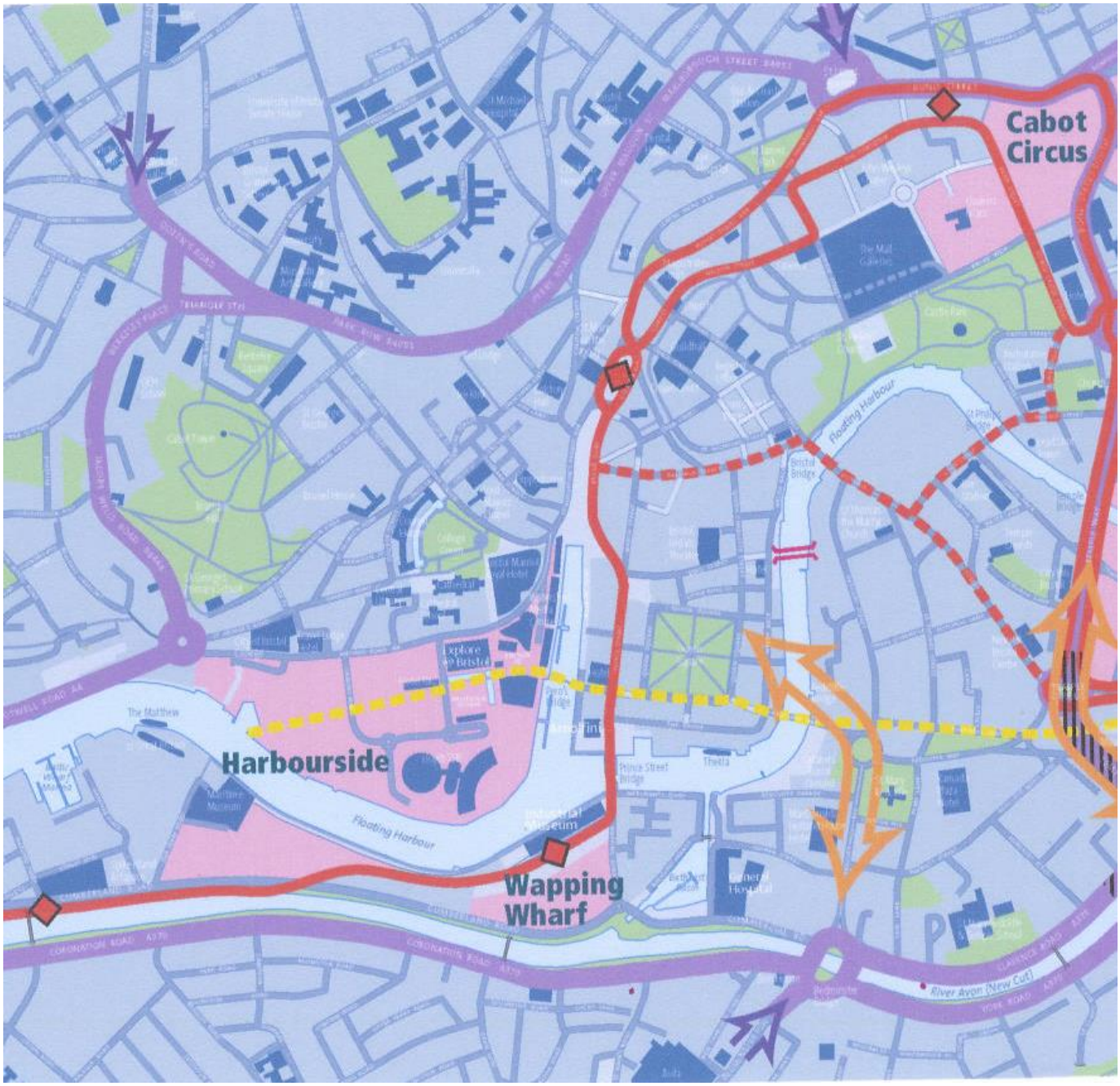

INVESTMENT FOR SUSTAINABLE TRANSPORT

Transport investment and carbon emissions in four Anglophone countries

NZCSC Policy Paper, November 2017

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INVESTMENT FOR SUSTAINABLE TRANSPORT

Abstract

This paper examines the extent to which central government land transport strategy and policy is supporting climate change mitigation in the transport sector. It examines transport strategies and policies as well as past and projected land transport spending in four countries – Ireland, the United Kingdom, Australia, and New Zealand. It then assesses the extent to which these strategies, policies, and funding regimes are supportive of a transition to sustainable transport regimes and substantial reductions in emissions.

Transport provides a significant challenge for countries seeking to reduce their carbon emissions. It is a primary driver of overall emissions on a national level, and has proved to be the hardest sector from which to cut carbon emissions. Central governments are responsible for setting overall national emission reduction goals and have a significant role to play in setting the strategic agenda for emission reductions from transport.

Substantial emission reductions from the transport sector are possible but will require, at the minimum, vehicle efficiency improvements, alternative fuel sources and modal shift from driving towards public transport, walking, and cycling. If transport is to play its part in the achievement of national emission reduction goals, a change in course is needed in all four countries, as all are off track with regard to emission reductions from transport. Of the four case study countries, only the United Kingdom has been able to reduce transport emissions to below 1990 levels, demonstrating that action to date has been insufficient to achieve the desired emission reductions. In New Zealand, Ireland and Australia, the change in course will need to be dramatic.

Introduction

Definitions of sustainable transport vary, but usually include: substantial reductions in carbon intensity of travel that is in line with substantial emission reduction goals, an emphasis on minimizing adverse heath effects and maximizing health benefits of travel, use of decision making tools and pricing mechanisms that reflect the external and internal costs of transport, and a shift from an emphasis on mobility and travel speed to accessibility (Banister, 2008).

While emissions from transport have historically risen with economic growth, modal shift away from motor vehicle travel, a reduction in trips and trip lengths, and increased energy efficiency offer pathways for emission reductions. Transport represents about 15% of global greenhouse emissions and represents a significant challenge for countries seeking to reduce their emissions (International Transport Forum, 2015; OECD, 2010). This is particularly relevant for developed countries which have committed to substantial reductions in carbon emissions in the coming decades. If substantial overall emissions reductions of 50-90% are translated to the transport sector, this represents a very demanding objective that will require a radical restructuring of the dominant transport paradigm through a range of measures (Chapman et al., 2017, 2008; Hickman, Ashiru, & Banister, 2011).

Academic research has called for significant increases in funding for public transport, walking and cycling infrastructure in order to achieve increased mode share for these sustainable transport modes (Dill, 2009; Hickman, Hall, & Banister, 2013; Pucher & Buehler, 2016). Transport is an especially promising area for reducing carbon emissions as it can also provide many co-benefits that are desirable regardless of emission reduction benefits (Chapman, 2008; Haines et al., 2009; Woodcock et al., 2009). These co-benefits include improving health outcomes through increased physical activity and decreased air

pollution; improving air and water quality; and lowering transportation costs for consumers (Carruthers & Úlfarsson, 2008; Chapman, 2008; Frank et al., 2006).

Transport infrastructure investments can play a significant role in determining travel patterns and associated emissions; car oriented development patterns can precipitate or entrench the dominance of private vehicle travel over other modes. Furthermore, past transport infrastructure and travel patterns can cause path dependencies, prescribing travel patterns and encouraging similar investments because of economies of scale (Sims et al, 2014; Upham, Kivimaa, & Virkamäki, 2013). For developed countries with high levels of car dependence, a transition towards a sustainable mobility paradigm requires major revisions to traditional transport planning in order to achieve a substantial modal shift away from motor vehicle travel, a reduction in trip lengths, and increased energy efficiency. Changes to traditional transport planning to achieve these outcomes include changes in the evaluation of costs and benefits of transport and the introduction of a transport hierarchy with active transport at the top and car use at the bottom (Banister, 2008).

This paper examines the extent to which central government land transport strategy and policy is supporting climate change mitigation in the transport sector. It examines transport strategies and policies as well as past and projected land transport spending in four countries – Ireland, the United Kingdom, Australia, and New Zealand. Queensland is taken to broadly indicate Australian trends, although no state is representative[1]. It then assesses the extent to which these strategies, policies, and funding regimes are supportive of a transition to sustainable transport regimes and substantial reductions in emissions.

These four counties were chosen as the focus of this analysis because they provide an instructive peer and aspirant group for New Zealand. They are Anglophone countries for

[1] However, in Figures 1-3, Australian national data are used.

which English language documents were readily available and with the exception of Australia, they are relatively similar in terms of governance institutions.

Carbon Emissions from Transport

Figure 1 shows transport as a percent of total greenhouse gas emissions in the four case study countries from 1990 to 2015.[2] Across all four countries, transport has been increasing its share of total greenhouse gas emissions. Whereas in 1990, emissions from transport ranged from 9 to 15% of total emissions, in 2015 emissions from transport had increased to between 17 and 24% of total emissions. Ireland has experienced the greatest growth in transport emissions, both as a percentage of total emissions and in absolute terms. In Ireland, absolute transport emissions more than doubled between 1990 and 2015 and transport's share of total emissions increased from 9 to 20%. Across countries, the trend towards increased transport emissions can be attributed to three factors: emissions reductions in other sectors, population growth, and growth in emissions per capita.

[2] Transport is taken here to be land transport, i.e. it excludes air and sea transport.

Figure 1:
Percent of total greenhouse gas emissions coming from transport

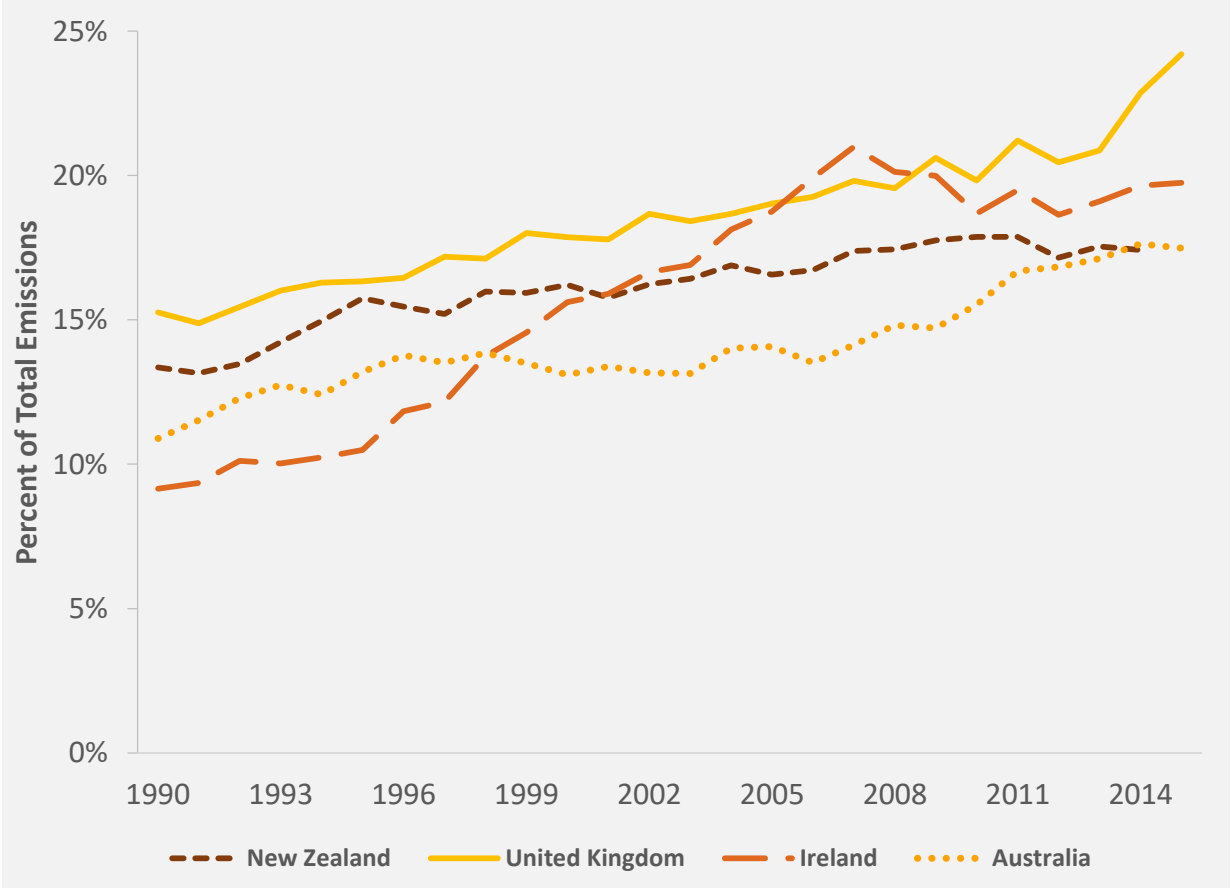


Figure 2 shows transport emissions per capita in the four countries from 1990 to 2014. The United Kingdom is the only country of the four that has been able to reduce per capita transport emissions, with a reduction of 0.31 tonnes per capita over the time period. Ireland has experienced the highest per capita increase in transport emissions, with a growth of 1 tonne per capita. However, Ireland has reduced emissions by 0.81 tonnes per capita relative to the peak in emissions in 2007. In Australia and New Zealand, transport emissions per capita have increased by 10 and 19%, respectively, since 1990.

Figure 2:
Transport Emissions per Capita

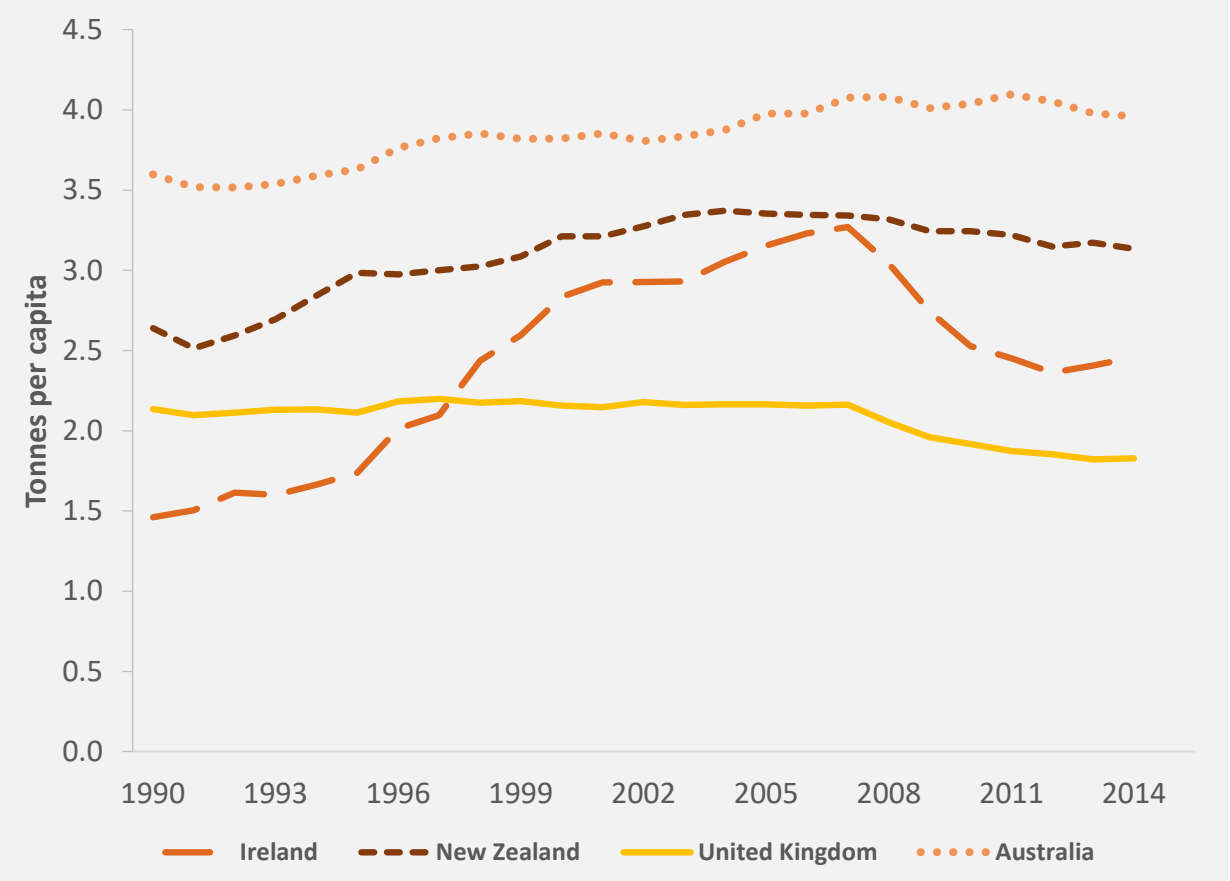
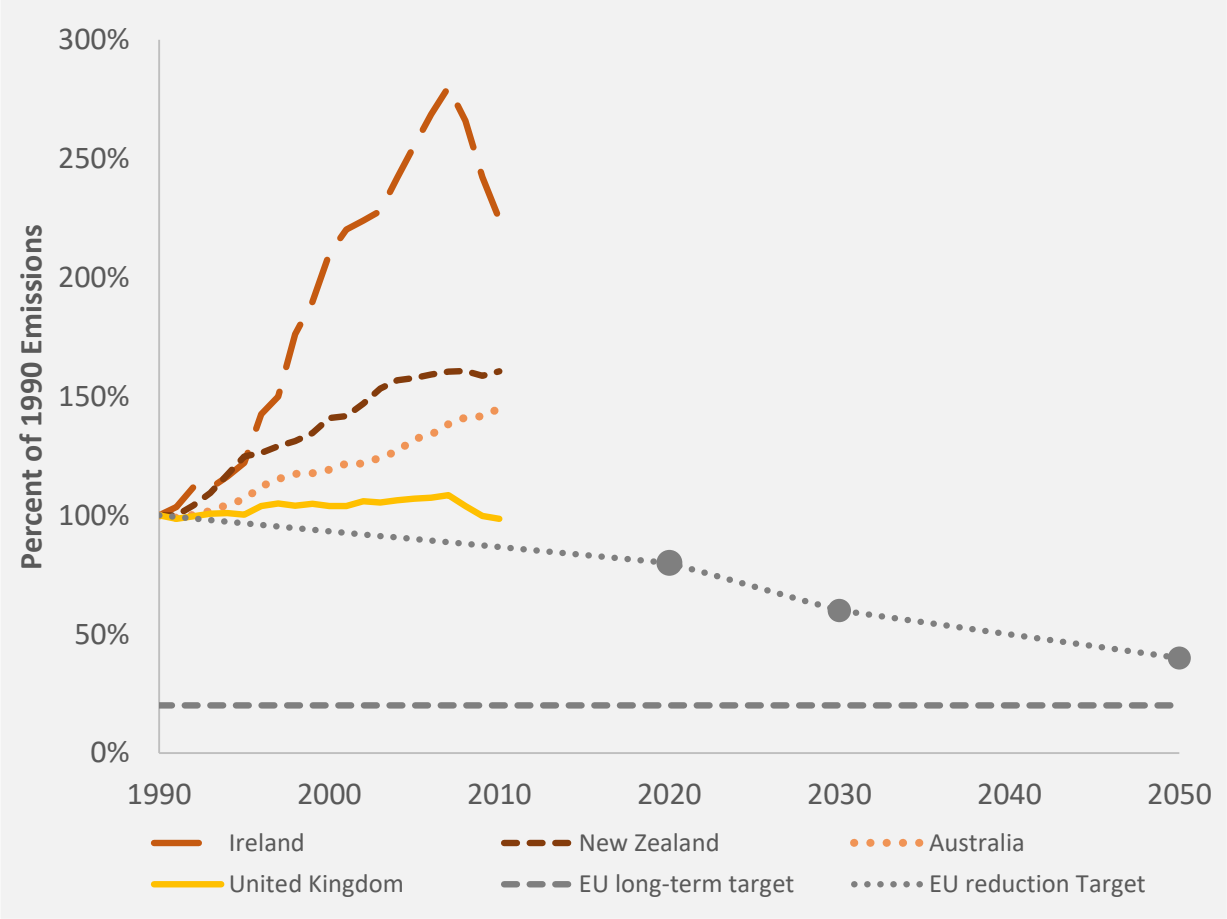


Figure 3 shows the trend in transport emissions in the four countries from 1990 to 2014, relative to 1990 emission levels. Trends in emissions can be compared to the EU goal of reducing transport emissions by 20% by 2020, 40% by 2030, and 60% by 2050. This reduction goal is less than the overall EU emission reduction goal of 80-95% by 2050, and implies that other sectors will need to make proportionately greater emission reductions if the overall 2050 goal is to be met. The horizontal line represents the long-term EU goal

Figure 3:
Transport Carbon Emissions and Reduction Targets



of reducing transport emissions by 80% relative to 1990 levels. This long-term goal would be consistent with ambitious long-term emission reductions in the range of 80-95%.

For the 2020 EU transport emissions target to be met, from 2015 to 2020 the United Kingdom would need to reduce its transport emissions by 16%. The United Kingdom is the only country of the four that had emissions in 2015 that were lower than in 1990, having reduced transport emissions by 2% over that time period.

Transport Strategy and Policy - Overview

Transport strategy at a national level can provide an indication of a country's strategic vision for transport, the relative emphasis placed on transport modes, and the outcomes for society and the environment that are accorded priority when countries make investment decisions. It also provides an indication of the extent to which carbon emission reduction targets have been identified and operationalised within transport planning at a national level.

The United Kingdom, Australia, New Zealand, and Ireland have transport strategies that on average span a 9 year time period. Three countries identify three main types of objectives for transport, while one, the United Kingdom, identified four types of strategic objectives. The primary objectives set forth in government transport policies can be grouped into five categories: economic growth, safety, service quality, economic efficiency, and environmental sustainability. Figure 4 shows the type of objective identified in each country's transport policy, with the largest circle representing the first listed objective and the smallest circle representing the last listed objective. Three objectives were listed by three of the four countries: economic efficiency, environmental sustainability, and service quality. Two objectives, safety and economic growth, were only identified by two countries, New Zealand and the United Kingdom. While there is broad consistency across countries in the types of goals identified in their transport planning objectives, there is also some variation in the strategic vision for transport across countries. Ireland and Australia (Queensland) have the most similarity, identifying the same categories of goals. New Zealand has the most economically oriented goals, and is the only country to identify both economic efficiency and economic growth in their primary transport objectives, while omitting goals related to transport service quality and environmental sustainability.

Figure 4:
Primary Transport Strategy Objectives by Country

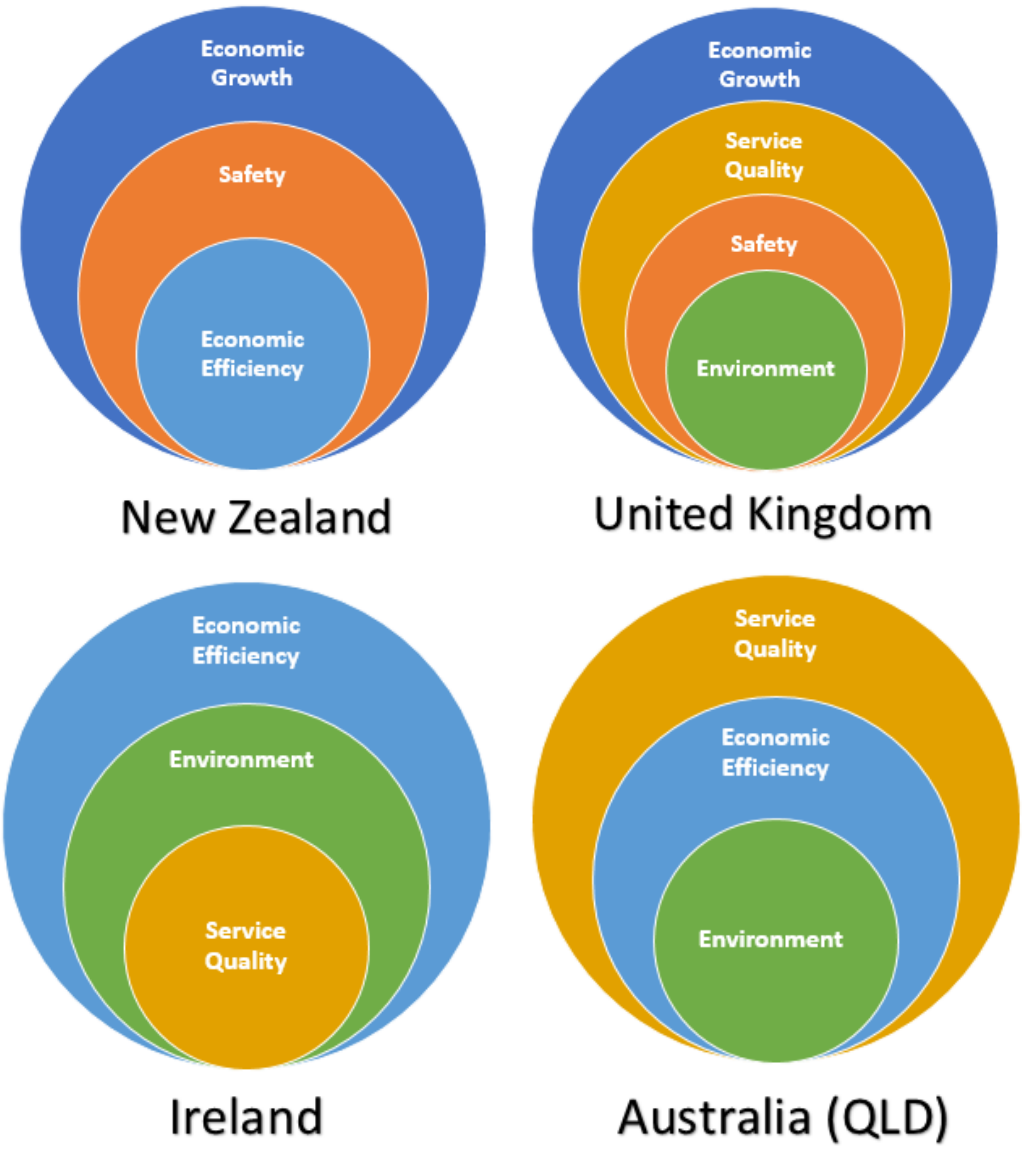


Table 1 outlines the primary objectives and environmental objectives outlined in transport strategies for each country. All four countries identify carbon emissions reduction as an objective in their transport strategy documents. However, none of the countries identify both an emissions reduction goal and the year by which it is to be achieved, making it difficult to ascertain precise reduction aims and progress towards their achievement. Australia and New Zealand have the most ambiguous reduction targets; although they state that emissions should be reduced, a percentage reduction is not identified, nor is a date by when these reductions should be achieved.

Ireland has a more defined goal of a reduction on 2005 emissions levels by 2020. However, this goal is significantly weaker than that identified by the EU. While the United Kingdom states that emission reductions from transport should 'play a part' in achieving the country's overall emission reduction obligation, it is not clear if this means that transport is intended to achieve a proportional reduction relative to 1990 levels as compared to overall reduction targets. The United Kingdom, Ireland, and Australia also have goals of reducing local air pollution. Australia has additional environmental goals such as increasing the resilience of the transport system to the impacts of climate change. In contrast, New Zealand's only additional environmental goal is to mitigate the adverse environmental impacts of transport projects to a sufficient extent (Ministry of Transport, 2017; Department of Transport and Main Roads, 2016; Department for Transport, 2016; Department of Transport, Tourism and Sport, 2009).

Table 2 shows the transport objectives identified for each country for four modes: walking, cycling, public transport, and roads/private vehicle travel. Increasing cycling is a commonly cited goal, identified by the United Kingdom, Ireland, and Australia. Ireland has the most ambitious goal for cycling, to quadruple cycling as a percentage of commuting trips and to quintuple cycling as a percentage of all trips. New Zealand has the least ambitious goal for cycling, to increase safe cycling, and does not have a goal to increase

overall cycling levels. Despite the evidence on the health benefits of walking, the United Kingdom is the only country to define a goal for walking as a transport mode, to reduce the decline in walking trips per person per year.

The countries identify a range of objectives for public transport. The United Kingdom and Australia have objectives of improving the accessibility and service quality of public transport. Ireland has an objective to increase the number of trips made by public transport by 230,000 by 2020. New Zealand identifies public transport investment as a means to increase productivity, but will only increase the provision of public transport if it is deemed to be justified by demand.

In the United Kingdom, Ireland, and Australia, goals for road investment reflect an increasing prioritisation of sustainable transport modes over private vehicle travel. Ireland has a goal of reducing driving mode share and containing the overall vehicle kilometres travelled as the population increases, implying a reduction in vehicle kilometres travelled per capita. Australia has goals to reduce road deaths and shift freight from road to rail. The United Kingdom's goal for roads is to maintain the current road network and to tackle problem areas on the road network. New Zealand, in contrast, has goals of directing funding towards motorway expansion through the Roads of National Significance programme.

Table 1:

Primary Transport Objectives by Country

COUNTRY	PRIMARY OBJECTIVES	ENVIRONMENTAL OBJECTIVES
New Zealand	• Economic growth and productivity • Road safety • Value for money	• Reduce greenhouse gas emissions from transport • Mitigate adverse environmental impacts
United Kingdom	• Boosting economic growth and opportunity • Building a One Nation Britain • Improving journeys • Safe, secure and sustainable transport	• Ensure transport plays its part in delivering climate change obligations • Delivery of the national air quality plan • International agreement for carbon emissions from international aviation
Ireland	• Reduce overall travel demand • Maximise the efficiency of the transport network • Reduce reliance on fossil fuels • Reduce transport emissions • Improve accessibility to transport	• A reduction on the 2005 figure for greenhouse gas emissions by 2020 • Reduce localised air pollutants
Australia (QLD)	• Meets the needs of all, now and into the future • Connects communities to employment and vital services • Efficient movement of people and freight to grow the economy • A cleaner, healthier and more liveable environment • Resilient to weather extremes	• Greenhouse gas emissions from transport decrease • Use of renewable fuel/energy sources increases • Emissions/spills from transport decrease • Resilience to the impacts of climate change and extreme weather events improves

Table 2:

Transport Objectives by Mode and Country

	WALKING AND CYCLING	PUBLIC TRANSPORT	ROADS
New Zealand	• Increased safe cycling through improvement of cycle networks.	• Increased provision of public transport to increase productivity, if justified by demand.	• Direct funding towards priority initiatives, particularly the Roads of National Significance.
United Kingdom	• Double the number of journeys made by bicycle by 2025. • Reduce the rate of cyclists killed or seriously injured • Reverse the decline in walking per person	• Improve access to public transport. • Improve journeys so that they are simpler, faster, cheaper, and more reliable.	• Tackle longstanding problems on road network. • Maintain and renew the strategic road network.
Ireland	• Cycling commuting to more than quadruple. • Cycling to increase from 2% to 10% of all trips by 2020.	• Public transport commuters to increase by 230,000 by 2020.	• Car commuting to reduce from 65% to 45% by 2020. • Total kilometres travelled by car not to increase significantly.
Australia (QLD)	• Cycling's share of commute trips doubles by 2021 and triples by 2031. • Improve the accessibility of active transport.	• Improve the accessibility of public transport. • Improve access to real-time transport information.	• Meet 'towards zero deaths on Queensland's Roads' targets. • Develop inland freight corridor and move freight from road to rail.

EU Action on Emission Reductions from Transport

In Europe, attempts at carbon emissions reductions in the transport sector have been guided by binding reduction targets and fuel efficiency standards at the EU level, as well as coordinated research and EU funded reduction programmes at a local level.

In 2011, the EU published a White Paper outlining reduction goals for transport and a roadmap for emissions reductions until 2050. The White Paper attempted to harmonise transport strategy across Europe and set a target to reduce transport GHG emissions by 60% by 2050 compared to 1990 levels and by around 20% by 2030 compared to emissions in 2008 (European Commission, 2016a).

In 2013, The European Commission introduced its Urban Mobility Package, which included financial support mechanisms for preparing *Sustainable Urban Mobility Plans* and research and innovation on sustainable urban mobility. Sustainable Urban Mobility Plans were intended to foster integration of transport modes and a shift towards sustainable transport modes through integrated land use and transport planning at a local level. They were also intended as a mechanism for sharing experiences and showcasing best practices across cities in Europe. By 2017, 526 cities in 28 countries had prepared Sustainable Urban Mobility Plans (Eltis, 2017). These plans are publicly available online, allowing for information sharing between urban areas.

In 2014, EU member states agreed to binding emissions reduction targets for 2020, 2030, and 2050 for the transport sector. These are 20%, 40%, and 60% reductions in carbon emissions relative to 1990 levels, respectively. Additionally, there is a long term non-binding goal of an 80% reduction in emissions from transport (see Figure 3).

The EU also sets mandatory emission efficiency targets for carbon emissions from passenger cars. The 2015 target was 130g of CO_2 per kilometre for new cars sold, which

was surpassed, with an average of 118g of CO_2 per kilometre for new cars sold in that year. There is also a 2020 target of 95g of CO_2 per kilometre, which represents a 40% reduction in emissions per kilometer compared to the 2007 new vehicle fleet average. Legislation mandating emissions reductions for vans was introduced in 2014. Vans must achieve 175g CO_2 per kilometre by 2017 and 147 grams of CO_2 per kilometre in 2020, which represents a 19% reduction relative to the 2012 average. Targets for heavy vehicles have not yet been adopted, but are under consideration (European Commission, 2016b).

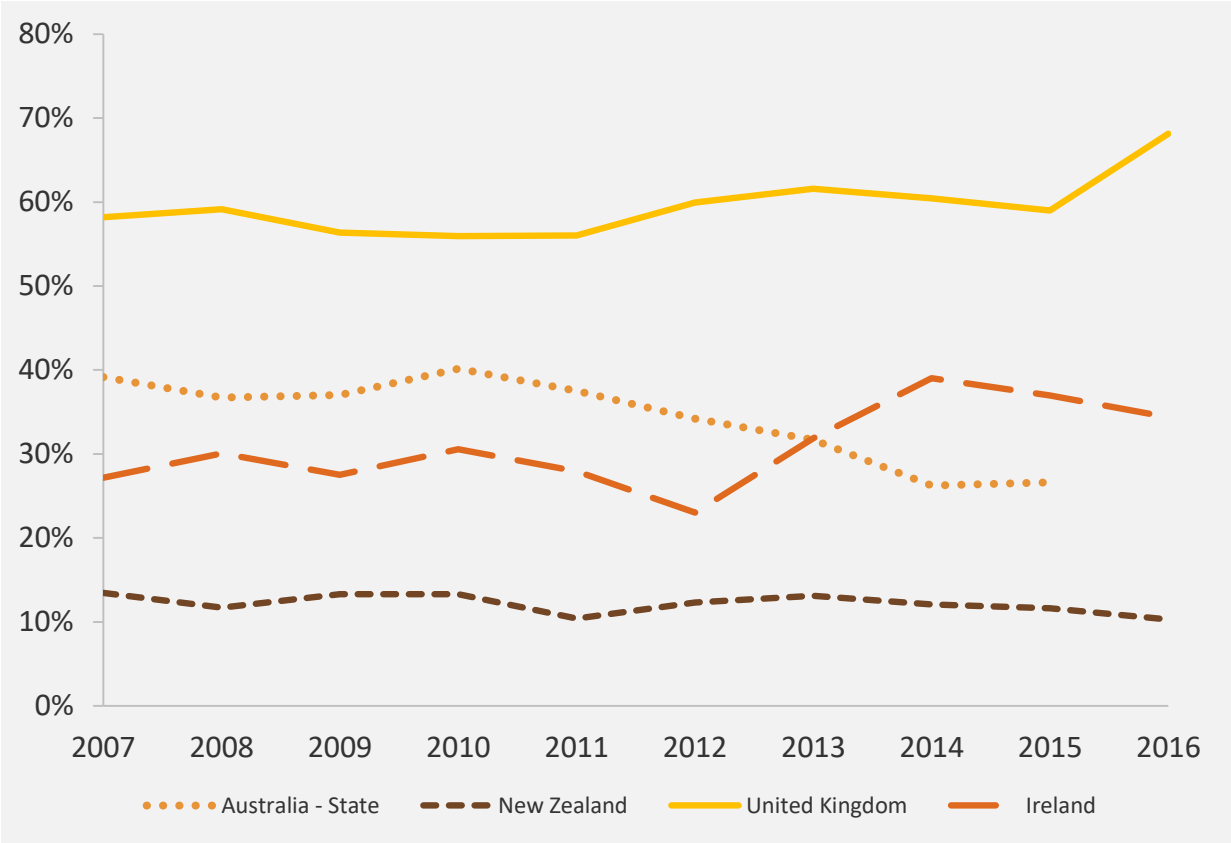
Transport Investment – Overview

A shift away from private vehicle travel towards walking, cycling, and public transport is an important component of achieving emission reductions from transport. For countries that have had historically high levels of roading investment and low levels of sustainable transport investment, this implies a need to increase the percentage of overall transport investment allocated to sustainable transport modes.

Figure 5 shows the percentage of central government land transport capital expenditure allocated to sustainable transport modes, defined as public transport, walking and cycling, and multi-modal transport projects, from 2007 to 2016. The United Kingdom has allocated the highest percentage to sustainable transport modes, and this figure has risen from 58% in 2007 to 68% in 2016.

Ireland has seen a modest increase in the proportion of funding allocated to sustainable modes while Australia (Queensland) has seen a modest decrease. New Zealand has spent by far the lowest percentage on sustainable transport modes, and this figure has dropped slightly from 13% in 2007 to 10% of land transport spending in 2016.

Figure 5:
Percent of Capital Expenditure on Sustainable Transport*



Measured in terms of US dollars per capita, New Zealand has also been spending least on sustainable transport, of the four countries considered (Figure 6), with the UK spending the most in recent years. However, New Zealand's relatively low income per capita does not explain the low spending, as spending on road investment in New Zealand is high in per capita terms (Figure 7).

*Defined as proportion of central government land transport capital expenditure. (In the case of Queensland, state land transport expenditure is the denominator.)

Figure 6:
National Capital Spending on Sustainable Transport (USD per capita)

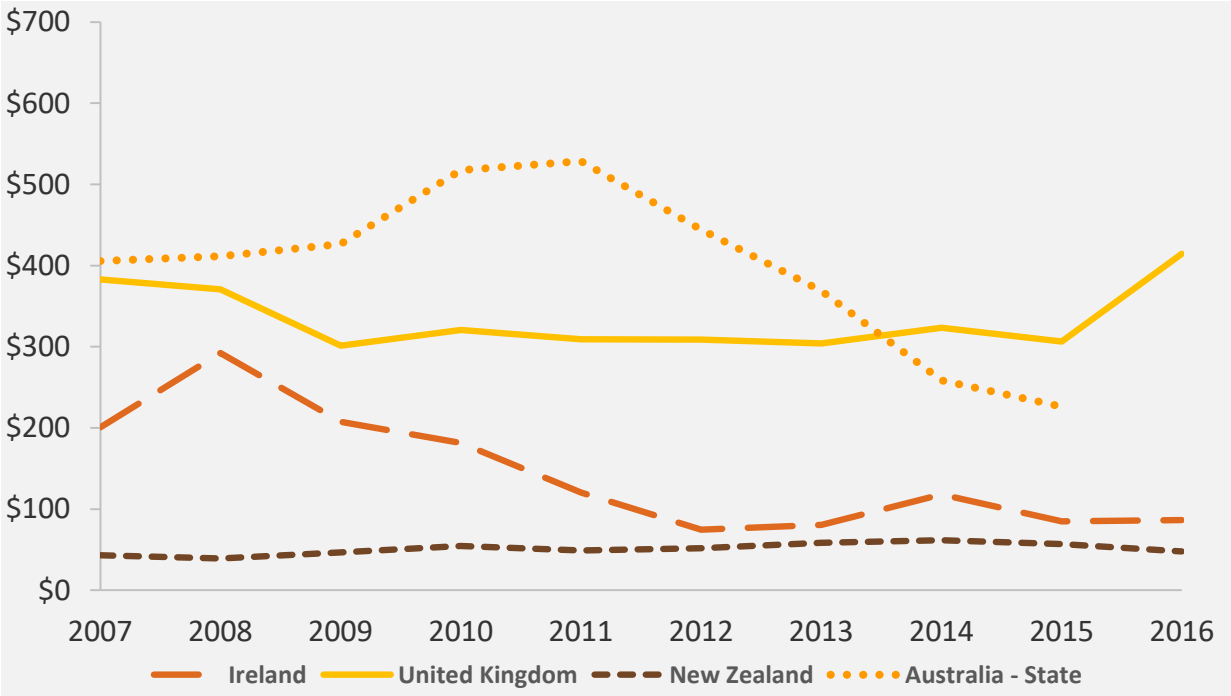


Figure 7:
National Capital Spending on Road Transport (USD per capita)

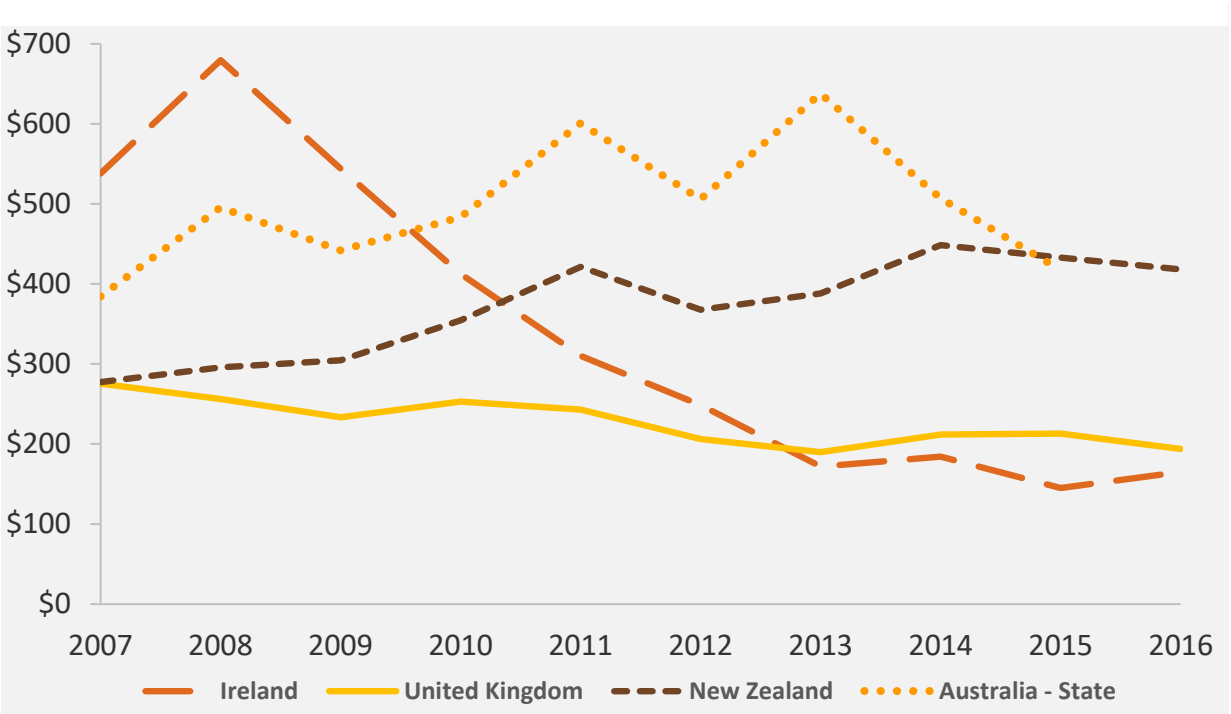


Figure 8:
Per Capita Spending on Active Transport (USD)

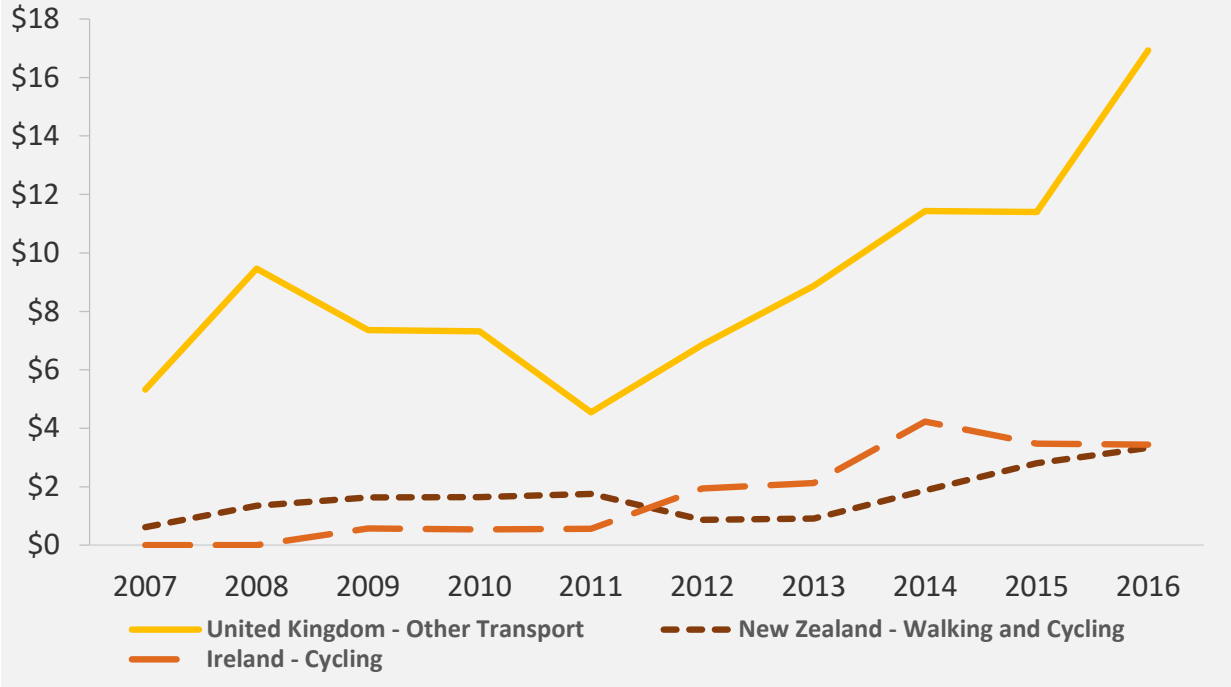
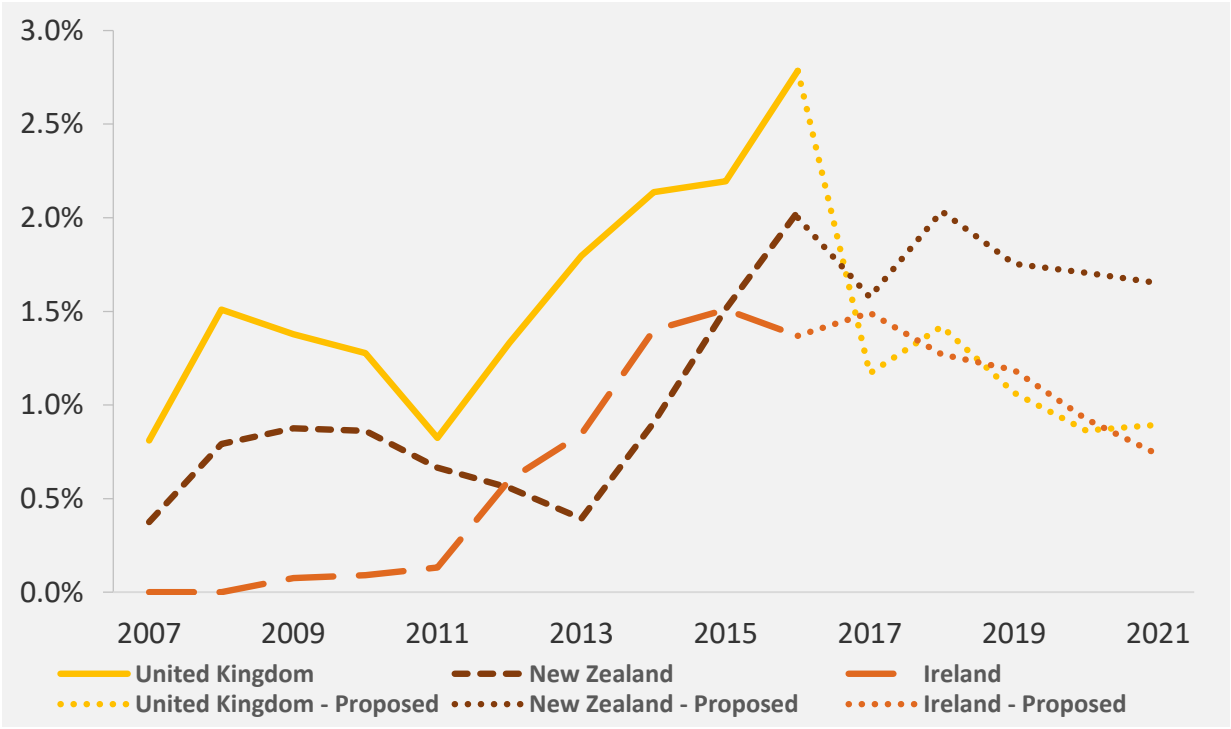


Figure 9:
Percent of Transport Expenditure Spent on Active Transport



Ireland

TRANSPORT STRATEGY AND POLICY

Ireland's recent transport strategy and spending has been significantly influenced by the global financial crisis from 2008. Prior to 2008, vehicle kilometres travelled and transport spending had experienced a consistent upward trend, and transport policy had focused on high cost motorway development. Recent policy has shifted towards reductions in transport spending and long term goals of reducing car travel and associated emissions (see Rau et al 2015). *Smarter Travel: A Sustainable Transport Future*, Ireland's overarching transport policy introduced in 2009, sets forth five strategic objectives for transport in Ireland: 1. reduce overall travel demand, 2. maximise the efficiency of the transport network, 3. reduce reliance on fossil fuels, 4. reduce transport emissions, and 5. improve accessibility to transport. The policy introduces specific goals for increases in cycling and public transport mode share and reductions in car travel, as well as improvements in the efficiency of motorised transport to reduce emissions (Table 2).

CARBON REDUCTION GOALS

Daly & Ó Gallachóir (2012) modelled potential carbon emissions reductions associated with Ireland's three extant policy measures for carbon reductions from transport: improving vehicle efficiency, switching fuel sources, and a flattening of vehicle kilometres travelled through modal shift and reduced travel demand. Flattening VKT through modal shift made the largest individual contribution to reducing emissions in 2030 (a 17.5% reduction) and all the measures combined resulted in a total reduction of 41.6% in 2030. This underlines that in order to achieve substantial reductions over a relatively short timeframe, a range of measures must be implemented simultaneously.

INVESTMENT FOR SUSTAINABLE TRANSPORT

Ireland's greenhouse gas emission reductions are currently guided by the Climate Action and Low Carbon Development Act 2015. The Act requires the creation of a national mitigation plan at least once every five years, with the overarching goal of an 80% reduction in emissions by 2050, relative to 1990 levels. Carbon reduction measures outlined in the National Mitigation Plan are intended to be iterative in nature. The first Draft National Mitigation Plan, released in March 2017, sets forth mitigation strategies for transport alongside electricity generation, energy use in buildings, and agriculture, forest, and land use.

With regard to transport, eight measures have been identified to reduce emissions and a further six measures are under consideration. Four of the eight measures are fuel efficiency standards required under EU legislation and do not require direct government spending. Two measures relate to low emission vehicle incentivisation and cost a combined €286 million per year. The last two measures are public transport investment and active travel investment, which cost €750 million and €15 million per year, respectively.

Ireland's Environmental Protection Agency produces yearly estimates of projected greenhouse gas emissions under two scenarios: *with existing measures* and *with additional measures*. In April 2017, Ireland's Environmental Protection Agency projected that transport emissions would *increase* by 12% in the period 2015 to 2020 under a business as usual scenario and would increase by 10% even if all government energy efficiency targets with regard to transport were met (Environmental Protection Agency, 2017). For the period 2020-2035, transport emissions are projected to increase by 11.3% under the existing measures scenario and an additional measures scenario has not been identified. Transport is projected to increase as a share of total emissions to 32% of all emissions by 2030. Collectively, funding allocated to emission reductions from transport represents 31% of the budget allocated to emissions reductions in all sectors (Department of

Communications, Climate Action and Environment, 2017). Ireland's transport emissions path is significantly off target as compared to EU targets for emissions from transport, which require member states to reduce emissions to 40% below 1990 levels by 2030.

INVESTMENT

In 2016, Ireland's overall spending on transport had dropped by 67% from its peak in 2008. This represents a reduction in per capita spending from $971 (USD) to $252 (USD) per year (Figures 6 and 7). While Ireland's transport planning documents emphasise a shift in focus away from road transport towards sustainable transport modes, an equivalent shift has not been seen in investment patterns (Figures 6 and 8). There has been a modest shift in the percentage of transport spending allocated to sustainable modes, from 27% of spending in 2007 to 33% in 2016 (Figure 5). The vast majority of this spending has been dedicated to public transport, with just 1.4% of central government transport funding allocated to cycling in 2016. (Figure 9). In 2016, the central government was responsible for 56.4% of transport spending and local governments were responsible for 43.6% of transport spending.

Following *Smarter Travel*, there has been a particular focus on increasing cycling for transport after decades of decline. The country's first National Cycle Policy Framework was introduced in 2009, and was intended to provide an integrated basis for the long term development and implementation of cycling policies. With regard to funding cycling improvements, there was initially a particular focus on the development of a national cycleway network, with €30 million in funding allocated for the development of an off-road network to encourage cycle tourism and recreational cycling (Manton el at 2010, Manton and Caulfield, 2017). Less funding and attention has been directed towards on-road cycle networks and cycling for transport (Swift, 2012). National funding has been made available for cycling and walking for transport through two funding programmes,

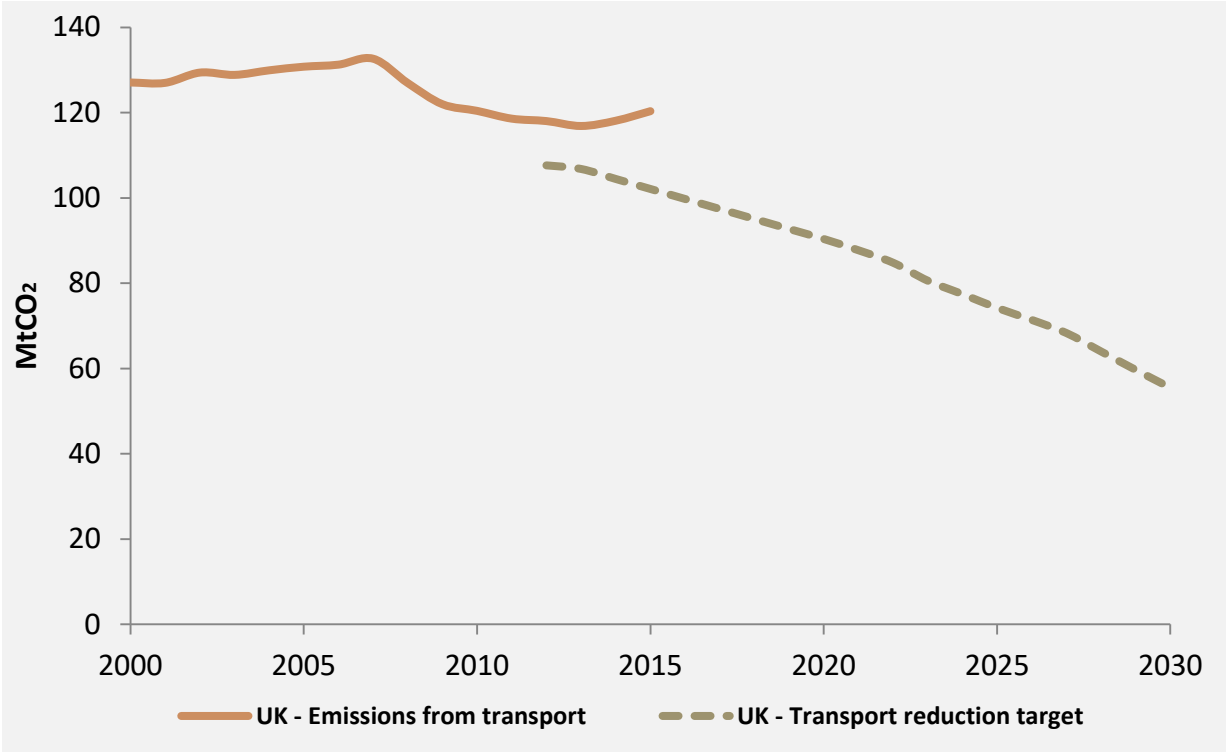
Smarter Travel Areas (2012-2016) and Sustainable Transport Measures Grants. Despite this increase in funding allocated to cycling, active transport investment still represented less than 1.5% of overall central government transport spending in 2016 (Figure 9). This represents a spending of around $3.45 (USD) per capita on cycling investments per year.

The United Kingdom

TRANSPORT STRATEGY AND POLICY

The governance of transport in the United Kingdom reflects the nation's multi-level government structure. The Department for Transport's *Single departmental plan 2015 to 2020* sets overall objectives for transport and outlines the country's infrastructure investment strategy. The *Single departmental plan* sets forth four strategic objectives for

Figure 10:
United Kingdom – Emissions from transport and reduction target

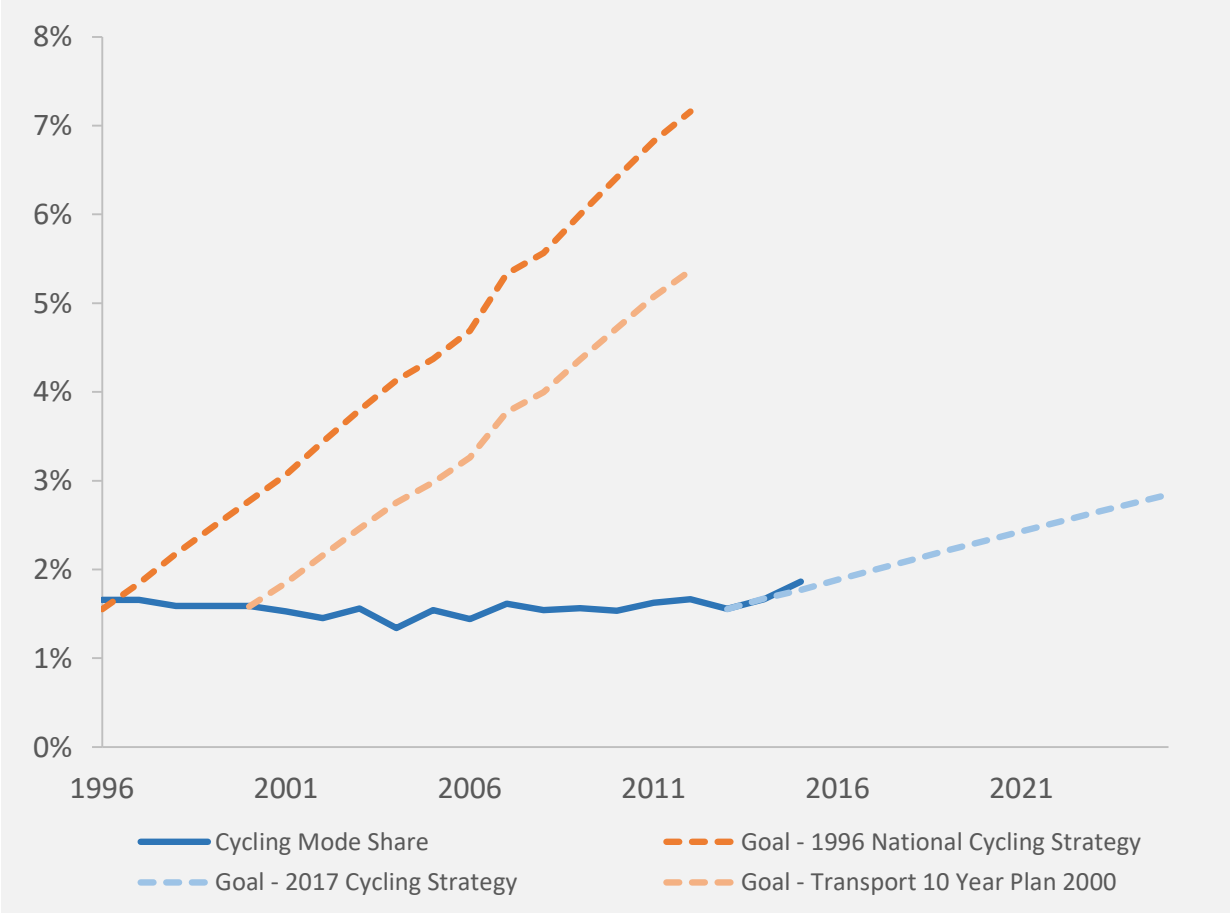


transport in the United Kingdom: 1. Boosting economic growth and opportunity 2. Building a One Nation Britain, 3. Improving journeys, and 4. Safe, secure and sustainable transport (Table 1). England and Scotland also publish their own transport strategies, which outline key objectives and include measures to reduce greenhouse gas emissions. Furthermore, there is also a significant amount of planning and decision-making at a sub-regional and local level. This multi-level system of governance often obscures the responsibilities for emission reductions (Marsden & Rye, 2010).

Great Britain's first cycling strategy was introduced in 1996, and had a goal of doubling the number of cycle trips by 2002 and quadrupling the number of cycling trips by 2012 (Figure 11). At the same time, £2 million in funding was dedicated to increase cycling at a local level in order to achieve this goal (Wardman, Hatfield, & Page, 1997). However, from 1996 to 2000, cycling mode share decreased further from 1.66% to 1.56% percent of trips. In 2000, this goal was amended to a trebling of cycling trips by 2012, relative to 1996. Although this represented a significant reduction in ambition after a four year period where cycling rates had decreased rather than increased, the *10 Year Transport Plan* stated that this was "an ambitious, but achievable objective" (Department of the Environment, Transport and the Regions, 2000). Significant increases in transport funding to local authorities were identified as the primary means to achieve increases in walking and cycling, although no portion of this funding was ring-fenced for cycling investment. Despite these successive goals to increase cycling, cycling as a percentage of all trips was the same in 2012 as it was in 1996, 1.66% of all trips, according to the National Travel Survey. Although the total number of cycling trips per year remained constant, the number of trips per capita decreased from 17 per person in 1996 to 15.7 per person in 2012.

In 2017, the United Kingdom introduced its first cycling strategy since 1996. The strategy set a goal of doubling the number of cycling trips made each year, from 800 million trips in 2013 to 1.6 billion stages in 2025 and reverse the decline in walking by 2020 (Figure 11). In response to this goal, the Committee on Climate Change estimated that a doubling in cycling rates could reduce overall emissions by 1%. However, the goal for increased cycling would not equate to a double in cycling rates, but instead relates to the number of trips. Because the average number of transport trips per person is expected to decrease and the population is projected to increase, this would not equate to a doubling in the percentage of trips made by bicycle or the annual number of bicycle trips per person. If this goal is achieved, the percentage of trips made by bicycle would increase from 1.55%

Figure 11:
United Kingdom – Cycling mode share and goals



in 2013 to 2.85% in 2025. This suggests that even if the current goal of doubling cycling trips is achieved, it would reduce overall emissions by less than 1%.

At the same time, a recent government meta-analysis of walking and cycling schemes funded through the Local Sustainable Transport Fund found that participating areas had greater reductions in traffic than comparable non-participating areas (Department for Transport, 2014). Although the impact of the schemes was not quantified, the walking and cycling schemes were given the highest rating in terms of value for money for transport investments.

CARBON REDUCTION GOALS

The United Kingdom was the first country to pass legislation for binding carbon emissions reductions. The Climate Change Act 2008 created a binding framework for an 80% reduction in emissions by 2050, relative to 1990. The Act requires the government to set emission limits for five year periods, referred to as carbon budgets, and annual progress reports on emission reductions must be submitted to Parliament by the Committee on Climate Change.

As part of a Department for Transport research programme, Hickman & Banister (2007) used a backcasting approach to estimate the options available for the UK to meet a 60% carbon emissions reduction in the transport sector by 2030. Aggressive goals for fuel efficiency were insufficient to reach the reduction goal, and a further 10% average reduction in car travel per person was necessary to meet the 60% reduction goal.

After the passage of the Climate Change Act, *Low Carbon Transport: A Greener Future* was published by the Department for Transport in 2009, to outline plans for carbon reductions in the transport sector. Specific reduction goals for the transport sector were

not identified and emphasis was placed on market mechanisms and encouraging low carbon choices.

The 2016 progress report by the Committee on Climate Change to Parliament estimated that domestic transport could contribute to 32% of total emission reductions from 2015 to 2030, and that transport emissions could be reduced from 120 $MtCO_2$ in 2015 to 55.5 $MtCO_2$ in 2030. Improved efficiency in cars, vans, and trucks accounted for 80% of this reduction, biofuels contributed 12%, reduced demand 5%, and other actions contributed 4% of reductions. The report acknowledged the lack of progress in decarbonizing the transport sector from 2008 to 2016, noting that transport emissions rose by 1.4% in 2015, and called for more aggressive policies. The report estimated that mode shift could result in a reduction of between 3 and 10% in emissions, with a central estimate of 5% (Committee on Climate Change, 2016). The Committee on Climate Change has also identified yearly goals for emission reductions from transport (Figure 10).

In 2011, the United Kingdom exceeded its goal for emissions from transport by 10% (Figure 10), and by 2015 it had exceeded its goal for emissions by 20%. This can be attributed to population growth, as well as a very modest reduction in emissions per capita due to increasing vehicle kilometres travelled. It also comes despite efficiency goals for transport being met or exceeded. In 2015, the UK surpassed its goal for energy efficiency in new light duty vehicles with average emissions of 121.4 g CO_2/km relative to a goal of 130 gCO_2/km. In 2015, electric vehicle sales were also well above a government target, at 28,342 relative to a goal of 10,425 (Committee on Climate Change, 2016).

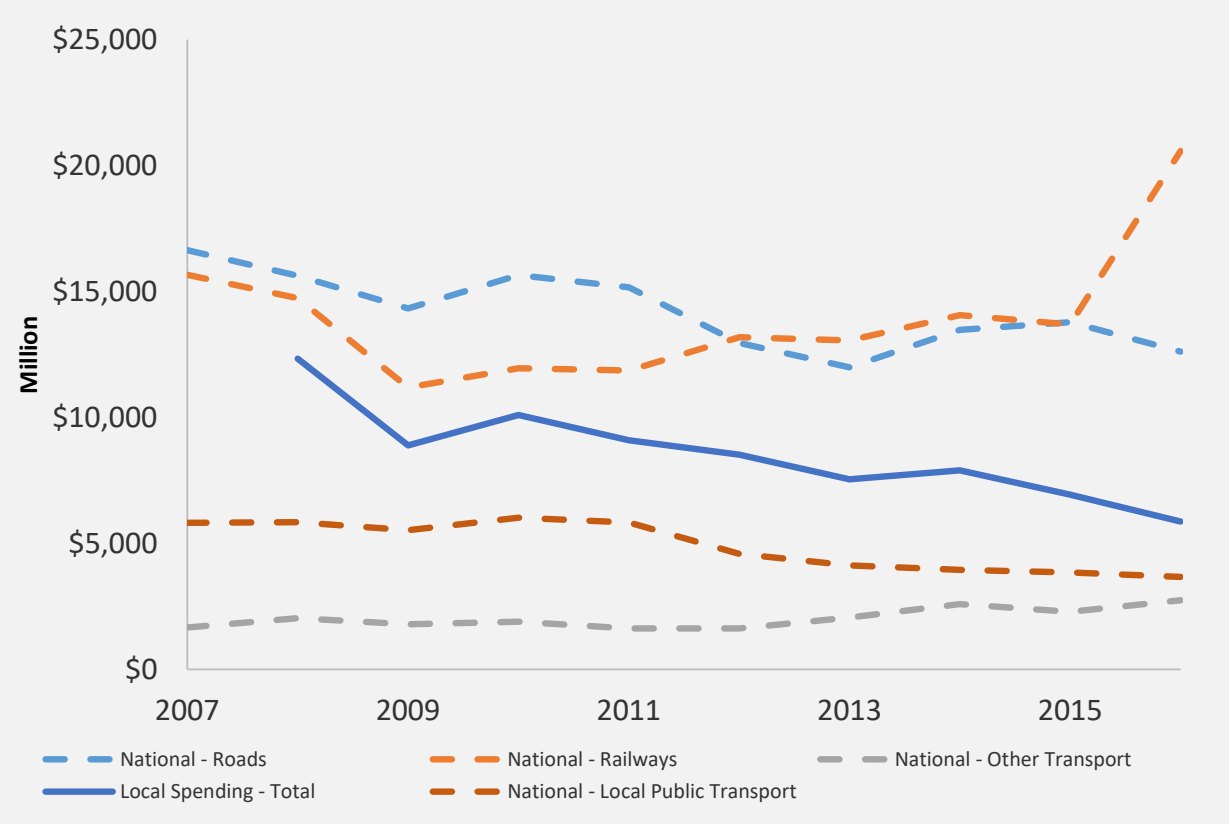
INVESTMENT

Of the four case study countries, the United Kingdom has spent the largest percentage of its transport spending on sustainable modes over the past decade (Figure 5). Conversely, from 2007 to 2016, road transport spending dropped from 42% to 32% of central

government transport spending. The majority of this spending on sustainable transport modes has been dedicated to the national railway system. In 2016, spending on national railways accounted for 76% of sustainable transport spending, while local public transport and other transport projects (including active transport and multi-modal projects) accounted for 14% and 10% of sustainable transport spending, respectively.

The central government is also the primary funder of transport investment in the UK, contributing 87% of overall transport spending in the country in 2016. This figure has gradually been increasing as local government spending on transport has decreased. Figure 12 shows local and national government transport spending in the United Kingdom from 2007 to 2016. From 2008 to 2016, local spending on transport decreased

Figure 12:
United Kingdom – Local and National Transport Spending



in absolute terms by 35%. While the central government has increased spending on national rail, local public transport investment has dropped by 7% from 2007 to 2016.

The UK's fund for walking and cycling schemes from 2017 to 2020 has two main objectives, economic growth and reducing carbon emissions. Despite goals to increase cycling, the amount of funding allocated to cycling for the period represents a significant decrease from previous years (Figure 9). It is not clear how this reduction will encourage cycling or emission reduction via mode switching. For 2021, less than 1% of the transport funding that has been allocated is allocated to active and multi-modal transport projects.

New Zealand

TRANSPORT STRATEGY AND POLICY

New Zealand's land transport strategy is articulated in the *Government Policy Statement on Land Transport*, which identifies objectives for transport and sets out projected transport maintenance and investment over a five-year period. *The Government Policy Statement* sets forth three strategic objectives for transport in New Zealand: 1. economic growth and productivity, 2. road safety, and 3. value for money.

CARBON REDUCTION GOALS

New Zealand has an unconditional target of a five percent greenhouse gas emission reduction by 2020 and a long-term target of a 50% reduction in emissions by 2050, both relative to 1990 levels. The country's principal approach to reducing greenhouse gas emissions is the New Zealand Emissions Trading Scheme, which was originally introduced in 2008 and is currently under review. From 2008 to 2014, net emissions increased by 19% and emissions from transport remained constant, making it clear that the Emissions

Trading Scheme as it has been configured has not been effective in achieving the desired emission reductions.

The New Zealand Government Policy Statement on Land Transport has a long term goal of mitigating "adverse environmental effects, including CO_2 emissions" (Ministry of Transport, 2017, p. 19). However, specific emissions reductions for the transport sector and pathways towards emission reductions have not been identified. The primary means by which the government intends to achieve reductions in the transport sector is the emissions trading scheme. While there is a requirement that the fuel economy of vehicles be displayed at their time of sale, there are no standards regarding vehicle fuel efficiency. Similarly, there are no goals with regard to alternative fuel sources. The Government does have a goal of an electric vehicle fleet of 64,000 by 2021, and has committed $7 million per year to encourage electric vehicle uptake. If this goal is achieved, electric vehicles would constitute about 2% of the light passenger vehicle fleet in 2021.

INVESTMENT

Figures 13 and 14 show New Zealand's central government transport spending over the past decade, and proposed spending from 2017 to 2021. Over the past decade, road transport spending has increased, both on an absolute basis and as a percentage of overall spending. By contrast, public transport spending has decreased as a percentage of overall spending, from 13% in 2007 to 9% in 2016, and remained constant in absolute terms. Walking and cycling funding has increased from negligible spending in 2007 to just under 2% of all transport spending, or $3.45 per capita in 2017 (Figures 8 and 9). Although cycling expenditure has increased, the percentage of transport funding allocated to sustainable modes has decreased from 13.3% in 2007 to 10.3% in 2016 due to reductions in public transport spending (Figure 5).

Figure 15 contrasts central government and local government transport spending from 2007 to 2016. Central and local governments have contributed roughly equal amounts into public transport, walking, and cycling, while the central government is the primary investor in the road network. While local government spending across modes has remained roughly constant over the past decade, central government has significantly increased per capita spending on road transport, from $377 per capita in 2007 to $600 in 2016. Recent transport spending patterns are projected to continue to 2021, according to the *Government Policy Statement on Land Transport* released in 2017. Using the midpoint in spending levels, roads are expected to account for 87% of land transport investment, while public transport and cycling are allocated 12% and 2% of funding, respectively, over the 2017-2021 investment period.

Figure 13:
Modal Allocation of NZ Central Government Transport Spending (%)

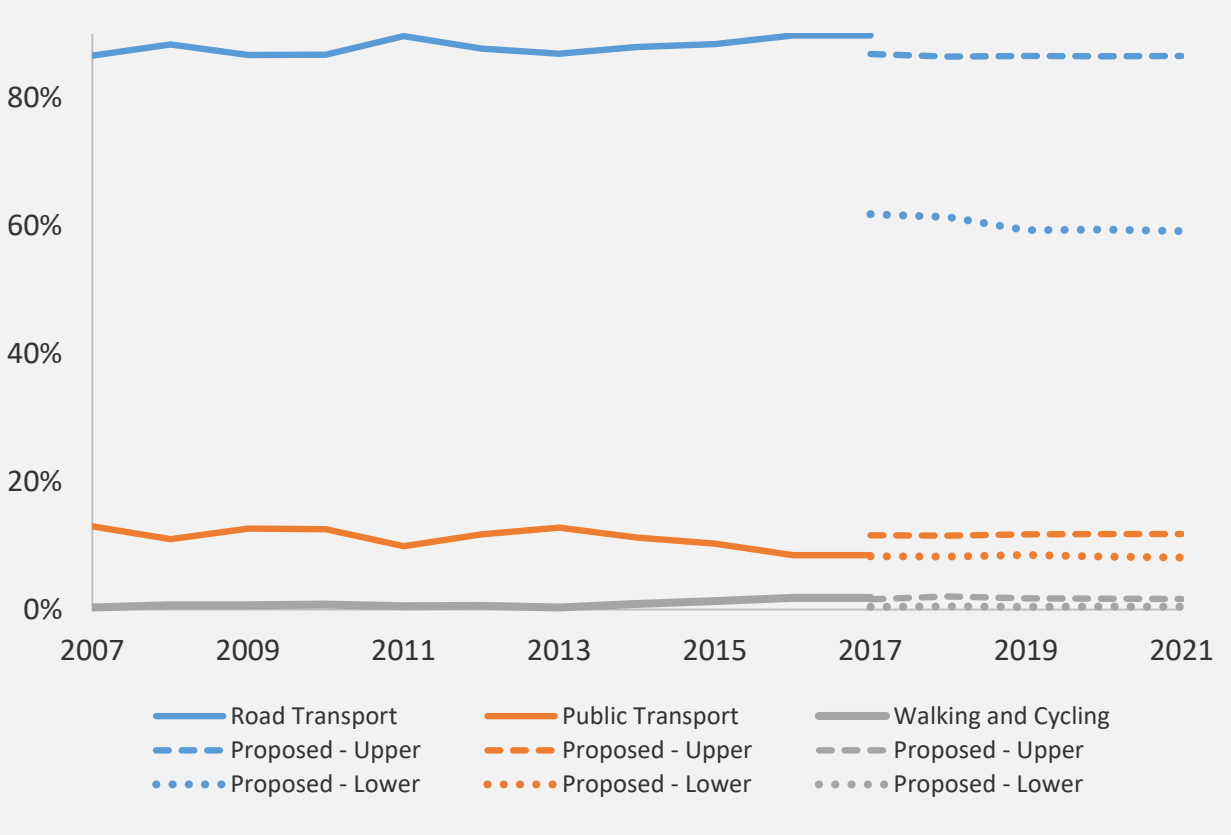


Figure 14:
New Zealand Central Government Transport Spending ($)

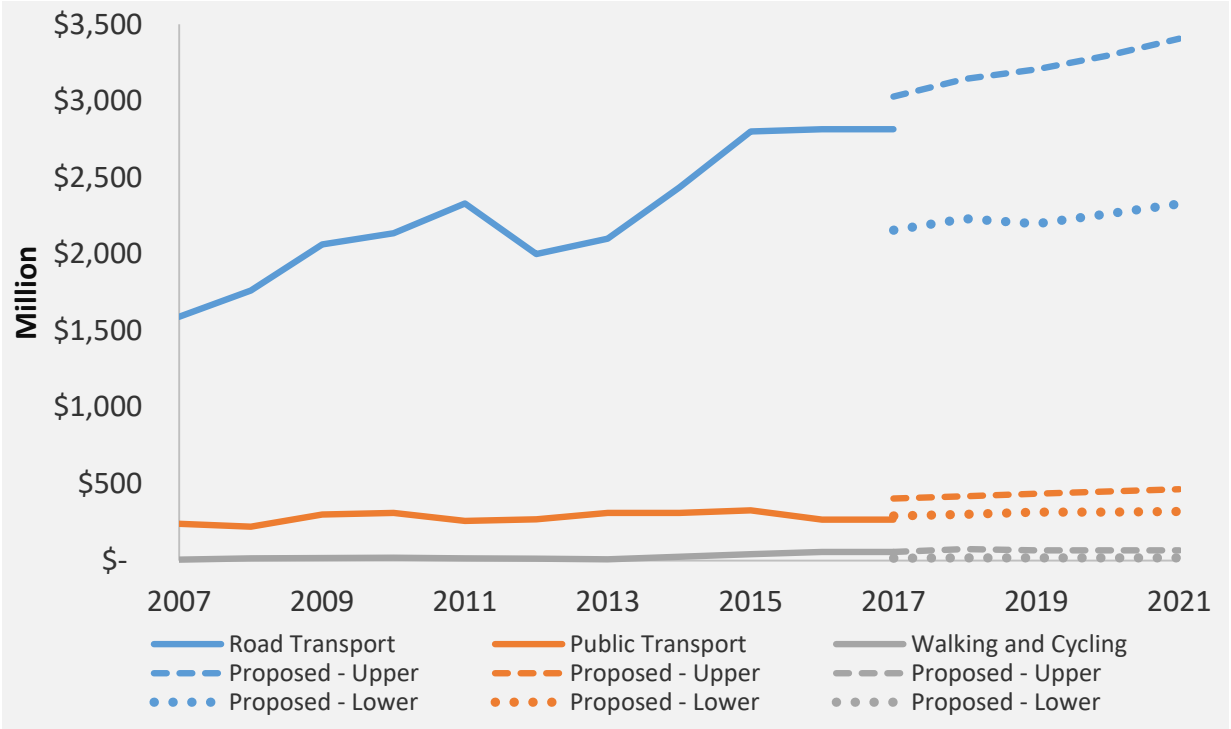
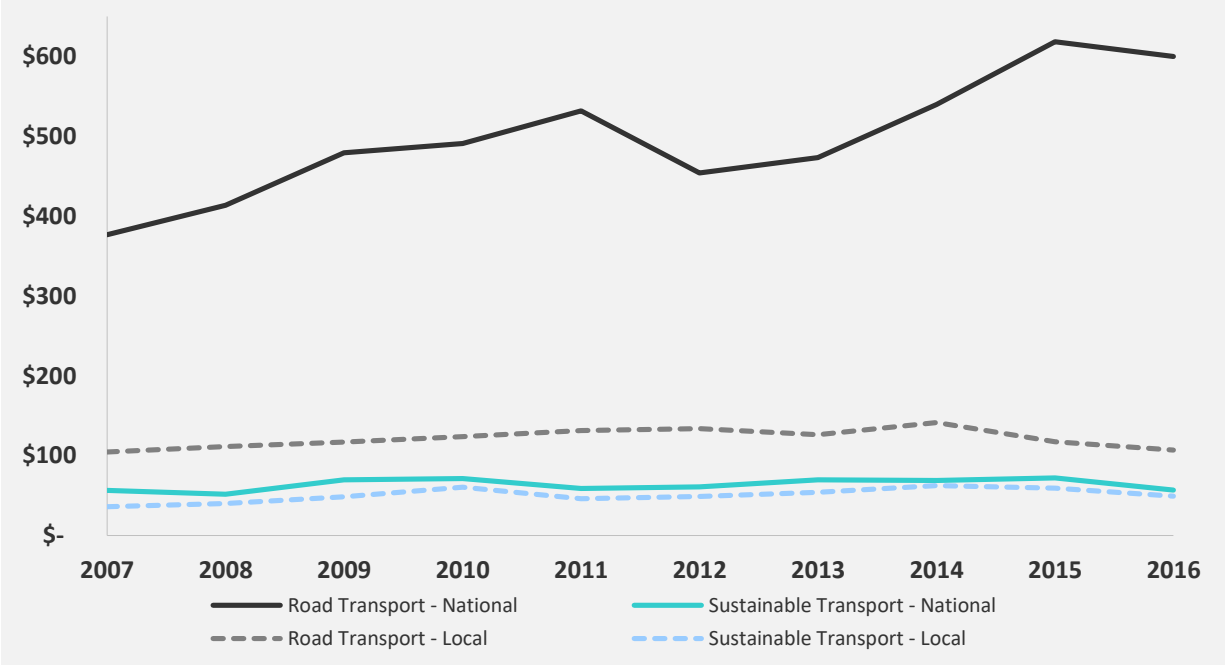


Figure 15:
New Zealand per capita Local and National Transport Spending (USD)



Discussion and Conclusion

Transport provides a significant challenge for countries seeking to reduce their carbon emissions. It is a primary driver of overall emissions on a national level, and has proved to be the hardest sector from which to cut carbon emissions. Furthermore, reductions may be complicated by allocation issues across multi-level governance structures (Marsden & Rye, 2010).

Although responsibility for transport may be spread across multiple layers of government, central governments are responsible for setting overall national emission reduction goals and have a significant role to play in setting the strategic agenda for emission reductions from transport. For emission reduction goals to be achieved, these should be clearly articulated and be accompanied by pathways to achieve those reductions in central government transport strategy. Allocation of funding to transport modes should also be consistent with a country's strategic vision for the transport sector, desired social outcomes, and identified greenhouse gas emissions reductions.

A review of transport strategy in the four case study countries suggests that emission reduction goals are often not clearly articulated, explicit pathways towards achieving emissions reductions goals are often not identified, and goals are not reflected in transport investment regimes. Moreover, national transport strategies usually give priority to economic growth or economic efficiency rather than the environment, and have a short time span of usually 5 or 10 years, whereas substantial emission reductions may require a time period of 20 to 30 years. Longer-term strategies for investment and emission reductions are desirable to achieve substantial emission reductions. Moreover, longer term reductions align better with the time span for urban form policies (Chapman et al., 2017).

Of the four case study countries, only the United Kingdom has been able to reduce transport emissions to below 1990 levels, demonstrating that action to date has generally been insufficient to achieve the desired emission reductions in 2020 and requires rethinking for the longer term. Recent experience in the United Kingdom suggests that energy efficiency gains alone are insufficient to achieve substantial emission reductions. While fuel efficiency targets have been achieved and exceeded, emission reductions are not on track, due to factors such as increases in vehicle kilometres travelled. Although the UK has had the most success of the four case study countries, achieving 2020 and longer-term emission reductions is likely to prove to be a challenge.

Actions in the UK and Ireland have largely focused on energy efficiency improvements and alternative fuel sources, guided by goals that have been set at an EU level. There has been much less success in reducing travel demand and mode shifts away from car travel, which can also play a significant role in reducing emissions. Both the UK and Ireland have identified cycling as a means of achieving modest emission reductions and other desirable outcomes in their transport strategy. Although funding for cycling has increased dramatically over the past decade, it still represents a small fraction of overall spending and is likely to be insufficient to achieve goals for increased cycling.

Ireland provides a useful case study of the integration of environmental goals into transport strategy. The country has identified specific and time bound goals for carbon emissions reductions from transport and modal shift away from car travel towards sustainable modes. However these goals have not always been reflected in central government transport spending, which is impeding efforts to reduce emissions.

In contrast to the other case study countries, New Zealand has done little to identify emission reduction targets or measures for the transport sector. This is evidenced by first, the lack of an emissions reduction goal for the transport sector or a pathway to

achieve emissions reductions from transport; second, by the absence of fuel efficiency standards; and third, no evidence of a shift away from car travel towards sustainable modes in investment strategy or central government policy.

Substantial emission reductions from the transport sector are possible but would require. at the minimum, vehicle efficiency improvements, alternative fuel sources and modal shift from driving towards public transport, walking, and cycling. There are many possible intervention pathways to achieve a transition towards sustainable urban mobility, and the suite of policies needed may vary between countries or even between local urban areas. These include changes in transport goals and evaluation frameworks, changes in the pricing of transport so that it reflects externalised costs and benefits, and changes in investment and planning regimes in order to enable transitions towards sustainable transport modes. The European experience with Sustainable Urban Mobility Plans provides examples of local implementation of positive urban form[3] and transport planning.

This paper has focused on the role of central government in setting transport strategy and investment regimes. If transport is to play its part in the achievement of national emission reduction targets, a change in course is needed in all four countries, as all are off track with regard to emission reductions from transport. In New Zealand, Ireland and Australia, as Figure 3 makes clear, the change in course will need to be dramatic.

[3] Urban form strategies complement transport strategies and are discussed for the New Zealand context in Chapman, R., Dodge, N., Whitwell, K., Reid, P., Holmes, F., Severinsen, C., . . . Sobiecki, L. (2017). Why and how New Zealand cities could become more compact and sustainable. In P. Howden-Chapman, L. Early & J. Ombler (Eds.), *Cities in New Zealand: preferences, patterns and possibilities.* Wellington: Steele Roberts Aotearoa.

References

Banister, D. (2008). "The sustainable mobility paradigm." Transport Policy, **15**(2): 73-80.

Carruthers, J. I. and G. F. Ulfarsson (2003). "Urban sprawl and the cost of public services." Environment and Planning B 30(4): 503-522.

Chapman, R. (2008). "Transitioning to low-carbon urban form and transport in New Zealand". Political Science **60** (June): 89-98.

Chapman, R., N, Dodge, K. Whitwell, P. Reid, F. Holmes, C. Severinsen, . . .L. Sobiecki, (2017). "Why and how New Zealand cities could become more compact and sustainable." In P. Howden-Chapman, L. Early & J. Ombler (Eds.), *Cities in New Zealand: preferences, patterns and possibilities*. Wellington: Steele Roberts Aotearoa.

Chapman, R., P. Howden-Chapman, K. Whitwell and A. Thomas (2017). "Towards zero carbon? Constrained policy ambition in two New Zealand cities." Australasian Journal of Environmental Management **24**(2): 97-116.

Committee on Climate Change. (2016). *Meeting Carbon Budgets - 2016 Progress Report to Parliament*. London, UK: Committee on Climate Change. Retrieved from https://www.theccc.org.uk/publication/meeting-carbon-budgets-2016-progress-report-to-parliament/

Daly, H. E., & Ó Gallachóir, B. P. (2012). Future energy and emissions policy scenarios in Ireland for private car transport. Energy Policy, 51, 172–183. https://doi.org/10.1016/j.enpol.2012.08.066

Department of Communications, Climate Action and Environment. (2017). *Draft National Mitigation Plan*. Dublin, Ireland: Department of Communications, Climate Action and Environment. Retrieved from http://www.dccae.gov.ie/en-ie/climate-action/consultations/Documents/4/consultations/DCCAE-National-Mitigation-Plan-Mar17.pdf

Department of Infrastructure, Local Government and Planning. (2016). *State Infrastructure Plan*. Queensland Government. Retrieved from http://www.dilgp.qld.gov.au/infrastructure/state-infrastructure-plan.html

Department of Transport and Main Roads. (2016). *Transport Coordination Plan 2016-2026*. Queensland Government. Retrieved from

https://www.tmr.qld.gov.au/About-us/Corporate-information/Publications/Transport-Coordination-Plan

Department of Transport, Tourism and Sport (2009). Smarter travel: a sustainable transport future. Dublin, Ireland. Department of Transport, Tourism and Sport. Retrieved from http://www.smartertravel.ie/

Department of Transport, Tourism and Sport. (2015). *Investing in our transport future: A strategic framework for investment in land transport*. Dublin, Ireland. Retrieved from http://www.dttas.ie/sites/default/files/publications/corporate/english/public-consultation-investing-our-transport-future/consultation-sfilt-investing-our-transport-future-steering-group-report.pdf

Department of the Environment, Transport and the Regions. (2000). *Transport Ten Year Plan 2000*. London, UK: Department of the Environment, Transport and the Regions.

Department for Transport. (2016). *Single departmental plan 2015 to 2020*. London, UK: Department for Transport. Retrieved from https://www.gov.uk/government/publications/dft-single-departmental-plan-2015-to-2020

Department for Transport. (2014). V*alue for Money Assessment for the Local Sustainable Transport Fund.* London, UK: Department for Transport.

Department for Transport. (2016, July 28). Transport analysis guidance: WebTAG - GOV. UK. Retrieved January 9, 2017, from https://www.gov.uk/guidance/transport-analysis-guidance-webtag

Department for Transport. (2017). *Draft cycling and walking investment strategy*. London, UK: Department for Transport. Retrieved from https://www.gov.uk/government/consultations/draft-cycling-and-walking-investment-strategy

Eltis. (2017, May 16). City database. Retrieved May 17, 2017, from http://www.eltis.org/mobility-plans/city-database

Dill, J. (2009). Bicycling for Transportation and Health: The Role of Infrastructure. Journal of Public Health Policy, 30(1), S95–S110. https://doi.org/10.1057/jphp.2008.56

European Commission. (2016a). *The implementation of the 2011 White Paper on Transport "Roadmap to a Single European Transport Area – towards a competitive and*

resource-efficient transport system" five years after its publication: achievements and challenges (No. SWD(2016) 226). Brussels, Belgium: European Commission. Retrieved from https://ec.europa.eu/transport/sites/transport/files/themes/strategies/doc/2011_white_paper/swd%282016%29226.pdf

European Commission. (2016b, November 23). Reducing CO2 emissions from vehicles [Text]. Retrieved May 17, 2017, from https://ec.europa.eu/clima/policies/transport/vehicles/vans_en

Frank, L. D., Sallis, J. F., Conway, T. L., Chapman, J. E., Saelens, B. E., & Bachman, W. (2006). Many pathways from land use to health: associations between neighborhood walkability and active transportation, body mass index, and air quality. Journal of the American Planning Association, 72(1), 75-87.

Haines, A., McMichael, A. J., Smith, K. R., Roberts, I., Woodcock, J., Markandya, A., . . . Wilkinson, P. (2009). "Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers." The Lancet, **374**(9707), 2104-2114.

Hickman, R., Ashiru, O., & Banister, D. (2011). Transitions to low carbon transport futures: strategic conversations from London and Delhi. Journal of Transport Geography, 19(6), 1553-1562.

Hickman, R., Hall, P., & Banister, D. (2013). Planning more for sustainable mobility. Journal of Transport Geography, 33, 210-219.

Hickman, R., & Banister, D. (2007). Looking over the horizon: Transport and reduced CO2 emissions in the UK by 2030. Transport Policy, *14*(5), 377–387. https://doi.org/10.1016/j.tranpol.2007.04.005

International Transport Forum. (2015). *Transport Greenhouse Gas Emissions: Country Data 2010* (Text). 2011. Retrieved from http://www.itf-oecd.org/transport-greenhouse-gas-emissions-country-data-2010

Manton, R. (2016). Spokes or strokes? Clientelism and cycling funding in Ireland. Irish Political Studies, 31(4), 443–460. https://doi.org/10.1080/07907184.2016.1141766

Manton, R., & Caulfield, B. Smarter Travel: An interim evaluation of Ireland's sustainable transport policy. UTSG paper. Retrieved November 30, 2017, from https://www.researchgate.net/profile/Richard_Manton/publication/312176074_

Smarter_Travel_An_interim_evaluation_of_Ireland%27s_sustainable_transport_policy/links/5874ce5708ae6eb871c971f9/Smarter-Travel-An-interim-evaluation-of-Irelands-sustainable-transport-policy.pdf

Marsden, G., & Rye, T. (2010). The governance of transport and climate change. Journal of Transport Geography, 18(6), 669–678. https://doi.org/10.1016/j.jtrangeo.2009.09.014

Ministry for the Environment. (2015). *New Zealand's Greenhouse Gas Inventory 1990–2014*. Wellington, New Zealand: Ministry for the Environment.

Ministry of Transport. (2015). *Statement of Intent 2015 -2019*. Wellington, New Zealand: Ministry of Transport. Retrieved from http://www.transport.govt.nz/assets/Uploads/About/Documents/statement-of-intent-2015-2019.pdf

Ministry of Transport. (2017, February). Draft Government Policy Statement on Land Transport 2018/19 - 2027/28. New Zealand Government. Retrieved from http://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/MOT-GPS-2018-web.pdf

New Zealand Transport Agency. (2016). *Economic Evaluation Manual*. Wellington, New Zealand: New Zealand Transport Agency. Retrieved May 17, 2017,

OECD. (2010). *Reducing Transport Greenhouse Gas Emissions: Trends and Data*. Leipzig, Germany: OECD International Transport Forum. Retrieved from http://www.internationaltransportforum.org/Pub/pdf/10GHGTrends.pdf

Pucher, J., & Buehler, R. (2016). Safer Cycling Through Improved Infrastructure. American Journal of Public Health, 106(12), 2089-2091

Rau, H., & Vega, A. (2012). Spatial (im)mobility and accessibility in Ireland: Implications for transport policy. Growth and Change, 43(4), 667-696.

Sims, R., Schaeffer, R., Creutzig, F., Cruz-Núñez, X., D'Agosto, M., Dimitriu, D., . . . Tiwari, G. (2014). Chapter 8 - Transport. In O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler & colleagues. (Eds.), *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge, UK and New York NY, USA: Cambridge University Press.

Swift, C. (2012) No room for manoeuvre: An analysis of factors impacting participation of cycling lobby groups in decision making on planning, Undergraduate Dissertation, School of Political Science & Sociology, NUI Galway.

Upham, P., Kivimaa, P., & Virkamäki, V. (2013). Path dependence and technological expectations in transport policy: the case of Finland and the UK. Journal of Transport Geography, 32, 12–22. https://doi.org/10.1016/j.jtrangeo.2013.08.004

Wardman, M., Hatfield, R., & Page, M. (1997). The UK national cycling strategy: can improved facilities meet the targets? Transport Policy, 4(2), 123–133. https://doi.org/10.1016/S0967-070X(97)00011-5

Woodcock, J., Edwards, P., Tonne, C., Armstrong, B. G., Ashiru, O., Banister, D., . . . Roberts, I. (2009). "Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport (Health and Climate Change 2)". The Lancet **374** (5 December).