An Roinn Iompair
Department of Transport

The Economic Cost of Congestion in the Regional Cities 2022-2040

Strategic Research and Analysis Division

Department of Transport

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This paper reflects the latest data and information available to the author at the time of writing. The views presented in this paper do not represent the official views of the Department of Transport nor the Minister for Transport.

Executive Summary

This report builds on *the Economic Cost of Congestion in the Greater Dublin Area 2022-2040*, published by the Department of Transport in 2023. This was prompted by commitments made under the National Investment Framework for Transport in Ireland (NIFTI). The methodology established in that report is applied to three of the regional cities, Cork, Galway, and Waterford. Headline results of this analysis under the Core Growth Scenario (2016 prices) indicate that the cost of congestion to the Cork Metropolitan Area (CMA) is estimated to have been €57.5m in 2022 and is forecast to rise to over €97.2m by 2040. In the Galway Metropolitan Area (GMA), the cost was €35.3m in 2022 and is forecast to hit €106.9m in 2040. In the Waterford Metropolitan Area (WMA), the equivalent figures are €5.8m in 2022 and €22.4m in 2040.

The per capita figures indicate that in 2040 the GMA will experience the highest cost of congestion per capita among the regional cities at €891, while the WMA will experience the lowest at €277. Results show that planned transport interventions in each city's transport strategies will have an impact in reducing the overall cost of congestion. However, they are not sufficient to offset most of the increased cost which is driven by factors such as population, employment and economic growth.

In line with the GDA report, the Alternative Future Scenario (AFS), which examined the impact of changes such as increased remote working, was also modelled for each city. This scenario resulted in reductions in the cost of congestion of between 15% and 34% in 2022, and between 21% and 31% in 2040, compared to the Core Growth Scenario. This demonstrates that behavioural change interventions can have significant impacts in reducing the cost of congestion.

The results also show a general trend of an increasing share in the cost of congestion experienced by goods vehicles. Goods vehicles experience higher congestion costs than personal vehicles as their travel time carries a higher value. This increase in cost share indicates a growth in economic activity in the regional cities. The distribution of congestion costs by time period is also modelled. Results show that congestion in the morning peak grows in the WMA and CMA, whereas in the GMA, the congestion will be more concentrated during the lunchtime hours from 2030 onwards.

Overall, the results of this analysis indicate that congestion will increase significantly over the coming decades within all three cities. Investment in transport infrastructure, particularly large-scale public transport projects like BusConnects and improvements to heavy rail will likely lead to a reduction in the rate of increase in the cost of congestion. Increased congestion is an unavoidable consequence of economic and population growth, but it can be mitigated with infrastructure provision, modal shift to sustainable modes, and behavioural change. To minimise congestion costs, accommodate the growing population, and meet climate policy obligations, continuous improvements will need to be made in sustainable transport in each regional city. These results will help inform and provide an evidence base for climate policy within the Department.

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1. Introduction

Congestion is the result of demand for transport exceeding the supply of road-space available within a network. Congestion is a major issue in most cities worldwide and has become a more pronounced issue in Irish cities in recent years. Dublin City has been noted in various traffic indexes for its exceptional levels of congestion, as mentioned in *The Economic Cost of Congestion in the Greater Dublin Area (GDA) 2022-2040* (hereafter, *2023 GDA Cost of Congestion study*) published in 2023.

This report expands upon the 2023 *GDA Cost of Congestion* study, and the same methodology will be applied to Ireland's regional cities, Cork, Galway, Limerick[1] and Waterford. These four cities and their suburbs combined represent a significant portion of Ireland's population; the four cities also represent major centres of economic activity in their respective regions.

While some level of congestion is to be expected, persistent high levels of congestion can have negative impacts on the economy, environment and society. Growing population, strengthened economic performance, and the need for balanced growth in regional cities are likely to be associated with an increase in demand for transport in urban centres. Without appropriate and timely interventions and wider policy measures, congestion in the regional cities will likely deteriorate in the coming years. This report will build on the methodology adopted in the previous 2023 *GDA Costs of Congestion* study prepared by the Department of Transport.

The aim of this analysis is to assess the level of congestion within the regional cities over the coming decades. This analysis will also assess the modal split of the cost of congestion examining the proportion of congestion which is attributable to private vehicles, goods vehicles and bus users as well as the time impact. The results of this study will help inform the scale of interventions required to address issues associated with congestion and provide an evidence base for policy development.

Section 2 of the study will set out the policy context providing an overview of key policy documents related to congestion and transport policy in Ireland. Section 3 will provide an overview of the existing transport context in each of the regional cities using data from the Central Statistics Office (CSO) and the National Household Travel Survey (NHTS). Section 4 will discuss the transport strategies of each city, focusing on the existing transport provision, the major challenges, and the measures that have been proposed to address the challenges. Section 5 sets out the methodology used in this report to model congestion and calculate the

[1] Due to the data collection issue, the analysis for Limerick will be published separately after this report.

associated cost. Section 6 presents the results of the analysis for each city and discusses the implications of the results in terms of time distribution, vehicle shares, and identifies key points of congestion. Section 7 concludes the report, comparing the regional city results with the previous report on the GDA, and provides recommendations for future analysis.

2. Policy Context

This section sets out an overview of relevant Government policies to provide context for the analysis being undertaken in this study.

2.1 The Economic Cost of Congestion in the Greater Dublin Area 2022-2040

In 2023, the Department of Transport conducted analysis to estimate the cost of congestion in the GDA. The report concluded that the cost of congestion in the GDA was €336 million in 2022, and is projected to rise to €1.5 billion by 2040. The methodology used in that report is also used in this analysis allowing comparisons to be drawn between the results. The economic cost is primarily due to travel time costs, but there are other indirect costs to congestion, including GHG emissions and adverse health impacts. The report indicated that infrastructure improvements can mitigate the cost of congestion, but overall growth is inevitable. Population and employment growth are the key drivers, especially in the city centre, with goods vehicles contributing heavily to congestion costs. Outside the city centre, private car use remains a major factor. Effective congestion management will require integrated transport and land-use planning alongside significant behavioural changes to reduce travel demand and increase modal shift. Investments in transport infrastructure can slow the rate of cost increase, but a comprehensive mix of policy interventions is essential to address the issue fully.

2.2 Climate Policy

The Climate Action Plan 2024 (CAP24) sets out an emissions reduction pathway for Ireland to achieve a 50% reduction in transport sector emissions (relative to 2018 levels) by 2030 and net zero emissions by 2050. In order to achieve this goal, the transport chapter of the CAP24 adopts an "Avoid-Shift-Improve" emissions reduction framework. Aligned to the National Sustainable Mobility Policy (2022), CAP24 further supports the implementation of the "avoid" and "shift" paradigm by committing to improved and expanded sustainable mobility options as well as to the continued development of *Moving Together: A Strategic Approach to the Efficiency of the Transport System in Ireland*. Demand management has the potential to leverage significant societal benefits through the implementation of measures such as road space reallocation and low-emissions zones, and to encourage the behavioural changes required to manage daily traffic more efficiently and reduce journeys taken by private cars. CAP24 establishes the goal of a 20% reduction in kilometres travelled and a 50% reduction in fuel consumption. Reducing congestion is often cited as a co-benefit of climate mitigation policies. This analysis will help set out the extent of congestion being experienced across the regional cities and help inform the degree of intervention required to address it.

2.3 Project Ireland 2040

The *National Planning Framework (NPF)*, recently updated in 2025[2] is the Government's strategic plan for facilitating the development of economic and population growth out to 2040, and to plan for the challenges which will arise over the coming decades. The NPF established sustainable mobility as a key National Strategic Objective and aims to reduce congestion and emissions and enable the transport sector to cater for the increase in demand associated with longer term population and employment growth in a sustainable manner. The NPF also establishes the need for balanced regional development. The NPF adopts 'regional parity' as a target for future growth in Ireland, where the combined Southern, Western, and Northern regional assembly areas will grow at a rate equivalent to the Eastern and Midland Region. Achieving this requires targeted growth across Ireland, including the regional cities. The NPF sets the target of 50% of overall national growth between the five regional cities, and 50% in smaller towns, villages, and rural areas.

The revised *National Development Plan (NDP)* establishes the Government's investment strategy from 2021-2030. This seeks to improve the speed of delivery of public infrastructure projects, such as public transport, and ensure value for money is achieved. Under the NDP, a series of investments in transport infrastructure are planned to tackle congestion being experienced in cities and urban centres.

The *National Investment Framework for Transport in Ireland (NITFI)* is the Department of Transport's strategic framework for prioritising future investment in land transport to support the delivery of the NPF National Strategic Objectives. NIFTI acknowledges traffic congestion as a key transport challenge, which is also associated with costs to public health, local environmental impacts and increased CO2 emissions. A key action arising from NIFTI was to update the previous cost of congestion analysis for the GDA and to provide an estimate of the cost of congestion for Ireland's regional cities; this analysis addresses that commitment.

[2] A draft revision was published in 2024, but the at time of writing, is yet to be adopted.

3. Transport in Regional Cities

This section examines transport patterns mainly focusing on commuting trips[3], as well as demographic and economic growth related to transport for the regional cities. Examining these trends in regional cities can assist with identifying factors which may contribute to congestion in regional cities and understanding how people in regional cities use the road space differently compared to Dublin and its suburbs.

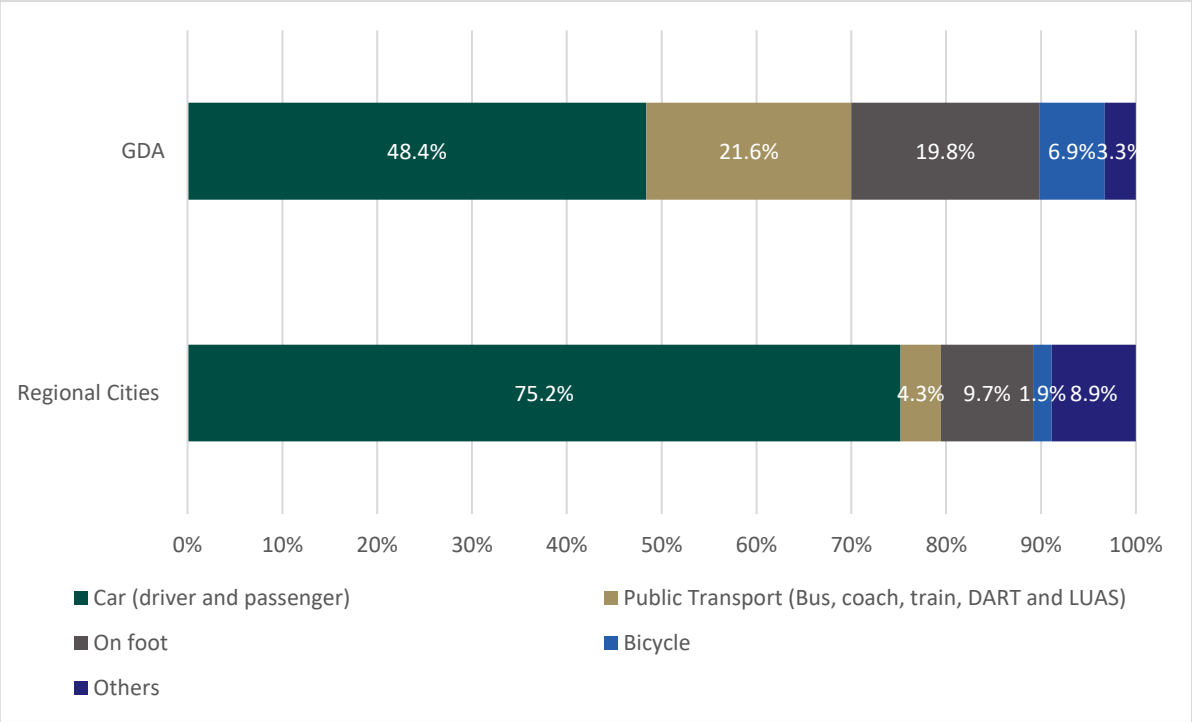
3.1 Travel Modes

The choice of travel mode significantly impacts traffic congestion. For instance, increased use of public transportation, cycling or walking can reduce the number of vehicles on the road, alleviating congestion. A lack of integrated public transport services is frequently referenced as one of the major challenges in regional cities compared to the GDA.

Figure 1 shows modes for commuting in the GDA and regional cities in 2022. Commuting trips to work and education account for a significant portion of total trips, approximately 40%, nationally. While a private car is the primary mode of transport for commuting in both the GDA and regional cities, the regional cities show more reliance on the private car as its share accounts for 75%. Unlike the GDA, the share of public transport in regional cities is only 4.3%. This reflects the insufficient scale and coverage of the public transport network as well as poor frequency and accessibility in regional cities. Also, these results indicate that road space may be occupied by single or low occupancy vehicles and reducing private cars from the road will be a key measure to reduce congestion in regional cities.

[3] The National Travel Survey does not publish data for the regional cities, only categorising into Dublin and all regions excluding Dublin.

Figure 1 - Travel Modes for Commuting in the GDA and Regional Cities in 2022

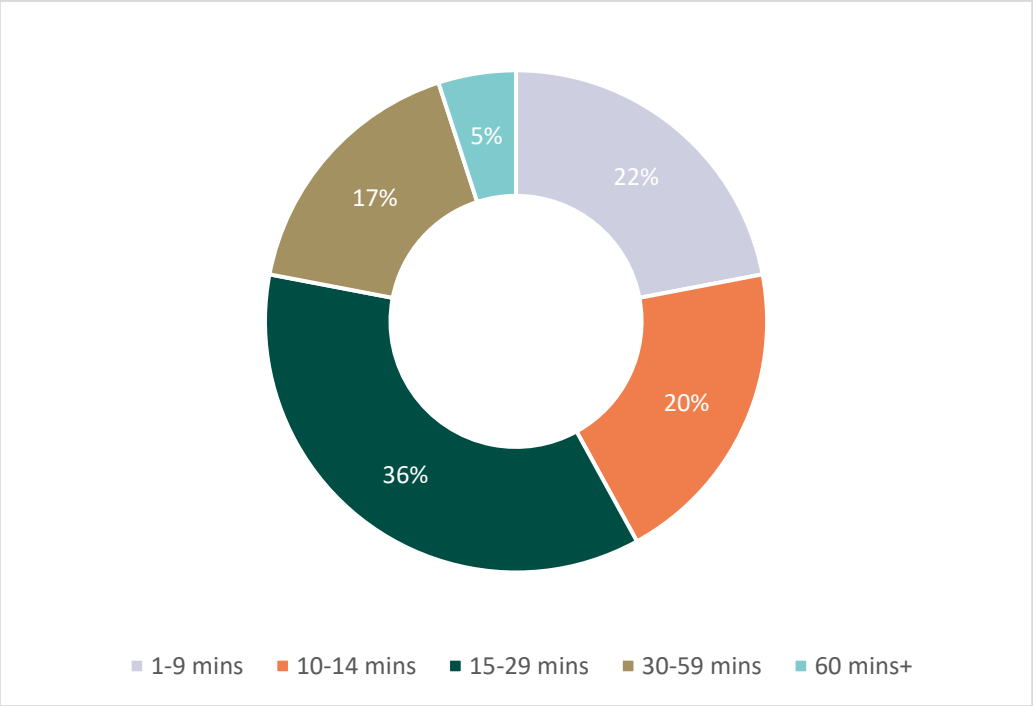


(Source: CSO, Census 2022)

3.2 Travel Times

The economic cost of congestion in this study is largely determined by the travel time delays experienced by transport users. Figure 2 shows the proportion of trips for all purposes taken by duration in the regional cities from the NHTS 2022. Over 40% of trips are short, less than 14 minutes in duration, and the largest proportion of trips taken, 36%, are between 15 and 29 minutes. Thus, over three quarters (76%) of all trips are less than 30 minutes in duration.

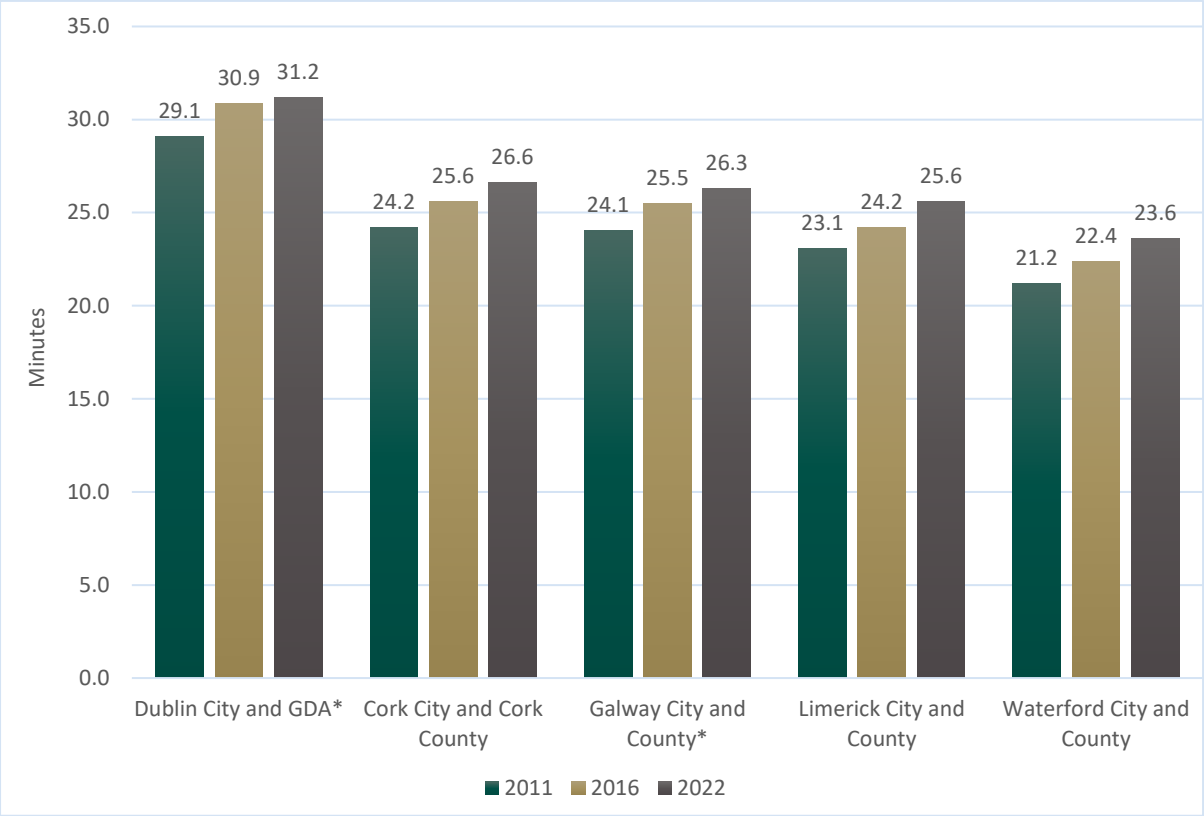
Figure 2 - Proportion of Trips Taken by Duration in Regional Cities



(Source: NTA NHTS 2022)

Figure 3 presents commuting times in regional cities from 2011 to 2022. It shows that the commuting times have increased in regional cities continually, 10.4% on average from 2011 to 2022. Waterford City and county shows the strongest increase, 11.3%. These increases are higher than those of Dublin City and the GDA, which shows an increase of 7.3%. This reflects aggravating congestion on the roads in regional cities.

Figure 3 - Regional Travel Times by Census Year[4]



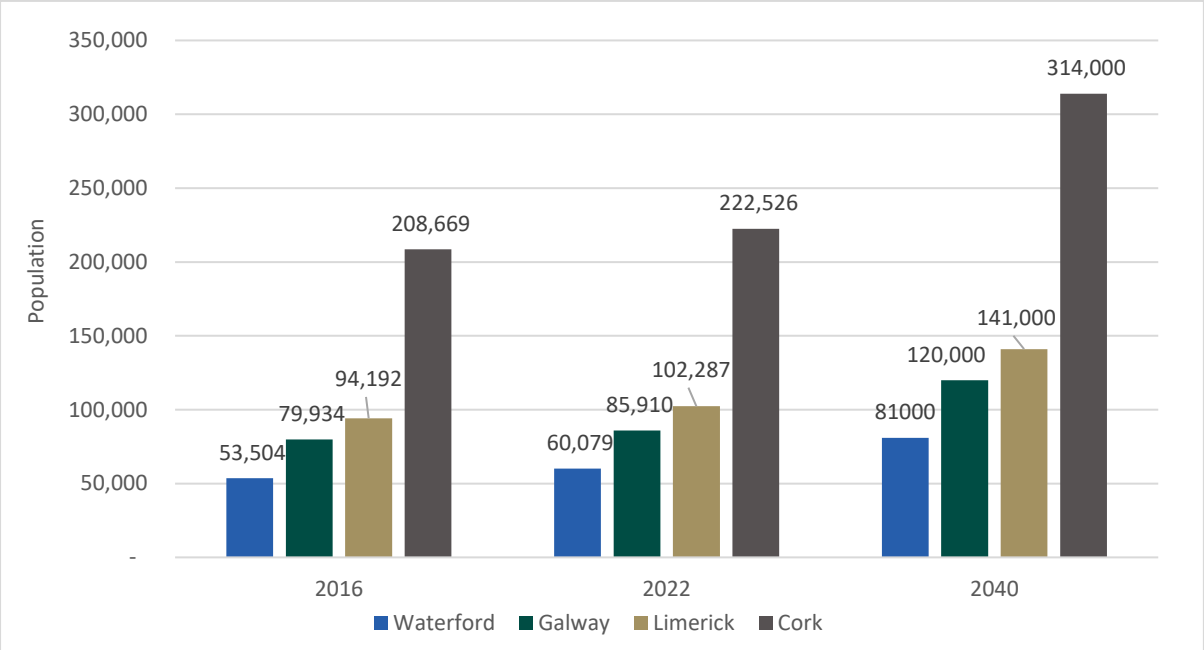
(Source: CSO Census 2011, 2016, 2022)

3.3 Population and Demand Projections

Population growth drives future transport demand. The population projections in this study are identical to those that support the NPF and are incorporated into the Core Growth Scenario by the National Transport Authority (NTA) for modelling the cost of congestion in this study. The targeted pattern of population growth in regional cities is forecast to be 50% to 60% by 2040. Figure 4 represents the targeted population growth range for the regional cities.

[4] For Dublin City and GDA, travel times are calculated as an average of the travel times in the cities and counties of Dublin City, Dún Laoghaire-Rathdown, Fingal and South Dublin. For and Galway City and County, an average time was calculated for Galway City and County.

Figure 4 - Population Growth Targets (50%) for Regional Cities in the NPF



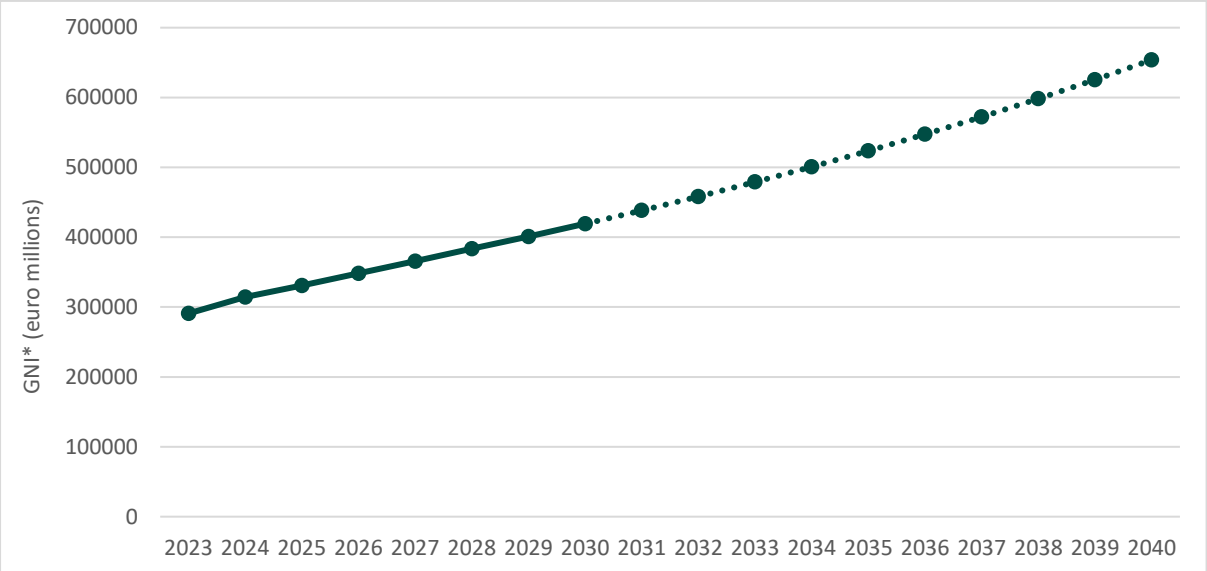
(Source: CSO Census 2016, 2022 and National Planning Framework (2040))

Populations for each city in 2040 are based on projections from the NPF while the population figures in 2016 and 2022 are results from Census 2016 and Census 2022. The NPF has been updated recently as of April 2025. This update contains a new targeted pattern for population growth based on Census 2022. However, this study uses the targeted population growth in the current NPF (2018) for consistency with the *2023 GDA Cost of Congestion* study and the NTA's Regional Modelling Systems.

Between 2016 and 2022, Waterford experienced the strongest growth rate of 12.3%, followed by Limerick (8.6%), Galway (7.5%) and Cork (6.6%). If these strong growth rates continue in the future, the regional cities populations could be above projections, and this may induce even higher levels of congestion.

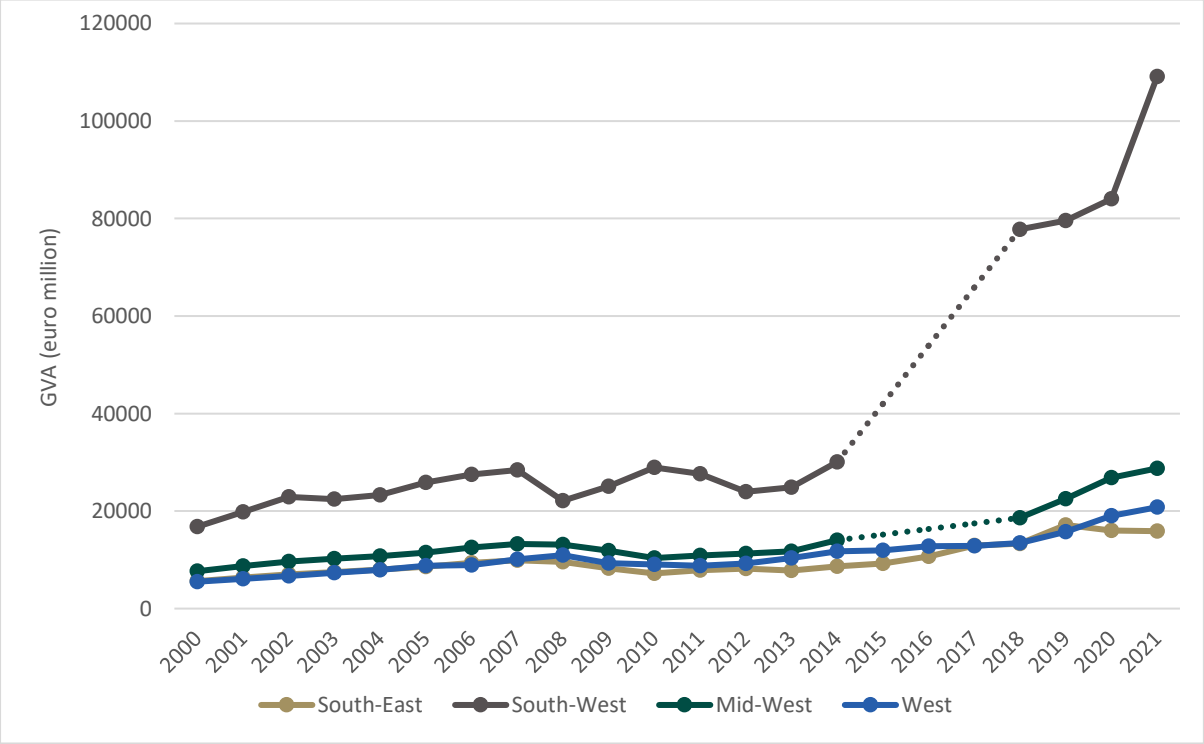
The *2023 GDA Cost of Congestion* study identifies that there is a correlation between economic activity and transport demand by examining data from 2000 to 2022. While there are a few exceptions due to the pandemic, there is a clear link between economic growth represented by modified Gross National Income (GNI*) and activity in the transport sector. Figure 5 and Figure 6 show forecasted GNI*, a measure of economic activity in the country and Gross Value Added (GVA) by region, an indicator of regional economic performance.

Figure 5 – GNI* Forecasts



(Source: Department of Finance for 2023 - 2030[5], Growth rates in 2029 and 2030 have been applied to show a trajectory of forecasts from 2031 to 2040.)

Figure 6 – Trends of GVA by Region



(Source: CSO, the values for the South-West and Mid-West regions are missing in 2015, 2016 and 2017.)

It is projected that GNI* will continue to grow to 2030, from €291 billion to €419 billion, a 44% increase.

[5] Department of Finance (2024), Budget 2025: Economic & Fiscal Outlook

Figure 6 shows that the provinces where the regional cities are located have experienced a significant growth in output for last 20 years, more than three times in that time frame. The regional cities play crucial roles in driving economic growth and activities within their respective regions. Also, these regions' GVA account for 43% of total GVA in 2021, contributing significantly to the national economic performance. As transport demand is derived from economic activities by other sectors for movements of goods and people, economic activity has an important implication for the cost of congestion with population growth. The continuous growth in economic activity will inevitably generate more demand for transport, not only in the GDA, but also in regional cities. As discussed in the *2023 GDA Cost of Congestion* study, this supports the needs for policy interventions to separate transport demand from economic growth to mitigate congestion and allocate road space effectively to manage continuous economic growth in regional cities.

4. Methodology

This study adopts the same definitions and methodology to define and measure congestion which are described *2023 GDA Cost of Congestion Study*. Thus, this section summarises key definitions and approaches to understand the results.

This study uses the NTA's Regional Modelling Systems (RMS) to estimate trip making behaviour in the regional cities. There are five Regional Multi-modal Models in the RMS and these models contain updated infrastructure and land use assumptions which are set out in the NDP for each year modelled up to 2040. The four models are used in this analysis.

- South West Regional Model (SWRM) for Cork,
- West Regional Model (WRM) for Galway,
- Mid West Regional Model (MWRM) for Limerick, and
- South East Regional Model (SERM) for Waterford.

As the base year of the models is 2016, the results of cost of congestion in each regional city are given in 2016 prices. Also, two demand forecast scenarios are considered: Core Growth and Alternative Future. The Core Growth Scenario is the NTA's growth projection, which is based on the National Planning Framework Demographic Projects and is the standard growth scenario used for most model applications. The Alternative Future Scenario (AFS) was developed by the NTA to take account of emerging trends after the COVID-19 pandemic (i.e. remote working).

This study follows the approach adopted in the previous cost of congestion studies in 2017 and 2023. In this study, the 80% volume over capacity (V/C) ratio – where the volume of traffic on a particular link is 80% of the capacity – was selected as the point at which congestion starts to occur. The models produce the congested (over 80% V/C) outputs where junctions can exceed their capacity. Then, the congested outputs are compared to the 80% volume over capacity ratio (V/C) thresholds to determine the cost of additional travel time between the congested network and the 80% V/C threshold. The difference between modelled traffic conditions and a 100% V/C ratio was also assessed as a sensitivity test. Section 4 of the *2023 GDA Cost of Congestion* study includes details on definitions of congestion and the methodology adopted to quantify it using the RMS.

The cost of congestion is calculated as the difference between the total travel cost when congested and at the 80% V/C threshold. To calculate the total travel cost at each level (congested and 80% V/C threshold) from the model outputs, the number of persons and travel times are calculated and combined and summed giving total person hours across the study area. Then the total person hours are multiplied by a value of travel time (VTT) by trip purposes (see Table 6 of the Transport Appraisal Framework (TAF) Module 8[6]) and the VTT figures are inflated by GNI* growth rates in line with the approach taken for GDA[7].

Box 1: Value of Travel Time

Time savings are a key benefit which can be monetised using a Value of Travel Time Savings (VTTS) measure. Each hour of travel time saved is worth a specific monetary value to users. This value differs based on the purpose of the journey taken. For example, the value of work travel time (€26.16 per hour, 2016 prices) is more costly than the value of non-work travel time (€8.90 for commuting).

The VTT is calculated using a 'Cost Savings Approach'. This approach assumes time spent in transport is unproductive, and the cost is the monetary value of the productivity lost based on average hourly labour costs.

While the methodology used in this report is the same as the one used in the *2023 GDA Cost of Congestion* study, this also presents a limitation when focusing on the regional cities. As traffic volumes and capacities are measured and averaged over 60 minutes in the RMS, the model will not show congestion if the demand within that 60-minute period does not exceed the capacity. For instance, a short peak in demand lasting less than 30 minutes at a junction may cause temporary delays. However, when averaged over the 60-minute period, the total traffic does not surpass the theoretical 60-minute capacity at this location. Consequently, such short-term congestion will not be reflected in the model, potentially understating the actual cost of congestion and distorting the cost of congestion in the regional cities more than in Dublin due to the lower overall congestion levels.

[6] Department of Transport (2023), Transport Appraisal Framework Module 8 – Detailed Guidance on Appraisal Parameters.
[7] The full VTT figures applied to this analysis are presented in Table 3 of The Economic Cost of Congestion in the Greater Dublin Area 2022-2040.

5. Results

This section analyses congestion and its economic impacts in regional cities using results from the NTA's RMS. The analysis for Limerick Shannon Metropolitan Area (LSMA) is not included in this section and will be published separately.

5.1 Cork Metropolitan Area (CMA)

The focus of the analysis is the Cork Metropolitan Area (CMA) as described in Figure 7.

Figure 7 - Study Area

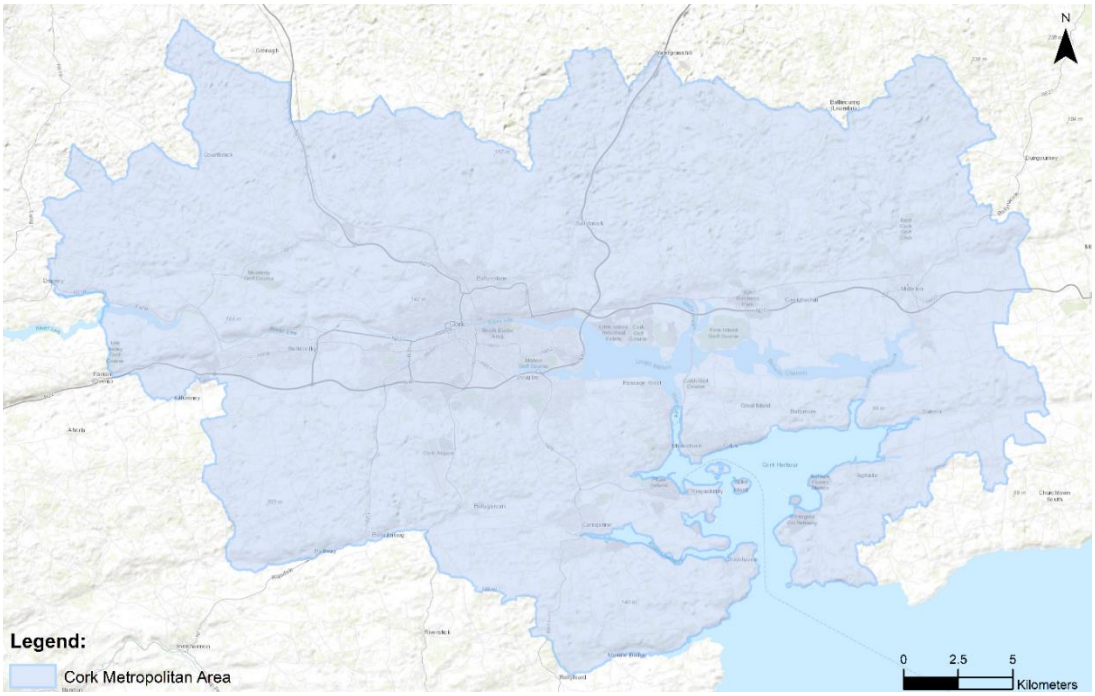
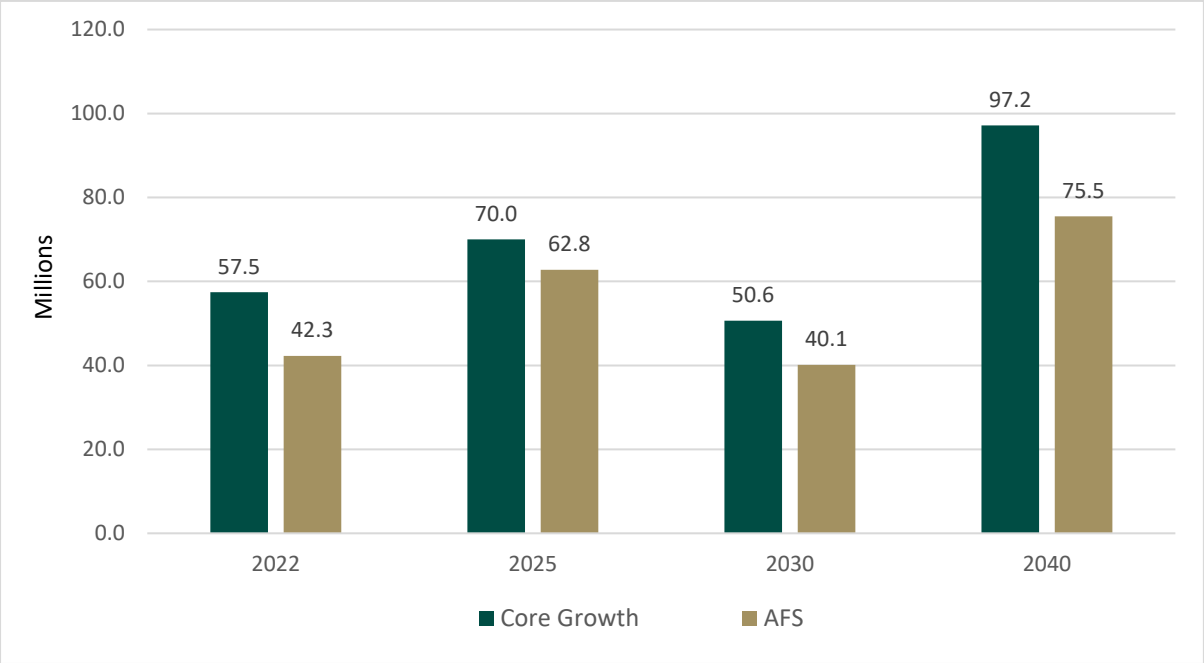


Figure 8 presents the headline results of analysis of cost of congestion in the CMA. The results show that the cost of congestion is projected to grow from €57.5 million in 2022 to €97.2 million in 2040, which is an increase of approximately 69% in the Core Growth Scenario.

Figure 8 - Annual Cost of Congestion



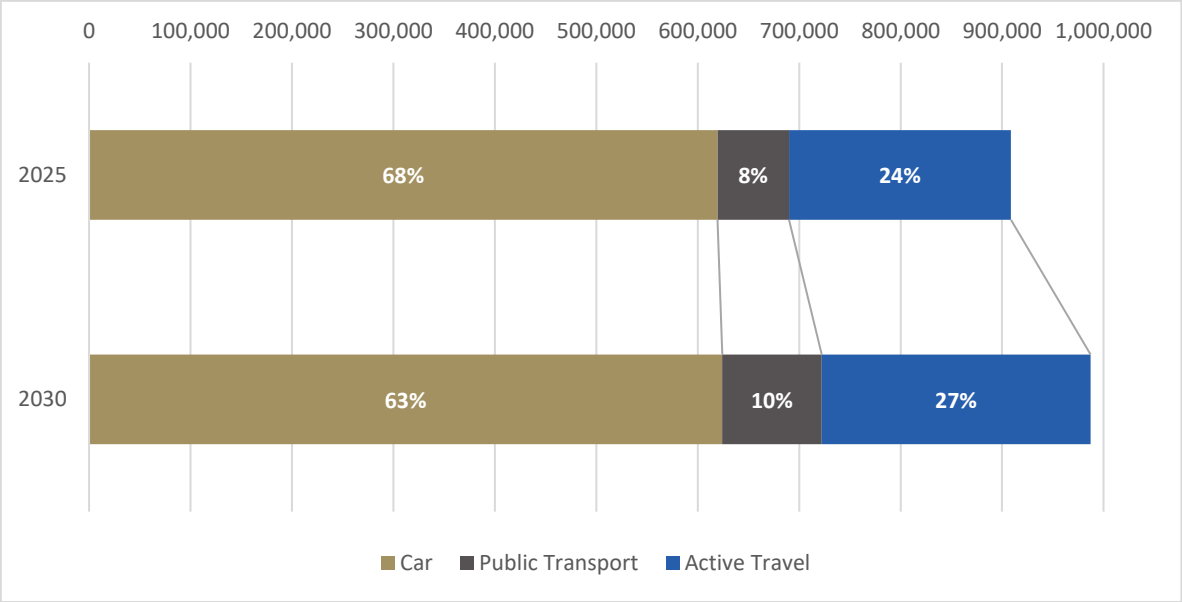
This result reflects an increase in demand as a result of population and economic growth over the period. The cost of congestion is lower for the AFS than the Core Growth Scenario, which is projected to grow from €42.3 million in 2022 to €75.5 million in 2040. This is an increase of approximately 79%. Under this scenario, the cost of congestion is 26% lower in 2022 at €42.3 million and 22% lower in 2040 at €75.5 million.

In both scenarios, the cost of congestion increases from 2022 to 2025, which can be considered as a result of increased travel demand and limited change in the network infrastructure. However, there is a decrease between 2025 and 2030 as the key infrastructure elements of the Cork Metropolitan Area Transport Strategy (CMATS) are assumed to be delivered in this period. Delays to the delivery of these projects will postpone the alleviation of congestion. New infrastructure such as improved bus networks and enhanced metropolitan rail service would be able to relieve congestion through the modal shift toward public transport.

As described in Figure 9, a share of public transport in total trips will increase from 8% to 10% and active travel will increase from 24% to 27% between 2025 and 2030 although the share of private cars will fall from 68% to 63%, regardless of increases in total trips. Among increased trips, 35% and 59% of these trips will be attributed to public transport and active travel respectively, while only 6% of the increased trips will be attributed to private cars. During this period, it is projected that critical improvements in sustainable modes will be implemented such

as Cork Area Commuter Rail Programme, which will provide a connection to Cobh and Midleton, Bus Connects, park and ride sites, and provision of a high-quality cycle network across the city. This indicates that infrastructure improvements in sustainable modes could encourage modal shift from private cars to sustainable modes and contribute to reducing congestion.

Figure 9 - Changes in Total Trips by Transport Modes between 2025 and 2030 in the CMA



However, the cost of congestion begins to increase again from 2030 to 2040. This increase is driven by an increasing number of trips, both by personal vehicle and public transport, as a result of demand catching up with the additional capacity provided in 2030, though the share of public transport will be retained at the similar level, about 10%. This demonstrates that while the expansion and improvement of road and sustainable transport infrastructure can temporarily alleviate congestion, demand will gradually increase in response to the increased supply. Provision of infrastructure alone, particularly roads, cannot have permanent and continuous effects to reduce congestion. Thus, demand management and further improvements in the sustainable modes will be needed.

Figure 10 presents the breakdown of cost of congestion by transport mode. The results show that the cost of congestion grows for private car and goods vehicles by 64% and 97% over the period 2022-2040 respectively. The shares of the cost of congestion attributed to buses are small in comparison to other transport modes, reflecting the proportion of trips being made by bus. The proportion of goods vehicles to the total cost of congestion is expected to increase

from 15% to 18% over the period. The growth in the share of the cost of congestion attributable to goods vehicles is driven by increased trips of goods vehicle due to the continuous economic growth. This indicates that the interventions to improve the efficient movement of goods vehicles should be considered in future years. The additional road infrastructure should increase the efficiency of cross city journeys for goods vehicles temporarily, though this will be diminished as demand for the road exceeds capacity.

Figure 10 - Modal Breakdown of Cost of Congestion (Core Growth Scenario)

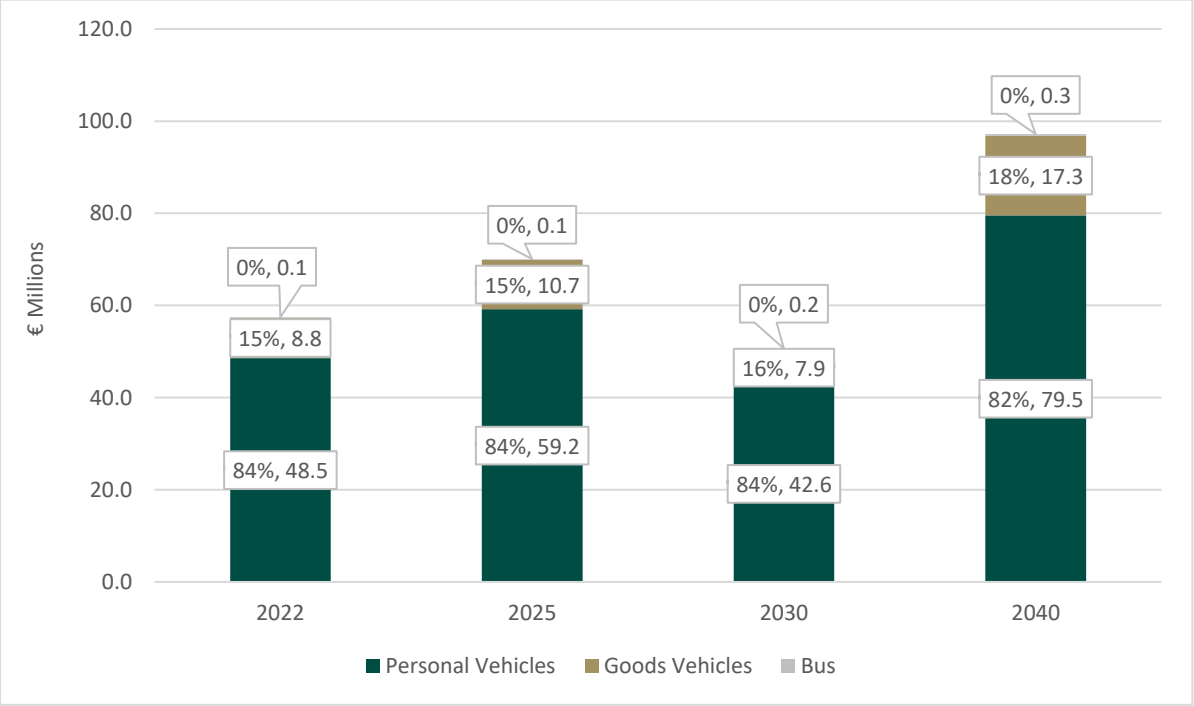


Figure 11 presents the breakdown of the cost of congestion by modelled hour. The congestion during the morning peak (AM) is the largest contributor and slightly increases over the period. The congestion in the evening peak (PM) shows the same pattern, its share slightly increases over the period while shares of lunchtime (LT) and school run (SR) remain the same or decrease. This indicates that the congestion during the commuting peak hours will likely get worse and the intervention such as demand management to disperse congestion from peak hours would be needed. This is supported by the fact that the congestion is distributed similarly in the lunchtime, morning, and evening peaks in the AFS, which considers reduced trips in commutes to work.

Figure 11 - Time Breakdown of Cost of Congestion (Core Growth Scenario)

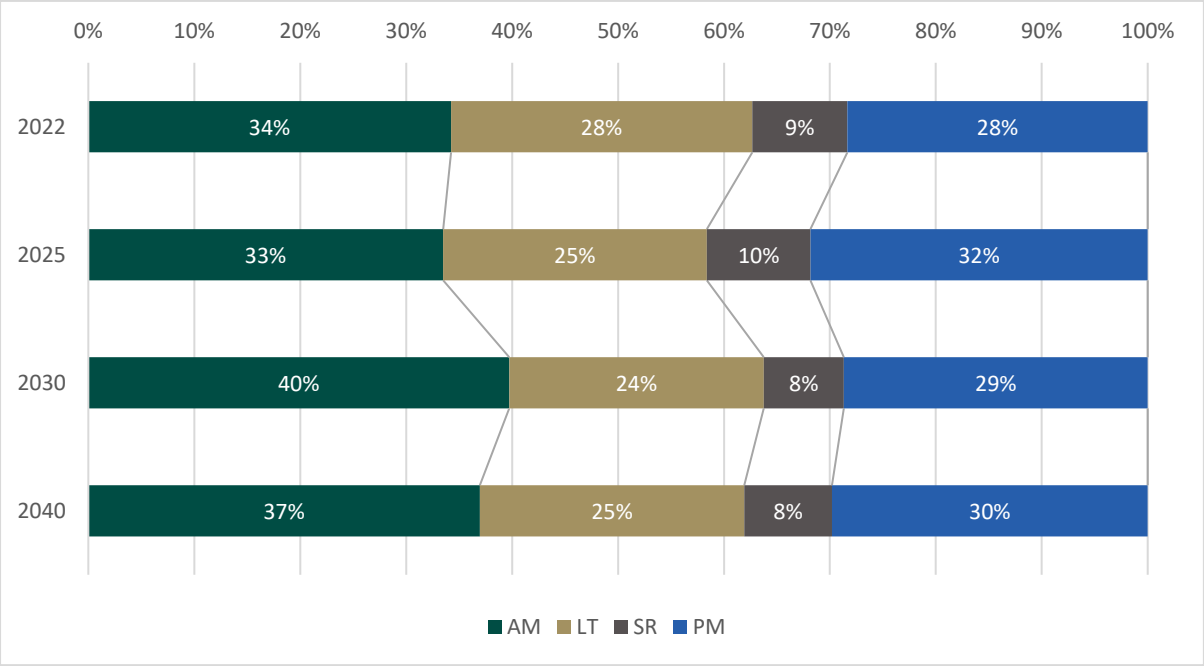
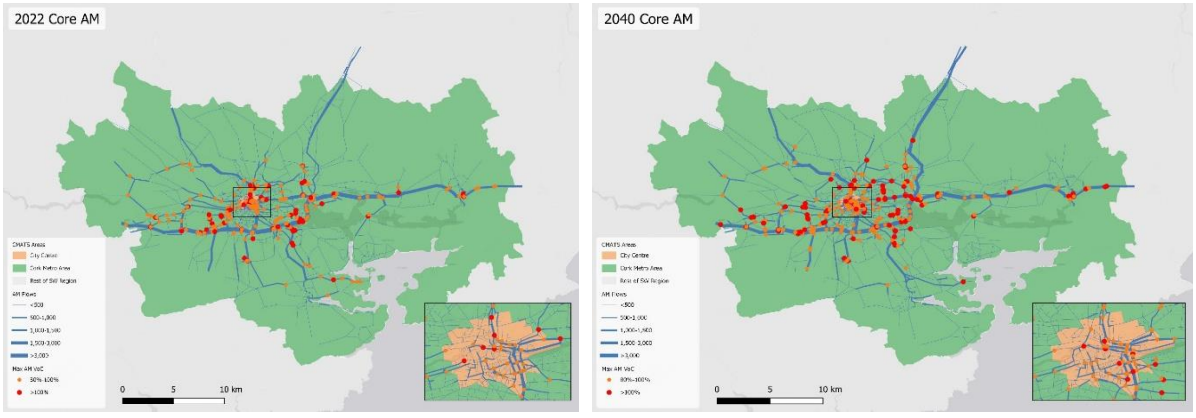


Figure 12 provides a summary of the geographic distribution of traffic volumes across the network during the morning peak travel time. The figures enable a high-level identification of areas which will experience an increase in traffic volumes. Orange circles denote junctions operating at 80%-100% of their V/C while red circles represent junctions operating at over 100% of their V/C. Thicker lines represent links experiencing greater traffic volumes.

Figure 12 - AM Peak Private Vehicle Traffic in the CMA 2022 (Left), 2040 (Right)



These results show that traffic flows on the major national road networks will get heavier and traffic congestion is projected to grow in more junctions over the period. While heavy congestion is mainly observed in junctions near the city centre in 2022, the congestion is likely to spread over to the east, west and north of the city centre. These findings support the results that the cost of congestion will increase from 2022 to 2040. Traffic flows from/to the CMA

will grow as well as in city centre, this will contribute to aggravated congestion at major junctions connecting main locations in the CMA. It is projected that increased traffic flows will be observed in 2040 following the provision of additional road infrastructure (expected to come available between 2025 and 2030) even after a large scale of improvements in sustainable modes. This could be interpreted as an indication that population and economic growth will only induce more trips by private cars if there are not continuous improvements in sustainable transport capacity.

In the CMA, population and economic growth will be likely to generate more demand for commuting trips. This results in the growth of congestion costs in the morning and evening peaks over the period as well as overall growth of congestion in this area. Deliveries of public transport and road infrastructure could reduce congestion temporarily; however, population and economic growth will likely generate demand that exceeds infrastructure provision.

5.2 Galway Metropolitan Area (GMA)

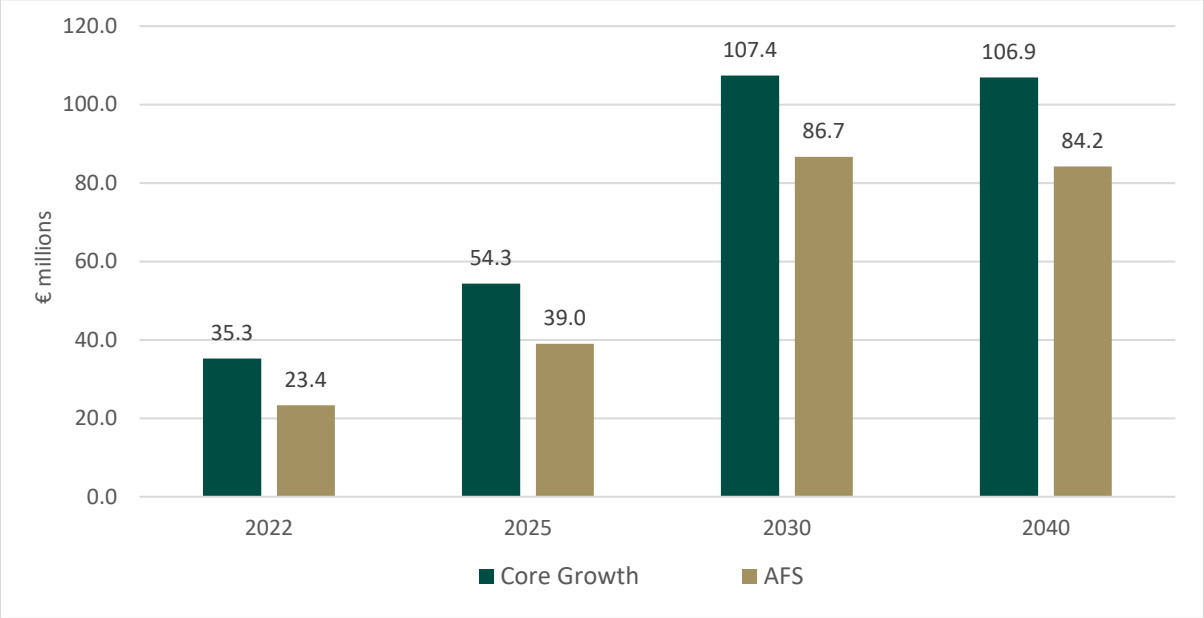
The focus of the analysis is the Galway Metropolitan Area (GMA) as described in Figure 13.

Figure 13 - Study Area

Figure 14 presents the headline results of the analysis of the cost of congestion in the GMA. The results show that the cost of congestion is projected to grow from €35.3 million in 2022 to €106.9 million in 2040, which is an increase of approximately 203% in the Core Growth

Scenario, while a slight decrease from €107.4 million in 2030 to €106.9 million in 2040 is expected.

Figure 14 - Annual Cost of Congestion



This result reflects an increase in demand as a result of population and economic growth over the period. The cost of congestion is lower for the AFS than the Core Growth Scenario, which is projected to grow from €23.4 million in 2022 to €84.2 million in 2040. This is an increase of approximately 261%. Under this scenario, the cost of congestion is 34% lower in 2022 at €23.4 million and 21% lower in 2040 at €84.2 million. This demonstrates that the proposed measures for demand management such as the promotion of remote and flexible working will be able to reduce the cost of congestion. The cost of congestion decreases slightly between 2030 and 2040. This result indicates that planned infrastructural developments between 2030 and 2040 could relieve some congestion in GMA. However, the overall cost increases over the period in both scenarios due to economic and population growth. While a number of provisions of sustainable modes in the GTS such as the Galway Metropolitan area bus and cycle plan and Ceannt Station redevelopment will play a role in reducing potential cost of congestion, the results show that a more proactive deployment of sustainable transport will be needed to tackle growing cost of congestion.

Figure 15 presents the breakdown of cost of congestion by transport mode. The results show that cost of congestion grows for private car and goods vehicles by 162% and 403% over the period 2022-2040 respectively. Also, the proportion of the cost attributed to goods vehicles is

expected to increase significantly from 17% to 28% over the period. While this is in part driven by the higher value of time assigned to business travel and goods vehicles, it is also driven by increased journeys by goods vehicles. This may be attributed to increasing congestion on national roads, which are typically used by goods vehicles. Measures outlined in the GTS diverting goods vehicle traffic from the city centre could contribute to easing the burden of congestion on goods vehicles by improving road infrastructure across the city.

Figure 15 - Modal Breakdown of Cost of Congestion (Core Growth Scenario)

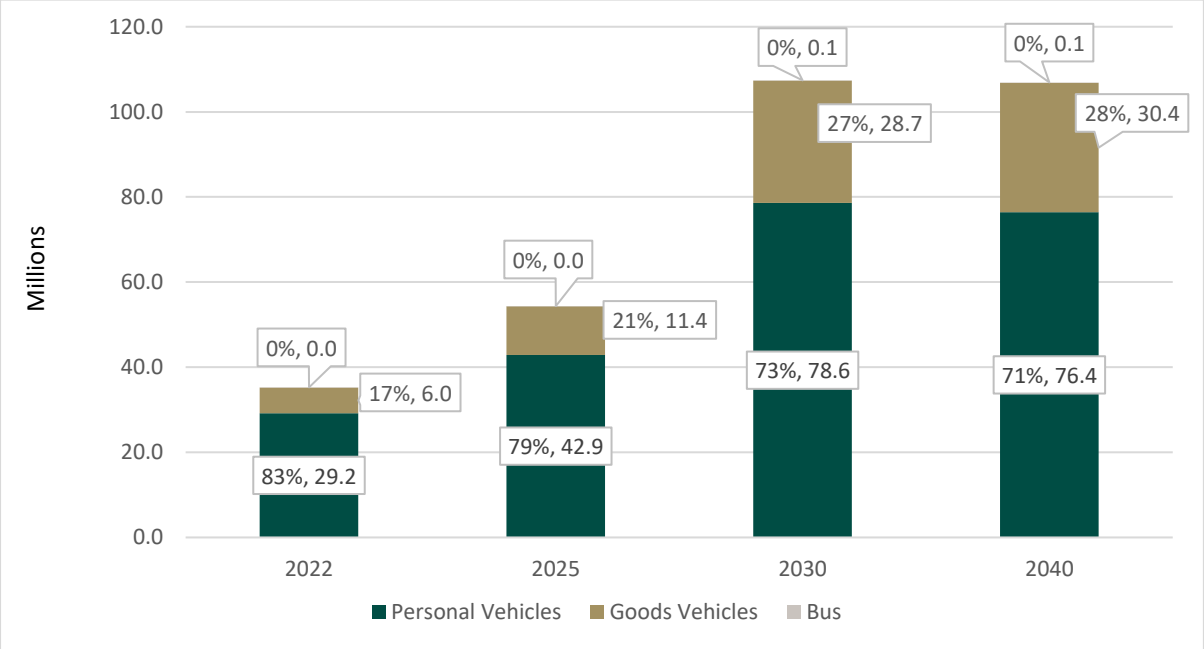


Figure 16 presents the breakdown of the cost of congestion by modelled hour. In the GMA, the congestion during the lunchtime (LT) will significantly increase from 14% in 2022 to 32% in 2040 and become the largest share of the congest of the day in 2030 and 2040. This is unique among the regional cities and is indicative of the rise in goods vehicles traffic in Galway. In 2040, the cost of congestion will not be as concentrated in the morning (AM) and evening (PM) peaks and will spread over to the lunchtime. This indicates that the GMA will be likely to experience congestion throughout the day, rather than having exceptional periods of traffic during commuting periods. This also reflects that travel patterns in Galway will be different to other cities due to the employment patterns and industry and increasing share of congestion experienced by goods vehicles.

Figure 16 - Time Breakdown of Cost of Congestion (Core Growth Scenario)

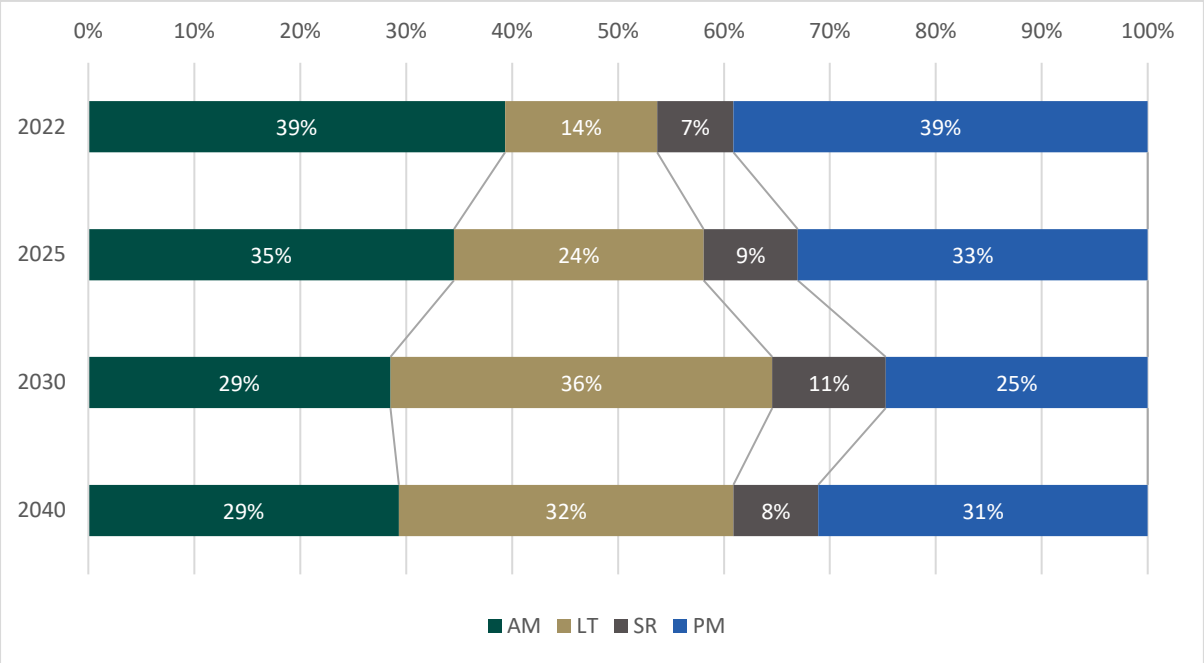
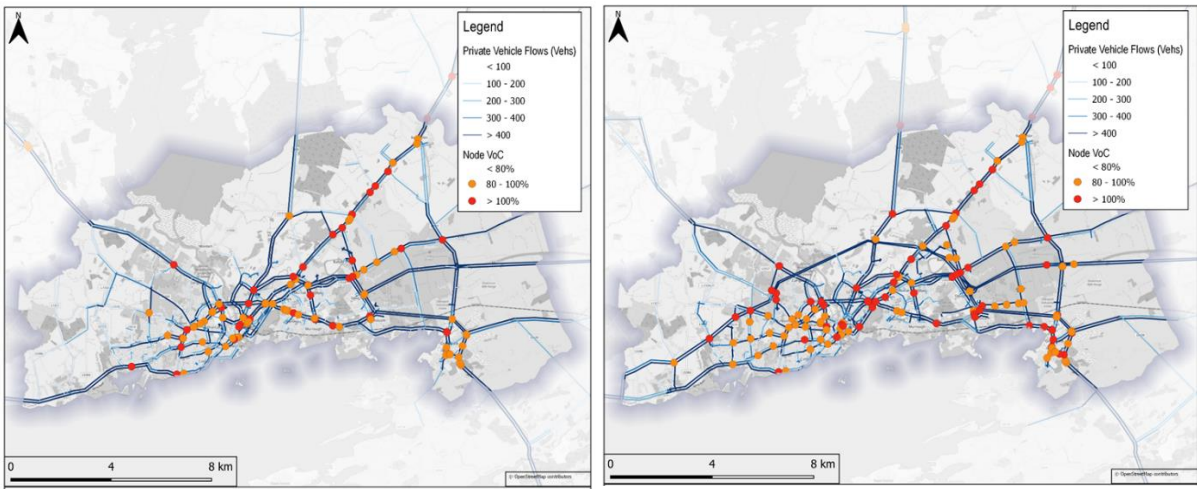


Figure 17 provides a summary of the geographic distribution of traffic volumes across the network during the morning peak travel time. The figures enable a high-level identification of areas which will experience an increase in traffic volumes. Orange circles denote junctions operating at 80%-100% of their V/C while red circles represent junctions operating at over 100% of their V/C. Thicker lines represent links experiencing greater traffic volumes.

Figure 17 - AM Peak Private Vehicle Traffic in GMA 2022 (Left), 2040 (Right)



In 2040, Galway outer bypass is assumed to be in place according to the GTS published in 2016. The modelled flows for 2040, illustrated in the figure above, show that the bypass will have heavy traffic flows for private vehicles although a slight decrease in cost of congestion is

observed in the GMA between 2030 and 2040. However, the junctions connected to the outer bypass will also experience heavy traffic flows. This indicates that the bypass will provide alleviation from congestion in the short term and will continue to facilitate cross city journeys throughout the period considered. However, increased transport demand will eventually result in the bypass becoming congested without further intervention. While traffic flows will become lighter and volumes in junctions will be less in 2040 in the city centre, overall congestion outside the city centre and around the metropolitan area will remain a challenge, even with planned transport provisions. Certain junctions will see reduced congestion due to improved infrastructure, while the overall level of congestion in the city will rise given the higher volume of vehicles on the road. Planned interventions are not sufficient to offset the increase in congestion in the city centre and wider metropolitan area.

In the GMA, the cost of congestion is projected to grow overall across the period due to population and economic growth with the exception of a slight decrease expected between 2030 and 2040. A share of morning interpeak (lunchtime) will grow significantly from 14% in 2022 to 32% in 2040, indicating congestion is likely to occur throughout the day. Spreading congestion over the day will cause increasing shares of cost of congestion attributable to goods vehicles, which is partly driven by the high value of travel time assigned to goods vehicles. Finally, the additional road infrastructure may reduce congestion temporarily; however, demand will eventually overtake the capacity of this infrastructure.

5.3 Waterford Metropolitan Area (WMA)

The focus of the analysis is the Waterford Metropolitan Area (WMA) as described in Figure 18.

Figure 18 - Study Area

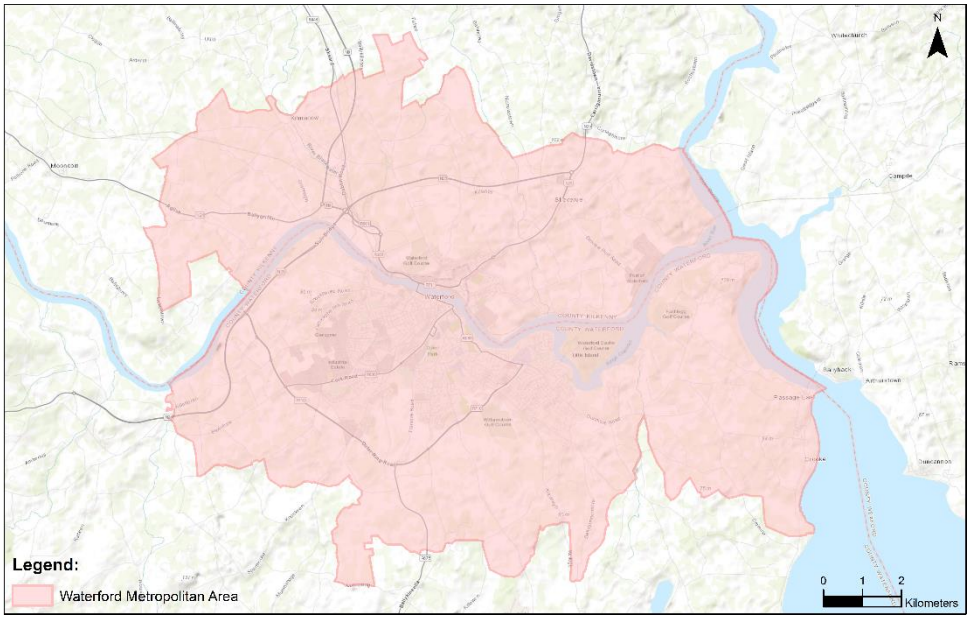
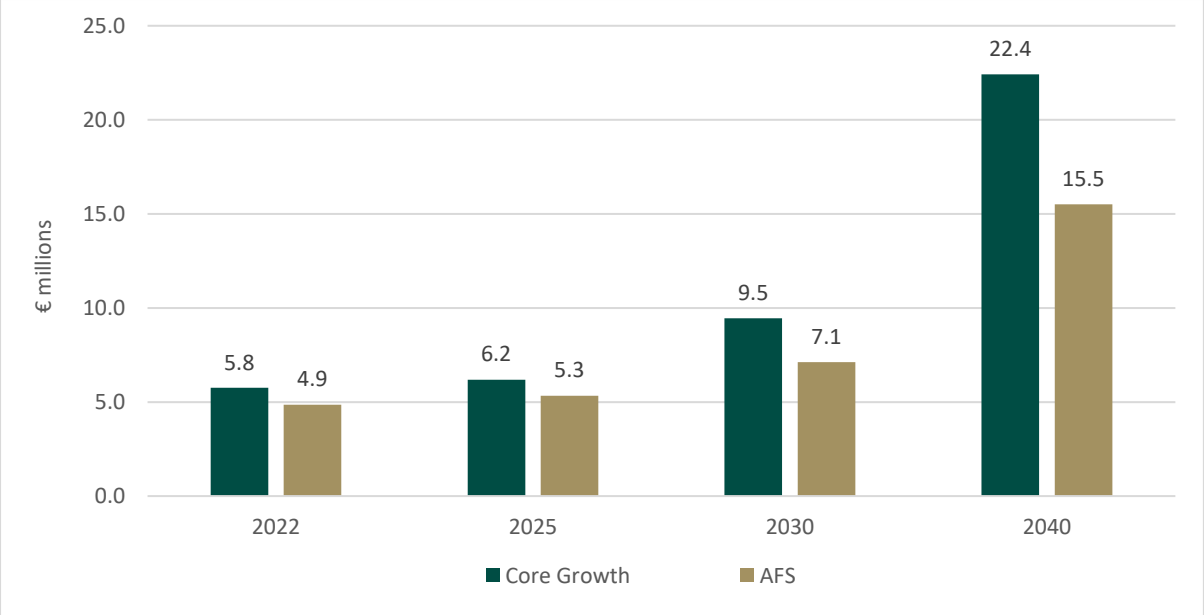


Figure 19 presents the headline results of the analysis of the cost of congestion in the WMA. The results show that the cost of congestion is projected to grow from €5.8 million in 2022 to €22.4 million in 2040, which is an increase of approximately 290% in the Core Growth Scenario.

Figure 19 - Annual Cost of Congestion



This result reflects an increase in demand as a result of population and economic growth over the period. The cost of congestion is lower for the AFS than the Core Growth Scenario, which

is projected to grow from €4.9 million in 2022 to €15.5 million in 2040. This is an increase of approximately 286%. Under the AFS, the cost of congestion is 15% lower in 2022 at €4.9 million and 31% lower in 2040 at €15.5 million. This indicates that successful demand management will substantially reduce cost of congestion, however, an increase in overall congestion relative to current levels will continue given the need for population and economic growth in the WMA as established by the NPF's goal of balanced regional growth.

Figure 20 presents the breakdown of the costs of congestion by transport mode. The results show that the cost of congestion grows for private cars and goods vehicles by 255% and 390% over the period 2022-2040 respectively. The proportion of cost attributed to goods vehicles to the total cost of congestion is expected to increase significantly, growing from 24% to 31% over this period, with the largest jump occurring between 2030 and 2040. This brings about a corresponding fall in the share for private vehicles, which falls from 75% to 69%. Similar to the GMA, this is partly driven by the increasing trips of goods vehicles due to economic growth, the higher value of travel time assigned to business travel and goods vehicles and goods vehicles' inability to adapt routes as easily as other types of traffic. Though the proportion of the cost of congestion attributed to private vehicles will decrease in 2040, it remains the largest source of congestion costs overall, the expansion of sustainable modes, such as BusConnects Waterford seems to be necessary to reduce cost of congestion of private vehicles.

Figure 20 - Modal Breakdown of Cost of Congestion (Core Growth Scenario)

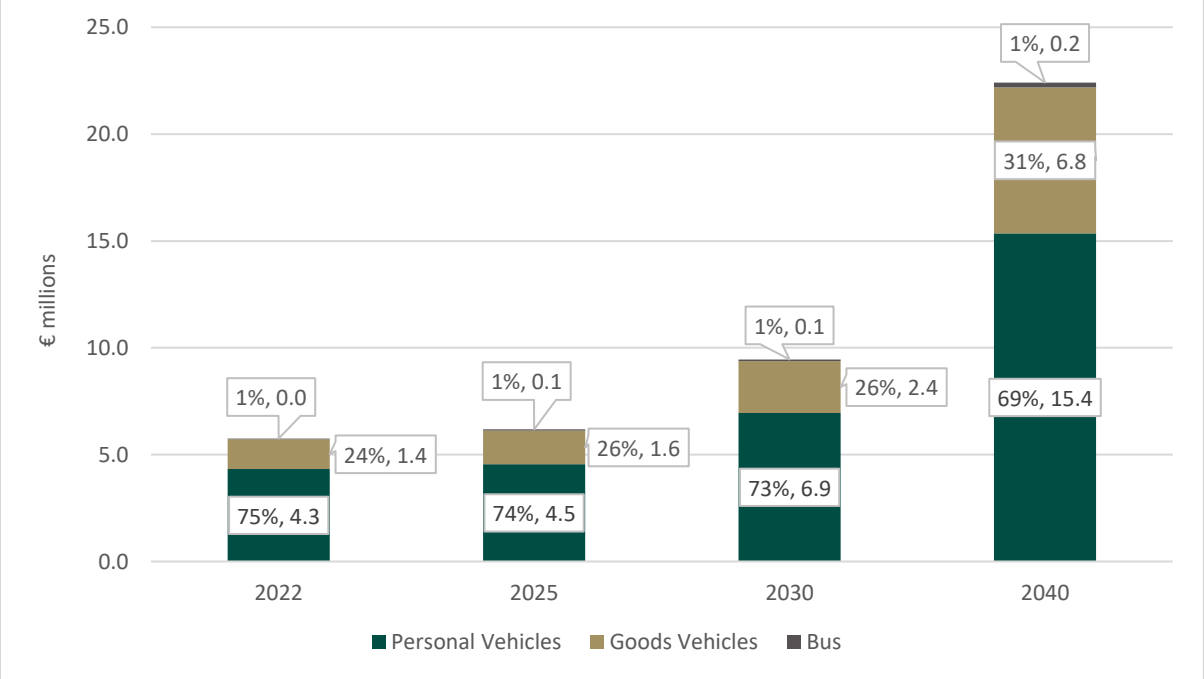


Figure 21 presents the breakdown of the cost of congestion by modelled hour. In the WMA, while the share in the morning peak (AM) decreases over each period, the share of congestion for the evening peak (PM) grows from 18% in 2022 to 22% in 2040, with a slight anomaly between 2022 and 2025 where it falls to 14%. The largest percentage increase occurs for the share attributed to the school run (SR), growing from 8% in 2022 to 15% in 2040. The lunchtime period is the most consistent over each period, increasing by 2% between 2022 and 2040. There are a number of factors that could contribute to the growth in the SR period, demographic shift, increased GV travel during interpeak hours, or changing patterns of employment could all play a role. It indicates that providing sustainable modes in the school commute such as cycling and walking-friendly routes could be key measurements to stop growth in the cost of congestion during the school run time. It is also likely that the growth is caused by greater volumes of goods vehicles travelling in interpeak hours, which is supported by the corresponding increase in the lunchtime share. The continued low share attributable to the bus indicates that further measures could be taken to increase modal shift to the bus network. The reduction in on-street parking and inner-city parking availability will contribute to this, making public transport more attractive relative to the private car. The planned introduction of 'park and ride', and 'park and stride' facilities will also reduce congestion in the city centre.

Figure 21 - Time Breakdown of Cost of Congestion (Core Growth Scenario)

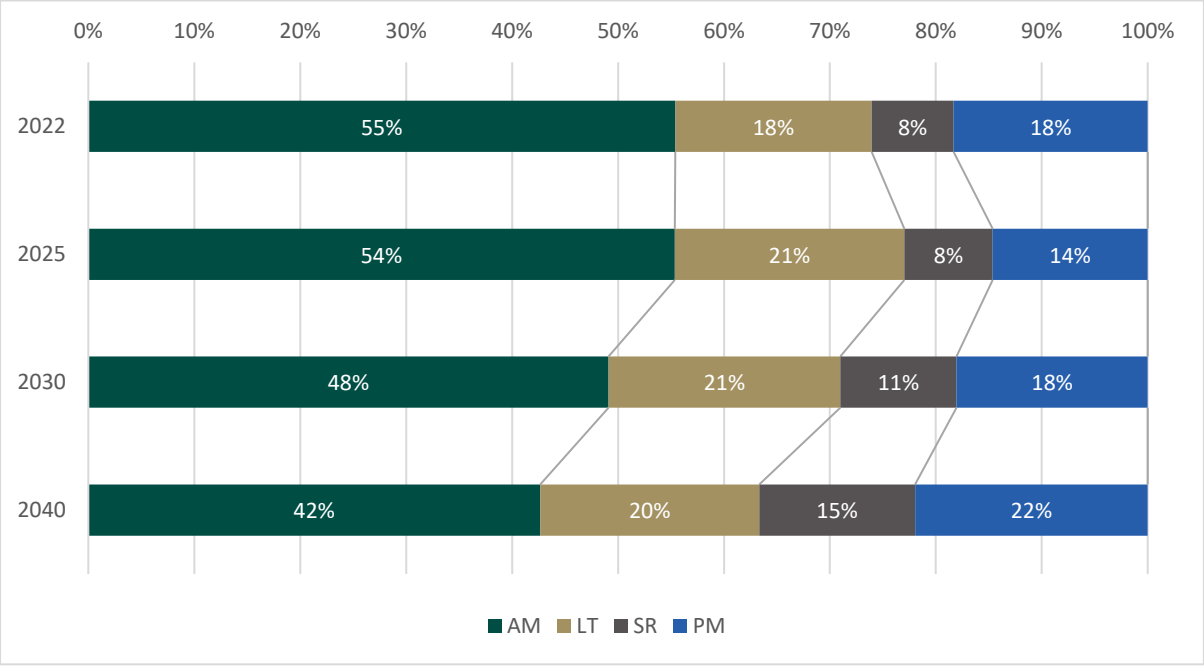
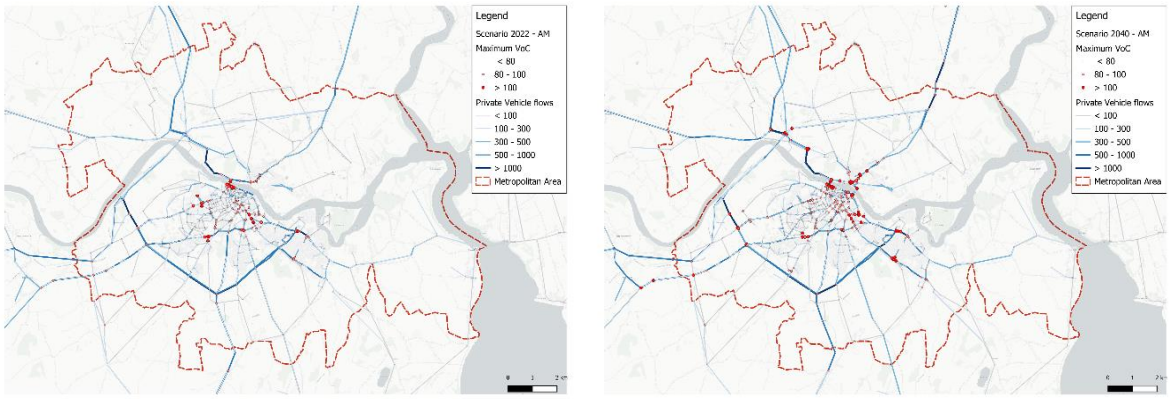


Figure 22 provides a summary of the geographic distribution of traffic volumes across the network during the morning peak travel time. The figures enable a high-level identification of areas which will experience an increase in traffic volumes. Orange circles denote junctions operating at 80%-100% of their V/C while red circles represent junctions operating at over 100% of their V/C. Thicker lines represent links experiencing greater traffic volumes.

Figure 22 - AM Peak Private Vehicle Traffic in WMA 2022 (Left), 2040 (Right)



In 2040, while traffic flows on some links are reduced due to new infrastructure, there are more links experiencing heavier flows overall in the WMA. The model assumes two major road infrastructure developments, Abbey Road Eastern Access and North Quay Development including additional the bridge on the east of River Suir. This will reduce congestion on the junctions on the bridge on the west of the river just after development in 2025. However, in 2040, the junctions around both bridges in the west and east of the city will have heavy congestion due to increase traffic volume. Also, significant growth in traffic volumes will be seen in the north of the WMA due to the development in North Quay and Ferrybank area. It indicates that the WMA could experience heavy traffic volumes and insufficient road capacity despite planned infrastructure development due to economic and population growth in the future.

In the WMA, the cost of congestion is projected to grow considerably over the period due to population and economic growth. While the morning peak still accounts for a large proportion of these costs each day, the proportions of other time periods - including off-peak times (lunch time and school run) and the evening peak - will grow, reflecting an increasing share of cost of congestion attributable to goods vehicles. These results reflect increasing traffic volumes in overall WMA over the period to 2040, which causes significant capacity issues on the junctions and links. As the demand will grow due to continuous population growth to 2040, the cost of

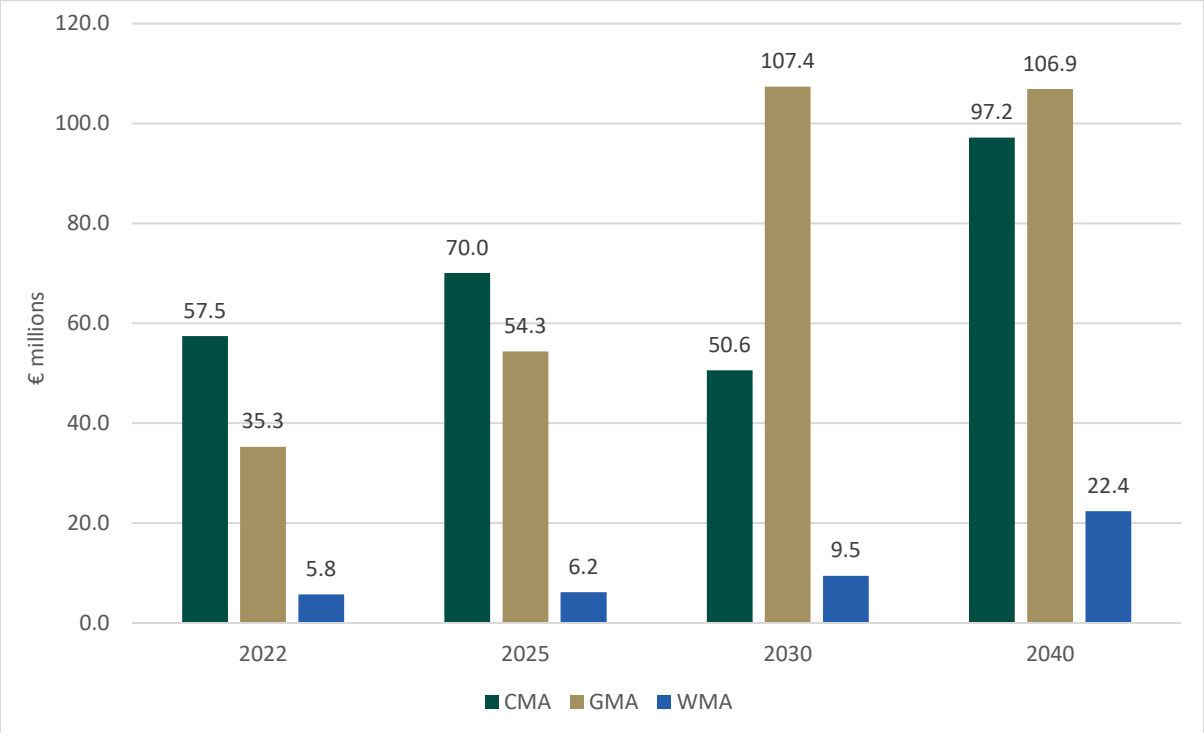
congestion will increase faster without redeployment of road spaces from car to sustainable transport modes.

3

6. Conclusion

This study estimates congestion and its economic impacts in regional cities using the NTA's RMS. Figure 23 presents the cost of congestion in three regional cities under the Core Growth Scenario from 2022 to 2040.

Figure 23 - Cost of Congestion in the CMA, GMA and WMA (Core Growth Scenario)



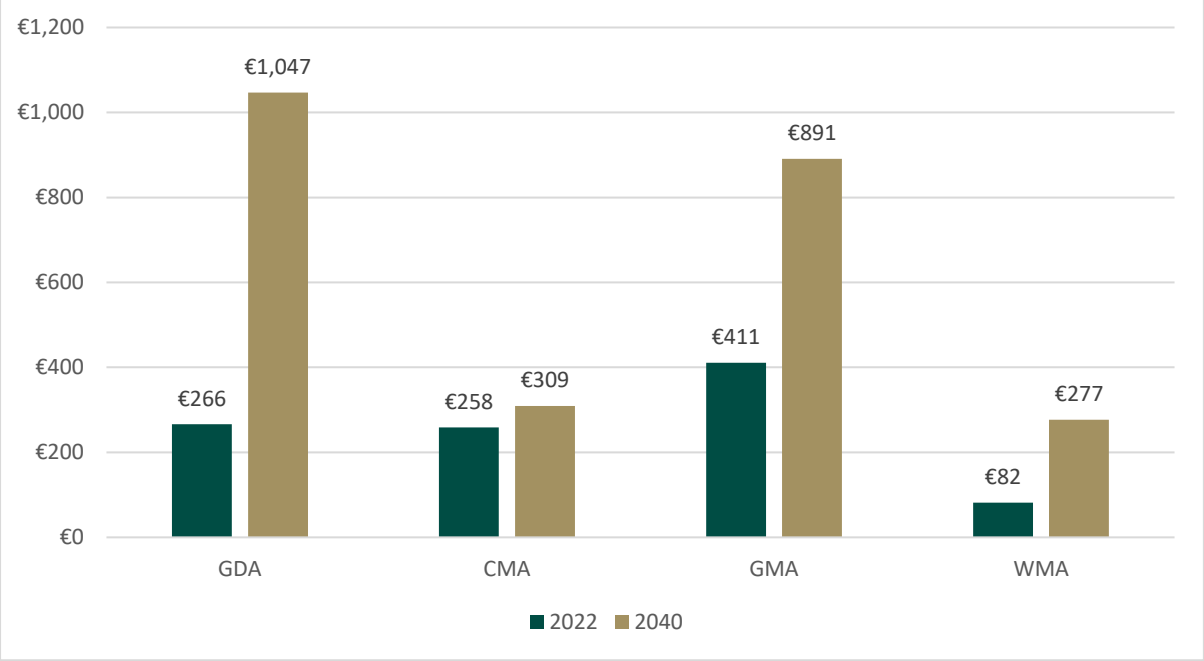
The results of this study demonstrate that congestion is projected to deteriorate further over the coming decades to 2040. Under the Core Growth Scenario, the costs in the CMA, GMA, and WMA grow by 69%, 203%, and 290% respectively. However, the results show that planned investments in the road and public transport network will be able to alleviate the potential cost of congestion, particularly in the CMA, where the cost decreases considerably between 2025 and 2030 due to significant improvements in bus, rail and active transport. Although, it is important to note that - due to continued economic and population growth - the impact will be temporary as cost of congestion in the CMA will be only reduced marginally and it will increase again in the CMA between 2030 and 2040.

Also, the costs of congestion under the Alternative Future Scenarios are 25% lower than the Core Growth Scenarios in average in both 2022 and 2040. The Alternative Future Scenario assumes growing rates of remote working which reduce transport demands. This demonstrates

that policies designed to reduce demand can have a significant impact on the broader costs of congestion.

Comparing the cost of congestion across different cities can allow us to better understand the economic impact of congestion relative to the population in each city. Considering population in the cost of congestion helps to measure the impact of congestion on an individual basis. Figure 24 shows the cost of congestion per population of each city. The results show varying levels of impact and growth in the GDA and regional cities. Higher cost of congestion per capita suggests that each resident is more affected by congestion, either through longer travel times, increasing fuel consumption, or worsening wellbeing outcomes.

Figure 24 - Cost of congestion per population in the GDA, CMA, GMA and WMA (Core Growth Scenario)



When considering population size, the cost of congestion in the GMA is the highest in 2022 at €411, indicating considerable economic impact in this area. In 2040, while the GDA's cost of congestion per population is projected to have the most significant increase among all cities, increasing by 294% to €1,047 per person, the GMA's cost of congestion is also set to increase significantly, more than doubling to €891, which is a 117% increase. The WMA, despite its smaller scale, shows a sharp increase of 238%, reaching €277 per person in 2040. Large increases in these cities highlight significant transport challenges that existing and planned capacities in the transport networks of these areas will not be able to support long-term

growths. Thus, strategic planning and investment in sustainable modes will be crucial to alleviate economic impacts of congestion in these areas, which can promote behavioural changes.

The CMA shows a relatively modest increase in cost of congestion, 20%, compared to other cities when considering population size. While the cost of congestion will grow over the period, this indicates that planned investments in the CMATS will play a significant role in reducing the overall growth over time in the cost of congestion, as wide ranging investments in sustainable modes - such as Cork Area Commuter Rail and BusConnects - seem to mitigate the economic impact of cost of congestion over the period. This demonstrates that large scale investments in sustainable modes can slow down the growth of congestion and that further proactive measures in improving sustainable modes and effective policies to control demand increases should be followed to keep congestion under control.

Overall, the results in this study indicate that congestion will increase significantly over the periods in all three regional cities, driven by population and economic growth, although the scales of growth vary in different cities. As discussed in the *2023 GDA Cost of Congestion* study, these levels of growth are strongly linked to higher levels of transport demand, as well as urban sprawl. Higher costs of congestion will negatively impact economic productivity by increasing the time and cost of commuting for workers and the transportation of goods.

Also, the previous studies for the GDA in 2017 and 2023 show that congestion is associated with negative externalities such as GHG emissions, local air pollutants, and adverse health outcomes and these are responsible for significant cost to society. Similar to the GDA, increased congestion will lead to higher emissions of pollutants and GHGs in the regional cities as well.

Therefore, tackling congestion is essential to prevent the deterioration of people's wellbeing and economic productivity in regional cities. As shown in the results from this study, the impacts of congestion on individuals will significantly increase. While it is a complex problem to stop growing congestion, this study shows that wide implementation of transport investment, particularly in sustainable modes, is effective in achieving a slower rate of increase in the cost of congestion. However, as an increasing population will result in growing transport demand, it will also be necessary to deploy policy interventions to control drivers of transport

demand such as additional modal shift, behavioural changes and integrated land-use planning to mitigate the economic impact of congestion.

Appendix: Transport Strategies for the Regional Cities

The NTA has published a series of transport strategies for four regional cities. These plans outline the main planned and ongoing projects and provide a framework for future projects as well as the existing transport context and challenges. This section sets out an overview of these transport strategies to provide context for the current transport provisions and future transport developments in the regional cities.

While the geography and infrastructure of each regional city are unique, there are some similarities between them, leading to a number of common issues among the four cities. Car dependence, congestion, and low modal share for public transport are more or less issues in each regional city for similar reasons. Old inner-city streets cause complications for road traffic and the construction of active and public transport infrastructure. There is variation in the level of walkability in the various city centres, but in general, walkability outside of the immediate centre is poor. The provision of public transport, particularly of high frequency bus routes, is lacking and there is a shortage of dedicated bus and cycle lanes.

A.1 Cork Metropolitan Area Transport Strategy 2040 (CMATS)

The CMATS was published in 2020 and represents a coordinated land use and transport strategy for the Cork Metropolitan Area (CMA) to cover the period up to 2040, given the existing transport context. The CMATS outlines the current situation and conditions in the CMA:

- Significant employment centres within the current City Council administrative area particularly in Mahon, the city centre, Model Farm Road and southwest of the city and outside the city such as Cork Airport, Ringaskiddy, Ballincollig and Little Island.
- High car dependency such that 74% of trips throughout the region and approximately 86% of trips to work in the metropolitan area outside of the urban centre are made by car.
- Insufficient cycling and walking infrastructure outside of the city centre while active travel infrastructure has been improved in the inner city in recent years.
- Bus network made up of radial, orbital, and cross-city routes that connect residential areas with key locations including the city centre and UCC.
- A number of rail connections to areas like Cobh and Midleton, and an hourly rail service between Cork and Dublin.
- Extensive strategic national road network in Cork connecting to multiple key destinations while high traffic volumes cause congestion at critical points and

inefficient and unsafe regional and local roads due to heavy traffic volumes and high speeds.

The CMATS also identifies the main issues affecting transport in Cork and the issues relate to land use, infrastructure and geography.

- Land use and physical constraints: dispersed development patterns of residential, employment, and retail development, particularly outside of the city centre area as well as steep hills, waterways, and narrow existing roads that limit the capacity for active transport.
- Travel behaviour: overreliance on the private car for relatively short trips which contributes to congestion and delays.
- Public transport: a limited number of high frequency bus services with unreliable schedules and poor supporting infrastructure and constraints on the rail network that limit frequency and capacity at Kent station.
- Road network: absence of strategic northern orbital route, high levels of congestion in the inner city and on surrounding strategic roads and over-provision of junctions along the N40 resulting use of the strategic road network for local trips.

The CMATS proposes key measures that will be taken over the course of the strategy's lifetime.

- Walking and Cycling: specific measures for active travel including the construction and regeneration of a number of strategic pedestrian routes and the construction of cycle lanes, tracks, and trails as well as developing mixed streets and quietways including those along disused railways with a better wayfinding system.,
- Bus: network enhancement by BusConnects with the addition of 220 buses to the fleet, 200km of cross city routes, 50km of orbital routes, and 150 km of radial routes including priority lanes.
- Rail: construction of new stations along existing lines, a light rail corridor running east-west across the city and the Cork Area Commuter Rail programme, and implementation of measures to enable interchange such as integrated ticketing, regionally integrated fares, and high-capacity parking at interchanges to enable park and ride journeys.
- Parking: development of Park & Ride facilities along with the BusConnects network and local mobility hubs.
- Road network: upgrades to key roads such as N27 and M20 to support regional connectivity, along with several bridge projects, and improvements in multi-modal access on important roads.

A.2 Galway Transport Strategy (GTS)

The GTS was developed in 2016 with the aim of creating an integrated strategy for the development of transport in Galway City in the short, medium, and long term. The strategy outlines the existing infrastructure and identifies the main weaknesses that the strategy seeks to address.

- Walkable environment with pedestrianised streets in the city centre and pedestrian infrastructure along the canal, outside the centre some residential areas have walkable routes that are not suitably connected and cycling infrastructure is limited.
- Disconnected bus service with low frequencies while the bus service has priority sections on key corridors.
- A single-track heavy commuter rail line from the east terminating at Ceannt Station that connects Galway to several key locations,
- The national and secondary road network providing links to city from surrounding areas while several bridges across the various waterways experience heavy congestion.

The GTS identifies the main challenges that Galway currently faces relating to infrastructure and development patterns, and geographical issues.

- High levels of car dependence resulting in congestion particularly during peak times and at key junctions.
- Residential development pattern inducing high volumes of cross city journeys which is compounded by poor active travel infrastructure near major employers despite proximity to residential areas, as well as the low modal shares for sustainable transport modes.
- Difficulties in development of efficient route due to geographical barriers in the form of waterways.
- The city acts an employment/leisure hub for a large area which attracts high volumes of journeys from surrounding areas while numerous non-central employment destinations make public transport journeys less viable.
- Poor connectivity between national and regional road networks.

The GTS sets out the main measures to address the current and future transport needs of Galway City and its environs.

- Walking and Cycling: Development of an integrated active travel network in the city and town centres, including greenways, cycle parking, and coordination with Gardaí to

reduce bike theft and user safety improvements including road crossings at roundabouts, and reduced speed in city and town centres.

- Sustainable mode: supports from the large employers to set up workplace travel plans to encourage employees to travel by sustainable modes, improvement of public transport network with the quality bus corridors along key routes, including park and ride sites on major access routes, traffic restrictions in the city centre, and an accompanying marketing campaign to encourage uptake.
- Traffic management: restriction of Heavy Goods Vehicles (HGV) access to the city centre and reduced street parking.
- Road network: Galway City Ring Road Project to provide an orbital route around the city.

A.3 Waterford Metropolitan Area Transport Strategy (WMATS)

The WMATS was published in 2022 and sets out the framework for an accessible, high-quality and integrated transport network that supports the sustainable growth of the Waterford Metropolitan Area (WMA). The WMATS outlines the current situation and conditions in WMA:

- Fragmented existing cycle network while active travel infrastructure in Waterford has been incrementally developed over the last few years and varied levels and quality of pedestrian environment despite improved walkability in the city centre with the pedestrianisation of some streets.
- Three high frequency bus routes in Waterford City and suburbs and additional lower frequency routes concentrated in the south of the city.
- Several regional bus links and intercity rail services which are direct connections to Kilkenny, Dublin, Carrick-On-Suir and Clonmel and connections via Limerick Junction to Cork, Tralee and Limerick.
- Well-developed road network in WMA while there are also high volumes of traffic in certain areas resulting in congestion at some locations and strong HGV demands between the areas of the M9 north, the N25 west and north, N24 to the west.

The WMATS identifies the main challenges affecting transport in the city, including physical constraints, and land use issues, such as the limited connectivity between the north and south of the city.

- Limited road connectivity and unsuitable infrastructure, particularly in the city centre, leading to congestion and competition for space.

- Over reliance on private cars, low cycling and walking rates, and high car use for school commutes.
- Inadequate public transport services, including limited high-frequency bus routes, poor rail access, and lack of Park & Ride facilities aligned with public transport.
- Traffic congestion during peak hours affecting investment potential and access to key locations, with insufficient public transport to cater for car-free workers.
  Public health concerns related to physical inactivity, poor air quality, and unequal access to essential services.

The WMATS sets out the main measures to tackle the challenges identified.

- Cycling and walking: expansion of the cycling network with high-quality infrastructure and supporting measures such as Bicycle Sharing Schemes (BSS), short and long stay cycle parking and end-of trip facilities. Development of primary pedestrian network and walking infrastructure improvements including improved footpaths and junctions with supporting measures such as wayfinding systems, provision of local amenity routes and pedestrianisation of key areas.
- Bus: introduction of BusConnects, with higher frequency bus services and dedicated bus lanes to improve reliability and connectivity, including development of Park & Ride facilities, fully accessible fleet and the transition to a Zero Emissions bus fleet by 2030.
- Rail: relocation of Plunkett Station for better access to the city, improvements in intercity services, and exploration of electrifying or upgrading the rail network to reduce emissions and enhance connectivity.
- Road: limited provision of additional roads in line with the NPF, improvement of the existing N25 through the creation of a dual carriageway, enhancement of connectivity in regional and local road and city centre traffic management.

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