioural Change Scenario, lost time by vehicle

Emissions – CO2e, NOx and PM10s

4.43 As with the Regional Scenario and Core Scenario, CO2e emissions from cars fall over the projection period. While CO2e emissions for LGVs fall, this decline is less significant than other types of vehicle, as the vehicle miles travelled is projected to increase significantly due to an increase in online shopping. This is shown in Figure 33.

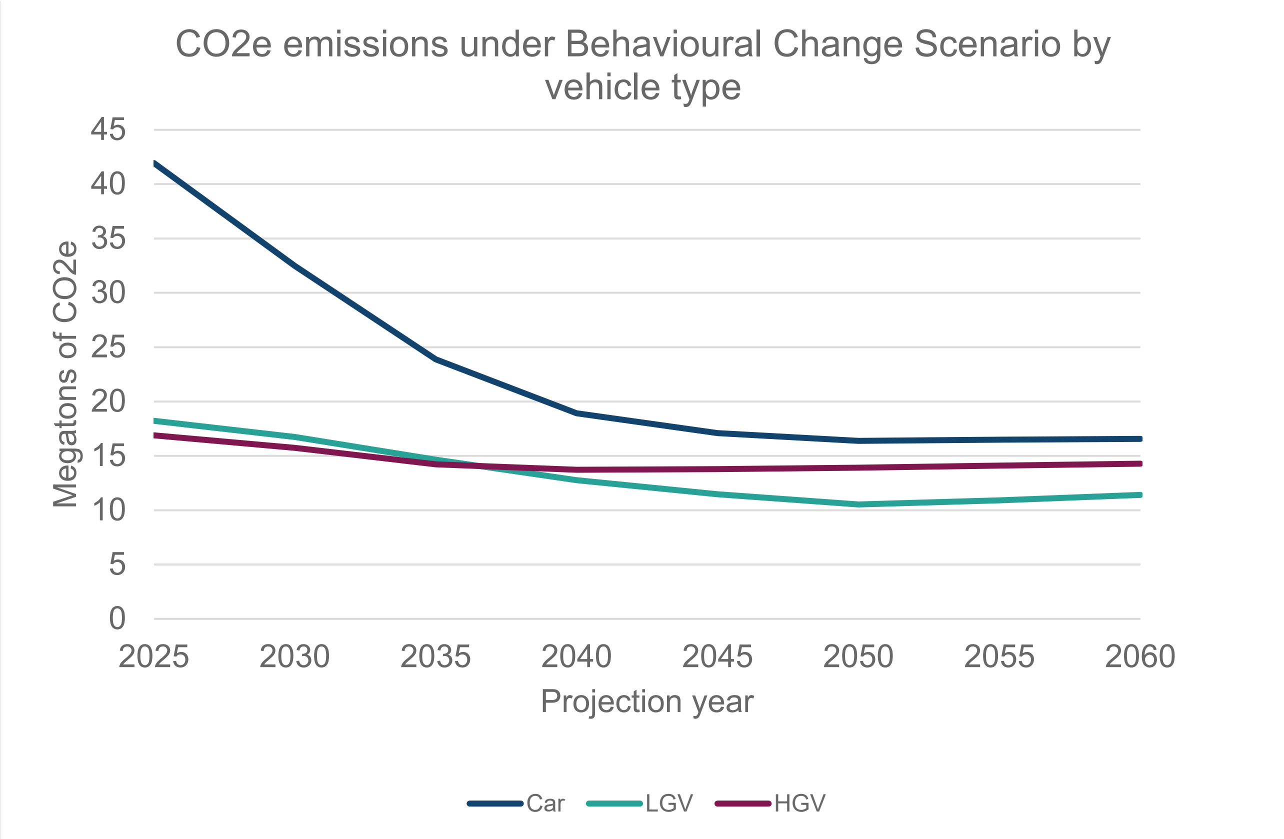

Figure 33 Behavioural Change Scenario, CO2e emissions by vehicle type

4.44 Figure 34 shows the similar profile of NOx emissions falling. However, the LGV decline is much less steep, again due to the increased vehicle miles travelled. Figure 35 shows a similar pattern with PM10 emissions.

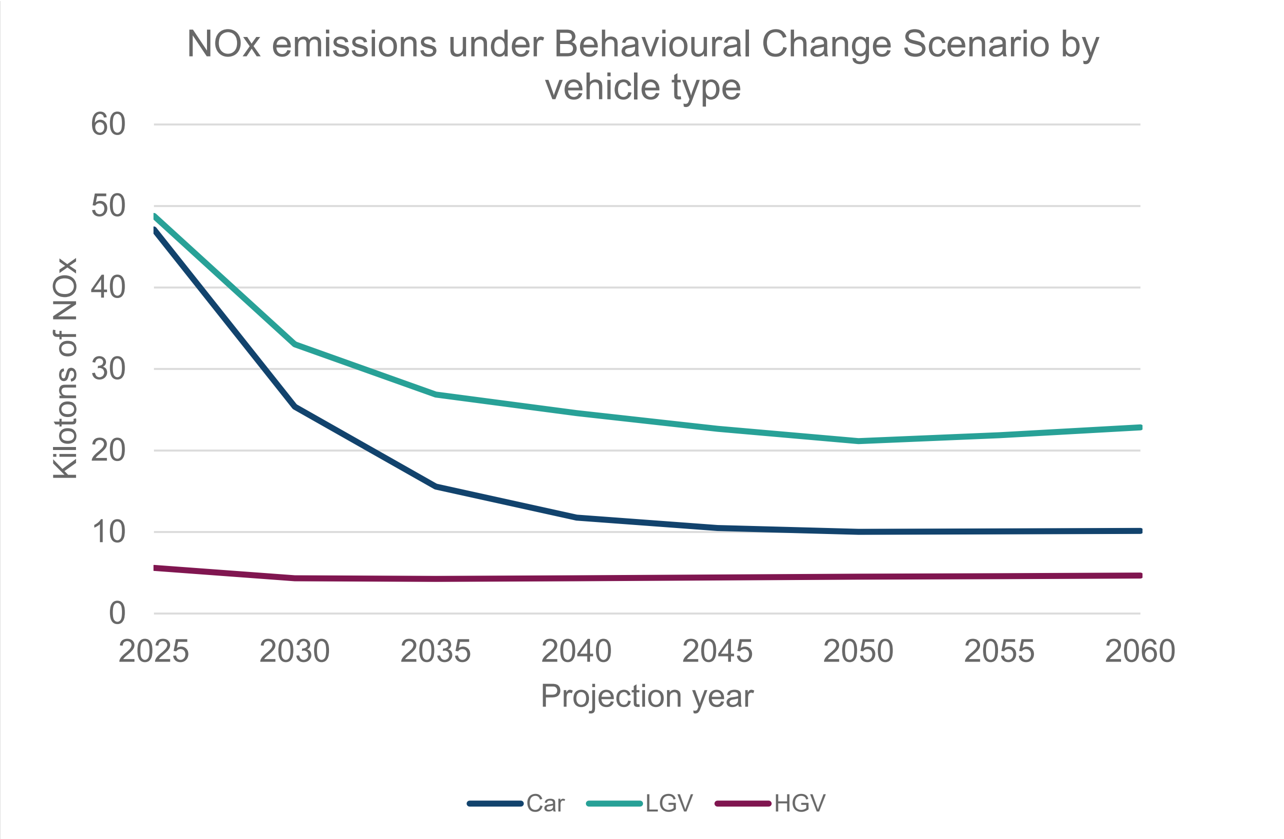

Figure 34 Behavioural Change Scenario, NOx emissions by vehicle type

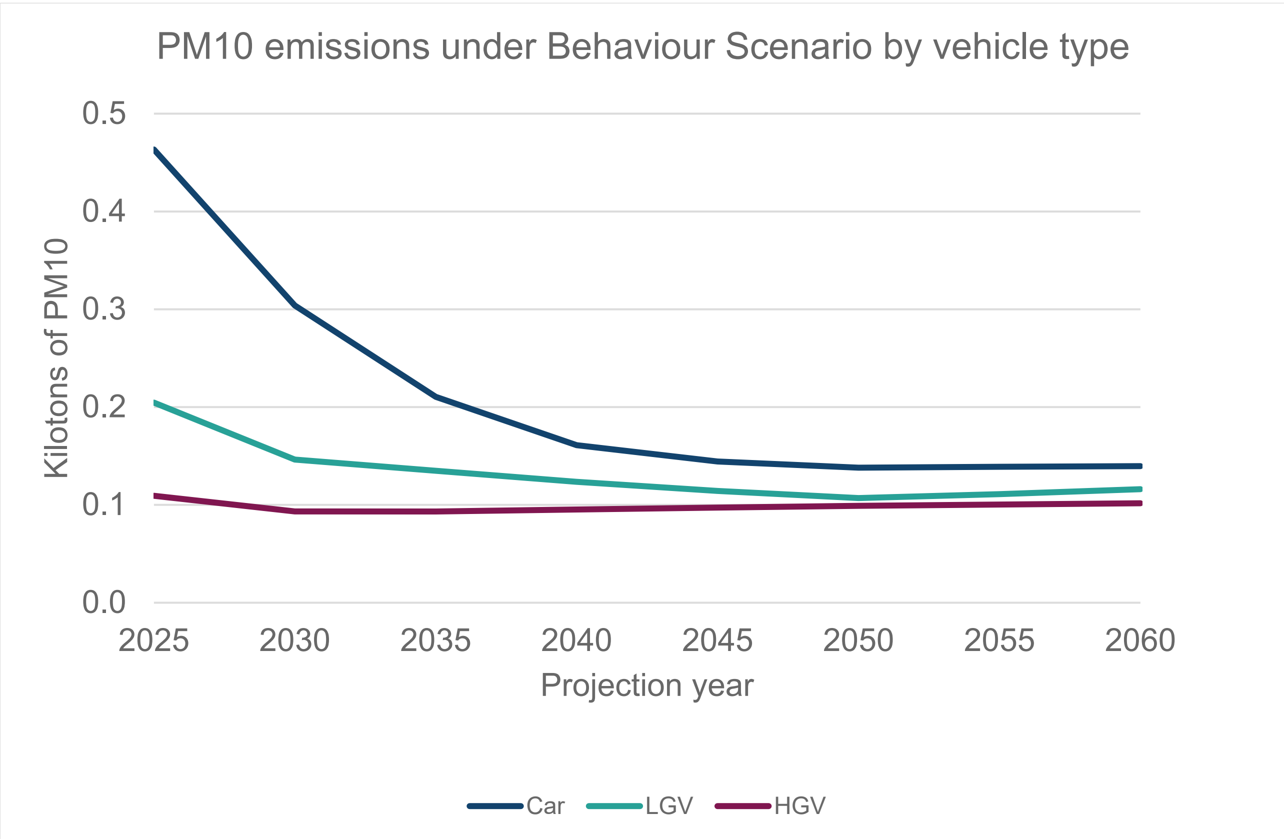

Figure 35 Behavioural Change Scenario, PM10 emissions by vehicle type

4.45 When split by road type in Figure 36, it can be seen that CO2e emissions on minor roads fall to the levels on motorways by 2045. This is because traffic on minor roads is projected to grow more slowly than on motorways.

4.46 Motorway CO2e emissions fall but towards the end of the projection period this is largely offset by the increase in vehicle miles travelled. The net result is that tailpipe CO2e emissions drop from 22 MtCO2e in 2025 to 15 MtCO2e by 2040 and reduce to 14 MtCO2e by the 2060.

4.47 A-roads also see a decline in CO2e emissions, in a similar strength as the fall for minor roads. There are similar profiles for NOx and PM10 which are not shown here. Across all road types there is a decline, but it is steeper for minor roads and less so for motorways.

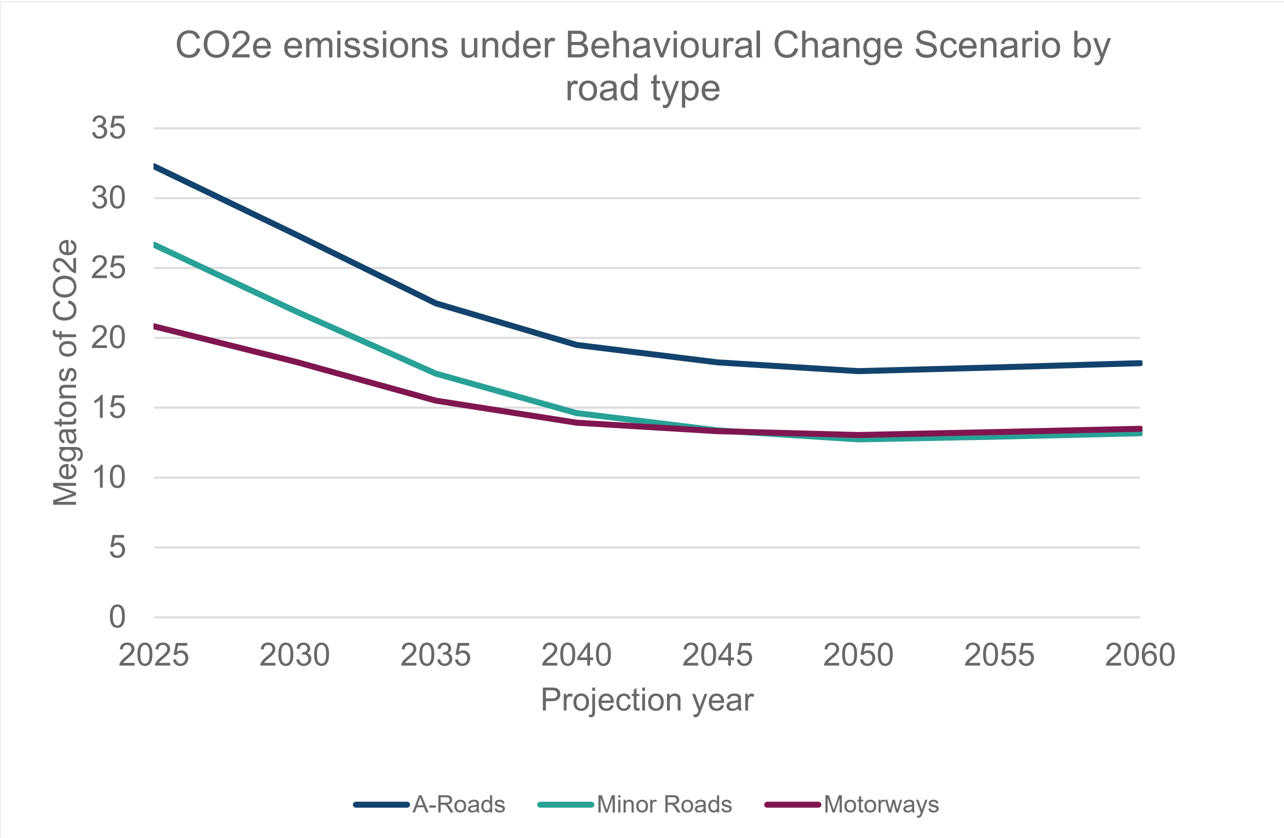

Figure 36 Behavioural Change Scenario, CO2e emissions by road type

Technology Scenario, Vehicle-led Decarbonisation Scenario and Mode-balanced Decarbonisation Scenario results

4.48 The Vehicle-led Decarbonisation Scenario and Mode-balanced Decarbonisation Scenario provide alternative scenarios for how decarbonisation of the transport sector and emerging technology could affect how people travel in the future. The scenarios all assume a high and fast uptake of EVs and ZEVs in line with the government's stated ambitions to end the sale of diesel and petrol cars, vans, HGVs, and buses/coaches. The Technology Scenario adds onto the Vehicle-led

Decarbonisation a single potential future for CAVs and their operation. It assumes a high uptake of CAV which account for 50% of the car fleet by 2047. This has the effect of increasing the mobility of the elderly and those who do not currently hold a driving licence. The technology scenario provides the upper bound in terms of traffic demand for the NRTP 22.

Traffic – distance

4.49 The Vehicle-led Decarbonisation Scenario is similar to the Technology Scenario in the earlier forecast years as electrification of the vehicle fleet takes off, but as this reaches 99%, traffic demand follows the profile of the Core Scenario.

4.50 The Mode-balanced Decarbonisation Scenario has all the benefits of decarbonisation without the increase in road vehicle traffic, so traffic demand stays below the Core Scenario, Vehicle-led Decarbonisation Scenario and Technology Scenario in all projection years.

4.51 As can be seen from Figure 37, the Technology Scenario presents a world of fast-growing traffic demand. Growth begins to increase more strongly in the 2040s, when self-driving cars begin to become mainstream.

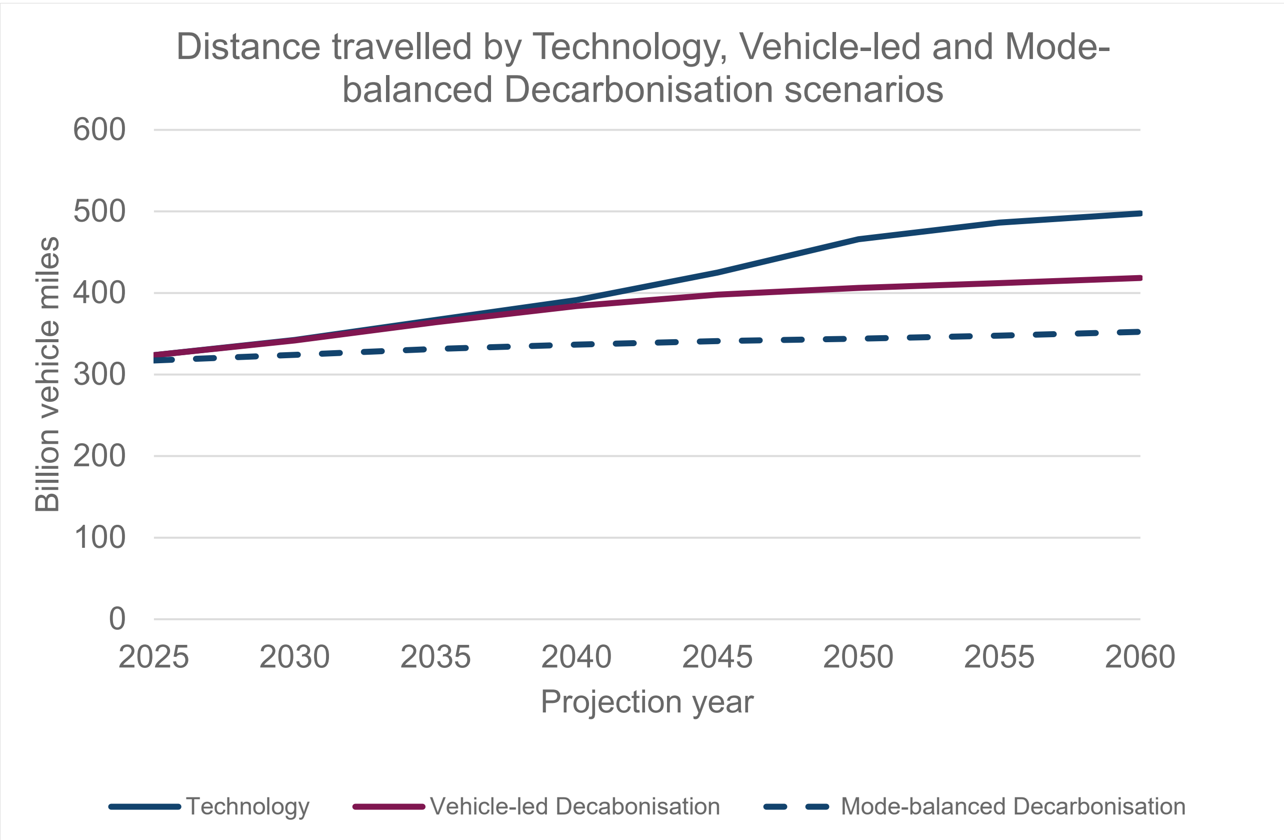

Figure 37 High EV uptake scenarios (Technology Scenario, Vehicle-led Decarbonisation Scenario, and Mode-balanced Decarbonisation Scenario), distance by scenario

4.52 From Figure 38, it is apparent how much car miles grow in the Technology Scenario, reaching 387 bvm by 2060. This is compared to 307 bvm for cars in the Vehicle-led

Decarbonisation Scenario (Figure 39) and 272 bvm for cars in the Mode-balanced Decarbonisation Scenario (Figure 40).

4.53 Over time travel demand increases, due to the increases in population and GDP. For road traffic it also increases due to the decarbonisation of the road fleet.

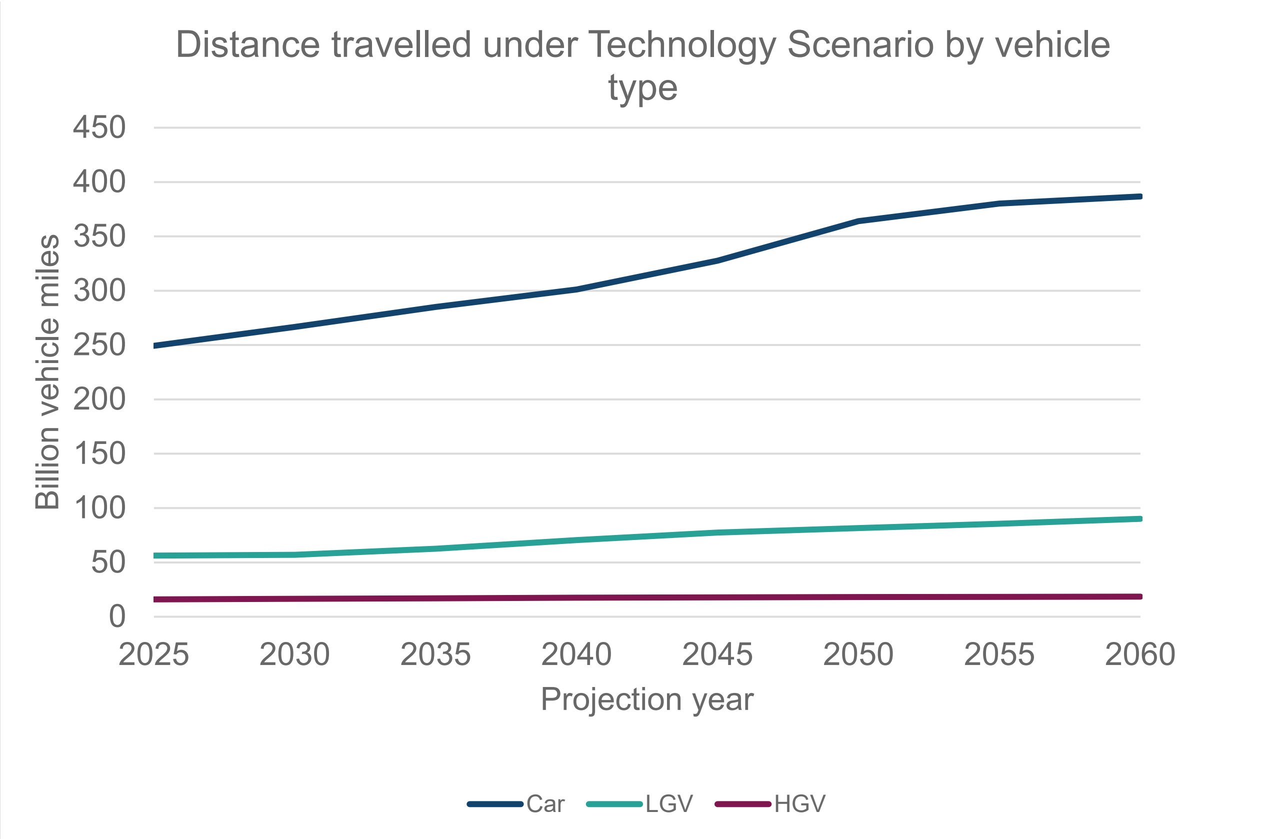

Figure 38 Technology Scenario, distance by vehicle type

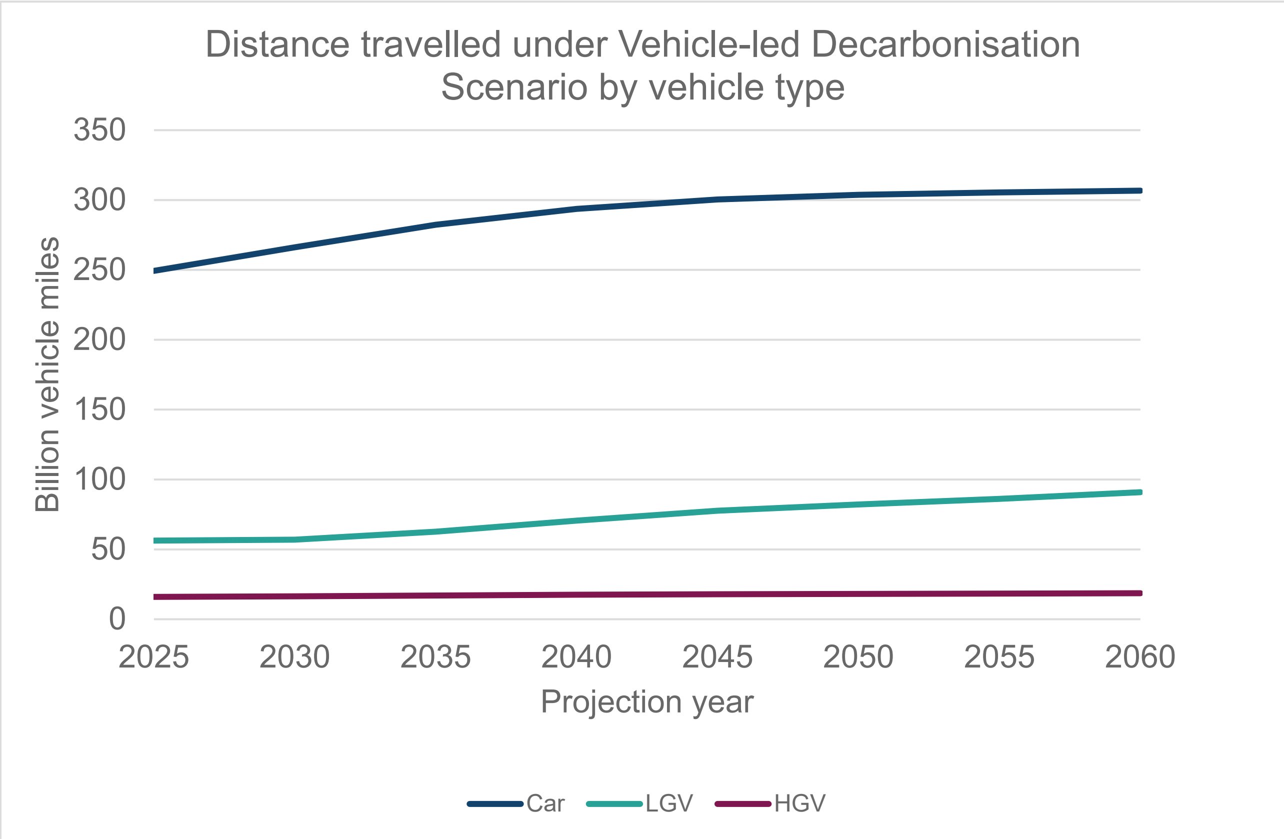

Figure 39 Vehicle-led Decarbonisation Scenario, distance by vehicle type

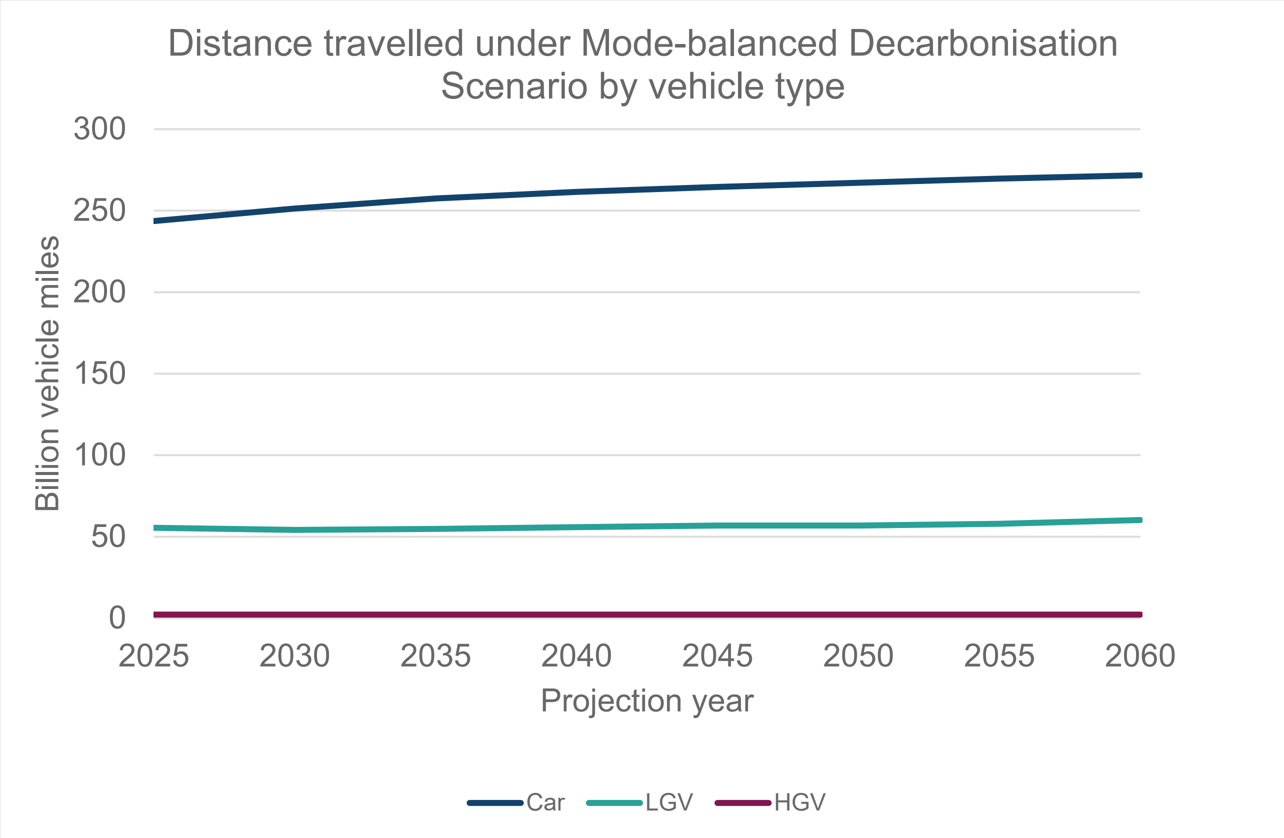

Figure 40 Mode-balanced Decarbonisation Scenario, distance by vehicle type

4.54 Under all decarbonisation scenarios, the greatest growth in traffic is seen on motorways. As distance travelled increases at a faster rate on motorways, so too does the gap between distance travelled by motorway and that of other road types.

4.55 Distance travelled on motorways is projected to grow by 72% between 2025 and 2060 (20 percentage points more compared to A-roads) under the Technology Scenario. Meanwhile, the distance travelled on motorways is projected to grow only 12% (1 percentage point higher than A-roads) under the Mode-balanced Decarbonisation Scenario.

4.56 Distance travelled on A-roads is projected to grow faster than minor roads, except in the Mode-balanced Decarbonisation Scenario where minor roads have a slightly higher growth than A-roads.

Traffic – trips

4.57 Car trips in the Technology Scenario increase relative to the Core Scenario. However, trips by car drivers significantly increase, whilst trips by car passengers significantly decrease. This is because of the changes made to driving licence holding (an across-the-board increase), and a decrease in vehicle occupancy, in line with what is stated in the GOV.UK publication CAS Databook.

4.58 By comparison, vehicle occupancy in the Vehicle-led Decarbonisation Scenario falls modestly. The fall is caused by the increased prevalence of low-cost EVs, which incentivise driving. Trips by car drivers increase quickly, in line with the uptake of EVs, whilst trips by car passengers increase at a much slower rate, resulting in decreased vehicle occupancy.

4.59 In the Mode-balanced Decarbonisation Scenario, as the cost of EVs is increased to the equivalent average of petrol and diesel vehicles, car costs are increased relative to the Vehicle-led Decarbonisation Scenario. This results in a decrease in car driving relative to being a car passenger. Vehicle occupancy increases relative to the Core Scenario, Vehicle-led Decarbonisation Scenario, and the Technology Scenario.

Congestion – Lost Time per mile

4.60 In the Technology Scenarios and decarbonisation scenarios, lost time reflects traffic levels. This can be seen in Figure 41.

4.61 Lost time per mile increases the most in the Technology Scenario, followed by the Vehicle-led Decarbonisation Scenario, then the Core Scenario and finally the Mode-balanced Decarbonisation Scenario. This replicates the story told by traffic levels, with the Technology Scenario having the highest levels of traffic and congestion.

4.62 It is worth noting that in the Technology Scenario, values of time decrease to reflect the ability to work or relax while travelling in a self-driving car. This means that, although congestion increases, travellers are more amenable to sitting in traffic, as they do not have to focus on driving.

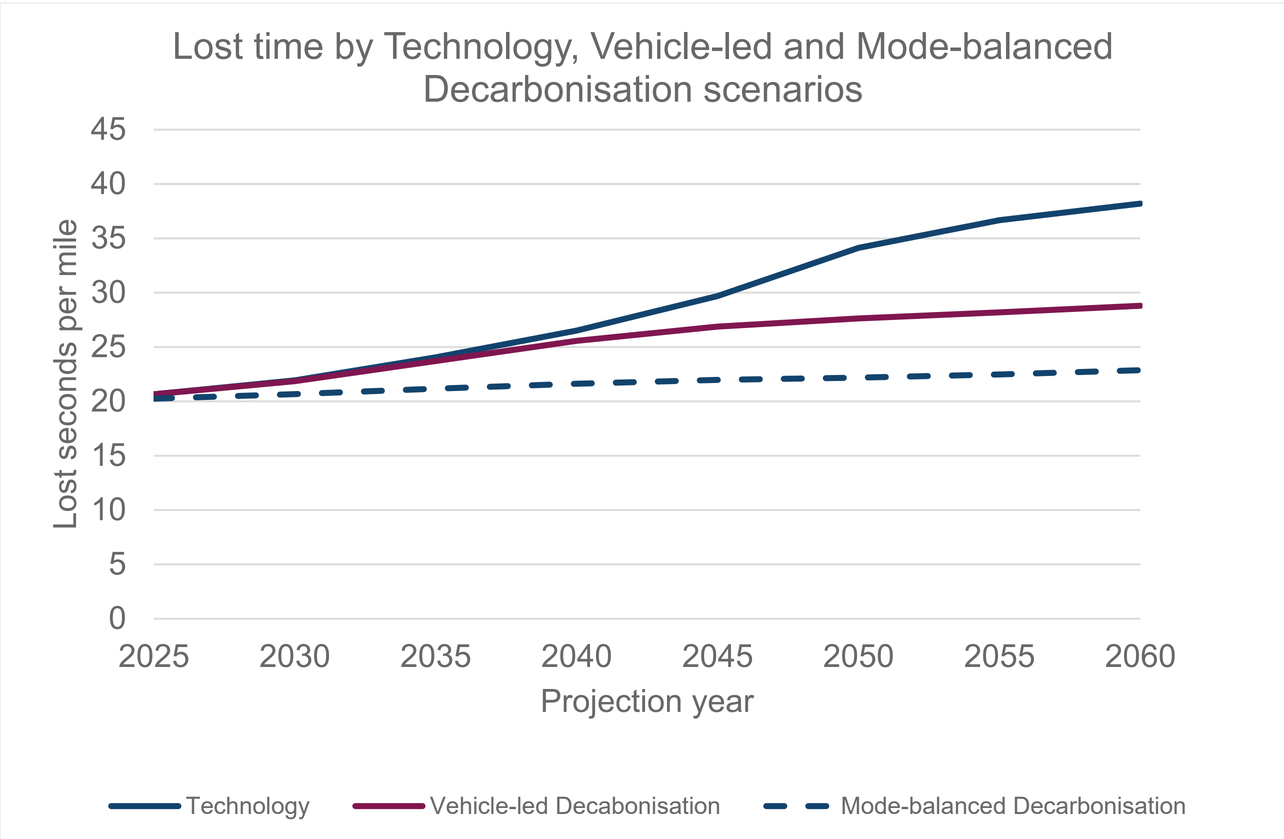

Figure 41 Technology Scenario, Vehicle-led Decarbonisation Scenario and Mode-balanced Decarbonisation Scenario, lost seconds by scenario

Emissions – CO2e, NOx and PM10s

4.63 Under the decarbonisation scenarios, the link between distance travelled and emissions is minimised. We can see, that despite the Vehicle-led Decarbonisation Scenario and Technology Scenario having amongst the highest vehicle miles (in response to the assumed reduction in VOC), the emissions produced are substantially lower when compared to other scenarios.

4.64 Even when considering the lower distance travelled under the Mode-balanced Decarbonisation Scenario, the further reduction in emissions is relatively small. This is highlighted in Figure 42 for CO2e emissions, which are projected to fall by 97% under the Vehicle-led Decarbonisation Scenario and Technology Scenario and by 98% under the Mode-balanced Decarbonisation Scenario between 2025 and 2050. This then flatlines to 2060 as the vehicle fleet is assumed to be 98% electric by 2050.

4.65 The same effects can be seen for NOx and PM10 emissions respectively, where NOx and PM10 emissions are both projected to fall by 98% under all decarbonisation scenarios.

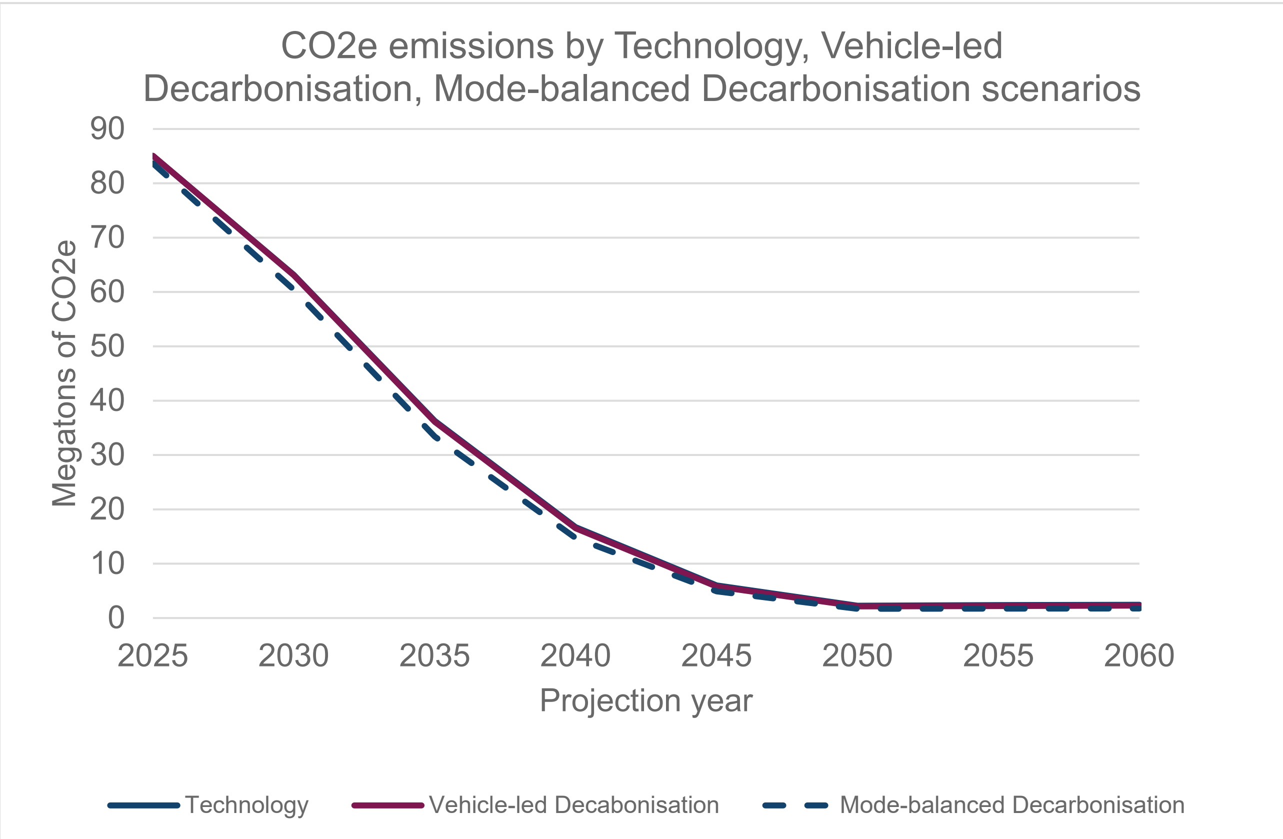

Figure 42 High EV uptake scenarios (Technology Scenario, Vehicle-led Decarbonisation Scenario and Mode-balanced Decarbonisation Scenario), CO2e emissions by scenario

5. Evaluating Performance and Confirming Current Approach

This chapter explains the differences between NRTP22 and our previous Road Traffic Forecasts (RTF18). An exploration of the main drivers and a comparison between the NTM and a regression model is also included.

Comparing the National Road Traffic Projections (NRTP 22) with the previous Road Traffic Forecasts (RTF 18)

5.1 The National Transport Model performance has been widely tested and documented. Two key reports are the National Transport Model - Analytical Review - December 2020 and the accompanying National Transport Model v2R Peer Review - June 2020. Building on this work the following section looks at the performance of RTF 18 and NRTP 22, comparing inputs, outputs and sense checking results against an entirely independent simplified method.

5.2 The NRTP 22 scenarios are broadly similar to the scenarios in RTF. However, the CAS are more coherent and narrative-based scenarios as opposed to testing specific sensitivities. This section compares the NRTP 22 Core Scenario to the previous RTF 18 reference case.

5.3 In RTF 18, GDP and fuel costs are varied in Scenarios 2 and 3, while migration is varied in Scenarios 4 and 5. The High Economy Scenario and Low Economy Scenario in the CAS combine both high and low GDP and population (not just migration) assumptions creating more extreme high and low scenarios. RTF 18 Scenario 6 is similar to the Behavioural Scenario in terms of trip rates declining and increased licence holding in young people, however, the Behavioural Scenario also adds the impact of the COVID-19 pandemic. RTF 18 Scenario 7 considered the uptake of ZEV, which is explored across three CAS scenarios (the Technology Scenario, the Vehicle-led Decarbonisation Scenario, and the Mode-balanced Decarbonisation Scenario).

Inputs

5.4 This next section compares the input assumptions used in the NRTP 22 Core Scenario to RTF 18 reference case. It focuses in turn on the three main drivers of travel demand: GDP, cost of driving and population growth.

GDP input comparison

5.5 The NRTP 22 GDP growth rate between 2025 and 2050 is 6% lower compared to RTF 18. This means that the projected value of time will grow more slowly in NRTP 22 leading to less growth of projected vehicle miles. Looking at indexed GDP in Figure 39 shows that RTF 18 consistently assumed higher GDP growth than NRTP 22.

5.6 Historical GDP levels have been updated by the OBR since RTF 18. This led to higher absolute GDP projections from 2025 to 2040 and a lower absolute GDP from 2045 to 2060 in NRTP 22 (assuming we extrapolate RTF 18 to 2060), as shown in Figure 40. This difference is only picked up in the LGV projected mileage which is modelled on absolute GDP levels rather than growth rate, thus projecting more LGV miles up until 2040.

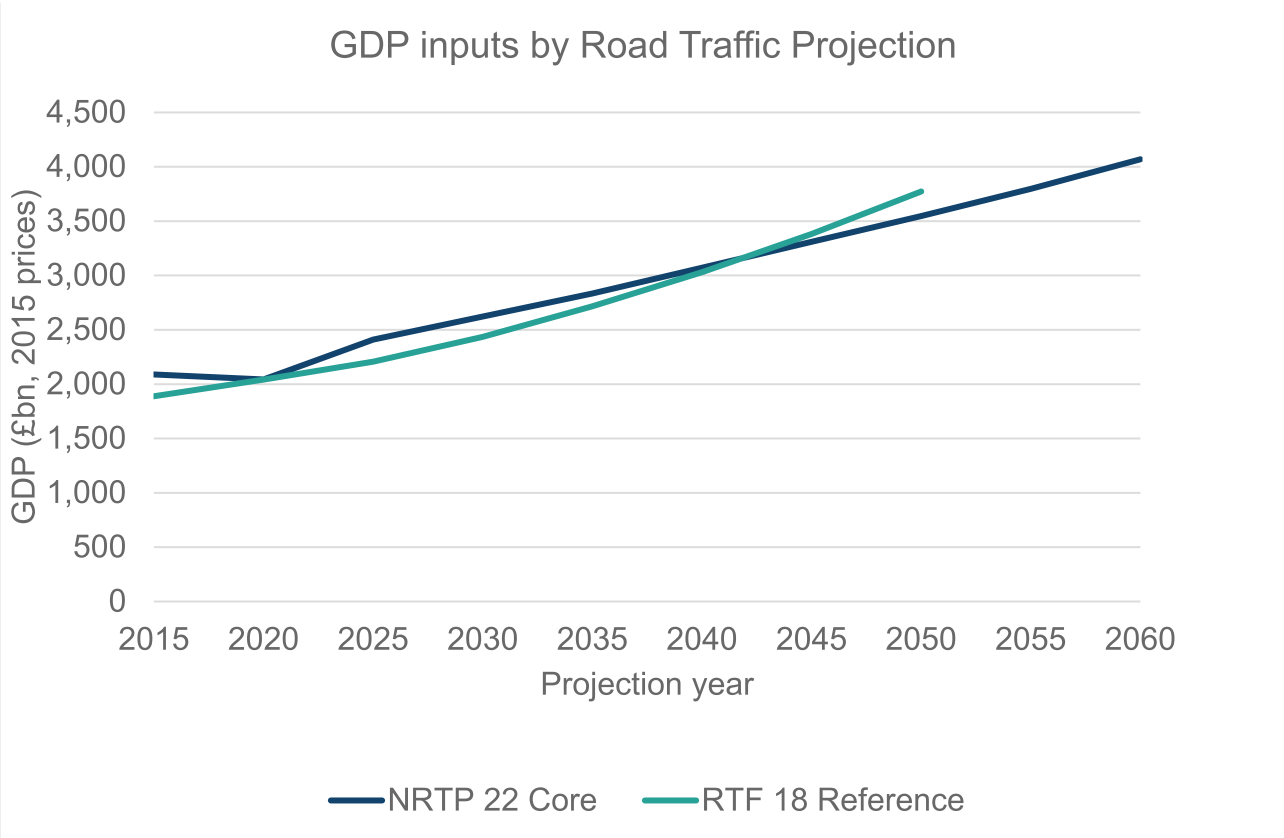

Figure 43 GDP inputs (levels) by Road Traffic Projection

Cost of driving input comparison

5.7 Across the full timeframe of the projections, post-tax petrol and diesel prices (including VAT) are assumed to be lower than projected for RTF 18. Electricity starts off more expensive in NRTP 22 but becomes marginally cheaper in the later forecast period. This can be seen in Figure 44 for petrol and diesel and Figure 45 for electricity. The changes to fuel efficiency are mixed. ICE Car fuel efficiency (across all fuel types) is projected to be lower in NRTP 22 than in RTF 18, with those differences increasing with time. Meanwhile, the projections for LGV and HGV fuel efficiencies (across all fuel types) improve faster relative to RTF 18. This is not continuous throughout the forecast period. HGVs and petrol LGVs are assumed to be relatively less fuel efficient than RTF 18, until 2030 and 2040 respectively.

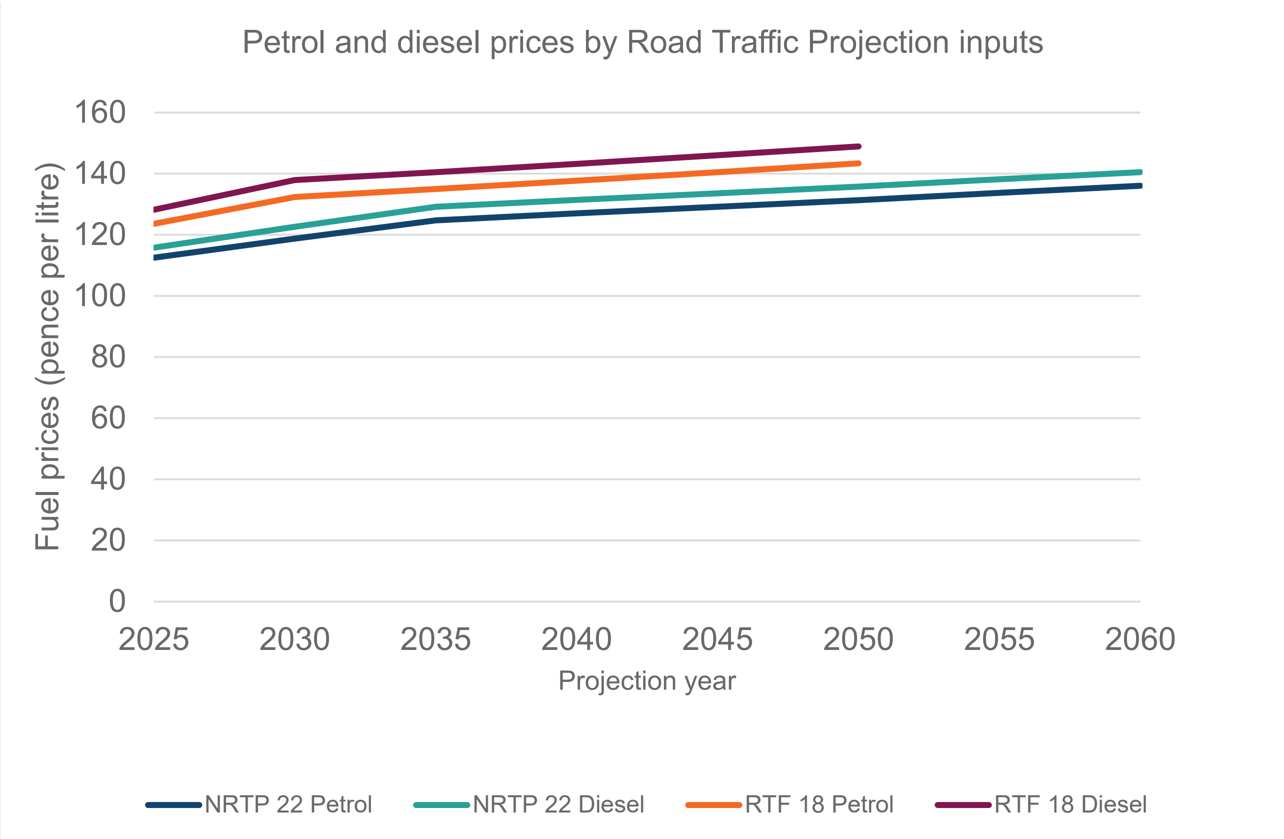

Figure 44 Petrol and diesel prices by Road Traffic Projection

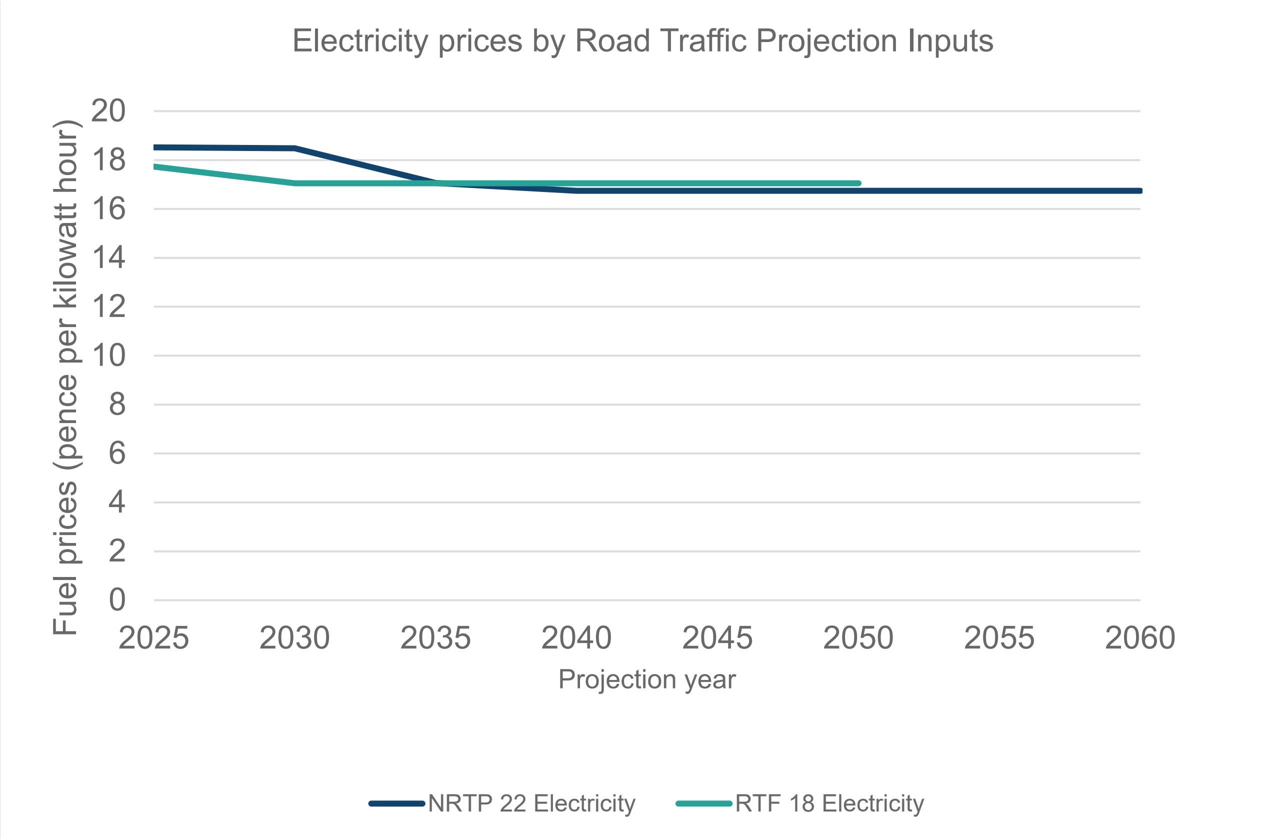

Figure 45 Electricity prices by Road Traffic Projection

5.8 The greatest impact on vehicle operating costs, however, is the electrification of vehicle fleets. Electric vehicles are assumed to be substantially cheaper to run per mile than their ICE equivalent. The use of electricity in cars and LGVs is projected to grow substantially faster in the NRTP 22 Core Scenario than in previous forecasts. This is due to the observed uptake of EVs being faster than previously assumed. As in the RTF 18 Reference, the NRTP 22 Core Scenario assumes no electrification of HGVs. Figure 46 and Figure 47 show the proportion of assumed car miles driven by fuel type under RTF 18 Reference and NRTP 22 Core Scenario respectively.

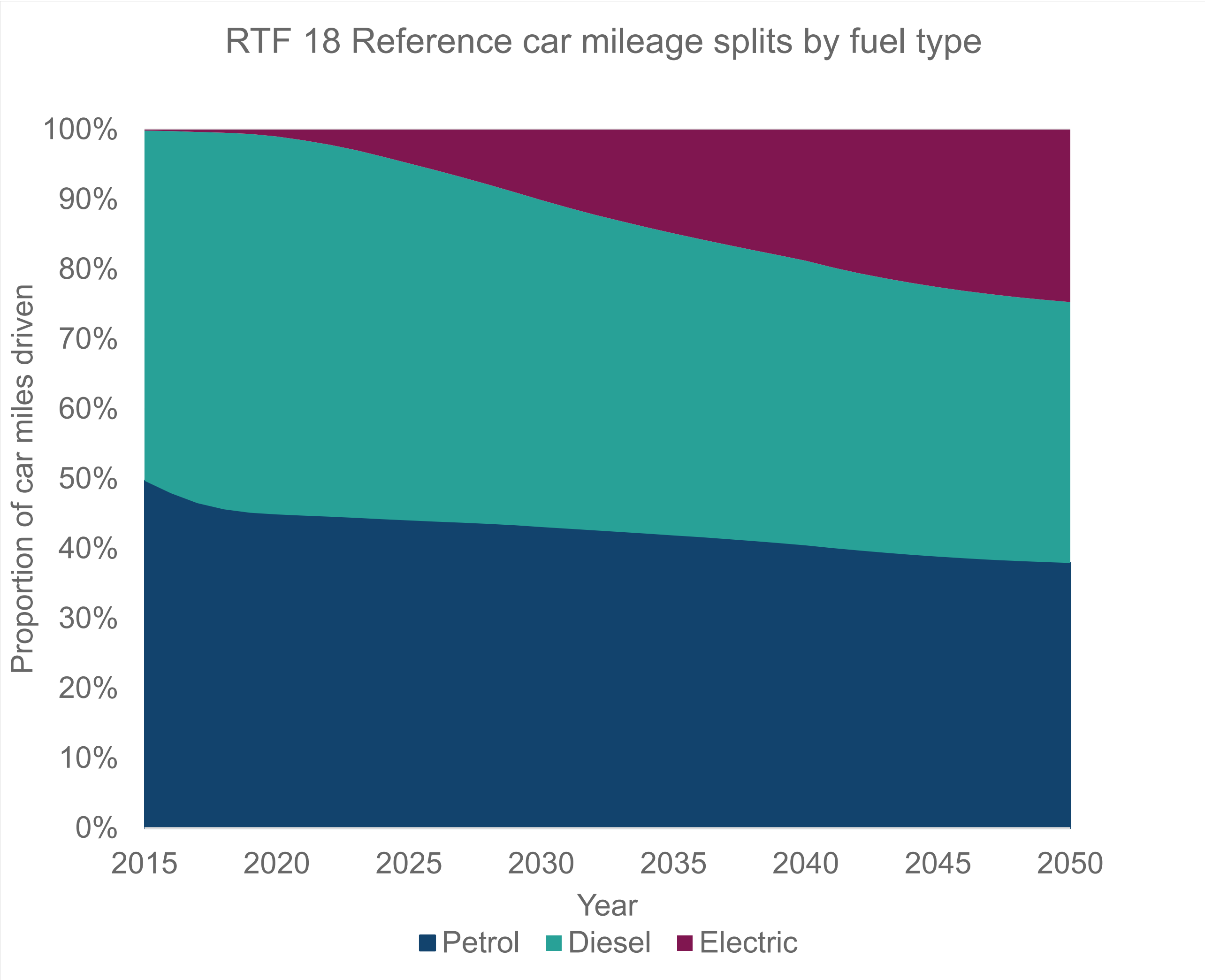

Figure 46 Car mileage splits by fuel type under RTF18 Reference

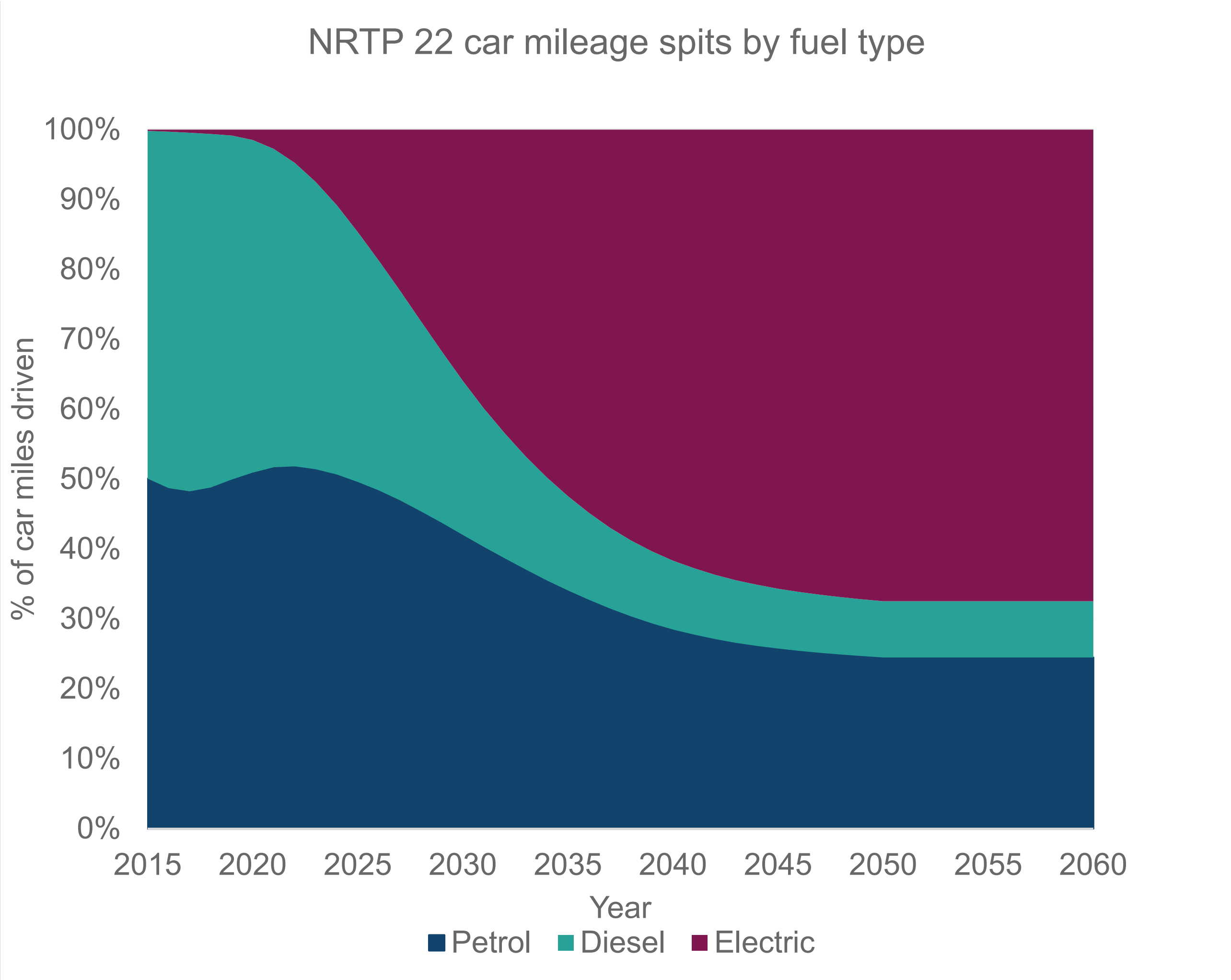

Figure 47 NRTP 22 Core Scenario car mileage splits by fuel type

Population input comparison

5.9 The ONS population projections used in NTEM and NTM were updated as part of the NRTP 22 projections. The NRTP 22 projections assume 5% less population by 2050 compared to RTF18, as can be seen in Figure 48 (note that the y-axis starts at 50). This points to lower levels of traffic growth.

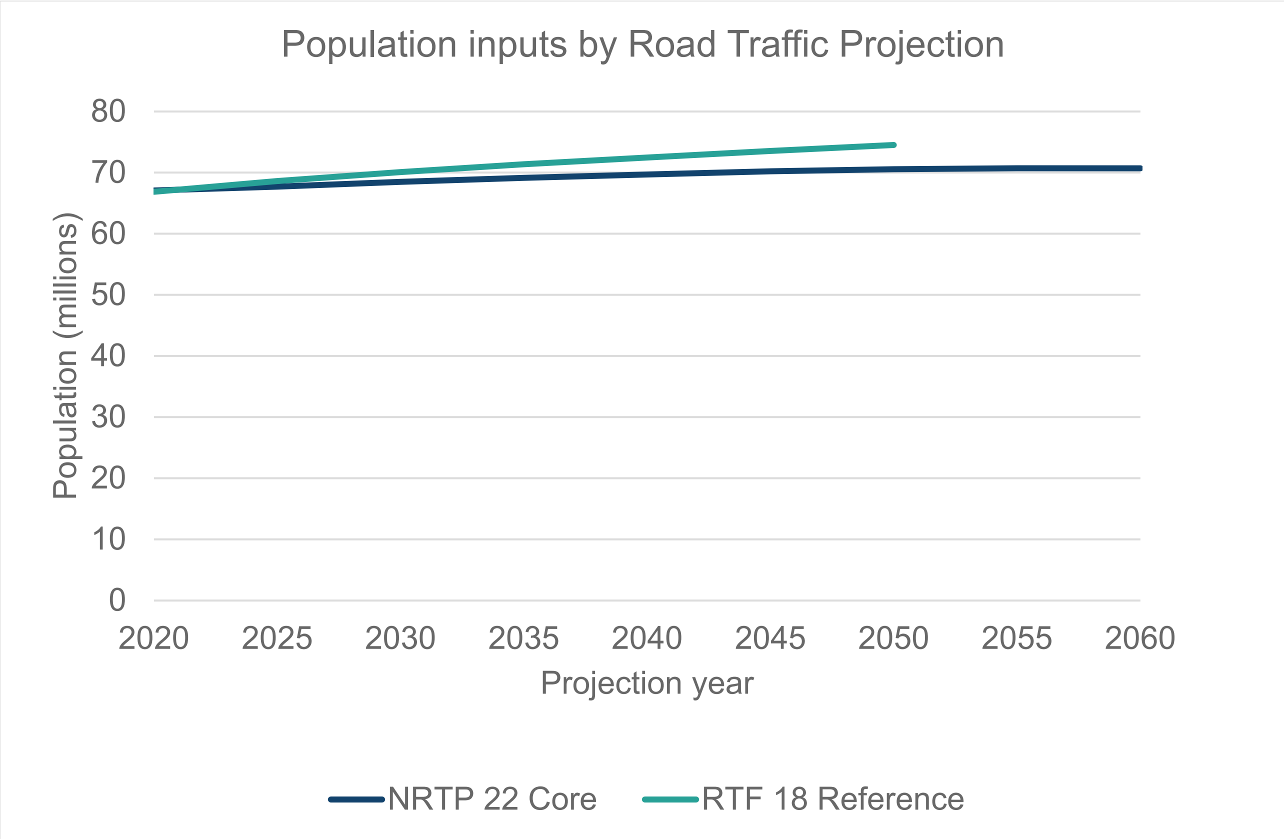

Figure 48 Population inputs by Road Traffic Projection

Outputs

5.10 This next section compares the outputs produced NRTP 22 Core Scenario to RTF 18 Reference Scenario. Focusing in turn, on total vehicle miles, CO2e and NOx.

Traffic - distance

5.11 The total traffic projections for the NRTP 22 Core Scenario and the RTF 18 Reference are similar (Figure 49). Total traffic under the NRTP 22 Core Scenario starts above the RTF 18 Reference Scenario and maintains this throughout most of the common forecast period. However, projected traffic growth in the NRTP 22 Core Scenario begins to slow by 2045. Consequently, RTF 18 Reference Scenario projects higher total traffic by 2050. Between 2025 and 2050, traffic is projected to grow 19% under NRTP 22 Core, compared to 21% under RTF 18 Reference.

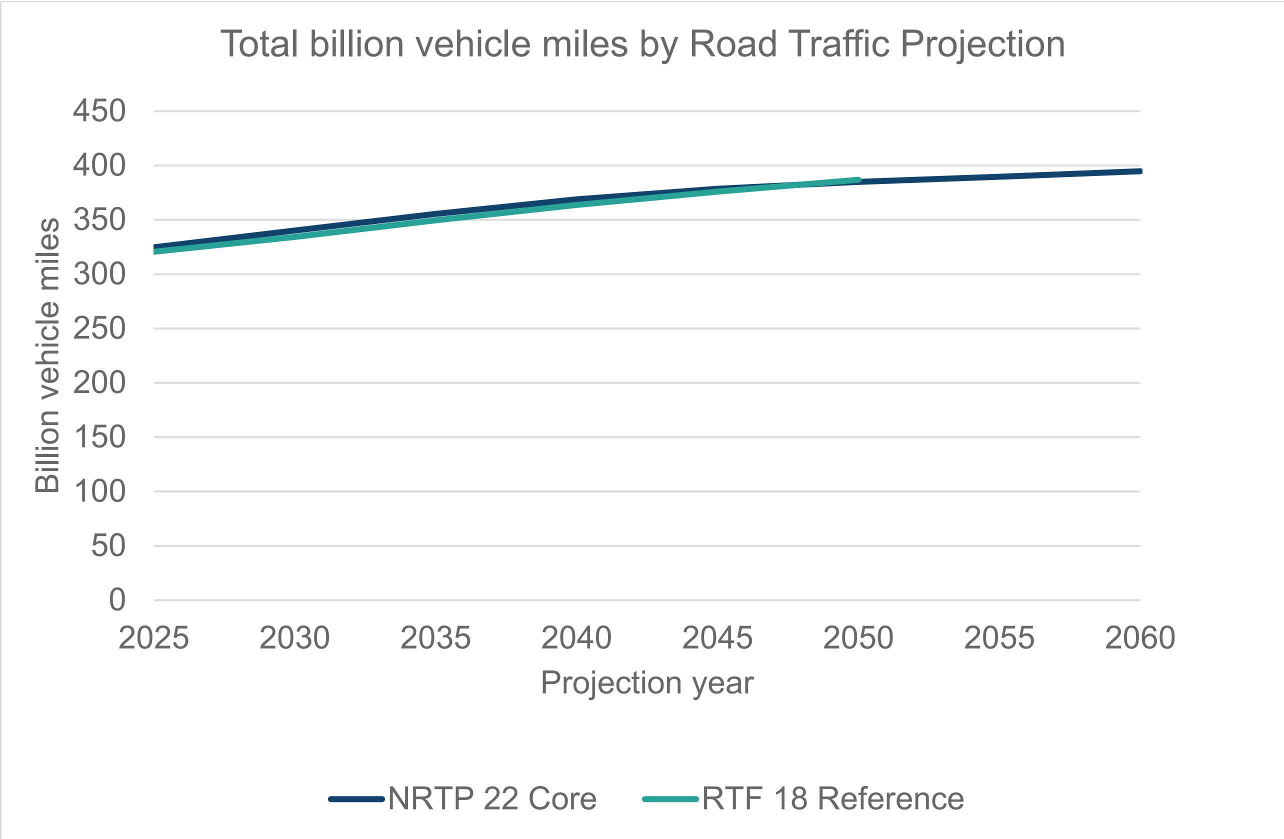

Figure 49 Distance travelled by Road Traffic Projection

5.12 Looking at long term traffic levels projected in NRTP 22 they are broadly similar to those previously published with total traffic in 2050 previously projected as 425 bvm, in the national road traffic projections that reduces to 422 bvm. This is a difference of around -1%. The key difference is the vehicle mix, with less growth in car traffic, and more growth in LGVs and HGVs.

Vehicle type	RTF18 traffic in 2050 (bvm)	NRTP22 traffic in 2050 (bvm)	% change
Car	334	322	-3%
LGV	71	78	9%
HGV	18	19	8%
Total	425	422	-1%

Table 50: NRTP 22 Core Scenario and RTF18 Reference, distance by projection

5.13 The main drivers of vehicle milage change between RTF 18 reference case and the NRTP 22 Core Scenario are the rebasing of published traffic statistics, the change in car fuel cost due to greater EV uptake, the increase in HGV and LGV traffic following COVID-19. These are broadly balanced out by downside pressures from slower population growth, slower GDP growth, the impact of COVID-19 on car traffic as can be seen in the chart below.

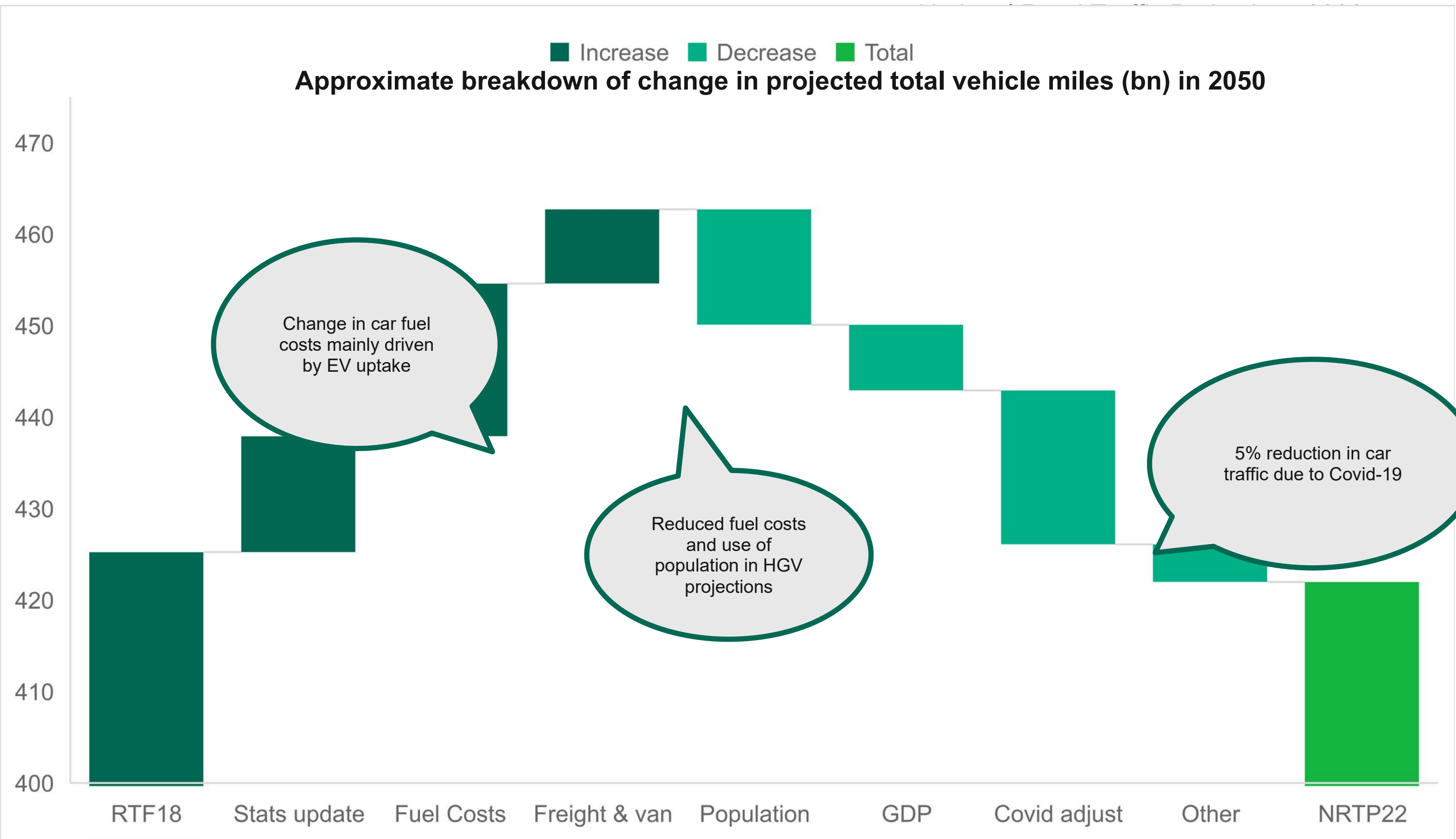

Figure 51 Approximate breakdown of change in projected total vehicle miles in 2050 between RTF 18 and NRTP 22

Tailpipe Emissions - CO2e, PM10 and NOx

5.14 The NRTP 22 Core Scenario tailpipe CO2e emissions are projected to fall 44% by 2050. In comparison, RTF 18 Reference CO2e tailpipe emissions fall by 10% over the same period. While the NRTP 22 Core Scenario starts at higher projected CO2e levels in 2025, it projects 26 MtCO2e lower emissions in 2050 than RTF 18 Reference.

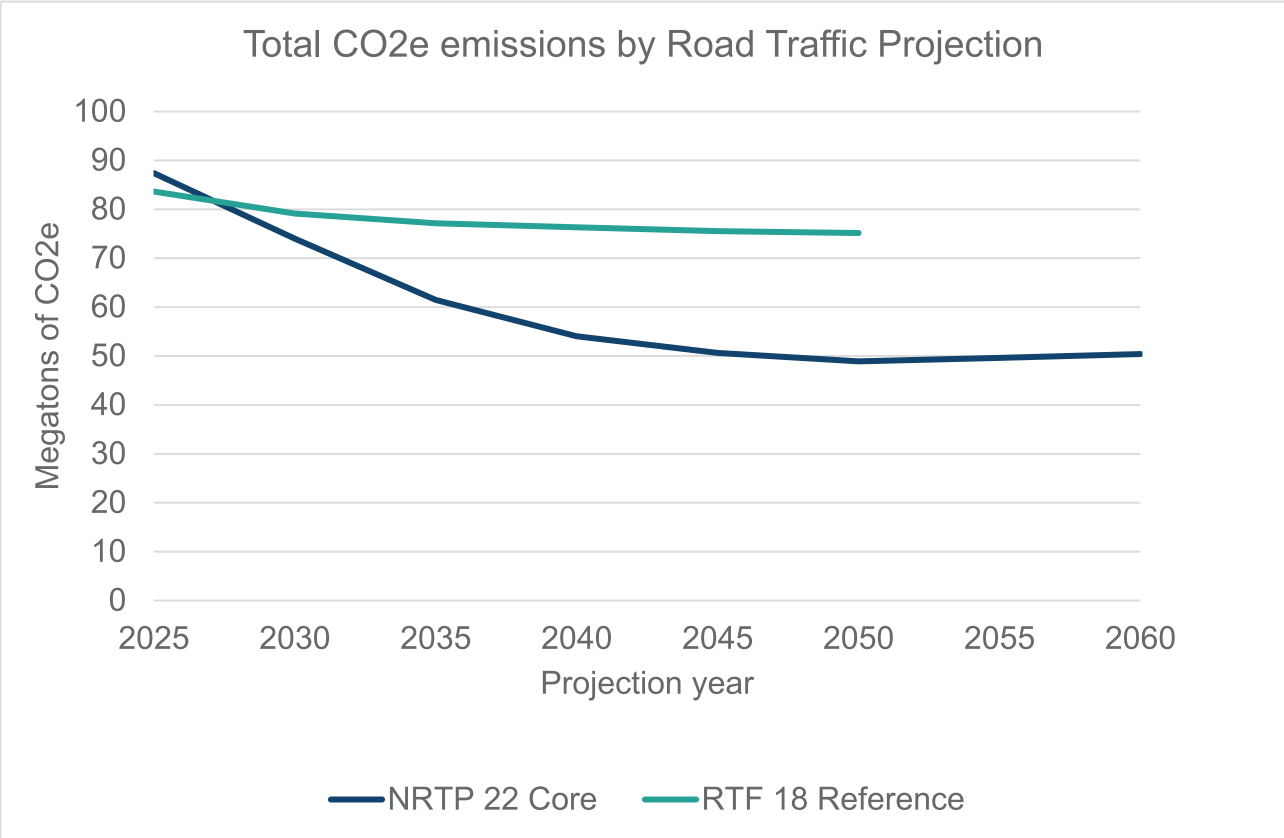

Figure 52 CO2e emissions by Road Traffic Projection

5.15 As with CO2e, the NRTP 22 Core Scenario projects lower tailpipe NOx and PM10 emissions. In this case, however, this is throughout the entire forecast period. There is an improvement in NOx emissions of 61 kilotons in 2050 between road traffic projections. Between 2025 and 2050, NOx emissions are projected to fall 65% under the NRTP 22 Core, more than triple the 19% reduction projected in RTF 18.

5.16 The main driver of this change in tailpipe emissions is the increased use of electric vehicles and, to a lesser extent, improvements to engine efficiencies.

Comparing RTF 18 projections with outturn data

Performance of forecasts

5.17 The RTF 18 was published in September 2018 and included a "reference" case and five alternative scenarios. This section compares the RTF 18 Reference to published annual road traffic estimates by vehicle type (TRA0101) and by road type and region (TRA0103).

5.18 In order to compare RTF 18 from its base year (2015) up to the first year of COVID (2020) three adjustments are needed:

- Interpolation between 2015 and 2020 which are the published forecast years in RTF 18. This was done using a single compound annual growth rate (assumes the same growth rate each year).
- adjusting for the differing geographical areas covered between our published statistics and the projections in RTF 18. The statistics in TRA0101 covers Great Britain, while RTF 18 covers England and Wales.
- after the publication of RTF 18, the estimates of road traffic mileage were adjusted including adjustments to previously published estimates. This increased the distance travelled by road in Great Britain by approximately 12.7bn vehicle miles.

5.19 The table below adjusts for these issues and compares the vehicle miles projected in RTF 18 with the official statistics of vehicle miles travelled. A positive percentage shows that RTF 18 projected more miles travelled than published statistics. RTF 18 is calibrated in the base year, with successive years under-estimating road traffic growth until 2020 the first year of COVID.

Year	2015	2016	2017	2018	2019	2020
Accuracy of adjusted RTF 18 Annual Car, LGV and HGV vehicle miles combined	0.0%	-1.5%	-2.1%	-2.2%	-3.0%	+26.0%

Table 53 : Performance of adjusted RTF 18 projections against adjusted published statistics of annual road traffic mileage.

Coronavirus (COVID-19)

5.20 It is not reasonable to try and explain the performance of RTF 18 against more recent outturn traffic levels because of the impact of COVID-19. The road traffic forecasts 2018 are a long run estimate of travel demand out to 2050 that could not and did not take account of the impacts of COVID-19.

Sense checking the impact of key drivers of travel demand and NRTP 22 Core Scenario results with a simple regression model

Rationale

5.21 It is a common criticism of the National Road Traffic Projections and its predecessors that they overestimate road traffic levels. As shown in section above comparing model inputs between NRTP22 and RTF18, there have been noticeable reductions in the GDP and population projections that feed into the NTM. As part of the quality assurance around the NRTP 22 projections, simple regression models have been constructed to investigate the strength of the relationship between two key drivers of travel demand: GDP and Population.

5.22 Outturn data for GDP and for total miles driven were used to calibrate a linear regression model. The resulting relationship shows some level of connection but not a defining one.

5.23 Figures 54 and 55 (note that the Y-axes start at 200) graph the relationship between road traffic and GDP and population respectively between 1995 and 2020. They both demonstrate a degree of closeness-of-fit with R squared values of 0.61 and 0.84 respectively.

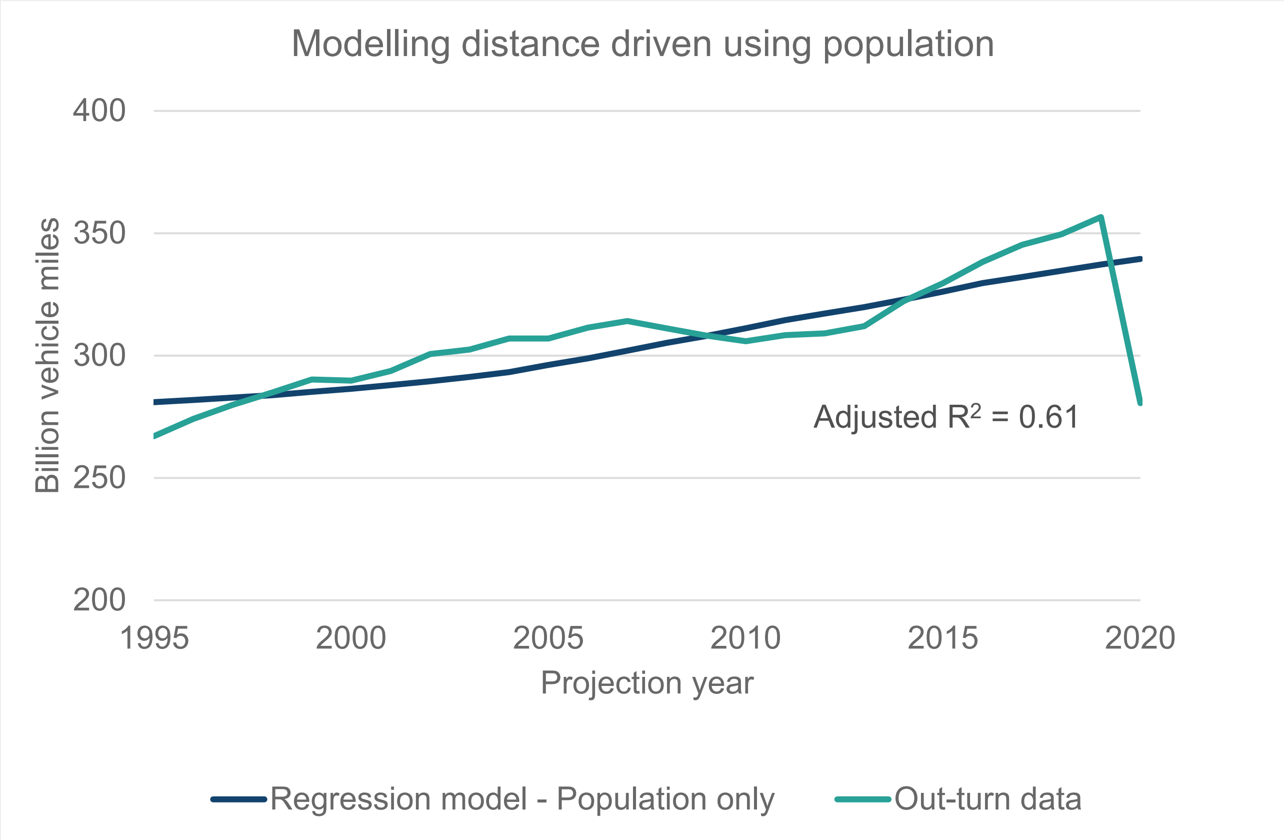

Figure 54 Showing the fit of the regression model to the historical data, using the population only

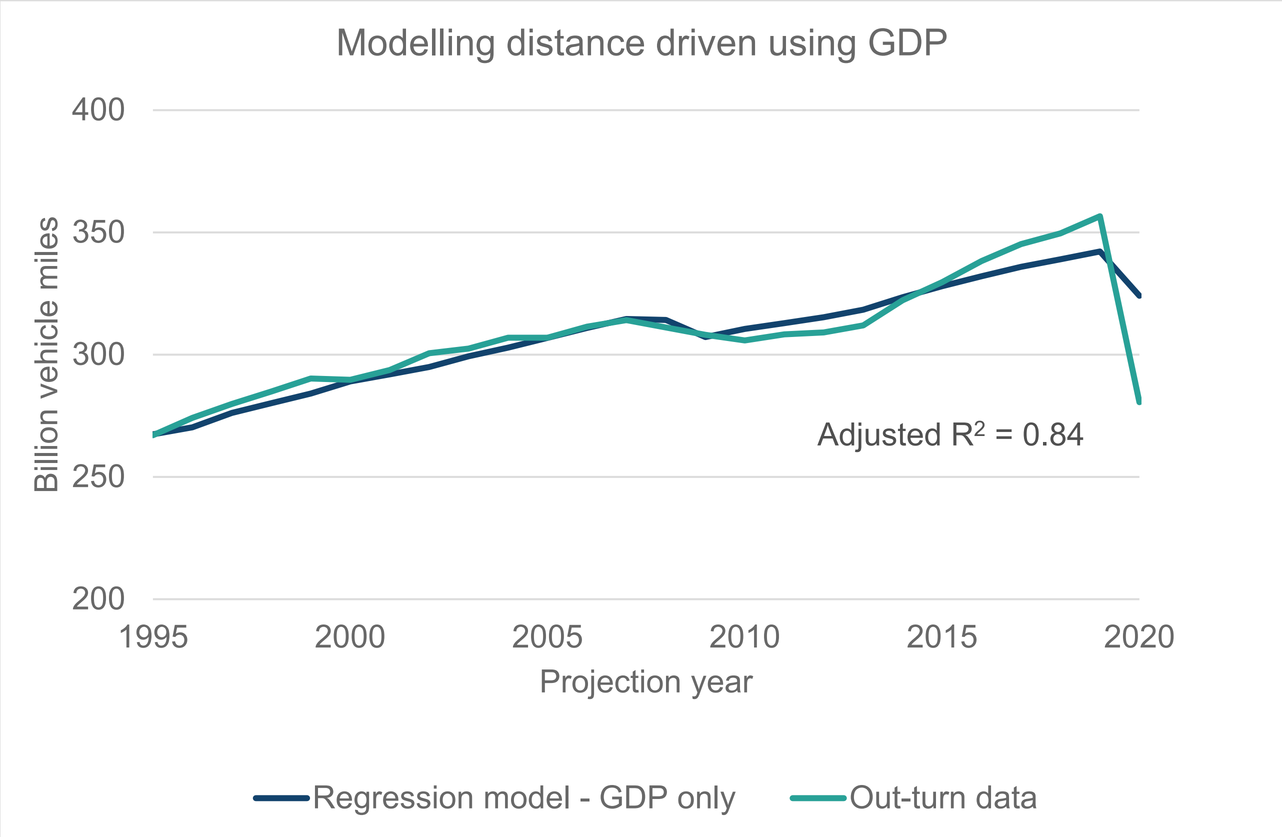

Figure 55 Showing the fit of the regression model to the historical data, using GDP only

5.24 Several different model specifications were tested. Of these, the multilinear regression with the best closeness-of-fit used real GDP levels, child (aged 0-15) and pension-aged (65+) population levels along with a dummy variable for COVID-19 in 2020 as predictors (Figure 56, note Y-axis starts at 200). The adjusted R squared value for this regression of 0.99 highlights the strong link between these variables and national traffic levels. This reinforces them being key drivers in projecting future road usage.

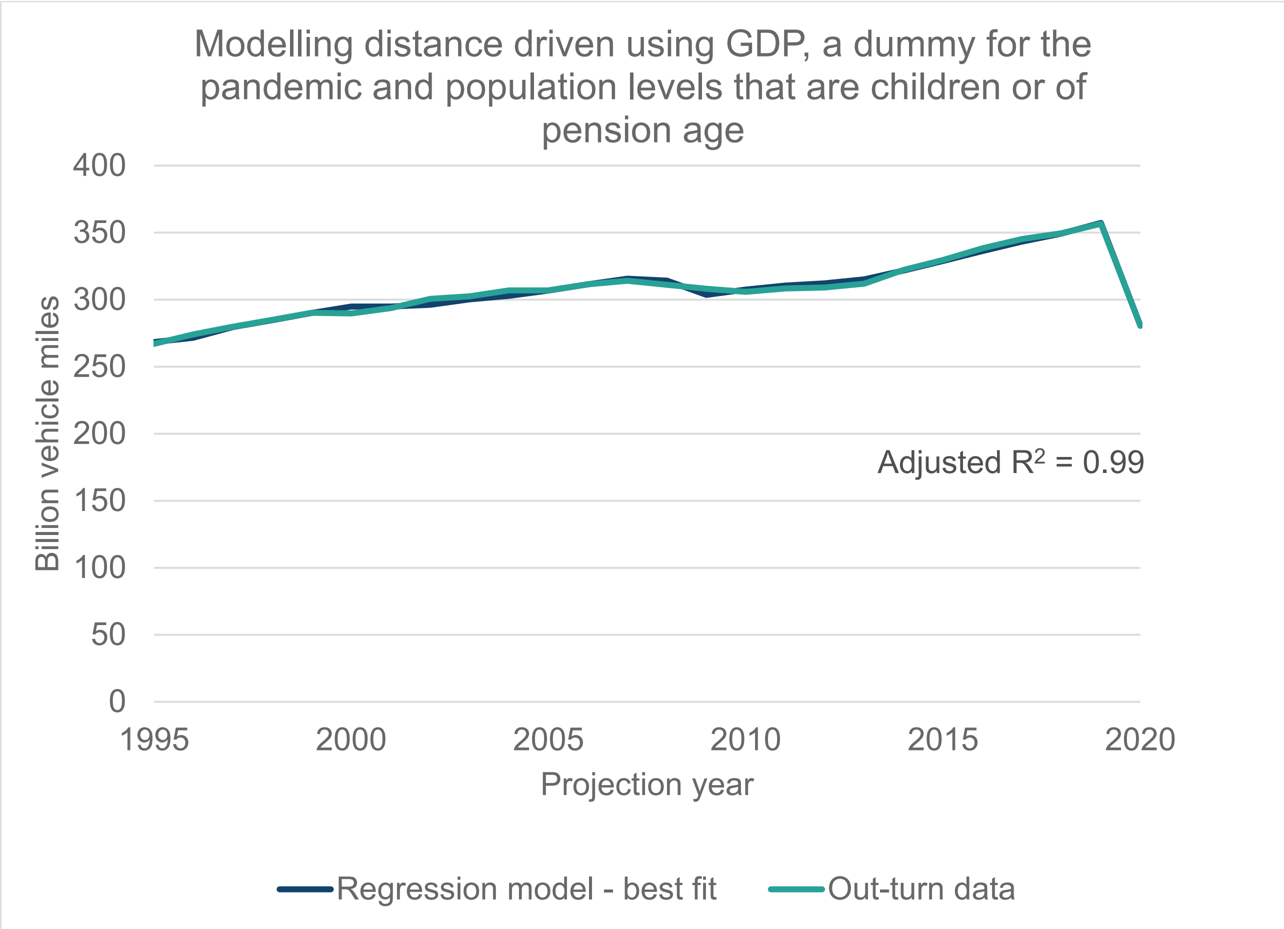

Figure 56 Showing the fit of the regression model to the historical data, using GDP, pandemic, and the age of the population

NRTP 22 comparison

5.25 To test the performance of NRTP 22 the regression model was used to extrapolate total travel into the future for comparison against NRTP 22 Core Scenario projections. This took the same inputs for GDP and population along with the flag for COVID and extrapolated to 2060.

5.26 The chart below shows total vehicle miles driven by year, with a line progressing from 359bn in 2025 to 486bn in 2060 for the full regression model, which lies above the results published in the NRTP 22 of 356bn in 2025 to 433bn in 2060.

5.27 As congestion increases in later years, the simple multi-linear regression model extrapolates greater traffic growth than the core projection in the NRTP. The NRTP has different methods for projecting car travel, van travel and lorry travel. The simplified multi-linear regression model extrapolates growth in all vehicle types using assuming identical growth rates.

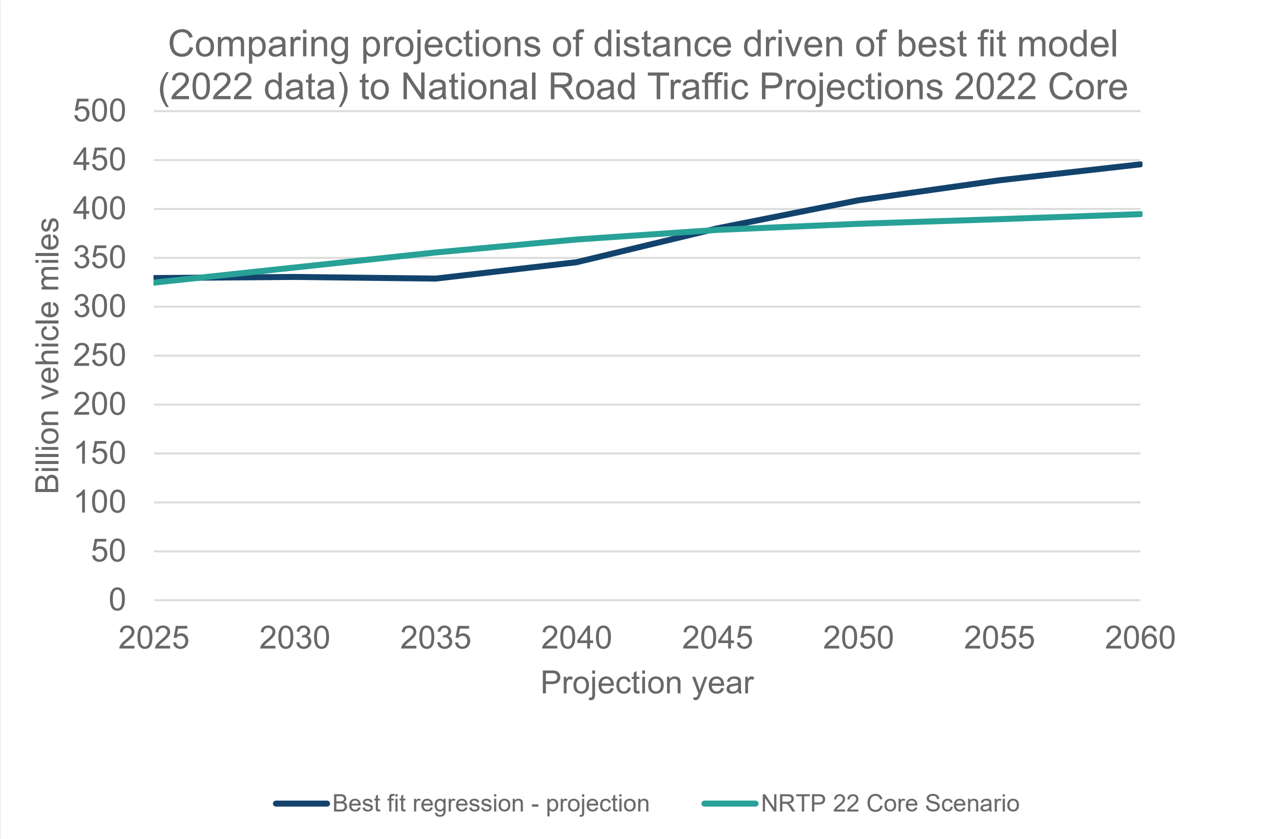

Figure 57 Comparing best fit regression model to the NRTP 2022 projections

Key takeaways

5.28 The simple linear regression models give us confidence that the links between GDP, population and traffic growth are strong. The general direction of traffic growth, if these relationships continue, is positive.

5.29 The order of magnitude of the projections in NRTP 22 are valid, and consistent with this alternative simplified method.

5.30 The use of a regression model is overly simplistic for long term projections, due to the complex nature of human behaviour, the importance of geography in transport choices, including origin and destination choices, mode choices, network capacity and route choices. The simplified regression model does not take these factors into account. The well-established approach taken in the NTM brings reliability and realism into NRTP 22.

6. Conclusions and Next Steps

The CAS provide a rich insight into how traffic, congestion and emissions may evolve under different plausible futures of the world. There are also other uncertainties not accounted for in the CAS. This section summarises the key results and the next steps.

Understanding of uncertainty from the Common Analytical Scenarios

6.1 The use of the common analytical scenarios enriches our understanding of how different plausible future states of the world may impact on road traffic demand, congestion and emissions. The key uncertainties that the CAS have explored are: economic and demographic growth, regional redistribution, behavioural and technological change, and decarbonisation.

6.2 The impact of input uncertainties and the relative importance of population, employment and GDP projections to the overall road traffic projection figures is clear to see. The range of projected traffic growth between 2025 and 2060 is 8% to 39% when considering uncertainties around population and economic growth.

6.3 Societal attitudes to travel are explored through the Behavioural Change Scenario. In particular, the balance between changing trip rates set against projected increases in GDP, reducing operating costs and increases in population. This scenario explores a future where historical trip rate decline was enlarged and extrapolated to 2040. The projected traffic growth is 12% between 2025 and 2060, whereas the projected traffic growth in the Core Scenario is 22% for the same period.

6.4 The impact of geographical spread of traffic growth is explored in the Regional Scenario. In this Scenario traffic growth was redistributed to areas outside of the Wider South East that show below average traffic growth. As the number of trips are constrained to the same totals, total vehicle miles in 2060 are only marginally different to the Core Scenario highlighting the relatively small impact geography has on average trip lengths. Differences in the geographic trip distribution can be noted.

6.5 The impact of technology and vehicle fleet electrification is explored through three scenarios: Technology Scenario, Vehicle-led Decarbonisation Scenario and Mode-balanced Decarbonisation Scenario. By 2060, across the high EV uptake scenarios traffic growth is projected to rise between an increase of 11% and 54%. Even with that background traffic growth, tailpipe CO_2e emission estimates reduce by between 97% and 98%. This shows the size and scale of the impact of EV uptake on tailpipe emissions outweighs the 54% increase in traffic levels.

Uncertainties not explored in the National Road Traffic Projections 2022

6.6 While the CAS include a wide range of uncertainty, it has not been possible to reflect every aspect of uncertainty around travel demand in these projections. There are other economic pressures that could have an impact on the projections if sustained. These have not currently been included as they have not progressed enough to have an evidence based judgement made on their impact.

6.7 Current high fuel prices, if sustained, would reduce projected traffic demand (roughly, a persistent 10% increase in fuel prices reduces traffic by 3%). While short-run fluctuations would not impact our long-run projections, structural changes such as the BEIS commitment to move away from Russian fossil fuels by the end of 2022 (0% and 18% of UK petrol and diesel imports respectively) could push prices up in the longer-term.

6.8 Recent cost of living pressures are not reflected in these projections. As with fuel prices, while short-run fluctuations are not critical for NRTP, permanent increases in the price level (the Bank of England have indicated it will take two years to return to target inflation levels), and corresponding reductions in real income, may dampen travel demand. With less disposable income, people are less likely to purchase cars and public transport tickets.

Next steps

6.9 As usual we will build on the work in NRTP 22 going forward. Monitoring changes to long run input assumptions such as GDP, fuel price and policy announcements. We will consider the impacts of these in the round and respond accordingly. We will undertake research to better understand changes in travel behaviour as well as complete research into projecting non-tailpipe emissions.

6.10 Separately the CAS will be monitored and considered to ensure future resilience and continued use.

Annex A: Glossary of Acronyms

Acronym	Long Title
ALBs	Arm's Length Bodies
AV	Autonomous Vehicle
BEIS	Department for Business, Energy & Industrial Strategy
BVM	Billion Vehicle Miles
CAS	Common Analytical Scenarios
CAV	Connected Autonomous Vehicle
CO2e	Carbon Dioxide equivalent
DfT	Department for Transport
EEP	Energy and Emissions Projections
EFO	Economic and Fiscal Outlook
EV	Electric Vehicle
FORGE	Fitting On Regional Growth Effects
GBFM	Great Britain Freight Model
GB	Great Britain
GDP	Gross Domestic Product
HGV	Heavy Goods Vehicle
ICE	Internal Combustion Engine
JADP	Joint Analysis Development Panel
kt	Kilotons
kWh	Kilowatt Hour
LGV	Light Goods Vehicle
Mt	Megatons
NATCOP	National Car Ownership Model
NNNPS	National Networks National Policy Statement
NOx	Generic term for the mono-nitrogen oxides
NRTP 22	National Road Traffic Projections 2022
NTAS	National Travel Attitudes Study
NTEM	National Trip End Model
NTM (v2R)	National Transport Model (Version 2, Rebaselined)
NTS	National Travel Survey
OBR	Office for Budget Responsibility
ONS	Office for National Statistics
PM10	Particulate Matter 10 micrometres or less in diameter

RIS 1	1st Road Investment Strategy
RIS 2	2nd Road Investment Strategy
RTF 18	Road Traffic Forecasts 2018
RTMs	Regional Traffic Models
SRN	Strategic Road Network
TAG	Transport Analysis Guidance (previously known as WebTAG)
VOC	Vehicle Operating Costs
VoT	Value of Time
ZEV	Zero Emission Vehicle

Annex B: How the National Transport Model works

Brief introduction to how the National Transport Model works

B.1 Projecting travel demand requires an understanding of the factors that influence it. The interactions between these factors and the nature of their relationship with travel demand make traffic forecasting a complex process. The NTM takes a four-stage multimodal approach to modelling travel behaviour which provides a robust way of taking account of this complexity. However, it is worth noting any model is by definition a simplified representation of a complex reality.

B.2 Our modelling splits travel-making choices across four key decisions following the classic 4-stage transport model approach:

- Whether to travel (Trip Generation) – whether a trip needs to be made (e.g. to work, the shops or to visit friends). The total number of trips are calculated by determining the frequency of productions and attractions in each zone by trip purpose. The choice of where to travel to is determined and constrained by the distribution of destinations to travel to i.e. the location of jobs, schools and shops. The National Trip End Model (NTEM) dataset and suite of models provides an initial forecast of travel demand based on:

  ─ Households by size in the study area for each forecast year;
  ─ Population by gender and age for each control area in each forecast year; and
  ─ Employment (jobs) by industry, gender and working status in the control area for each forecast year.
  ─ Car Ownership (NATCOP, see Figure 58) by household type based on licence holding, income, population, car costs and employment

- Where to travel to (Trip Distribution) - the demand model (PASS1 - see Figure 58 matches productions with attractions determining where trips start and end and the distance of the trip.
- Which mode to travel by (Mode Choice) – taking into account the time and monetary costs of travelling by different modes to distribute the trips from NTEM to different modes of transport in the demand model in NTM.

- Which route to be assigned to (Highway Assignment) – taking into account the time and monetary costs relating to using each route. This is handled in the Fitting On Regional Growth Effects sub-model (FORGE) (see Figure 58) based on road capacity, forecast demand levels, costs of different modes as a result of congestion, speed flow curves and a comprehensive database of actual traffic data. This step is only for cars; LGVs and HGVs, walking, cycling and public transport are not assigned in FORGE.

B.3 There is then an iteration between demand (stages 2 and 3) and route assignment (stage 4), as the cost of travelling on roads will then have an impact on travel behaviour.

B.4 Analysing decisions using these four aspects helps explain the aggregate travel patterns observed, identify where changes are occurring and where the main uncertainties are. A diagrammatic representation of each of the above stages as well as key inputs to the model can be seen in Figure 58.

B.5 A more comprehensive description of how the NTM works can be found at the NTM webpages.

NTEM

B.6 NTEM is one stage of generating traffic projections. Due to its importance as a stand-alone stage, it is undertaken separately and the results published independently of NRTP 22.

B.7 NTEM forecasts the potential demand for personal travel based on the economy, population and land use. It does not consider the constraints of capacity and cost arising from the transport networks themselves. The NTEM results are published and can be accessed using the TEMPro program from here.

B.8 NTEM consists of a sequence of sub-models:

- ‘Scenario Generator’ looks at the population and dwellings to model household formation and dissolution. It compares the ages and roles of household members to the types of jobs to give adults employment status.
- ‘NATCOP’ takes the households from scenario generator and models them deciding whether or not to own a car, or more than one car.
- Finally, CTripEnd models how many trips each household will make for each purpose. These are the home-based productions. Now it creates an equal number of home-based attractions in proportion to jobs (e.g. for commute) or households (e.g. for visiting friends). The non-home-based productions are in proportion to the home-based attractions, and again the non-home-based attractions are balanced with the non-home-based productions.

B.9 More information on NTEM sub-models can be found here.

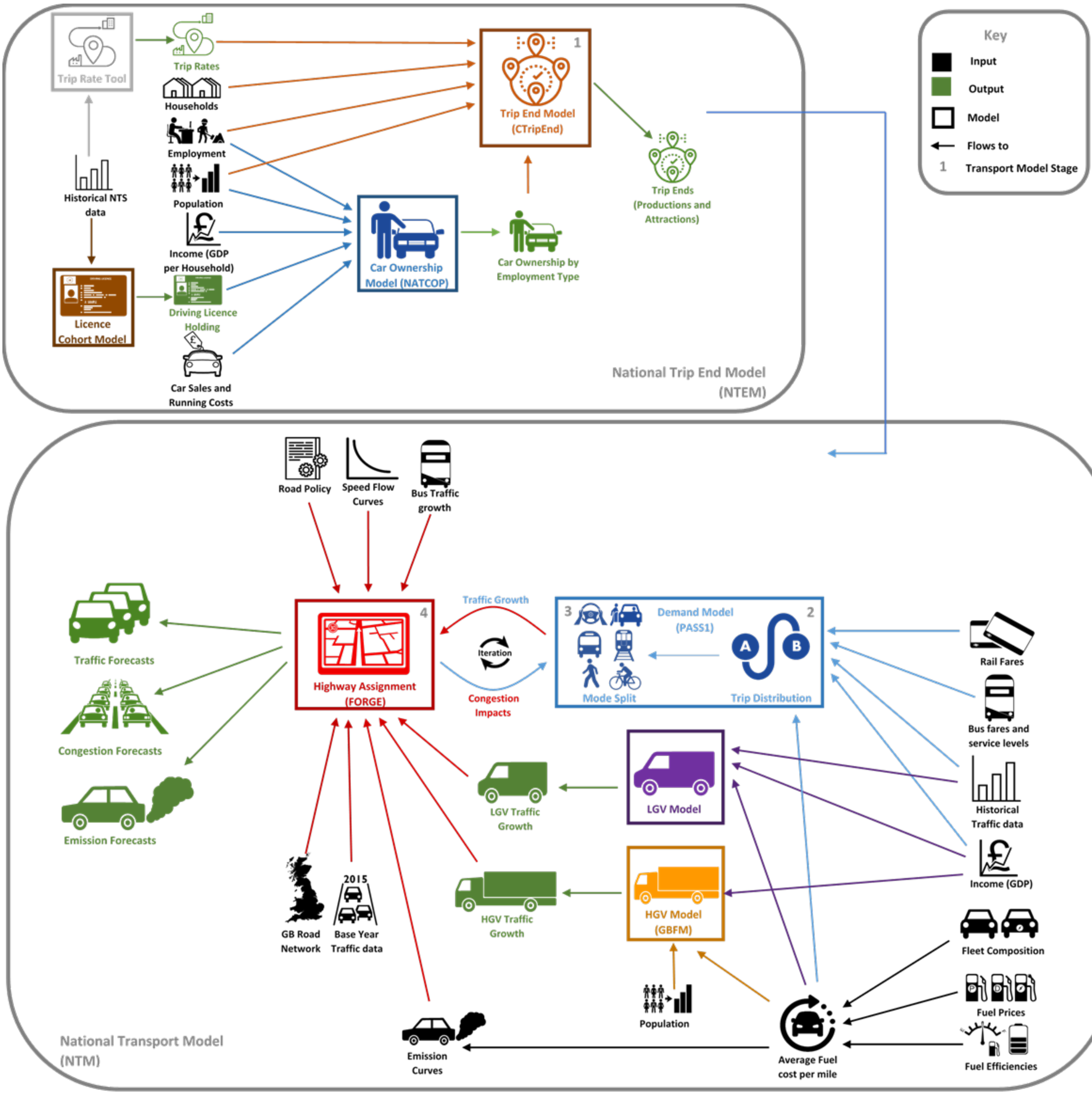

Figure 58 The NTEM and NTM model structure

HGV Model

B.10 The GB Freight Model version 5 (GBFM) is a freight transport demand model estimating HGV traffic growths which are then input to the NTM, as can be seen in Figure 58.

B.11 The HGV traffic projections are derived through estimating the future year HGV traffic based on freight transport costs to business (including HGV fuel efficiencies and consumptions) and freight tonnages growths driven by both population growths and international trade forecasts. The population growths in this set of updates have replaced the manufacturing estimations adopted in previous forecasts.

B.12 The GBFM v5's report was published in 2009 and can be found on the national archives here. The GBFM revalidation report describes the updates to GBFM and its results in detail. It is published on the GOV.UK website.

LGV model

B.13 LGV traffic growth is projected by the LGV Model. This is a sub-model of the NTM, as can be seen in Figure 58.

B.14 This is a regression-based model that forecasts LGV traffic using three main inputs:

- LGV lagged traffic (past two years' traffic figures for LGVs);
- GDP;
- Average Fuel cost of an LGV (accounting for fuel prices, fuel efficiencies and fuel makeup of the LGV fleet).

6.12 This regression model was initially developed 2014 and projected out to 2040. An overview of the model can be found here.

B.15 The model has since been updated for RTF 18 and NRTP 22. In this instance, the following changes have been made:

- The model was extended to model out to 2060.
- The historic LGV distance travelled has been updated to the latest Road Traffic Statistics out to 2020. These statistics include the 2019 benchmarking exercise.
- Analysis suggested that applying the (two year) lagged terms to 2020 supresses modelled LGV traffic growth by more than the realised impact of COVID-19. Instead, separate pre-model estimates have been produced for these years. For 2021, 2019 statistics have been multiplied by the averaged change in daily traffic volumes for LGVs in 2021 relative to 2019. Since 2022 is incomplete, the same 2021 methodology was applied but relative to same period in 2019. The LGV model begins modelling from 2023 using these pre-model estimates for 2021 and 2022.
- The GDP elasticity was held constant from 2050.

Public transport & active modes

B.16 While this publication presents the Department's road traffic projections, the NTM takes account of the choice between walking, cycling, rail and bus as well as car, at a high level. The purpose of the representation of other modes in the NTM is to ensure the relative attractiveness of those modes are accounted for in the demand model in response to changing costs, levels of congestion or policy changes. The Department has specialist models that are more detailed and appropriate for forecasting demand for those specific modes.

B.17 As relationships describing the impact of cycling and motor cycling on road capacity and traffic congestion are unavailable, these modes are not assigned to the NTM road network and motorcycles are not modelled in the NTM.

B.18 In the wider context of the NTM, public transport and active modes are not currently a high proportion to overall road traffic and usage. The NTM uses mode choice to represent cycling and walking and the impact on road traffic. However, these are high level assumptions appropriate for national traffic projections, more detailed methods should be used for active mode appraisal. Below is a graph showing the distance travelled by mode and year, with car travel exceeding 400 billion miles in 1992 while walking, cycling, bus and rail combined totalled around 75 billion miles in the same year.

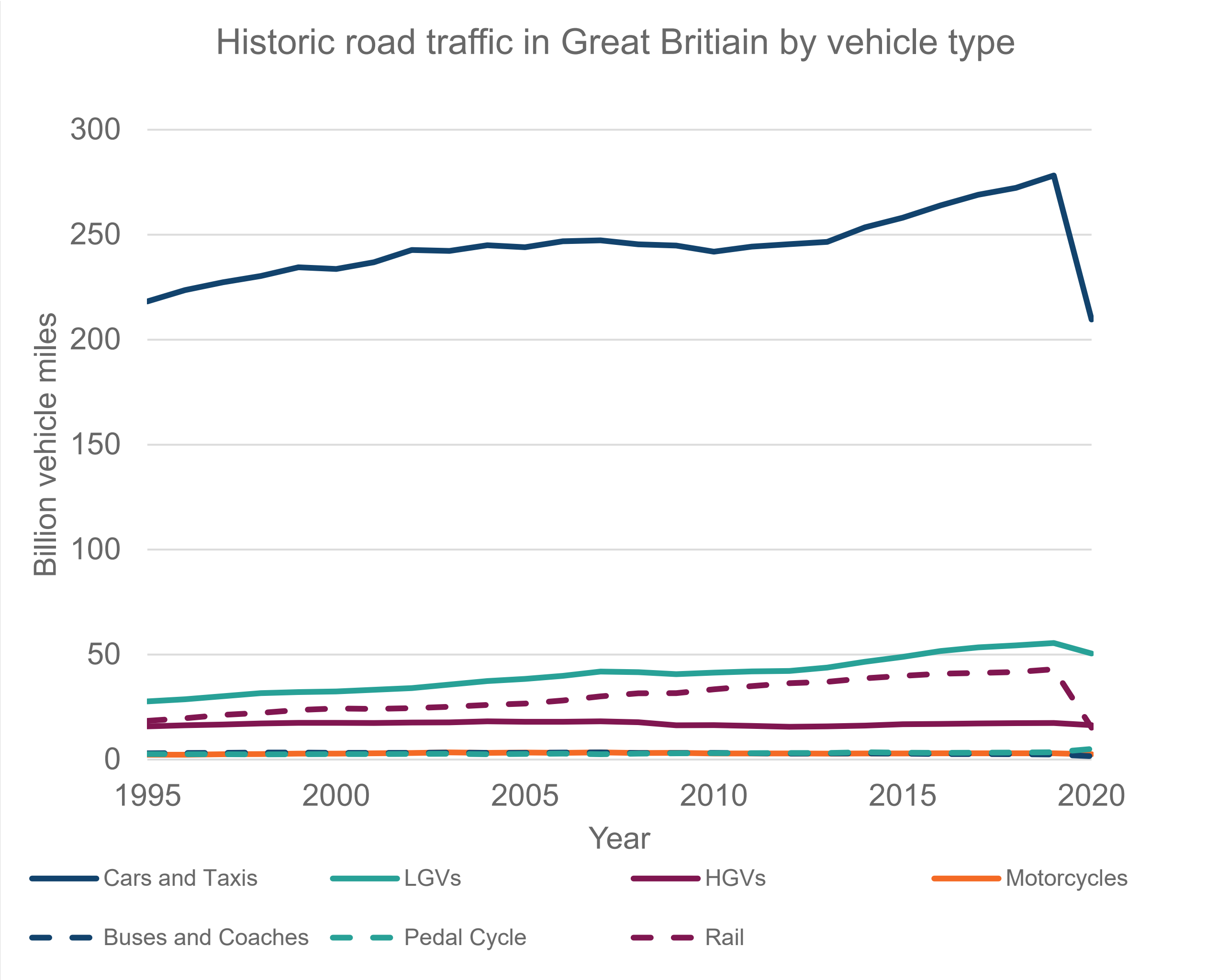

Figure 59 Billion passenger miles travelled, by mode, for Great Britain

Non-tailpipe emissions

B.19 The NTM produces forecasts of tailpipe emissions of Carbon Dioxide equivalents (CO2e), Nitrogen Oxides (NOx) and particulates (PM10). These are projected by taking account of policy across all sectors of the economy and published in Energy and Emissions Projections (EEP) produced by the Department for Business, Energy & Industrial Strategy (BEIS).

B.20 NTM (v2R) does not capture other vehicle related emissions such as non-tailpipe NOx and PM2.5 emissions from brake dust, tyre wear and road abrasion particles. Nor does it cover road maintenance, operation, or highway development activities.

Annex C: Adjusting for Coronavirus

Adjusting for COVID-19

C.1 The base year model for NRTP 22 is 2015 and there have been significant changes in travel demand that have happened during the intervening years. Hence the department has developed an adjustment to final traffic estimates which is our interpretation of current TAG guidance as laid out in M2.2 paragraph 4.4.4 that guides users on the use of old data. The key section is: “Practitioners should establish evidence on scale of changes to land use and demographic characteristics, transport networks, and travel patterns… and use this evidence to assess the validity of ‘old’ data sources and their suitability for the intended use(s) of the model.”

C.2 The method laid out here is the department’s approach for the purpose of adjusting National Transport Model outputs for the production of national road traffic projections. Other model owners should use knowledge of their model and policy questions to interpret TAG guidance to line up with their circumstances and specific needs.

C.3 COVID-19 has had a significant impact on travel demand in terms of volumes, location, time of travel, mode choice and journey purpose. We have been through an unprecedented period of modern history, with travel being restricted by law during 2020 and 2021. The timings and nature of these restrictions are shown in the House of Commons library paper: Coronavirus: A history of English lockdown laws.

C.4 Taking account of multiple data sources collected either directly by the department or other surveys, we have considered peoples stated responses to the pandemic, and compared that to the observed impacts on road traffic. The main DfT data sources are:

- Transport use during the coronavirus (COVID-19) pandemic - DfT statistics on transport use by mode since 1st March 2020
- Travel behaviour, attitudes and social impact of COVID-19 - a study into the travel behaviour of people during and following the COVID-19 pandemic
- National Travel Survey (NTS) - a household survey that collects information on how, why, when and where people travel as well as factors affecting travel
- National Travel Attitudes Study (NTAS) - a study of attitudes towards different aspects of travel including safety, the environment and congestion.

C.5 Figure 60 uses data from the 'Transport use during the coronavirus (COVID-19)' report. This shows traffic volumes by vehicle type and it is clear that car traffic has been lower than pre-pandemic levels since March 2020.

C.6 However, for HGVs and LGVs the story is different. Freight, particularly LGV traffic, has experienced increases compared to average traffic volumes from a hypothetical non-COVID-19 2020. There is little or no evidence that LGV traffic will decline from current levels. Therefore, the projections for LGVs take into account current LGV usage and the GBFM is not adjusted for COVID-19. It should also be noted that LGV and HGV traffic combined are typically around 4 times smaller than car traffic.

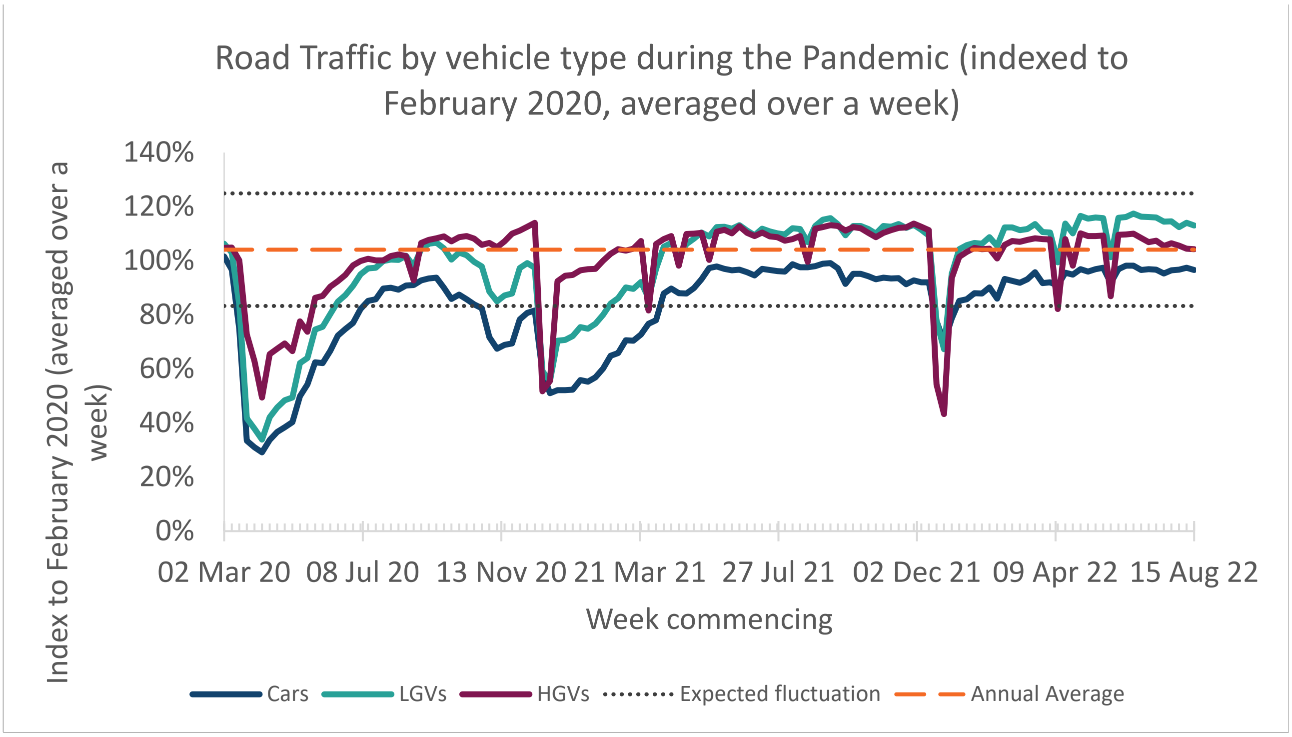

Figure 60 Comparative figures for road traffic during the pandemic

C.7 In February 2022 traffic was 8% lower than 2019 levels. Typically, traffic growth for 2 years is around 3%. Thus, the reduction in traffic in February 2022 was approximately 11% lower than might have been expected without the impact of COVID-19 and government restrictions on travel.

C.8 In order to publish the NRTP 22 to support the National Networks National Policy Statement (NNNPS) we have taken a pragmatic approach that works on the principle that we can be confident the projection is inside an upper and lower bound. The lower bound assumes that the reduction in traffic in February 2022 is permanent. The upper bound estimate is if COVID-19 had never happened. There is still considerable uncertainty over which aspects of COVID-19 induced changes in travel patterns will persist long term. Evidence suggests that people have formed new habits and expectations, particularly around working from home and online shopping, but it is unclear how these habits will evolve over time. We have undertaken a thorough review of literature and survey evidence to make an informed assumption that lies between these bounds.

C.9 The Department has commissioned significant survey work through the NTAS and the NTS alongside monitoring social and behaviour research from Arm's Length Bodies (ALBs) and other transport sector organisations to build a picture of how people intend to travel after the pandemic. The jointly sponsored DfT National Highways longitudinal survey of travel behaviour before and during COVID-19 asked people about their travel patterns. Table 61 shows the NTAS November 2021 Wave 5 results. It gives the proportion of respondents that travelled by car for a given journey purpose. It compares the answers between two timeframes, before COVID-19 described here as January to March 2020, and during COVID-19 represented by November 2021 data. It also shows the percentage point difference and the relative change.

Journey purpose	January - March 2020*	November 2021	Difference	Relative change
Shopping	81	78	-3	-3.7%
Visiting friends/relatives	66	53	-13	-19.7%
Going to a pub/bar/restaurant to sit inside/outside	48	41	-7	-14.6%
Travelling to meet up with people indoors/outdoors	46	41	-5	-10.9%
Travelling (commuting) to place of work	51	39	-12	-23.5%
Travelling to medical, hospital or dentist appointments	46	35	-11	-23.9%
For recreation/keeping fit	34	33	-1	-2.9%
Travel to access services e.g. hairdressers, libraries, estate agents and banks	40	26	-14	-35.0%
Travelling to access entertainment/arts	36	24	-12	-33.3%
Running errands for people e.g. going out food shopping on behalf of others	21	22	1	4.8%
Holiday or a day trip somewhere	37	18	-19	-51.4%
Picking up or dropping off child(ren) at school/place of education/nursery etc.	16	17	1	6.3%

Giving lifts to friends and family for other reasons	21	15	-6	-28.6%
Business travel (excluding travelling/commuting to your usual place of work)	13	8	-5	-38.5%
Travelling to education yourself (as pupil/student)	9	6	-3	-33.3%
Other	1	2	1	100.0%

Table 61: The change in trip rates by purpose of trip. Source: NTAS November 2021 Wave 5 results

C.10 The 16 NTAS journey purposes are combined to represent the 9 relevant journey purposes in the national travel survey. Table 62 shows the proportion of respondents that travelled by car for a given journey purpose. It compares the answers between two timeframes, before COVID-19 described here as January to March 2020, and during COVID-19 represented by November 2021 data. It also shows the percentage point difference and the relative change.

National Travel Survey Journey purpose (National Travel Attitudes Survey purposes)	January - March 2020*	November 2021	Percentage Difference
Commuting	51	39	-23.5%
Business	13	8	-38.5%
Education (education and education escort)	25	23	-8.0%
shopping	81	78	-3.7%
Giving lifts to friends and family for other reasons	42	37	-11.9%
Personal business (medical appoints and other services)	86	61	-29.1%
Leisure (combination of 5 purposes). (see note 1 below the table)	267	210	-21.3%
other	1	2	100.0%

Table 62: The change in trip rates by purpose of trip - NTAS purpose breakdown. Source: NTAS November 2021 Wave 5 results

Note: Leisure is the combination of “Visiting friends/relatives, Going to a pub/bar/restaurant to sit inside/outside, Travelling to meet up with people indoors/outdoors, For recreation/keeping fit, Travelling to access entertainment/arts and Holiday or a day trip somewhere”

C.11 Using this evidence alongside the upper and lower bound estimates the Department has applied a net reduction of 5% in car vehicle miles compared to a no-COVID-19 projection. This lies between the upper and lower bound estimates and reflects evidence around Journey purpose especially for people who have working from home available. The split by purpose for car traffic is 6% reduction in commuting trips, 9% for business trips and 4% for all other trip purpose.