



Rialtas na hÉireann
Government of Ireland

Five Cities Demand Management Study

Recommendations Report
Phase Two Updates
November 2021





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SYSTRA

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Foreword



The development of the Five Cities Demand Management Study is a result of the urgent requirement to reduce transport-related greenhouse gas emissions and address rising concerns in relation to air quality. Transport accounts for approximately 20% of Ireland's greenhouse gas (GHG) emissions. Road transport is responsible for 96% of those GHG emissions and is also directly responsible for a range of air pollutants that negatively impact both human health and the environment. This Study reflects the 2021 Climate Action Plan, which targets a reduction of 42-50% in transport related GHG emissions by 2030.

In addition, the Study reflects the need to manage the impacts of urban congestion and improve the quality of life for people living, visiting, working and studying in our cities.

Taking decisive and rapid action to address these issues will be a major challenge, but the benefits for our cities' residents and visitors and our climate policy are huge – cleaner air, a sustainable use of the world's scarce resources, more connected and healthier communities and liveable vibrant cities.

This Study provides a focused and evidence-based approach to addressing the carbon, congestion and air quality challenges facing our cities – using insight from an extensive international best practice review, national and local stakeholder engagement and supported by detailed qualitative and quantitative appraisal. It reflects the importance of building momentum to ensure the accelerated implementation of Transport Demand Management measures in order to deliver the 2021 Climate Action Plan targets.

Minister Eamon Ryan
Minister for Transport



Five Cities Demand Management Study

Introduction

1

Introduction

The City Challenges

Addressing the Challenges

The Demand Management
Study - The Policy Context

This Study provides a focused and evidence-based approach to addressing the carbon, congestion and air quality challenges facing our cities

City Challenges

Decarbonisation

Climate disruption is already having diverse and wide ranging impacts on Ireland's environment, society, economic and natural resources. The accelerating impact of greenhouse gas emissions on climate disruption must be arrested, with the need for the transport sector to chart a course towards the delivery of ambitious decarbonisation targets more important than ever.

By 2040 the population of Ireland is expected to grow by over 1 million to 5.7 million people. This growth, along with other National Planning Framework (NPF) growth projections on the economy and employment rates, will drive greater demand for transport across various modes, with increased movement of people and goods. While this is a sign of a vibrant economy, it intensifies our decarbonisation challenge.¹

Transport was responsible for 20.4% of Ireland's greenhouse gas emissions in 2019² and was second only to agriculture in terms of emission share by sector³. Road transport accounted for the majority of these emissions, with private cars accounting for 54% in 2020, Heavy Goods Vehicles (HGVs) for 20%, Light Goods Vehicles (LGVs) for 18%, and public and private buses accounting for 7% of emissions.

In 2015, Ireland, as a member state of the European Union, became a signatory of the Paris Agreement which aims to limit global warming to below 2 degrees centigrade above pre-industrial levels and to limit the temperature increase to 1.5 degrees. To contribute to the achievement of this, Ireland is required to deliver a 30% reduction (relative to 2005 levels) in greenhouse gas emissions by 2030.

In 2021, the European Commission published its Fit for 55 Package⁴ to enable the EU to meet those targets and achieve net zero by 2050. The Fit for 55 Package encompasses a suite of legislative initiatives across various sectors, including energy, transport and buildings, which is intended to fundamentally overhaul the EU's climate policy framework and put the EU on track to deliver on its 2030 climate target of 55%.

The Climate Act 2021 embeds the process of setting binding and ambitious emissions-reductions into law, in order to achieve the targets required for Ireland to adhere to the Paris Agreement.

The Climate Action Plan 2021⁵ sets out an ambitious course of action for the transport sector, with a significant greenhouse gas emissions reduction target of 42-50% by 2030. Car travel will need to be reduced by at least 500,000 journeys a day by 2030, which will require significant modal shift from car to public transport and active travel, with half a million more daily journeys to be completed by either walking, cycling or on public transport by 2030. It will also require a significant uptake of electric vehicles (with the aim to have almost one million electric vehicles in operation in Ireland by 2030), increasing rail and bus electrification (including 1,500 electric buses) and increasing the biofuels mix to reduce emissions from the existing fleet.



1 <https://www.dccae.gov.ie/documents/Climate%20Action%20Plan%202019.pdf>

2 <https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-provisional-greenhouse-gas-emissions-1990-2020.php>

3 <https://www.epa.ie/ghg/currentsituation/>

4 https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

5 <https://www.gov.ie/en/press-release/16421-climate-action-plan-2021-securing-our-future/>

City Challenges

Air Pollution

In addition to the urgent requirement to tackle climate change, there is also a need to address growing concerns in relation to air quality and public health in urban areas. Air pollution emitted from transport contributes to poor local air quality, in the form of increased micro-particulates and nitrogen dioxide (NO_x), which reduces people's quality of life and harms their health.

The World Health Organisation has described air pollution as the 'biggest single environmental health risk' and estimates there are 4.2 million premature deaths worldwide as a result of ambient air pollution and 400,000 within Europe. In Ireland, the EPA have estimated that the number of premature deaths attributable to air pollution is around 1,300 per annum⁶. In comparison, there were 148 fatalities on Irish Roads in 2020.⁷

The European Union has taken progressive steps to address growing concerns relating to air quality. This includes the 'Clean Air Policy Package' launched in 2013 which set compliance limits and targets for 2020 and 2030 and the more recent 2018 communication 'A Europe that protects: clean air for all' that provides national, regional and local actors with practical help to improve air quality in Europe⁸.

Whilst air quality in Irish cities is generally good in comparison to many other member states and cities, there are worrying localised issues.

A report published by the Environmental Protection Agency (EPA)⁹ in 2019 showed high levels of Nitrogen Dioxide (NO₂) within Dublin city centre, at the entrance to the Port Tunnel and along the M50 motorway. There are many areas where the levels of NO₂ have the potential to be elevated under certain meteorological conditions, e.g. on certain Dublin streets, the M50 motorway or at the entrance and exit to the Dublin Tunnel. Elevated levels can be problematic in locations where there is pedestrian access or fixed habitation.

In September 2020, the EPA¹⁰ reported that there was an exceedance of the annual average nitrogen dioxide (NO₂) EU limit value at one traffic monitoring location in Dublin city centre (St John's Road West). The report also shows that, in urban areas, the impact of traffic related nitrogen dioxide pollution is increasing - with the EPA highlighting that these types of exceedances will continue unless we curb our reliance on fossil fuel powered transport, particularly diesel cars. The four Dublin local authorities are currently preparing a legally required air quality action plan in response to the exceedance at St John's Road West. This action plan will set out measures which the local authorities and other stakeholders such as the NTA and TII will take to curb air pollution in the Greater Dublin Area. Demand management measures are likely to play an important role in the action plan.

While there haven't been any other confirmed exceedances in Ireland, the EPA previously noted potential future exceedances of air quality on the Lower Glanmire Road and MacCurtain Street in Cork. The EPA is currently working with local authorities to identify suitable locations to site monitoring stations in Galway and Limerick. Without any interventions, we will likely see more exceedances in future.

There are also potential exceedances of air quality noted by the EPA on the Lower Glanmire Road and MacCurtain Street in Cork. The EPA are currently working with local authorities to identify suitable locations to site monitoring stations in Galway and Limerick.

NO_x is associated with high level of traffic emissions and can be harmful to the human respiratory system particularly for those with existing conditions such as asthma¹¹ and may impact the lung development of children¹².

6 <https://www.epa.ie/irelandsenvironment/air/>

7 <https://rsa.ie/RSA/Road-Safety/RSA-Statistics/Deaths-injuries-on-Irish-roads/#:~:text=In%20the%20period%20January%20%2D%20December,the%20full%20year%20of%202018>

8 https://ec.europa.eu/environment/air/index_en.htm

9 https://www.epa.ie/pubs/reports/air/quality/Technical_report_NOx_modelling_Dublin.pdf

10 <https://www.epa.ie/mobile/news/name,69491,en.html>

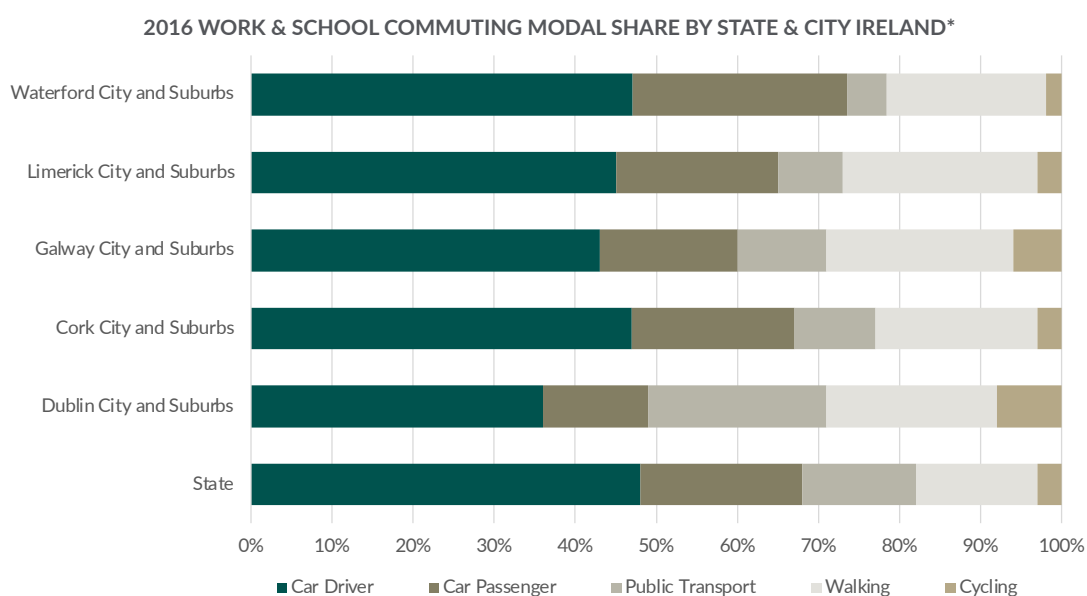
11 <https://thorax.bmj.com/content/57/8/687>

12 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3855518/>

In response to the potential breaches, the EPA has increased the number of permanent monitoring stations to improve the availability of data. If continued monitoring shows further breaches of EU limits, local authorities will be required by EU law to prepare Air Quality Action Plans to address the issues. To date, a number of EU countries have been brought to the European Court of Justice due to repeated breaches of NO_x levels and failure to introduce adequate measures to address these breaches¹³.

City Challenges Congestion

The reliance on the private car as the primary mode of transport in Ireland has led to increased congestion, particularly within our cities. The 2016 Census commuting data for work and education shows that private cars still constitute a significant majority of residents' trip-making in each of the five major Irish cities.



*The above data excludes those answer categorised as Not Stated, Working mainly from Home & Other.

A research report published by DoT in 2017¹⁴ found that the cost of time lost due to 'aggravated'¹⁵ congestion within the Greater Dublin area was €358 million in 2012, and this was forecast to rise substantially to €2.08 billion per year in 2033. Cork has seen increased congestion within the city in recent years and Galway experiences significant levels of congestion and heavy traffic volumes within the city centre and along the N6 ring road. There are issues with congestion noted in Limerick, particularly around the city centre, University of Limerick, the Technology Park and close to schools. Although congestion is less of an issue in Waterford in comparison to the other cities, it has a high car mode share.

Increased congestion also exacerbates emissions and air quality problems. A reduction in speeds due to congestion results in longer travel times and resultant increase in emissions per kilometre travelled. Congestion can also lead to a disruptive driving style. Driving with more accelerations, decelerations, stops and starts increases exhaust emissions and contributes to wear on brakes and tyres, which in turn produces more particulate emissions.

13 https://ec.europa.eu/commission/presscorner/detail/en/IP_18_3450

14 <https://assets.gov.ie/13615/110debccab3346aa9a6f871f0ae660d9.pdf>

15 Defined in the report as congestion levels above those which would be expected on a properly-functioning, busy road.

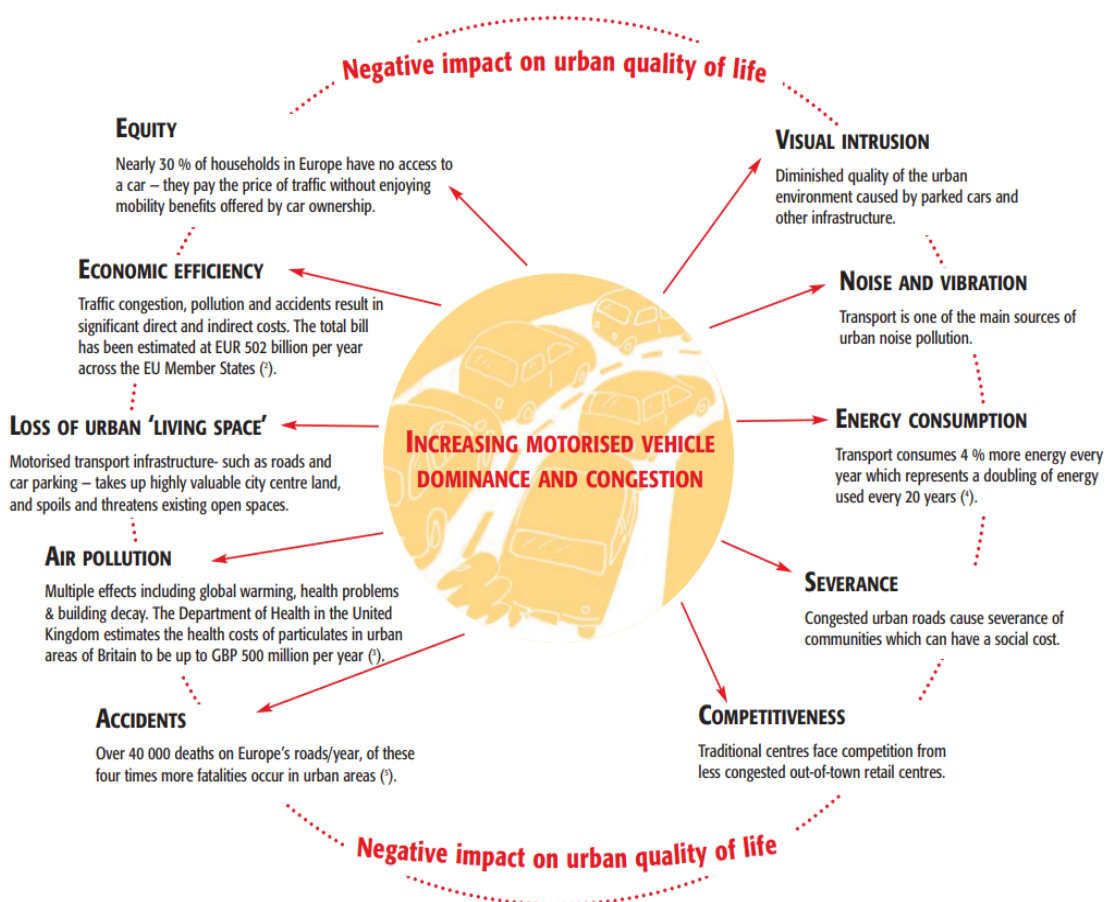
In most cases, providing additional road infrastructure in response to congestion is unlikely to solve the issue. There is limited space to provide significant extra road capacity, particularly in historic medieval cities such as Galway and Waterford. More importantly, there is the likelihood that additional road capacity will induce additional car-based travel, ultimately resulting in a further increase in emissions and a return to the congested road conditions, but with even greater environmental damage, due to the increased volume of road traffic.

To accommodate the future sustainable growth of the cities, it is vital that congestion is carefully managed and that growth in travel demand is as far as possible catered for sustainably, through increased public transport usage, walking and cycling.

City Challenges Urban Environment

Higher levels of traffic and congestion can have a significant negative impact on the quality of life of residents within urban areas. Aside from the public health impact of reduced air quality, increased congestion can result in greater noise pollution, severance of urban communities (including vulnerable groups such as the young, the elderly and those with mobility impairments), loss of green space, road accidents and visual intrusion.

THE MAIN PROBLEMS ASSOCIATED WITH INCREASING URBAN TRAFFIC AND CONGESTION¹⁶



16 https://ec.europa.eu/environment/pubs/pdf/streets_people.pdf

Traffic and congestion can also have a significant impact on those commuting and the residents of the urban areas. A 2016 European Quality of Life Survey¹⁷ found people living in Dublin had the 5th longest commute of all European cities surveyed, with an average daily commuting time of around 60 minutes.

Improving the urban environment by making active travel more attractive also offers opportunities for reducing obesity, by building physical activity into people's everyday lives.

Addressing the Challenges

The Five Cities Demand Management Study

Given the scale of the challenges outlined above in relation to decarbonisation, there are seven broad transport-specific measures and 28 actions identified within the 2019 Climate Action Plan aimed at achieving the required greenhouse gas reductions.

Action 81 of the 2019 Plan states:

“Develop a regulatory framework on low emission zones and parking pricing policies and provide local authorities with the power to restrict access to certain parts of a city or a town to zero-emission vehicles only. Examine the role of demand management measures in Irish cities, including low emission zones and parking pricing policies.”

The 2021 Climate Action Plan retains and strengthens this demand management focus (Actions 244 and 252)

Therefore, the Department of Transport (DoT) appointed SYSTRA Ltd. to undertake a study to identify and review the drivers for, and potential management measures of, vehicle movements in Dublin, Cork, Galway, Limerick and Waterford.

These measures, known as Transport Demand Management (TDM), aim to influence and change travel demand patterns, and encourage more efficient and sustainable use of transport resources.

This Study also supports the delivery of other desirable outcomes outlined in the Climate Action Plan, including helping to deliver cleaner air, manage congestion, accelerate the uptake of lower emission vehicles and increase levels of active and sustainable mobility - while minimising any negative impacts on local city economies or exacerbating any transport-related inequalities experienced by vulnerable groups.

¹⁷ https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef18025en.pdf

The Demand Management Study - The Policy Context

The Demand Management Study is not meant to repeat or duplicate strategies already in place such as the National Planning Framework: Project Ireland 2040, the Climate Action Plan, or the transport strategies for the five cities.

Rather, it is intended that this Study informs the direction of complementary demand management policy measures to address car movements at a local and national level.

A summary of the prevailing national and regional policies which inform and interact with the Demand Management Study is outlined below. These include those directly related to transport, climate change and land use planning.

National

- **National Planning Framework 2040 (NPF)** - sets out Ireland's planning policy up to 2040, outlining a series of national strategic outcomes and key principles which are intended to inform policies at a regional and local level and guide development and investment in the years to come. The NPF Outcomes include: compact growth, sustainable mobility and transition to a low carbon and a climate resilient society. It identifies a number of strategic investment priorities including sustainable development, environmentally sustainable public transport and climate action. The NPF also outlines objectives to cut emissions through the use of renewable or low carbon alternatives and improve air quality through integrated land use and spatial planning that supports public transport, walking and cycling in preference to increased use of the private car.

To achieve compact growth, the NPF sets a target for 40% of new housing development to be built on sites within the existing urban footprints, with 50% of this growth to be accommodated within the five Demand Management Study cities and suburbs.

- **National Development Plan 2021 - 2030 (NDP)** - sets out the investment plan to underpin the NPF's ten National Strategic Outcomes.
- **National Climate Action Plan 2021 (NCAP)** - following on from the **National Mitigation Plan**, the NCAP sets out actions for Ireland to achieve the level of decarbonisation required to achieve its 2030 targets for carbon emissions and creating a pathway towards achieving net zero emissions by 2050, in line with our international commitments under the Paris Agreement. Decarbonising transport is a key tenet of the Plan, which identifies a range of actions in the following areas:
 - Mode Shift
 - Conversion of Public Fleet
 - Incentives & Regulation
 - EV Charging Network
 - Use of Biofuels
 - CNG Network
 - Emerging Technologies
 - Demand Management
- **Investing in our Transport Future - Strategic Investment Framework for Land Transport** - the forthcoming National Investment Framework for Transport in Ireland will update the Strategic Investment Framework for Land Transport (SIFLT) and will serve as the Department of Transport's framework for prioritising future investment in the land transport network to support the delivery of the National Strategic Outcomes of the National Planning Framework and National Development Plan.
- **Smarter Travel - A Sustainable Future** - sets out a vision for sustainability in transport with five key goals: 1) to reduce overall travel demand; 2) to maximise the efficiency of the transport network; 3) to reduce reliance on fossil fuels; 4) to reduce transport emissions and 5) to improve accessibility to public transport. A new Sustainable Mobility Policy will be published by end-2021, which will replace the Smarter Travel policy.
- **National Cycle Policy Framework 2009 - 2020** - sets a mission to create a strong national cycling culture where all cities, towns, villages and rural areas will be bicycle friendly to achieve the objective that 10% of all trips will be by bike by 2020. The Framework supports the planning, development and design of towns

and cities in a cycling and pedestrian friendly way, ensuring that the urban road infrastructure is designed/retrofitted so as to be cyclist-friendly. The new Sustainable Mobility Policy will also replace the National Cycle Policy Framework.

- **Get Ireland Active - The National Physical Activity Plan (NPAP)** - this plan recognises that physical inactivity is a demonstrated clear risk to health and wellbeing in Ireland. Action Area Four of the NPAP focuses on the use of the natural and built environment as a way to build in daily physical activity. It recognises that promoting active transport is the most practical and sustainable way to increase physical activity as part of people's everyday routine. It specifically identifies the role of walking or cycling for utility transport as a means to increase people's physical activity levels.
- **Get Ireland Walking** is an initiative by Sport Ireland and supported by Healthy Ireland which is delivered by Mountaineering Ireland. The core aim of the initiative is to unify and enable the efforts of all agencies interested in promoting walking. It is a nationwide initiative to deliver programmes in conjunction with All Sports Partnerships. The programme hopes to create a vibrant culture of walking throughout Ireland.
- **Design Manual for Urban Roads and Streets (DMURS)** - sets out the manner in which roads and streets in suburban areas should be designed to prioritise the needs of pedestrians, cyclists and public transport users and reduce the dominance of the private car.
- **Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities** - these updated standards include a default policy for car parking provision to be minimised, substantially reduced or wholly eliminated in highly accessible areas; and a significant uptake in the quantity and quality of cycle parking provision and design.

Regional

- **Regional Spatial & Economic Strategies (RSES)** - at a regional level, the NPF 2040 recommends the development of RSEs to ensure better coordination in planning and development policy matters across local authority boundaries. The three Regional Assemblies (Eastern & Midlands RA in relation to Dublin; the Northern & Western RA in relation to Galway; and the Southern RA in relation to Cork, Limerick and Waterford) have prepared new RSEs for their region. The RSEs provide a link between the NPF, the City and County Development Plans and the Local Economic and Community Plans.
- **Metropolitan Area Strategic Plan (MASP)** - the NPF also recommends the development of MASPs in order to provide a more specific focus on city and metropolitan issues for the Cork, Dublin, Limerick, Galway and Waterford Metropolitan areas. In line with the RSEs, the MASPs will be provided with statutory underpinning to act as a 12-year strategic planning and investment framework for the city metropolitan areas, addressing high-level and long-term strategic development issues.
- **Metropolitan Area Transport Strategies (MATS)** - these strategies (such as the Cork Metropolitan Area Transport Area Strategy (CMATS), the Galway Transport Strategy, the Transport Strategy for the Greater Dublin Area 2016-2035, the developing Limerick Shannon Metropolitan Area Transport Strategy or the forthcoming Waterford Metropolitan Transport Strategy) provide the transport building blocks for regional planning in the Metropolitan areas, and are/will be informed by the national policy objectives contained within the NPF 2040 and the NDP.

Local

The third tier in the planning and policy hierarchy is local planning, which involves the planning framework for the implementation of national and regional guidance at the local level. These set out frameworks for cities to achieve sustainable development and economic growth, facilitate population growth and improve the quality of life of its citizens. These include:

- **County and City Development Plans**
- **Local Area Plans**
- **Local Economic & Community Plans**
- **City Noise Action Plans**
- **Local Transport Plans / Area Based Transport Assessments**

These National, Regional and Local Plans and Policies have informed and guided the development of the Demand Management Study, as has the June 2020 **Programme for Government**, which sets out a programme for reducing emissions and decarbonising the Irish economy.

The most relevant measures set out in the Programme for this study are summarised in the Table below.

NATIONAL PROGRAMME FOR GOVERNMENT: SUMMARY OF RELEVANT MEASURES

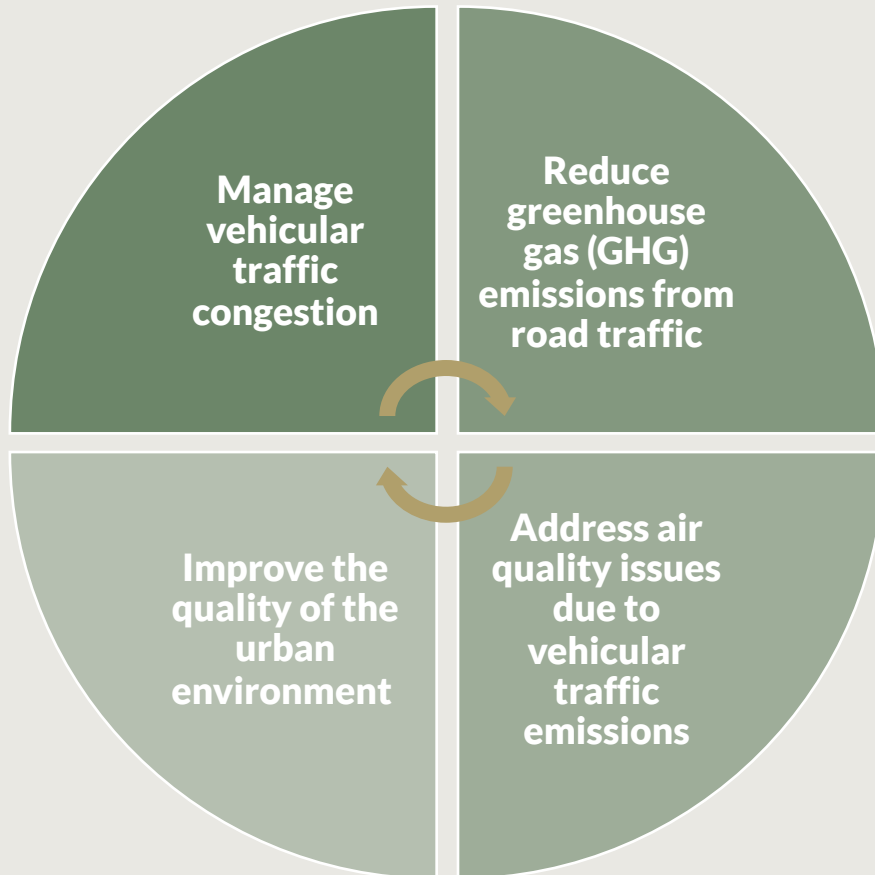
Mission area	Description
Town centres first	Development of a Town Centres First Policy which will promote development of unused building and land within towns as per the National Planning Framework.
A national clean air strategy	Develop Regional Approach to air quality and noise enforcement Invest in the network of monitoring stations
Transport	Each local authority will be immediately mandated to carry out an assessment of their road network, to see where space can be reallocated for pedestrians and cyclists. An allocation of 10% of the total transport capital budget for cycling projects and an allocation of 10% of the total capital budget for pedestrian infrastructure. Mandate every Local Authority to adopt a high-quality cycling policy and develop cycle network plans. Expand expertise on active travel within NTA and Local Authorities. Increase the number of children walking and cycling to school through engagement by the Department of Transport and local initiatives such as cycle bus and school streets and offer cycle training to all children. Widen the eligibility of the Bike to Work scheme. 2:1 ratio of expenditure between new public transport infrastructure and new roads. Develop and implement the existing and planned transport strategies for each city. Prioritise plans for the delivery of Metrolink, Luas and other light rail expansion, DART expansion and interconnector and Bus Connects in Dublin, Cork, Galway, and Limerick. Review fare structures to ensure that public transport and incentivises off-peak travel. Task the NTA to produce a park and ride implementation plan for each of the five cities. A national integrated public transport system. Accelerate sustainable mobility plans for schools. Incentivise use of electric vehicles (EVs) Legislate to ban the registration of new fossil-fuelled cars and light vehicles from 2030 onwards and phase out diesel and petrol cars from Irish cities from 2030. Review the current motor taxation regime to ensure that it adequately captures the harm caused by NO _x and SO _x emissions. This will only apply to newly registered vehicles. EV strategy to ensure that charging infrastructure stays ahead of demand and provide planning guidance to local authorities. Require that all new urban buses be electric hybrid or electric. Legislate for e-scooters and e-bikes. Publish and implement a 10-year strategy for the haulage sector focused on helping the sector move to a low carbon future. Support the greening of the taxi fleet and continue to provide financial assistance to taxi drivers switching to BEV and PHEV. Review and reduce speed limits, where appropriate, to address road safety issues and carbon emissions. Run a pilot to examine the potential for ride-sharing apps to improve rural connectivity.
Public finances and taxation	Increase the carbon tax to 100 euro per tonne by 2030, informed by the findings of an ESRI study, to be published by October 2020 on how best to prevent fuel poverty.
Emissions	Commitment to an average 7% per annum reduction in overall greenhouse gas emissions from 2021 to 2030 (a 51% reduction over the decade) and to achieving net zero emissions by 2050. Accelerating the electrification of the transport system, including electric bikes, electric vehicles, and electric public transport, alongside a ban on new registrations of petrol and diesel cars from 2030. Ensuring an unprecedented modal shift in all areas by a reorientation of investment to walking, cycling and public transport.
Rural development	Accelerate roll-out of National Broadband plan to help support home-working and reduced travel. Support the development of digital hubs to facilitate remote-working.

2

Study Objectives

Study Objectives

The measures recommended as part of the Demand Management Study have been developed in order to deliver the following key Study Objectives within each of the five cities:



Five Cities Demand Management Study

3

Methodology

Development of the Study -
overview

Context and Study Objectives

Identify the Potential Solutions

Refine the Solutions

Test the Solutions

Recommendations & Delivery
Roadmap

The methodology which we have used to develop the Demand Management Study recommendations is outlined below

Development of the Study

The methodology which we have used to develop the Demand Management Study recommendations is outlined below.



Phase A: Context and Phase B: Study objectives

The 2019 Climate Action Plan - Action 81 provides the overall context for this Study and the development of the overarching Study objectives.

Phase C: Identify potential solutions

Phase C of the study involved the identification of potential demand management measures appropriate to the five cities was generated by:

- 1 An extensive review of **International Best Practice** case studies in relation to urban demand management. From this, a range of themed measures were identified.



Recognising the existing demand management initiatives already being delivered across the five cities, measures were also categorised as follows:

- **New measure** - not previously implemented
- **Existing measure** - which should be retained over the longer term
- **Existing enhanced measure** - which should be retained and enhanced (e.g. through: applying a level of consistency at national and city level; and/or additional focus invested in its application; and/or transferring best practice from one city to another)

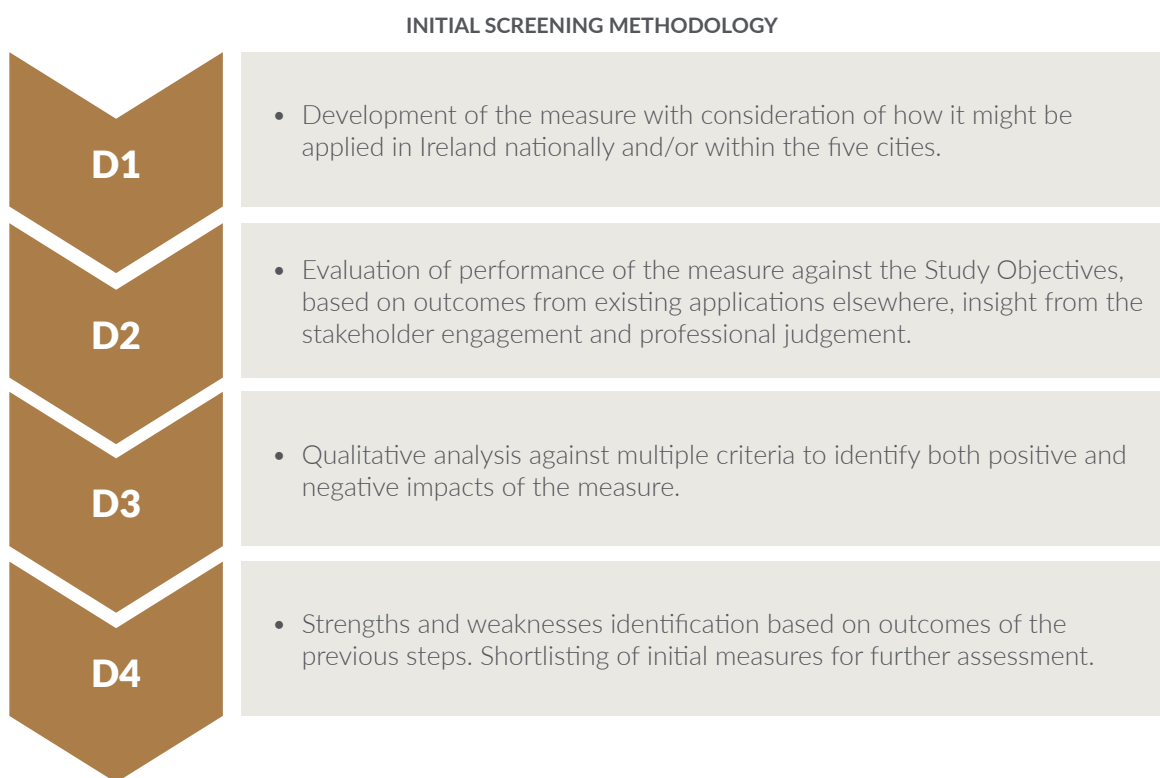
- 2 A **Baseline Review** of the current situation in each city, including: the extent to which demand management measures may be needed within each city in relation to climate change, congestion and air quality; existing and planned transport networks and planning policies; current demand patterns and projected future population growth; future city transport strategies; and existing demand management measures already in place and plans for future initiatives.
- 3 Extensive **stakeholder consultation** was undertaken to discuss and explore potential measures relevant to the urban Irish context and based on the steps above. This took the form of in-depth interviews and workshops with local authorities, the Climate Action Regional Offices (CARO) and a range of national stakeholders including the NTA, TII, EPA, Gas Networks Ireland, ESB Cars, the National Disability Authority (NDA), the Road Safety Authority (RSA) and the Sustainable Energy Authority of Ireland (SEAI).

Phase D: Refine solutions

Review and analysis of potential solutions - initial screening

The findings of the international best practice review and the insight from the stakeholder engagement were used as the foundation of Phase D of the Study, the **refinement of solutions**. The initial list of demand management measures was very varied and included some measures that are long-established and well-defined interventions, while others are relatively new and still evolving in their application.

It was important at the initial screening stage that potentially beneficial measures were not dismissed too early in the process. The initial screening methodology included the following steps:



Refinement of potential measures

Measures which were deemed to not meet the Study Objectives, or which were considered unacceptable following the assessment approach outlined above, were discounted at this stage of the appraisal process.

Phase E: Test solutions

Following the initial screening, shortlisted measures were tested using more detailed quantitative and qualitative appraisal in order to assess their impact in reducing emissions, tackling congestion and improving air quality in the five cities. At this stage of the Study, measures were identified as either Strategic Framework measures, National Toolkit measures or City Toolkit measures (delivered as a tailored package by individual cities).

Step 1 - stakeholder engagement

SYSTRA designed and distributed an online survey for self-completion by a wide selection of stakeholders, agreed in consultation with DoT, and the Study Steering Group using a national and city level stakeholder mapping exercise and the contact details of those taking part in the initial phase of stakeholder engagement. The survey assessed views towards the shortlisted measures, including:

- The extent to which stakeholders felt the measure was suitable for further consideration at a national level.
- If believed to be suitable, the year by which the measure should be delivered by national strategy.
- Which measures should be considered a national priority.
- Identification of measures deemed not suitable and the reasons for this.
- Identification of the key constraints in the delivery of local level measures.
- Suggestions of alternative measures not captured in the shortlist.

Step 2 - study objectives assessment

A detailed evaluation considered the performance of each measure against the Study Objectives, based on the best available information on the application of the measure internationally and evidence from Irish-based experience and studies. The direct and indirect impact of the measure was considered. For example, if restrictions on vehicular traffic in specific areas result in redistribution of traffic to other areas, this was considered.

The likelihood of impact in achieving the objective was considered as well as the scale of impact. Together, this gives an indication of the overall performance of the measure against each Study Objective, ranked on a seven-point scale as follows:

Rating	-3	-2	-1	0	1	2	3
Description	Significantly Adverse	Moderately Adverse	Slightly Adverse	No or Neutral Impact	Slightly Beneficial	Moderately Beneficial	Significantly Beneficial

Step 3 - quantitative fleet modelling

A key element informing the Recommendations is the assessment of the impact of individual measures on vehicle ownership and purchase responses towards 'cleaner, greener' fleets - and the impact this is likely to have on the carbon emissions and air quality of individual city fleets.

Using the baseline fleet profiles for each city (which took place in February 2020 via Automatic Number Plate Recognition (ANPR) surveys undertaken by Tracsis Traffic & Data Services), the Study team undertook spreadsheet based 'fleet modelling' to predict the cumulative impacts of vehicle ownership responses to appropriate demand management measures in each city.

The fleet modelling used scrappage rates developed from existing Irish data, in order to inform likely conversion to cleaner fleets over time and behavioural response parameters derived from existing relevant research. These parameters are based on values from recent research undertaken by SYSTRA in a number of English Clean Air Zone Studies - in particular the pattern of responses to various Clean Air measures predicted by the local behavioural research undertaken by SYSTRA in Bradford, Sheffield and Rotherham.

Step 4 - strengths and weaknesses assessment

Based on the outcomes of the previous steps, the main strengths and weaknesses of each measure were identified and summarised. In doing so, it is possible to ascertain:

- How efficient the transport demand management measure is.
- How effective the transport demand management measure is.
- The transport demand management measure's contribution to the study objectives.
- The deliverability of the transport demand management measure.

Step 5 - qualitative analysis against multiple criteria

More detailed qualitative analysis was undertaken for those measures where:

- The scale of delivering the Study Objectives was deemed to be substantial.
- There would be significant change from existing demand management approaches.

This included additional analysis to identify the national and local policy, legislative, economic and fiscal implications of different measures.

In identifying appropriate criteria for analysis, a blended evaluation approach was developed, so that all relevant criteria were explored. Firstly, consideration was given to the standard criteria included in the Department of Transport's Common Appraisal Framework¹⁹ (Economy, Safety & Physical Activity, Environmental, Integration, Accessibility & Social Inclusion). In addition, other established approaches were utilised, including a PESTLE analysis (political, economic, social, technological, legal, environmental).

Each measure was considered in the context of the criteria listed below and the key performance indicators were assessed on a seven point scale from Significantly Positive to Significantly Negative.

EVALUATION CRITERIA & KEY PERFORMANCE INDICATORS

Evaluation criteria	Key performance indicator
Economic	Fiscal implications - cost to the Exchequer Cost to the transport user (including direct monetary cost and value of time) Impact on the national economy Impact on the local economy
Political	Political/public acceptability
Accessibility & social inclusion	Impact on those suffering from social deprivation and/or geographic isolation Impact on those with mobility and/or sensory disabilities
Safety, physical activity & health	Transport user - levels of physical activity by transport users
Implementation	Implementation - technology. Extent of technological barriers or opportunities Implementation - timescale. Timescale for delivery and risks
Integration	Integration with relevant National strategies and policies Integration with relevant city & regional strategies and policies Transport integration - between different modes, providing opportunities for multi-modal connectivity
Legal	Extent of legislative changes required

Step 6 - cost effectiveness

The cost effectiveness of the measures examined in more detail in Step 5 was used in determining which measures are most suitable to be brought forward as recommendations from this study. Using qualitative analysis, the cost effectiveness was calculated based on performance against the study objectives versus the combined cost to the exchequer and the travelling public. The results of the multi-criteria evaluation were added to obtain an overall score that was used to rank the measures and inform the development and prioritisation of the Delivery Roadmap.

19 <https://assets.gov.ie/34326/6bb58b8fe9424bce9595f0a118fc334e.pdf>

Step 7 – RMS quantitative modelling

As part of Phase Two of the Recommendations Report, the National Transport Authority's (NTA) Regional Modelling System (RMS) has been used to assess quantitative multi-modal impacts of shortlisted demand management measures and likely outcomes for the study objectives including congestion and transport emissions. These measures have been analysed using the models for a single forecast year (2030).

The transport modelling results were used to examine the difference in performance compared to the reference case scenario. In the reference case scenario, allowance has been made for the forecast change in the car fleet based on recent trends and the expected replacement of the fleet over time without additional demand management measures. This analysis was undertaken on key performance indicators derived from model outputs and used to predict and quantify the impacts of the demand management measures on a city by city basis.

The RMS assessed measures which can be quantified using the models. The relevant measures and their associated elements of the RMS are outlined in the table below.

RECOMMENDED MEASURES & RMS APPRAISAL

Category	Subcategory	Measure	Measure Type	RMS Component
Fiscal	Vehicle Taxation	Progressive Vehicle Taxation (FM01)	Tier 1 Strategic	Adjustment to Price per km (PPK) input and Environment Module
		Time/Location based Vehicle Taxation (FM03)	Tier 1 Strategic	Adjustment to Price per km (PPK) input and Environment Module
	Alternative Fuels	Alternative Fuelled Vehicle Support (FM05)	Tier 1 Strategic	Environment Module
	Congestion Charging	Further examination/evidence in relation to Congestion Charging within a specified zone (Cork & Dublin) (FM11)	Tier 1 Strategic	Road Assignment Model – Road charges and bans
Air Quality	Clean Air Zones (CAZ)/Low Emissions Zones	Clean Air Enabling Legislation (AQ01)	Tier 1 Strategic	Environment Module
		CAZ via a National Sticker Scheme (AQ05)	Tier 1 Strategic	Environment Module
Parking & Traffic Management	Workplace Parking Levy	Workplace Parking Levy within a pilot City (Galway) (PTM01)	Tier 1 Strategic	Changes to spaces available in Free Workplace Parking Module
	On-Street Parking Controls & Pricing	Public Parking Controls (PTM04)	Tier 1 Strategic	Parking Distribution Model

The Key Performance Indicators (KPIs) extracted from the model outputs for each of the assessed measures have been aligned to the key Study Objectives (Congestion, Carbon, Air Quality and the Urban Environment) and are consistent across all tested scenarios. These KPIs are as follows:

STUDY OBJECTIVES AND MODELLING KPIS

STUDY OBJECTIVE	RMS KEY PERFORMANCE INDICATOR
Manage vehicular traffic congestion	● Road network impacts – change in total travel times
	● Road network impacts – change in delays
Reduce greenhouse gas (GHG) emissions from road traffic	● Emissions – change in CO ₂
Address air quality issues due to vehicular traffic emissions	● Emissions – change in NO _x
	● Emissions – change in particulates (PM ₁₀)
Improve the quality of the urban environment	● Car usage – change in total car trips

The RMS results build on the Phase 1 Fleet Modelling with the RMS allowing for traffic impacts to be considered whilst also allowing for the comparison of different fleet profiles through the Environment Module. The results presented in this report for Phase 2 focuses on the variance between the future 2030 do minimum compared to the modelled reflection of the measure.

In order to determine the wider impacts of each measure tested in the RMS, the results were assessed based on two geographic areas within each of the five cities, as follows:

- **City Core Study Area** – the area roughly defined by the ANPR surveys conducted for as part of the Baseline Assessment of this Study. This covers the city centre for each of the five Study cities.
- **Wider City Study Area** – for the smaller cities this is roughly the area of urban development and for Dublin it is the area inside the M50. The Wider City Study Area results include those of the Central Study Area.

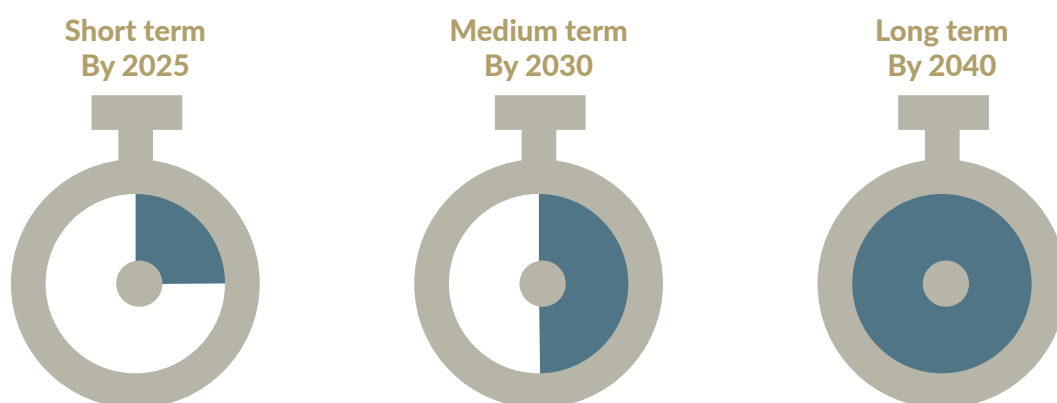
The KPI outputs of the RMS modelling assessment have been used to inform further prioritisation and refinement of the Demand Management Study and Delivery Roadmap as part of Phase Two of the Recommendations Report.

Phase F: Recommendations & Delivery Roadmap

The phases above culminate with the identification of a set of proposed **Recommendations** for the Demand Management Study at both a national level and for each city and the development of the **Delivery Roadmap**. These can be found in subsequent sections.

The Tier 1 TDM Strategy measures have been given an indicative priority ranking based on the detailed qualitative and quantitative assessment undertaken.

The proposed delivery of the Demand Management Roadmap has been segmented into different timeframes as follows:





Five Cities
Demand Management Study

4

Tier 1 -
Strategic
Framework

Introduction to the Tiered
measures approach

Tier 1 Strategic Measures

Demand Management Measures

Introduction to the Tiered Measures

Tier 1 TDM Strategy Pillars

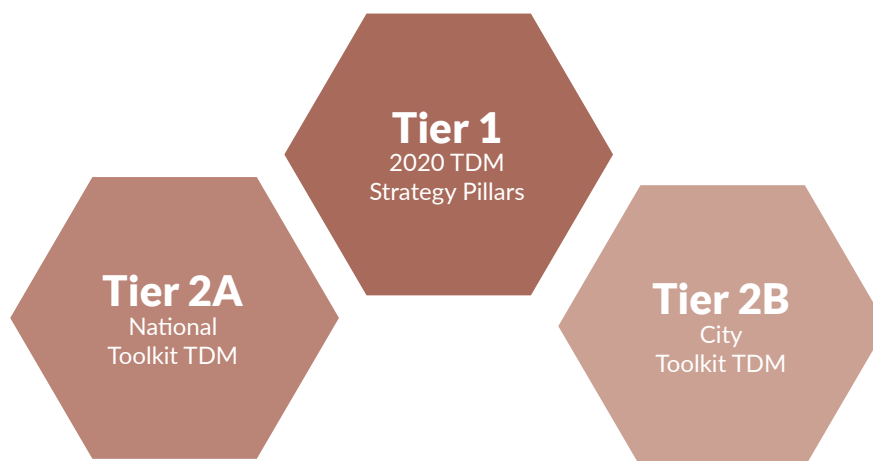
Subsequent to the shortlisting of suitable transport demand measures for further consideration and in commencing the more detailed qualitative analysis, it became apparent that some measures would lead to such a scale of impact or change that they would benefit from more detailed analysis to identify the most appropriate strategy.

All of these measures would have far reaching impacts both geographically within the five cities and beyond. These measures have been grouped in Tier 1 as the 2020 Transport Demand Management (TDM) Strategy Pillars.

Tier 2 TDM Toolkit

The remaining measures have been assessed in terms of their effectiveness in delivering the key Study Objectives. Utilising a Toolkit approach, the recommended Tier 2 demand management measures can be applied in different ways and intensities, recognising the different circumstances of each of the five cities and their current and planned application of demand management interventions. These Tier 2 Toolkit measures offer flexibility and additional options for local and national interventions to address the significant challenges ahead. For ease of reference and in recognition of the nature of their application, the Tier 2 measures are split into two toolkits, 2A National and 2B City.

All three Tiers in combination will form the future strategic direction of demand management in the five cities.



Tier 1 measures – informing the Delivery Roadmap

Given the scale of the Tier 1 measures, it is unlikely that all of them would be implemented. Indeed, some Tier 1 measures would be considered mutually exclusive. In other cases, the benefit of a measure would be diminished if certain alternative measures were implemented, therefore making them unsuitable for recommendation. In addition, some Tier 1 measures are better suited to particular cities more than others.

These factors have been considered in the preparation of the TDM Delivery Roadmap (outlined in Chapter 8), where Tier 1 measures are considered collectively for each of the five cities in turn. To help in the Delivery Roadmap development, the detailed quantitative analysis for Tier 1 measures was used to provide an overall ranking. The ranking is not intended as a means of excluding measures, rather it is used as a guide when decisions need to be made between potentially competing measures.

Tier 1 - Strategic Framework

Demand Management Measures

Fiscal Management (FM)	Vehicle Taxation	FM01: Progressive Vehicle Taxation
		FM02: Vehicle Taxation per km
		FM03: Time/Location based Vehicle Taxation per km
	Alternative Fuels	FM05: Alternative Fuelled Vehicle Support
	Congestion Charging	FM11: Congestion Charging
Air Quality (AQ)	Clean Area Zones/Low Emissions Zones	AQ01: Clean Air Enabling Legislation
		AQ04: Clean Air Zone (CAZ) via ANPR
		AQ05: Clean Air Zone (CAZ) via National Vehicle Sticker Scheme
Parking & Traffic Management (PTM)	Workplace Parking Levy	PTM01: Workplace Parking Levy
	On-Street Parking Controls & Pricing	PTM04: Public Parking Controls
Planning Policy (PP)	Transport & Public Health	PP01: Healthy Streets Assessments
	Transport Appraisal Enhancements	PP03: Transport Appraisal Methodologies
	National Planning Framework Delivery Management	PP04: Enhance Delivery of National Planning Framework
	Development of 15-minute neighbourhoods	PP08: 15-Minute Neighbourhoods

Vehicle Taxation Introduction

FM01, FM02, FM03

Taxation is one of the longest established methods to influence vehicle purchasing behaviour. Ireland's existing taxation measures aim to deter the purchase and use of cars which emit high levels of CO₂. Motor vehicle taxation is generally targeted at private cars which comprise 78% of all vehicles in Ireland and are responsible for around twice as much annual CO₂ emissions as Heavy Goods Vehicles and Light Commercial vehicles combined. In addition, emissions-based taxation policies are likely to be more effective in relation to private cars, as there is a greater range of vehicles and alternative modes available.

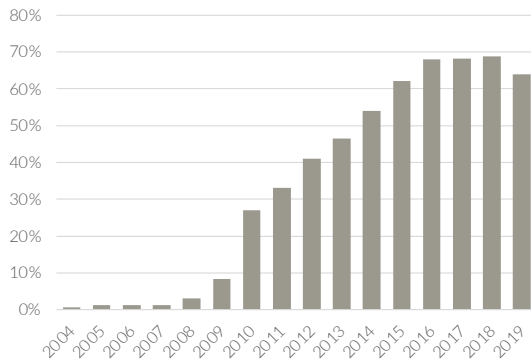
The number of private cars in Ireland's vehicle population has been growing steadily since 2011 with 300,000 additional cars on our road in 2019²⁰. Looking further back, whilst some of the growth up to 2008 was reversed in the early 2010s, the general trend is for total number of private cars to rise steadily year-on-year. Recent data indicates that the annual growth in private cars in Ireland was +3.25% in 2019 alone²¹.

There is a significant risk that without effective intervention to move away from long terms trends, the Governments' policy to radically reduce total road transport emissions will not be achieved.

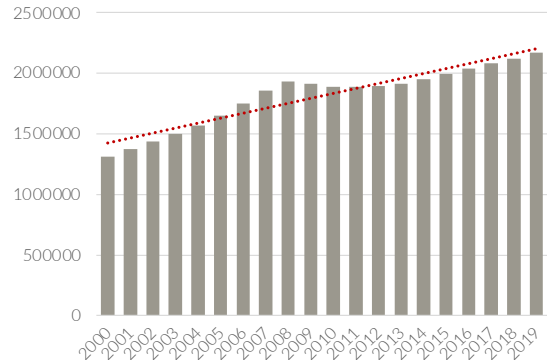
Existing Situation

Since 2008, Ireland's Vehicle Registration Tax (VRT) and Motor Tax structures for private cars have been linked to CO₂ emissions. Prior to this, Motor Tax bands were calculated on engine size and these bands continue to be applied to cars registered pre-July 2008. In 2008 when the measure was introduced, only 3% of the cars registered were compliant with the lowest tax band (Band A). Since 2015, in excess of 60% of vehicles registered for the first time, both new and second-hand, were in the lowest tax band.

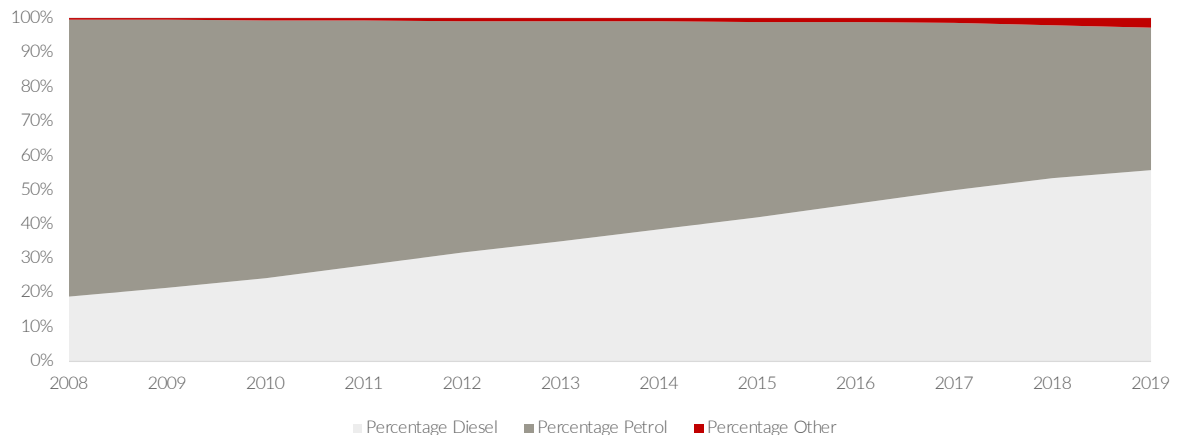
PRIVATE CARS REGISTERED FOR FIRST TIME
PERCENTAGE WITHIN BAND A



PRIVATE CAR
VEHICLE POPULATION



VEHICLE POLLUTION PRIVATE CARS



20 CSO, StatBank, Road Traffic Volumes Statistical Series

21 Climate Action and Tax, Tax Strategy Group - 20/06, Department of Finance, September 2020

In addition to large scale changes in the distribution of the car fleet across the emissions bands, there has been a significant shift from petrol to diesel since the taxation structure changes in 2008. Whilst growth in hybrid and battery electric vehicles has accelerated in recent years, Ireland's high diesel market share remains an outlier in Europe.

The measurement of CO₂ and fuel consumption used over the last decade has been based on the now discredited laboratory based New European Driving Cycle (NEDC) emissions test. Due to the divergence between NEDC derived CO₂ emissions and estimated real world values, it is likely that the rates of taxation applied to private cars have been far too low. Data reported by the Tax Strategy Group indicates that in 2017 real world CO₂ emissions could be of the order of 40% higher than NEDC calculated values.

Under EU regulations, car manufacturers are being obliged to produce fleets with increasingly lower CO₂ emissions rates. The World Harmonised Light Vehicles Test Procedure (WLTP) test became mandatory for all new car registrations from September 2018 with the transition to WMTP for the purposes of motor vehicle taxation mandated from the 1st January 2021. A recent report by the Tax Strategy Group set out policy options for the transition of vehicle taxes to a WLTP base with the stated policy objective to: "both maintain a level playing field for new and used cars while delivering on the Government's climate action goals to the greatest extent possible".

First time car registrations are comprised of new car registrations and second-hand imports (generally from the UK). The rate of second-hand imports has fluctuated considerably over time, in large part due to fluctuations in the relative value of the Euro and Pound Sterling, but also due to influences of UK demand management measures on the second-hand car market. The cost of second-hand diesel cars in the UK has fallen in recent years, as demand declines in response to the introduction of clean air zones and concerns over future taxation changes. Second-hand imports to Ireland, of mainly UK diesel cars, has risen from a third of first registrations in 2015 to around a half in 2019. This, along with the CO₂ based taxation structures since 2008, has intensified the recent dieselisation of the Irish car fleet.

Given that diesel cars (even new Euro 6 ones) generate significantly more NO_x emissions than all but the oldest petrol cars, these recent trends in diesel car ownership in Ireland are very concerning from an air quality perspective. In response, a VRT surcharge tied to nitrogen oxide (NO_x) emissions levels was introduced in the 2020 Budget. This measure seeks to address the harmful environmental and public health impacts of vehicle emissions and aligns with the 'polluter pays' principle.



Vehicle Taxation

FM01: Progressive Vehicle Taxation

Progressive taxation measures towards cleaner, safer fleets

4

FM01

European Examples

Every vehicle registration in the Netherlands is charged vehicle registration tax. The tax applies to both new and second-hand vehicles. The amount varies depending on the CO₂ emissions of the vehicle as well as its fuel type. The tax is relatively flat up to 80 gCO₂/km but raises substantially thereafter.

Norway has the highest level of BEV adoption in Europe, with BEVs gaining a 54% share of new car sales in 2020. Vehicle purchase and registration taxes are high in Norway and the exemption of BEVs from all purchase taxes (including VAT) results in BEV and ICE versions of similar vehicles being similarly priced in Norway.

Many other incentives for uptake of EVs in Norway exist including exemption from annual motor tax, use of bus lanes and, up until 2017, free municipal parking and exemption from road toll charges. However, a large study of BEV owners in Norway found that the fiscal incentives on purchase and registration taxes were by far the most decisive incentive for their BEV purchase.

Description of Measure

The current taxation structure will not be fit for purpose into the future and this measure seeks to ensure that necessary changes to VRT and Annual Motor Tax will take appropriate cognisance of the objectives of this study. There is a recognised need to review the effectiveness and appropriateness of Ireland vehicle taxation structures and a number of reports and proposals have been prepared including:

- An Analysis of the Sustainability of Vehicle Registration and Motor Tax, Parliamentary Budget Office, Houses of the Oireachtas, Publication 50 of 2019.
- Climate Action and Tax, Tax Strategy Group - 20/06, September 2020 & 21/09, September 2021.

Budget 2021 saw a significant overhaul of VRT and Motor Tax in order to facilitate the uptake of EVs and to address the environmental and public health effects of vehicle emissions. In the first half of 2021, 31.9% of all new cars licensed were electric and hybrid cars; compared with 18.7% over the same period in 2020.²²

Budget 2022 (announced in October 2021) will see further increases in the rates of VRT in order to reinforce the 'polluter pays' principle, beginning with a 1% increase for vehicles that fall between bands 9-12; 2% for bands 13-15; and a 4% increase for bands 16-20. The VRT relief on Battery Electric Vehicles will be extended for a further two years.²³

A key challenge in the years ahead will be to balance the need to support and encourage a shift to lower emissions vehicles with the need to break the link between economic growth and growth in the vehicle population. At present, the base cost of less polluting vehicles is comparatively high, particularly in relation to older second-hand diesel imports from the UK. Therefore, in broad terms, it is considered appropriate to apply comparatively low tax levels on low emission vehicles, with a greater level of differentiation to maintain the 'polluter pays' principle and reflect both greenhouse gas pollution rates and other harmful environmental impacts such as NO_x.

While a complete shift to Electric Vehicles (EVs) would bring about positive reductions in tailpipe greenhouse gas and air pollutants, it would not eliminate certain transport-based air pollution or congestion. For example, Battery Electric Vehicles (BEVs) still emit damaging PM_{2.5} and PM₁₀ due to non-exhaust emissions (predominantly from brakes and tyre wear). There are also some concerns in relation to the negative environmental impacts of the manufacture of EVs, the associated electricity generation and the need to provide infrastructure to accommodate the physical space occupied by private vehicles. To manage these undesired impacts, with the expectation that technological advancements and scale of production will reduce the relative base cost of EVs in the medium to longer term, consideration should also be given to increasing the rates of taxation on non-ICE (Internal Combustion Engine) cars.

Best Practice Evidence

Countries that apply emissions or fuel-based registration taxes have significantly lower average CO₂ emissions.

22 <https://assets.gov.ie/86999/d525b314-3751-4936-83b8-5084fe6e4263.pdf>

23 <https://assets.gov.ie/201244/2bb2e8d2-5220-4c05-be1b-41cb546df6e4.pdf>

Stakeholder Feedback

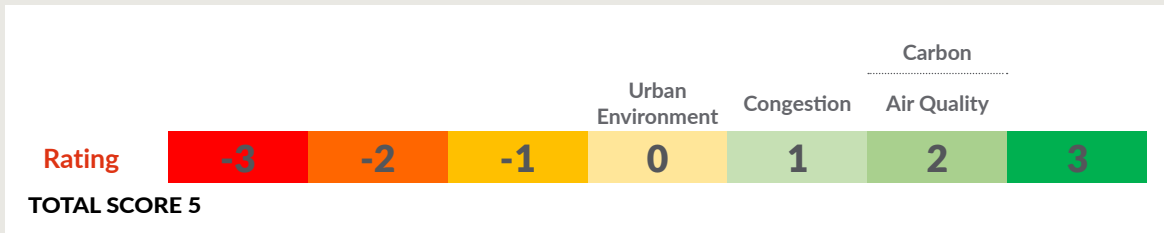
Perceived issues and concerns	Perceived benefits and opportunities
<ul style="list-style-type: none"> ○ Alternatives need to exist prior to delivery - including financial incentives to switch. ○ Should tax fuel instead. ○ Negative economic impacts on city centres. 	<ul style="list-style-type: none"> ○ General support shown for measure - newer vehicles should not be penalised, even if they include more expensive parts. Should be paired with FM04. ○ Exemptions should also be in place for those car-pooling.

“Taxing negative behaviour without matching initiatives to provide affordable and reliable sustainable mobility offer (across private and public modes) will have negative socio-economic effects and impact businesses, so to counter such opposition, we need matching incentives and availability of the green alternative.”

Assessment of Likely Impact in Delivering the Study Objectives

There is very strong evidence from Ireland and internationally that VRT and Motor Taxation measures have a significant impact on fleet profiles. With suitable adjustments to balance the support for the multiple study objectives, progressive taxation will deliver significant benefits.

Impact in Delivering the Study Objectives

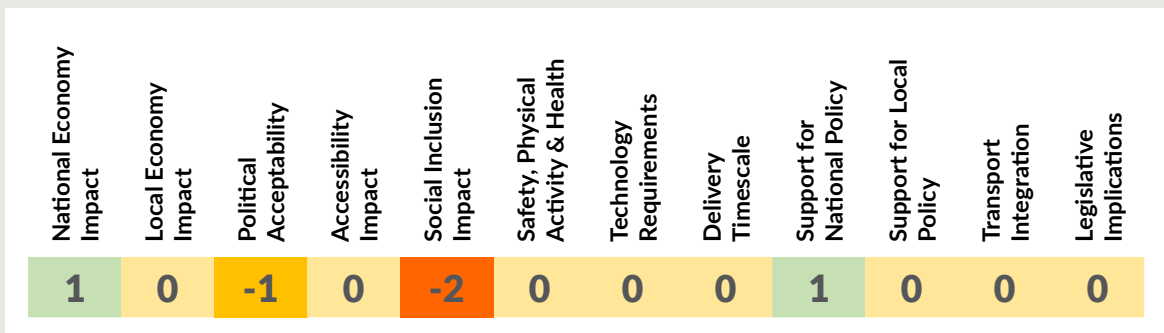


Exchequer Cost Significantly Beneficial

With progressive taxation, the decline in motor tax revenues will reverse.

User Cost Moderately Adverse

Will likely result in a mixture of higher and lower charges for some users in the short term. In the medium term, charges will potentially need to increase to act as a demand management tool.



Quantitative Modelling Assessment of FM01 Progressive Vehicle Taxation

Vehicle taxation is not directly included as a parameter in the Regional Modelling System (RMS). To achieve an understanding of the scale of quantitative impacts of the measure, consideration was given to the likely

impact on fleet profile and vehicle utilisation. FM01 will allow for a more progressive vehicle taxation structure to encourage the uptake of lower polluting vehicles. The measure will likely result in higher car costs either through taxation of more polluting vehicles or the generally higher cost of purchase of lower polluting vehicles. The modelling accounted for an increase in cost with tests run for Dublin and Waterford and a change in the fleet profile with tests run for all five cities. The qualitative scores for impacts, including costs to transport users and social inclusion considerations, have been carried across to the Phase 2 assessment and are taken into consideration in the ranking of measures.

Indications from Quantitative Modelling

The modelling results indicate that FM01 would have a consistently positive impact on reducing carbon emissions of between 4% and 6% across the five cities. Reductions of this magnitude are considered to be moderately to significantly beneficial in meeting the study objective of reducing carbon emissions from transport. These reductions are in addition to the underlying reductions in carbon emissions in the 2030 reference case.

The impact on air quality indicated by the modelling results ranges from a 3% to a 5% reduction in NO_x and a negligible impact on PM₁₀ except in the case of Dublin where a 3% reduction in PM₁₀ is shown.

The modelling results show a small decrease in car trips in Dublin, both within the City Core and in the wider city as a whole and no change in Waterford. There is an estimated decrease in both travel time and delay across the whole of the Dublin City Study Area which is a significant benefit in terms of addressing congestion.

The Environmental Module was used to measure impacts on emissions for Cork, Limerick and Galway. The traffic impacts were not assessed for these cities but are assumed to correlate to the results for Dublin and Waterford.



* Derived from modelling results for Dublin and Waterford with the measure assumed to perform better in larger cities with more extensive public transport given the results available.

Dublin	Urban Realm	Congestion	Air Quality	Carbon			
Cork	Urban Realm	Congestion	Air Quality	Carbon			
Limerick	Urban Realm	Congestion	Air Quality	Carbon			
Galway	Urban Realm	Congestion	Air Quality	Carbon			
Waterford	Urban Realm	Congestion	Air Quality	Carbon			
Rating	-3	-2	-1	0	1	2	3

Implementation Considerations

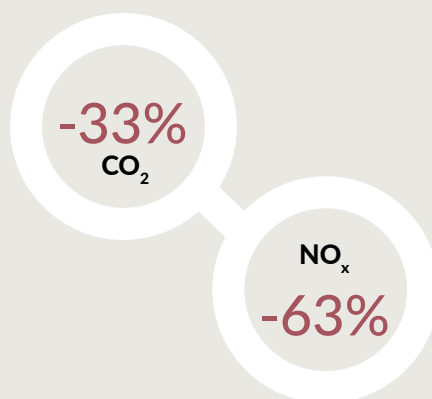
There is some evidence from the international best practice review to indicate that vehicle registration tax is more impactful on behavioural choice than annual recurring taxes. The financial implications of the recurring tax are harder to calculate in advance and are uncertain due to potential changes in laws. In many cases, CO₂ is only one of several tax components and the financial advantage of buying a low-emission vehicle is less clear. Consumers are thus less sensitive to ownership taxes than to one-off registration taxes with a clear price signal.

Care must be taken that the application of incentives to choose vehicles with less tailpipe emissions does not overly encourage the early disposal of reasonable quality fleet. When assessed on a life cycle basis, taking account of emissions embedded in the manufacturing and end-of-life cycle of a car, if fleet is turned over too quickly there will be a negative impact on overall emissions, even in the case of replacing certain ICE vehicles with an alternative fuels vehicle.

Implementation Timescale



Fleet Modelling Results



Overall Priority Rank



The Fleet Modelling reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump'-related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

The Fleet Modelling results above relate to the reductions per car km from the end of 2019 to 2030. These figures therefore include the 11 years of fleet improvements (including the uptake in EVs), as well as the impact of the relevant Demand Management measures.

The figures on the previous page are lower, as they just include the change in emissions delivered by the Demand Management measures in each city by 2030.

The additional evidence afforded by the Phase 2 modelling is consistent with the findings of the Phase 1 qualitative assessment whilst Phase 2 provides some greater clarity on the potential variation of impacts between the cities.

The priority rankings for the individual cities are:



4

FM02 & FM03

FM02

Mileage Based Vehicle Taxation per km

- Simple per km motor tax charge could disadvantage long distance motorists who have no suitable alternative, e.g. in rural areas
- Without variations in charges by time of day or location, there are limitations on the effectiveness in tackling urban congestion
- The management of cross border travel could be challenging

FM03

Mileage Based Vehicle Taxation varied by time and/or location

- Implemented through an automated system such as the Global Navigation Satellite System (GNSS)
- Charges applied per km with adjustments for vehicle type, location and time of day
- Higher per km rate could be applied in congested urban areas versus rural roads
- Likely to be a number of years before suitable technology and systems are available for use

Vehicle Taxation

FM02: Vehicle Taxation per km

Mileage Based Vehicle Taxation per km

FM03: Time/Location based Vehicle Taxation per km

Mileage Based Vehicle Taxation varied by time and /or location (e.g. between urban and rural areas)

Description of Measures

In terms of demand management, existing VRT is a sunk cost, in that the payment is due as a one-off tax when the vehicle is registered for the first time. The decision to purchase a vehicle is generally a very infrequent occurrence and there is little opportunity to influence behaviours dynamically. Whilst the existing measures have a direct impact on the profile of the private car fleet, there is no direct impact on the utilisation of vehicles once the purchase has been made. A heavily used vehicle with moderate emissions rates could very well be more harmful to the environment than an infrequently used high polluting vehicle.

FM02 and FM03 seek to address this weakness by introducing a distance-based taxation. It is envisaged that rates of charge would continue to be varied based on rates of vehicle emissions.

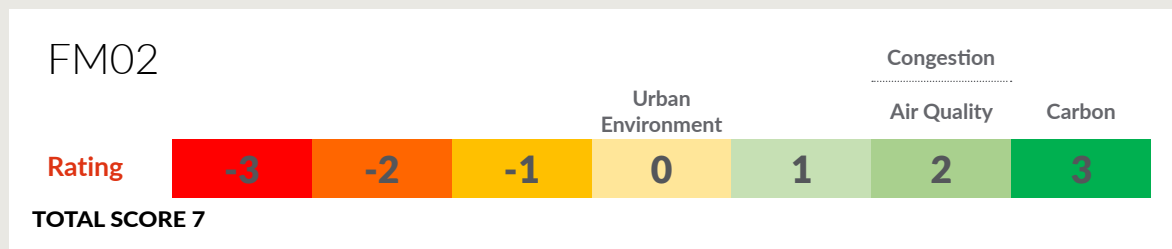
Best Practice Evidence

There are no established examples of similar demand management measures in operation in relation to private cars. There are a number of distance-based charging structures in existence for heavy goods vehicles. New Zealand has extended their measures to include light diesel vehicles. The scheme is administered through on-board distance-based recording devices. Singapore's electronic road pricing system is currently being updated so that physical gantries which clock the presence of cars are supplemented with the Global Navigation Satellite System (GNSS) technology.

Stakeholder Feedback

	Perceived issues and concerns	Perceived benefits and opportunities
Both measures	<ul style="list-style-type: none"> Public acceptability Difficulty related to measurement or self-declaration of distance travelled Negative economic impacts on city centres Alternatives need to exist prior to delivery - including financial incentives to switch 	<ul style="list-style-type: none"> Support for usage-based tax system, based on mileage Could support transition to Smart Cities and Smart Regions
FM02	<ul style="list-style-type: none"> Negative impacts on tourists Negative impacts on rural communities Increased costs for taxis - need support 	
FM03	<ul style="list-style-type: none"> GDPR concerns Technological constraints Political constraints 	

Impact in Delivering the Study Objectives

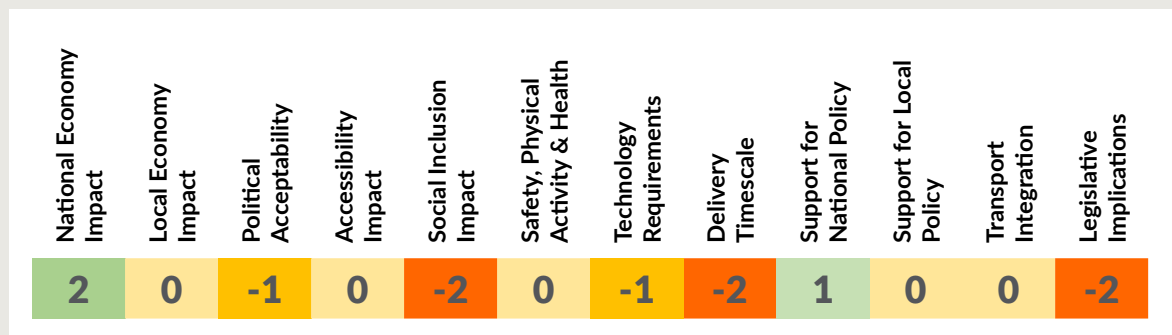


Exchequer Cost Moderately Beneficial

With progressive taxation, the decline in motor tax revenues will reverse. Increased cost of administration.

User Cost Slightly Adverse

Per km use will result in those who travel less paying comparatively lower tax. Follows the 'polluter pays' principle.



Implementation Considerations

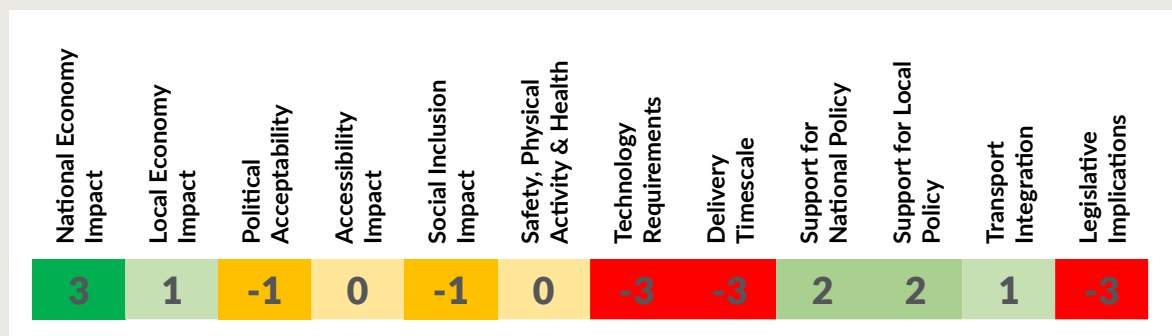
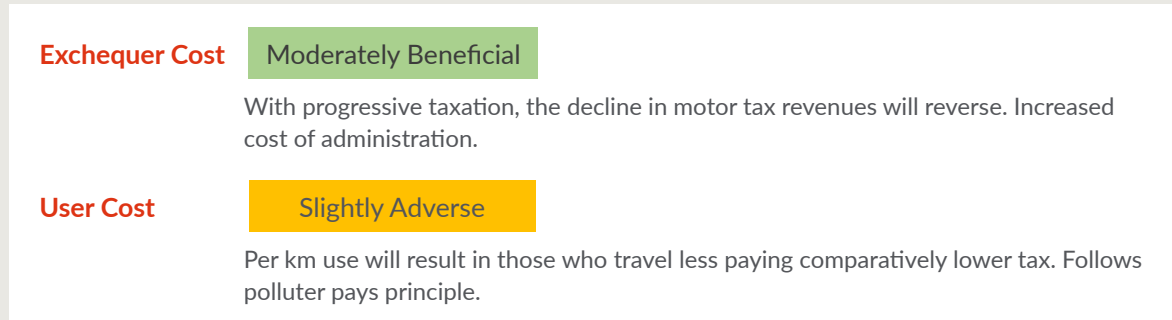
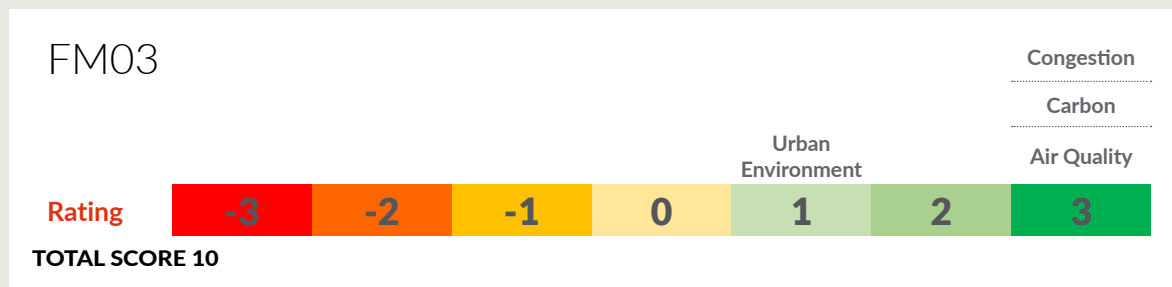
Implementation Timescale



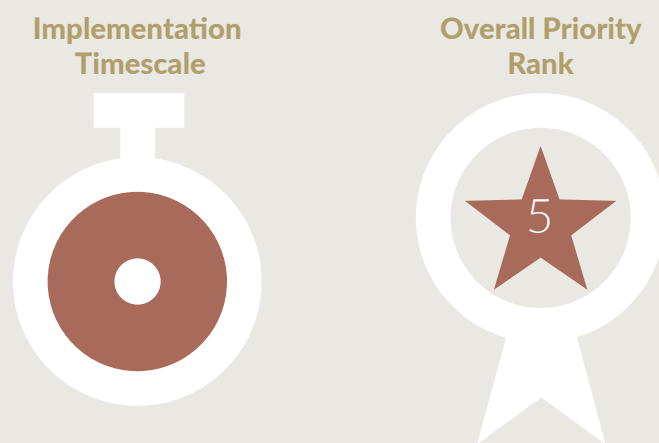
Overall Priority Rank



Impact in delivering the Study objectives



Implementation Considerations



FM02 and FM03 could not be applied simultaneously though there could be a transition from one to the other. It is not considered practical to have different taxation structures in different cities.

Quantitative Modelling Assessment of FM03 Time/Location based Vehicle Taxation per km

The impact of FM03 Time/Location based Vehicle Taxation per km was assessed in the Regional Modelling System (RMS) using a fleet profile reflecting a substantial uptake in cleaner vehicles – along with a 50%

increase in Price per KM (PPK) in conjunction with Price Per Minute (PPM) during the road model to determine the cheapest route between Origin and Destination (which is not always the shortest or alternatively, not always the quickest). In these initial tests, a flat rate of additional cost per kilometre was tested within the model's functionality. This means that in modelling terms, the results from the analysis completed thus far for FM01, FM02 and FM03 are identical. Whilst the modelling results give an indication of the scale of impact from the measures, more detailed analysis should be undertaken to seek to improve upon the benefits, particularly for FM03 which will allow for significant flexibility in taxation rates.

Indications from Quantitative Modelling

The modelling results for Dublin indicate that FM03 would have a positive impact on congestion, with small reductions within the City Core and more noted impacts across the wider City Study Area level – with a 4% reduction in travel time and a 5% reduction in delay time. This is likely due to the impact of the measure on longer trips, which contributes to more congestion in the wider city area than in the urban core.

The modelling results also indicate that FM03 would have a positive impact on reducing carbon emissions of 6% across the wider City Study Area which is considered to be significantly beneficial. The impact on air quality indicated by the modelling results is a 3% reduction in NO_x and PM₁₀.

In terms of the urban environment, car trips across both the wider City Study Area and the City Core are slightly reduced, with a shift away from car onto sustainable modes. However, there is an increase in HGV traffic through the city centre (+5%), due to HGVs travelling through the city centre in order to avoid longer routes due to the Price Per Kilometre (PPK) increase. One possible mitigation to address this issue would be an expansion of the current HGV traffic restrictions to include smaller HGVs and also to expand the area covered by the HGV restrictions. Alternatively, the charge per km for HGVs could be adjusted to manage demand with potentially higher rates applying to HGVs in certain areas.

The modelling results indicate a negligible impact on access in terms of total trip changes, both in the City Core and in the wider City Study Area. A slight increase in walking and cycling trips was observed in the wider City Study Area.

The modelling results in Waterford show lower levels of impact with negligible impact on travel time, delays and the volume of car trips. The additional costs are not as significant as they are based on distance travelled and journey lengths are relatively short. In addition, the availability of alternative transport is more limited than is the case in Dublin. Nonetheless, the fleet responses do give rise to moderate to significantly beneficial impacts on air quality and de-carbonisation.

Dublin	-6% CO ₂	-3% NO _x	-3% PM ₁₀	-1% Car Trips	-4% Travel Time	-5% Delay
Cork	-6% CO ₂	-5% NO _x	0% PM ₁₀	-1%* Car Trips	-4%* Travel Time	-5%* Delay
Limerick	-5% CO ₂	-4% NO _x	0% PM ₁₀	-0.5%* Car Trips	-2%* Travel Time	-2.5%* Delay
Galway	-4% CO ₂	-3% NO _x	0% PM ₁₀	-0.5%* Car Trips	-2%* Travel Time	-2.5%* Delay
Waterford	-5% CO ₂	-4% NO _x	0% PM ₁₀	0% Car Trips	0% Travel Time	0% Delay

* Derived from modelling results for Dublin and Waterford with the measure assumed to perform better in larger cities with more extensive public transport given the results available.

Dublin			Urban Realm	Congestion Air Quality	Carbon		
Cork			Urban Realm	Congestion Air Quality	Carbon		
Limerick			Urban Realm	Congestion	Air Quality Carbon		
Galway			Urban Realm	Congestion Air Quality	Carbon		
Waterford			Urban Realm Congestion	Air Quality	Carbon		
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling showed a variation in performance between Dublin and Waterford. The results for Dublin were consistent with the findings of the Phase 1 qualitative assessment. The results indicate that FM03 as modelled is less impactful in Waterford, notwithstanding the benefits in reducing emissions from transport. Whilst Phase 2 quantitative data showed lower benefits for the urban realm and congestion, in the case of Dublin, the overall ranking of the measure is unchanged from Phase 1 when FM03 was ranked 5th.

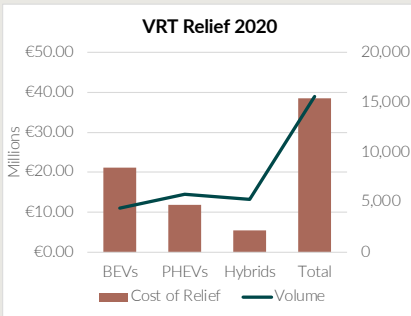
As mentioned above, with a measure such as FM03, there would be considerable flexibility to set the levels of taxation to further support measures and it is not considered unrealistic to attain higher benefits than indicated by these initial modelling results.

The priority rankings for the individual cities are:



4

FM05



Alternative Fuels

FM05: Alternative Fuelled Vehicle Support

BEV: Battery Electric Vehicle

FCEV: Fuel Cell Electric Vehicle (e.g. hydrogen)

HEV: Hybrid Electric Vehicle

PHEV: Plug-In Hybrid Electric Vehicle

ICE: Internal Combustion Engine (generally petrol or diesel)

VRT: Vehicle Registration Tax

Description of Measure

The initial capital cost of alternative fuelled vehicles is often significantly higher than comparative ICE options. As cost is a significant factor in vehicle purchase decision making, there is a risk that the differential will limit the attractiveness of alternative fuelled vehicles. To address the cost differential, many countries have introduced purchase grants or subsidies to encourage the purchase of alternative fuelled vehicles.

Another barrier to switching from ICE to alternative fuels is the (perceived) lack of publicly-available charging infrastructure. Home-charging infrastructure (for vehicle owners with off-street parking) converts this issue of charging from a barrier into an asset, by providing the ability to charge vehicles cheaply over-night. Grants are widely provided to support the installation of this 'home-charging' infrastructure. Similar grants or tax breaks can be provided for commercial organisations investing in fleet charging infrastructure.

This measure covers the continuation, enhancement or phasing out of financial supports or requirements for the purchase of alternative fuelled vehicles and/or supporting infrastructure. Related vehicle registration tax and motor tax incentives are addressed in FM01.

Existing Situation

Purchase grants of up to €5,000 are available through the SEAI for a new BEV purchased and registered in Ireland, with grants of up to €2,500 available for PHEVs. In addition, these vehicles also qualify for VRT relief of up to €5,000 for a BEV and €2,500 for a PHEV, providing a maximum combined subsidy (grant + VRT relief) of €10,000 for BEVs and €5,000 for PHEVs. The €5,000 relief for Battery Electric vehicles is tapered for vehicles with an Open Market Selling Price (OMSP) over €40,000, so that no amount of relief is available for BEVs with a value of over €50,000. The VRT relief for PHEVs will no longer be available from 1st January 2022 but has been extended for BEVs until the end of 2023.

In 2021, a new 20-band rates table was introduced for VRT, allowing for a more graduated approach in order to strengthen the environmental rationale of the VRT regime in line with the 2019 Climate Action Plan. The charging structure for the NO_x surcharge was also adjusted so that 1-40mg are charged at €5 per mg, and 41-80 mg are charged at €15 per mg. Whereas 2020 VRT rates ranged from 14% to 30%, the 2021 VRT table has a range from 7% for cars with carbon emissions up to 50g/km to 37% on vehicles with emissions over 191g/km. In the 2022 budget, a revised VRT table will be introduced. The 20 band table will remain, with an uplift in rates with a 1% increase for vehicles that fall between bands 9-12; 2% for bands 13-15; and then a 4% increase for bands 16-20.

The NTA also administer taxi purchase grants for Small Public Service Vehicles (SPSVs) such as taxis and hackneys. The scheme has increased from €1m in 2020 to €15m in 2021, with grants of up to €20,000 currently available to existing SPSV drivers who scrap older, high mileage vehicles for new full electric models. As part of the previous scheme, drivers could apply for grants of up to €10,000 towards the purchase of a new full battery eSPSV with a further €2,500 available to convert it to a wheelchair accessible model. Those scrapping older, more polluting, or high mileage vehicles are now eligible for double the normal grant if they make the switch to electric, with €20,000 available for a new full electric or €25,000 for a wheelchair accessible new battery electric vehicle.

With the increasing popularity of alternative fuelled cars, the cost to the exchequer of supports has been increasing significantly. In 2020, €38.6million in VRT reliefs were administered. To ensure value for money, consideration is being given to adjusting the structure to in effect cap the level of support, particularly for higher value cars.

The EU Clean Vehicles Directive legislates for public procurement at European level and it has now been transposed into Irish law. The Directive will oblige public sector bodies to meet minimum targets for the share of 'clean' (low-emission and zero-emission) vehicles in public procurement since August 2021. The Directive additionally obliges Ireland to ensure that public transport (bus) procurement strategies include low-emission alternatives and a minimum level of zero-emission buses (BEV or FCEV).

Best Practice Evidence – Private Cars

Looking only within Europe, it is very common for incentives to be provided to encourage the purchase of alternative fuelled cars. In general, the levels of subsidy/grant are of the same order of magnitude as those applied in Ireland. There are some notable differences, in particular where support is given to FCEV. Most countries provide lower levels of support and certain limits on PHEV, such as requirements for minimum distance range in electric mode.

Whilst the current levels of support are comparable, there is some divergence in the future direction. In Flanders, Belgium, purchase supports which were available since 2016 ended in 2020. Denmark is phasing out VRT exemptions/reductions. France and Germany on the other hand are planning to increase supports.

	Purchase Support			Registration Tax Exemptions/Reductions			Home Charging Grants
	BEV	PHEV	FCEV	BEV	PHEV	FCEV	
Ireland	✓	✓	✗	✓	✓	✗	✓
Austria	✓	✓	✓	Implied	Implied	Implied	✓
Belgium	Ended 2020	✗	Ended 2020	✓	Ended 2020	✓	✓
Denmark	✗	✗	✗	Phased out by 2023	Phased out 2022	Phased out 2021	✗
France	✓	Ended 2018	✓	Implied	Implied	Implied	✓
Germany	✓	✓	✓	N/A	N/A	N/A	✓
Sweden	✓	✓	✓	N/A	N/A	N/A	✓
Netherlands	✓	✗	✗	✓	✗	✓	N/A
UK	✓	✗	✓	✓	✗	✓	✓

Best Practice Evidence – Commercial Vehicles

There is a broad range of tax reliefs applied across Europe in relation to the purchase of alternative fuelled vehicles. In Belgium, for example, BEVs are 100% deductible from company taxes. There are also examples of supports for the provision of supporting infrastructure. In Denmark, between 2016 and 2019, commercial charging investments were tax exempt; support for electric charging for buses will continue until 2024.

Case Study – Austria

The Austrian government is planning to provide significant subsidies for the purchase of commercial vehicles across private companies and local authorities. The subsidies will include:

- Up to €130,000 for electric buses
- Up to €60,000 for electric commercial vehicles
- Up to €30,000 for charging stations for commercial vehicles

Best Practice Evidence – Public Procurements

A number of European countries have introduced restrictions on and funding for the purchase of vehicles by public bodies and others are planning to, as the EU Clean Vehicles Directive is implemented.

The Swedish government mandates the adoption of environment-friendly and electric cars in government fleets, with the exception of some classes of cars (e.g. emergency vehicles, cars with more than five seats, vehicles used by security and protection institutions). By 2025 public authorities in Brussels can only purchase zero-emission cars and light duty vehicles, which also applies to the public transport buses.

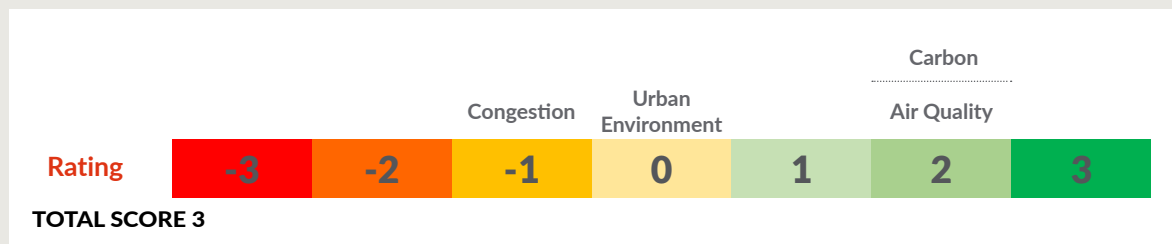
In Denmark, funding programmes to support municipalities have been in operation since 2013. Public procurement is moving quickly in Copenhagen, which aims to convert its entire bus fleet to electric vehicles by 2031.

Stakeholder Feedback

There were high levels of support for the take up of alternative fuels, with the suggestion that the measure should be extended to cover all public transport fleets. Furthermore, there was a view that this measure would seek to address range anxiety and the high costs of EVs.

Perceived Issues and Concerns	Perceived Benefits and Opportunities
<ul style="list-style-type: none"> Low impact. Alternatives may be expensive. Funding should be focused on other areas, such as to enable switch to new low emissions vehicles. 	<ul style="list-style-type: none"> Extended to grants for renewals of clean features e.g. AdBlue systems in Euro 6 HGVs or clean exhausts.

Assessment of Likely Impact



Exchequer Cost	Significantly Adverse
	Very significant direct cost to the exchequer.
User Cost	Slightly Positive
	The grants will generally help close the capital cost gap between zero-emission vehicles and ICE's and the tariffs for the electricity and the price of petrol/diesel (and the 2nd-hand car market) will then determine when the total cost of ownership tips in favour of the zero-emission vehicles.

National Economy Impact	Local Economy Impact	Political Acceptability	Accessibility Impact	Social Inclusion Impact	Safety, Physical Activity & Health	Technology Requirements	Delivery Timescale	Support for National Policy	Support for Local Policy	Transport Integration	Legislative Implications
0	0	3	0	0	0	-1	-1	3	2	0	-1

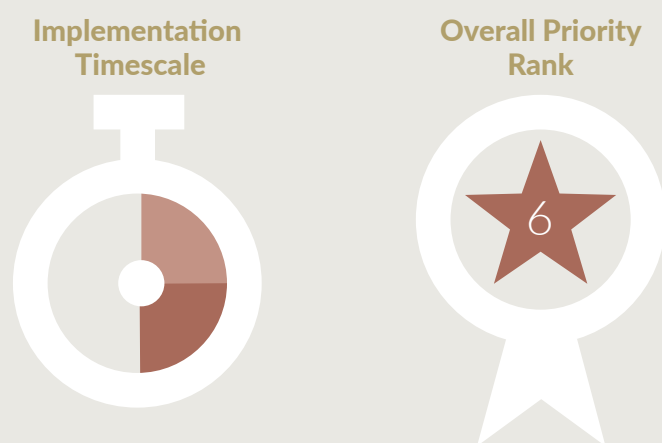
Implementation Considerations

The provision of grants is very costly to the exchequer. There are also potential issues of equity, as even with the grants, many people cannot afford to purchase a new alternatively fuelled vehicle and state aid issues arise if the level of grant subsidies for commercial organisations exceed 'de minimis' levels.

With very significant financial implications for the exchequer it is unlikely to be sustainable or prudent to continue this measure in the long term. However, in the short to medium term this will likely be a key measure to manage the switch to alternative fuelled vehicles. Whilst it is acknowledged that the market is changing rapidly, it would be preferable to have a clear strategy for the phasing of interventions and their likely expiry date.

It is recommended that support for the uptake of alternative fuelled vehicles is continued as a demand management measure with the following considerations:

- PHEV supports are phased out as soon as possible.
- Supports for BEV for both private and commercial are continued and adjusted to meet market characteristics (i.e. increased if take up is slower than desired or decreased if base costs fall relative to ICE).
- Supports for FCEV and Hydrogen combustion engines are provided which particular consideration for large commercial vehicle purchases (e.g. private buses).
- Supports are provided for charging/fuelling infrastructure to encourage the switch to alternative fuelled vehicles.
- Rules for public procurement of vehicles are enacted with supporting legislation as required.



Quantitative Modelling Assessment of FM05 Alternative Fuelled Vehicle Support

FM05 will allow for focused incentives to encourage the uptake of lower polluting vehicles. Due to the nature of the measure, it is expected that it will have more impact on vehicle technology choice than vehicle utilisation. To achieve an understanding of the scale of quantitative impacts of the measure, consideration was given to the likely impact on the fleet profile and emissions. Therefore, the ENEVAL Environment Model was applied to assess the potential level of the impact of FM05. The impact of this measure was assessed across all five cities against the reference case and modelled through emissions modelling rather than mode choice modelling.

Indications from Quantitative Modelling

The modelling results indicate that FM05 would have a small but consistently positive impact on reducing carbon emissions across all five cities, both within the City Core and the wider City Study Area.

The impact on air quality indicated by the modelling results identifies a positive reduction in NO_x across all five cities, ranging from a 4% reduction in the wider Dublin City Study Area to a 6.5% reduction in NO_x in Cork. This reduction in NO_x is driven by a shift towards cleaner vehicles as a result of this measure, in particular the shift from hybrid to full EV. These reductions are in addition to the underlying reductions in carbon emissions in the 2030 reference case.

The impact on PM_{10} particulate matter was also positive, although much lower (between -0.2 and -0.4%

reductions). This negligible impact on particulate matter emissions is due to the bulk of these emissions being generated by tyre and break abrasion, rather than from tail pipe emissions.

The traffic impacts of this measure are expected to be of a small order of magnitude and were not modelled. Nonetheless, the incentivisation to purchase vehicles and the potential increase in fleet size could result in a slightly negative impact on congestion across all five cities.



* Car trips, travel time and delay are not modelled within the RMS Environmental Module.

Dublin	Congestion	Urban Environment	Carbon	Air Quality			
Cork	Congestion	Urban Environment	Carbon	Air Quality			
Limerick	Congestion	Urban Environment	Carbon	Air Quality			
Galway	Congestion	Urban Environment	Carbon	Air Quality			
Waterford	Congestion	Urban Environment	Carbon	Air Quality			
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling is consistent with the findings of the Phase 1 qualitative assessment, with Phase 2 providing some greater clarity on the potential variation of impacts between the cities in terms of air quality.

The quantified reduction in carbon is less beneficial than the rating awarded in Phase 1. It may be possible to improve on FM05's performance in terms of carbon through more targeted, higher level supports for zero emission vehicles as opposed to lower emission vehicles such as hybrids.

The priority rankings for the individual cities are:



Congestion Charging

FM11: Congestion Charging

4

FM11

Description of Measure

The economic cost of congestion is considerable. Additionally, traffic congestion is damaging to quality of life and wellbeing and can also inhibit the movement of other modes, walking, cycling and public transport. In urban areas congestion results in significant negative impacts air quality and CO₂ emissions, as slower traffic speeds and higher levels of stop/start movements have negative impacts on fuel efficiency.

Congestion charging/road pricing is often advocated as a means of managing the harmful impacts of traffic. In principle, it is expected that an increase in the cost of driving will reduce car-based demand.

The impact of Congestion Charging scheme depends on a great many things including the:

- area affected
- level of charges
- hours of operation
- availability of alternative transport
- relative attractiveness of alternative destinations
- availability of alternative routes particularly for through traffic.

Congestion charging schemes are expensive to implement and operate, as they need extensive signing, vehicle recognition infrastructure (usually ANPR cameras &/or automated tolling technology) to detect when individual vehicles are being driven within the controlled area and a 'back office' to process the collection of the charges (unless fully automated tolling is used), issuing and collecting fines and processing appeals etc.

Best Practice Evidence

There are a number of schemes in operation around the world in the form of charging or permit systems and a number of cities are considering potential implementation. The schemes in operation demonstrate a significant reduction in traffic volumes and transport related emissions (see Best Practice Report for more details).

Case Study	Year of Implementation	Outcomes
London	2003	Traffic reduction of 19%, increase in bus patronage and cyclists. 16%, 13% & 7% decrease in CO ₂ , NO _x and PM ₁₀ .
Stockholm	2007	Traffic reduction of 20%, NO _x decreases of 8.5%, 10-14% reduction in airborne pollutants & 2-3% reduction in CO ₂ (wider metropolitan area).
Gothenburg	2013	Traffic reduction of 12%.
Milan	2012 (replacing 2008 scheme)	Traffic reduction of 38%, road accidents reduction of 26%. CO ₂ reduction of 35% and PM ₁₀ by 18%.
Singapore	1998	Traffic reduction of 24% and congestion on arterial roads.
Trondheim	1991	Inbound traffic reduction by 10%.
New York	Planned 2022	Not yet implemented.

It is important to note that many of the implemented schemes faced, and still face, significant public and political opposition, though in some cities public opinion of the charges have improved since implementation. In 2005, a referendum on a congestion charge for Edinburgh was rejected by nearly three quarters of voters. Proposals for congestion charges in Manchester and Copenhagen have also failed to be progressed to date. In the case of New York, whilst congestion charge proposals prepared in 2008 failed to progress, proposals were revisited and it is now planned to implement a congestion charge scheme in 2022.

European Experience – Milan

A €5 daily charge is applied to vehicles entering the city centre (Area C) on weekdays during working hours. Various exemptions were made for non-polluting vehicles, taxis, PT, disabled person's parking card holders etc. Residents have 40 free accesses per year and pay a reduced fee of €2 thereafter.

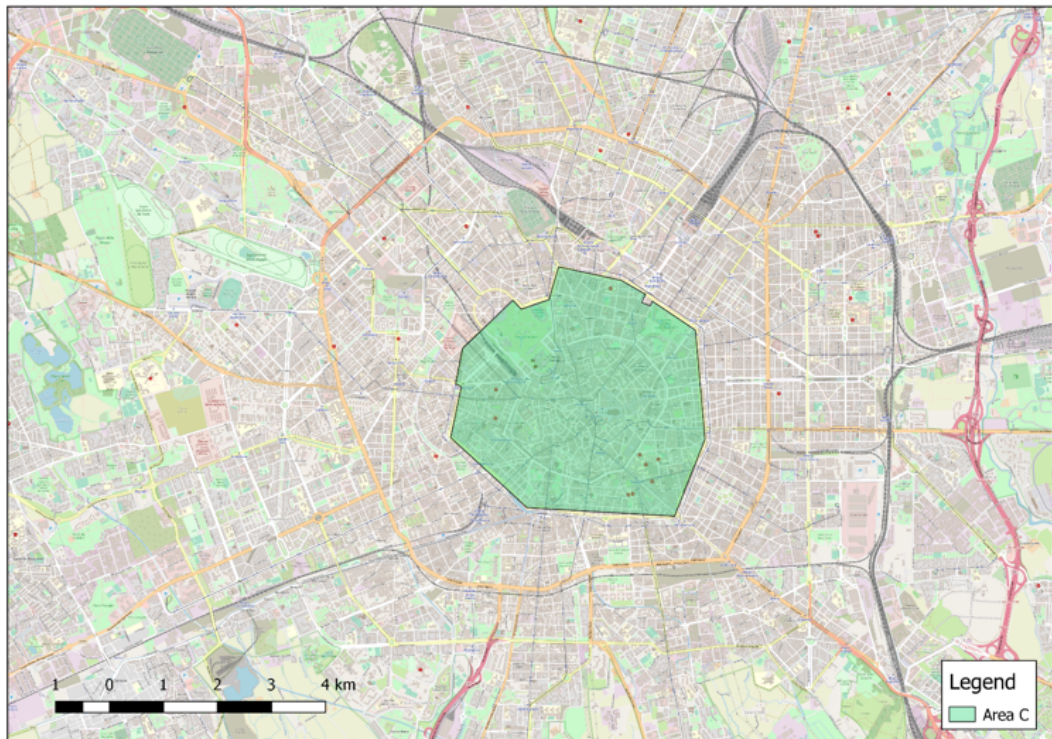
Motorists must obtain a ticket from a meter, designated shops or via the Italian electronic toll tag system Telepass. The system is monitored by cameras.

Some allowances have been made for city centre businesses, for example, the charging hours are curtailed on Thursday to support late night shopping.

There is no indication that the scheme has resulted in increased parking around the edge of the zone or a modal shift to public transport. The reduction in traffic is being attributed to lower levels of through traffic.

All the incomes from Area C have been reinvested in projects for sustainable mobility:

- 62 % for the strengthening of public transport in order to improve frequency
- 22 % for the development of sustainable mobility projects
- 16 % is the cost of IT management access control the software management and authorizations of payment channels



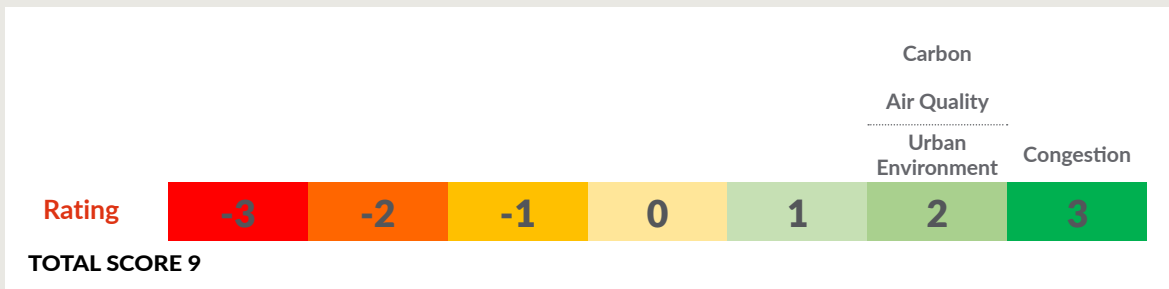
Stakeholder Feedback

Perceived Issues and Concerns	Perceived Benefits and Opportunities
<ul style="list-style-type: none"> Displacement effects and rat running. 	<ul style="list-style-type: none"> Revenue should be re-invested in sustainable mobility.
<ul style="list-style-type: none"> Potential for negative impacts on specific groups/communities – should be exemptions to mitigate these. 	
<ul style="list-style-type: none"> Alternatives need to exist prior to delivery. 	
<ul style="list-style-type: none"> Need exemptions for Electric Vehicles. 	
<ul style="list-style-type: none"> Negative economic impacts on city centres. 	
<ul style="list-style-type: none"> Significant financial investment required. 	

“Congestion charges are interesting in a general sense, to try and force people to think about how they travel and what are the optimal ways of travelling. My starting point would be how you can get people moving around the place by their own power, and then public transport and then these sorts of solutions.”

Assessment of Likely Impact

There is very strong evidence that Congestion Charging delivers reductions in traffic volumes, improves air quality measures and reduces the levels of CO₂ from transport emissions. There are concerns of the impact on the local economy and risks that the measure will have on social inequality. Experience from elsewhere has shown that schemes can be challenging in terms of political acceptability.



Exchequer Cost

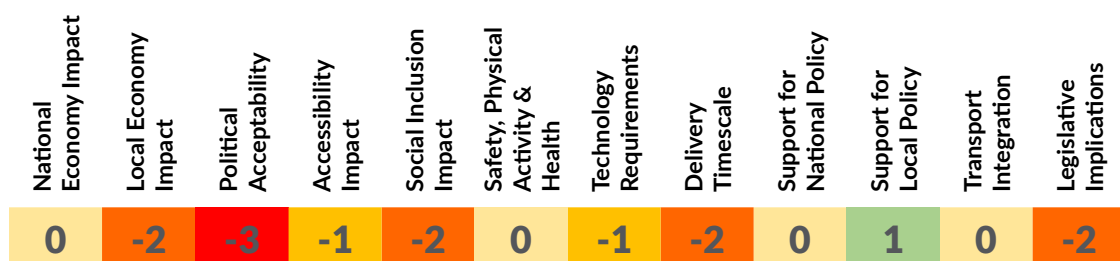
Slightly Positive

Whilst there will be significant up-front infrastructure and administration costs, the scheme is expected to generate a net surplus for the exchequer.

User Cost

Moderately Adverse

Direct cost to the user and potentially additional travel costs for those who choose to avoid the congestion charge. Expected to be exemptions/reduced charges for particularly user groups which could include residents



Implementation Considerations

There is potential to integrate a congestion charge zone with a low emission zone (see AQ04) as has been done in Oslo for example. In effect, the congestion charge would be varied depending on the vehicle emissions, with higher rates charged for the most-polluting vehicles.

There will be a lead in time required to plan and ensure acceptability of the measure.

Significant infrastructure will be required to enforce the charges.

The congestion charge zone would need to be large enough to be impactful and to limit impacts around the cordon, including rerouting on unsuitable orbital routes round the controlled area and increased edge-of-zone parking on neighbouring streets. Large zones either fail to target internal movement (if the scheme is implemented as a charge for crossing a cordon) or significant numbers of additional ANPR cameras (including mobile camera units), if the charge is to be applied throughout the controlled area.

Not all cities will have a suitable area which can find this 'sweet spot' between too small and too large a controlled area and a road network which avoids the through traffic creating significant orbital congestion.

At present, it is considered that there is merit for further consideration in the case of the cities of Dublin and Cork. Opportunities may arise in Galway with the delivery of improved public transport and park and ride facilities as envisaged in the Galway Transport Strategy.

Implementation Timescale



Overall Priority Rank



Quantitative Modelling Assessment of FM11 Congestion Charging

An initial quantitative modelling assessment of Congestion Charging was undertaken in the case of the cities of Cork and Dublin. For Dublin, the Congestion Charge boundary was set at the Canal but also included the docklands and the Port Tunnel. For Cork the boundary chosen was the natural boundary of the River Lee, both north and south of the city centre.

The impact of FM11 Congestion Charging was assessed in the Regional Modelling System (RMS) utilising the Road Assignment Model (road charges and bans). Congestion Charging was applied in the model as a toll incurred when entering the Congestion Charging Zone. Once in the Congestion Charging Zone, no further charges were applied, nor were they applied on exiting the Congestion Charging Zone.

Two scenarios were tested in each city:

City	Scenario Reference	Congestion Charge Rate
Cork	FM11 - C1	€10.00 all day flat rate
	FM11 - C2	€10.00 during peak times & €5.00 during off peak
Dublin	FM11 - D1	€10.00 all day flat rate
	FM11 - D2	€10.00 during peak times & €5.00 during off peak

Quantitative Modelling Assessment of FM11 Congestion Charge

Study Objective		Quantitative Analysis			
		Dublin	Dublin	Cork	Cork
		€10.00 all day flat rate	€10.00 peak times & €5.00 off peak	€10.00 all day flat rate	€10.00 peak times & €5.00 off peak
Congestion	Travel Time Wider City	-6%	-6%	0%	-1%
	Travel Time City Core	-29%	-26%	-24%	-22%
Carbon	CO ₂ Wider City	-1%	-1%	+1.5%	+1%
	CO ₂ City Core	-12%	-9%	-15%	-14%
Air quality	NO _x Wider City	-1%	-1%	+2%	+1%
	NO _x City Core	-10%	-7%	-12%	-11%
	PM Wider City	0%	0%	+1%	+1%
	PM City Core	-12%	-9%	-13%	-11%
Urban environment	Change in Car Trips Wider City	-2%	-1%	-2%	-1%
	Change in Car Trips City Core	-14%	-3%	-7%	-5%

Indications from Quantitative Modelling

The modelling results indicate that FM11 would have a significantly positive effect on congestion in Dublin with reductions in car travel time within the City Core of nearly a third. As expected, the impact is less in the wider City Study Area, nonetheless a 6% reduction in travel time across Dublin is also significantly positive.

The modelled results for Cork imply more mixed results, with reductions in congestion in the City Core of up to a quarter, but little impact in the wider City Study Area. This indicates that there is an amount of car trip redistribution away from the City Core to areas outside the modelled Congestion Zone.

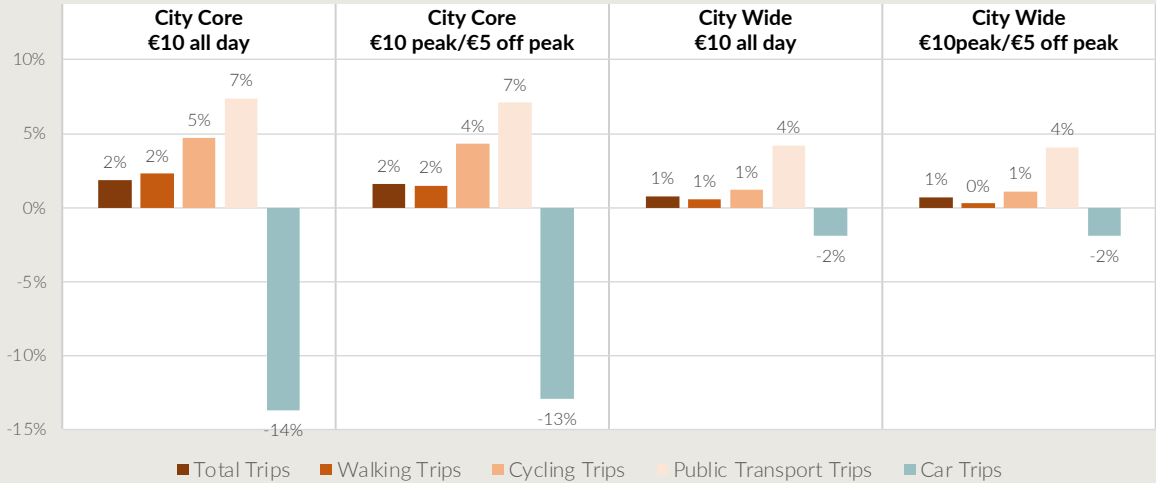
The same pattern is exhibited in the analysis of modelled carbon impacts. In the case of Cork, it is likely that, as modelled, FM11 would result in a net increase in carbon emissions overall.

Importantly, the model results indicate that FM11 would result in significant reductions in pollutants affecting air quality within the City Core of both Dublin and Cork, with reductions of 7% to 12% in NO_x and 9% to 13% in PM. It is expected that the reduction in car trips and improvements to air quality would result in significantly positive impacts on the urban environment within the City Core. In the case of Cork, the model results show that traffic redistributing elsewhere presents a risk of higher concentrations of vehicle emissions affecting air quality outside the City Core.

Looking more closely at the model outputs, data on trips by mode indicate that an all-day charge would reduce the volume of car trips in the Dublin City Core area by 14%. The total number of trips to the City Centre remain broadly the same, with a slight increase of around 2% in the scenario where congestion charging is applied.

The model data indicates increased levels of walking and cycling – with subsequent benefits for health and physical activity. There is also an increase in public transport use in both the City Core area and the wider City Study Area, as trips shift away from car.

Dublin - Change in Trips

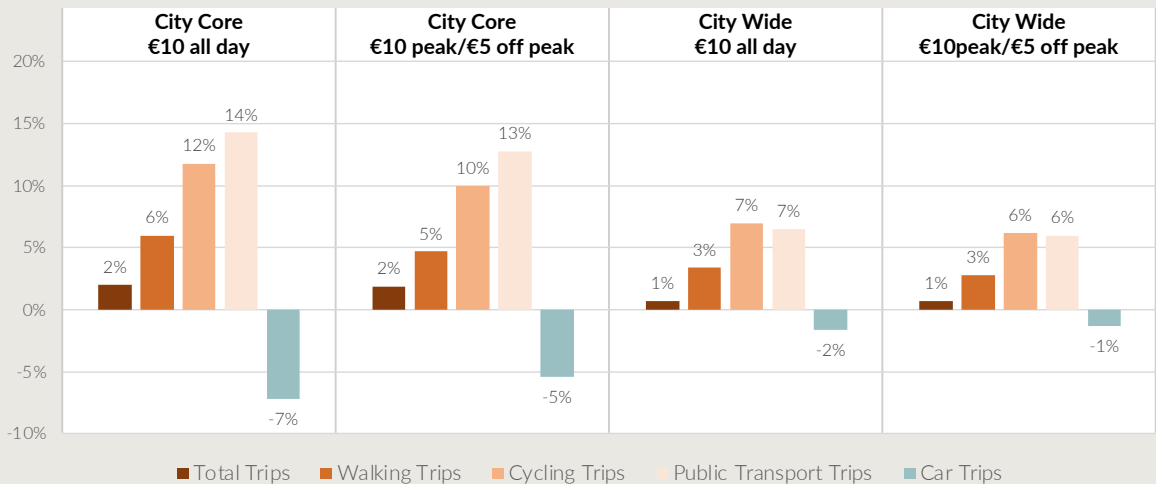


Whilst the impacts are less pronounced at the City wide level, as would be expected, the pattern of change is consistent showing little impact on overall trip numbers and a shift away from car to sustainable modes.

In Cork, data on trips by mode indicate that an all-day charge would reduce the volume of car trips in the Cork City Core area by 7%. The total number of trips to the wider City Study Area and to the City Centre remain broadly the same, with a slight increase of between 1% and 2% respectively.

The model data also indicates increased levels of walking and cycling in both the City Core and the wider City Study Area – with subsequent benefits for health and physical activity. This increase in Cork is more noticeable when compared to increases in active travel in Dublin. This may be due to the lower existing modal share for active modes in Cork when compared to Dublin, and also reflect the shorter distance car trips. There is also an increase in public transport use as trips shift away from car, most notably in Cork’s City Core area.

Cork - Change in Trips



Overall the model data indicates that a form of congestion charge would perform well against the objectives, particularly in Dublin.

In Cork, there is a risk that redistributed traffic would reduce the benefits and potentially result in a negative overall impact against the Study objectives, for example, a small increase in carbon emissions. The work undertaken to date did not extend to identifying mitigation measures or traffic management interventions to address the knock-on impacts outside the congestion zone, which should be examined if FM11 proposals are brought forward.

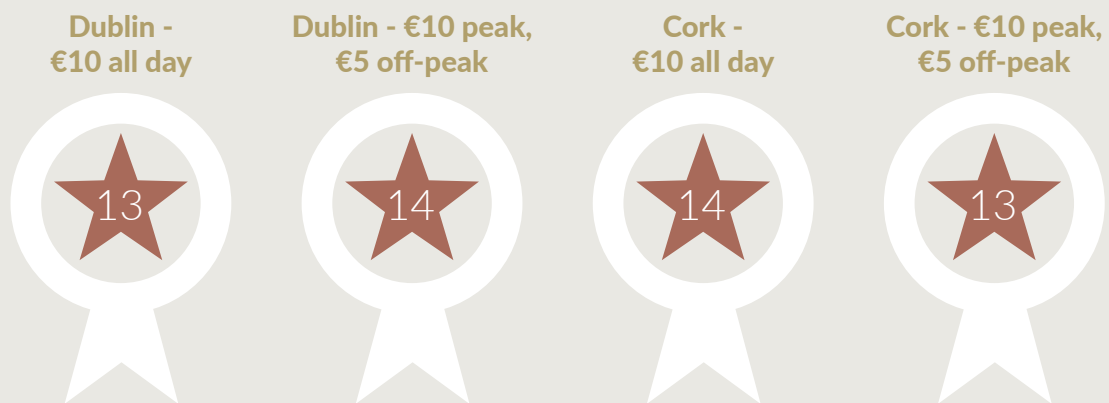
Dublin - €10 all day	Carbon Air Quality		Congestion Urban Environment				
Dublin - €10 peak, €5 off peak	Carbon Air Quality	Urban Environment	Congestion				
Cork - €10 all day	Congestion Carbon Air Quality		Urban Environment				
Cork - €10 peak, €5 off peak	Congestion Carbon Air Quality		Urban Environment				
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling provides greater clarity on the potential variation of impacts between Cork and Dublin and all day versus a peak focused congestion charge.

Overall, the results in terms of urban environment and congestion impacts are consistent with Phase 1 in the case of Dublin. The modelling results do not show as positive performance for FM11 in Cork within this initial scenario testing.

For both cities, the results indicate lower benefits for carbon and air quality, though, it is notable that the results are significantly better within the congestion zone compared to the city as a whole.

Overall, it is likely that these results could be improved upon with further refinement of FM11 including mitigation measures to prevent redistribution of traffic. Based on the tests to date, the priority rankings for Cork and Dublin are:



4

AQ01

Existing Legislation

The EU Air Quality Clean Air for Europe (CAFE) Directive (2008/50/EC) has resulted in national regulations outlining acceptable, and non-acceptable, levels of air pollution.

Ireland has transposed the CAFE directive into Irish legislation through the Air Quality Standards Regulations 2011.

European Examples

Germany has a national Air Quality framework and only certain criteria can be altered by location, for example timings, location and emission standard. Over 50 environmental zones have been introduced in Germany to date.

In England, the Clean Air Zone Framework sets out the principles and expected approach to be taken by local authorities when implementing and operating a Clean Air Zone.

Clean Area Zones/Low Emissions Zones

AQ01: Clean Air Enabling Legislation

Clean Air Enabling Legislation, including taxi & bus licensing impacts

Description of Measure

The air quality in Irish cities is presently good; however, there are concerns that, unless the harmful effects of road traffic are addressed, there will be exceedances in NO_x levels in the near future. In September 2020, the EPA10 reported that there was an exceedance of the annual average nitrogen dioxide (NO_x) EU limit value at one traffic monitoring location in Dublin city centre (St Johns Road West). The report also shows that, in urban areas, the impact of traffic related nitrogen dioxide pollution is increasing - with the EPA highlighting that these types of exceedances will continue unless we curb our reliance on fossil fuel powered transport, particularly diesel cars.

Should a breach be identified, Local Authorities are required to prepare a clear, comprehensive and accessible Air Quality Plan or review. Ideally, there should be a range of options available to address air quality issues, as and when needed, including traffic management, charging mechanisms and restrictions on the most-polluting vehicles.

Whilst current legislation identifies the need for an Air Quality Plan in the event of a breach, the legislative supports for delivery are complex. This demand management measure aims to ensure that the legislative framework enables the most appropriate actions to be taken, should they be required and that they can be suitably enforced. It is envisaged that legislation would provide for the emissions-related regulation of private cars, goods vehicles, taxis and buses.

Best Practice Evidence

Many European countries have established approaches to enacting and enforcing Clean Air Zones (CAZ) and/or Low Emissions Zones (LEZ), through permanent and temporary mechanisms in response to pollution emergencies. Usually this means that vehicles with higher emissions cannot enter the area or that tiered charges are applied to more polluting vehicles, either as they cross a cordon to enter the zone or as daily charge for using any of the streets within it.

Stakeholder Feedback

"Should make clear who is responsible addressing instances where Air Quality limits are breached."

Impact in Delivering the Study Objectives

Legislation in and of itself will not enact a Clean Air Zone or similar; however, it is expected that the existence of legislation and a framework for interventions will inform the public as to what actions might be taken. This knowledge is likely to inform vehicle purchasing behaviours and result in less demand for vehicles with the poorest air quality standards, e.g. older diesel cars.

Quantitative Modelling Assessment of AQ01 Clean Air Enabling Legislation

The quantitative modelling for AQ01 looks at the impact that Clean Air Enabling Legislation would likely have as a signalling mechanism to inform vehicle purchasing behaviours towards cleaner vehicle alternatives. To achieve an understanding of the scale of quantitative impacts of the measure, consideration was given to the likely impact on the fleet profile and emissions. The impact of this measure was assessed across all five cities, and was modelled through the ENEVAL Emissions Module.

Study Objective		Quantitative Analysis				
		Dublin	Cork	Limerick	Galway	Waterford
Congestion		Not directly modelled – no elements of the model’s travel demand assignment were changed for AQ01, as the measure is focused on cleaner vehicle take-up rather than vehicle utilisation.				
Carbon	CO₂ Wider City	-2%	-2%	-1%	-2%	-1%
	CO₂ City Core	-1%	-2%	-1%	-2%	-1%
Air quality	NO_x Wider City	-4%	-6%	-6%	-6%	-6%
	NO_x City Core	-2%	-5%	-4%	-5%	-5%
	PM Wider City	negligible	negligible	negligible	negligible	negligible
	PM City Core	negligible	negligible	negligible	negligible	negligible
Urban Environment		Not directly modelled – no elements of the model’s travel demand assignment were changed for AQ01, as the measure is focused on cleaner vehicle take-up rather than vehicle utilisation.				



Indications from Quantitative Modelling

The modelling results indicate that AQ01 would have a consistently positive impact on reducing carbon emissions across all five cities, both within the City Core and the wider City Study Area. The anticipated shift from diesel to petrol vehicles within the tested scenario somewhat mutes the impact of higher EV uptake on CO₂ reductions.

The impact on air quality indicated by the modelling results identifies a positive reduction in NO_x across all five cities, ranging from a 4% reduction across Dublin to a 6% reduction in Cork's wider study area. This reduction in NO_x is driven by a shift towards cleaner vehicles as a result of this measure, in particular the shift from hybrid to full EV.

The impact on PM₁₀ particulate matter was negligible due to the bulk of these emissions being generated by tyre and break abrasion, rather than from tail pipe emissions.

Dublin	Congestion Urban Environment		Carbon Air Quality				
Cork	Congestion Urban Environment		Carbon	Air Quality			
Limerick	Congestion Urban Environment		Carbon	Air Quality			
Galway	Congestion Urban Environment		Carbon	Air Quality			
Waterford	Congestion Urban Environment		Carbon	Air Quality			
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling indicate slightly higher benefits for air quality and carbon. This has been taken into account within a revised scoring for AQ01, however the overall priority ranking did not change as a result.

The priority rankings for the individual cities are:



Clean Area Zones/Low Emissions Zones

AQ04: Clean Air Zone (CAZ) via ANPR

Clean Air Zone (CAZ) via ANPR (where significant Air Quality concerns arise in individual cities)

AQ05: Clean Air Zone (CAZ) via National Vehicle Sticker Scheme

Clean Air Zone (CAZ) via National Vehicle Sticker Scheme (where significant Air Quality concerns arise in individual cities)

4

AQ04 & AQ05

Description of Measures

CAZs and LEZs are an increasingly common demand management measure to address significant air quality issues arising from transport in European cities. Fundamentally, the measure comprises either bans or charges to deter the use of the most-polluting vehicles or both. There is a broad scale of CAZs allowing for regulations to be tailored to impact specific ranges of vehicles, times of day and geographic areas. Exemptions can be applied to specific vehicles or for specific groups, such as disabled drivers.

The method of enforcement of the CAZ is a key consideration and can result in significantly different costs, both fixed and operational. Levels of compliance are also dependent on the enforcement approach. This can affect behavioural responses, for example, people who access the CAZ infrequently by car may be less likely to replace a non-compliant vehicle and instead take a chance that they will not be charged or fined if the restrictions are not enforced.

Two methods of enforcement are widely used in Europe, ANPR and sticker systems:

ANPR

- ANPR automated number plate recognition is used to identify vehicles entering the zone &/or driving within it and charges or fines are applied to every non-exempt vehicle.
- The technology is similar to that used to enforce the M50 barrier free tolling.
- In some countries, data protection rules make the implementation of ANPR enforcement impractical.
- Higher infrastructure costs and ongoing administration and maintenance costs.

Vehicle Sticker Scheme

- Sticker systems requires vehicle owners to display a clearly visible sticker or disc that is often colour coded.
- Sticker systems offer greater flexibility to adjust or expand the geographic area comprising the clean air zone.
- Higher level of non-compliance expected, especially for through traffic.
- Enforcement costs would depend on level of enforcement and who would administer it (Gardaí, traffic wardens or other).



LEZ stickers with Euro-norm indication in use in Germany.



New 2020 Dutch signage indicates for which vehicles the LEZ applies (with text 'Euro norm and higher allowed')

Best Practice Evidence

ANPR Case Study London and European Examples

There is currently both a LEZ and ULEZ in London, covering the wider London area and city cordon respectively. To enter the ULEZ without a charge, petrol vehicles must be 'Euro 4 or better' and diesel vehicles must be Euro 6. Non-compliant light vehicles are charged £12.50 per day to operate within the ULEZ and non-compliant heavy vehicles are charged £100 per day. The ULEZ has helped deliver a 29% decrease in NO_x concentrations and an estimated reduction of 4% in CO₂ emissions²⁵. The ULEZ will soon be expanded to an area up to 20 times greater than the current area covered.

Across the UK, a number of major cities including Birmingham, Bristol, Greater Manchester, Leeds, and Sheffield, have been mandated by the UK government to introduce CAZs, to tackle their current air quality breaches. Birmingham and Leeds were expected to introduce charging CAZs using ANPR in 2020; however, this timeline has been impacted as a result of the COVID-19 pandemic.

ANPR enforcement of clean air zones is also used in Brussels and Amsterdam.

Sticker Enforcement Case Studies: Germany and Paris

In Germany, a national standardised sticker system which is currently applied to over 50 LEZ and 80 cities, is in operation. To enter zones covered by the scheme, all vehicles must display a certified sticker indicating how polluting their vehicles is. Certain classes of vehicles are prohibited from entering LEZs and police are tasked with checking stickers and fining offending drivers. This is much cheaper to implement than using ANPR, but works best when the polluting vehicles are banned, rather than just subject to a modest daily charge, so that enforcement consists of issuing fines to a small number of vehicles, rather than collecting daily charges from a large number of non-compliant vehicles entering the zone each day. In general, the lead-time for introducing a ban on non-compliant vehicles will be longer than the time needed to introduce a 'modest' daily charge. The evaluation of the impact of LEZ in Germany and elsewhere has been complicated by the effects of the diesel emissions scandal, which has reduced the popularity of new (Euro 6) diesel cars, even though these are normally exempt from the CAZ charges.

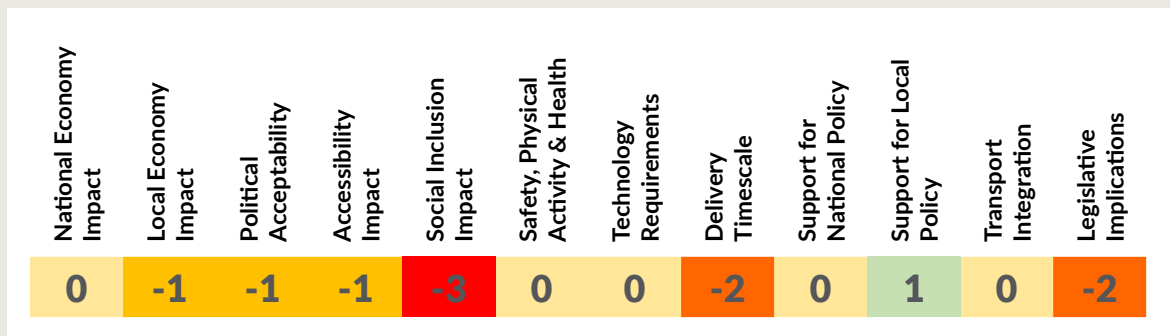
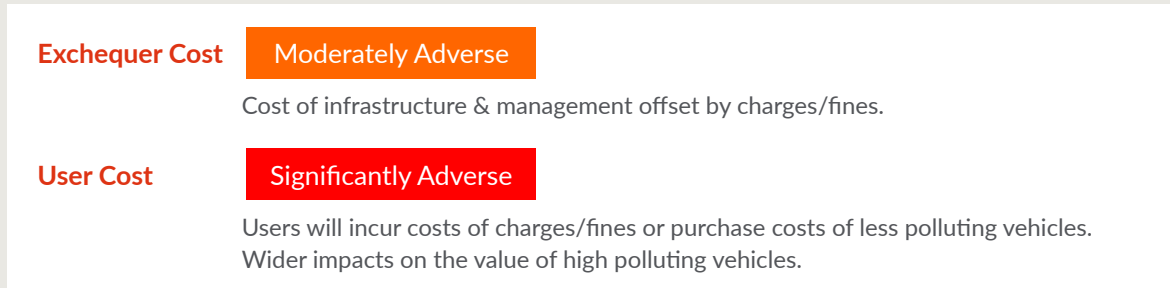
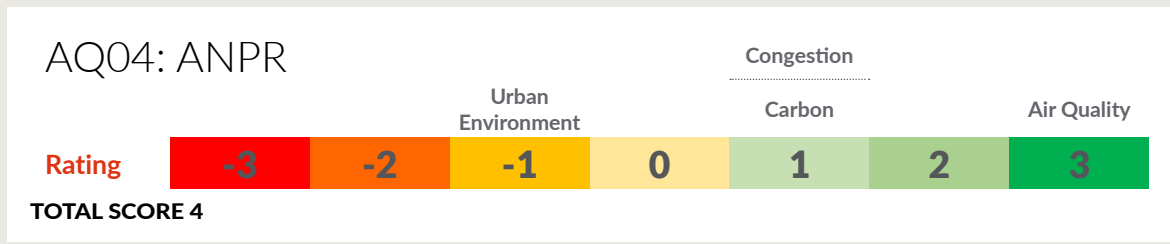
In Paris, a similar sticker system has been implemented and has resulted in a drop of 19% in NO_x concentrations, 13% of PM_{2.5} and 8% of PM₁₀. The LEZ impact led to 290,000 fewer Parisians being exposed to an annual average NO_x level above the legal limit. The sticker system in both countries has relatively lower costs to implement compared to ANPR; however, it is much easier to evade fines than with camera-based enforcement.

Stakeholder Feedback

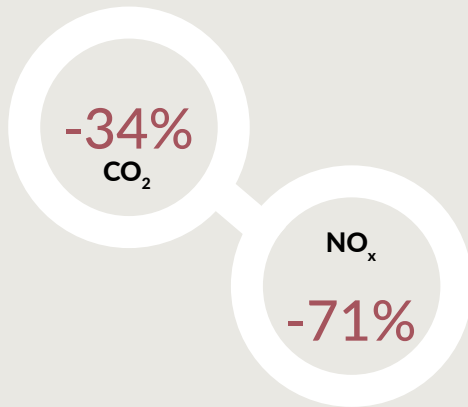
	Perceived issues and concerns	Perceived benefits and opportunities
CAZ/LEZ regardless of enforcement	<ul style="list-style-type: none"> Political constraints Public acceptability, with potential for negative equalities impacts for those on lower incomes or with disabilities Displacement effects and negative road safety impacts on the zone boundary Alternatives need to exist prior to delivery - including affordable and accessible EV taxis; Negative economic impacts on city centres 	<ul style="list-style-type: none"> Would follow examples of good practice and major impacts in UK and Europe Should also include promotion of active travel Should progress to an outright ban on vehicles Could contribute to better quality of life and place making
ANPR	<ul style="list-style-type: none"> GDPR concerns There needs to be exemptions for taxis or financial support to upgrade 	<ul style="list-style-type: none"> Practicable
Sticker System	<ul style="list-style-type: none"> Enforcement issues 	<ul style="list-style-type: none"> Likely to be more cost effective than ANPR

²⁵ https://www.london.gov.uk/sites/default/files/ulez_six_month_evaluation_report_final_oct.pdf

Impact in Delivering the Study Objectives



Fleet Modelling Results

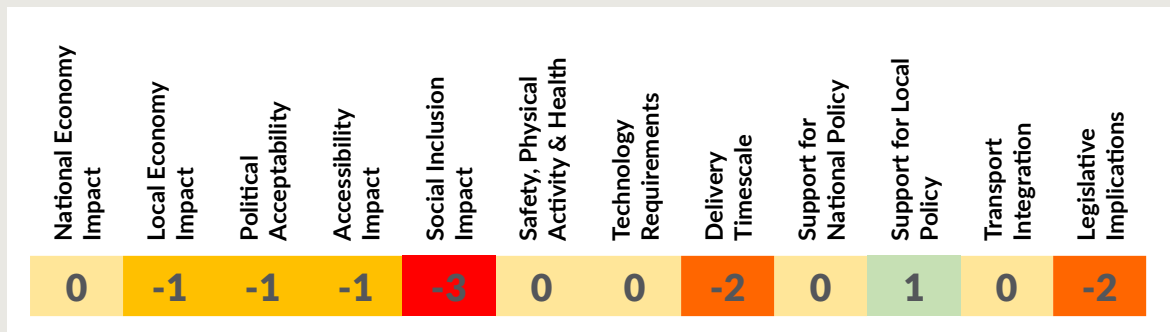
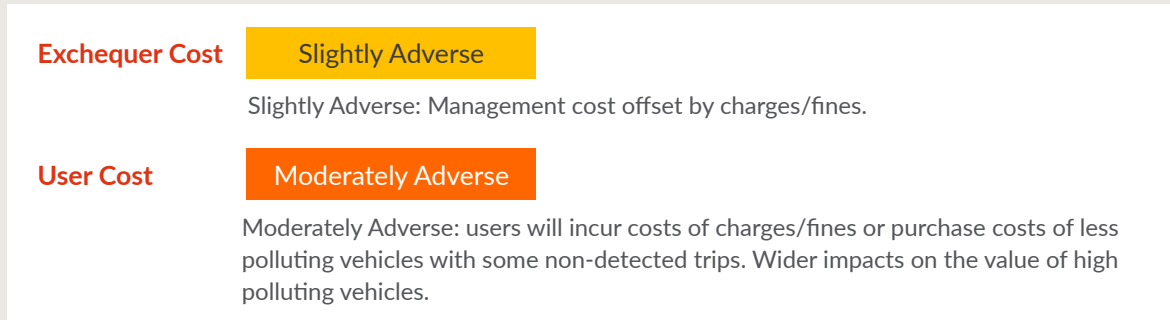
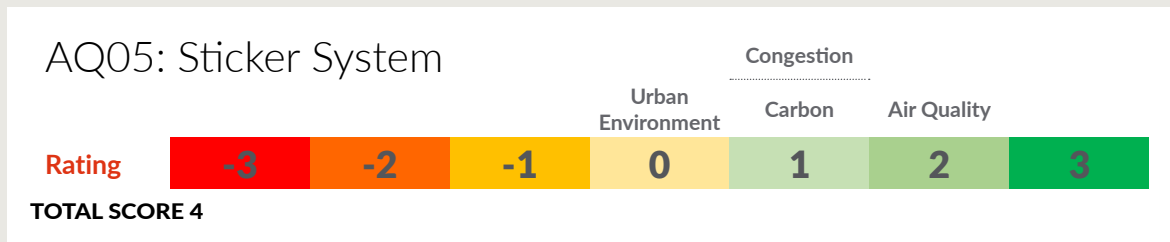


Overall Priority Rank



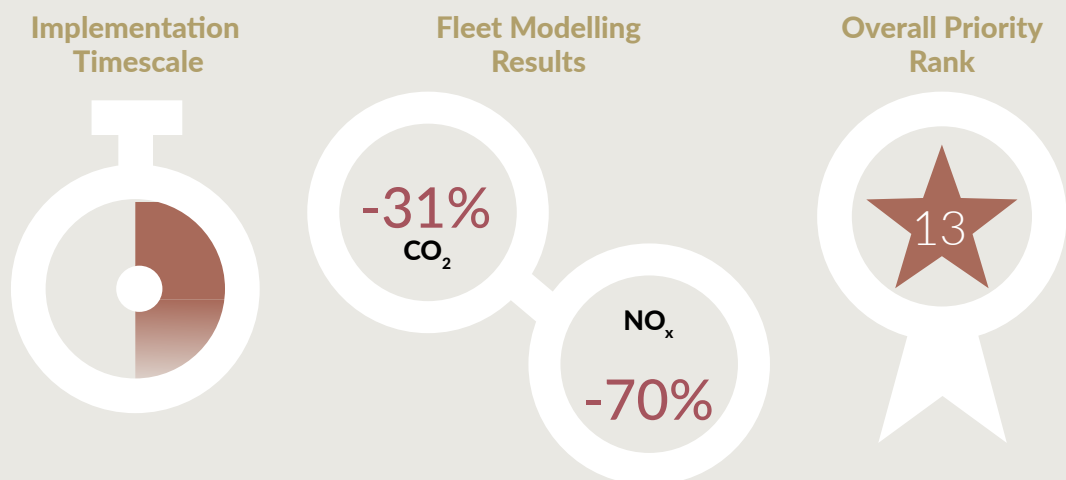
The Fleet Modelling reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump' -related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

Impact in Delivering the Study Objectives



Implementation Considerations

This measure would benefit from a clear legislative framework. AQ04 and AQ05 are mutually exclusive in any one city and whilst it would be possible to apply different enforcement in different cities, for simplicity of understanding a common framework for all cities would be preferable. CAZ/LEZ schemes can be combined with congestion charging as is the case in Milan in Italy (see measure FM11 for more details).



The Fleet Modelling reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump'-related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

The Fleet Modelling results above relate to the reductions per car km from the end of 2019 to 2030. These figures therefore include the 11 years of fleet improvements (including the uptake in EVs), as well as the impact of the relevant Demand Management measures.

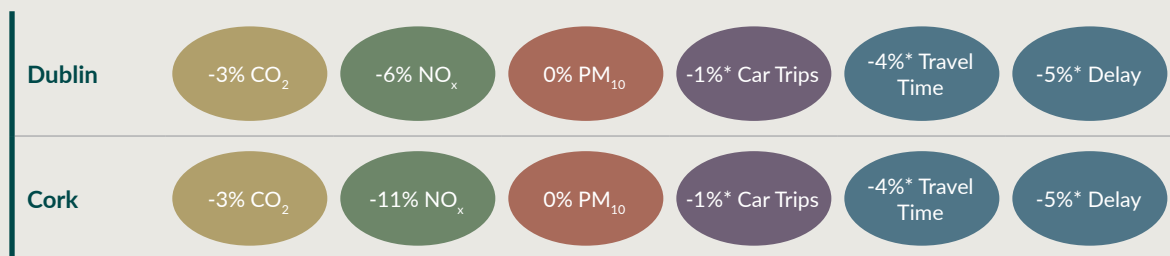
The figures on the following page are lower, as they just include the change in emissions delivered by the Demand Management measures in Dublin and Cork by 2030.

Quantitative Modelling Assessment of AQ05 Clean Air Zone with a National Sticker Scheme

The impact of AQ05 Clean Air Zone with a National Sticker Scheme was assessed in the cities of Cork and Dublin through fleet modelling and the ENEVAL Environmental Module of the Regional Modelling System (RMS).

The results show benefits for the reduction of carbon citywide of the order of 3%. A greater benefit is the reduction in NO_x of 6% in Dublin and 11% in Cork. Over time, it is expected that AQ05 will result in higher car costs, through additional charges for more polluting vehicles or additional costs of purchase of less polluting vehicles. Additional cost is expected to have an impact on car use and to reflect that, the results from the modelling of FM01 are also used to derive a measure for the potential scale of impact.

Whilst the benefits are more limited than other demand management measures, the costs of implementation are relatively low and, in an effort to improve air quality, AQ05 is worthy of consideration.



* Derived from FM01 results.

Dublin	Urban Environment			Congestion Carbon Air Quality			
Cork	Urban Environment			Congestion Carbon	Air Quality		
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling indicates slightly more beneficial congestion and carbon impacts. Should AQ05 be implemented, the level of impact will depend on the charging structure or limitations on more polluting vehicles.

In Cork, the benefits for air quality are higher than estimated at Phase 1. The reference fleet in Dublin has a greater proportion of lower emissions vehicles, which may account for the variation in performance as compared to Cork.

The evidence from the Phase 2 modelling has been taken into account and the priority rankings for AQ05 are:



4

PTM01

Workplace Parking Levy

PTM01: Workplace Parking Levy

Undertake additional examination and research as to potential application of a Workplace Parking Levy within a pilot City (Cork and/or Galway and/or Dublin)

Description of Measure

A Workplace Parking Levy (WPL) enforces charges on parking provided by employers. In 2012, Nottingham introduced the first WPL in Europe. A particular attribute of the scheme was that the revenues raised are legally obligated to be used to support public transport investments in the City, principally Phase 2 of the Nottingham tram (NET - Nottingham Express Transit).

A WPL would generally permit local authorities to levy a tax on employers for every parking space they provide for employees. Businesses can decide whether to absorb the costs or transfer them on to the employee, or some combination of both.

As a demand management measure a WPL could:

- Directly influence commuters' decisions to travel by car.
- Reduce the space used by parked cars at workplaces.
- Reduce costly parking infrastructure in new development.
- Generate revenue which can be used to support other measures which encourage more-sustainable mobility.

Existing Situation

A €200 parking levy on workplace parking spaces was announced in the 2008 budget and provision was made in law for the imposition of a WPL (under the 2008 Finance Act). It was intended that the levy would apply to both the private and public sector. The levy faced significant objections and was never implemented.

The Office of Public Works no longer provides "stand-alone" car parking spaces for Government Departments and offices (i.e. spaces which are not provided by a landlord as part of the building itself).

The Transport Strategy for the Greater Dublin Area includes aims to "reduce of the availability of workplace parking in urban centres to discourage car commuting where alternative transport options are available". The Cork Metropolitan Area Transport Strategy (CMATS) and the draft Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) both propose examining the case for a workplace parking levy in order to reduce congestion and ring-fence funding for sustainable transport.



Best Practice Evidence

The parking levy in Nottingham is the only example of a comprehensive, specific WPL in operation in Europe. The levy is charged at a rate of £400 per workplace parking space per annum and has raised over £50 million in funding for transport investment since its introduction in 2012. Employers with fewer than 11 spaces are exempt. Nottingham's WPL has resulted in a reduction in the number of liable workplace parking spaces from 30,000 to 25,000. Many employers pass the levy onto their employees which encourages the employee to find alternative means of travel to work. There is strong evidence that the WPL is having no significant impact on economic growth, and has increased the attractiveness of brownfield site development. The scheme initially faced strong objections from employers and the Chamber of Commerce, with significant engagement required to find consensus.

Partly in response to the increasing need to address the harmful impacts of transport on air quality, a number of other towns and cities in the UK are considering implementing WPLs. Edinburgh and Glasgow councils are considering implementing WPLs in the near future, while further schemes are under consideration in Reading, Oxford, Bristol, Cambridge, and the London boroughs of Brent, Camden, Hounslow and Merton. Further afield, parking levies are applied in some Australian cities, specifically Sydney, Perth and Melbourne. In Sydney, the levy is applied in the Central Business District (CBD) and a select number of additional locations with lower levels of charges applied to the latter.

The levy in Nottingham is currently £400 per space per annum and levies of the order of £500 to £1,000 pa are generally expected elsewhere, should schemes progress. In Scotland, the charges will not be applied to hospitals and NHS buildings and further exemptions are possible.

Stakeholder Feedback

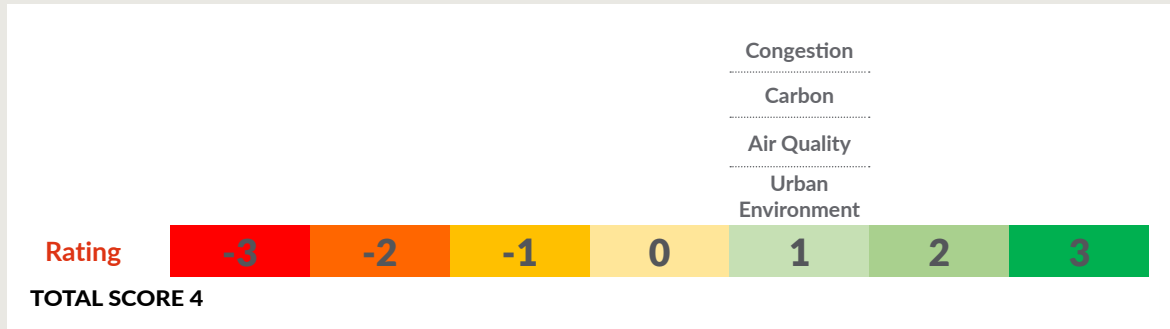
There was general support for a workplace parking levy.

Perceived issues and concerns	Perceived benefits and opportunities
<ul style="list-style-type: none"> ● Enforcement issues ● Displacement effects (for example, employees parking on residential roads near employment sites) ● Low impact if employer pays ● Political constraints ● Alternatives need to exist prior to delivery - suggestion that employers should be provided with fiscal incentives to invest in and provide sustainable alternatives for staff and convert commercial fleets ● Negative impacts on the workforce 	<ul style="list-style-type: none"> ● General support expressed

"If business pays the employer parking fee it won't change the mindset."

"Will only be useful when alternatives to Workplace Parking are available, without alternatives a levy will only increase costs without any significant reduction in traffic."

Impact in Delivering the Study Objectives

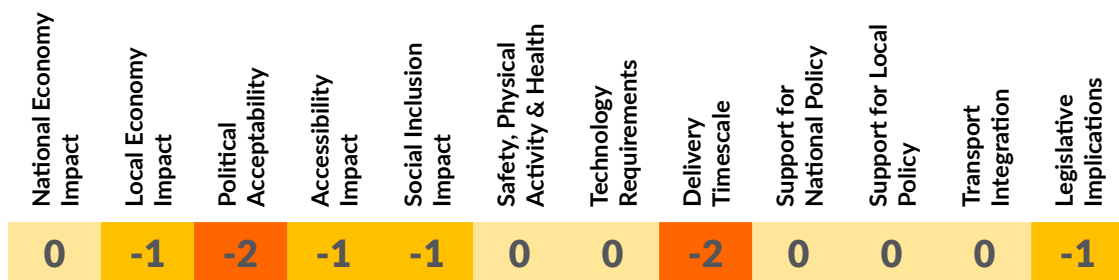


Exchequer Cost Moderately Positive

Levy will offset cost of implementation and funds raised can be ringfenced for investment in transport infrastructure.

User Cost Moderately Adverse

Potential direct cost to user or reduction in the availability of workplace parking spaces - expected that trial will be targeted to those who have reasonable alternative means of travel.



Implementation Considerations

This measure could be implemented alongside investment in alternative transport, such as was the case in Nottingham. An advantage of a WPL is that it is applied to both existing and future workplace parking stock. As a flat tax, there is some concern that the impacts will be greater on lower income employees and/or those without suitable alternative transport options. Employers can help to mitigate this impact by developing appropriate policies to reduce costs for those on lower incomes and/or without viable transport alternatives to commuting by car. The identification of spaces may be challenging and the identification of a suitable area of enforcement will require further planning which may delay implementation. Where car parking spaces are currently provided for a number of employers (for example at Business or Industrial Parks), mechanisms would need to be developed to levy such fees to individual employers. Detailed feasibility and planning phases would be required in the short term in order for implementation in the medium term.

Implementation Timescale



Overall Priority Rank



Quantitative Modelling Assessment of PTM01 Workplace Parking Levy (Galway)

A Workplace Parking Levy (WPL) for Limerick and Waterford was discounted as an appropriate measure at the initial Screening Stage of the Study. As part of the Phase One Recommendations Report, further consideration was given to its application within Dublin, Cork and Galway – with Galway recommended for further examination and evidence.

The suitability to implement a particular measure such as PTM01 depends on whether other interventions proceed. In the case of a WPL, it would likely provide only marginal additional benefits to a Congestion Charge or Clean Air Zone (depending on configuration). As Congestion Charging was recommended in Phase One of the Recommendations Report for further consideration for Cork and Dublin, it is not proposed to consider a WPL for those cities at this time.

Therefore, the impact of a WPL was assessed for the city of Galway, which has a large number of employment sites with free workplace parking.

The WPL scenario modelled in the RMS was a 75% reduction in free workplace parking spaces available for employees. This used changes to the Free Workplace Parking (FWPP) element of the RMS model. This part of the model allocates a number of spaces in a destination zone as free parking for the commute and education user classes, separate from each other. The purpose of this element is to represent the free parking available in many workplaces. When FWPP capacity is reached, remaining demand is handled by the Parking Distribution element of the model (where applicable) or incurs a charge through the Parking Charge element of mode choice. By reducing the available spaces for FWPP, the parking capacity is reached quicker, forcing more trips to avail of the publicly available parking, which in many cases has a charge applied. This methodology provides an indication of the level of impact though further analysis would be required should the measure be progressed to confirm the anticipated benefits.

Study Objective		Quantitative Analysis	
		Galway	Galway
		Wider City	City Core
Congestion	Travel Time	-11%	-12%
	Delay Time	-16%	-16%
Carbon	CO ₂	-3%	-4%
Air quality	NO _x	-2%	-3%
	PM	-2%	-4%
Urban environment	Change in Car Trips	-5%	-5%

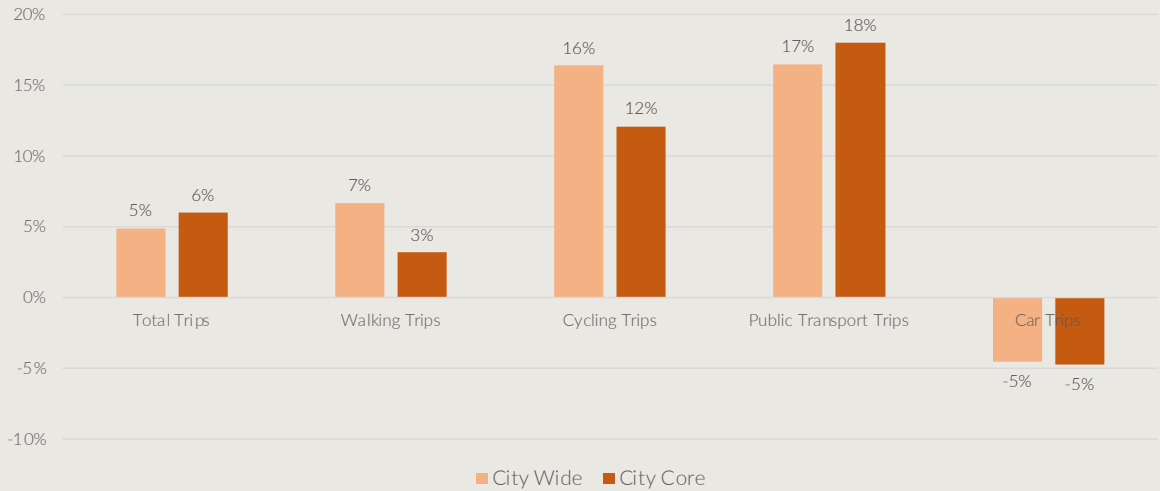
Indications from Quantitative Modelling

The modelling results indicate that PTM01 would have a very positive effect on congestion in Galway with reductions in travel time both in the wider City Study Area and within the City Core of over 10%. Delays also decreased significantly (with reductions of 16% in both the wider City Study Area and within the City Core) – leading to quicker journeys and a less congested network.

A positive reduction in CO₂ levels in the Galway is also observed, with a 3% reduction across the wider City Study Area and a 4% reduction in the City Core.

The model results also indicate that the reduced level of car trips as a result of PTM₁₀ would have positive reductions in pollutants affecting air quality within both the City Core and the wider City Study Area, with reductions of 2% to 3% in NO_x and 2% and 4% in PM₁₀.

Galway - Change in Trips



The modelling results indicate that PTM01 leads to a positive reduction in car trips across both the wider City Study Area and the City Core of 5% – with consequent benefits for the quality of the Urban Environment.

The total number of trips to the city centre increase by 6% (and by 5% in the wider City Study Area), with access increasing due to the reduced congestion on the roads, allowing for both car and sustainable travel users to have greater access to amenities in both the wider City Study Area, but more so in the Urban Core of Galway.

The model data indicates increased levels of walking trips and notable increases in cycling trips (between 12% to 16% increases) – with subsequent benefits for health from increased levels of physical activity. There is also a significant increase in public transport trips of nearly 20% in both the City Core area and the wider City Study Area, as trips shift away from car. This suggests that the availability of free parking is one of the factors for the high level of car mode share within the reference case, and that the impact of PTM01 would encourage a shift from driving towards more sustainable mode choices, particularly for shorter commuting journeys.

Galway					Air Quality Urban Environment	Carbon	Congestion
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling indicates significantly higher congestion benefits and slightly higher carbon impacts as compared to the Phase 1 evaluation. These initial modelling results would require further analysis to confirm the level of benefit. Significant consultation would also be necessary to determine whether the extent of the change in workplace parking represented in the modelling is practical taking note of potential wider impacts such as the impact on access to retail.

Based on the modelling data available from this initial analysis the priority ranking for PTM01 is:



4

PTM04

On-Street Parking Controls & Pricing

PTM04: Public Parking Controls

Development/refresh of city centre Parking Controls & Pricing Strategy to strengthen parking as a Traffic Demand Management Measure, including EV parking pricing strategies and targeted removal of on-street parking

Description of Measure

Controlling the availability and cost of parking is one of the most widely used demand management measures. The average car is parked at home 80% of the time, parked elsewhere for about 16% of the time and only in active use the remaining 3 to 4%. The management of public parking controls and pricing is actively undertaken in all five cities. This measure would seek to further enhance public car parking policy with a view to:

- Reducing demand for car-based transport.
- Balancing the use of limited road space.
- Improving the efficient use of limited car parking resources.
- Supporting placemaking, consolidated growth and brownfield development (e.g. replacing surface car parks).
- Encouraging the uptake in alternative fuelled vehicles.

This measure is focused on the management of existing public parking stock. Parking controls for new developments are covered within the Tier 2 City Toolkit Measures PTM08, PTM09, PTM10. PTM04 Public Parking Controls could comprise:

- Tiered rates of parking charges with levels set to proactively manage demand.
- Restrictions on the permitted duration of parking.
- Longer hours of operation of parking controls.
- Proactive enforcement to reduce incidents of inconsiderate parking (for example on pavements and cycle lanes) in order to safeguard road space for vulnerable and active travel users.
- Targeted removal of on-street public parking.
- Reduced on-street residential parking permit entitlements in certain situations.
- Integration of EV charging strategies with parking policy.
- Consideration of emissions-based parking charging, in particular as a targeted measure to improve Air Quality.
- Specific measures to facilitate Park & Stride to reduce school-gate congestion.

Existing Situation

Parking controls and charging are already in place in each of the five cities with varying levels of charges and extent of management. Local authorities provide a limited number of free parking spaces to EV owners linked to on-street public charging infrastructure. Public parking controls are a reserved function, with policies set by local Councillors. Specific parking measures are taken for disabled drivers.

The Cork MATS states:

"There will be a general reduction in on-street parking levels in city and town centres over the lifetime of the Strategy to accommodate a wide range of sustainable transport measures including bus priority, laybys, safer crossing facilities, seating, contra-flow cycle lanes, bicycle share schemes and cycle parking."

The Transport Strategy for the Greater Dublin Area recognises the need to:

"Secure the introduction or expansion of on-street parking controls, and charging structures, that seek to reduce commuter parking and which contribute to greater parking turnover for non-commuting purposes;"

The Galway Transport Strategy, as part of the plan to manage traffic in the central area, states that:

"It is envisaged that the availability of on-street parking will be reduced, and access routes to off-street parking facilities will be rationalised and managed to minimise car circulation within the city centre.... There will also be a need to adopt a parking pricing structure which seeks to set the cost of city centre parking at a level that does not undermine travel by public transport as a financially-realistic alternative to car travel."

The Limerick Shannon MATS recognises that:

"a gradual reduction in on-street parking levels in urban centres over the lifetime of this Strategy will be required".

Case Study: Amsterdam

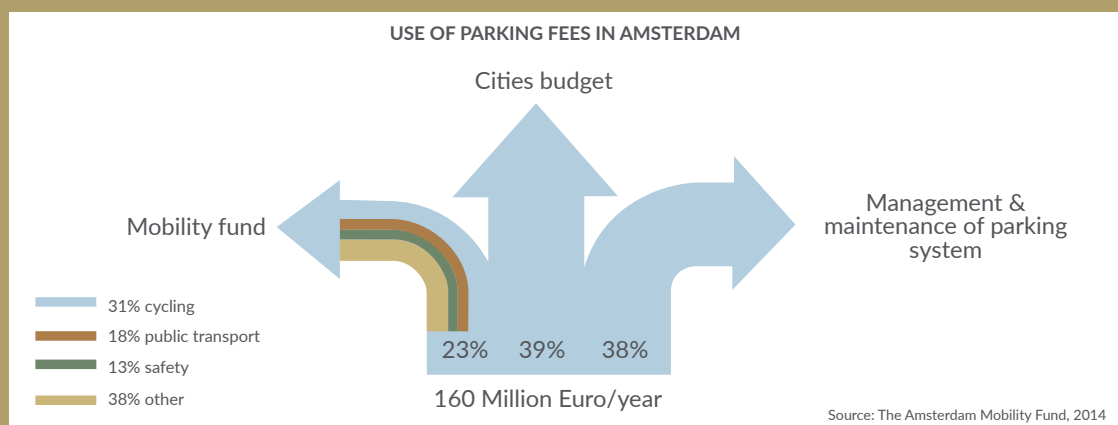
Parking controls in Amsterdam cover a large proportion of the city having been extended over a number of years. A tiered scale of parking charges is applied from as little as 10c an hour up to €5 an hour in the historical core. Hours of operation vary too, with charges applied up to 24 hours a day. In 2012, the gross revenue from parking was nearly €160 million. Nearly 40% of parking revenue generated was used to cover the cost of management and approximately a quarter was allocated to the city's Mobility fund, which invests in cycling, road safety and public transport projects.

Residential parking permits are limited and if no parking permits are available, applicants are placed on a waiting list. Whilst many areas have waiting lists of 8 months or less, a small number have indicative waiting times extending to years. The fee for parking permits varies by area. Environmental factors are incorporated into parking permit rules as follows:

- Parking permits are not issued for diesel cars registered before 2004 and other cars registered before 1992.
- Electric vehicle owners are given priority on waiting lists for parking permits.

A maximum of one or two permits per address is applied, with the number of private parking spaces at the address deducted from the allowance. Parking permits are not available for new-build projects.

Over the last 20 years there has been a 30% reduction in car use in the city centre partly driven by parking charges and the investment made in alternatives. There has been a significant growth in cycling over the same period. Nearly three quarters of adults living in Amsterdam do not own a car.



Best Practice Evidence

Parking controls and pricing is the most widely used transport demand management measure and is applied in most cities across Europe and beyond. Best practice on innovative parking control measures has been collated, with examples presented here.

Parking Supply Caps: Zurich and Hamburg

Some cities place a limit on the total number of parking spaces through a fixed cap. When a new space is built off-street, an on-street space has to be removed and repurposed, e.g. to widen pavements, provide cycle space.

Emissions-Based Parking Charges/Controls: Amsterdam and London

Residential parking permits in an increasing number of London boroughs are priced based on CO₂ emissions. Examples of parking surcharges for diesel vehicles for both residential permits and short stay parking are also to be found in London. Islington applies a £3 per hour surcharge for diesel vehicles for short stay parking and a surcharge of £120 to resident parking permits. Exemptions for Blue Badge disability holders are applied. In Amsterdam, parking permits are not issued for high-polluting vehicles (see case study).

Parking Integration with Sustainable mobility Investments: Barcelona and Strasbourg

Barcelona uses the surplus revenue from on-street parking charges to finance a public bicycle sharing scheme. In Strasbourg, there has been significant success with Park & Ride sites. As the city expanded its tram network, parking control zones were expanded, and parking spaces were reallocated to sustainable modes. The parking removed from the city was relocated to Park & Ride sites at the end of the tram lines. Combined, these measures resulted in a 28% decrease in the number of cars entering the city over an 18-year period (up to 2011).

Repurposing Public Spaces: Copenhagen

Copenhagen removed hundreds of parking spaces in the city centre and created high quality pedestrian districts and cycle facilities. The city has also designed play-streets with traffic calming measures and, for example, former parking spaces replaced by wooden picnic tables or cargo bike parking. Parking charges applied to the remaining spaces vary by location and time of day, with the highest charges applied during peak hours and the lowest charges applying overnight and free parking only from Saturday afternoon to Monday morning.

Stakeholder Feedback

There were differing views on the scope and scale of using public parking controls and pricing as a demand management tool.

Perceived issues and concerns	Perceived benefits and opportunities
<ul style="list-style-type: none">○ Displacement effects○ Alternatives need to exist prior to delivery○ Reductions in council income○ Potential for negative economic impacts on city centres and retail vitality○ Can be difficult to control existing parking at private car parks, including workplace car parks and other large sites that have historically had large quantities of free parking available	<ul style="list-style-type: none">○ Potential for a cap on parking on an area wide basis – need a clear distinction between controls to parking at destination and origin, with a standard national approach○ Suggestion that parking charges should be higher in peak traffic hours○ General support for stronger enforcement of parking, including illegal parking in disabled spaces and parking on pavements

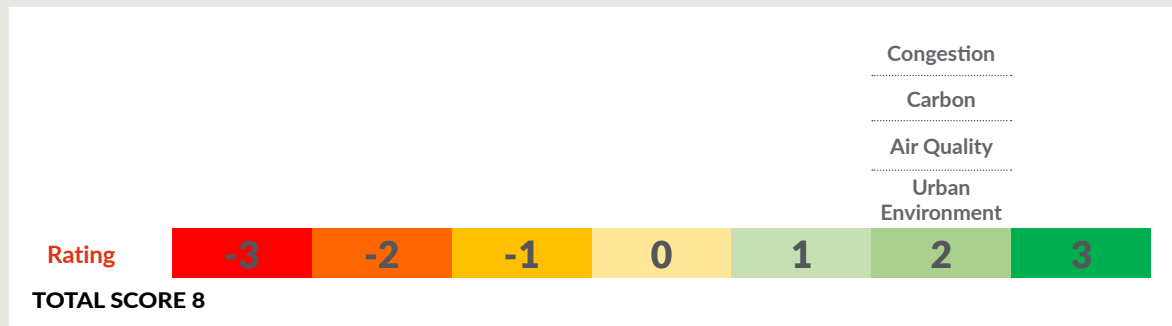
"If we increase the parking charges, we may be pushing cars into multi-storey car parks, and it is a very important financial string for us, at the moment... if it's easier for people to park in the shopping centres in the outskirts of the city, it'll drive people out of the city centre."

"Not everybody has access to public transport so that has to be considered carefully if you're imposing any car parking charges."

"Control of parking and enforcement of same is challenging in Galway as although clamping is provided for in the bye-laws, the elected members passed a motion a number of years ago not to clamp vehicles."



Assessment of Likely Impact



Exchequer Cost

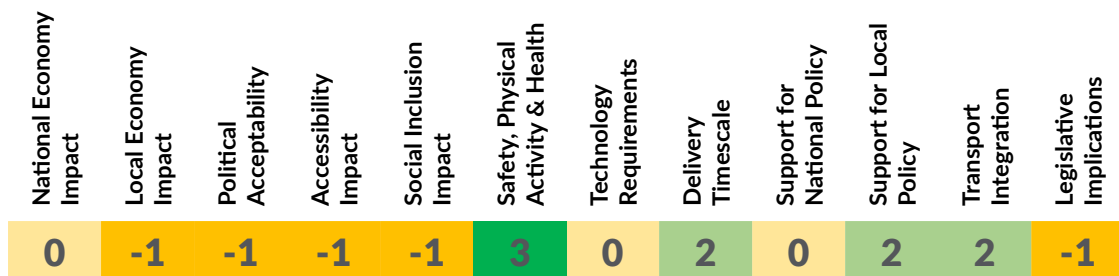
Slightly Positive

Additional enforcement costs, some potential loss of revenue from parking charges; offset by higher parking charges in spaces and reduced cost of providing roadscape for parking. Reallocating car parking spaces would reduce the investment required to deliver sustainable mobility infrastructure.

User Cost

Moderately Adverse

Direct additional cost to the user.



Implementation Considerations

Implementation Timescale



Overall Priority Rank



Public parking controls can be a cost-effective demand management measure, quickly implemented and adaptable in response to demand at a very local and focused level.

There is scope to make public parking pricing more demand responsive, e.g. raise prices in the busiest areas, particularly those that are highly accessible by alternative modes and in line with the delivery of sustainable mobility infrastructure. There is also potential to remove parking to better balance the space allocated to cars versus space available for the increasing volumes of pedestrians, cyclists and public transport users. Finally, on-street parking has a significant impact on the public realm and increased levels of parking management could provide opportunities to improve the quality of the urban environment.

When parking supply is restricted, poor management of available parking can increase local congestion due to increased search time; therefore, the ongoing management of parking needs to consider the traffic impacts of limited parking with possible mitigations such as real time variable message signing on space availability. Another important consideration is the relative availability and cost of private parking, particularly outside the city centres, which may attract trips if stricter controls are enforced on public parking spaces. A long term approach to the availability of private parking associated with existing developments needs to be considered, including the improvement of sustainable transport alternatives, restrictions on increases in parking associated with the redevelopment of existing sites and the implementation of paid parking as a development control measure.

Cross working between neighbouring local authority areas is also important to achieve consistent and effective parking management. One potential mechanism to achieve this local authority partnership approach is the concept of Area Based Parking Management (which current planning in Ireland does not currently allow for). This concept identifies and addresses the parking needs of a local area and can be utilised to reinforce the sustainable travel hierarchy (whereby car storage is subordinate to the needs of walking, cycling and public transport). Such an approach could be integrated with the implementation of 15-Minute Neighbourhoods (PP08) and Area Mobility Management Plans (BC08).

As the number of EVs increases, the need to address the impact of private vehicles on congestion and the urban environment will require a review of parking charge exemptions, including charging structures and/or limits on duration of stay for EVs. This issue should be considered within the context of a wider EV charging strategy (see PTM02).

Parking management is highly adaptable and varying measures are and will be implemented within all five cities. A national policy on parking would help to structure interventions and provide support to agencies responsible for parking management.

Quantitative Modelling Assessment of PTM04 Public Parking Controls

The measure PTM04 Public Parking Controls was assessed in the RMS in two phases.

Phase One

Phase One looked at four variations of the measure and tested them individually in one city (Limerick) in order to establish what was the likely optimum variation for assessing their impact in the four other Study cities.

- A. 50% increase in parking charges (150% current) – chosen as a modest level of increase.
- B. 300% increase in parking charges (400% current) – chosen as a more ambitious approach. This level of increase was assessed after the initial assessment of the 50% increase in parking charges showed limited impact.
- C. 25% reduction in parking availability – chosen as a modest level of reduction.
- D. 50% reduction in parking availability – chosen as a more ambitious reduction in parking availability.

These variations of the PTM04 measure were tested in Limerick by changing either charges or availability in the Parking Distribution Model (PDist) and in the Parking Charge applied to mode choice (PCharge) of the RMS. The assessment undertaken in Limerick identified that Scenario B, ambitious increases in parking charges, was the most impactful in terms of delivering the Study Objectives.

Phase Two

The Phase Two modelling of PTM04 took the optimum result from the four scenarios above and applied them to the remaining four regional models to assess the impact in the other four cities.

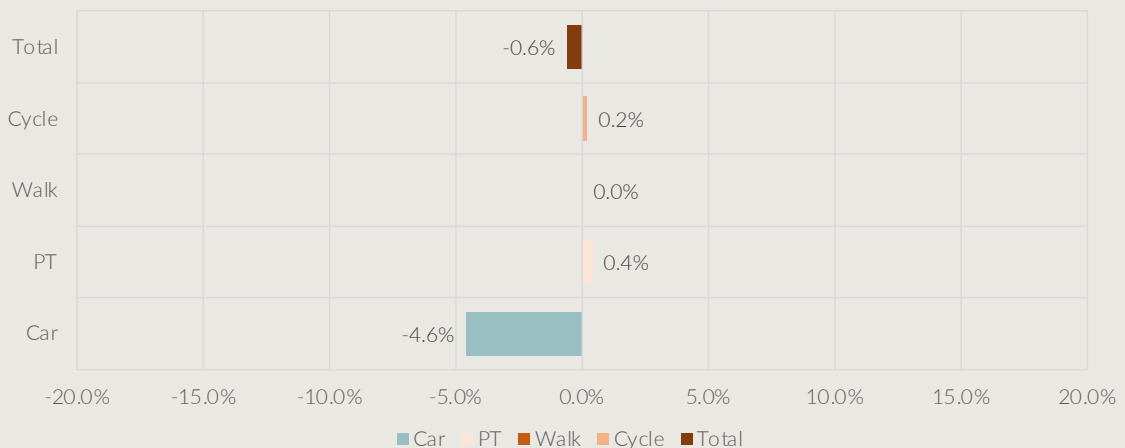
The model results indicate the largest benefit from significantly increased parking charges is a reduction in City Centre congestion, of between 2% in Dublin and Waterford and 8% in Limerick, and a reduction in the volume of cars in the urban core, of between 3% in Waterford and 11% in Limerick. The latter would particularly benefit the urban realm and provide for the opportunity to reallocate road space from car to other purposes.

Vehicle emissions across the Cities as a whole are also shown to reduce very slightly in the modelling results with 1% less CO₂, NO_x and PM₁₀ arising from traffic. The air quality benefits in the urban core are higher with up to 3% less NO_x and 4% less PM₁₀ shown in Galway and Limerick.

Whilst the benefits in the urban core are highly positive, there is less of an impact in the cities as a whole. This is not unexpected, as within the model, the parking charge increases only apply in the city core areas where there are existing parking controls and across all five cities there are significant numbers of freely available parking spaces outside the city core. The results indicate that a widespread change in parking controls and levels of charging would be required to derive significant citywide benefits.

There is a risk that PTM04 would reduce the overall levels of trips to the central city areas, with modelled trips falling between 0.5% in Dublin and 4% in Cork and Limerick. The lower levels of reduction in Dublin, far less than the -5% change in car trips, may be as a result of the better availability of alternative public transport options. It would be worth exploring the impact of the potential to divert parking revenues from higher charges to investment in sustainable modes as has been done elsewhere and evidenced in the best practice review.

Change in Trips – Central Study Area



The modelling clearly shows that where parking controls are in force and when the levels of charging are significant, PTM04 has the potential to be a very effective demand management measure to meet the objectives of reducing congestion and carbon and improving air quality and the urban environment.

The modelling analysis did identify the risk that, in the absence of suitably attractive alternatives, public transport and walking and cycling accessibility, the number of trips would likely decline which would have an impact on the local economy. It would be best to combine the implementation of PTM04 with a comprehensive plan to support non-car travel and urban realm improvements as has been proven to be successful in cities across Europe.

Dublin				Carbon Air Quality	Congestion Urban Environment		
Cork				Carbon Air Quality	Congestion Urban Environment		
Limerick				Air Quality	Congestion Carbon	Urban Environment	
Galway				Air Quality	Congestion Carbon Urban Environment		
Waterford				Carbon Air Quality	Congestion Urban Environment		
Rating	-3	-2	-1	0	1	2	3

The additional evidence afforded by the Phase 2 modelling is generally consistent with the findings of the Phase 1 qualitative assessment whilst Phase 2 provides some greater clarity on the potential variation of impacts between the cities.

Notably, the modelled carbon and air quality impacts in Dublin and Waterford are lower than estimated in Phase 1. In the case of Dublin, this may be because parking controls and charges are relatively high in the reference case and that the availability of alternative travel options is such that those who chose to avail of parking are relatively price insensitive. In the case of Waterford, a high general car dependency may also result in price insensitivity to parking charges.

The priority rankings for the individual cities remains unchanged for Cork, Limerick and Galway whilst being overtaken by other measures for Dublin and Waterford:



4

PP01, PP03, PP04 & PP08

NPF

National Policy Objective 2a:
A target of half (50%) of future
population and employment
growth will be focused in the
existing five cities and their
suburbs.

Integrated Planning Policy:

PP01: Healthy Streets Assessments

Develop and embed the concept of Healthy Streets assessments through the national and local planning process, implementing the approach at a local level

PP03: Transport Appraisal Methodologies

Appraisal of 'softer benefits' of transport schemes within the appraisal process - review of appraisal approach to transport projects with potentially greater consideration of non-economic impacts such as environment, policy integration and human impact & communities

PP04: Enhance Delivery of National Planning Framework

Foster stronger integration as part of the National Planning Framework between land use and transport

PP08: 15-Minute Neighbourhoods

Develop or embed the concept of 15-minute city / 10-minute neighbourhoods through national and local plans and strategies, providing resourcing to incentivise their implementation through national funding/grants scheme

Introduction

The need for transport originates with our population, where they live and where they want to go, what they produce and consume and how these are delivered. Transport, particularly in our cities, is intertwined with the quality of the local environment, economic vitality and the health and wellbeing of our population.

Ireland has one of the fastest growing populations and economies in Europe. As recognised in the National Planning Framework, the projected growth of an extra one million people over the next 20 years places Ireland "on the cusp of a great change". In the short, medium and long term, Ireland faces challenges of how best to provide the infrastructure needed by our growing population, housing, transport, services and employment opportunities.

There is an opportunity to rethink the planning of our cities and their transport networks. To provide for a sustainable future we must break the links of the past between economic growth and increased car use.

The Importance of Land Use and Transport Integration

Location	Reduces distances travelled. Residents in the urban fringe tend to travel further than those in the city centre.
Density	Reduces vehicle ownership, travel and increases use of alternative modes. Supports the provision of high-quality public transport.
Land Use Mix	Increases use of alternative modes, particularly walking.
Attractive Urban Realm	Encourages walking, cycling and the use of public transport.
Transport Network Connectivity	Continuity in network design can better manage traffic and providing sustainable mobility networks to access wider areas with consistent high-quality design can reduce car dependency.
Accessibility	Designing for those with mobility impairments can bring wider benefits to the entire population.

The study has examined how to potentially manage transport demand, through different approaches to land use planning and urban realm improvements.

Description of Measure

PP01: Healthy Streets Assessments

In practice, it is often challenging to ensure that the collective impacts of interventions (or lack thereof) are properly considered and addressed. Effective, practical and implementable guidelines on how best to evaluate the design of our streets can be a highly effective management measure to support sustainable mobility. One such approach is Healthy Streets²⁶, which was developed by Lucy Saunders in collaboration with Transport for London (TfL).

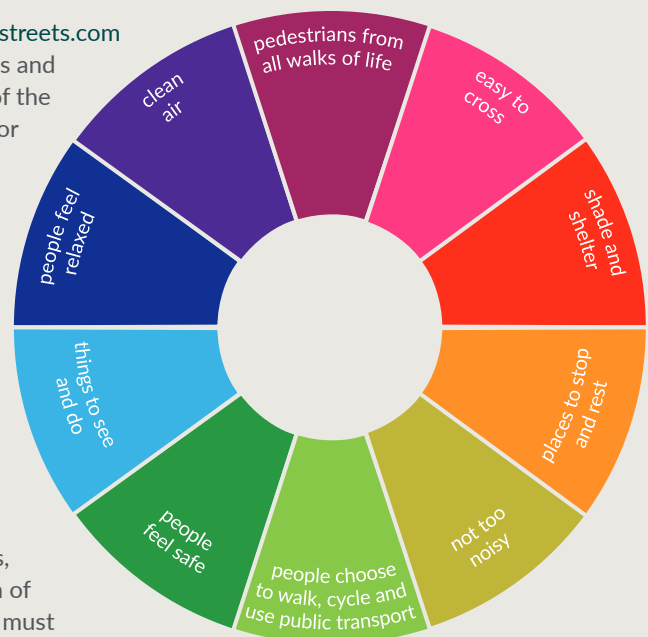
The Healthy Streets approach aims to improve air quality and congestion, reduce car dependency and make active travel more attractive and to create a streetscape fit for community interaction. TfL have released guidance for designers which outlines their future approach to street design, and the approach is now embedded in the 25-year London Plan spatial planning document.

There are ten indicators used to assess how “healthy” a street is and to structure the guidance on what to address.

There are a variety of tools on the <https://healthystreets.com> website for local authorities to assess their streets and guidance on engaging with the public and users of the streets. There is also a Healthy Streets checklist for designers.

TfL have released a “Healthy Streets for London” document on their future approach to streets in London incorporating Healthy Streets. In it, they state that “London’s streets account for 80 per cent of the city’s public space, yet too often they are dominated by traffic”. In London cars cover 19% of street space in the centre of London but only account for 11% of journey kilometres.

The London Plan mandates that the Healthy Streets approach be used in all planning decisions, development plans must demonstrate application of Healthy Streets and any new or upgraded streets must conform to the Healthy Streets approach and demonstrate how they deliver against the ten indicators.



Healthy Street

²⁶ <https://healthystreets.com>

The Healthy Streets Toolkit includes resources to help put the Healthy Streets Approach into practice and cover the whole process from initial assessment, through implementation to evaluation.

Stakeholder Feedback

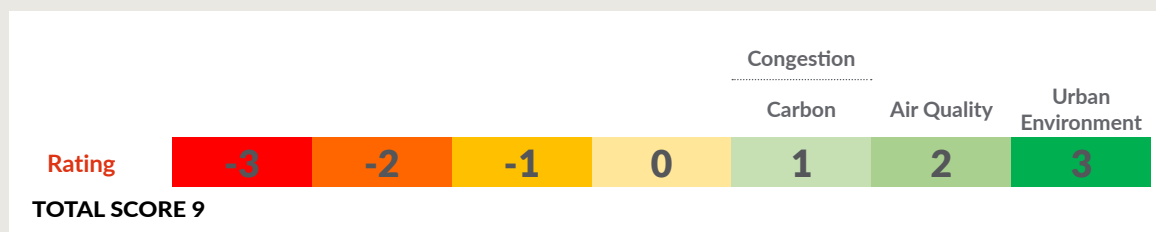
There were high levels of support for embedding Healthy Streets assessments in the national and local planning process, with the suggestion that place-making benefits could arise as a result.

Place-making is the process of creating quality places that people want to live, work, play, and learn in.

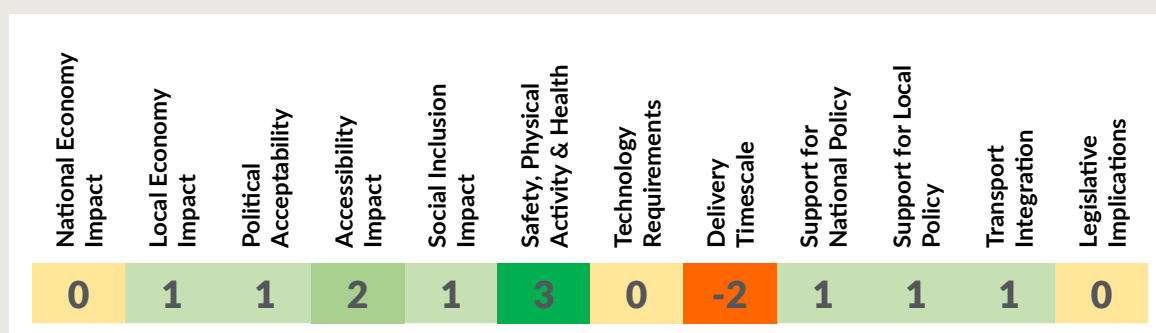
Perceived Issues and Concerns	Perceived Benefits and Opportunities
None stated	<ul style="list-style-type: none"> Could speed up the delivery of cycle infrastructure and EV charging stations and therefore encourage switch to sustainable modes. Consider sustainable mobility targets at city level, informed by data and supported by local authority grants for delivery. Place-making benefits.

Assessment of Likely Impact

Healthy Streets is a relatively new initiative, but is expected to have a wide range of benefits including direct health benefits from higher levels of physical activity, air quality benefits and local economic benefits.



Exchequer Cost	Moderately Adverse
	Infrastructure and planning costs to improve existing streets. Health benefits would bring about a direct saving to the exchequer.
User Cost	Neutral Impact
	Potential direct cost to user or reduction in the availability of workplace parking spaces - expected that trial will be targeted to those who have reasonable alternative means of travel.



Implementation Considerations

To be successful, this measure would need to be embedded into local planning policy. Funding will be required to initiate the measure and to resource the management of it on an ongoing basis. It would be preferable if a

consistent approach was adopted across all cities. To achieve this, if progressed, consideration should be given to piloting the measure in one city first, with the outcomes of the pilot study informing the development of a national framework for urban areas.

Implementation Timescale



Overall Priority Rank



Description of Measure

PP03: Transport Appraisal Methodologies

Ireland's current transport appraisal is guided by the Department of Public Expenditure and Reform's Public Spending Codes and the Department of Transport's Common Appraisal Framework (CAF). CAF plays a significant role in informing decisions on major transport investment. There are several other countries where formal appraisal approaches are implemented in their investment decision making. Ireland appraisal approach is similar to that used elsewhere, especially the Department for Transport, UK's Transport Appraisal Guidelines.

Appraisal guidance has evolved over time and continues to be improved upon in Ireland and internationally. Future updates to CAF should continue to enhance appraisal and guide transport practitioners and sponsoring authorities as to how best to consider the impacts and benefits of transport investment. Whilst recognising the need for robust appraisal, informed by international best practice, in the context of this Study, there are opportunities for augmented guidance on how to account for the impacts of transport projects and programmes on congestion, greenhouse gases, air quality and urban realm.

Ireland's CAF guidance gives a good basis for Multi-Criteria Assessment and recognises that economic benefits should not be considered in isolation. Consideration could be given to possible enhancements to CAF to provide more specific guidance for the appraisal of urban transport schemes. The role of Transport Demand Management should also be considered at the Gateway Stage Zero decision point of the development of all schemes - for example, would the application of TDM measures address the issues in question that the scheme is seeking to solve.

Existing Situation

Under CAF, a multi-criteria assessment approach is set out with transport schemes evaluated under 6 criteria:

- Economy
- Safety
- Integration
- Environment
- Accessibility & Social Inclusion
- Physical Activity

CAF provides for optional weighting of the criteria "to reflect their relative importance to a decision". However, no standard weighting to the criteria is recommended in CAF and it is acknowledged that choosing these weights can be contentious.

Cost Benefit Appraisal (CBA) is a key element of CAF. As some benefits are more easily quantifiable in monetary terms, they tend to have more impact on the CBA outcome. Evidence from the UK and New Zealand estimated that approximately 80% of quantified benefits related to the economy in the form of Value of Travel Time Savings.

In fast-growing urban areas, where there is significant potential for induced demand, travel-time savings may not be the ideal measure of the benefits from transport interventions. In 2011, the World Bank published research on "Going Beyond Travel Time Saving". The paper concluded that the World Bank "should adopt a more robust and inclusionary framework for evaluating urban transport projects, one that supplements mobility-based measures like travel-time savings with metrics tied to accessibility, sustainability, liveability, safety, and affordability."

Stakeholder Feedback

There were high levels of support for enhanced guidelines on the appraisal of a potentially wider range of transport impacts and benefits, with the suggestion that place-making benefits could arise as a result. However, concerns were expressed that additional appraisal might cause unintended delays in the planning process.

"Public transport planning is already very slow."

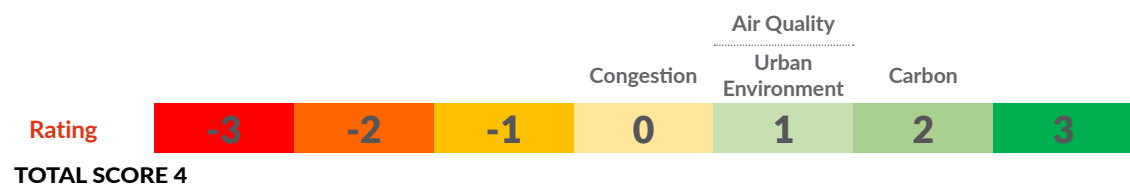
Perceived issues and concerns

- Delays in planning process.

Perceived benefits and opportunities

- General support shown for measure.
- Place-making benefits.
- The Common Appraisal Framework has issues in relation to the limits of the objectives it considers.

Assessment of Likely Impact



Exchequer Cost

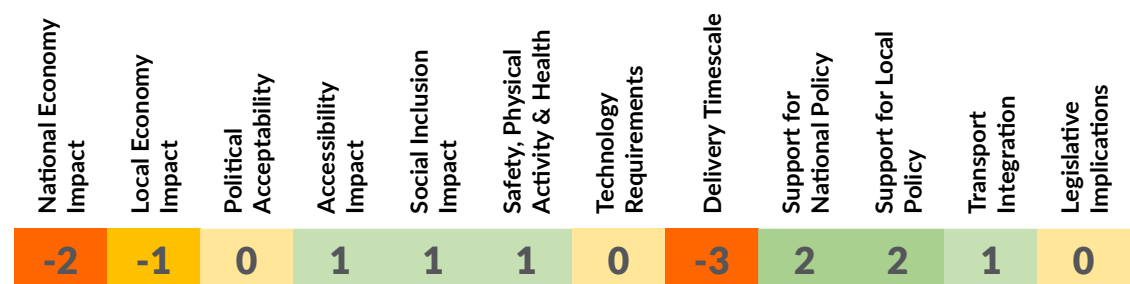
Slightly Adverse

Additional effort and cost of appraisal. Risk of impact on financial costs of projects and cost to the exchequer.

User Cost

Neutral Impact

The implementation of this measure was assessed as having a neutral impact on User Cost.



Implementation Considerations

The impact of the measure will depend in large part on the scale of change to appraisal approaches. Ireland's current guidance is in line with international best practice and to deviate considerably from this might risk generating unpredictable consequences. The assessment of all benefits will need to utilise quantified and evidence-based data and indicators. More fundamentally, consideration of TDM should be involved at Gateway Stage Zero decision making of all scheme development – i.e. is the scheme actually needed or are there TDM measure(s) that could be implemented to address the issue/need instead?

Implementation Timescale



Overall Priority Rank



Description of Measure

PP04: Enhance Delivery of the National Planning Framework

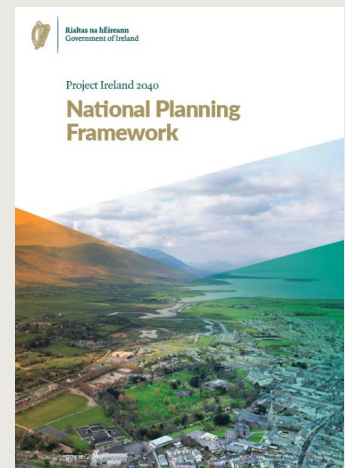
Land use planning and the integration of land use and transport planning has a key role to play in the reduction of private car use and dependency. Historically, urban areas within Ireland have experienced significant urban sprawl, which has resulted in lower densities and challenges in terms of the provision of accessible public transport.

The Government of Ireland published the National Planning Framework (NPF) in February 2018. The NPF will guide the development of Ireland over the next 20 years, as the population grows by a projected 1 million with 660,000 additional jobs and 550,000 new homes. Half of the projected growth is planned to be located in our cities with:

- 25% in Dublin.
- 25% across the other four cities combined (Cork, Limerick, Galway and Waterford) with each growing their population and jobs by 50-60%.

The NPF includes aims that will address the current unsustainable travel patterns and potential worsening congestion by enabling people to live closer to key destinations and through the co-ordinated deliver of infrastructure and services in tandem with growth to help. The NPF recognises that planning and transport policies are highly interdependent. The National Transport Authority has a significant role in supporting more integrated approaches to the planning and delivery of integrated transport infrastructure both on a national basis generally and especially in the Greater Dublin Area (where the NTA currently has a more detailed remit). It is a National Policy Objective of the NPF to extend the statutory arrangements that are already in place for transport planning in the GDA to all of Ireland's cities. The National Development Plan 2021 - 2030 (NDP) sets out the investment priorities that will underpin the implementation of the National Planning Framework, through a total investment of approximately €165 billion.

The implementation of both the NPF and NDP is complex and involves the work of many different agencies. As major transport projects progress through the proper planning, design, procurement and construction, there will be undoubtedly variations in the timescale of delivery and the configuration of the projects themselves. If the delivery of transport and land use diverge, interventions will be needed if we are to maintain the possibility of achieving the sustainable objectives of the NPF. This will be particularly important for what might be viewed as the more difficult transport and land use changes within our urban areas, which can come up against opposition from existing residents and may lack political support. Furthermore, if the climate targets in relation to transport are not on the right trajectory, a significant rethink may be warranted.



The forthcoming *National Investment Framework for Transport in Ireland* will serve as the Department of Transport's framework for prioritising future investment in the land transport network and will support the delivery of the National Strategic Outcomes of the NPF and NDP.

In terms of this TDM Study, an enhanced delivery of the NPF would comprise monitoring of the key relevant outcomes of compact growth and sustainable mobility, with appropriate action taken to improve results if required. Further enhancements could include: prioritisation and urgent implementation of relevant policy objectives; regular review of progress in the delivery of the NPF; and potential revised governance structures to support implementation.

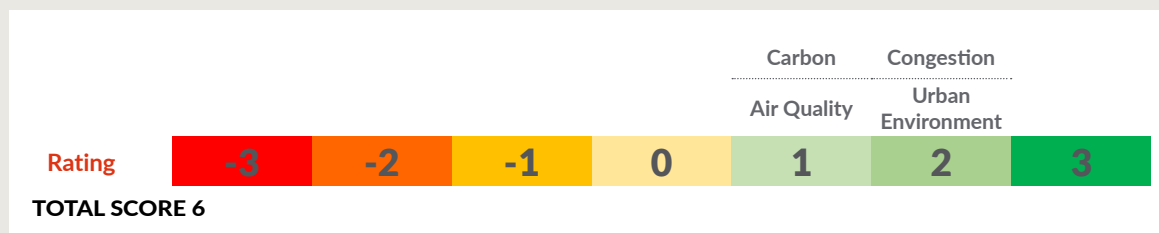
Stakeholder Feedback

General support for stronger integration between land use and transport, as part of the NPF, with the suggestion that one agency should be responsible for this integration, which would help deliver the associated place-making benefits.

"Less agencies - preferable one agency with responsibility for transport and land-use integration."

Monitoring progress on achieving the right densities, growth in the right locations and concentration of activity in close proximity to public transport nodes and corridors is an important tool to assess are land use patterns following NPF, RSES and Local Policy and is behavioural change occurring.

Assessment of Likely Impact



Exchequer Cost

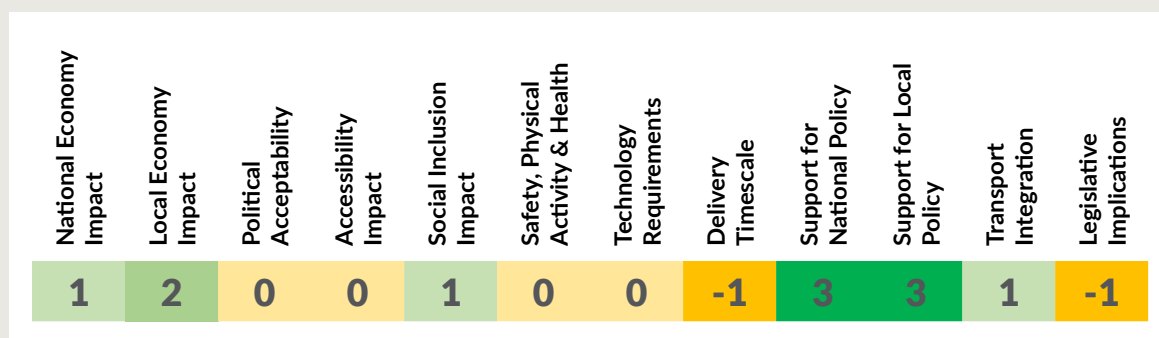
Slightly Adverse

Additional resources required to monitor and adapt to change over time, to ensure stronger integration. Some investment in sustainable mobility may need to be front-led, resulting in additional costs to the exchequer.

User Cost

Slightly Positive

Should result in reduced transport costs for users, with potentially some 'big wins', such as reduced car dependency.



Implementation Considerations

Structure and assigned responsibilities will be required to undertake a review of the progress towards the intended land use distribution set out in the NPF for Ireland's cities and the delivery of transport infrastructure to support sustainable growth, particularly public transport and walking and cycling schemes. The five-yearly cycle of the Census provides an excellent opportunity to track the progress of Ireland's development. In the interim, given the importance of successful land use and transport integration ongoing monitoring and oversight by a duly-authorized organisation (with access to suitable modelling) would be of benefit to ensure we are heading in the right direction. The benefits of available tools should be maximised such as the National Transport Authority's Regional Modelling System.

Implementation Timescale



Overall Priority Rank



Description of Measure

PP08: 15-Minute Neighbourhoods

The 15-minute city / 10-minute neighbourhood concept is that the population of cities should be able to access everything to meet their daily needs within a short walk or cycle, including access to public transport to reach any more-distant services or workplaces. At its core is the idea of liveable, walkable communities, where what people need is within an easy walk, i.e. employment opportunities, shops, education, healthcare, leisure and recreation facilities. Championed by Professor Carlos Moreno at the Sorbonne in Paris "la ville du quart d'heure" is based on four general principles: proximity, diversity, density and ubiquity. There are a growing number of cities looking to develop the concept.

The measure is essentially designing/retrofitting a walkable neighbourhood, where most trips to school, shops, work, recreation and to public transport are within walking distance for the majority of residents. This has numerous benefits including reducing car use and dependency but also promoting physical activity and healthy neighbourhoods. This in turn can reduce air pollution, traffic congestion and improves road safety. During 2020, many towns and cities have introduced temporary COVID mobility measures (including road space reallocation) as a practical response to the COVID-19 pandemic to enable residents to safely access local shops and services on foot or by bike while maintaining social distancing. For example in Paris, over 650km of emergency bike lanes have been introduced to facilitate movement and access to local services while public transport capacity is restricted.

Under the RSES and with support from the Interreg Europe MATCH-UP project, the Southern Regional Assembly have also developed a framework and methodology to be used by local authorities to integrate the '10 Minute Town Concept' for their Key Towns into future Local Development Plans. This approach was developed following an assessment of three Key Towns (Carlow, Ennis and Tralee) and aims to support an increase in the use of sustainable transport and reduce carbon emissions in the Southern Region.²⁷

15 Minute neighbourhood examples	20 Minute neighbourhood examples
○ Paris	○ Melbourne
○ Ottawa	○ Detroit
	○ Portland

²⁷ <https://www.southernassembly.ie/regional-planning/rses-implementation/10-minute-towns>

International Best Practice

Case Study: Melbourne

In January 2018, the 20-Minute Neighbourhood Pilot Programme for Melbourne was launched. The program is being delivered in two project stages in partnership the Heart Foundation, Victoria Walks, Resilient Melbourne and local government.

“The 20-minute neighbourhood is all about ‘living locally’—giving people the ability to meet most of their daily needs within a 20-minute walk from home, with safe cycling and local transport options.”

The hallmarks of a successful 20-minute neighbourhood have been identified by the partners as needing to:

- Be safe, accessible and well connected for pedestrians and cyclists to optimise active transport.
- Offer high-quality public realm and open spaces.
- Provide services and destinations that support local living.
- Facilitate access to quality public transport that connects people to jobs and higher-order services.
- Deliver housing/population at densities that make local services and transport viable.
- Facilitate thriving local economies.

To achieve liveable communities the Melbourne approach identifies the following features:



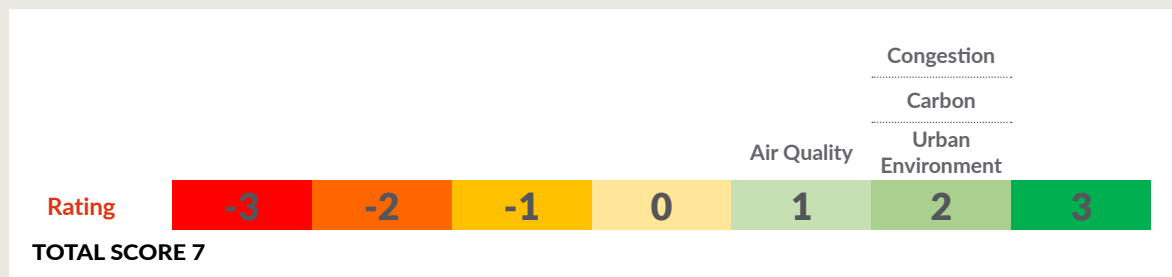
Stakeholder Feedback

There was general support for the concept of 15-minute neighbourhoods, with stakeholders suggesting that the concept should be supported at a national level, with financial incentives provided for the implementation of projects that seek to create 15 Minute Cities/Towns. While recognising the definite potential of 15-Minute Neighbourhoods to support more walking and cycling, it was noted that the concept would be complicated to implement in some Irish cities that have historic urban sprawl.

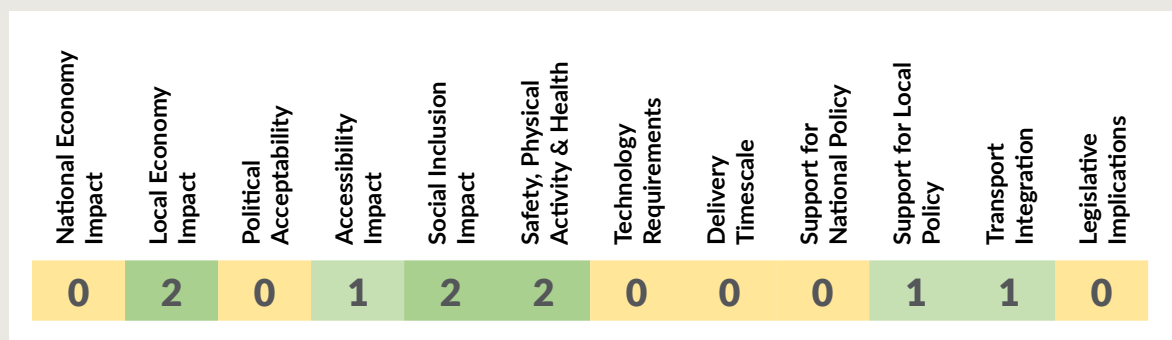
“For demand management, implementation of 10 Minute City and Town Concepts, identified as a tool in this study, should be backed at a national level and financial rewards to implement projects that create 10 Minute Cities/Towns should follow those cities, towns and communities that put a framework in place.”

Assessment of Likely Impact

As a formal approach to planning, 15-minute neighbourhoods are relatively new initiatives. They are also highly adaptable to local environments, making a comparison of outcomes difficult. It is expected that walkable, 15-minute neighbourhoods reduce car dependency, promote equity, enhance local economies, improve physical and mental health, and reduce greenhouse gas emissions.



Exchequer Cost	Moderately Adverse
	Additional cost of infrastructure, e.g. provision of public transport, upgraded cycle and pedestrian facilities.
User Cost	Significantly Positive
	Reduced transport costs for users, with potentially some ‘big wins’ such as reduced car dependency. Reduced travel times due to proximity of services will also bring about user benefits.



Implementation Considerations

To be successful, this measure would need to be embedded into local planning policy. This could be tailored to the individual cities to be 10, 15 or 20 minute neighbourhoods depending on achievability. They could be delivered in phases, to address both legacy issues in existing planning and to support priorities for new development areas. This approach would require investment, especially to retrofit existing areas of our cities.

Implementation
Timescale



Overall Priority
Rank



Five Cities
Demand Management Study

5

Tier 2 - National Toolkit

Tier 2 - National Toolkit
Measures

Demand Management Measures

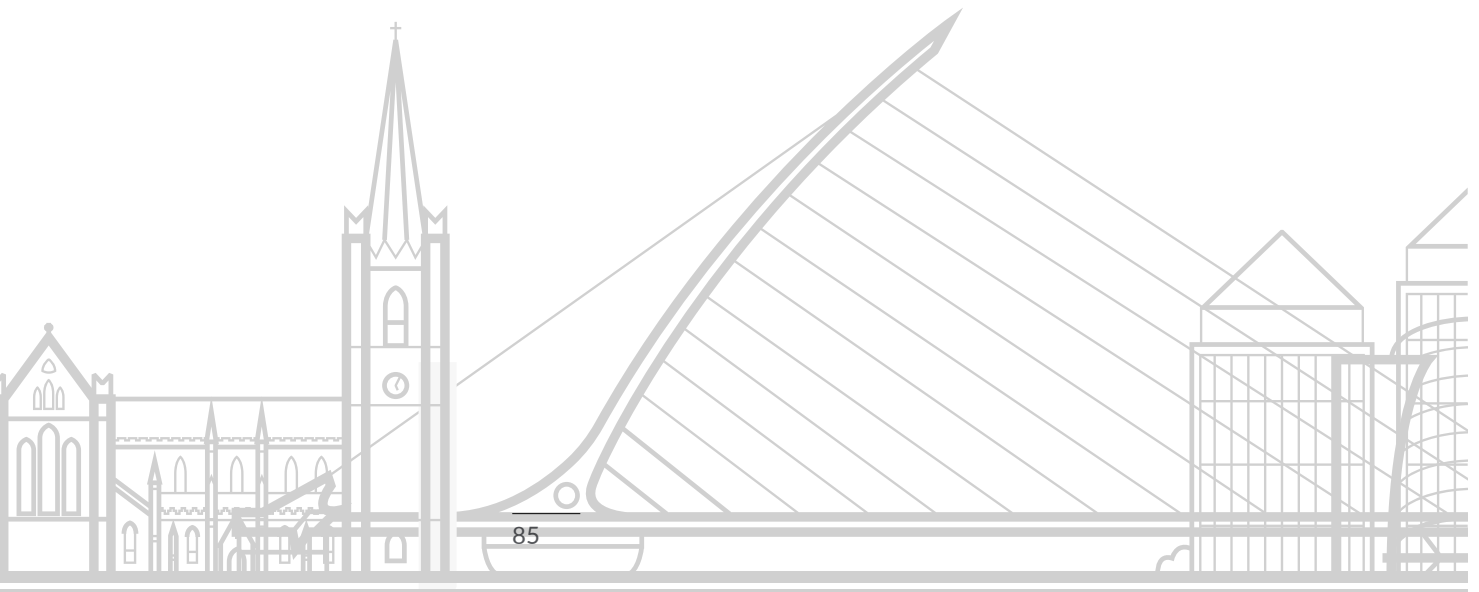
Tier 2 - National Toolkit

Demand Management Measures

In addition to the Tier 1 TDM Strategy Pillars, a range of other TDM measures were identified and assessed for implementation as part of the overall TDM strategy. These form the Tier 2 measures and have been compiled into two Toolkits, one containing national measures which could be implemented at a city level. The Toolkits are intended to be a resource for stakeholders to identify appropriate measures for given situations.

While the potential Tier 2 National Toolkit measures are not ranked, each of the potential measures are assessed in more detail in this Chapter.

Fiscal Measures (FM)	Alternative Fuels	FM06: Hydrogen Vehicle Trials
	Fuel Pricing	FM07: Fuel Taxation
	Scrappage Schemes	FM08: Vehicle to Vehicle Scrappage Scheme
		FM09: Vehicle to Mobility Credit Scrappage Scheme
Incentivising Sustainable mobility	FM10: Sustainable Mobility Incentives	
Air Quality (AQ)	Clean Area Zones/Low Emissions Zones	AQ02: Air Quality Monitoring
		AQ03: Air Quality Citizen Engagement
Parking & Traffic Management (PTM)	EV Parking Strategies	PTM03: Electric Vehicle Charging Management
Planning Policy (PP)	Transport & Public Health	PP02: Public Health & Transport
Behavioural Change (BC)	ISO 50001 Energy Management Certification	BC01: ISO50001 Energy Management Standard - Public Sector
		BC02: ISO50001 Energy Management Standard - Private Sector
	Eco-driving	BC09: Eco-Driving
	Behavioural Change Campaigns	BC10: Behavioural Change Campaign - Cleaner Fleets
Technology & Communication (TC)	Integrated Ticketing and Mobility as a Service	TC01: Next Generation Ticketing
		TC02: Mobility as a Service Pilot
	Connected Vehicles	TC09: Connected Vehicles



Alternative Fuels

FM06: Hydrogen Vehicle Trials

Continue measures to support innovation trials in relation to Hydrogen vehicles

5

FM06

MEASURE TYPE

Existing Enhanced

Additional Description

Hydrogen can be used to power vehicles through combustion (similar to a conventional engine) or through fuel cell technology (FCEVs, in effect, an electric engine powered by hydrogen). Hydrogen vehicles have zero tailpipe emissions (other than water) and have the potential to contribute to air quality improvements and reductions in CO₂. It should be noted that if fossil fuels are used in the production of hydrogen, this can result in associated carbon emissions. When hydrogen is generated from solar or wind electrolysis to process hydrogen there are zero total life-cycle CO₂ emissions.

Hydrogen is significantly lighter than battery technology and takes up less space, making hydrogen fuel cells an option for heavier vehicles operating over greater ranges, for example buses. Hydrogen is not currently widely in use in the transport sector in Ireland.

This measure would specifically invest public funds in the trialling of hydrogen powered vehicles. Consideration of financial incentives for the private purchase of hydrogen fuelled vehicles and fuelling infrastructure is included in FM05.

Current Situation in Ireland

As part of the Department of Transport's Low Emission Bus Trial, the testing of a single-deck hydrogen fuel-cell bus took place in November 2020. A hydrogen fuel cell electric double-deck bus was tested in August 2021 on a modified Dublin Bus route ⁹²⁸.

In addition, the NTA and Bus Éireann are currently trialling three hydrogen-fuel-cell-electric double-deck buses on commuter services in the Greater Dublin Area.

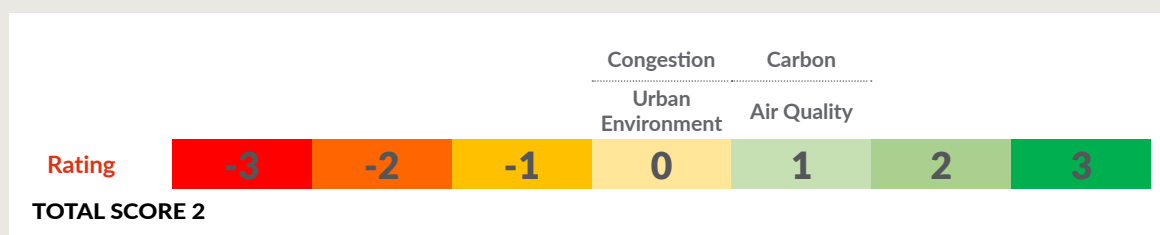
The report on the findings of Phase Two of the Low-Emission Bus Trial will be published later this year.

In March 2021, new grants (administered by TII) were announced to support business to switch from diesel heavy duty vehicles to electric or alternatively fuelled vehicles. The €2m Alternately-Fuelled Heavy Duty Vehicle (AFHDV) Purchase Grant Scheme supports the owners of large vans, trucks, buses, coaches and refuse collection vehicles to switch to battery electric, plug in hybrid, gas or hydrogen fuelled vehicles.²⁹

²⁸ <https://www.gov.ie/en/press-release/fb42f-ireland-takes-next-step-in-testing-hydrogen-buses-in-transport-fleet/>

²⁹ <https://www.gov.ie/en/press-release/4dbaf-minister-announces-hdv-grant-scheme-to-encourage-companies-towards-zero-or-lower-carbon-emission-vans-trucks-and-buses/>

Impact in Delivering the Study Objectives



Summary Assessment

- Hydrogen is an immature vehicle technology and available vehicles have very high costs.
- Hydrogen production across Europe is extremely limited at present.
- There is limited hydrogen refueling infrastructure currently in operation in Ireland, with the current Low Emission Bus Trial vehicles being refuelled by BOC gases.
- Few commercial organisations would be capable of bearing the cost of a stand-alone hydrogen project.
- A publicly funded hydrogen trial could speed up the introduction of hydrogen vehicles.
- A trial would provide data on maintenance and operation costs in an Irish context.
- There is accelerating interest in hydrogen internationally, particularly as an alternative zero emission vehicle for use when EVs are considered unsuitable due to range, power or time taken to recharge.
- Other countries are investing in hydrogen trials with the assistance of EU funding.

Best Practice Evidence

In the UK, the Office for Low Emission Vehicles (OLEV) is one of the main national programmes supporting the uptake of zero emission mobility. A number of hydrogen trials have been funded by OLEV including buses in Brighton and Hove, Birmingham and London under the Ultra Low Emissions Bus Scheme. OLEV's £23m Hydrogen for Transport Programme provides funding to support the roll out of hydrogen refuelling stations and fuel cell vehicles in the UK.

Under the Hydrogen Mobility Europe project (www.h2me.eu), €67m has been invested to trial hundreds of fuel cell electric cars, vans and trucks and provide associated refuelling infrastructure across 8 European countries. In the context of operations within cities, the study is indicating that there are potential benefits of adopting hydrogen FCEVs for fleets with high utilisation (such as taxis, police, and ambulance vehicles). Another project, H2-Share, part funded by the EU with finance from regional governments in Antwerp and Noord-Brabant (Netherlands) is investing €3.5m trialling heavy-duty hydrogen vehicles.

Stakeholder Feedback

There was general support for measures to support innovation trials in relation to hydrogen despite concerns that the measure would only have small impacts.

"Trials are good for r&d but they are not likely to have impact like policy would."

Fuel Pricing

FM07: Fuel Taxation

Progressive taxation measures to discourage diesel use and enhance take up of alternative cleaner fuels

5

FM07

MEASURE TYPE

Existing Enhanced

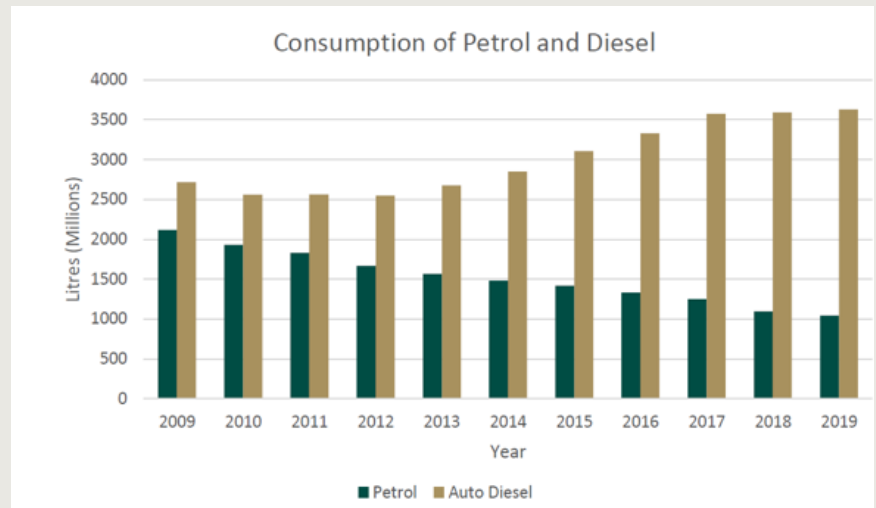
Additional Description

Fuel taxation is a long-established measure to raise funds to offset exchequer costs; however, revenue generation is not the only reason for taxing fuels. At present fuel taxation measures include:

- Fuel duty on petrol and diesel.
- Carbon taxes.
- VAT.
- Diesel rebate scheme.

Fuel duty is higher on petrol than diesel. The trend over the last 10 years shows increasing consumption of diesel as a proportion of total car sales, reflecting the growing proportion of diesel cars in the Irish fleet (see FM01). In 2019, the volume of diesel sold in Ireland was significantly higher than petrol, with an even more significant difference noted in 2020 (including during the Covid-19 pandemic lockdown, highlighting the use of diesel in the HGV fleet).

2019	Fuel Duty (per 1000 litres)	Carbon Tax (per 1000 litres)	VAT	Volumes (millions litres)
Petrol	€541.84	€59.85	23%	1,043
Diesel	€425.72	€69.18	23%	3,679

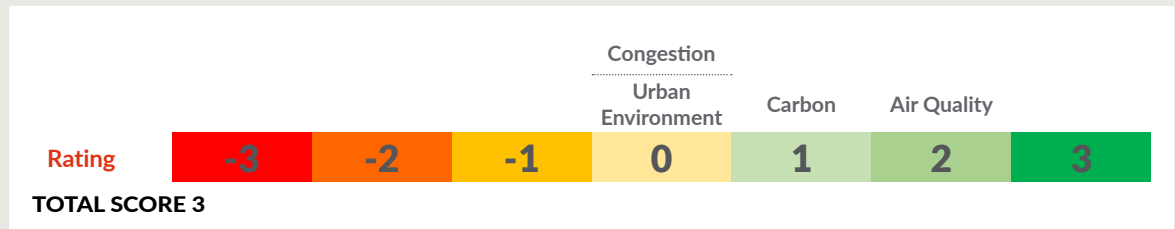


Diesel is more expensive in Northern Ireland, due in part to equity in the duty on petrol and diesel in the UK. This price disparity results in legal 'fuel tourism' with northern Irish vehicle owners buying a significant volume of fuel, predominantly diesel, in the south. It is notable that fuel tourism contributes to recorded Republic of Ireland emissions as emissions are recorded based on where the fuel is sold rather than where it is used.

To discourage diesel use, fuel duty on diesel could be substantially increased.



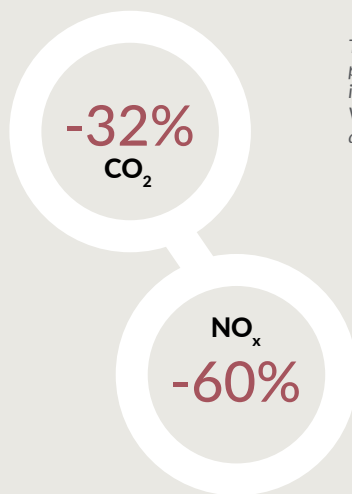
Impact in Delivering the Study Objectives



Fleet Modelling

The implementation of progressive taxation measures to discourage diesel use and enhance take up of alternative cleaner fuels is predicted to contribute to:

Fleet Modelling Results



These reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump' -related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

Summary Assessment

- There is volatility in the resource cost of fuel and there can be sudden and dramatic changes in crude oil prices as demonstrated with falling demand as a result of the COVID19 pandemic.
- Cross border issues arise based on the relative cost of diesel fuel north and south of the border.
- Fuel taxes would apply nationally and affect all vehicles including goods vehicles that may have limited affordable alternative options.
- Given the broad impact of fuel taxation, it may not be perceived as an appropriate demand management measure for the five cities.
- There are concerns that very significant increases in fuel taxation would have a disproportionate impact on the less well-off and those with limited alternative transport options.
- The use of fuel tax to influence behaviour is challenging due to the potential fluctuations in the retail price of fuel.

Best Practice Evidence

The taxation of energy products and electricity in the European Union is governed by the provisions of Council Directive 2003/96/EC. For fuels, the structure of excise duties is harmonised across the EU, although the rates themselves can vary from one country to another. Revision of the Energy Tax Directive is currently underway through the European Union's Fit for 55 programme in order to align it to the EU's energy and climate change goals.

Stakeholder Feedback

There was support for progressive fuel taxation, with the suggestion that those with newer diesel vehicles should pay different fuel tax to those with older diesel vehicles. However, the following concerns were also noted:

- Fuel demand is extremely inelastic.
- Viable alternatives to diesel do not exist, especially for long-distance passenger transport.
- Political constraints due to the negative economic impacts on city centres.

"Euro 6 has very low emissions and operators should not be taxed more for investing in these vehicles."

"Fuel pricing actually worked extremely well 20 years ago... if it's used as an incentive, rather than a financial stick to beat people with, I think it will actually have a place. "

Ruled Out as a Measure

Based on the detailed evaluation, it was concluded that Fuel Pricing that involved progressive taxation measures to discourage diesel use and enhance take up of alternative cleaner fuels (FM07) should not form a key recommendation of this Study.

While the measure will penalise the purchase of diesel fuel encouraging the uptake of alternative fuels bringing resulting environmental benefits, it would not be possible to target its impact within the five cities. Furthermore, the underlying fluctuations in the resource cost of fuel result in significant price changes that cannot be controlled for as would be needed to best meet the objectives of this Study. Fuel taxation is an important national fiscal measure and is directly aligned to the polluter pays principle, however, it is ruled out as a demand management measure in the context of this Study relating specifically to the five cities.

5

FM08 & FM09

MEASURE TYPE

New³⁰

Scrappage Schemes

FM08: Vehicle to Vehicle Scrappage Scheme

Vehicle Scrappage Schemes which provide discounts on the purchase of new, clean private and commercial vehicles when high-polluting vehicles are scrapped (in addition to an EV grant)

FM09: Vehicle to Mobility Credit Scrappage Scheme

Vehicle Scrappage Schemes which provide mobility credits for sustainable mobility in exchange for high-polluting private vehicles being scrapped (further examination/evidence as regards the potential for Pilot Study in larger cities, with smaller cities pending outcomes)

Additional Description

Vehicle Scrappage Scheme - Purchase of Electric Vehicle

A vehicle scrappage scheme would aim to incentivise the removal of older, more polluting vehicles from the national fleet, particularly ones which are regularly used in areas of poor air quality. Owners could also be incentivised to purchase newer, cleaner vehicles or, in well-connected areas, to change their travel habits from driving to using public transport and active travel.

A scrappage scheme was introduced in Ireland with Budget 2009, mainly to give a boost to car dealerships during the financial crisis. Under the scheme, drivers could trade in a car of ten years or older to be scrapped and receive VRT relief of €1,500 on the registration of a new vehicle. The scheme was extended for 6 months in the 2010 budget, with reduced relief of €1,250. New car purchases under the scheme accounted for a sizeable portion of new car sales in 2010, with 16.1% of new car sales in Q1 2010 bought using the scrappage scheme³¹.

In relation to the taxi fleet, in 2021 changes were announced so that those scrapping older, more polluting, or high mileage vehicles are now eligible for an eSPSV grant if they make the switch to electric, with €20,000 available for a new full electric or €25,000 for a wheelchair accessible new battery electric vehicle.

Under measure FM08, a similar scheme would be introduced to bring a further reduction in the price of purchasing an EV for private use (on top of existing incentives) when a high-polluting vehicle is scrapped.

Vehicle Scrappage Scheme - Mobility Credits

Under FM09, when a high polluting vehicle is scrapped, “mobility credits” would be provided to the registered owner. These credits would be loaded onto a smart card like the Leap Card, or into the owner’s account with Next Generation Ticketing, to ensure that any scrappage proceeds are spent on sustainable mobility

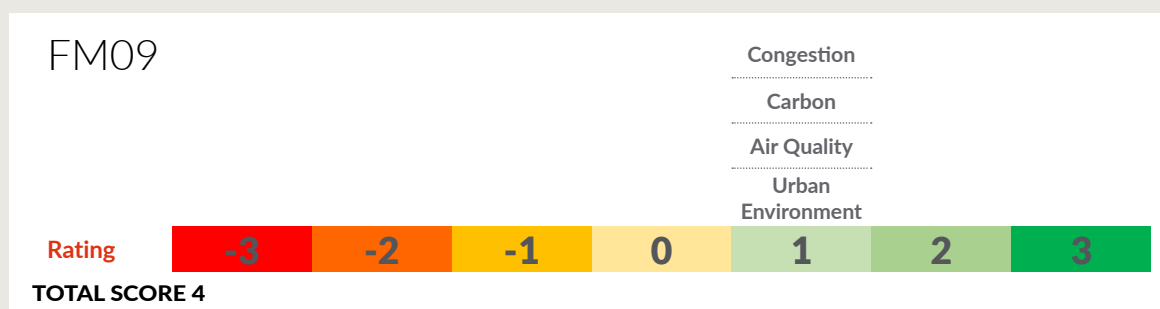
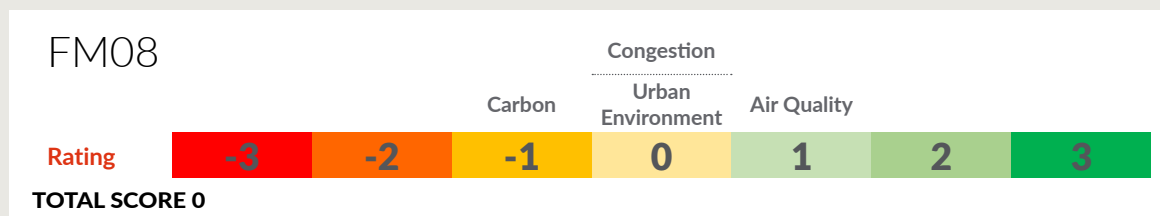
30 Scrappage scheme previously ran from 2010-2011 but no scrappage scheme is currently in place

31 <https://www.centralbank.ie/docs/default-source/publications/quarterly-bulletins/qb-archive/2011/qb3-2011.pdf?sfvrsn=6>

and not on another vehicle. The credits would aim to cover reasonable travel expenses for at least one year and could be spent on bus, Luas, rail and bike share. Taxis could be included, but this would only make sense if the taxi fleet was much cleaner than the vehicles being scrapped.

Whereas FM08 seeks to replace high polluting vehicles with zero tailpipe emission vehicles, FM09 seeks to drive modal shift and reduce overall car usage.

Impact in Delivering the Study Objectives

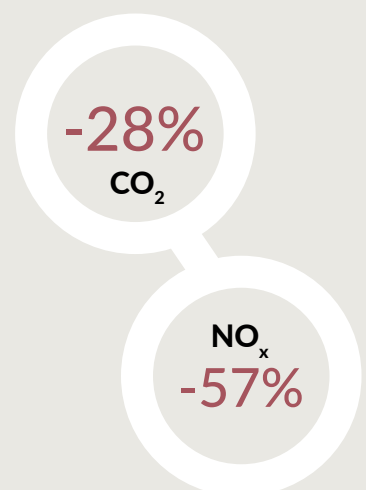


Fleet Modelling

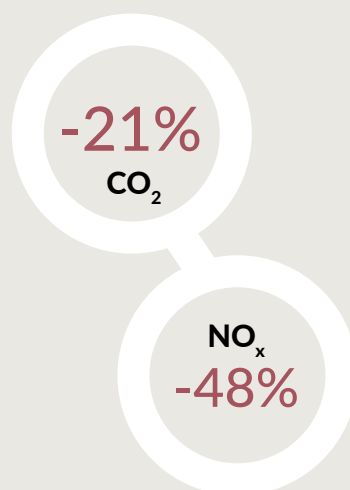
The level of the incentive will determine the impacts of these two measures on the fleet. Here it was assumed that this incentive is set high enough to double the annual scrappage rate of older diesel vehicles, FM08 also encourages the uptake of electric vehicles (due to the discount being offered against the price of BEVs), while FM09 is assumed to reduce the overall emissions from older diesels by 5%, due to the mode shift impacts. FM08 is predicted to have a relatively wide-spread take-up and lead to a noticeable decrease in the worst polluting vehicles in the fleet, and associated increase in EVs.

FM09 is predicted to have more limited take up, focussed around high quality transport corridors (FM09 would therefore cost significantly less than FM08, due to more-limited take-up of the relevant scrappage grants), and while the removal of a polluting vehicle has a positive effect on the fleet, it doesn't do as much to encourage the uptake of EVs and therefore does less for the average emissions per kilometre of the remaining fleet; however, it should be noted that someone availing of FM09 and switching to sustainable mobility would generate far less CO₂ emissions than someone availing of FM08 and switching to an electric car and that FM09 will therefore be more cost-effective than FM08 (i.e. more emissions reduction per scrappage grant paid).

FM08: reduction in private car emission rates



FM09: reduction in private car emission rates



These reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump' -related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

Summary Assessment

- The concept of old-for-new scrappage schemes, as in FM08, for encouraging upgrades of the car fleet is 'tried and tested' in Ireland, whereas car for mobility credits, as in FM09, is not.
- Both FM08 and FM09 would result in the removal of a portion of the most polluting vehicles from the national fleet.
- FM08 would likely have a more-widespread uptake than FM09, as it doesn't require any change in travel habits, whereas FM09 requires giving up a car (probably often the household's 'second car') and moving those journeys to more-sustainable modes.
- FM09 would be primarily targeted at high quality public transport corridors.
- FM08, while contributing to a cleaner fleet, does not contribute to a net reduction in car use and associated congestion.
- If we were to adopt a life cycle approach to calculating car emissions (i.e. including the carbon emissions associated with the manufacture of new vehicles), incentivizing scrappage of otherwise roadworthy vehicles and replacing them with new ones as in FM08, is likely to lead to an overall net increase in carbon emissions³², as the 'embedded carbon' in the extra new vehicle is likely to more-than-offset the fuel efficiency savings of the upgraded fleet.
- Scrappage schemes like FM08 work best in countries with significant car manufacturing industries (which then benefit from the additional demand for new vehicles) and their effectiveness in reducing GHG emissions are rarely positive³³.
- Due to existing VRT treatment of EV registrations, no VRT is paid on EVs with a market price (before incentives) of €40,000 or less, which means no VRT is paid on the registration of most EVs³⁴. Therefore, a scrappage scheme operated via VRT would only reduce the costs of higher end EVs (with changes to VRT in 2021 meaning that no amount of relief will be available for BEVs with a value of over €50,000).
- The overlap of people who own old, highly polluting vehicles and people looking to purchase a high end EV is likely to be small.



32 <https://www.eea.europa.eu/signals/signals-2017/infographics/range-of-life-cycle-CO2/view#tab-related-publication>

33 https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/ldv_scrappage_schemes_en.pdf

34 <https://assets.gov.ie/86999/d525b314-3751-4936-83b8-5084fe6e4263.pdf>

Best Practice Evidence

A mobility credit scrappage scheme is currently being trialled in Coventry, UK. Coventry residents with an older, polluting car can exchange their car for £3,000 of mobility credits. The credits can be spent on public transport, car clubs, bikeshare, scooters hire, taxis and on-demand bus services.

The credits are issued on a prepaid debit card that can only be used on transport services - thus mitigating the risk that proceeds from the scrappage scheme will be used to purchase a new car. The trial is limited to specific areas of Coventry with air quality concerns and/or those along high-quality public transport corridors.

Stakeholder Feedback

High levels of support for scrappage schemes, with stakeholders recognising the importance of providing incentives alongside penalties such as increased taxation. The following was also noted:

- The scrappage scheme should cover private, commercial and public fleets.
- Encouraging the purchase and manufacturing of new vehicles, especially EVs, could have negative carbon impact.
- Does not help manage/reduce congestion.
- Viable sustainable mobility options need to exist prior to delivery.

"It ignores the environmental impact of constructing new vehicles."

"This measure incentivises use of cleaner cars but also encourages car purchase/proliferation which could be counter to sustainable mobility/demand management objectives. Also, maybe wasteful of existing resources in terms of discarding much of current fleet that is in good working order. Maybe we need to retain existing cars but use them less."

Ruled Out as a Measure

Based on the detailed evaluation, it was concluded that Vehicle Scrappage Schemes which provide discounts on the purchase of new, clean private and commercial vehicles when high-polluting vehicles are scrapped (FM08) should not form a key recommendation of this Study.

While having definite benefits in terms of reducing the number of worst polluting vehicles in the fleet, and increasing the number of EVs, its impact to deliver the key Study Objectives within the five cities was assessed as not sufficient to warrant inclusion as a Study recommendation. This is principally due to likely increased carbon emissions when adopting a life cycle approach to calculating car emissions.

5

FM10

MEASURE TYPE

Existing Enhanced



Incentivising Sustainable mobility

FM10: Sustainable Mobility

Incentives

Progressive tax subsidies to incentivise sustainable travel (e.g. Tax Saver; Cycle to Work scheme; Business related EV & cycle mileage eligibility & incentive improvements)

Additional Description

Under the Cycle to Work Scheme an employer can purchase a bicycle and safety equipment for an employee. The employee then covers the cost of the bicycle over a period of 12 months from their gross salary, providing savings of tax that would have been paid on that income. The limits of the scheme were raised in August 2020, to €1,500 for e-bike and €1,250 for other bikes³⁵. E-bikes can extend the range of easily cyclable commutes and provide cycling as an option for some people with reduced mobility who could not otherwise cycle.

TaxSaver tickets are monthly or annual public transport tickets operated on a similar basis to the Cycle to Work scheme, enabling employees to benefit from reduced tax payments, effectively resulting in heavily discounted public transport tickets. It is a successful scheme with an estimated 35,000 users³⁶.

Currently available measures like TaxSaver and Cycle to Work are only available to people who work with participating employers. As savings are much higher for those paying higher rates of tax, they are regressive tax measures. These schemes could be modified to encompass more employees - for example, introducing more attractive public transport TaxSaver incentives for those paying lower rates of tax and/or those working part-time and also potentially widening eligibility to the self-employed. By introducing such changes and also making the process more simple and attractive for smaller employers to offer both the TaxSaver and the Cycle to Work scheme to their staff, this could widen the pool of people able to benefit from these sustainable travel tax incentives and reduce inequity.

A reduction or elimination of VAT on bicycles (subject to EU agreement as VAT is an EU competency) could be a more equitable way to reduce the cost of bicycles than the cycle to work scheme. An additional measure to encourage cycling could be to offer grants to stimulate take-up of e-bikes among the general public (and potentially make the replacement of a second car with an E-bike a more attractive proposition). For example, in Austria, grants are available at national level offering €100 for electric bikes, €250 for electric cargo bikes and €200 for cargo bikes. The retailer is expected to match the grant with a discount of the same amount. France offer a series of grants at national and state level from between €200 to €600. Sweden offer 25% towards the purchase of an e-bike to a maximum of approximately €1,000 - with 87,000 sold within a year and “about half of the use of e-bikes substituting for driving a car.”³⁷

In the United Kingdom, employees using bikes for business travel are entitled to 20p per mile, tax free, from their employer in mileage allowance payments³⁸ (the rate is 45p when using a car). In Ireland an employee is entitled to 8 cent per kilometre, compared to 44.79 cent per kilometre for cars over 1,500cc³⁹. In

35 <https://www.revenue.ie/en/jobs-and-pensions/taxation-of-employer-benefits/cycle-to-work-scheme.aspx>

36 <https://www.oireachtas.ie/en/debates/question/2019-03-26/236/>

37 www.bicycleassociation.org.uk/wp-content/uploads/2019/07/The-Case-for-a-UK-Incentive-for-E-bikes-FINAL.pdf

38 <https://www.gov.uk/expenses-and-benefits-business-travel-mileage/rules-for-tax>

39 <https://www.revenue.ie/en/employing-people/employee-expenses/travel-and-subsistence/civil-service-rates.aspx>

Belgium, employees who commute to work using a bike are entitled to a tax-free payment of 23 cents per kilometre from their employer. This serves as a far greater incentive for mode shift than payments for business travel alone, evidenced by 9% of Belgium’s workforce availing of this cycling allowance in 2015⁴⁰.

In Ireland, mileage rates incentivise driving larger vehicles:

IRISH MOTOR TRAVEL RATES²⁹

Distance band	Engine capacity up to 1200cc	Engine capacity 1201cc - 1500cc	Engine capacity 1501cc and over
Up to 1,500 km (band 1)	37.95 cent	39.86 cent	44.79 cent
1,501 - 5,500 Km (band 2)	70.00 cent	73.21 cent	83.53 cent
5,501 - 25,000 Km (band 3)	27.55 cent	29.03 cent	32.21 cent
25,001 Km and over (band 4)	21.36 cent	22.23 cent	25.85 cent

These reimbursement rates (which include a reflection of the cost of wear and tear of a vehicle) could be re-structured to incentivise travel with less polluting vehicles, with the payment for the most-polluting vehicles reduced to reflect the ‘cost to society’ of the harmful emissions and/or as a specific incentive to reduce the use of large fossil-fuelled cars for business travel.

Sustainable Travel Grants could also be made available for employers and schools implementing Mobility Management Plans (for example on a match-funded basis for cycle parking and changing/shower facilities) to improve destination facilities for active travel users.

Impact in Delivering the Study Objectives



Summary Assessment

- Measures would reduce car usage, which is the most effective way to reduce transport emissions and congestion.
- Widening access to the TaxSaver and Cycle to Work schemes through fare and tax structure changes and making it easier for more employers to offer such schemes to their employees could improve social equity and take-up of sustainable travel.
- Reducing the VAT on bicycles (including e-Bikes) or offering grants for e-bikes available to all members of the public (similar to grants for EVs) and not just those on the Cycle to Work scheme could also improve social equity and take-up of sustainable travel.
- Widening access or bringing in new fiscal incentives similar to the Cycle to Work scheme or TaxSaver tickets would require sizeable exchequer expenditure.
- Travel payments for business trips already have rates for bicycles, this rate could be increased to promote business travel by bike.
- Similarly, motor travel rates could be altered relatively simply to incentivise trips by low polluting vehicles instead of vehicles with larger engines.
- Using existing travel rates framework, a cycling allowance similar to Belgium’s for commuting by bike would be a very powerful fiscal incentive for cycling.
- Travel rates and cycling allowances would not require exchequer expenditure, although potential abuse of the system to lower tax payments would require monitoring.

40 <https://ecf.com/news-and-events/news/tax-breaks-bike-commuters-european-trend>

Best Practice Evidence

Travel to work is the most commonly reported trip purpose for public transport users in Ireland, accounting for 42% of trips (TFI customer satisfaction research in 2018). Employees can avail of the TaxSaver ticket scheme which provides for the purchase of annual and monthly public transport tickets through employers from an individual's gross salary thereby providing savings of either 28% and 52% depending on the applicable tax band.

It is estimated that there are 35,000 users of the TaxSaver scheme annually equating to €3.5m in revenue foregone.

Stakeholder Feedback

General support for progressive tax subsidies to incentivise sustainable mobility, with stakeholders recognising the importance of providing incentives alongside penalties such as increased taxation or penalty charges. The following was also noted:

- There is currently no leadership in this area - subsidies and incentives are covered by multiple different government departments.
- TaxSaver should be extended to parents of students who often pay for travel.
- TaxSaver should also benefit part-time workers or for those working from home several days a week.

"In addition to costs and penalties to the polluter, there needs to be financial incentives and rewards for going green, both private and commercial. Tax reductions, grants, and financial rewards for going green will push demand for green technology and push the market to respond with affordable choices."

"Tax saver should be extended to students' parents who pay for their children's travel."



Clean Area Zones/Low Emissions Zones

AQ02: Air Quality Monitoring

Continue EPA roll out of AQ monitoring stations, building capacity and capability for AQ modelling

AQ03: Air Quality Citizen Engagement

Continue EPA roll out of AQ citizen engagement programmes (e.g. Globe Schools, Curious Noses/Clean Air Ireland) to enhance awareness of air quality and support behavioural change.

Additional Description

The EPA's National Ambient Air Quality Monitoring Programme commenced at the end of 2017. The programme provides real-time air quality information from a total of 84 monitoring stations nationwide. 24 of these stations were installed in 2019. There are 1,300 premature deaths in Ireland every year which can be linked to air pollution according to latest estimates⁴¹.

The EPA's Air Quality Report 2019⁴² reported the EPA's first recorded exceedance of the EU annual average legal limit values at St. John's Road West in Dublin. This exceedance results in a legal requirement to develop an air quality action plan for Dublin. The report sites transport emissions as the leading factor in the NO_x emissions breach. 33 out of 84 monitoring stations recorded breaches of the tighter WHO guideline values, the dominant issue being PM2.5 emissions.

The Global Learning and Observations to Benefit the Environment (GLOBE) Programme is an international science and education programme⁴³ that is managed in Ireland by An Taisce in partnership with the EPA. Participating schools learn about air quality and the weather by making scientific measurements and using their data to carry out research.

5

AQ02 & AQ03

MEASURE TYPE

Existing



41 <https://www.epa.ie/newsandevents/news/name,69490,en.html>

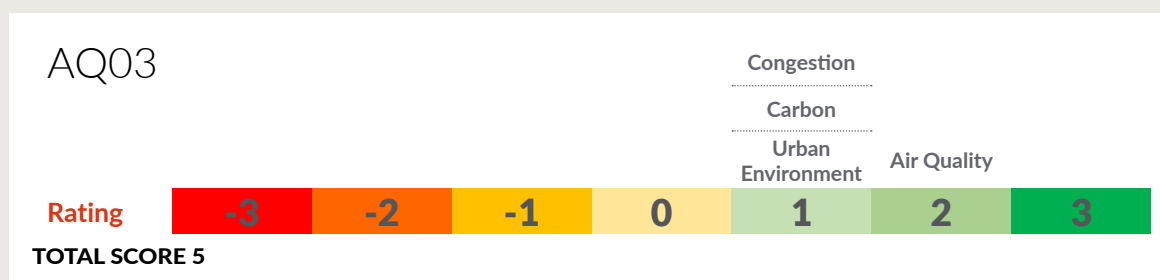
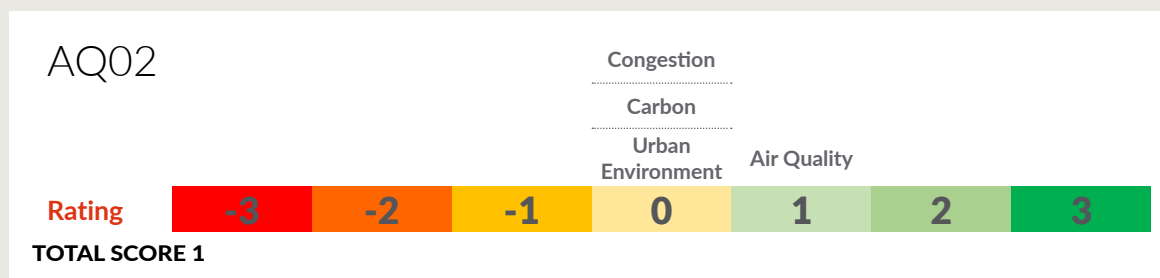
42 <https://www.epa.ie/pubs/reports/air/quality/epairqualityreport2019.html>

43 <https://www.globe.gov/web/ireland>

The EPA are working on a new project called Clean Air Ireland, modelled on the Curious Noses project in Flanders, Belgium⁴⁴. The project involved giving out NO_x tubes to volunteers in the city. After the tubes were returned the project team were able to give volunteers the results from their tube, where it fit compared to the wider results in Antwerp and what that meant from a public health perspective. The data was also used to validate air quality modelling for Antwerp. The resulting increase in citizen engagement on air quality led to a major increase in calls for government action, including legal challenges. Clean Air Ireland will involve the distribution of 1,000 tubes on a pilot basis, initially in Dublin.

The EPA is attempting to acquire funding through the EU's LIFE funding vehicle⁴⁵ to provide modelling that would enable a 48-hour Air Quality forecast for Ireland. This forecast could be provided to the public, in a similar manner to how weather forecasts, and road watch segments are currently.

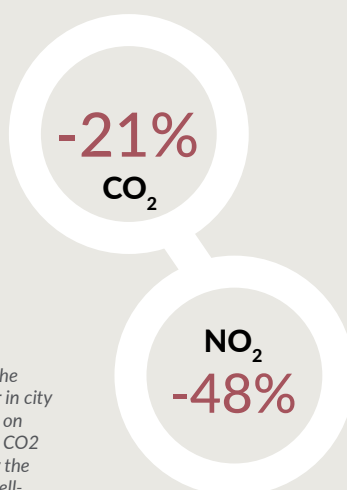
Impact in Delivering the Study Objectives



Fleet Modelling

In modelling the impact of measure AQ02 on the fleet, it is assumed that increased air quality monitoring will lead to earlier action on air quality limit exceedances, which will contribute to driving a switch in the fleet away from older, more polluting diesel vehicles.

AQ02: Reduction in private car emission rates



These reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump' -related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

⁴⁴ <http://www.flanderstoday.eu/curious-noses-measure-air-quality-across-flanders>

⁴⁵ <https://ec.europa.eu/easme/en/life>

Summary Assessment

- The benefits of the EPA's air quality monitoring stations are evidenced by the recording of a breach of EU annual average legal limit values at St. John's Road West in 2019 which would otherwise have gone undetected.
- The implementation of the air quality action plan that must be developed as a result of the breach will result in improved air quality in Dublin and may impact future purchases of diesel vehicles.
- Air quality monitoring must be supported by robust air quality modelling capabilities.
- AQ03 creates effective air quality advocates in young people, who have the most to gain from air quality improvements.
- NO_x tubes given out to schools will only sample NO_x in the immediate area around the school and could miss areas of poorer air quality nearby.
- Both measures are valuable in terms of gathering data and raising awareness but neither will have a direct impact on air quality.

Stakeholder Feedback

High levels of support for continued EPA roll out of AQ monitoring stations and citizen engagement programmes, with stakeholders noting how these measures could contribute to better quality of life, place making, improved air quality and the Smart City concept. There was also a suggestion that engagement programmes should emphasise and promote active travel as a solution to air quality issues, with awareness of issues being high.

"Such data recording of environmental conditions is central to the Smart City concept... Through these recommendations, there are also positive opportunities for promoting good quality of life, health of a city/town/community and the contribution of a clean environment for place making, which attracts people to love, work and invest."



5

PTM03

MEASURE TYPE

Existing Enhanced

EV Parking Strategies

PTM03: Electric Vehicle Charging Management

Technology to support efficient booking and use of public EV charging facilities

Additional Description

At present, ESB ecars are the main provider of publicly available EV charging points in Ireland, operating and maintaining approximately 1,100 charging points nationwide. They provide a mix of standard (22kW) and fast (50kW) chargers, a roll out of high power chargers (150kW) began in 2020. The ESB ecars Connect App provides a map of all ESB ecars charging points and some third-party chargers. The app provides the location and type of charger for all ESB ecars and third-party chargers and real time availability information for ESB ecars chargers. The app also allows users to start, end and pay for charging sessions using ESB ecars chargers.

ESB ecars introduced tariffs for the use of their public fast charging points in November 2019 and for using their standard chargers in August 2020. While the entry of other commercial EV charging operators to Ireland was limited while use of ESB ecars charging points was free, this is changing with the ESB's introduction of tariffs. For existing networks run by other operators in Ireland, the EV user usually needs to use a separate smart card or app for each operator's charging points, although some operators offer more expensive 'pay as you go' rates through mobile browsers.

There are a number of mapping services/apps that provide relatively comprehensive maps of charging points in Ireland. Zap Map provides real time availability information for many charging points, using data provided by ESB ecars and information for other chargers relying on crowd-sourced data.

There are currently no apps that provide booking functionality for public EV charging points in Ireland. Zap Map⁶ and Bookmycharge have the capability to run a booking system, including allowing people to list their own private spaces/driveways with EV charging points for booking; however these services are currently only available in the UK and generally do not cover public charging points.

This measure seeks to create a 'one-stop-shop' app that enables the user to see all charging points across all operators on a single map, with availability information for all points and booking functionality for charging points. This app could potentially be incorporated into Transport for Ireland's Journey Planner app, enabling users to plan routes and book chargers as necessary along their planned route or close to their destination. This could then be integrated with journey planning on public transport networks, allowing the app to suggest park & ride (with charging) options and potentially open up a wider range of charging locations close to the destination of the trip.

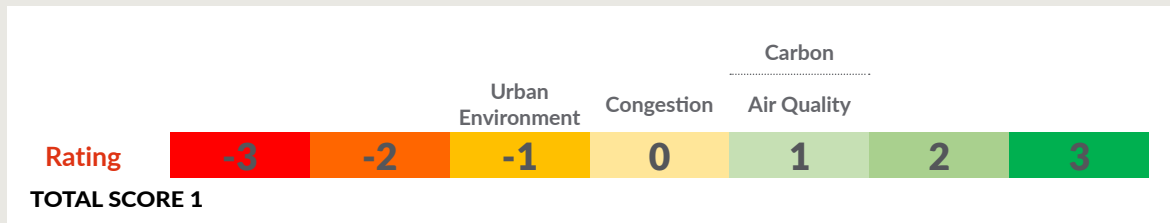
Ideally the app would use information about the EV user's current position, destination and remaining battery range to identify a set of candidate chargers en route or close to the destination and provide some or all of the following information for this set of candidate chargers:

- Information about the candidate chargers' status (operational or out of order)
- Tariffs
- Current and near-future availability

- A booking system
- A payment mechanism
- Identification of the 'optimum' location (e.g. Minimising the combination of charging time, diversion off the shortest route and the estimated price of the charge)
- A payment mechanism
- A fault-reporting capability.

Impact in Delivering the Study Objectives

Progressive tax subsidies to incentivise sustainable mobility



Summary Assessment

- Important that the new app adds to the market and does not merely duplicate what is being done by other apps.
- App would reduce cruising time while searching for an available charging space in urban areas but could lead to an increase in use of public EV charging by drivers who have the option of charging at home or at work.
- Robust access to charging networks, and the ability to book charging points in advance, will be particularly important as the EV market matures, particularly as increasing numbers of EV users without access to private off-street charging start to purchase and use EVs.
- The ability to book charging points, and increasing awareness of the existing charging network, will address range anxiety amongst potential EV owners.
- Potentially tying the proposed app in with the TFI Journey Planner and enabling drivers to see the fastest way to complete a route given their current charge level, potential charging locations and public transport/park & ride options could increase the utility of the app and reduce development/maintenance costs.
- Use of on-street parking spaces for EV charging has a negative effect on the urban environment compared to reallocation of road space to modes which are more sustainable than private cars.
- There would a significant cost to the exchequer in development and maintenance of the app.
- The measure would probably only have a slight/moderate positive impact on EV uptake.
- The app would not reduce the overall demand for car travel.

Stakeholder Feedback

General support for technology to support efficient booking and use of public EV charging facilities, despite concerns over:

- The significant financial investment required when EVs should mostly be charged at home.
- EVs have a significant carbon footprint and still cause congestion.

"Few EV users should need public charging facilities and owners should be encouraged to park and charge at home."

5

PP02

MEASURE TYPE

Existing enhance



Transport & Public Health

PP02: Public Health & Transport

Improve integration between Public Health & Transport, including focused resources to embed physical activity and improve air quality outcomes through the health system, land use planning & behavioural change programmes

Additional Description

According to the Irish Society for Clinical Nutrition & Metabolism and the Association for the Study of Obesity in Ireland (ASOI), if current trends continue, by 2025, 33% of adults in Ireland will be obese and the annual cost of treating obesity-related diseases will be €2.1 billion⁴⁶. With one in four children in Ireland overweight or obese, and with a 70% risk of this continuing into adulthood, this can result in lifelong and inter-generational ill health. This estimated cost per person associated with obesity in children is in excess of €16,000 per person in the Republic of Ireland⁴⁷. Measures designed to promote walking and cycling and reduce car dependency therefore have the potential to yield substantial health-related savings within a relatively short time.

Building physical activity into everyday lives by reducing car dependency (particularly for short trips) and replacing these trips with walking and cycling (including as part of a public transport journey) can play a role in an overall obesity reduction programme, as well as supporting demand management.

The closer integration between transport and public health can be achieved in a number of ways, including:

- **GP Active Travel Prescriptions** (e.g. access to a bike and cycle training, such as that announced by the NHS in England in Summer 2020).
- **Planning policy that integrates a public health focus with sustainable development**, ensuring that the built environment favours and enables active, healthy travel choices, rather than continuing car dependency through an obesogenic⁴⁸ environment. The Lancet Commission on Obesity⁴⁹ (LCO) states that radical changes are required to harness the common drivers of “obesity... and climate change.” Urban design, land use, and the built environment are included in these drivers. The report highlights pedestrian priority and dignity, wide pavements, access to open-green spaces within 0.5-km radius, redistribution of land use, and access to quality, adequate capacity, comfortable, and well-networked public transport, as some of the interventions that require urgent implementation and monitoring.
- **Behavioural change campaigns** that support people to integrate active travel into their daily lives at minimal cost or additional time (e.g. commuting by bike rather than gym membership), while benefiting their own health, reducing congestion and improving air quality - such as those delivered by Health Ireland’s www.getirelandactive.ie campaign.

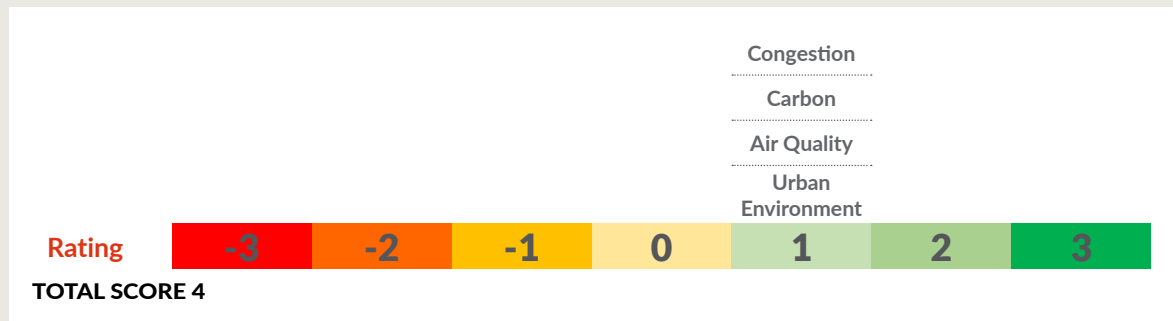
46 <http://www.irishhealth.com/article.html?level=4&id=25955>

47 <https://www.healthmanager.ie/2018/01/cost-of-obesity-in-ireland/> prioritise cars over walking and cycling.

48 <https://onlinelibrary.wiley.com/doi/full/10.1111/obr.12938>

49 <http://www.irishstatutebook.ie/eli/2014/si/426/made/en/pdf>

Impact in Delivering the Study Objectives



Summary Assessment

- This measure will have health, environmental and urban realm benefits.
- By focusing on encouraging and facilitating more people to replace short trip car journeys with active travel choices, it will help to manage congestion and reduce carbon emissions.
- The focus on reducing vehicle kms also has the potential to improve local air quality.
- Investment in reducing car dependency and promoting and enabling more physical activity offers longer term savings for the Irish health system.
- There is potential to deliver longer term urban realm benefits through the future development of the built environment that prioritises people's propensity to undertake physical activity - rather than obesogenic environments that reduce this propensity and make walking and cycling more difficult than driving, particularly for short trips.
- Integrating public health and sustainable mobility behavioural change campaigns will deliver cross-departmental benefits and opportunities for sharing of resources and expertise.

Stakeholder Feedback

General support for improved integration between Public Health & Transport, with the assumption that air quality, health and place making benefits could arise as a result. The following was also noted:

- Could speed up the delivery of cycle infrastructure and therefore encourage switch to sustainable modes.
- Could also consider sustainable mobility targets at city level, informed by data and supported by Local Authority grants for delivery.

Consider sustainable mobility targets set at a city level/neighbourhood level, informed by data and evaluate how investment in public transport, improved permeability and active travel make a difference. Reward Local Authorities with additional funding and grants where investment in smarter travel initiatives are making improvements and reaching modal change targets. Such measures also benefit placemaking qualities and the attractiveness of place."

5

BC01 & BC02

MEASURE TYPE

New (mandatory element public sector)/Existing enhance

ISO 50001 Energy Management Certification

BC01: ISO50001 Energy Management Standard - Public Sector
Mandatory implementation of ISO50001 Energy Management Standard (or similar Energy Management standards) for all public sector bodies

BC02: ISO50001 Energy Management Standard - Private Sector

Resources to support and encourage private sector to implement ISO50001 Energy Management Standard (or similar Energy Management standards) (e.g. via SEAI's EXEED scheme)

Additional Description

Public Sector

The Sustainable Energy Authority of Ireland (SEAI) has a mandate for energy efficiency and greenhouse gas reduction as part of the 2019 Climate Action Plan, which sets 2030 targets for the Public Sector to reduce CO₂ equivalent emissions from the sector by 30% and improve energy efficiency by 50%.

The National Energy Efficiency Action Plan (NEEAP) and the European Communities Regulations have set out the obligations and targets for public bodies. Energy management programmes must be embedded in every public sector organisation. Every public body is legally obliged to publish an annual statement (the format of which is specified by SEAI) describing the actions been taken to improve its energy efficiency and an assessment of the energy savings from these actions (Regulations 5(5), SI 426 of 2014) - including transport and compliance with the EU Clean Vehicles Directive. In the future, it will be mandatory for the public sector to report the carbon impacts of their:

- Grey fleet/business travel
- Staff travel/commuting

There are circa 30 organisations in the public sector in Ireland who now have ISO50001 Energy Management Standard⁵⁰ accreditation. The ISO50001 standard provides an internationally recognised, practical and consistent way to improve energy use (including transport related activities), through the development of an energy management system.

It is recommended as best practice for organisations in the public sector to attain ISO accreditation, and is encouraged but not mandatory for the public sector. Therefore, there is an opportunity to enhance the public sector governance in relation to decarbonisation activities and reporting through the mandatory accreditation of all public sector bodies to the implementation of ISO50001 Energy Management Standard (or a similar Energy Management standard).

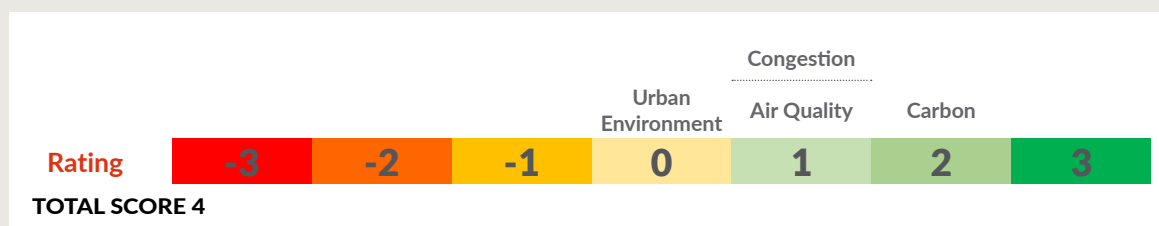
⁵⁰ <https://www.iso.org/iso-50001-energy-management.html>

Private sector

Decarbonisation within the private sector is voluntary and primarily market driven - therefore the monitoring approach is different to that of the public sector - with most private companies implementing it on the grounds of cost efficiencies and due to their Corporate Social Responsibility (CSR) policies (through ISO accreditation or (in the UK) initiatives such as the Carbon Charter⁵¹ for SMEs). SEAI provide an Accelerator Programme for ISO accreditation, including offering up to 10 days of support⁵².

The ISO includes a transport focus, so could be a very useful standard to promote and encourage for both the public and private sector to achieve.

Impact in Delivering the Study Objectives



Summary Assessment

- ISO50001 accreditation would support transport decarbonisation of the public and private sector, as the standard covers organisational fleet operations, grey fleet and commuting.
- Promotion and increased use of greener fleets and sustainable mobility options as part of ISO accreditation will benefit congestion management, carbon reduction and air quality.
- Would require significant public sector investment to achieve accreditation.
- Although the measure meets the study objectives in comparison to other measures, the impact may be on a smaller scale - as take up may be limited to the private sector already engaged in the sustainability agenda and/or larger employers.

Best Practice Evidence

In France, a regulatory greenhouse gases footprint is compulsory every four years for companies of more than 500 employees covering three areas of emissions. Scope 1 and 2 are mandatory reporting requirements, with Scope 3 recommended but voluntary.

- Scope 1: emissions directly linked to a company's activities - e.g. the consumption of fuel of vehicles under a company's control.
- Scope 2: emissions indirectly linked to a company's activities - e.g. energy such as electricity and the production of heat for non-manufacturing companies.
- Scope 3: other indirect emissions of greenhouse gases e.g. business travel and commuting.

Stakeholder Feedback

General support for ISO5001 implementation, with stakeholders noting that the public sector should lead by example, with central government oversight. There was also a suggestion that viable low-carbon alternatives need to exist prior to delivery.

"The need to seek improved performance by public transport agencies is critical as public agencies should lead by example."

"Requires strong commitment and oversight by government."

"This can only be introduced when alternative vehicles are available."

51 <https://carboncharter.org/>

52 <https://www.seai.ie/business-and-public-sector/standards/energy-management-systems-andiso-50001/>

5

BC09

MEASURE TYPE

Existing enhanced

Behavioural Change

BC09: Eco-Driving

Strategy to encourage and support increased levels of eco-driving for freight, public transport operators, grey fleet and private cars

Additional Description

Eco-driving is an approach to driving that strives to maximise fuel efficiency (and therefore fuel costs) and vehicle wear and tear, while reducing carbon emissions. Eco driving techniques include:

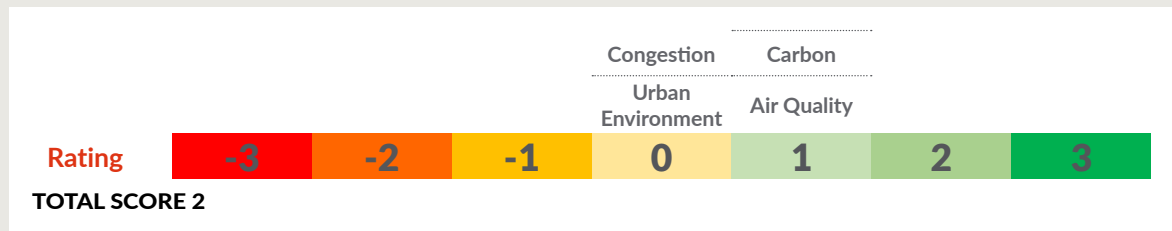
- Accelerate gently (for example take 5 seconds to accelerate your vehicle up to 20 km/per hour).
- Maintain a steady speed and avoid high speeds.
- Anticipate traffic and keep a comfortable and safe distance from vehicles and other road users, to avoid sudden braking.
- Coast to decelerate instead of using your brakes.
- Avoid engine idling.
- Maintain recommended tyre pressure.
- Remove unnecessary loads from your vehicle (e.g. roof racks) when not required.

The majority of private drivers claim to drive efficiently to the best of their knowledge, but indicative evidence suggests most could do lot more - e.g. UK private drivers average “6 out of 10” on an efficient driving scale. Indicative evidence in the UK suggests that around 20% of organisations with a vehicle fleet have provided training on efficient driving for their employees and around 25% have introduced in-vehicle telematics. Larger organisations with larger vehicle fleets are also reported to be most likely to be implementing measures to support efficient driving.

The development of an eco-driving strategy to encourage and support increased levels of eco-driving for freight, grey fleet, public transport operators and private cars should continue and be enhanced across a number of transport sectors - including through the use of vehicle telematics and incentivised eco-driver training for more groups of drivers (currently Driver CPC Training Module 1 Control of the Vehicle and Eco-driving techniques are required for licence holders C and D categories).

Segmented marketing campaigns should focus on different driver segments - for example, while eco-driving is currently part of the Driver Theory test, there are opportunities to continue to promote the financial, safety and carbon benefits of eco-driving to drivers of grey fleet and private cars, through focused marketing activities.

Impact in Delivering the Study Objectives



Summary Assessment

- Little or no impact on congestion.
- Fuel-efficient driving techniques burn less fuel and thus produce fewer greenhouse gas (GHG) emissions.
- Reduces fuel consumption, therefore has a slight positive impact on air quality.
- However, previous analysis (see National Mitigation Plan, 2017) shows that the maximum potential saving from this measure is only equivalent to 0.25% of the emissions of the transport sector in Ireland.
- There is strong evidence of road safety benefits arising from efficient driving (e.g. training for efficient driving has been reported to correlate with reductions in subsequent accidents rates of between 14% and 35%).
- Without a widespread public awareness campaign, continued use of eco-driving techniques is mainly limited to private sector organisations who are already engaged in the sustainability agenda and/or large freight and public transport operators.

Best Practice Evidence

According to a study by Fiat (which included 5,700 drivers in five countries), eco-driving saves an average of 15% of fuel costs.

The potential CO₂ savings from efficient driving being adopted more widely are significant - potentially over 220 Kg of CO₂(e) per car per year. The total potential financial savings for drivers is estimated in excess of £15 billion per year across the EU and circa £96 per driver.

Communication campaigns to promote efficient driving are often cited as a necessary accompaniment to either training-based or technology-based approaches, but only one campaign in the Netherlands - which revealed a cost of €9 per tonne of avoided CO₂ - has been robustly evaluated, meaning drawing conclusions about their effectiveness is difficult.

Stakeholder Feedback

General support for the deployment of this measure, with the following noted:

- Suggestions that Eco Driving could be implemented in a number different ways, e.g. a legislative requirement, a support programme, incentives (e.g. tax relief).

5

BC10

MEASURE TYPE

Existing enhanced

Behavioural Change Campaigns

BC10: Behavioural Change Campaign - Cleaner Fleets

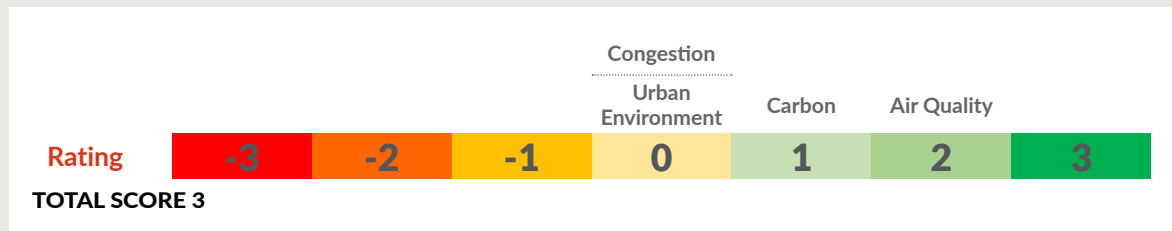
Behavioural change campaign to support switch to cleaner, lower emission fleets for next vehicle purchases (including private cars & taxis)

Additional Description

Targeted behavioural change campaigns to encourage low emission vehicle purchase - for example, a focused social media and community based marketing approach to reach the taxi driver community (to promote the uptake of e-taxis) and more-general 'Don't Buy Diesel' campaigns to persuade car owners to avoid buying diesel vehicles for use in urban environments, etc.

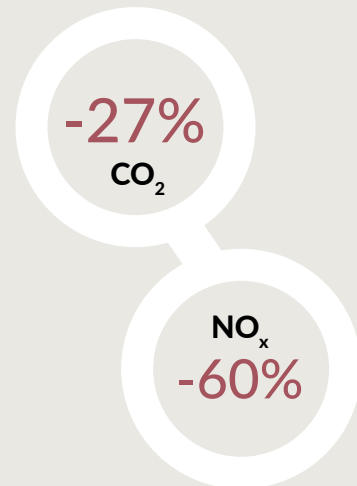


Impact in Delivering the Study Objectives



Fleet Modelling

The implementation of a Behavioural Change campaign to encourage purchases of cleaner, lower emissions fleet is needed to support the electrification of the car fleet, which is predicted to contribute to:



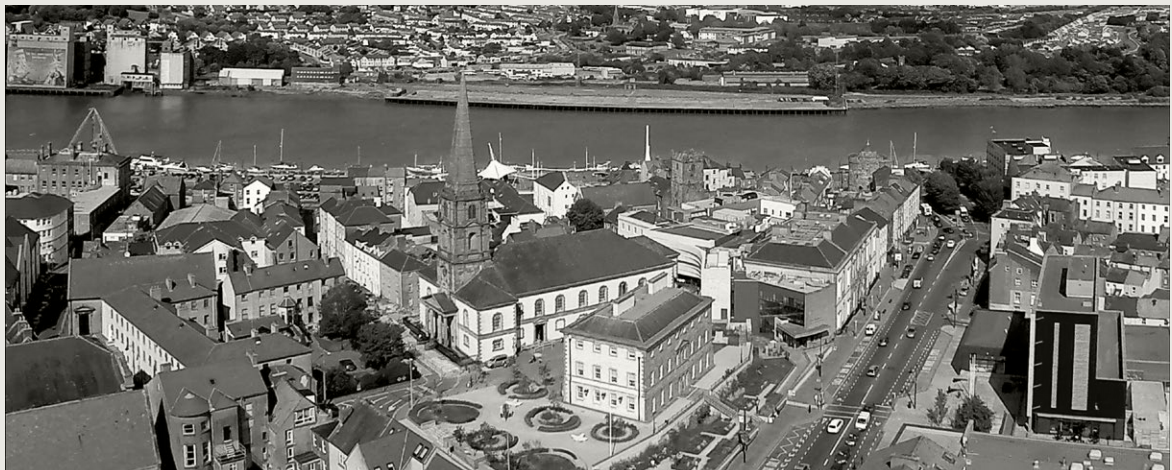
These reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery Electric Vehicles (BEVs), but not the other 'well-to-pump' -related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

Summary Assessment

- Neutral impact on congestion as does not support mode shift.
- Positive impacts of cleaner fleets weighed against impact of EV carbon footprint.
- Positive impacts on air quality as people transition to cleaner, lower emission vehicle purchase.

Stakeholder Feedback

General support for behavioural change campaigns, with stakeholders highlighting COVID-19 as creating an opportunity for change in behaviour; however, concern was raised for the general lack of funding and resource available for behavioural change work.



5

TC01 & TC02

MEASURE TYPE

New

Integrated Ticketing and Mobility as a Service

TC01: Next Generation Ticketing

Roll out of next generation ticketing systems across all modes including PT, cycle hire & parking

TC02: Mobility as a Service Pilot

Mobility as a Service - further examination and evidence review to identify potential to undertake a pilot, including trialling demand responsive services

Additional Description

Integrated Ticketing allows public transport users to use the same ticket or card for trips on multiple modes of transport and across different operators. The NTA launched Ireland's version of this concept with the Leap Card in 2011 and usage has since grown substantially with over three million cards sold⁵³ and 70% of fare payments on buses now being made via Leap Card.⁵⁴ Leap is available on all services operated by Dublin Bus, Bus Eireann, Go-Ahead Ireland, Luas, DART, Dublin and Cork Commuter trains and some intercity rail services, as well as circa 15 private bus operators.

Next Generation Ticketing forms part of the BusConnects Dublin programme and expanding nationwide thereafter, subject to funding. The NTA propose to overhaul the existing ticketing systems by moving to account based ticketing and allowing the use of contactless debit/credit cards and mobile phones to make fare payments. The capital costs of Next Generation Ticketing's development will be included in the BusConnects Dublin business case, with its roll out to other parts of the network requiring additional funding.

Initial stakeholder engagement as part of this Study indicated a desire to see integrated next generation ticketing extended to:

- All regional cities.
- More private bus operators (for example to enable a seamless payment system for those travelling by bus from rural areas into the regional cities).
- Other modes such as cycle hire and parking (to better facilitate multi-modal interchange and improve the customer journey e.g. from park and ride to bus or train station and then bike hire to final destination).

Mobility as a Service (MaaS) offers an extension of integrated ticketing that aims primarily to replace car ownership (and therefore reduce congestion) by offering a subscription service that covers all modes of transport - enabling users to seamlessly use and pay for a range of travel choices. It takes the idea of traditional city monthly or yearly multi-modal public transport tickets and aims to integrate them with multi modal travel options - including integrated journey planning, booking, and payment systems available in real-time to users.

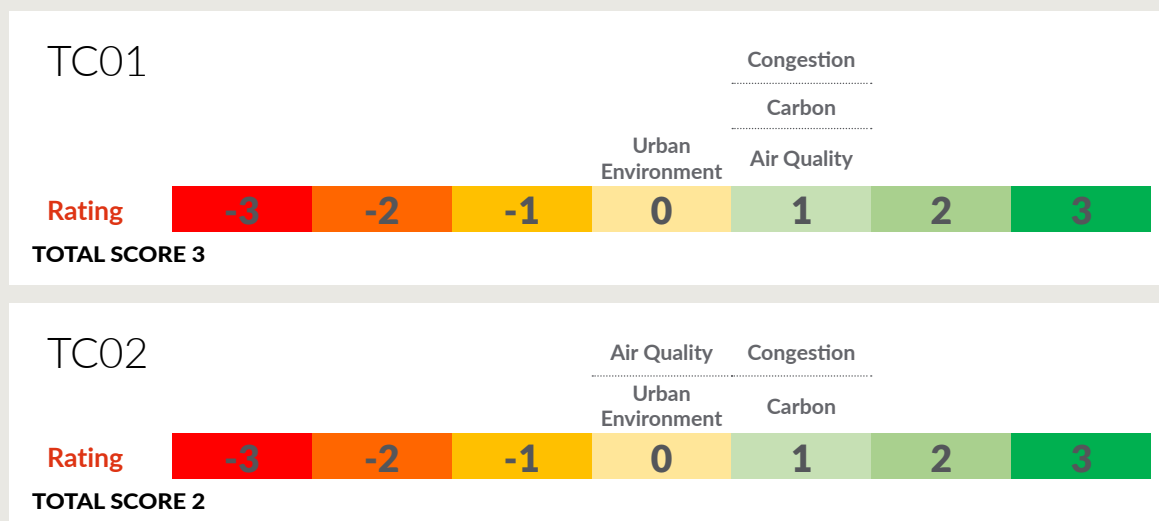
Transport options are multi-modal and could include access to a bike share scheme, car club membership, online car-pooling services, on-demand taxi services (or ride sharing) and on-demand responsive bus services (such as IOKI and Shot!). A single app can act as a journey planner, allowing the user to see which modes of transport best suits the given journey.

53 <https://www.nationaltransport.ie/news/reaching-new-heights-leap-card-passes-3-million-mark/>

54 <https://busconnects.ie/initiatives/just-the-ticket/>

It is recommended that further examination and evidence review is undertaken in order to identify the potential to undertake a MaaS pilot in one of the five cities, including trialling demand responsive services. For example, Smart Dublin⁵⁵ held a MaaS Gap Analysis Workshop in early 2020. The NTA are considering the findings of this workshop along with other research, with a view to the potential initiation of a MaaS programme for Dublin.

Impact in Delivering the Study Objectives



Summary Assessment

TC01

- Will increase the ease of using public transport and speed up boardings which reduces journey time, increase capacity on the network and enhance the attractiveness of public transport compared to private car travel.
- New Generation Ticketing will bring about further (and genuine) integration through a move to a multi-modal zonal type fare system. The move from having an integrated ticket (the physical Leap card) to actual integrated ticketing is a positive development.
- Provides for integration of fares/ticketing across all modes and operators, encouraging and supporting sustainable mobility use and mode shift - thereby benefiting congestion management, carbon reduction and air quality improvement; however, integrated fares and/or fare capping may reduce public transport operator revenue (as the reduced fares may not generate enough additional patronage to fully offset the revenue reduction).
- Increased functionality can enable targeted discounts/incentives to target groups (e.g. part time workers who may otherwise drive) and provide for first/last km integration (e.g. between rail and cycle hire).
- Still a developing technology.

TC02

- Although still at the early innovation stage, MaaS can be an effective alternative to private car usage where there are viable sustainable mobility options available to users.
- A pilot could include trial of demand responsive public transport services.
- Still in innovation stage, with governance and the roll of private operators unclear.
- MaaS requires strong public transport provision as backbone/option of first choice, therefore application across all five cities may be limited (Dublin could potentially act as pilot city).

There is a risk that MaaS may contribute to a rise in individual vehicle journeys. For example, ride-share apps

⁵⁵ <https://smartdublin.ie/smart-dublin-and-city-possible-host-maas-gap-analysis-workshop-to-determine-a-way-forward-for-better-mobility-in-dublin/>

caused significant additional congestion issues in areas like San Francisco⁵⁶ (where Uber and Lyft journeys account for 13% of traffic) with people also switching from public transport to taxi services. MaaS services are still formulating systems that ensure they don't create these problems and offer a net increase in the use of more-sustainable mobility alternatives.

Best Practice Evidence

The most high profile MaaS app currently in operation is the Whim app, developed by MaaS global.⁵⁷ This is currently operating in Helsinki and has 60,000 monthly users⁵⁸ and two million trips have been made through the app as of 2018. A 2019 study *Whim: Insights from the World's First Mobility as a Service Solution* indicated that a good public transport system is the backbone for MaaS:

- Whim users make 73% of their trips with public transport compared to 48% trips made by the average citizen.
- 42% of all Whim users' city bike trips are combined with public transport.
- Whim users are steeped into multi-modalism, using both bicycles and taxis to solve the first mile - last mile problem.
- Whim users combine taxis three times more often with public transport, compared to other users in Helsinki on average.
- Whim customers use a wide range of transportation services, and are clearly shifting to sustainable mobility patterns, which will have a major impact on city congestion and car dependency⁵⁹.

Stakeholder Feedback

General support for Integrated Ticketing and Mobility as a Service, with stakeholders recognising that such a system would improve accessibility, support the Smart City concept and have positive impacts for tourism. The following considerations were also noted:

- Any Integrated Ticketing and Mobility as a Service system needs to include taxis, bike sharing and car sharing.
- Any system also needs to offer both public and private sector transport solutions to facilitate innovation - and keep pace with these; however, this did raise privacy concerns and stakeholders suggested that regulation would be required.
- A concern was raised for slow progress in this area, with alternatives needing to exist prior to delivery.

"Attractive, easy to understand fares and ticketing options are vital in encouraging greater use amongst visitors."

"Private sector may be better placed to lead on this with apps/mobile technology but important to have regulation and control of social inclusion aspects, employee rights in service provision companies and data protection."

"An issue to address is the regulatory regime keeping pace and flexible enough to integrate new technology, data, digital platforms - if people can move in a seamless way across a variety of modes for their daily travel needs, their behaviour will change and looking up timetables, real time information on next available service, booking a shared car/EV, booking a bicycle or electric scooter (which are not permitted for use under current regulations) all from a phone while on the move, should be the reality."

"Having been involved in such discussions since early 90's I would like to see a more committed effort."

56 <https://drive.google.com/file/d/1FIUskVkj9IsAnWJQ6kLhAhNoVLjFdx3/view>

57 <https://whimapp.com/history-of-maas-global/>

58 <https://medium.com/sidewalk-talk/whim-is-a-mobility-app-with-a-modest-proposal-give-up-your-carf2db0bf2ba65>

59 <https://whimapp.com/rambolls-whimimpact-study-reveals-that-public-transportation-is-the-backbone-of-mobility-as-a-service/>

Connected Vehicles

TC09: Connected Vehicles

Development and use of connected vehicles, leading to more efficient driving and use of road space.

5

TC09

MEASURE TYPE

New



Additional Description

Increasing connectivity between vehicles is part of the technological advancements in connected, autonomous vehicles (CAVs). Vehicles can be connected to each other and the road infrastructure to allow the sharing of information and co-ordination of actions to drive efficient use of the road network. In 2016, the European Commission established a European Strategy on Cooperative Intelligent Transport Systems (C-ITS) to facilitate and co-ordinate investment and regulatory frameworks for connected vehicles and intelligent transport systems across the EU.

CAVs are a broad topic - however, this toolkit measure is focused on connected vehicles and in particular the potential for vehicle platooning on strategic urban roads. As defined by Catapult Transport Systems, vehicle platooning involves two or more vehicles connected with 'vehicle to-vehicle communication', allowing them to effectively communicate with each other and operate as a single unit. The lead vehicle takes control of the speed and direction of all the vehicles in the platoon.

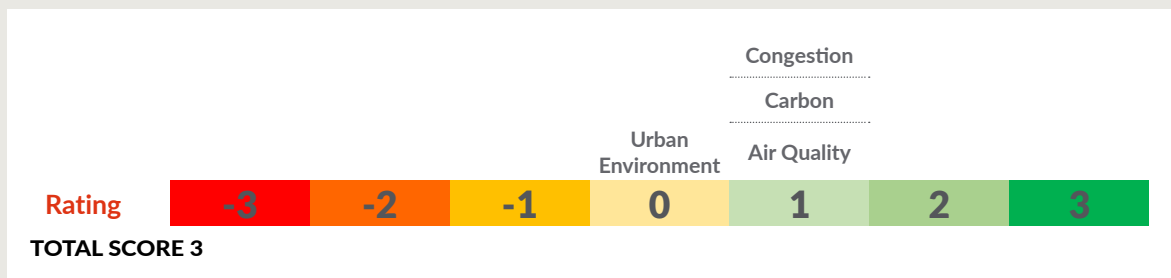
Consideration of increasing autonomous vehicles more generally was ruled out as an appropriate demand management measure during the initial sifting, given their limited impact on air quality and greenhouse gas emissions, coupled with the cost and difficulties of implementation this new and evolving technology. There is the potential for Connected Vehicles to play a role in managing demand; however, this needs further examination and evidence of the benefits as the technology evolves. The RSA have recently commissioned a study into the application of CAVs on Irish Roads to examine technologies, policies and governance and includes the use of CAV in road freight.

Summary Assessment

- Connected platooning offers opportunities to improve congestion and road safety through more efficient operation and use of strategic road space. The constant controlled speed delivers fuel savings and environmental benefits through the reduction of CO₂ emissions, whilst the ability to decrease the distance between vehicles increases road network capacity.
- Increased road capacity can induce demand for car journeys, resulting in an overall net increase in the number of vehicles on the roads.
- This technology could have particular advantages for the strategic movement of freight. HGV platooning could reduce CO₂ emissions from between 1 to 8% for the lead vehicle and between 7 and 16% for the following vehicles compared to standard driving, according to a study commissioned by ACEA (European Automobile Manufacturer's Association).
- There are also road safety benefits from vehicle platooning as when the lead vehicle brakes, the following vehicles automatically brake with zero reaction time, significantly increasing road safety.
- Connected HGV vehicles are likely to have a limited impact on air quality and carbon emissions within the context of the five Study cities. In terms of the overall benefits of HGV platooning, long-distance motorway driving makes up a relatively small proportion of Irish vehicle kilometres and therefore, there would be limited emission benefits for urban conditions.

- More efficient use of the roads, creating an increased capacity may also allow reallocation of this space for other uses, including greater provision for active modes and improved urban realm.
- The technology for connected vehicles is still evolving and there are varying views on when such an intervention would be implemented on public roads; certainly it is a longer-term option.
- Current barriers to implementation include concerns around safety and the legal responsibilities for any accidents (particularly when considering connected autonomous vehicles), as well as the high cost of the technology.
- The current cost of the technology also makes it expensive and exclusionary for those that cannot afford CAV vehicles.
- Overall, there is the potential for Connected Vehicles to play a role in managing demand; however, this needs further examination and evidence of the benefits as the technology evolves.

Impact in Delivering the Study Objectives



Best Practice Evidence

Vehicle platooning has been in development across Europe since the 1990s and trials are ongoing:

- The English Department for Transport (DfT) and Highways England commissioned the first real-world operational trial of platooning vehicles on UK roads. The £8.1m HelmUK trial is predicting significant benefits to road safety, capacity, congestion, CO₂ efficiency and fuel economy but is currently paused due to the COVID-19 outbreak.
- ENSEMBLE is a three-year multi-brand truck platooning trial on European roads. Results are expected in 2021.

Stakeholder Feedback

Stakeholders noted that more research and development was needed in the area of connected and autonomous vehicles.

Five Cities
Demand Management Study

6

Tier 2 -
City Toolkit

Tier 2 City Toolkit Measures

Demand Management Measures

Tier 2 - City Toolkit

Demand Management Measures

The Tier 2 measures have been compiled into two Toolkits, one containing national measures and one containing measures which could be implemented at a City level. The Toolkits are intended to be a resource for stakeholders to identify appropriate measures for given situations.

While the potential Tier 2 City Toolkit measures are not ranked, each of the potential measures are assessed in more detail in this Chapter.

Fiscal Measures (FM)	Tolling	FM12: M50 Multi-Point Tolling
Parking & Traffic Management (PTM)	EV Charging Infrastructure Strategies	PTM02: Electric Vehicle Charging Strategy
	On-Street Parking Controls & Pricing	PTM07: Car Clubs/Car Sharing
		PTM08: Residential Parking Standards
		PTM09: Workplace Parking Standards
	Residential & Workplace Parking Standards	PTM10: Residential Parking Standards - EVs & Car Clubs
	Freight/Goods Delivery Management	PTM12: HGV Management Strategy
		PTM13: Active Kerbside Management
Traffic Management	PTM14: Slow Zones	
	PTM15: Decreased Speed Limits on Urban Motorways	
	PTM16: Park & Ride	
	PTM17: Car Free Zones & Streets	
Behavioural Change (BC)	Mobility Management Plans	BC03: School Mobility Management Plans (MMPs)
		BC14: School Streets & Safe Routes to School
		BC04: Workplace Mobility Management Plans
		BC05: Flexible Working
		BC06: Staggering School and Workplace Start and Finish Times
		BC07: Residential Mobility Management Plans
		BC08: Area Mobility Management Plans
		BC11: Reward Schemes
Behavioural Change Campaigns	BC12: Marketing New Schemes	
	BC13: Disruption & Resilience	
Technology & Communications (TC)	Intelligent Transport Systems	TC03: Real Time Passenger Information
		TC04: Ramp Metering on National Roads
	Variable Speed Limits	TC05: M50 Variable Speed Limits
	Urban Traffic Management Centres	TC06: Public Transport Control Centres
		TC07: Urban Traffic Management Centres
Parking - Wayfinding & Variable Message Systems	TC08: Smart Parking Wayfinding & VMS	

This City Toolkit recognises the current and planned delivery of a range of demand management measures by each of the five Study cities (for example, HGV Management in the cities of Dublin and Waterford; residential and workplace parking standards; and mobility management initiatives to name but a few). The Toolkit approach enables each city to continue to embed and enhance demand management within their existing and future transport plans, tailored to meet their particular needs.

Tolling

FM12: M50 Multi-Point Tolling

Further examination/evidence required in relation to multi-point tolling on the M50

6

FM12

MEASURE TYPE

New

Additional Description

The 2014 M50 Demand Management Study⁶⁰ recommended that the current single point tolling system on the M50 should be replaced with a variable distance-based system. This would result in between 80% and 100% of users being subjected to a toll, depending on the type of system implemented. Toll amounts would vary for different vehicles (as is the case with the current eFlow toll), and could vary for different times of the day and/or week to reflect varying levels of demand. Due to the technological costs of a closed system at the time of writing, the Study recommended an indicative scheme to provide for an open system with five toll points (including the existing eFlow toll location where the toll rate would be reduced).

If a decision is taken in the future to implement a distance-based toll scheme, the 2014 Study recommends that a further, more detailed study is required to determine whether to implement an open multi-point tolling system, or to adopt a closed tolling system which would charge for distance of the M50 used based on entry and exit points.

The 2014 Study highlights that any future toll scheme would require a period of approximately three years for consultation, approval and implementation, and would also be subject to the statutory process set out in the Roads Act. The scheme would also consider the mitigation of impacts that would be necessary on local roads as a result of the tolling proposals.

Transport Infrastructure Ireland (TII) are also undertaking assessments as part of their workstream on next generation user charging to replace the current tolling arrangements (i.e. as and when the concessions expire, and the toll road assets return to TII - circa. 2030). The main focus of this is to ensure that TII can assess any replacement user charging regimes from an equity perspective.

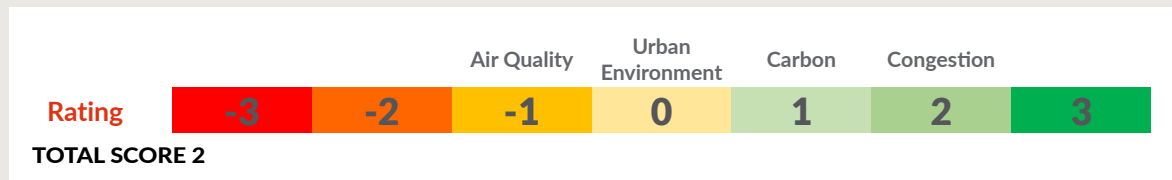


60 <https://www.tii.ie/tii-library/strategic-planning/strategic-reports/M50DemandManagementReportApril2014.pdf>

Summary Assessment

- Well-established method of demand management, with additional tolling supporting the management of private vehicular traffic in order to protect the strategic nature of vehicular traffic on the M50.
- Tolling can also be configured to provide incentives to use less polluting vehicles, such as reduced tolls for EVs.
- Significant improvements likely on the M50 which is of national strategic importance. Managing congestion on this key strategic route will have wider network benefits. New variable speed limits are also being introduced on the M50 - see measure TCO5 for more details.
- Likely to result in displacement of traffic on to non-tolled alternative routes. This is already evident in Limerick and Waterford which are not considered appropriate for further tolling on this basis.
- Potential air quality benefits along the M50; however may result in air quality issues along displaced traffic as a result of the scheme.
- Introduction of additional tolls on existing infrastructure is politically challenging.
- Alternative travel options for users are currently limited and orbital bus provision (and bus priority), although challenging, will be key to providing viable alternatives for people. Otherwise, tolling would be viewed as a tax on people who have no realistic more-sustainable alternatives.

Impact in Delivering the Study Objectives



Best Practice Evidence

The 2014 M50 Demand Management study showed clearly that fiscal measures had by far the most significant impact on managing future demand on the M50. It noted that in the absence of additional fiscal measures, it is unlikely to be possible to protect the traffic capacity provided by the M50 Motorway Upgrade Scheme over its design life.

Stakeholder Feedback

Stakeholders showed concern for the implementation of multi-point tolling on the M50 due to:

- Displacement effects and rat running meaning low impacts on congestion for the wider Dublin network.
- Negative effect on HGV emissions from stop/start driving.
- Exemptions to the toll for EVs should be considered.

"Further tolling with encourage rat races to avoid tolls." (Transport Operator, National)

"Any user charging scheme developed should focus on reducing trips and not displacing them.

1) Toll points probably promote more diversion than distance-based charging schemes.

2) Not all trips are the same and understanding the type of trip and the behaviours related to it would be important in the design of any user charging scheme."

EV Charging Infrastructure Strategies

PTM02: Electric Vehicle Charging Strategy

Development & implementation of an EV charging strategy for each city for private cars and taxis, including: County Development Plan Parking Standards; on-street, Park & Ride, Rail Stations, Mobility Hubs, Multi-Storey parking and e-Taxi charging infrastructure

6

PTM02

MEASURE TYPE

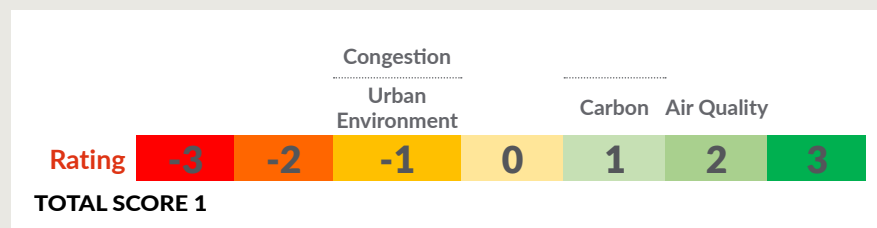
Existing enhanced

Additional Description

While encouraging mode shift towards sustainable travel is the primary focus of TDM, the requirements for Electric Vehicle (EV) recharging infrastructure is also important as take up of EVs increases. While focusing on home-based origin charging as the principal place of charging EVs, a comprehensive network of EV charging is required across each city, in order to meet future demand as vehicle fleets in cities move over to EV, particularly to cater for vehicle owners who do not have private off-street parking (e.g. drives or garages) which can be used for home-charging. The charging approach also needs to ensure consistency in EV charging facilities for those with mobility impairments.

The Department of Transport, who lead on the development and funding of EV charging infrastructure, are working on an overarching charging infrastructure strategy, with a target to be set for the supply of infrastructure to stay ahead of demand. The Strategy will review and update the targets originally set in the National Policy Framework for Alternative Fuels Infrastructure, taking into account the proposed uptake of EVs set out in the Climate Action Plan.

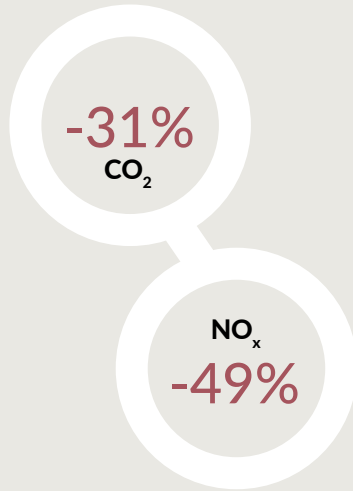
Impact in Delivering the Study Objectives



Fleet Modelling

The implementation of a package of EV Charging Measures is needed to support the electrification of the car fleet, which is predicted to contribute to:

Fleet Modelling Results



These reductions refer to the percentage change in the emissions per kilometre from the average private car in city centre traffic in 2030, relative to 2019 levels, based on ANPR data collected in Cork in February 2020. The CO₂ value includes emissions from the electricity used by the Battery EVs (BEVs), but not the other 'well-to-pump' -related emissions or the additional 'embedded carbon' associated with the manufacture of BEVs.

Summary Assessment

- Charging infrastructure should be planned and provided in order to encourage origin/home based charging as the default choice, to avoid the unintended consequences of encouraging people to drive to other destinations (including workplaces) to charge their EVs. In addition, overnight charging at home also means recharging vehicles when there is a greater proportion of sustainable energy available.
- Provision will meet future projected demand for EV take up, in particular for on-street/shared provision at point of origin, and for e-taxi fleets.
- Limited congestion benefits, as the additional EVs are simply replacing existing fossil-fuelled vehicles.
- Comprehensive EV charging provision will support EV uptake, thereby reducing the 'tail-pipe' carbon (including the emissions from the additional electricity used by BEVs, based on the predicted Irish electricity supply in 2030). Impacts of the additional 'embedded carbon' in BEVs are excluded from the % reduction value but taken account of in the qualitative scoring.
- May have adverse impact on urban environment, due to the increased requirements for 'street furniture', leaving less room for pedestrians and cyclists.
- The investment required to deliver a comprehensive EV charging network which fully supports the EV uptake projections assumed in our fleet modelling may be challenging.

Stakeholder Feedback

General support for more EV parking and charging, with consideration that adding EV parking/charging spaces is currently difficult due to over-subscribed residential and on-street parking provision. The following detailed points were also noted:

- Any recharging strategy should ensure modal shift towards sustainable travel remains the key priority, through identifying strategic locations for EV charging facilities rather than adopting a blanket coverage approach to their provision.
- Need for consistency in EV parking and pricing standards across Local Authorities in urban areas.
- Impacts of EV charging infrastructure on urban space for active modes.
- EVs have a significant carbon footprint and still cause congestion.
- Need to deliver consistency in the accessibility and usability of EV charging facilities for people with disabilities - including: step up from roadside; sizing of the EV parking bays; height of the EV unit; and access to and the ease of using the charger itself.

6

PTM07

MEASURE TYPE

Existing enhanced

On-Street Parking Controls & Pricing

PTM07: Car Clubs/Car Sharing

Foster partnership between national and Local Authorities and private car-share operators with an emphasis on allocation of on-street Car Club/Car Share spaces within City Parking Strategies

Additional Description

Car clubs/car sharing provides members with quick and easy access to a vehicle on a short-term hire basis, with insurance, fuel and other costs all included in an hourly fee. Car share schemes can enable city populations to live without owning a car, while maintaining access to the use of a car for trips that are not well served by sustainable transport.

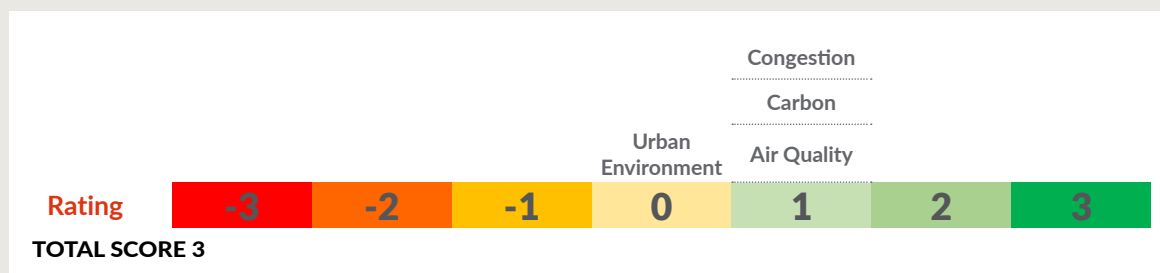
GoCar is the largest car club company in Ireland with over 50,000 members and 700 cars and vans available across 200+ locations nationwide, although the majority are within or close to Dublin. Waterford is the only one of the five cities that does not currently have a public car share scheme.

Car clubs tend to have a newer fleet and some new entrants into the market have entirely electric vehicles, for example Green Mobility have plans to set up a scheme with 400 electric vehicles in Dublin.

Integrating agreements with car share operators into City Parking Strategies can provide a better spread of car share spaces and ease the roll out of spaces by operators to provide more comprehensive coverage across a city. For a car share scheme to provide a proper alternative to car ownership for occasional trips, it is important that there are sufficient spaces to meet demand in a given city area.



Impact in Delivering the Study Objectives



Summary Assessment

- Promotes the concept of Shared Mobility, reducing the need for individual car ownership (leading to reduced overall car use) and making more intensive use of each vehicle (reducing the space needed for storing multiple private cars).
- A study of commuters in the Greater Dublin Area found that car owners were surprised when presented with the average costs of car ownership for their car model⁶¹. This suggests that an information campaign on the potential savings from the use of car share could help to stimulate a switch from private car ownership to car share membership.
- No significant weaknesses, but reliant on commercial operators, who will be impacted by external market conditions and demand, to deliver car sharing services.

Best Practice Evidence

On average, the majority of cars in Europe are inactively parked (before or after trips are made) for approximately 16 hours a day, actively parked (during trip) for nearly 7 hours and driven less than 1 hour each day⁶². Cars also typically cost in the region of €6,500 to own and run annually⁶³. This combined with the fact the average car requires 150m² of urban land to park results in a considerable waste of land resources. In the past number of years, more drivers are opting to use shared car club vehicles rather than purchase their own car and there are now shared car companies in larger European cities.

In 2000, Antwerp entered into a public-private partnership (PPP) to act as the parking authority in the city called GAPA. GAPA manages, oversees and controls all public on-street and off-street parking. GAPA handles all the costs associated with parking management. As part of this arrangement GAPA aims to incentivise car sharing. It sets aside spaces for car sharing where parking demand is high and gives residents who are members of car sharing clubs the equivalent of parking permits to park near their house.

Between 2000 (when GAPA began parking management) and 2006, private car use dropped 50%. As the two largest transport projects in Antwerp during this time were cycling infrastructure improvements and parking management, "it can reasonably be assumed that parking management is partly responsible for people shifting to more sustainable transport modes"⁶⁴. Although the allocation of parking space to encourage car sharing is certainly part of this, a significant increase in parking charges and expansion of charging zones is likely to be the primary driver for this mode shift.

Stakeholder Feedback

No specific comments were received from stakeholders with regards to Car Club/Car Share parking.

61 <http://www.greeningtransport.ie/wp-content/uploads/2017/07/Carroll-et-al.-2017-Car-shedding-UTSG-2017-copy.pdf>

62 http://publications.europa.eu/resource/cellar/2d5d968f-4f4c-4ee0-82e2-a7a136dfd187.0001.02/DOC_1

63 <https://www.transportenvironment.org/sites/te/files/publications/Does-sharing-cars-really-reduce-car-use-June%202017.pdf>

64 <https://www.itdp.org/2011/01/18/europes-parking-u-turn-from-accommodation-to-regulation/>

6

PTM08, PTM09 & PTM10

MEASURE TYPE

Existing enhanced



Residential & Workplace Parking Standards

PTM08: Residential Parking Standards

Reduced Residential Parking Standards for new developments in appropriate locations

PTM09: Workplace Parking Standards

Reduced Workplace Parking Standards for new developments

PTM10: Residential Parking Standards - EVs & Car Clubs

Continue to require EV & Car Club spaces within new Residential developments

Additional Description

Parking standards for developments stipulate the amount of parking (including both car parking and cycle parking) that must be provided as part of new developments. Parking standards for residential and workplace developments have traditionally focussed on ensuring there is an adequate amount of parking to cater for potential demand. This policy did not take full account of the negative impact of increasing car use in our cities.

PTM08 and PTM09 seek to control the amount of parking provided with new developments, aiming to reduce car use as much as possible, while avoiding the problems of parking spill-over into neighbouring areas. This involves stipulating maximum (rather than minimum) parking standards for new developments, including car-free developments where appropriate and an area-based approach to parking. These standards will vary by city and by locations within cities, based on a variety of factors including availability of alternative sustainable mobility options to/from an area. (See London's Public Transport Accessibility Level in the Best Practice section below).

A developer can sign a contract with a car club company to provide a certain number of car club vehicles to be located, when not in use, within the car parking provided in a development. This increases the visibility and convenience of car clubs for residents and can reduce the need for car ownership, while maintaining access to cars when needed.

EV charging facilities in residential developments facilitate a transition to owning and using battery EVs. Lack of access to home-charging would be a significant barrier to EV ownership. EV charging spaces can also facilitate car clubs converting some or all of their fleets to EV, offering the potential for the car club to generate additional emissions reductions. However, care is needed to avoid over-rating this synergy, as car club users tend to be nervous of booking/using BEVs, often due to a perceived risk of the vehicle being picked up with insufficient charge to complete the planned trip and requiring a significant (unplanned) charging period within the booked slot.

- Given the considerable growth targeted for all five cities under Project Ireland 2040 (50-60% in regional cities, 20-25% in Dublin), there is a significant opportunity to constrain the resulting growth in car traffic by significantly reducing residential parking standards in the new developments.
- Surface areas that would otherwise be used for parking in residential and workplace developments, can be better used for urban realm improvements if/when parking standards are reduced.
- Provision of car club spaces (PTM10) can reduce the need for car ownership and storage, reducing car usage and its associated negative impacts on congestion, GHG emissions and air quality. Research from European car club schemes has found that each car can replace the need for up to 16 privately owned vehicles⁶⁵, and while 40% of users didn't own a car prior to joining a car club, a further 22-32% gave up their car as a result of the availability of the car club.
- Access to cycle hire schemes (either public schemes or cycle hire offered exclusively to residents) can also reduce the need for car ownership within a new development. Examples from other countries where bikes are provided, regularly serviced and branded for new developments include the UK's Brompton Locker Bike Hire scheme and the USA's On Bike Share scheme (<https://onbikeshare.com/bikeshare-for-residentialproperties.html>).⁶⁶
- A risk inherent in PTM10 is a reliance on private car share operators that are largely beyond the control of the relevant Local Authorities or central government and potentially prone to the impacts of market forces.

Best Practice Evidence

Many European cities have moved to introduce maximum instead of minimum off-street residential parking standards. This allows higher densities to be achieved and encourages sustainable mobility from new developments within the cities.

In London, parking standards are tied to the accessibility and location of the site. In Stockholm, the system is similar to London's, however extra reductions in standards are granted for access to car clubs, high quality bike parking, bike sharing, free public transport and service boxes for deliveries.

London's Public Transport Accessibility Level (PTAL) is an index of accessibility of public transport calculated based on frequency of routes and walk times to stops from the development site, the higher the PTAL the better the accessibility to public transport. Where a site falls between two PTAL levels, the more restrictive parking standard should be applied.

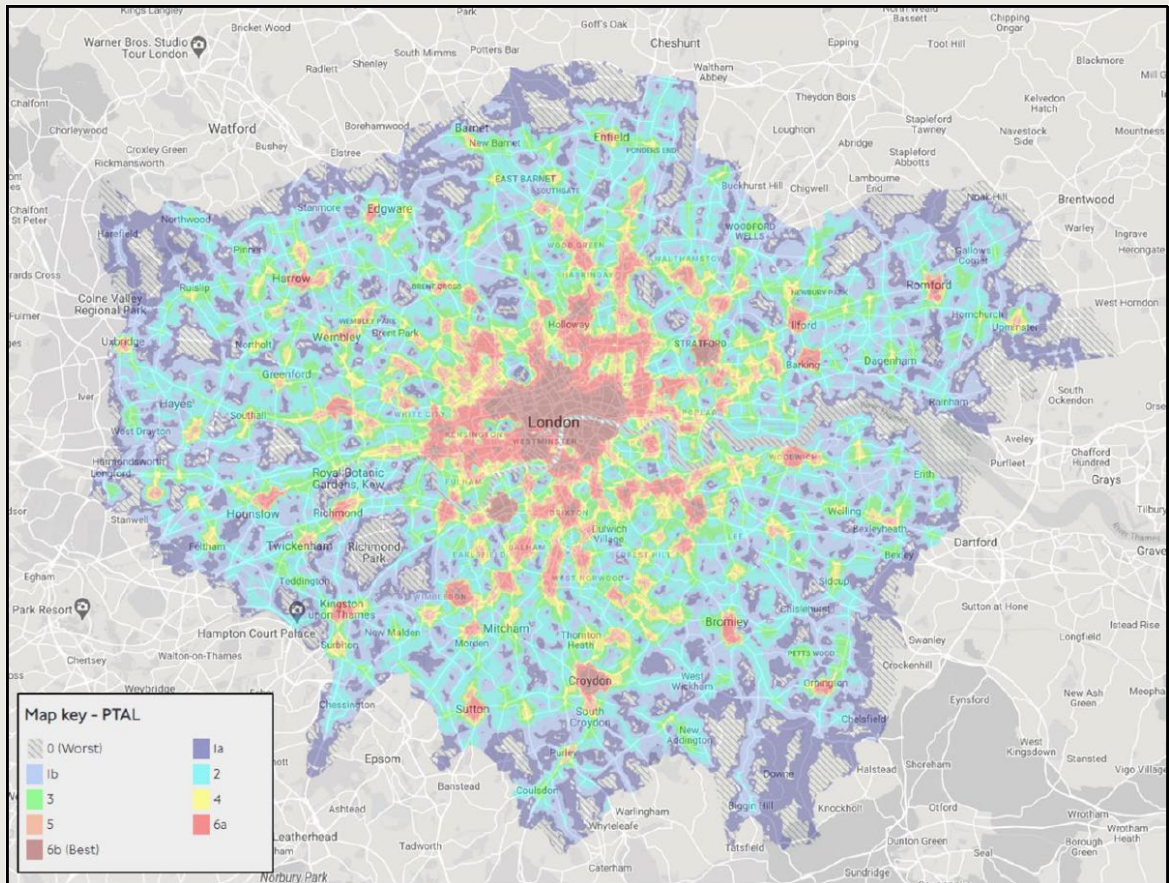
MAXIMUM PARKING STANDARDS LONDON BASED ON PTAL

Location	Maximum Parking Provision
Central Activities Zone Inner London Opportunity Areas Metropolitan and Major Town Centres All areas of PTAL 5-6 Inner London PTAL 4	Car-free
Inner London PTAL 3	Up to 0.25 spaces per unit
Inner London PTAL 2 Outer London PTAL 4 Outer London Opportunity Areas	Up to 0.5 spaces per unit
Inner London PTAL 0-1 Outer London PTAL 3	Up to 0.75 spaces per unit
Outer PTAL 2	Up to 1 space per unit
Outer PTAL 0-1	Up to 1.5 spaces per unit

65 https://share-north.eu/wp-content/uploads/2018/08/Analysis-of-the-Impact-of-Car-Sharing-in-Bremen-2018_Team-Red_Final-Report_English_compressed.pdf

66 <https://www.bromptonbikeshare.com/page/brompton-locker> and the USA's On Bike Share scheme (<https://onbikeshare.com/bikeshare-for-residentialproperties.html>)

LONDON'S PUBLIC TRANSPORT ACCESSIBILITY LEVEL MAP



Stakeholder Feedback

Stakeholders noted the following difficulties in relation to reducing parking at new developments:

- Displacement effects.
- Viable sustainable mobility options need to exist prior to delivery.
- Reductions in council income from changes in parking.
- Potential for negative economic impacts on city centres.

Despite concerns, reducing parking at new developments was felt to be more effective and practicable than removing existing parking provision. The exception to this being the removal of parking at workplaces, with COVID-19 providing an opportunity to reduce parking, as less staff are travelling to work locations.

"In the context of COVID-19 and greater levels of staff working from home, there may be opportunities to use staff car parking spaces for more sustainable mobility usage."

Freight/Goods Delivery Management

PTM12: HGV Management Strategy

Development & implementation of a HGV Management Strategy for each city

PTM13: Active Kerbside Management

Active Kerbside Management, cargo bikes/last mile distribution hubs

6

PTM12 & PTM13

MEASURE TYPE

Existing enhanced



Additional Description

HGV Management Strategies are already partially or fully implemented in some Irish cities. Dublin City Council introduced an HGV Management Strategy in 2007. Drivers of 5+ axle lorries are required to obtain a permit to enter a restricted zone between 0700 and 1900hrs. This restriction gives incentives to use the Dublin Port Tunnel instead, which is located just outside the cordon. 5-axle HGVs are currently banned in Waterford city centre, with weight restrictions also in place on specific streets in the wider Waterford city region.

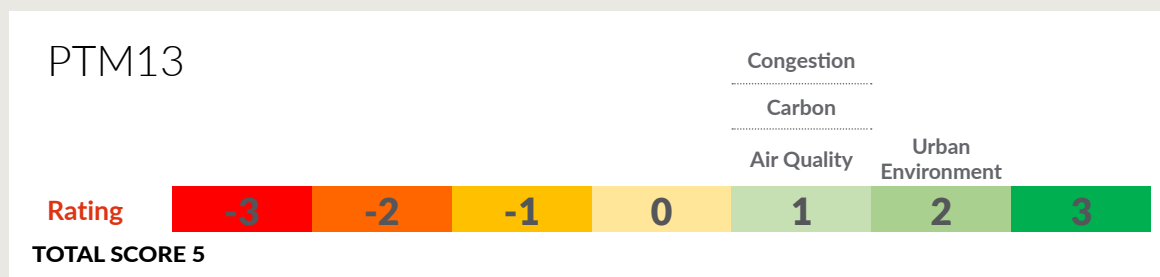
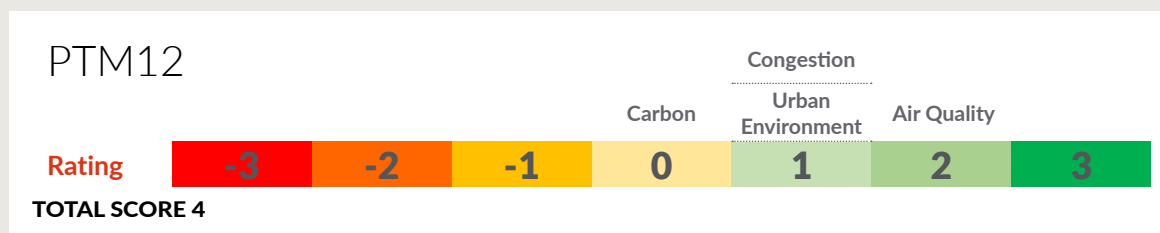
While many demand management measures focus on allocation of road space, active management of the kerbside for parking, deliveries and access can also be an important tool in efficient use of the road network. Active kerbside management can include:

- The adoption of kerbside hierarchies that prioritise certain vehicles or activities such as cycle parking around stations and bus stops, loading bays for servicing and deliveries in retail areas.
- Use of mobility technology to offer digital parking and reservation services, which can display real-time availability of kerbside space for loading/unloading and parking and loading restrictions and other disruptions or temporary restrictions, to make freight movements and deliveries more efficient.

Freight consolidation can also limit the impact of delivery vehicles in city centres, by reducing the number of trips required. These schemes often use a logistics hub to consolidate multiple deliveries for an area into a smaller number of 'last-mile' vehicle trips. These trips can be undertaken by smaller and more environmentally friendly vehicles including EVs and cargo bikes. Cargo bikes are particularly effective for short 'last mile' trips in urban areas. Innovative solutions to last mile delivery are considered as part of the Smart Dublin programme, co-funded by Enterprise Ireland and Dublin City Council, in partnership with Belfast City Council⁶⁷. A pilot in late 2018 involved six companies securing funding to test solutions at a number of sites in Dublin and Belfast. These include consolidation hubs using e-vehicles, e-bikes and cargo bikes to make deliveries into the city centres and the use of apps for drivers to book kerbside and loading bay spaces. Learnings from the pilots included the need to upgrade parking bye-laws, to reflect technological advancements and the importance of stakeholder engagement and buy-in from local businesses.

⁶⁷ <https://smardublin.ie/trialling-and-testing-innovative-solutions-to-last-mile-delivery-challenges-in-dublin/>

Impact in Delivering the Study Objectives



Summary Assessment

- The HGV Management Plan in Dublin has shown improvements to air quality and likely safety benefits. HGV movements in the cordon area reduced by 91%, with corresponding city centre congestion, air quality and road safety benefits in areas of high population density; however, due to the longer distances required for HGV movements, total emissions from all traffic across the Dublin Region increased (8% and 21% in NO_x & CO₂ respectively).
- As well as the possible increase in total emissions, depending on the alternatives being provided, emissions may be relocated rather than reduced.
- Roads designed for heavier vehicles require more carriageway space, restriction on heavier vehicles allows for lower level of segregation and more emphasis on walking and cycling infrastructure. Also provides a safer environment.
- Active kerbside management leads to reduced HGV/LGV in city centres, resulting in improved safety and urban realm improvements.
- Additional delivery costs to businesses, e.g. due to the extra set of freight handling.
- Enforcement of kerbside management may also be challenging.

Best Practice Evidence

The introduction of the Dublin HGV Management Strategy in 2007 after the opening of the Dublin Port Tunnel was very successful in decreasing HGV movements, with a decrease of HGV movements by 91% through the city centre; however, it did mean HGVs travelled further, resulting in an overall increase in CO₂, NO_x and PM emissions from total traffic over the Dublin Region. It should be noted though that these emissions would have been released further away from the denser urban population of the city centre, the measures would therefore probably still have had a positive impact in terms of public health. There are also significant road safety benefits associated with the removal of HGVs from the urban core.

In 2018, Sainsbury's trialled cargo bikes for home deliveries in the UK. Five zero emission bikes were able to make up to 100 home deliveries a day from their Streatham Common store in South London. The bikes were provided by e-cargobikes.com and had a capacity of 480 litres and a payload of 125kg. This trial found that around 97% of Sainsbury's on-line grocery orders could be fulfilled in a single cargo bike delivery. Other benefits included short journey times, particularly with the ability to use cycle and bus lanes, as well as shorter 'doorstep/delivery' times, as cargo bikes can often get closer to the customer's front doors.

Stakeholder Feedback

General support for cargo bikes and last mile solutions and the development and implementation of an HGV Management Strategy, with stakeholders:

- Recognising Road Safety And Environmental Benefits From Reducing HGV Movements.
- Supporting a Euro 6 HGV standard as a minimum, with the provision of grants to support vehicle upgrades.

Concerns were raised with regards to the potential for displacement effects and for active kerbside management.

“Obviously, there is a road safety benefit with inner-city areas... they are also producing a high percentage of carbon.”



Traffic Management

PTM14: Slow Zones

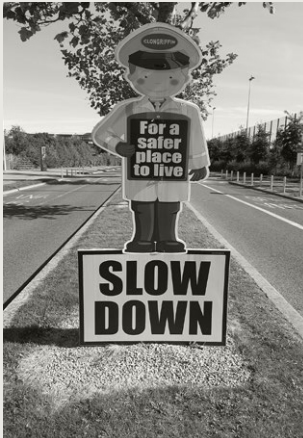
Expansion of Slow Zones in residential areas

6

PTM14

MEASURE TYPE

Existing enhanced



Additional Description

This measure involves the roll out of more 30kph Slow Zones in urban residential areas.

These 30kph speed limit 'Slow Zones' are generally applied in urban residential areas (rather than arterial city roads). They are typically supported by:

- Traffic calming measures such as speed humps, chicanes, road narrowing, planting and other measures to both physically and visually reinforce the nature of the road.
- Signage.
- Fixed speed cameras and/or periodic enforcement.
- Roadside messaging (using bespoke material and existing street furniture) to encourage driver compliance.



All of the five Study cities currently operate Slow Zones within parts of their cities, including within parts of the city core and in residential areas (Cork, Dublin, Galway, Limerick, Waterford). Speed limits on public roads are set nationally and the implementation of special speed limits (such as the introduction of Slow Zones) are a reserved function for local authorities. There is a limited range of special speed limits provided for in current legislation.

The Design Manual for Urban Roads and Streets⁶⁸ (DMURS) states the following:

- Within cities, towns and villages in Ireland a default speed limit of 50kmh is applied.
- Speed limits in excess of 50kmh should not be applied on streets where pedestrians are active due to their impact on place and pedestrian safety.
- Lower speed limits of 30kmh are a requirement of Smarter Travel (2009) within central urban areas, where appropriate.
- Where pedestrians and cyclists are present in larger numbers, such as in Centres, lower speed limits should be applied (30-40kmh).
- Where vehicle movement priorities are low, such as on local streets, lower speed limits should be applied (30km/h).

68 <https://www.dmurs.ie/>

Summary Assessment

Road safety is the principal rationale driving the introduction of Slow Zones. In terms of road safety, 2020 saw 148 deaths recorded on Irish roads. A report by the Road Safety Authority on fatal collisions between 2008 and 2012 found that excessive speed was a contributory factor in almost one third of all fatal collisions during that time.⁶⁹ As a general rule, a 1% reduction in average speed will see a 4% reduction in fatal collisions. A pedestrian or cyclist hit by a vehicle travelling at 60 kph will only have a one in ten chance of survival, however if the speed of the vehicle is reduced to 30kph, nine out of ten will survive⁷⁰.

Slow zones and 30kph speed limits on city roads can create an improved local environment that makes other modes more attractive, thereby supporting more cycling and walking. This is particularly important for creating safer environments where more vulnerable road users (such as school children and their parents/carers) feel more comfortable and confident in taking more trips by bike or on foot – thereby helping to manage congestion.

The impact on emissions of 30kph restrictions is unclear depending on how measures are implemented. If it results in more acceleration/deceleration (e.g. through the use of speed humps) emissions are likely to increase; however, some studies have found with correct management, slow zones can result in smoother driving.

30kph is not an efficient speed for diesel vehicle operation, therefore this measure could lead to negative impacts on air quality. The impact on air quality is dependent on the transition to cleaner fleets, in order to offset the negative impacts of diesel at 30kph.

There is potential for redistribution of traffic outside the Slow Zone that might have negative impacts elsewhere for congestion, air quality and the quality of the urban environment.

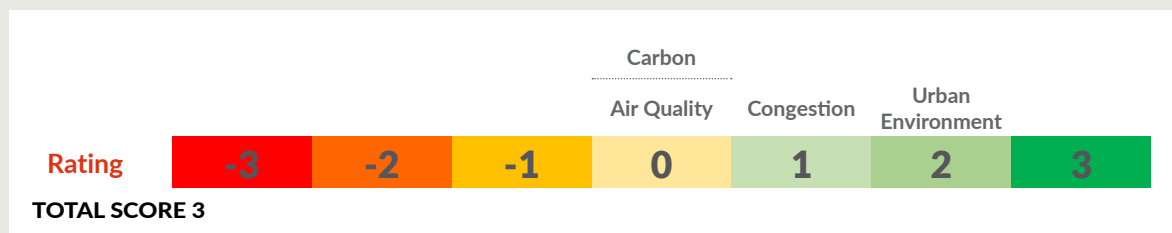
It is difficult to enforce wide spread speed reductions without resource deployment of fixed speed cameras or regular mobile speed patrols.

Slow Zones are a relatively low-cost option to provide recognised safety benefits and opportunities for increased levels of walking and cycling and an improved public realm.

In addition to the recognised safety benefits, there are also wider community benefits of lower speeds including environmental benefits (such as reduced noise pollution, provided the scheme does not generate significant additional vehicle deceleration and acceleration) and community engagement benefits (through reduced community severance and opportunities for enhanced community interaction).

Throughout much of Europe, more cities are now introducing 30kph as the default urban speed limit. For example, the city of Bilbao in Spain has recently just adopted an 18mph (30kph) speed limit for the entire urban area of the city, covering circa 300,000 inhabitants.⁷¹

Impact in Delivering the Study Objectives



Stakeholder Feedback

Stakeholder Feedback indicated widespread support for this measure.

69 <https://www.rsa.ie/en/Utility/News/2020/National-Slow-Down-Day-22nd--23rd-May-2020/>

70 <https://www.irishtimes.com/news/crime-and-law/dublin-cork-and-waterford-drivers-worst-in-national-speeding-crackdown-1.405661>

71 https://drivetribe.com/p/bilbao-becomes-the-first-major-FFEYD_E3R2yyG53iDJs37Q?iid=TLkSswcKSFm_GG1yc-2xoqg

Traffic Management

PTM15: Decreased Speed Limits on Urban Motorways

6

PTM15

MEASURE TYPE

New

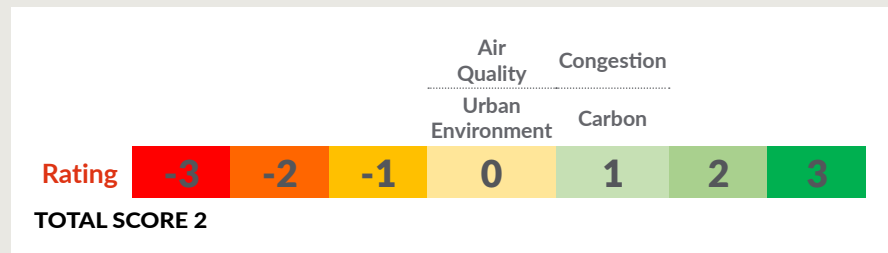
Additional Description

During the preparation of the 2017 National Mitigation Plan⁷², the impact of reducing maximum speed limits on motorways from 120kph to 110kph for cars and vans, and from 90kph to 80kph for heavy duty vehicles was modelled.

It was estimated that potential total emissions of circa 1,700kt CO₂ between 2020 and 2030 could be achieved. An annual average saving of 170kT CO₂ would represent approximately 1.4% of annual transport emissions. These relatively modest emissions reductions were judged to have a high economic cost (over €570 per tonne of carbon abated), in part due to longer journey times.

This proposed measure would see trials of decreased speed limits on applicable sections of urban motorways.

Impact in Delivering the Study Objectives



Summary Assessment

- This measure would have a low cost of implementation compared to the introduction of Variable Speed Limits, however this measure is less effective than Variable Speed Limits for managing congestion.
- Reduction from 120kph to 110kph or 100kph is shown to reduce fuel consumption, therefore this measure would have positive impacts on carbon.
- Will require stronger enforcement to ensure compliance.
- A reduction in speed would result in an increase in user travel times. The Consultants engaged by the Department of the Environment, Climate and Communications to conduct the Marginal Abatement Cost Curve analysis to inform the preparation of the 2019 Climate Action Plan considered the speed limit reduction proposal and concluded that the cost benefit ratio was too high to include in their recommendations for the Climate Action Plan.⁷³
- Limited application within the Study area, given that there are relatively few sections of 120kph motorways within the five cities Study areas.

72 <https://www.dcae.gov.ie/documents/National%20Mitigation%20Plan%202017.pdf>

73 <https://assets.gov.ie/78998/41a99d59-c525-44d4-8d81-a189edc67bd6.pdf>



Best Practice Evidence

Highways England are currently trialling a reduction in speed limits on four motorways in England to reduce local air pollution⁷⁴. Speeds will be reduced from 70mph (112.6kph) to 60mph (96.6kph) in areas that have seen non-compliant levels of nitrogen dioxide. The trials will take place on stretches of nearly five miles (M6 junctions 6 to 7 by Witton, M1 junctions 33 to 34 by Rotherham, M602 junctions 1 to 3 by Eccles and M5 1 to 2 by Oldbury). The impact of the new 60mph limit will be reviewed in a year's time.

The Netherlands and Austria have recently introduced schemes to lower speed limits, with the aim of reducing air pollution rather than to lower carbon emissions, with speeds in the Netherlands set to 100kph except on certain sections between 1900 and 0600 hrs. Austria applies speed limits to sections of the motorway network – when air quality indicators rise above certain thresholds, the speed limit is lowered from 130kph to 100kph (with EVs exempt)⁷⁵.

Stakeholder Feedback

Some stakeholders did not feel that decreased Speed Limits on Urban Motorways was an appropriate measure within the context of the five cities and the overall Study objectives.

Ruled Out as a Measure

Based on the detailed evaluation, it was concluded that decreasing Speed Limits on Urban Motorways should not form a key recommendation of this Study. While having benefits in terms of reducing emissions on the overall national strategic road network, its impact to deliver the key Study Objectives within the five cities was assessed as not sufficient to warrant inclusion as a Study recommendation.

This is principally due to its limited application on urban motorways within the Study area. In addition, the disbenefits in terms of increased journey times of lower speed limits on applicable sections of urban motorways would offset the benefits from reduced emissions.

A 'watching brief' should be kept on the Highways England trials currently underway and the impact of these trials on local air pollution. If in the future, there are legal obligations to achieve a given level of air quality along stretches of urban motorways, learnings from these trials can be applied, as part of any future re-assessment of this measure.

Note that schemes to introduce variable speed limits (on the M50 and/or elsewhere), as a way of managing congestion on these motorways are considered elsewhere in this report within the recommended City Toolkit measures.

In addition, stricter enforcements of existing speed limits on high speed inter-urban routes (using average speed cameras), would generate road safety benefits and carbon emission reductions, particularly since the emission curves for most vehicle types start to rise steeply a vehicle speeds exceed 100kph; however, this inter-urban measure is beyond the scope of this Study.

74 <https://www.bbc.com/news/uk-england-54130862>

75 <https://assets.gov.ie/78998/41a99d59-c525-44d4-8d81-a189edc67bd6.pdf>

Traffic Management

PTM16: Park & Ride

Improve interchange opportunities via Park & Ride provision on outskirts of cities, focused on reducing longer distance car commuting

6

PTM16

MEASURE TYPE

Existing enhanced

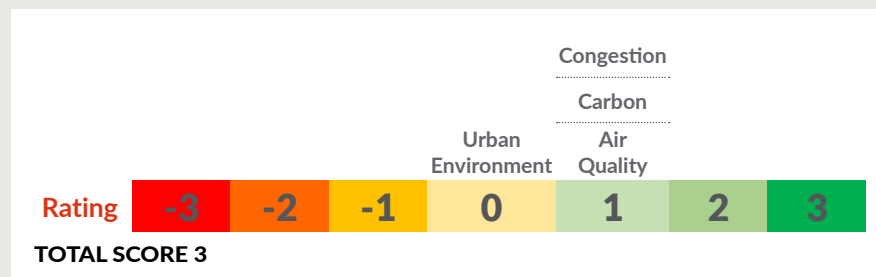
Additional Description

(Formal) Park & Ride involves the provision of a dedicated car park beside a public transport station or interchange. Park and Ride schemes also often include the provision of additional (sometimes dedicated) high-quality public transport services serving the car park location. Drivers can park their car and continue on public transport for the rest of their journey. Park & Ride is attractive if there is a disincentive to continue driving (e.g. congestion, tolls, limited parking spaces available at destination) and/or the public transport offering is fast and (usually) frequent. The public transport services therefore usually need to either be segregated from traffic congestion (e.g. heavy or light rail, trams, segregated busways etc), or have effective bus priority measures (bus lanes, bus priority at signalised junctions etc). These conditions are required to make Park & Ride more attractive than continuing the journey by car, despite the combined penalty of the extra interchange, the wait-time and the public transport fare.

The new NTA Park & Ride Design Office⁷⁶ will develop various Park & Ride projects through their design and planning stages, including the development of both strategic and local Park & Ride locations.

Impact in Delivering the Study Objectives

Park & Ride



Summary assessment

- Park & Ride often provides a more-attractive option than 'pure' public transport for car-available travellers who live beyond the city's core high frequency public transport network.
- If well-signed, they are also attractive to visitors who are unfamiliar with finding routes through &/or parking in the town or city.
- Park & Ride will only be used if the public transport offering is competitive with continuing to drive.
- In particular, they tend to be most effective when city centre parking is limited &/or expensive.

⁷⁶ <https://irl.eu-supply.com/ctm/Supplier/PublicTenders/ViewNotice/226935>

- Park & Ride can complement other measures, such as a workplace parking levy, public parking controls and reduced workplace parking standards, that make driving into the city centre less convenient.
- Provision of Park & Ride can result in some people who would have previously used sustainable mobility to travel to the station to now drive instead^{77/78}, or can cause people who previously used public transport for their entire trip to now drive to a Park & Ride site to avail of a faster or more comfortable public transport offering.
- The location choice of Park & Ride sites can also lead to unintended consequences, whereby additional vehicle trips may be generated that might otherwise be undertaken locally by sustainable means – for example, trip chaining involving commuting and then shopping.
- Well-used Park and Ride schemes can help reduce city centre congestion & air pollution, though care is needed to ensure that the emissions from any additional public transport is significantly lower than the emissions from the replaced car trips, taking account of any additional car trips to/from the Park & Ride site.
- Park & Ride sites occupy land adjacent to high quality public transport that could be otherwise be used for urban development.
- Taking a long-term perspective, Park & Ride increases the accessibility of hinterlands and can trigger car-dependant urban sprawl and hence may contribute to an overall long-term increase in car use⁷⁹.
- As Park & Ride sites can often lead to increases in traffic, their main benefit is often the reduction in demand for city centre parking, rather than their ability to encourage more sustainable mobility.
- Careful design and appraisal is needed to find the optimum locations for Park & Ride, to ensure these are sufficiently attractive to car users, while removing as much of the car journey as possible.
- Park & Ride needs to be considered with the rest of a city transport and demand management strategy, to ensure car travel demand reduction and mode shift from the car is taking place, and that, as far as possible, only drivers who would otherwise have driven into the city use Park & Ride sites.

Best Practice Evidence

As Strasbourg enlarged its tram network, it took the opportunity to increase the city's parking-controlled zones and reallocate road space from on-street parking to cycle paths, pedestrianised zones and green areas. These spaces were replaced with Park & Ride sites at the end of the new tram lines.

Strasbourg has had significant success with its Park & Ride usage. Surveys carried out by the city show that the majority of users previously travelled exclusively by car. Tickets are heavily subsidised, with a return tram trip to the Park & Ride site for all car occupants (up to seven people) and all day car parking costing just €4.20.

Stakeholder Feedback

It was noted that Park & Ride was an important tool to encourage a reduction of vehicle trips into the city centre core. There was general support for Park & Ride, with stakeholders suggesting lower overall costs to park at Park & Ride locations compared to city centre parking. However, it was also noted that where cities had free workplace parking spaces available on their outskirts, offering Park & Ride journey times and costs comparable to direct trips to these sites would be a challenge in order to make Park & Ride an attractive option for these commuters.

"An abundance of park and ride facilities with lower overall cost to park and ride than would apply to city parking."

77 <https://www.sciencedirect.com/science/article/abs/pii/S0966692313000185?via%3Dihub>

78 <https://pdfs.semanticscholar.org/c150/02a99cd7042d00ce16adcb97756fa5be619.pdf>

79 <https://www.tandfonline.com/doi/full/10.1080/21650020.2019.1690571>

Traffic Management

PTM17: Car Free Zones & Streets

Identify areas within cities that could have a positive impact on Air Quality and quality of the Public Realm

6

PTM17

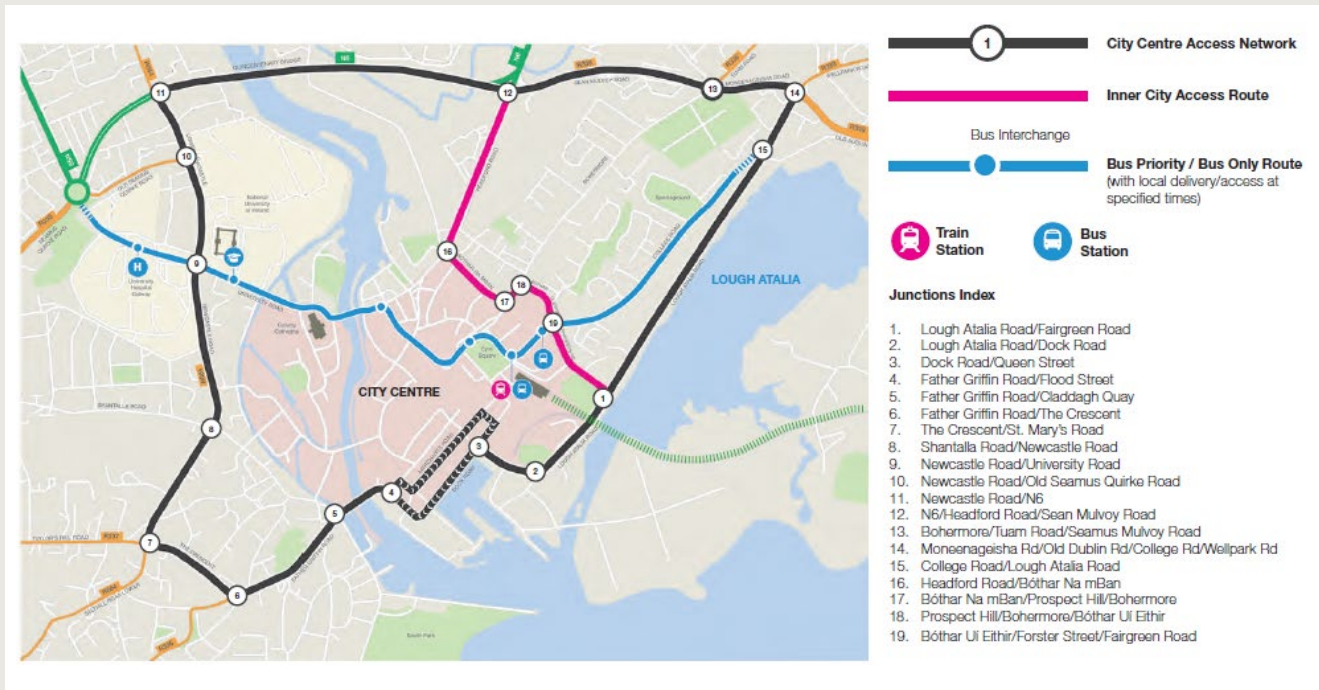
Additional Description

Car-free zone or streets that restrict vehicular access to particular areas; this can be limited to certain vehicle types and specific times, or even days of the year, to reduce congestion and pollution and allow more space for sustainable modes of travel, particularly walking and cycling.

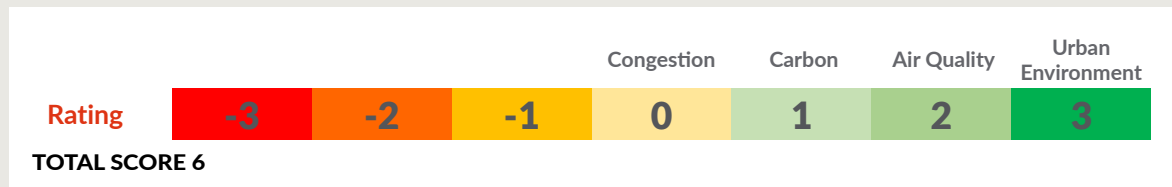
Certain restrictions are already in place across Irish cities and there are plans to expand this in some cases. For example, the Galway Transport Strategy includes proposals to restrict roads to vehicles of a suitable size and origins or destinations in the city centre through the 'City Centre Access Network'. This will include reducing speed limits, measures to discourage through-traffic, and prioritisation of public transport movements over the private car. Further details can be found in the Figure below.

MEASURE TYPE

Existing enhanced



Impact in Delivering the Study Objectives



Summary Assessment

- Re-balances road space in favour of active and sustainable modes, which has subsequent benefits for health, vibrant urban realm and local economy.
- This reallocation of space can encourage mode shift to more sustainable modes.
- Potential for local objection and therefore extensive stakeholder engagement required.
- Must consider the needs of those with particular mobility/accessibility requirements.
- Any displaced traffic has the potential to create disbenefits, so it is important to consider the impact of any re-routing traffic etc.
- No revenue raised for reinvestment in public transport.
- The existing public transport network therefore needs to provide a credible alternative.

Best Practice Evidence

In Ghent, (the largest city in the East Flanders province of Belgium), the city council proposed multiple measures in its 1997 Mobility Plan for the Inner City to tackle air quality and congestion issues in its city centre. A 35 ha. zone in the historical centre was pedestrianised as part of the plan. This zone banned almost all vehicles, except public service vehicles, delivery vehicles, taxis, and private vehicles with a special permit. The plan initially met with considerable opposition, particularly from retailers in the city centre. Despite this, political support for the strategy was consistent. The political majority in the city was in favour of the plan, and a strong collaboration between local politicians and the city administration enabled the plan to proceed. Over 300 public hearings took place in the year prior to implementation and a strong communication strategy was put in place.

In 2017, a new Mobility Plan strengthened and expanded these measures. Within the ring road surrounding the city, the urban core has been divided into seven areas: the city centre and six zones surrounding it. No vehicle traffic can travel between zones without driving back to the ring road. Therefore, there is no through-traffic through the centre, or between zones. All through-traffic is routed around the ring road, resulting in lower traffic levels, fewer accidents, more trips made by sustainable modes and reduced air pollution in the city centre. Although no data is available on the impacts of the initial restrictions, the 2016 mobility strategy resulted in a reported 20% decrease in NO_x concentrations.

Stakeholder Feedback

There was general support for Car Free Zones and Streets from stakeholders, due to their environmental, public realm and safety benefits, with the suggestion that temporary introductions may enhance stakeholder and public buy-in.

"Working closely with stakeholders, and from a bottom-up perspective, as opposed to a top-down policy implementation, I think is really important. People will come around once they understand... we have huge stakeholder engagement in the design... so they can see what is coming."

Stakeholders also noted that alternatives need to exist prior to delivery of Car Free Zones and Streets, to reduce any negative economic impacts on city centres. Concerns were also raised about the displacement effects and re-routing traffic.

School Mobility Management Plans

BC03: School Mobility Management Plans (MMPs)

School Mobility Management Plans (MMPs) - resources to support Local Authorities and An Taisce with local school MMP implementation e.g. site specific support

BC14: School Streets & Safe Routes to School

Resources to support local School Streets & Safe Routes to School initiatives including consultation, implementation and monitoring

6

BC03 & BC14

MEASURE TYPE

Existing enhanced



Additional Description

In Ireland, the percentage of primary schools' students being driven to school has more than doubled, from 24% in 1986 to 59% in 2016. Increased traffic associated with the school drop off is contributing to congestion, poor air quality and road safety problems on the streets to, from and around schools across Irish cities.

Mobility Management Plans (or School Travel Plans) are management tools which bring together behaviour change measures and infrastructure improvements in a co-ordinated framework, allowing educational establishments to implement measures against an agreed plan to reduce demand for and use of private cars associated with the school run, and increase and promote the attractiveness and practicality of active and sustainable modes.

Funding for the Green Schools Travel programme is currently provided by the Department of Transport and delivered by An Taisce.

The School Street Initiative introduces temporary road closures adjacent to the school gates at school opening and closing times. Students and parents are supported to seek alternative modes of transport or to park and stride away from the school gates, with Local Authorities also developing Safe Routes to School initiatives, to support active travel.

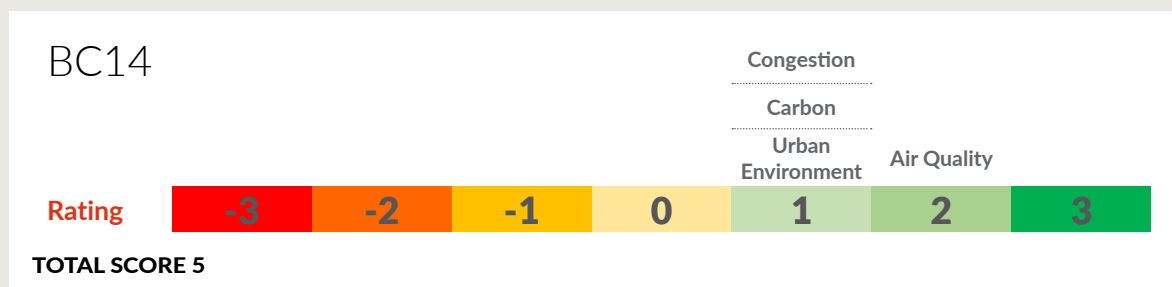
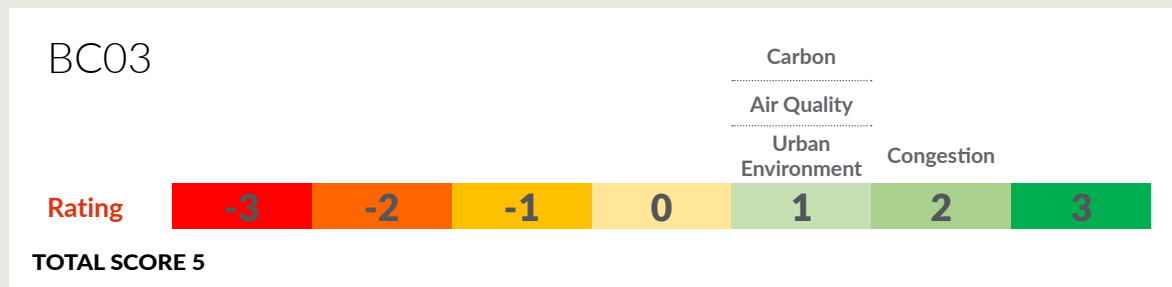
In March 2021, a new 'Safe Routes to School' initiative was announced under the €1.8 billion committed under the Programme for Government, to support walking/scooting and cycling to primary and post-primary schools. The programme aims to create safer walking and cycling routes within communities, alleviate congestion at the school gates and increase the number of students who walk or cycle to school. The improvements to the school commute could range from an upgraded footpath or new cycle lane to a complete reworking of a school's entrance - with all schools eligible to apply to the programme.



Summary Assessment

- MMPs and School Streets are proven measures to deliver modal shift and positive impacts on congestion, particularly for short trips associated with the school run.
- School Streets address air quality issues in the immediate vicinity of the school gate.
- Reduced car trips to schools gives positive opportunities for localised active travel infrastructure and improvements to the public realm and provides a safer environment for children.
- The measures would resolve current resource gaps to effectively support Local Authorities & An Taisce to deliver more MMPs for Schools.
- Requires multi-agency, whole school community and site-specific support - and are ineffective without committed school buy-in.
- Requires alternative sustainable mobility options in place to be effective.
- School Streets are resource intensive (e.g. consultation & ongoing enforcement without ANPR).
- School Streets are not appropriate for all locations (e.g. schools on main roads) - however following the first Irish pilot, there is potential for further roll out at suitable sites.

Impact in Delivering the Study Objectives



Best Practice Evidence

The An Taisce School MMP programme shows an average 20-26% reduction in car use for each two-year programme since 2008.

The implementation of the Fingal School Streets pilot in Malahide found a 20% reduction in air pollution, a reduction in private car usage from 37% to 18%, with park and stride increasing from 24% to 39%, walking from 30% to 35% and cycling numbers doubling (from 15 to 30 students).

In 2020, Galway City Council, in partnership with Scoil Iognáid, the NTA and An Taisce's Green-Schools programme launched a pilot School Streets programme. Follow up consultation with parents indicated very positive modal shift results as a result of the pilot, with a 14% fall in daily car use to school, 7% increase in daily cycling, 11% increase in daily walking and a 3% increase in daily scooting. Teaching staff also noticed an improvement in children's mood, behaviour, readiness to learn and physical activity levels. *"I have noticed a huge improvement when the children arrive to school. They are much more awake and a lot less sluggish. They have rosy cheeks, bright eyes and are fresh and ready to start."*

Stakeholder Feedback

General support for the deployment of these measures, with the following noted:

- Overcomes resource constraints related to Mobility Management Plans.
- Behavioural change in this area could/should be delivered as part of COVID-19 recovery.
- School Streets received positively, despite ongoing enforcement concerns.
- Alternative sustainable mobility options need to exist, prior to delivery.

6

BC04, BC05, BC06 & BC08

MEASURE TYPE

Existing enhanced



Mobility Management Plans

BC04: Workplace Mobility Management Plans

Workplace Mobility Management Plans (MMPs) - resources to support Local Authorities and the NTA Smarter Travel Team with local workplace & campus MMP implementation e.g. planning compliance monitoring, site specific support

BC05: Flexible Working

Programme of support for employers to encourage flexible working/home working/remote hub working

BC06: Staggering School and Workplace Start and Finish Times

Staggering school and workplace start and finish times

BC08: Area Mobility Management Plans

An area based approach to Mobility Management Planning

Additional Description

BC04

Mobility Management Plans (MMPs) are management tools which bring together behaviour change measures and infrastructure improvements in a co-ordinated framework, allowing employers to implement measures against an agreed plan to reduce demand for and use of private cars associated with the workplace, and increase and promote the attractiveness and practicality of active and sustainable modes. The NTA has produced guidance 'Achieving Effective Workplace Travel Plans' which is available to support local authorities and individual employers develop and deliver Workplace Mobility Management Plans. These plans usually focus on commuting and business travel, but can extend to fleet management and freight transport if these are significant activities for the business in question (particularly those with a focus on reducing the overall carbon footprint of their operations).

Destination based MMPs are typically used at employment sites (either larger employers or clusters of employers for example in a business park), education sites (including schools, Colleges and Universities) or other large trip generators (such as hospitals and shopping centres).

BC06

Staggered start and finish times are also used as part of an MMP to mitigate against people travelling during peak congestion times on local roads - for example, at factory shift change over times or within educational establishments to reduce 'school gate' parking pressure.

BC05

A common feature of an MMP is the facilitation of flexible working to reduce the overall demand for travel to and from a site, through HR policies such as home working, remote working via hubs and compressed working weeks. It is too early to draw any permanent conclusions in relation to the impact of recent patterns of home working as part of the response to the COVID-19 pandemic on long term travel demand is currently unclear. A recent study⁸⁰ found that 86% of respondents favour a hybrid model where time working remotely blended with time in the workplace - with 67% citing reduced commuting time as a positive factor associated with home working during the pandemic.

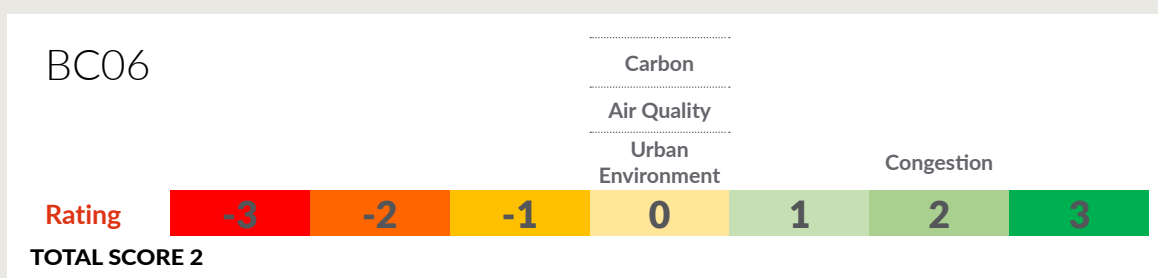
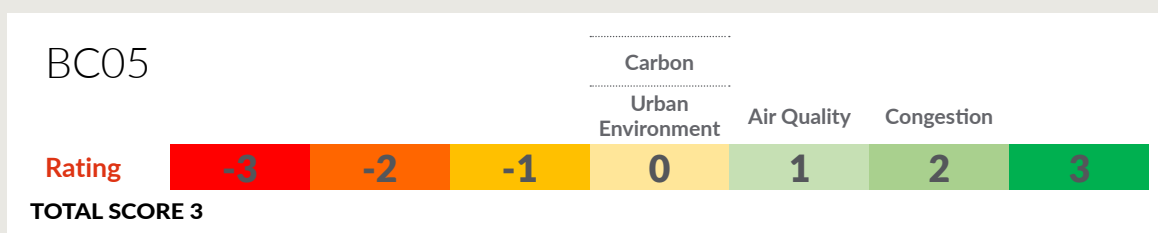
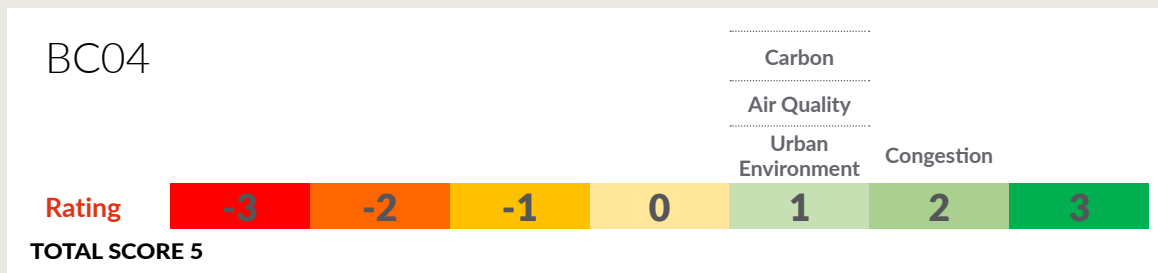
In January 2021, the Government announced the new 'National Remote Work Strategy'⁸¹ to ensure that remote working is a permanent feature in the Irish workplace in a way that maximises economic, social and environmental benefits. The strategy includes proposals for the following:

- Mandating that home and remote work should be the norm for 20 percent of public sector employment.
- Reviewing the treatment of remote work for the purposes of tax and expenditure in the next Budget.
- Mapping and investing in a network of remote working hubs across Ireland.
- Legislating for the right to request remote working.

BC08

MMPs are effective on a site-by-site basis, but their impact can be improved where individual sites within a local area work together with other stakeholders - for example within a Business Park or Industrial Estate near to the strategic road network, or a city centre Business Improvement District. This Area MMP approach can address issues of common concern (e.g. improving local transport supply such as a local bus service timetable or cycle route provision), utilise combined resources for marketing sustainable mobility activities (e.g. promoting a Cycle Challenge competition between different employers) and maximising opportunities for new measures (e.g. an area wide car share scheme).

Impact in Delivering the Study Objectives



80 <https://www.forsa.ie/largest-ever-employee-survey-reveals-huge-appetite-for-remote-working/>

81 <https://enterprise.gov.ie/en/Publications/Publication-files/Making-Remote-Work.pdf>

Summary Assessment

Site-specific and Area-wide MMPs

- MMPs are proven measures to deliver modal shift and therefore have positive impacts on congestion, carbon and air quality - particularly for commuting trips.
- The measures would resolve current resource gaps to enable the NTA Smarter Travel Team and the Local Authorities to support more intensive and wider Workplace MMP delivery (and also to monitor planning compliance).
- Reduced car commuting gives positive opportunities for reduction in workplace parking, enabling private land to be put to more cost-effective or commercially beneficial use. It can also offer increased opportunity for additional urban realm improvements.
- MMPs require alternative sustainable mobility options in place to be effective, along with continued employer commitment to implementation.
- Area MMPs enable efficiencies to be achieved through the pooling of resources, giving opportunities to deliver measures at a scale that may not be cost effective for single sites (e.g. workplace shuttle buses and car-pooling initiatives).
- Area MMPs can take time to generate and sustain an area-based approach and multi-agency commitment to mobility management and are usually best delivered through existing governance frameworks (such as Business Improvement Districts, Business Park Tenant Forums).
- Area MMPs will have limited application dependent on business type and would not be feasible or applicable across a whole city - but are likely to be effective in targeted areas such as near to congested parts of the strategic road network, or in city 'quarters'.
- Embedding the development and delivery of Area MMPs within transport and land use plans and policies (for example through County Development Plans, Local Area Plans (LAPs), Area Based Transport Assessments (ABTAs) & Local Transport Plans (LTPs) would reinforce the role of TDM and Mobility Management in land and transport use planning and policies).

Flexible working/remote working

- In line with the Avoid/Shift/Improve approach to Demand Management, home working reduces travel commuting demand and therefore improves congestion and air quality, while flexible working patterns can alleviate peak hour travel demand.
- A 2013 Study for the Scottish Government⁸² in relation to mobile and flexible working programmes as a travel demand management measure highlighted the concerns around the 'Rebound Effect', where energy efficient systems generate more demand for energy through increased usage elsewhere. This is relevant to flexible working in a variety of ways, but perhaps the most direct is through an income effect, where energy improvements (or commute time and money savings) for the employee leave more income (or time) for further consumption (i.e. travel) in other areas. Likewise, the fact that someone is not driving to work may mean that another household member makes use of a car that would not previously have been available to them. The 2013 Study above identified that the bulk of the literature supports the idea that there probably is a significant rebound effect, but under most circumstances the emissions-related impacts of this 'rebound' are generally smaller than the impacts of the primary change in behaviour.
- Home working reduces the carbon impact of transport commuting trips; however, there will be additional rebound effects (over and above the travel rebound effects described above) arising from the energy consumed by individual homes (e.g. home central heating, lighting, etc.), compared to centralised office buildings, which are likely to be more energy efficient. Research conducted by WSP Environmental⁸³ found that while transport related carbon emissions are saved by reduced commuting, the extra heating and power used at home (especially in winter) can outweigh the benefits. The research estimates that if an employee works at home all year, they will generate 2.38 tons of carbon dioxide, whereas a typical office worker will produce only 1.68 tons of carbon.
- While it is too early to assess the impact of COVID-19 on future patterns of home working/remote working, should the predicted hybrid model of working patterns become the 'new normal', this will require further assessment into the impact on emissions (both from transport and other sources). Such a hybrid model may also require an adjustment to current public transport fares, which offer substantial season ticket savings to those commuting five days a week.
- Increased sustained levels of home working may negatively impact on city centre retail vitality.

82 <https://www2.gov.scot/resource/0044/00440462.pdf>

83 <http://www.telegraph.co.uk/earth/earthnews/3295393/Go-green-work-at-the-office-not-at-home.html>

Staggered start and finish times

- Reduces peak hour congestion levels.
- Trips are still made, so there is limited impact on carbon emissions or air quality.
- Trips still made therefore there is limited impact for additional sustainable mobility infrastructure within the urban environment, but this measure could have some road safety benefits (for example, where start and finish times within a school are staggered by year group).



Best Practice Evidence

The NTA have found that where workplaces actively engage with their Workplace Travel Plan, the average reduction in car commuting is 18%.⁸⁴ A review of the Smarter Travel Areas programme found that these behavioural change programmes had been most effective in the University of Limerick where they had been combined with a “carrot” in the provision of sustainable mobility infrastructure and a “stick” in the form of parking charges.⁸⁵

Internationally, numerous studies report emission reduction impacts through the implementation of remote working policies; the degree of benefits delivered varies significantly based on the number of days per week working from home, land use patterns, commute distances, socio-demographic characteristics, public transport availability and internet infrastructure.

Some studies claim significant emission reductions employ scenarios where employees telework full-time or spend only one day in the office, as well as marked energy savings through businesses downsizing their premises. While some authors disagree with the use of remote working as a tool to reduce the need to travel, arguing that the potential benefits can be offset by rebound effects, such as more dispersed patterns of land use leading to longer non-commute trips (for example, where individuals choose to live in rural or suburban areas), thus creating new &/or longer car trips.

Stakeholder Feedback

- There was general support for Mobility Management measures, with stakeholders suggesting that the measures proposed could overcome the resource constraints currently experienced.
- The MMP area-wide approach, with oversight for multiple sites in specific local areas (e.g. locations such as Business Parks), was thought to work to reduce local authority resource constraints, rather than support being delivered by Local Authorities on a single employer /site- specific basis.

84 <http://www.nationaltransport.ie/wp-content/uploads/2011/12/Achieving-Effective-Workplace-Travel-Plans-Guidance-for-Local-Authorities211.pdf>

85 <https://assets.gov.ie/40421/04d2d97e6c834470800a1f394967a610.pdf>

6

BC07

MEASURE TYPE

Existing enhanced

Mobility Management Plans

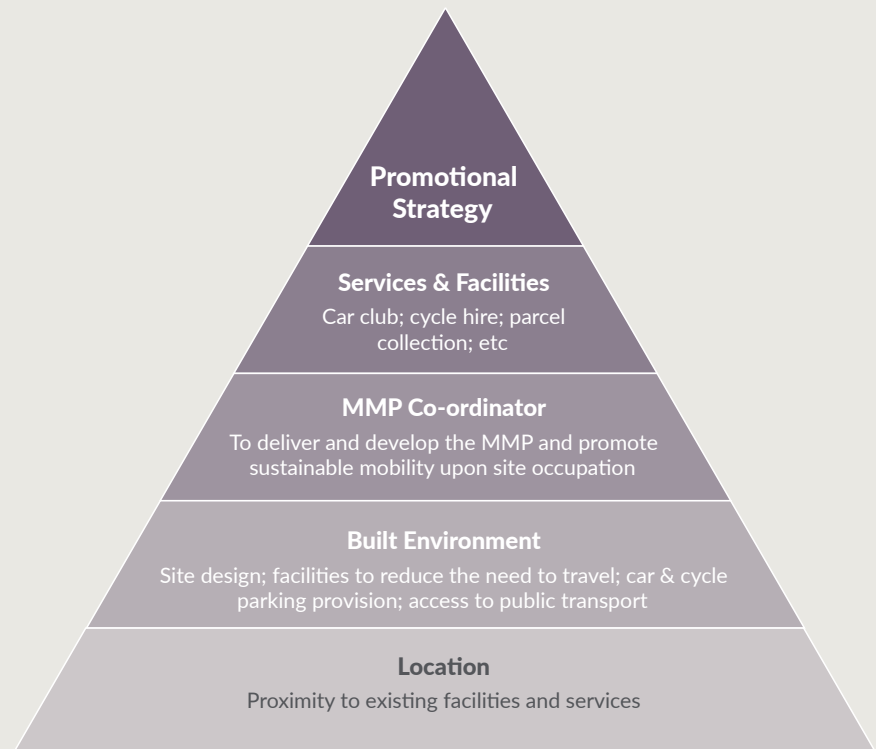
BC07: Residential Mobility Management Plans

Residential Mobility Management Plans (RMMPs) - resources to support planning compliance monitoring and site-specific support

Additional Description

A RMMP is an origin-based demand management tool i.e. it addresses all aspects of a residential development that create a need to travel by residents of the development. The RMMP 'pyramid' below demonstrates how successful plans are built on the firm foundations of sustainable location and good site design.

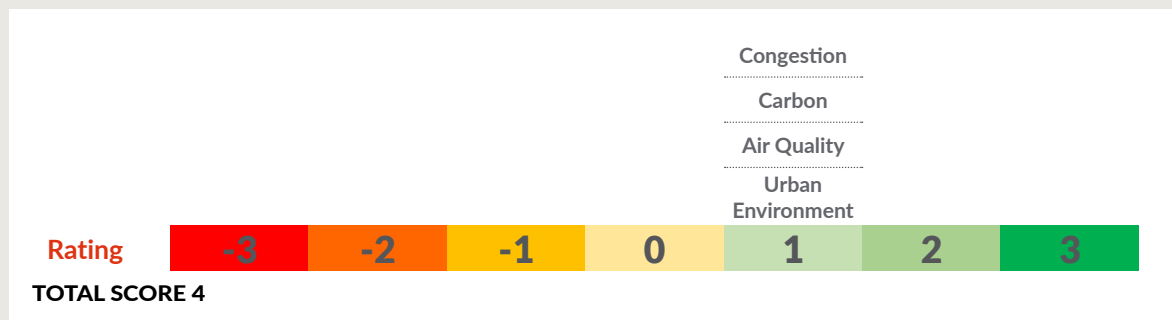
A RMMP typically combines hard measures (e.g. cycle parking, access to a car club, safe walking routes to bus stops) and soft measures (such as Travel Welcome Packs, bus taster tickets, personalised journey planning & access to on-site services). All measures should be integrated into the design, marketing and occupation of the site - with parking restraint often crucial to the success of the MMP in reducing car use.⁸⁶



A RMMP is about managing travel demand at source, and can be added as a planning condition to new residential developments, at both pre-occupation stage and during the life of the development.

86 <https://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/pgr/sustainable/travelplans/rpt/mrtpw.pdf>

Impact in Delivering the Study Objectives



Summary Assessment

- Residential MMPs supports demand management at source, encouraging reduced car ownership through the provision of site-specific alternatives (e.g. bike & car share) and tailored marketing to residents - therefore supporting carbon emissions reduction and the ongoing management of local urban congestion and air quality issues.
- Residential MMPs also offer the opportunity to deliver enhanced active travel infrastructure at source, improving the urban environment.
- Focuses on minimising the impact of traffic arising from a new development at the outset, rather than managing it afterwards.
- This measure only impacts new residential developments, not existing housing stock - therefore, its impact is limited in comparison to other measures; however, its inclusion within the City Toolkit recognises the NPF population growth targets within urban areas, and the role that RMMPs can play in developing sustainable communities.
- RMMPs require ongoing resource commitments from both developers and Local Authorities, to continue implementation post-site occupation. The implementation of this measure needs to recognise the limited resources currently available within local government for monitoring, supporting and enforcing RMMPs conditioned as part of new housing developments.

Best Practice Evidence

Although the effectiveness of travel plans is generally well established at pre-existing sites, there is limited evidence of the impacts when they are applied to new developments, particularly residential sites. In response to this situation, a series of multimodal person trip counts and parking surveys was undertaken at four case sites (residential developments with travel plans) and four control sites (similar residential developments without travel plans) in Melbourne, Australia. Results indicated that the average weekday (7:00 a.m. to 9:00 a.m.) mode share for car driver trips was 14 percentage points lower at the case sites than at the control sites.⁸⁷

Stakeholder Feedback

General support for the deployment of this measure, with the following noted:

- Overcomes resource constraints related to Mobility Management Plans monitoring and support.
- Alternative sustainable mobility options need to exist prior to delivery.

⁸⁷ <https://journals.sagepub.com/doi/abs/10.3141/2537-14?journalCode=trra>

6

BC11, BC12 & BC13

MEASURE TYPE

Existing enhanced



Behavioural Change Campaigns

BC11: Reward Schemes

Incentive-based applications to reward sustainable travel and off-peak travel behaviour

BC12: Marketing New Schemes

Resources to lock in benefits of active & sustainable travel infrastructure investment through focused social marketing and behavioural change campaigns

BC13: Disruption & Resilience

Resources to reduce demand, build transport resilience and/or embed sustainable habits during times of disruption through focused social marketing and behavioural change campaign

Additional Description

BC11: Reward schemes

The use of incentive based applications to reward sustainable mobility and off-peak travel behaviour has been trialled in other countries as a demand management measure. The user downloads an app on their mobile phone, which automatically records their journeys via GPS tracking. Sustainable mobility trips via public transport, walking, cycling and car-sharing are typically rewarded via 'points' which can be exchanged for discounts at local retailers (negotiated in advance or via a sponsorship arrangement) to support the local economy.

Before and after user data is recorded to track the impact of the campaign - with the ability to calculate not just mode shift but other impacts such as CO₂ savings, calories burned, etc. The app can focus incentives on usage of particular modes (e.g. a new bus route), particular times of day (e.g. off-peak travel to mitigate congestion at peak times of the day) or particular market segments (e.g. workplaces). The loyalty scheme element of the approach has the advantage of both attracting new users and rewarding/retaining existing sustainable mobility users.

BC12: Marketing new schemes

To maximise return on investment for new sustainable mobility infrastructure (e.g. a new cycle route), effective marketing to key user groups is required to lock in the benefits of the investment and maximise usage. Few companies would launch a new product or service and not advertise it - the same approach needs to be applied to new transport infrastructure as part of a wider demand management approach.

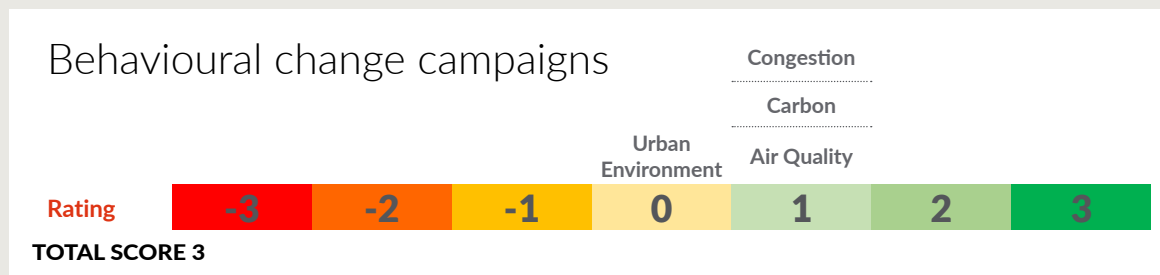
For example, focused marketing of a new cycle route could include: a social media campaign to reach local communities; led rides along the route (e.g. by local schools, workplaces or community groups); monitoring usage and feeding back results in real time via cycle counters along the route combined with positive messaging; marketing imagery that shows 'people like me' using the route; and marketing messages that focus on people's motivations to use the route (e.g. freedom, health, enjoyment). Supporting measures could include free/subsidised cycle training, bike maintenance checks and access to bike hire. Resources to deliver this approach should be embedded within the infrastructure budget.

BC13: Disruption & resilience

Some disruptive events can lead to lasting impacts on travel choices e.g. during large events or planned large-scale roadworks. Through careful planning, resilience can be built into a transport network, to ensure it can still operate effectively during these times of disruption - and the use of temporary demand management measures can also offer opportunities to embed new sustainable mobility habits for those effected by the disruption.

Periods of planned disruption therefore represent opportunities to trial demand management measures on a temporary basis and embed new sustainable mobility habits - as occurred during the 2012 Olympic & Paralympic Games in London, the Birmingham Queensway Tunnel closures and current COVID-19 mobility measures, such as the removal of parking to enable social distancing and active travel.

Impact in Delivering the Study Objectives



Summary Assessment

BC11: Reward schemes

- Can deliver modal shift and/or support off-peak travel patterns, with positive impacts on congestion, carbon and air quality.
- Enables effective monitoring of behaviour change.
- Incentive points can be linked to local retail offers, supporting the vibrancy of a cities' retail function.
- Can promote & incentivise multi-modal journeys e.g. cycling & rail.
- Can be targeted at localised areas with air quality and/or congestion issues.
- Requires access to smartphones.
- Typically requires a level of upfront retailer discounts funded by the programme and/or sponsorship to prove case for local retailers before offers are given by them directly.



BC12: Marketing new schemes

- Maximises potential for mode shift, thereby reducing carbon emission and air pollution.

- Maximises investment in new and existing sustainable mobility infrastructure by using marketing techniques to recruit and retain new users, thus supporting overall demand management.
- Positive marketing of new sustainable mobility infrastructure can build community support for future investment in the urban environment.
- Culture shift required to embed the benefits of Behavioural Change programmes within engineering mindsets. Requires marketing rather than traditional transport/engineering skills.

BC13: Disruption & resilience

- If deployed correctly, can achieve longer term impacts on mode shift - thereby reducing congestion, carbon emissions and air pollution.
- Time-limited and driven by need (e.g. major roadworks).
- Resource intensive.
- Requires behavioural change and social marketing expertise (rather than traditional transport/engineering skills) for successful delivery.

Best Practice Evidence

BC11: Reward schemes

In 2017, Bologna's public transport authority wanted to try a new approach to tackling CO₂ emissions and air quality. They had tried banning the use of polluting vehicles during the day, which had been unpopular with citizens, and wanted to see if incentives would be more effective than penalties. With funding from the European Commission's Horizon 2020 EMPOWER programme, they partnered with BetterPoints to build Bella Mossa, an incentive scheme that would encourage large numbers of people to reduce their day-to-day reliance on single-occupancy car journeys. Bella Mossa awarded participants points for walking, cycling or using public transport. Points could be redeemed for discounts or payment towards merchandise and services from 85 retailers, including supermarkets, sports retailers, bike stores, opticians, bookshops, cinemas, restaurants and bars. The app also included messaging to users and gamification to attract younger users. Running from 2017 to 2018, the six-month programmes are estimated to have saved 1.4 million Kg of CO₂ emissions and engaged over 20,000 residents⁸⁸.

BC13: Disruption & resilience

During the 2012 London Olympics, there were some exceptional parking restrictions and road closures.

To prepare Londoners for this, a "Get Ahead of the Games" advertising campaign was launched to raise awareness about these coming measures and to distribute travel planning trips to people living in London or planning to visit for the games. The campaign promoted travel alternatives on routes and in areas that would be affected by the games. A study tracked the travel patterns of 1,132 London residents. 61.9% changed their travel behaviour during the Olympics and 6% sustained this change after the restrictions were lifted.⁸⁹

Stakeholder Feedback

General support for behavioural change campaigns, with stakeholders highlighting COVID-19 as creating an opportunity for change in behaviour; however, concern was raised for the general lack of funding and resource available for behavioural change work.

"There's absolutely no policy that talks about behavioural change being important, there is very little to back it up in terms of any type of resources, or funding, it really needs a full look at."

⁸⁸ <https://www.betterpoints.ltd/blog/20000-people-incentivised-to-travel-more-sustainably-in-bologna/>

⁸⁹ Understanding travel behaviour change during mega-events: Lessons from the London 2012 Games, Parkes, SD, Jopson, A and Marsden, G (2016)

Intelligent Transport Systems

TC03: Real Time Passenger Information

Continue the NTA roll out of multi-modal Real Time Passenger Information (RTPI) across all cities

6

TC03

MEASURE TYPE

Existing enhanced

Additional Description

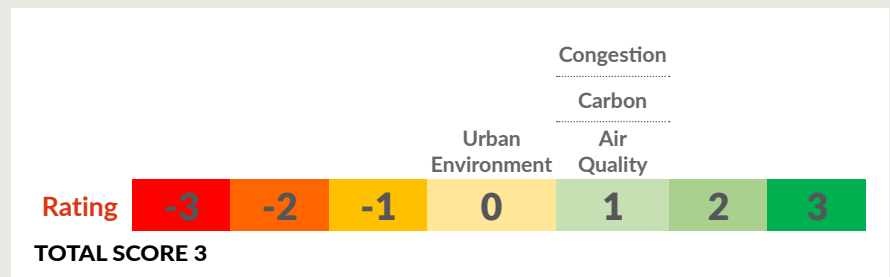
The NTA currently provides Real Time Passenger Information (RTPI) in the five Study cities at some bus stops and online or through mobile apps. Irish Rail and Luas also operate RTPI systems at all stations. 70% of surveyed passengers use RTPI. Almost two-thirds feel that RTPI has improved the reliability of the service. Almost 30% cite using the bus more often since the introduction of RTPI.⁹⁰

Passengers tend to over-estimate their actual waiting times for buses when they do not have access to real-time estimates of arrival times. RTPI screens that provide arrival and wait times help to provide a more accurate measure of the passing of time, thus decreasing perceived waiting times, even when there has been no actual improvement in service frequency or punctuality.

The continued expansion and improvement of the RTPI system in Ireland, particularly at bus stops, would help to maintain and improve customer patronage and satisfaction.

The expansion of real-time bus locator mapping on the existing journey planner mobile app (as a dynamic map showing the location of buses on the network) would also allow users to see where the bus is on its route and how far it is from their bus stop.

Impact in Delivering the Study Objectives



Summary Assessment

- Improves customer perception, patronage and satisfaction, and builds confidence in the reliability of public transport services.
- RTPI is an effective demand management measure which supports public transport use, therefore has positive impacts on congestion, air quality and carbon reduction.
- Integration of real time air quality information within RTPI systems at specific locations/hot spots can raise awareness of air quality and embed behavioural change messaging.

⁹⁰ https://www.nationaltransport.ie/wp-content/uploads/2015/10/Demand_Management_Report.pdf

- The need for at-stop count-down equipment could be superseded by the use of easy-to-use/well-advertised smart phone apps, as the penetration of the relevant smart phone technology among public transport users continues to rise towards 100%
- At-stop RTPI equipment does not 'reach' car users, so its main benefits are for existing regular &/or occasional public transport users.

Best Practice Evidence

Brakewood and Watkins⁹¹, who analysed the existing RTPI literature in depth, identify seven distinct categories of positive effects that are associated with RTPI. These are:

- Better use of wait time.
- Improved image of the system.
- Increased willingness-to-pay.
- Higher journey satisfaction.
- Efficient travel choices (e.g. better route choice due to waiting for correct service, adjustment of behaviours during travel disruption).
- Efficient travel behaviour adjustments (e.g. willingness to let crowded vehicles pass by, knowing another is following close behind).
- Other psychological effects that make public transport more attractive (e.g. increased sense of security at night).

Stakeholder Feedback

General support for RTPI, with the suggestion that all transport information systems require public trust in their reliability of the information provided.

"We talk about reliability and building trust in the technology system... the reliability of the information, is it real time?"

The need to ensure access for all (for example for people with visual impairments) in real time passenger transport information systems was also noted, along with the need for intelligent transport systems to keep pace with and retain flexibility in integrating new technology, data, and digital platforms as they become available.



⁹¹ Brakewood, C., & Watkins, K. (2019). A literature review of the passenger benefits of real-time transit information. *Transport Reviews*, 39(3), 327-356.

Intelligent Transport Systems

TC04: Ramp Metering on National Roads

6

TC04

MEASURE TYPE

Existing enhanced

Additional Description

Ramp Meters are generally traffic signals placed on motorway entrance ramps and which operate when traffic volumes on the main carriageway are high, in order to control the flow of vehicles accessing the motorway. They are designed to improve the average speed of all vehicles on the mainline motorway by avoiding the flow breakdown and near-stationary traffic which can occur as the main carriageway approaches its operating capacity, either due to the merging traffic, or downstream where the traffic volume starts to approach the operating capacity of the route.

Essentially, ramp meters perform the function of managing traffic flow onto strategic routes via traffic lights, to maintain consistent flow on these strategic routes. Ramp metering is currently used at the Dublin Port Tunnel/M50 access.

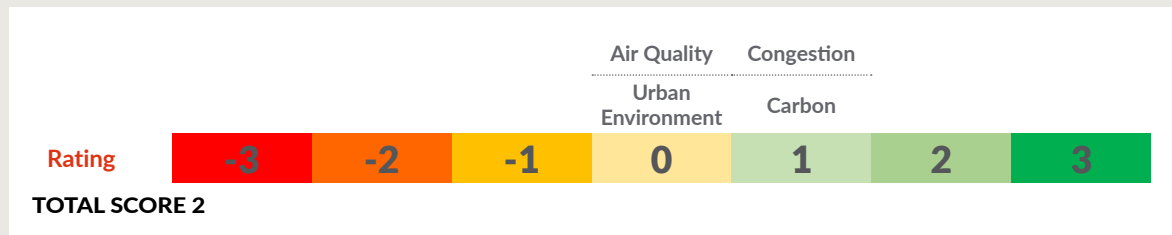
Summary Assessment

- Ramp metering can improve road network efficiency and safety.
- Their effectiveness in reducing congestion is dependent on suitability of the individual junction and traffic characteristics - and may result in redistribution of congestion elsewhere on the road network dependent on the scheme.
- There may be potential for implementation on focused parts of the strategic road network in urban areas.
- Ease of delivery is uncertain and may be limited due to physical constraints.
- The 2011 NRA/TII study identified that Ramp Metering would not provide benefits for the M50 in Dublin.
- The 2017 N40 Demand Management Study in Cork concluded that the number of junctions suitable for Ramp Metering on the N40 is limited. The only area identified where ramp metering would provide benefits for the N40 is the westbound on-slip at Bloomfield Interchange. Detailed design work on optimising the operation of the Bloomfield Interchange and its interaction with the N40 is being undertaken as part of the M28 Cork Ringaskiddy Upgrade Scheme and further detailed examination of potential ramp metering will be undertaken as part of this work.⁹²
- Current congestion levels within Waterford do not warrant ramp metering, nor is it likely to be effective. Ramp metering is not part of the proposed Galway Ring Road due to the road configuration.

⁹² <https://www.tii.ie/tii-library/strategic-planning/strategic-reports/N40-Demand-Management-Study-June-2017.pdf>



Impact in Delivering the Study Objectives



Best Practice Evidence

The European Ramp Metering Project undertook five real world tests of ramp metering⁹³ at locations across Europe, and two simulation tests, and found the three main outcome of ramp metering were as follows:

- Proof that socio-economic benefits can be gained from the operation of local ramp metering.
- A warning that the delays for the cars held back on the ramps can outweigh the travel time gains for the vehicles on the mainstream motorway, if the metering is applied too harshly.
- Proof that co-ordinated metering is superior to local metering strategies and that substantial additional benefits can be gained from the co-ordination.

Stakeholder Feedback

Ramp metering was reported as a concern by some stakeholders.

Ruled Out as a Measure

Based on the detailed evaluation, it was concluded that Ramp Metering should not form a key recommendation of this Study. While having definite benefits in terms of managing congestion on the strategic road network, and addressing motorway safety and reliability, its impact to deliver the key Study Objectives within the five cities was assessed as not sufficient to warrant inclusion as a Study recommendation. This is principally due to its limited application outside the strategic road network.

Furthermore, ease of delivery is uncertain and may be limited due to physical constraints - however, there may be additional potential for Ramp Metering on other parts of the strategic road network in Dublin, at the Bloomfield Interchange in Cork, and also in the future in Limerick. Outside this Study, additional research and examination would be required to assess the feasibility and benefits of this as a demand management measure on focused parts of the strategic road network.

93 <https://trimis.ec.europa.eu/project/european-ramp-metering-project#tab-results>



Variable Speed Limits

TC05: M50 Variable Speed Limits

Review impact of current TII plans (subject to legislation) for implementation of variable speed limits along the M50 (as part of eMOS project)

6

TC05

MEASURE TYPE

New

Additional Description

A variable speed limit is a dynamic speed restriction on a given stretch of road. The speed limit changes according to the current environmental and traffic conditions and is displayed on an electronic traffic sign. Signs typically indicate a maximum speed. This helps avoid stop-start driving behaviour and reduces disruptions along the strategic road network.

Transport Infrastructure Ireland (TII) are currently progressing the implementation of variable speed limits along the M50, which is expected to improve journey time reliability and road safety along the route.

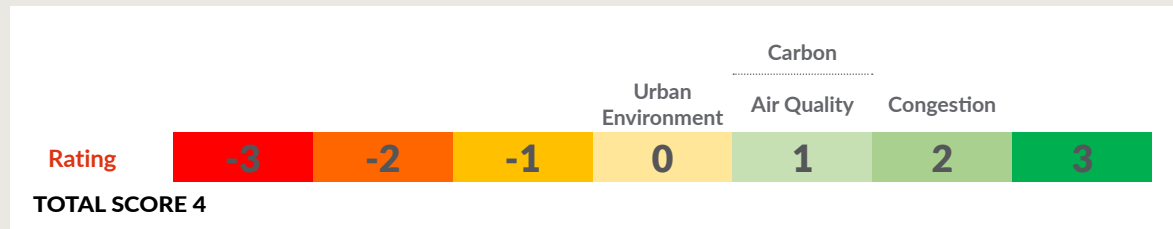
Following the proposed M50 trial, this measure would review the outcome of this trial and its potential application of Variable Speed Limits for other strategic roads in the other four cities - both in terms of managing congestion and its impact on local air quality.



Summary Assessment

- Can improve road network efficiency and safety but not suitable for all roads.
- Potential for application is limited to targeted areas of the strategic road network within the five cities.
- Has the potential to deliver congestion, carbon and air quality benefits.

Impact in Delivering the Study Objectives



Best Practice Evidence

In Barcelona metropolitan area, a fixed speed limit of 80 km/h was introduced in 2008 on congested stretches of the motorway network. In 2009, its variable speed limit systems were also introduced along other stretches of the motorway. Fixed speed limits were found to cause a 1.7–3.2% increase in NO_x and 5.3–5.9% in PM_{10} . Where there were variable speed limits in place NO_x and PM_{10} pollution reduced by 7.7–17.1% and 14.5–17.3%⁹⁴.



Urban Traffic Management Centres

TC06: Public Transport Control Centres

Continue NTA investment in control centre for all public transport modes, including interactions with Luas

TC07: Urban Traffic Management Centres

Proactive Urban Traffic Management including SCATS system development & resources and the implementation of other initiatives e.g. bus gates

Additional Description

All of the five cities identified the benefits of continued investment in proactive Urban Traffic Management as an effective demand management tool. This included investment for continued SCATS (Sydney Co-ordinated Adaptive Traffic System) development and deployment, along with the implementation of other initiatives (e.g. bus gates).

For example, Galway has operated an Urban Traffic Management Centre since 2011. This provides a hub for urban traffic control in the city, together with the Parking Guidance System, Variable Message Signs, CCTV and fault monitoring system. The system has the capability to expand to integrate real-time bus priority, journey time monitoring and environmental monitoring.

6

TC06 & TC07

MEASURE TYPE

Existing enhanced



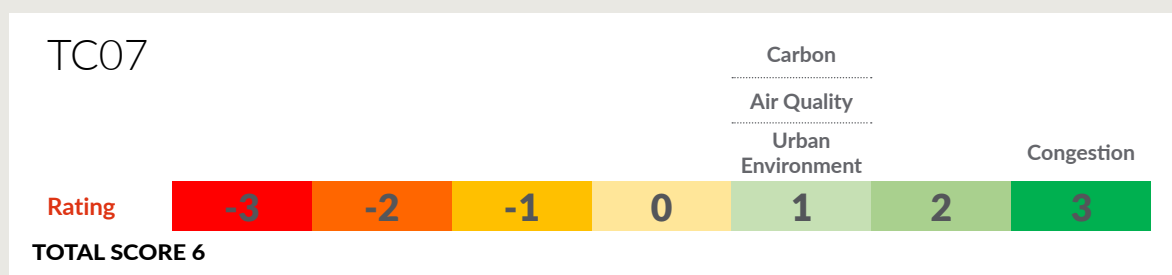
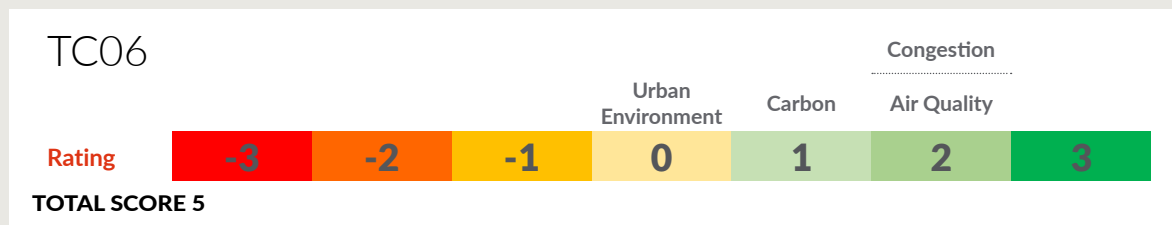
Dublin City Council operate Dublin’s Traffic Management Centre in collaboration with Dublin Bus and An Garda Síochána. Using over 300 CCTV cameras and SCATS signalling technology, traffic volumes at hundreds of junctions are monitored and junction timings are adjusted dynamically depending on traffic flows. When traffic accidents occur, traffic light timings can be overridden to reduce congestion. Investment is ongoing to use the data gathered to drive further automation and incident detection.⁹⁵

Further integration of traffic management with public transport operation will take place when Dublin City Council’s Traffic Management Centre is co-located with the recently approved new National Train Control Centre to be constructed at Heuston Station⁹⁶. This control centre will oversee management of all train traffic in the country and all road transport in Dublin. There are potential benefits for continued NTA investment in control centres for all public transport modes in each of the cities, as public transport supply increases through the delivery of the planned city strategies.

Summary Assessment

- Urban traffic control centres can play a key role in more efficiently managing the capacity of the existing transport network, smoothing demand through integrated partnership working and the pushing out of key disruption information combined with travel alternatives. Therefore, they offer substantial congestion management benefits, with correlating benefits for reducing carbon and improving air quality and the urban environment.
- SCATS require ongoing operations management, maintenance and upgrades to maximise efficiency of the existing transport network.
- Implementation of initiatives such as Bus Gates (via ANPR) can be a very effective demand management measure that does not require new road space.
- A co-ordinated control centre for public transport in each city will allow for better management and integration of existing public transport infrastructure, resulting in more-reliable and more-efficient public transport services and ultimately help retain passenger numbers.
- This centre would also offer opportunities to ‘push’ out relevant travel information during times of disruption/incident management.
- As with SCATS, this approach will require ongoing operations management, maintenance and upgrades to maximise efficiency.

Impact in Delivering the Study Objectives



⁹⁵ <https://smartdublin.ie/smartstories/traffic-management-centre/>

⁹⁶ <https://www.irishtimes.com/news/ireland/irish-news/new-135m-rail-control-centre-planned-for-heuston-station-1.3960614>

Best Practice Evidence

Transport for the West Midlands⁹⁷ launched a Regional Transport Coordination Centre (RTCC) in January 2020 which aims to bring together real time information for all transport modes in coordination with existing control centres in the region. Staff from West Midlands transport authorities, emergency services, bus, rail and tram operators will work together during major events and incidents. Similarly, to the Dublin Traffic Management Centre, staff have the access to CCTV footage from junctions across the region and can rephase traffic lights to alleviate bottlenecks, reduce 'bus bunching' and re-route buses in the event of a traffic incident.

Stakeholder Feedback

Concern was shown for the lack of resource required for control centres for all public transport modes and Urban Traffic Management Control systems (UTMCs). The use of different UTMC systems across Ireland was also noted as a concern, with the need for one common system noted. Stakeholders did recognise the need to keep pace with and retain flexibility in integrating new technology, data, and digital platforms, as they become available.

"We have the UTMC there, it's an automated system so we don't have it fully resourced at the moment, the person who was running that ... is running two jobs at the moment, so there is a resource issue there ..., especially with COVID-19 at the moment. We do have the technology there, but I suppose we're probably not harnessing it as much as we could be at the moment."

"We do have an Urban Transport Control Centre, and I suppose the reality is we keep on growing it. Really, it takes a lot of money to grow that whole asset outside the business so we are very much reliant on the support of NTA as we bring on more schemes to actually grow that system."

"There needs to be a common system in Ireland. The UK uses the one system and professional staff that move between local authorities are trained in the one system. Consulting Engineers are also familiar with the one system. In Ireland there are different systems, SCATS in Dublin, Spot Utopia in Galway, SCOOT in Limerick and Cork. The Highways Agency in the UK sets the standard and specification for UTMC and signals in the UK. There is a need for a similar specification in Ireland."

97 <https://www.wmca.org.uk/news/transport-secretary-officially-opens-congestion-busting-transport-centre-for-the-west-midlands/>

6

TC08

MEASURE TYPE

Existing enhanced



Parking - Wayfinding & Variable Message Systems

TC08: Smart Parking Wayfinding & VMS

Continued development & resources for Smart Parking wayfinding & Variable Messaging Systems (VMS) to support proactive traffic management

Additional Description

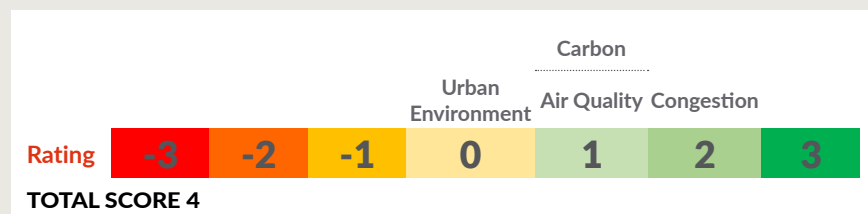
There are currently a number of signs in each of the five study cities indicating the available number of parking spaces in nearby car parks in real-time. The continued development and implementation of 'smart parking' wayfinding and VMS is recommended as part of the Five Cities Toolkit.

Car parking wayfinding and VMS can also support the proactive Urban Traffic Management measure described above.

Summary Assessment

- The implementation of 'smart parking' can have numerous benefits for drivers, city businesses and overall congestion, improving overall road network efficiency and safety.
- For drivers, it reduces the unpredictability of finding a parking space and reduces journey times (and emissions) by limiting the time spent searching for spaces or driving to multiple car parks.
- Businesses can benefit from the improved accessibility of the city centre, particularly where businesses are impacted by other demand and traffic management measures.
- Overall, the availability of parking information can reduce cruising time searching for parking, therefore reducing traffic congestion, travel times, carbon and air pollution.
- The reduced delays for car users looking for parking spaces and any reduction in congestion this generates are both likely to hinder efforts to reduce overall car use.
- VMS also offers opportunities to provide information about sustainable mobility mode alternatives (for example cycle parking information, or sustainable mobility messaging), as illustrated in the image above.

Impact in Delivering the Study Objectives



Stakeholder Feedback

Stakeholders indicated general support for parking wayfinding and variable message systems.

7

Summary of Measures not included for Recommendation

Summary of Measures not included within Study Recommendations

Based on the assessment a number of the Study measures were excluded from the recommended Demand Management Study.

Some of these discounted measures are as a result of an alternative (and mutually exclusive) measure having been assessed as more closely meeting the Study Objectives and as a result of the more detailed qualitative assessment, (including cost effectiveness) in comparison to that alternative measure. Others have been discounted due to their similarity to another measure, where both meet the Study Objectives and scored well on the more detailed qualitative assessment, but it was judged that the recommendation of both measures would lead to duplication of efforts and undue complexity in implementation.

The Tier 1 measures have been considered in more detail as to how they might be applied in each of the cities individually. In some cases, the measures are more suitable for implementation in particular cities whilst not being particularly appropriate for others. Therefore, some measures are not recommended within this study for particular cities.

Other discounted measures, while having merit in their own right, were assessed as not strongly enough meeting the Study Objectives (and are therefore out of scope for the purposes of this Study), or of having limited geographical application within the context of the five cities.

TABLE SUMMARY OF DISCOUNTED DEMAND MANAGEMENT MEASURES

Theme	Sub-Theme	Discounted Measure	Measure reference	Measure Description	Note
Tier One – Transport Demand Management Strategy Pillars					
Fiscal	Vehicle Taxation	Vehicle Taxation per km	FM02	Mileage Based Vehicle Taxation per km	FM03 Time/Location based Vehicle Taxation per km recommended instead. FM02 cannot act as a targeted demand management measure for the five cities. With flat rates applying across the country there are risks of disproportionate impact on those without access to alternatives and rural areas where driving distances tend to be greater. FM03 has advantages in that the rate of tax can be adjusted geographically and temporally and thereby facilitates targeted TDM to address specific issues within the five cities. FM02 and FM03 could not be applied simultaneously although there could be a transition from one to the other. Whilst FM02 is discounted in the specific context of the Five Cities Transport Demand Study, it may be appropriate at a national level to serve wider objectives.
	Congestion Charging	Congestion Charging – Galway	FM11	Further examination/ evidence required in relation to Congestion Charging within a specified zone (Cork, Dublin & Galway)	Congestion Charging for Limerick and Waterford were discounted as a measure at the initial Screening Stage of the Study. Further consideration was given to its application within Cork, Dublin and Galway. This concluded that there is merit in further consideration of this option in Dublin and Cork, but not for Galway. As part of Phase Two of the Recommendations Report, the quantified RMS modelling indicated that in Cork, there is a risk that redistributed traffic would reduce the benefits and potentially result in a negative overall impact against the Study Objectives, for example, a small increase in carbon emissions. The work undertaken to date did not extend to identifying mitigation measures or traffic management interventions to address the knock on impacts outside the congestion zone, which should be examined if FM11 proposals for Cork are brought forward by relevant stakeholders. Opportunities may arise in the future in Galway with the delivery of enhanced public transport and park and ride facilities as envisaged in the Galway Transport Strategy, but for now, congestion charging for Galway does not form part of this Study's recommendations.
Air Quality	Clean Area Zones/Low Emissions Zones	Clean Air Zone via ANPR	AQ04	Clean Air Zone (CAZ) via ANPR (where significant Air Quality concerns arise in individual cities)	AQ04 and AQ05 are mutually exclusive in any one city and whilst it would be possible to apply different enforcement in different cities, for simplicity of understanding a common framework for all cities would be preferable. AQ05 Clean Air Zone via Vehicle Sticker System is recommended instead of AQ04 Clean Air Zone via ANPR – principally due to the high cost of implementing ANPR infrastructure and ease of any future city-by-city roll out programme (should this be required). CAZ/LEZ schemes can be combined with congestion charging as is the case in London and Milan and would typically utilise ANPR. It is recommended that the planning of the implementation of a CAZ (should it be required), takes into consideration the outcome of the RMS modelling assessment regarding a Congestion Charge for Cork and / or Dublin (FM11). FM11 performed well in Dublin, therefore if required, a CAZ with ANPR may be suitable in Dublin. In Cork, additional work would be required to identify mitigating measures or traffic management to address the impacts of a Congestion Charge – therefore this should be examined if either FM11 or AQ04 is brought forward by relevant stakeholders in Cork.
Parking & Traffic Management	Workplace Parking Levy	Workplace Parking Levy – Dublin and Cork	PTM01	Undertake additional examination and research as to potential application of a Workplace Parking Levy within a pilot City (Cork, Dublin & Galway)	A Workplace Parking Levy for Limerick and Waterford city was discounted as a measure at the initial Screening Stage of the Study. Further consideration was given to its application within Dublin, Cork and Galway, with Galway recommended for further examination and evidence. The suitability to implement some measure depends on whether other interventions proceed. In the case of workplace parking levy, it would likely provide only marginal additional benefits to a Congestion Charge or Clean Air Zone (depending on configuration). As Congestion Charging is recommended for further consideration for Dublin and Cork, it is not proposed to consider a Workplace Parking Levy for those cities at this time.
Integrated Planning Policy	Transport & Public Health	Healthy Streets	PP01	Develop and embed the concept of Healthy Streets assessments through the national and local planning process, implementing at local level	Both PP01 and PP08 15 Minute Neighbourhoods were ranked highly as potential demand management measures, ranking 3rd and 1st respectively. Given the similarity between the two Planning-led approaches, it was felt that this duplication would add an additional layer of complexity in Ireland's planning process. Healthy Streets has to date only been implemented in London whereas 15 Minute Neighbourhoods is increasingly being applied in towns and cities across Europe and elsewhere. It is recommended that PP08 15 Minute Neighbourhoods is taken forward, with relevant elements of best practice exemplified by Healthy Streets utilised to support the ongoing implementation of PP08 – including the assessment of new planning applications and the evaluation and engagement approach to assess the impact of the initiative on people living, working and visiting local areas and streetscapes.

Theme	Sub-Theme	Discounted Measure	Measure reference	Measure Description	Note
Tier Two A – National Toolkit Demand Management Measures					
Fiscal	Fuel Pricing	Fuel Pricing	FM07	Progressive taxation measures to discourage diesel use and enhance take up of alternative cleaner fuels	Fuel taxation is an important mechanism to ensure the user contributes to the cost of providing road infrastructure and the cost of mitigating the harmful environmental impacts of road-based transport. As a demand management approach to influencing people's travel decisions within the five cities, FM07 is considered to be largely ineffective. The underlying fluctuations in the resource cost of fuel results in significant price changes that cannot be controlled for as would be needed to best meet the objectives of this Study. Fuel taxation is an important national fiscal measure and is directly aligned to the polluter pays principle; however, it is ruled out as a demand management measure in the context of this Study relating specifically to addressing the Study Objectives within the five cities.
	Scrappage Schemes	Vehicle Scrappage Scheme – Purchase of Electric Vehicle	FM08	Vehicle Scrappage Schemes which provide discounts on the purchase of new, clean private and commercial vehicles when high-polluting vehicles are scrapped (in return for an EV grant)	While having air quality benefits by reducing the number of worst polluting vehicles in the fleet, the impact of FM08 to deliver the overall Study Objectives was assessed as limited. This is principally due to the likelihood that scrapping road-worthy vehicles before the end of 'their natural life' was likely to generate more carbon emissions (from the production of the new vehicles) than would be saved by the improved fuel efficiency. This measure was also out-performed by FM09 (Scrappage in return for mobility credits).
Tier Two B – City Toolkit Demand Management Measures					
Parking & Traffic Management	Traffic Management	Decreased Speed Limits on Urban Motorways	PTM15	Decreased Speed Limits on Urban Motorways	While having benefits in terms of reducing emissions on the overall national strategic road network, the impact of PTM15 to deliver the key Study Objectives within the five cities was assessed as not sufficient to warrant inclusion as a Study recommendation. This is principally due to its limited application on urban motorways within the cities. In addition, the disbenefits in terms of increased journey times of lower speed limits on applicable sections of urban motorways would offset the benefits from reduced emissions and would do little to reduce traffic demand within the five cities. A 'watching brief' should be kept on the Highways England trials currently underway and the impact of these trials on local air pollution. If in the future, there are legal obligations to achieve a given level of air quality along stretches of urban motorways, learnings from these trials can be applied, as part of any future re-assessment of this measure. Note that schemes to introduce variable speed limits (for example on the M50), as a way of managing congestion on these motorways are considered elsewhere in this report within the recommended City Toolkit measures.
Technology & Communications	Intelligent Transport Systems	Ramp Metering on National Roads	TC04	Ramp Metering on National Roads	While having definite benefits in terms of managing congestion on the strategic road network, and addressing motorway safety and reliability, the impact of TC04 to deliver the key Study Objectives within the five cities was assessed as not sufficient to warrant inclusion as a Study recommendation. This is principally due to its limited application outside the strategic road network. Furthermore, ease of delivery is uncertain and may be limited due to physical constraints. There may be potential for Ramp Metering on other parts of the strategic road network in Dublin, at the Bloomfield Interchange in Cork, and also in the future in Limerick. Outside this Study, additional research and examination would be required to assess the feasibility and benefits of this as a demand management measure on focused parts of the strategic road network.

Five Cities Demand Management Study

8

Delivery Roadmap

The Roadmap Approach

Tier 1 Framework Demand
Management Measures

Tier 2 National & City Toolkit
Roadmap

The Roadmap Approach

The five Study cities are challenged with meeting steadily increasing mobility demands as our population grows. Effective Transport Demand Management (TDM) measures will be needed to respond to the increasing mobility needs of the growing population and economies of the five cities, while continuing to manage congestion, reduce greenhouse gas emissions, improve air quality and improve the urban environment.

This Study has identified a wide range of TDM measures that have been qualitatively assessed to be effective in addressing the Study Objectives. The challenge now is to help progress the implementation of these measures through the preparation of an emerging Delivery Roadmap.

The Recommended Tier 1 TDM Measures

The Tier 1 measures have been examined at the national and individual city level and combined to form the recommended strategic pillars for the future development of TDM in Dublin, Cork, Limerick, Galway and Waterford. Where appropriate, these Tier 1 measures have also been further refined and assessed utilising the NTA's Regional Modelling System as part of Phase 2 of this Study – which has in turn informed the refinement of the Delivery Roadmap.

Recommended Tier 2 TDM Measures

The recommended Tier 2 measures have been compiled into two toolkits, one containing national measures and one containing measures which could be implemented at a city level. The TDM Tier 2 Delivery Roadmap is intended to be a resource for stakeholders to identify appropriate measures for given situations.

Delivering the Roadmap – Funding and Organisation

Consideration of this emerging Tier 1 Roadmap and the recommended Tier 2 Toolkits would be beneficial in informing the future investment, planning and ongoing funding of demand management. The management of funding of TDM is complex given the diverse measures and many interactions with wider issues. Whilst a central or dedicated funding stream for TDM would ringfence investment, it may not be the most efficient use of resources, particularly if there is duplication with other publicly funded interventions.

It is recommended that a signposting resource is developed to aid delivery of TDM under the Tier 2 Toolkits. This is envisaged as an online 'live' database that would identify potential alignment between the implementation of desirable TDM measures and available national and EU funding sources.

Given the complexity and interdependency of the range of recommended TDM measures, embedding a TDM approach into national, regional and local planning, policies and delivery mechanisms will be critical to provide an integrated framework to achieve the Study Objectives, both nationally and within each of the five Study cities.

Outcome of Tier 1 Assessment – Phase 1

Rank	Recommended for Inclusion in emerging Roadmap	Not included in Roadmap due to higher ranking alternative	Further Consideration to Come
1	PP08 15 Minute Neighbourhoods		
2	PP04 National Planning Framework Delivery Management		
3		PP01 Healthy Streets – Overlaps with PP08	
4	PTM04 Public Parking Controls		
5	FM03 Time/Location Based Vehicle Taxation per km		
6	FM05 Alternative Fuelled Vehicle Support		
7	FM01 Progressive Vehicle Taxation		
8	PP03 Transport Appraisal Enhancements		
9		FM02 Vehicle Taxation per km – Overlaps with FM03	
10	AQ01 Clean Air Enabling Legislation		
11			FM11 Congestion Charge
12			PTM01 Workplace Parking Levy
13			AQ05 Clean Air Zone via National Vehicle Sticker System
14			AQ04 Clean Air Zone via ANPR (in conjunction with FM11 in Dublin)

Please note, the fleet-related impacts of the package of vehicle fleet-influencing measures in each city are reported in Supporting Document D.

Outcome of Tier 1 Assessment – Phase 2

Following the quantitative RMS modelling, the outcome of the Tier 1 Assessment has been refined as outlined in the Table below. This outcome utilises an average across applicable cities for each measure.

Rank	Recommended for Inclusion in Delivery Roadmap	Change from Phase 1 Assessment	Not included in Roadmap due to higher ranking alternative
1	PP08 15 Minute Neighbourhoods	No change	
2	PP04 National Planning Framework Delivery Management	No change	
3		No change	PP01 Healthy Streets – overlaps with PP08
4	PTM04 Public Parking Controls	No change	
5	FM01 Progressive Vehicle Taxation	Previously 7th	
6	FM05 Alternative Fuelled Vehicle Support	No change	
7	FM03 Time/Location Based Vehicle Taxation per km	Previously 5th	
8	PP03 Transport Appraisal Enhancements	No change	
9		No change	FM02 Vehicle Taxation per km – overlaps with FM03
10	AQ01 Clean Air Enabling Legislation	No change	
11	FM11 Congestion Charge (Dublin & Cork)	No change	
12	PTM01 Workplace Parking Levy (Galway)	No change	
13	AQ05 Clean Air Zone via National Vehicle Sticker System	No change	
14	AQ04 Clean Air Zone via ANPR	No change	

In addition, the outcome of the Tier 1 Assessment on a **city-by-city basis** is also shown below.

DUBLIN

Rank	Recommended for Inclusion in Delivery Roadmap	Not included in Roadmap due to higher ranking alternative
1	PP08 15 Minute Neighbourhoods	
2	PP04 National Planning Framework Delivery Management	
3		PP01 Healthy Streets – overlaps with PP08
4	FM01 Progressive Vehicle Taxation	
5	FM03 Time/Location Based Vehicle Taxation per km	
6	FM05 Alternative Fuelled Vehicle Support	
7	PP03 Transport Appraisal Enhancements	
8	PTM04 Public Parking Controls	
9		FM02 Vehicle Taxation per km – overlaps with FM03
10	AQ01 Clean Air Enabling Legislation	
11	AQ05 Clean Air Zone via National Vehicle Sticker System	
12	AQ04 Clean Air Zone via ANPR	
13	FM11 Congestion Charge	

CORK

Rank	Recommended for Inclusion in Delivery Roadmap	Not included in Roadmap due to higher ranking alternative
1	PP08 15 Minute Neighbourhoods	
2	PP04 National Planning Framework Delivery Management	
3		PP01 Healthy Streets – overlaps with PP08
4	PTM04 Public Parking Controls	
5	FM01 Progressive Vehicle Taxation	
6	FM03 Time/Location Based Vehicle Taxation per km	
7	FM05 Alternative Fuelled Vehicle Support	
8	PP03 Transport Appraisal Enhancements	
9		FM02 Vehicle Taxation per km – overlaps with FM03
10	AQ01 Clean Air Enabling Legislation	
11	AQ05 Clean Air Zone via National Vehicle Sticker System	
12	AQ04 Clean Air Zone via ANPR	
13	FM11 Congestion Charge	

LIMERICK

Rank	Recommended for Inclusion in Delivery Roadmap	Not included in Roadmap due to higher ranking alternative
1	PP08 15 Minute Neighbourhoods	
2	PP04 National Planning Framework Delivery Management	
3		PP01 Healthy Streets – overlaps with PP08
4	PTM04 Public Parking Controls	
5	FM01 Progressive Vehicle Taxation	
6	FM05 Alternative Fuelled Vehicle Support	
7	FM03 Time/Location Based Vehicle Taxation per km	
8	PP03 Transport Appraisal Enhancements	
9		FM02 Vehicle Taxation per km – overlaps with FM03
10	AQ01 Clean Air Enabling Legislation	

GALWAY

Rank	Recommended for Inclusion in Delivery Roadmap	Not included in Roadmap due to higher ranking alternative
1	PP08 15 Minute Neighbourhoods	
2	PP04 National Planning Framework Delivery Management	
3		PP01 Healthy Streets – overlaps with PP08
4	PTM04 Public Parking Controls	
5	FM05 Alternative Fuelled Vehicle Support	
6	PP03 Transport Appraisal Enhancements	
7	FM01 Progressive Vehicle Taxation	
8	FM03 Time/Location Based Vehicle Taxation per km	
9		FM02 Vehicle Taxation per km – overlaps with FM03
10	AQ01 Clean Air Enabling Legislation	
11	PTM01 Workplace Parking Charges	

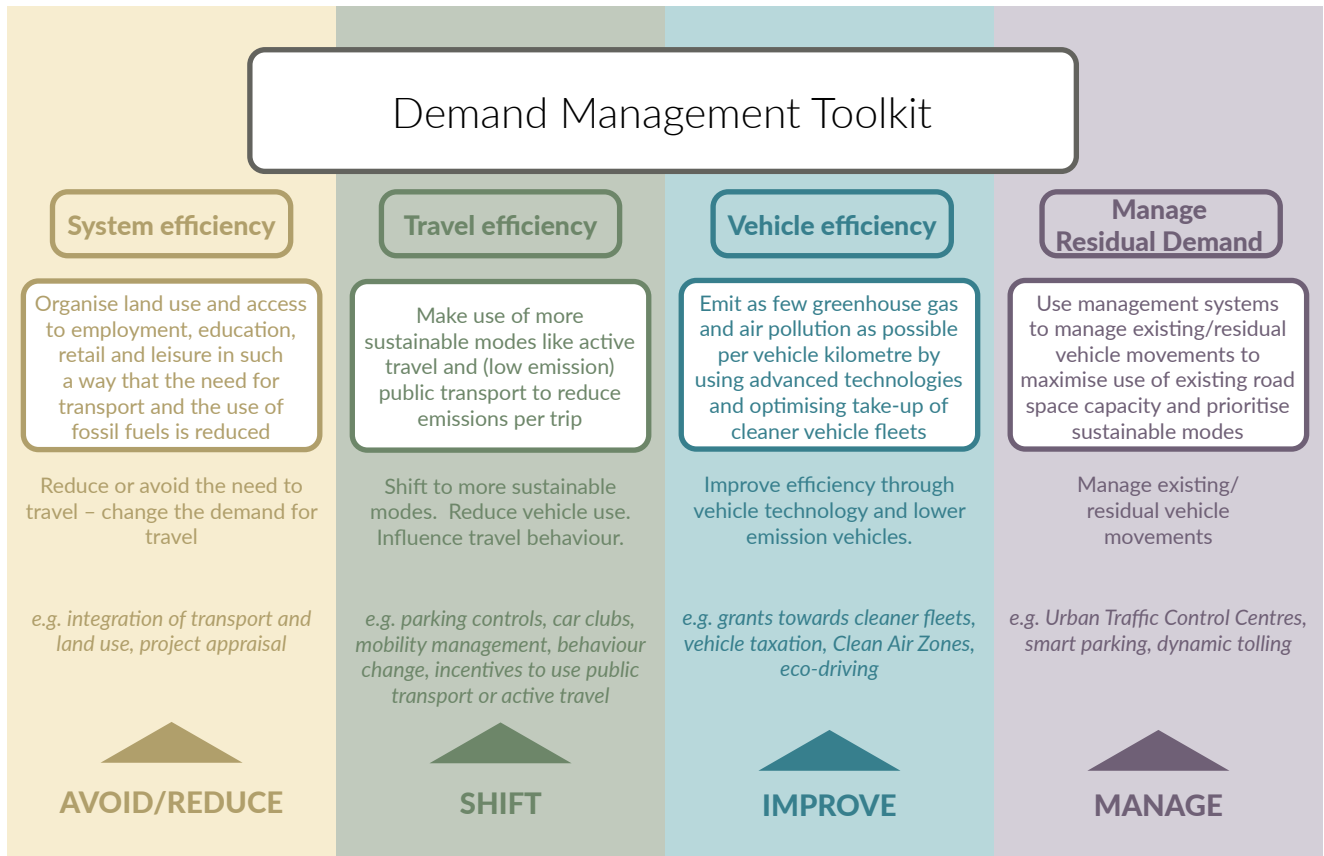
WATERFORD

Rank	Recommended for Inclusion in Delivery Roadmap	Not included in Roadmap due to higher ranking alternative
1	PP08 15 Minute Neighbourhoods	
2	PP04 National Planning Framework Delivery Management	
3		PP01 Healthy Streets – overlaps with PP08
4	FM05 Alternative Fuelled Vehicle Support	
5	FM01 Progressive Vehicle Taxation	
6	PP03 Transport Appraisal Enhancements	
7	PTM04 Public Parking Controls	
8	FM03 Time/Location Based Vehicle Taxation per km	
9		FM02 Vehicle Taxation per km – overlaps with FM03
10	AQ01 Clean Air Enabling Legislation	

Development of the Roadmap

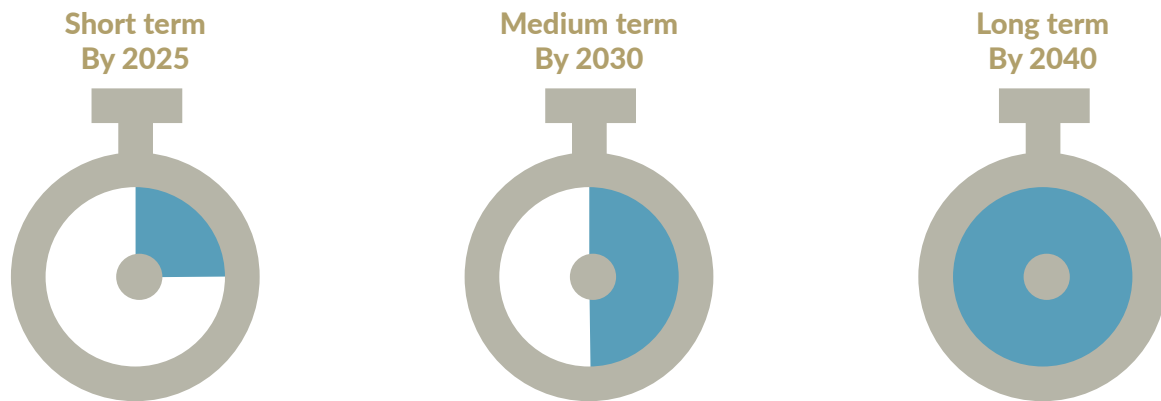
In developing this emerging roadmap, the influence of the measure has been considered using an approach, known as A-S-I (Avoid/Reduce; Shift; Improve). The A-S-I approach entails three categories which we have expanded for the purposes of this Study by adding a fourth pillar 'Manage':

- **Avoid/Reduce** – avoid or reduce the need to travel.
- **Shift** – to more sustainable transport modes.
- **Improve** – environmental sustainability of residual vehicular traffic.
- **Manage** – day to day efficiency of the transport network.



Delivery Roadmap – Timescales

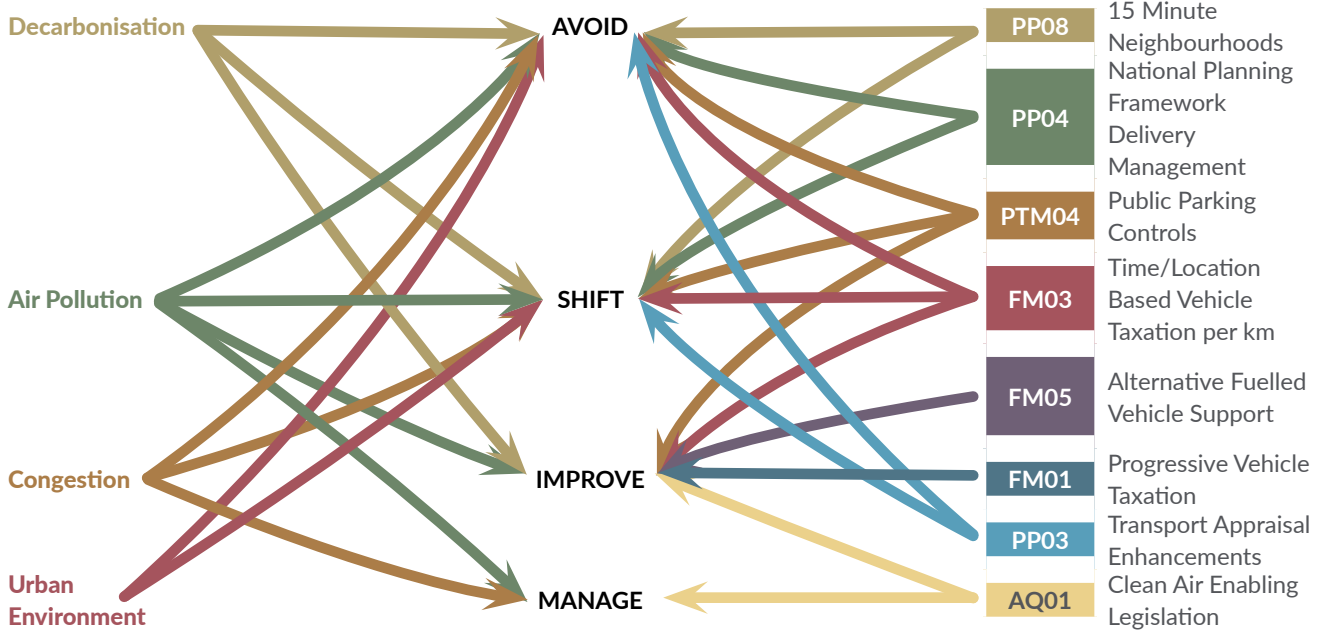
The proposed delivery of the Demand Management Roadmap has been segmented into different timeframes as follows:



Tier 1 Framework Demand Management Measures

The assessment has identified clear rankings of the TDM pillars. It is envisaged that these pillars will be used to underpin future TDM in all five cities. The Tier 1 Pillars support the A-S-I-M approach.

As illustrated on the figure below, there is more correlation between the Tier 1 and the A-S-I-M categories, which is not unexpected given their strategic nature, as opposed to day to day management of transport demand.



The top three ranked Tier 1 measures within the emerging Roadmap are expected to have relatively greater impact in achieving the Study objectives. These three priority measures have been considered in some extra detail.

TDM	City Considerations	Timescale Considerations	Implementation Considerations	Lead Responsibility
PP08 15 Minute Neighbourhoods	Each city has its own characteristics. It is envisaged that 15 Minute Neighbourhoods will be adopted as a broad goal, with specific priorities for intervention set at a local level for existing and new development areas.	Initial planning for the implementation of 15 Minute Neighbourhoods should commence in the short term, with implementation ongoing into the medium and longer term.	Guidance on the implementation of the 15 Minute Neighbourhood TDM to be prepared and action plans created for each City. A training, assessment, evaluation and monitoring framework should be prepared and followed.	Dept of Housing, Local Government & Heritage , Dept of Transport & Office of the Planning Regulator
PP04 National Planning Framework Delivery Management	The Metropolitan Area Transport Strategies, Regional Spatial and Economic Strategies and the Local Plans to come will progress the aims of the NPF. Arising out of these, key challenges for the delivery of strategic transport and well-integrated major development areas can be identified for each city.	All five cities are facing immediate challenges to deliver significant levels of growth in a sustainable manner as per the objectives of the NPF. The delivery of the NPF is already underway and will extend into the long term.	It will be important not to duplicate the functions of existing agencies and oversight structures. A national level partnership approach to the management of land use and transport integration as part of the delivery of the NPF may be most efficient, with consideration for the creation of tailored institutional set-ups to co-ordinate and oversee specific key development areas and transport projects within the cities.	Dept of Housing, Local Government & Heritage , Dept of Transport & Office of the Planning Regulator
PTM04 Public Parking Controls	The cities are not uniform in their parking pressures, stock or controls. In general, parking controls have been progressively improving in recent years. Whilst parking policy will help to support the further development of parking controls, there will need to be flexibility to allow for locally tailored interventions.	Parking controls are an existing TDM and it is envisaged that they will continue to play a vital role in achieving the study objectives in the short, medium and longer term.	It is important to understand the issues as fully as possible, before any significant change to parking policy is implemented. An audit and record of parking, both public and private, should be established. A national level parking policy structure would be beneficial, particularly to ensure co-ordination of parking controls across neighbouring authorities. All policies should include for enforcement considerations, cost of parking management and financial implications. The development of an Area Based Parking Management approach (which is essentially about the management of all vehicle parking within urban spaces), would also support the sequencing of activities in relation to a number of other measures including 15-Minute Neighbourhoods, EV recharging strategies, Car Clubs, Parking Standards and Area Mobility Management Plans - providing a framework for delivery.	Dept of Housing, Local Government & Heritage, Housing & Local Government , Dept of Transport, Local Authorities

THE REMAINING TIER 1 MEASURES THAT ARE INCLUDED IN THE DELIVERY ROADMAP ARE AS FOLLOWS:

TDM	Roadmap Considerations	Timescale	Lead Responsibility
FM01 Progressive Vehicle Taxation	Frequent major overhauls of vehicle taxation will not be politically acceptable. A certain level of certainty on the direction of taxation is needed to maximise the beneficial impacts.	Short to Medium term	Dept of Finance & Dept of Transport
FM05 Alternative Fuelled Vehicle Support	It is anticipated that support will need to be dynamic and varied, to respond to market and economic conditions. Further research to ascertain barriers to uptake of alternative fuelled vehicles would be beneficial, to inform the detailed implementation of the measure.	Short term	Dept of Finance & Dept of Transport
FM03 Time/Location Based Vehicle Taxation Per Kilometre	Cannot be progressed until technology is proven to support practical implementation. Longer term planning required.	Long term	Dept of Finance & Dept of Transport
PP03 Transport Appraisal Enhancements	Transport appraisal should be proportionate to the scale of the project. Enhancements should not be overly onerous that they delay key projects.	Across the Roadmap period	Dept of Transport, National Transport Authority, Transport Infrastructure Ireland
AQ01 Clean Air Enabling Legislation	The UK's Department for Environment, Food & Rural Affairs and Department for Transport produced a policy paper on air quality: clean air zone frameworks for England. Similar guidance for Ireland, setting out the principles local authorities should follow when setting up a CAZ, would be beneficial.	Short Term	EPA, Dept of the Environment, Climate & Communications and the Dept of Transport
FM11 Congestion Charge (Dublin & Cork)	Additional more detailed Feasibility Studies would be required by local stakeholders to determine in more detail the feasibility and detailed business case of implementing a congestion charge in Dublin or Cork, including the required mitigation measures.	Short Term	Dept of Transport for initial progression; with later responsibility likely to be given to Dublin/Cork Local Authorities, the National Transport Authority and/or Transport Infrastructure Ireland
PTM01 Workplace Parking Levy (Galway)	A more detailed Feasibility Study would be required by local stakeholders to determine in more detail the feasibility and detailed business case of implementing a Workplace Parking Levy in Galway, including the required mitigation measures.	Short to Medium Term	Dept of Transport for initial progression; with later responsibility likely to be given to Galway City Council and the National Transport Authority
AQ05 Clean Air Zone via National Vehicle Sticker System	For consideration if the need for Clean Air Zones arise in the medium to long term. A National Vehicle Sticker System has the benefit of being applied across individual towns and cities should issues be identified in the future with air pollution at a local or city level. The implementation of AQ05 over AQ04 would provide a level of national consistency, provide flexibility for implementation and reduce the requirement for set up installation costs when compared to AQ04.	Short to Medium Term	EPA, Dept of the Environment, Climate & Communications, Dept of Transport and the National Transport Authority
AQ04 Clean Air Zone via ANPR		Short to Medium Term	EPA, Dept of the Environment, Climate & Communications, Dept of Transport and the National Transport Authority

SUMMARY OF TIER 1 IMPLEMENTATION TIMESCALES

A-S-I-M			Short Term	Medium Term	Longer Term
Avoid to: Decarbonise Address Air Pollution Manage Congestion Improve the Urban Environment	PP08	15 Minute Neighbourhoods	→		
	PP04	National Planning Framework Delivery Management	→		
Shift to: Decarbonise Address Air Pollution Manage Congestion Improve the Urban Environment	PTM04	Public Parking Controls	→		
	PP03	Transport Appraisal Enhancements	→		
	FM03	Time/Location Based Vehicle Taxation Per Kilometre	→		
	PTM01	PTM01 Workplace Parking Levy (Galway)	→		
Improve to: Decarbonise Address Air Pollution	FM05	Alternative Fuelled Vehicle Support	→		
	FM01	Progressive Vehicle Taxation	→		
Manage to: Address Air Pollution Manage Congestion	AQ01	Clean Air Enabling Legislation	→		
	AQ04 & AQ05	Clean Air Zones	→		
	FM11	Further assessment of Congestion Charging (Dublin & Cork)	→		

Summary

The Phase 1 qualitative assessment and Phase 2 quantitative modelling has informed this Delivery Roadmap for the implementation of Transport Demand Management (TDM) measures across the five cities.

While there may be some measures that have performed more strongly in some cities compared to others, a combined national level approach to the planning and implementation of demand management is recommended. In some cases, it may not be possible or practical to implement very similar measures in multiple cities. For example, it is unlikely to be possible to implement both FM01 and FM03 concurrently. Also, for the purposes of public understanding, it would be desirable to avoid the complexity of implementing similar measures, such as AQ04 and AQ05, separately in different cities.

What has also emerged clearly from this Study is that there is no silver bullet or one single solution. In order to deliver the key Study Objectives of reducing carbon, managing congestion, and improving air quality and the urban environment, it is clear that a package of TDM measures is required at both a national and a city level.

Tier 2 National & City Toolkit Roadmap

Tier 2a National Toolkit Roadmap

Using the A-S-I-M principles of sustainable travel demand management outlined above, the proposed Delivery Roadmap for the Tier Two National Toolkit measures is outlined in the table below. This Toolkit would be used by national organisations and cities to address particular areas of concern in relation to carbon, air quality and congestion in order to enable the focused implementation of measures to address these issues.

The table below also outlines the proposed timeline for the delivery of the recommended measures within the National Toolkit, along with those organisation(s) identified as lead responsibility for the implementation of individual measures.

TABLE IMPLEMENTATION ROADMAP - TIER 2A NATIONAL TOOLKIT

Approach	Measure Ref	Measure	Measure Description	Delivery Timescale	Lead Responsibility		
System Efficiency	AVOID / REDUCE DEMAND	Change demand for travel	PP02	Public Health & Transport	Improve integration between Public Health & Transport, including focused resources to embed physical activity and improve air quality outcomes through the health system, land use planning & behavioural change programmes	Short to Medium	HSE (with DoT and NTA)
			BC01	ISO50001 Energy Management Standard – public sector	Mandatory implementation of ISO50001 Energy Management Standard (or similar Energy Management standards) for all public sector bodies	Short	SEAI
Travel Efficiency		Reduce vehicle use	BC02	ISO50001 Energy Management Standard – private sector	Resources to support and encourage private sector to implement ISO50001 Energy Management Standard (or similar Energy Management standards) (e.g. via SEAI's EXEED scheme)	Short	SEAI
			FM09	Vehicle Scrappage Scheme – Mobility Credits	Vehicle Scrappage Schemes which provide mobility credits for sustainable transport in exchange for high-polluting private vehicles being scrapped (further examination / evidence as regards the potential for Pilot Study in larger cities, with smaller cities pending outcomes).	Short	Dept of Transport (with NTA and Pilot City)
SHIFT DEMAND		Influence travel behaviour	FM10	Sustainable Travel Incentives	Progressive tax subsidies to incentivise sustainable travel (e.g. Tax Saver; Cycle to Work scheme; Business related EV & cycle mileage eligibility & incentive improvements)	Short	Dept of Finance (with DoT & NTA)
			AQ03	Air Quality Citizen Engagement	Continue EPA roll of AQ citizen engagement programmes (e.g. Globe Schools, Curious Noses/ Clean Air Ireland) to enhance awareness of air quality and support behaviour change	Short	EPA (with Local Authorities)
			TC01	Next Generation Ticketing	Roll out of next generation ticketing systems across all modes including PT, cycle hire & parking	Short to Medium	NTA
			TC02	Mobility as a Service pilot	Mobility as a Service - further examination and evidence review to identify potential to undertake a pilot, including trialling demand responsive services	Short to Medium	NTA (with Pilot City)

Approach		Measure Ref	Measure	Measure Description	Delivery Timescale	Lead Responsibility	
Vehicle Efficiency	IMPROVE VEHICLE EMISSIONS	Change to cleaner fleets	FM06	Hydrogen Vehicle Trials	Continue measures to support innovation trials in relation to Hydrogen vehicles	Short to Medium	Department of Transport with NTA
			AQ02	Air Quality Monitoring	Continue EPA roll out of AQ monitoring stations, building capacity and capability for AQ modelling	Short	EPA
			PTM03	Electric Vehicle Charging Management	Technology to support efficient booking and use of public Electric Vehicle charging facilities	Short	Dept of Transport with SEAI
			BC09	Eco Driving	Strategy to encourage and support increased levels of eco-driving for freight, public transport operators, grey fleet and private cars	Short	Dept of Transport
			BC10	Behavioural Change - Cleaner & Lower Emission Fleets	Behavioural change campaign to support switch to cleaner, lower emission fleets for next vehicle purchases (including private cars & taxis)	Short	SEAI
Manage Residual Demand	Manage residual vehicle movements	TC09	Connected Vehicles	Development and use of connected vehicles, leading to more efficient driving and use of road space	Long term	RSA	

Tier 2b City Toolkit Roadmap

Building on the extensive Demand Management work already undertaken by existing cities (please see *Supporting Document B Baseline Report*) this City Toolkit has been developed to support delivery of the Study objectives.

Utilising the A-S-I-M principles of sustainable travel demand management outlined above, the proposed Delivery Roadmap for the Tier Two City Toolkit measures is outlined in the table below. This Toolkit would be used by each city to address particular areas of concern in relation to carbon, air quality and congestion at a city level in order to enable the focused implementation of measures to address these issues.

It is recommended that all of the measures within the City Toolkit are considered for implementation in the short term (i.e. within the next five years) as required by the individual needs of cities, and that these measures continue to be implemented over the strategy period.

The table below outlines these toolkit measures, along with those organisation(s) identified as lead responsibility for their implementation.

TABLE IMPLEMENTATION ROADMAP - TIER 2B CITY TOOLKIT

Approach	Measure ref.	Measure	Measure Description	Lead Responsibility
System Efficiency	PTM08	Residential Parking Standards	Reduced Residential Parking Standards for new developments in appropriate locations	Local Authorities
	PTM09	Workplace Parking Standards	Reduced Workplace Parking Standards for new developments	Local Authorities
	BC05	Remote Working	Programme of support for employers to encourage flexible working / home working / remote hub working	Local Authorities & Dept of Business, Enterprise & Innovation (DBEI)

Approach	Measure ref.	Measure	Measure Description	Lead Responsibility				
Travel Efficiency	Reduce vehicle use	PTM07	Car Clubs Car Sharing	Foster partnership between national and Local Authorities and private car-share operators with an emphasis on allocation of on-street Car Club/ Car Share spaces within City Parking Strategies	Local Authorities & Car Club operators			
		PTM16	Park & Ride	Improve interchange opportunities via Park & Ride provision on outskirts of cities, focused on reducing longer distance car commuting	NTA & Local Authorities			
		PTM17	Car Free Zones & Streets	Identify areas within cities that Car Free Zones & Streets could have a positive impact on Air Quality and quality of the Public Realm	Local Authorities & EPA			
	SHIFT DEMAND	Influence travel behaviour	BC03	School Mobility Management Plans	School Mobility Management Plans (MMPs) – resources to support Local Authorities and An Taisce with local school MMP implementation e.g. site specific support	Local Authorities & An Taisce		
			BC14	School Streets & Safer Routes to School	Resources to support with local School Streets & Safer Routes to School initiatives including consultation, implementation and monitoring	Local Authorities & An Taisce		
			BC04	Workplace Mobility Management Plans	Workplace Mobility Management Plans (MMPs) – resources to support Local Authorities and the NTA Smarter Travel Team with local workplace & campus MMP implementation e.g. planning compliance monitoring, site specific support	Local Authorities & NTA Smarter Travel Workplaces Team		
		BC07	Residential Mobility Management Plans	Residential Mobility Management Plans (RMMPs) – resources to support planning compliance monitoring and site-specific support	Local Authorities			
		BC08	Area Mobility Management Plans	An area based approach to Mobility Management Planning (including sites near the strategic road network)	Local Authorities & NTA Smarter Travel Workplaces Team & TII			
		BC11	Behavioural Change – reward schemes	Incentive-based applications to reward sustainable travel and off-peak travel behaviour	Local Authorities & NTA			
		BC12	Behavioural Change – marketing new schemes	Resources to lock in benefits of active & sustainable travel infrastructure investment through focused social marketing and behavioural change campaigns	Local Authorities, NTA and SEAI			
		BC13	Behavioural Change – disruption & resilience	Resources to reduce demand, build transport resilience and/or embed sustainable habits during times of disruption through focused social marketing and behavioural change campaigns	Local Authorities & NTA			
		Vehicle Efficiency	IMPROVE VEHICLE EMISSIONS	Change to cleaner fleets	PTM02	Electric Vehicle Charging Strategy	Development & implementation of an EV charging strategy for each city for private cars and taxis, including: County Development Plan Parking Standards; on-street, P&R, Rail Station, Hub, Multi-Storey and eTaxi charging infrastructure	Local Authorities, SEAI and the Dept of Transport
					PTM10	Residential Parking Standards – Electric Vehicles & Car Clubs	Continue to require Electric Vehicle & Car Club spaces within new Residential developments	Local Authorities

Approach	Measure ref.	Measure	Measure Description	Lead Responsibility	
Manage Residual Demand	FM12	Tolling	Further examination/evidence required in relation to multi - point tolling on the M50 (Dublin only)	TII	
	PTM12	HGV Management Strategy	Development & implementation of a HGV Management Strategy for each city	Local Authorities	
			Dublin and Waterford already implementing		
	PTM13	Active Kerbside Management	Active Kerbside Management, cargo bikes/last mile distribution hubs	Local Authorities	
	PTM14	Slow Zones	Expansion of Slow Zones in residential areas	Local Authorities	
	Manage residual vehicle movements	BC06	Staggering school and workplace start and finish times	Staggering school and workplace start and finish time	Local Authorities, Dept for Education, local schools & employers
		TC03	Real Time Passenger Information	Continue the NTA roll out of multi-modal Real Time Passenger Information (RTPI) across all cities	NTA and the Local Authorities
		TC05	M50 Variable Speed Limits	Review impact of current TII plans (subject to legislation) for implementation of variable speed limits along the M50 (as part of eMOS project (Dublin only)	TII
		TC06	Public Transport Control Centres	Continue NTA investment in control centre for all public transport modes, including interactions with Luas.	NTA
		TC07	Urban Traffic Management Centres	Proactive Urban Traffic Management including SCATS system development & resources and the implementation of other initiatives e.g. bus gates	Local Authorities
TC08		Smart Parking Wayfinding & VMS	Continued development & resources for Smart Parking wayfinding & VMS systems to support proactive traffic management	Local Authorities	

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Appendix A - Acronyms

Acronyms

ABTA	Area Based Transport Assessment
ACEA	European Automotive Manufacturer's Association
ANPR	Automatic Number Plate Recognition
AQ	Air Quality
ASOI	Association for the Study of Obesity in Ireland
BEV	Battery Electric Vehicle
CAF	Common Appraisal Framework
CAFE	Clean Air for Europe
CARO	Climate Action Regional Office
CAV	Connected and Autonomous Vehicle
CBA	Cost-Benefit Analysis
CBD	Central Business District
CCTV	Closed-Circuit Television
CITS	Co-operative Intelligent Transport Systems
CMATS	Cork Metropolitan Area Transport Strategy
CNG	Compressed Natural Gas
CO₂	Carbon Dioxide
CSO	Central Statistics Office
CSR	Corporate Social Responsibility
DART	Dublin Area Rapid Transport
DBEI	Department of Business, Enterprise and Innovation
DECC	Department of the Environment, Climate and Communications
DfT	Department for Transport (UK)
DHLGH	Department of Housing, Local Government and Heritage
DMURS	Design Manual for Urban Roads and Streets
DoT	Department of Transport
eMOS	Enhancing Motorway Operating Services
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
eSPSV	Electric Small Public Service Vehicles
ESRI	Environmental Systems Research Institute
EU	European Union
EV	Electric Vehicle
EXEED	Excellence in Energy Operating Services
FCEV	Fuel Cell Electric Vehicle

GDPR	General Data Protection Regulation
GHG	Greenhouse Gas
GLOBE	Global Learning and Observations to Benefit the Environment
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HEV	Hybrid Electric Vehicle
HGV	Heavy Goods Vehicle
HSE	Health Service Executive
ICE	Internal Combustion Engine
ISO	International Organisation of Standardisation
KPIs	Key Performance Indicators
LAP	Local Area Plan
LCO	Lancet Commission on Obesity
LEZ	Low Emission Zone
LGV	Large Goods Vehicle
LSMATS	Limerick Shannon Metropolitan Area Transport Strategy
LTP	Local Transport Plan
MaaS	Mobility as a Service
MASP	Metropolitan Area Strategic Plan
MATS	Metropolitan Area Transport Strategy
MMP	Mobility Management Plan
NCAP	National Climate Action Plan
NDA	National Disability Authority
NDP	National Development Plan
NEDC	New European Driving Cycle
NEEAP	National Energy Efficiency Action Plan
NET	Nottingham Express Transit
NHS	National Health Service (UK)
NO_x	Nitrogen Oxide
NPAP	National Physical Activity Plan
NPF	National Planning Framework
NTA	National Transport Authority
OLEV	Office for Low Emission Vehicles
OMSP	Open Market Selling Price
P&R	Park and Ride
PHEV	Plug-In Electric Vehicle
PM	Particulate Matter

PPK	Price per Kilometre
PPM	Price per Minute
PPP	Public Private Partnership
PT	Public Transport
PTAL	Public Transport Accessibility Level
RA	Regional Assembly
RMMP	Residential Mobility Management Plan
RMS	Regional Modelling System
RSA	Road Safety Authority
RSES	Regional Spatial and Economic Strategy
RTCC	Regional Transport Coordination Centre
RTPI	Real Time Passenger Information
SCATS	Sydney Coordinated Adaptive Traffic Systems
SEAI	Sustainable Energy Authority of Ireland
SIFLT	Strategic Investment Framework for Land Transport
SPSV	Small Public Service Vehicles
TDM	Transport Demand Management
TFI	Transport for Ireland
TfL	Transport for London
TII	Transport Infrastructure Ireland
ULEZ	Urban Low Emission Zone
UTMC	Urban Traffic Management Centre
UTRAP	Urban Traffic-Related Air Pollution
VAT	Value Added Tax
VMS	Variable Messaging System
VRT	Vehicle Registration Tax
WLTP	Worldwide Harmonised Light Vehicles Test Procedure
WPL	Workplace Parking Levy



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