Bonneagar Iompair Éireann
Transport Infrastructure Ireland

TRANSPORT INFRASTRUCTURE IRELAND

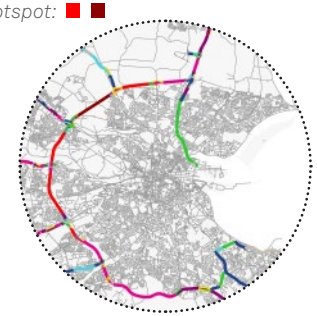
NATIONAL ROADS NETWORK INDICATORS 2021

May 2022

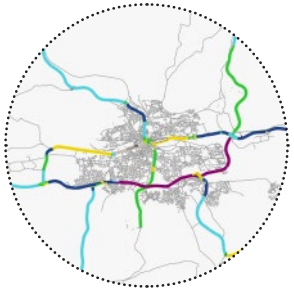
A: KEY TREND SUMMARY

TRAVEL HOTSPOTS:

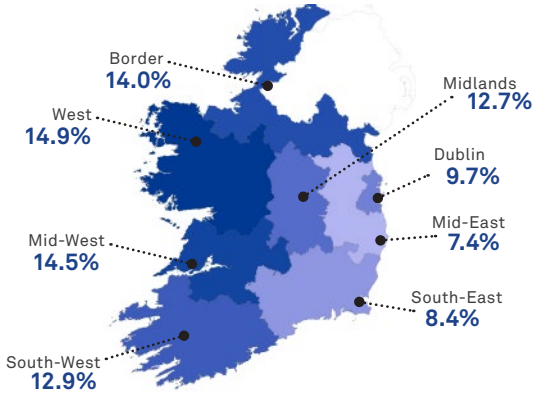
M50 Dublin area:
100,000 or more vehicles per day hotspot:



N40 Cork area:
50,000 or more vehicles per day hotspot:

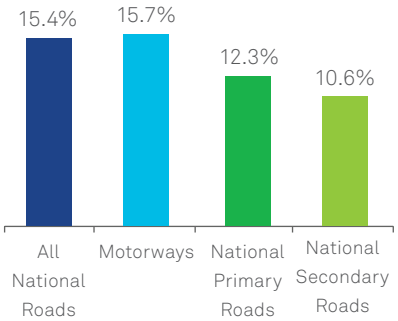


TRAFFIC GROWTH 2020 - 2021:



15.4%

Traffic across the network increased by 15.4% in 2021



M50 KEY NETWORK STATISTICS:

13,171
Highest hourly flow recorded on the N7 - N4 section between 4pm and 5pm on 21st September

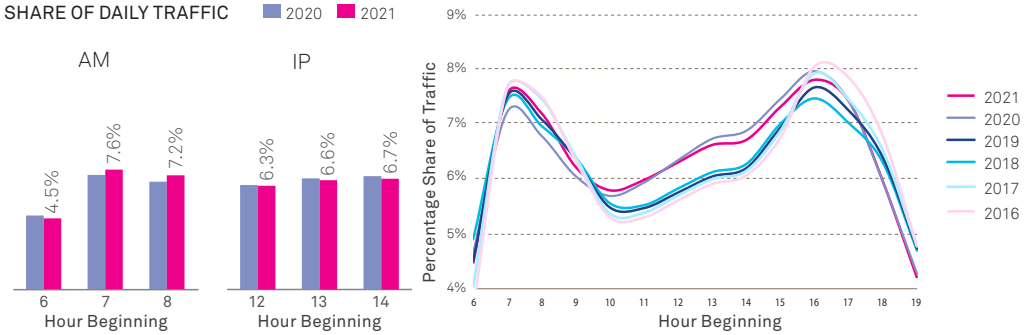
1.26 billion
Vehicle km travelled which represents a 10% increase on 2020

174,404
Highest Daily Flow Recorded between the N3 - N2

1,335
Total No. of Incidents

CHANGES IN PEAK HOUR SPREAD M50:

The peak periods remain the same as 2020: 6:30 - 9:30 and 15:30 - 18:30. The proportion of demand has increased in the AM peak period as some have returned to work due the easing of some COVID-19 restrictions in 2021. The proportion of activity in the inter peak period between 10:00 and 15:00 decreased slightly in 2021.

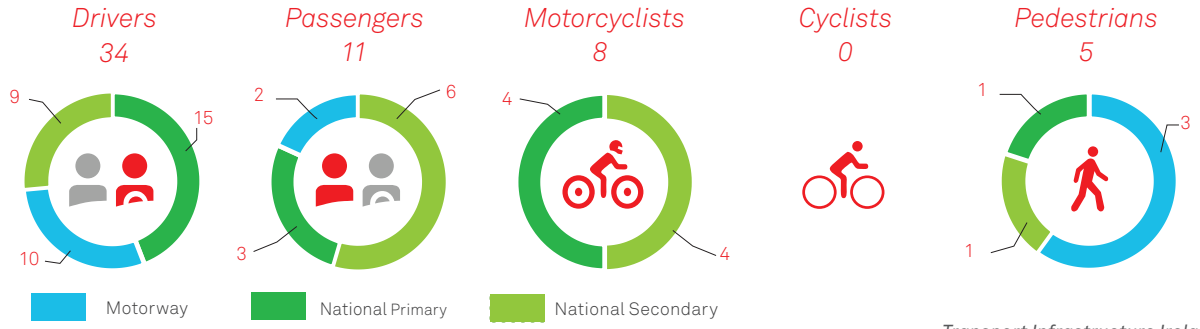


FATAL COLLISIONS ON THE NATIONAL ROADS NETWORK 2016 - 2021:

Total fatal collisions on National Roads:

**In 2021, 49 fatal collisions resulted in 58 fatalities*

TOTAL FATALITIES ON THE NATIONAL ROADS NETWORK IN 2021:



B: NEWS & INFORMATION

News

Traffic Count Database
TII's traffic count database has been upgraded to a cloud based platform. The website has a new URL trafficdata.tii.ie and the website itself has undergone aesthetic changes with enhanced reporting facilities also provided. There are new individual site dashboards providing site details and summarised figures plus monthly and annualised graphs. There are also two global reports available for download, including an all site monthly summary report and all site Annual Average Daily Traffic (AADT) and Heavy Goods Vehicle (HVG) percentage (%) report.

Road Emissions Model
TII has developed a tool to quantify emissions from road transport to help answer key questions facing Ireland concerning Greenhouse Gas Emissions and Air Quality Emissions and how these will change in the future. The tool draws together information on the vehicle fleet, considers how this vehicle fleet may change over time and uses vehicle emission rates combined with the number, composition and speed of vehicles projected on the roads network to make predictions on total emissions.

Information on the existing fleet in Ireland comes from sources such as the Central Statistics Office (CSO), while several alternative future scenarios in relation to the vehicle fleet (from various sources) can be assessed. Vehicle emission rates are taken from COPERT and other sources, whilst traffic volumes, speeds and compositions are provided by the TII National Transport Model (NTpM).

Information

Traffic Monitoring Units
TII has over 387 TMU sites around the country which are used to monitor traffic volumes and to plan future interventions. Additional TMU sites were delivered in 2021 and a programme of works to deliver additional TMU sites in 2022 is on-going.

See website: trafficdata.tii.ie

Motorway Service Helpline
A Motorway Service Helpline has been set-up to assist roads users in difficulty on a Motorway. All calls are directed through the Motorway Traffic Control Centre (MTCC) and the number is:

0818-715-100 or;
operator@nraits.ie

Further information and live traffic updates are available on www.tiitraffic.ie

C: ONGOING IMPACT OF COVID-19

In 2021 COVID-19 continued to impact when, how and whether people travelled.

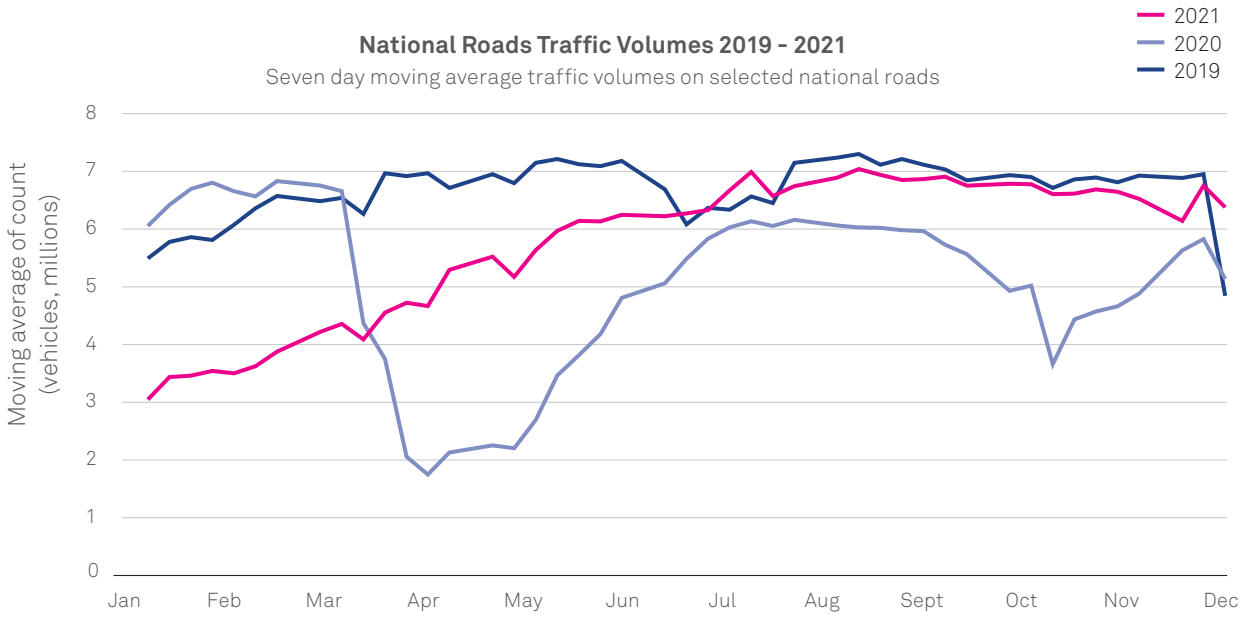
With many people continuing to work from home, there was less travel to employment centres, but more travel to and within local centres compared to 2019, before the COVID-19 pandemic. The impact on how goods were consumed and therefore how these goods were distributed on the National Roads Network continued in 2021. For example, increased online shopping redistributed delivery traffic from retail outlets to the front door of consumers.

2021 saw an aggregate increase in overall traffic on the National Roads Network of 15.4% compared to 2020, although it remained down 17.0% compared to 2019. Of note is that the second half of 2021 (by which time many travel restrictions had been lifted) was down just 3.8% compared to the second half of 2019. The importance of maintaining reliable freight networks continued to be highlighted and overall freight traffic increased by 4.8% in 2021 on the National Roads Network, bringing it to just above 2019 levels.

Traffic volumes increased in line with the easement of travel restrictions through 2021 with the weekly moving average in July exceeding the 2019 equivalent and those for the remainder of the year tracking closely below 2019 equivalents. The ongoing impacts of COVID-19 on daily travel mean that the traditional analysis of examining a typical day for 2021 was again difficult. In addition, summarising annual average conditions in terms of demand levels and network performance in 2021 may be more meaningful than for 2020 but still not entirely comparable to prior years. However, for consistency with previous versions of the TII National Roads Indicators reports, and to facilitate ongoing analysis of trends, the approach of representing typical network conditions and average annual analysis in this report was

National Roads Traffic Volumes 2019 - 2021

Seven day moving average traffic volumes on selected national roads



15% increase on 2020

Overall Demand

5% increase on 2020

HGV Demand

174% increase

Apr 11-17

Largest increase in average weekly traffic volume 2020-2021

49% reduction

Jan 24-30

Largest reduction in average weekly traffic volume 2020-2021

CONTENTS

INTRODUCTION

Transport Infrastructure Ireland's mission is to deliver transport infrastructure and services that contribute to the quality of life of the people of Ireland and support the country's economic growth

For this purpose, TII has overall responsibility not only for the planning and supervision of the construction and maintenance works on these roads, but also for ensuring the efficient use and safe operation of the National Roads network.

Efficient use of the National Roads network provides benefits to road passengers, bus users and road freight users in the form of shorter journey times, reduced congestion and reductions in the cost of operating vehicles. Society as a whole benefits from increased economic productivity, reduced energy consumption and a better environment.

If the National Roads network is operated to a high standard, then road users will enjoy safe journeys with predictable journey times.

Transport Infrastructure Ireland considers it important to monitor the performance and use of the National Roads network and to share this information with the public.

This publication sets out some key indicators of performance and usage of the National Roads network.

ONE: ROAD NETWORK

A: LENGTH OF NATIONAL ROADS NETWORK

Length of National Roads network by road type 2021

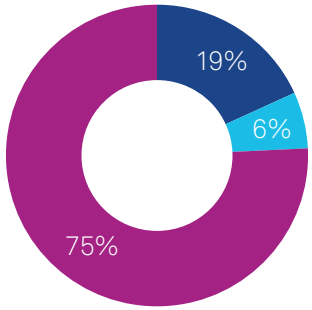
There are almost 5,300 kilometres of National Roads network in Ireland.

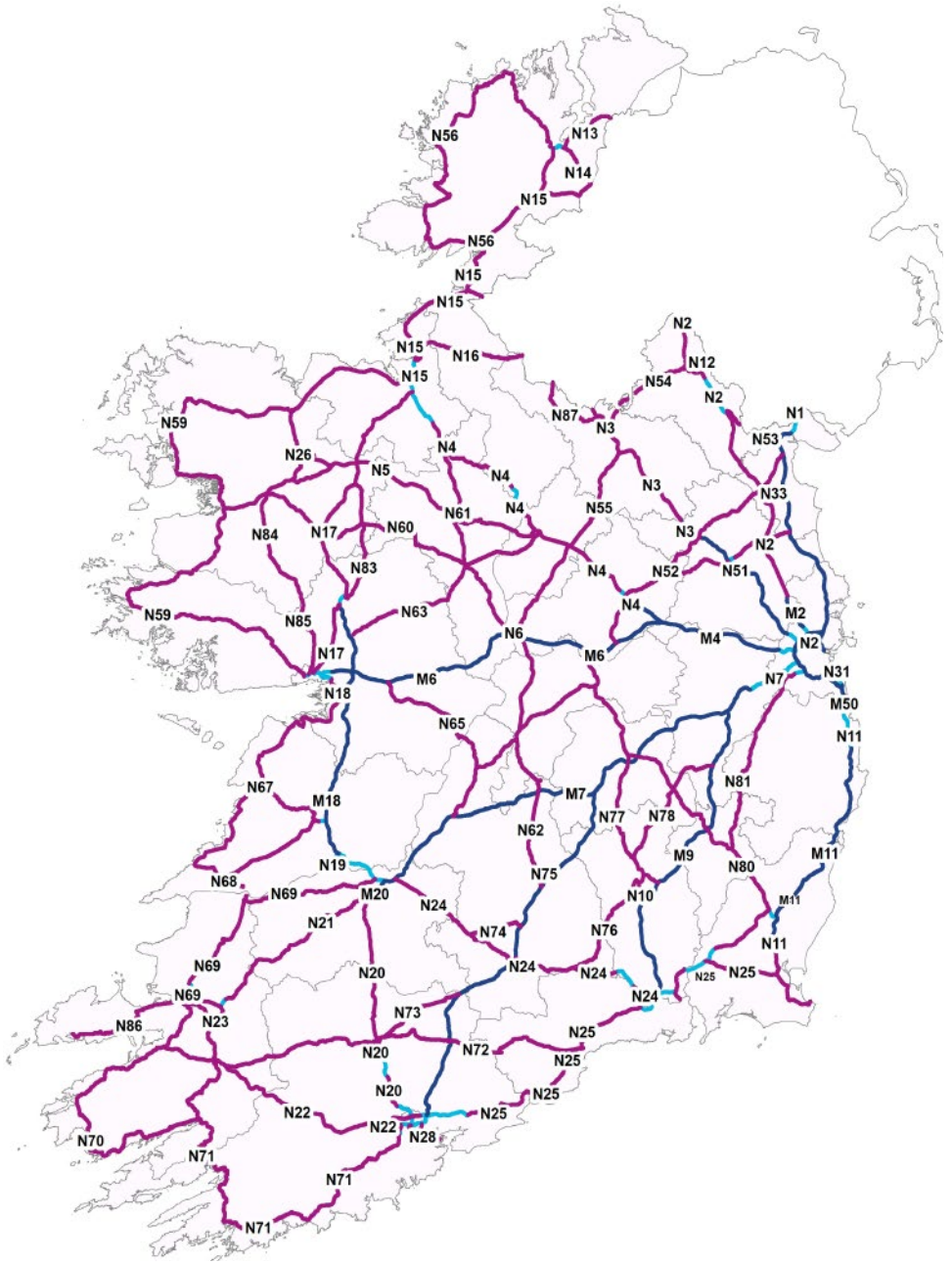
The National Roads network is comprised of 995 km of motorway, 332 km of dual carriageway and 3,966 of single carriageway.

The actual length of the National Roads network fluctuates year on year due to road reclassification, realignments to existing National Roads and completion of new roads.

Road type:

Motorway	995km
Dual carriageway	332km
Single carriageway	3,966km



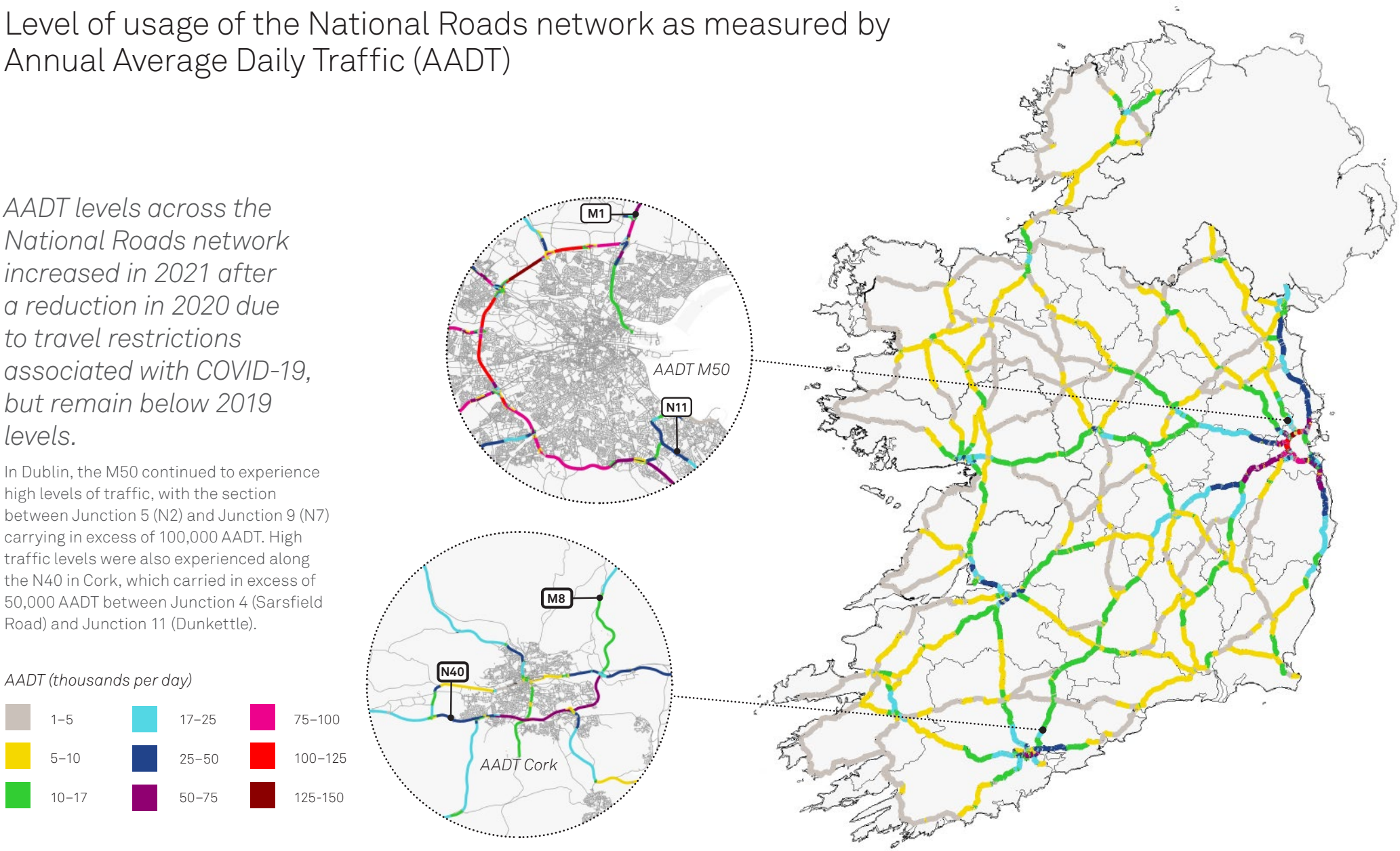


B1: LEVEL OF USAGE OF THE NATIONAL ROADS NETWORK

Level of usage of the National Roads network as measured by Annual Average Daily Traffic (AADT)

AADT levels across the National Roads network increased in 2021 after a reduction in 2020 due to travel restrictions associated with COVID-19, but remain below 2019 levels.

In Dublin, the M50 continued to experience high levels of traffic, with the section between Junction 5 (N2) and Junction 9 (N7) carrying in excess of 100,000 AADT. High traffic levels were also experienced along the N40 in Cork, which carried in excess of 50,000 AADT between Junction 4 (Sarsfield Road) and Junction 11 (Dunkettle).

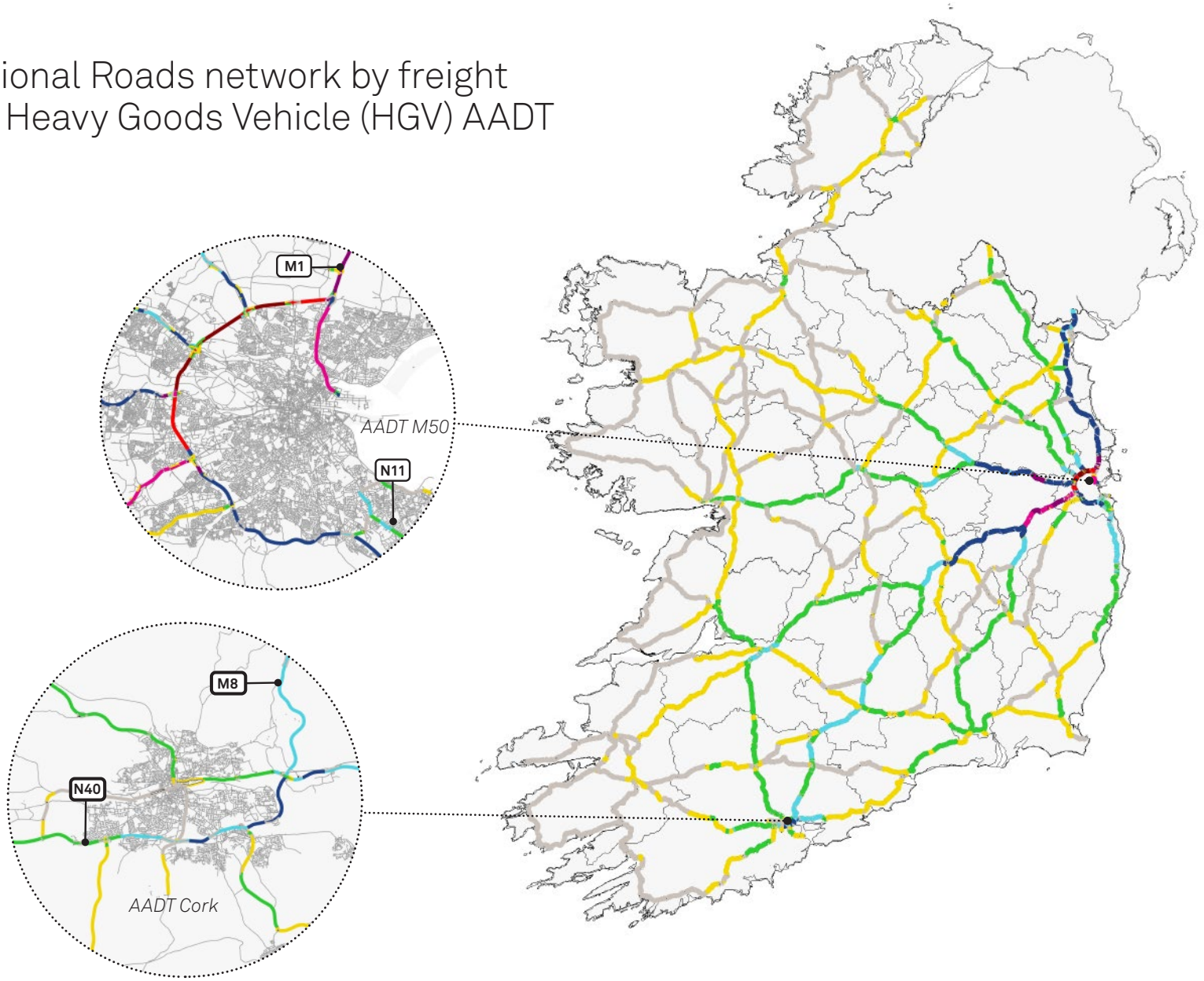


Source: TII National Transport Model, 2021

B2: FREIGHT MOVEMENTS ON THE NATIONAL ROADS NETWORK

Level of usage of the National Roads network by freight vehicles as measured by Heavy Goods Vehicle (HGV) AADT

The usage of the National Roads network by freight vehicles experienced growth again after a slight reduction in 2020. The M50, Dublin Radial and N40 routes continued to carry the highest level of HGV traffic in 2021.



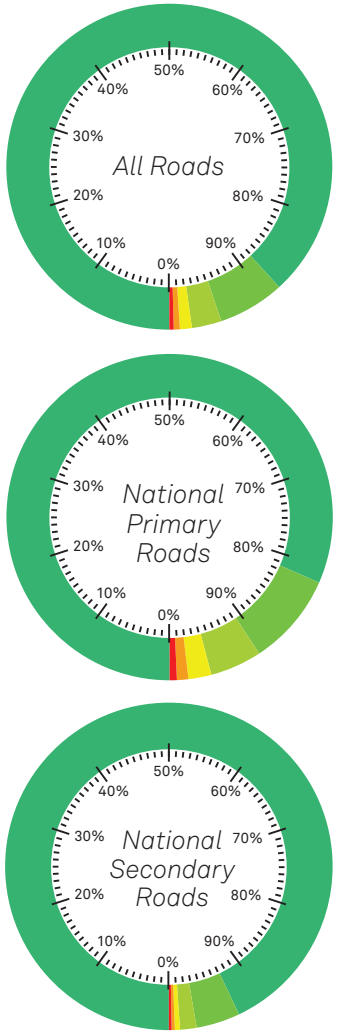
Source: TII National Transport Model, 2021

C1: LEVEL OF SERVICE:
MORNING RUSH-HOUR, NATIONAL ROADS

Proportion of the National Roads network operating under each level of service condition

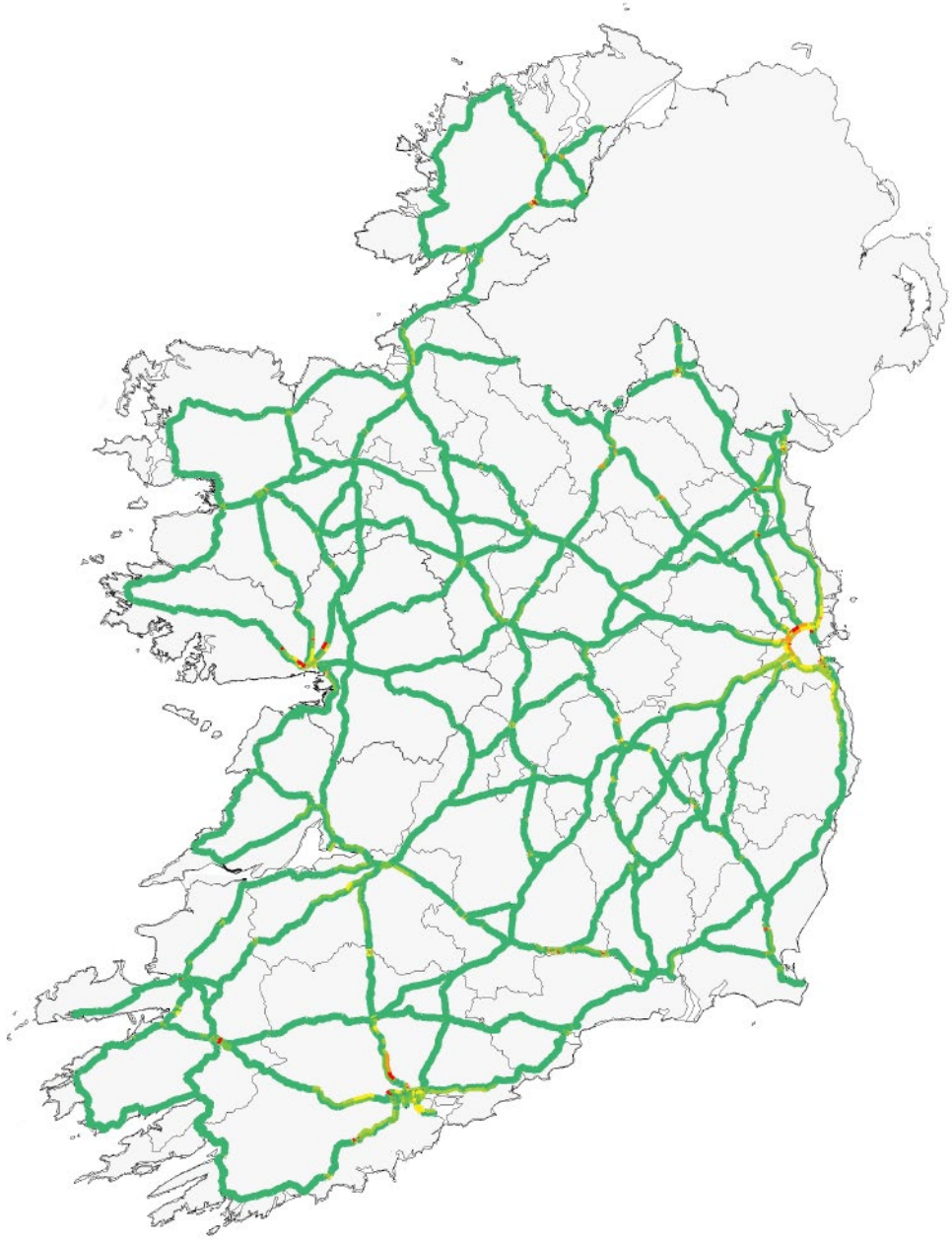
The level of service (LOS) provided by roads may be assessed using recognised international standards. LOS is a quality measure describing operational conditions within a traffic stream. Following the substantial investment in National Roads in recent times, most route sections are operating to the highest standard of service.

For further information see: Transport Research and Information Note: A Study of Lane Capacity, online at www.tii.ie/tii-library/strategic-planning



Level of Service

- A. Free flow
- B. Reasonably free flow
- C. Stable flow
- D. Approaching unstable flow
- E. Unstable flow
- F. Forced or breakdown flow



Source: TII National Transport Model, 2021

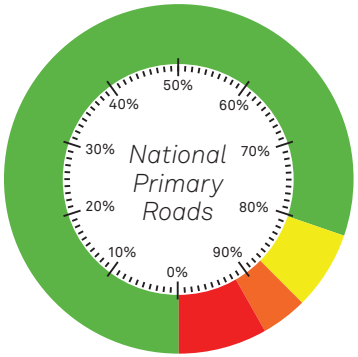
C2: VOLUME TO CAPACITY RATIO: NATIONAL PRIMARY ROADS

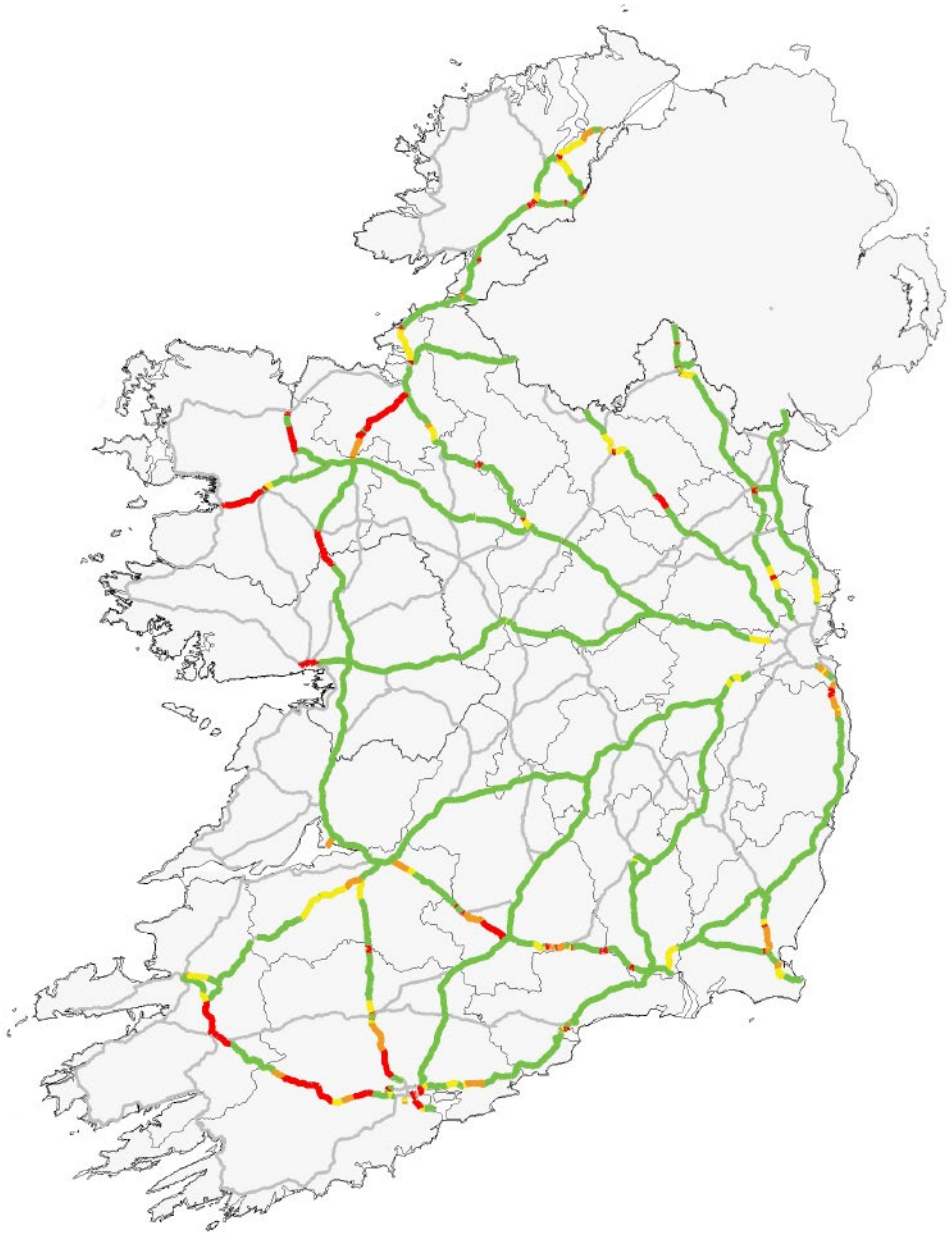
Proportion of the National Primary Roads network operating at each level of capacity

The Volume to Capacity (V/C) Ratio relates the AADT volume carried on a section of road to its daily operational capacity*.

The V/C Ratio for the National Primary Roads network indicates that over 80% of the network is operating at or below 80% of its daily capacity. This reflects the significant investment made in the National Primary Roads network in recent times.

*Capacity based on TII Rural Road Link Design Standard Table 6.1 (DN-GEO-03031)





- Operating Below 80% Capacity
- Operating between 80% - 100% Capacity
- Operating between 100% - 120% Capacity
- Operating above 120% Capacity

Source: TII National Transport Model, 2021

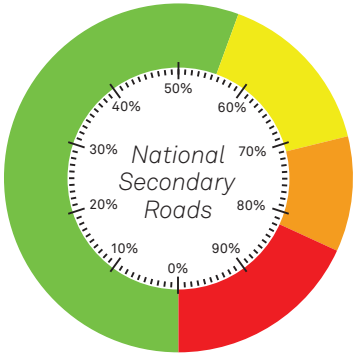
C3: VOLUME TO CAPACITY RATIO: NATIONAL SECONDARY ROADS

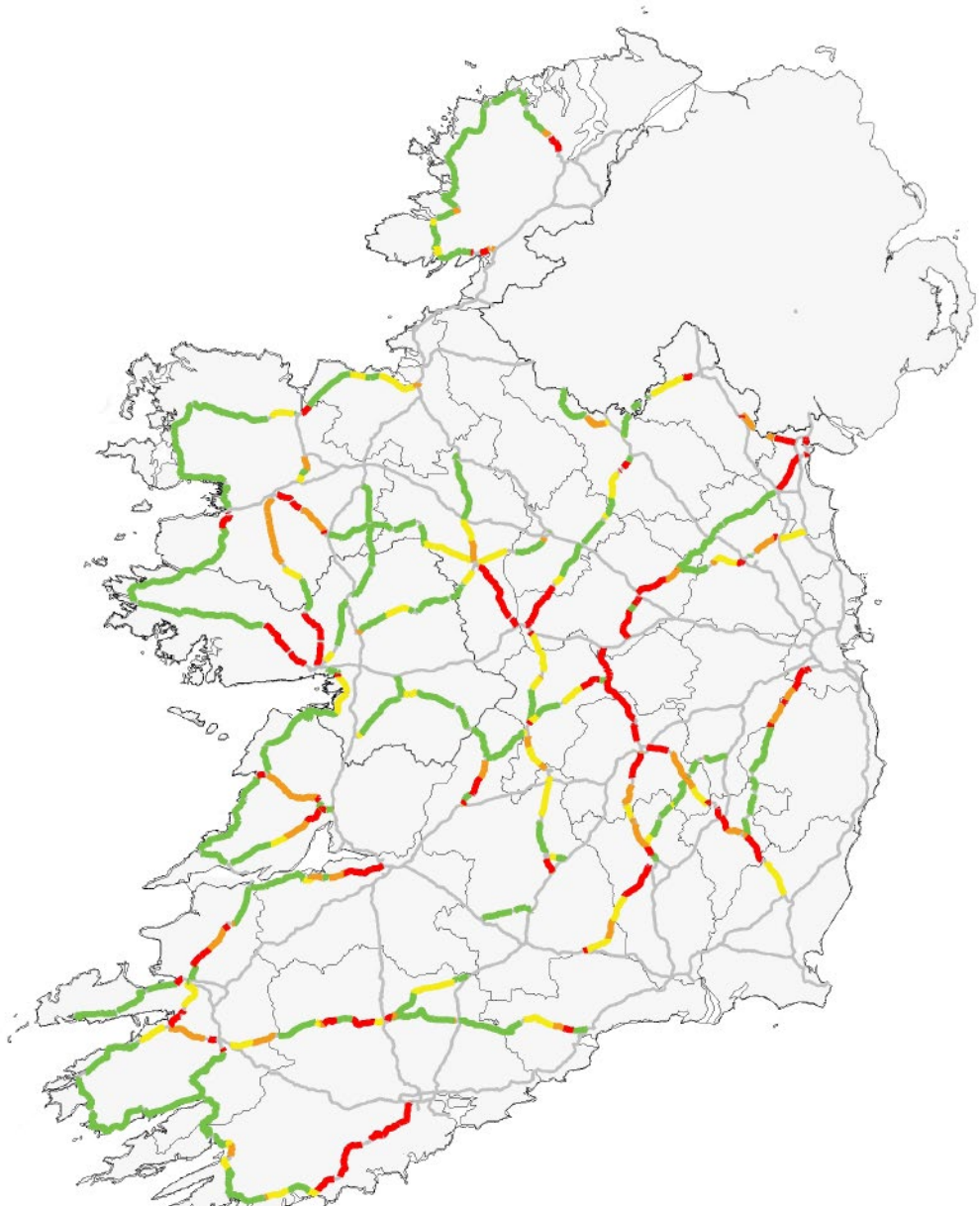
Proportion of the National Secondary Roads network operating at each level of capacity

The Volume to Capacity (V/C) Ratio relates the AADT volume carried on a section of road to its daily operational capacity.

The V/C Ratio for the National Secondary Roads network indicates that over 55% of the network is operating at or below 80% of its daily capacity. This indicates that investment is required in the National Secondary Roads network to match the performance of the National Primary Roads network.

*Capacity based on TII Rural Road Link Design Standard Table 6.1 (DN-GEO-03031)





- Operating Below 80% Capacity
- Operating between 80% - 100% Capacity
- Operating between 100% - 120% Capacity
- Operating above 120% Capacity

Source: TII National Transport Model, 2021

D1: M50 PERFORMANCE SUMMARY

2021 Key network statistics

The M50 is the most heavily trafficked road in the country with close to 125,000 vehicles using several sections on an average day.

13,171

Highest hourly flow recorded on the N7 - N4 section between 4pm and 5pm on 21st September

1.26 billion

Vehicle km travelled which represents a 10% increase on 2020

174,404

Highest Daily Flow Recorded on M50 between the N3 - N2

1,335

Total No. of Incidents of which **475** were Traffic Collisions

FRIDAY

Busiest Typical Day

10 minutes

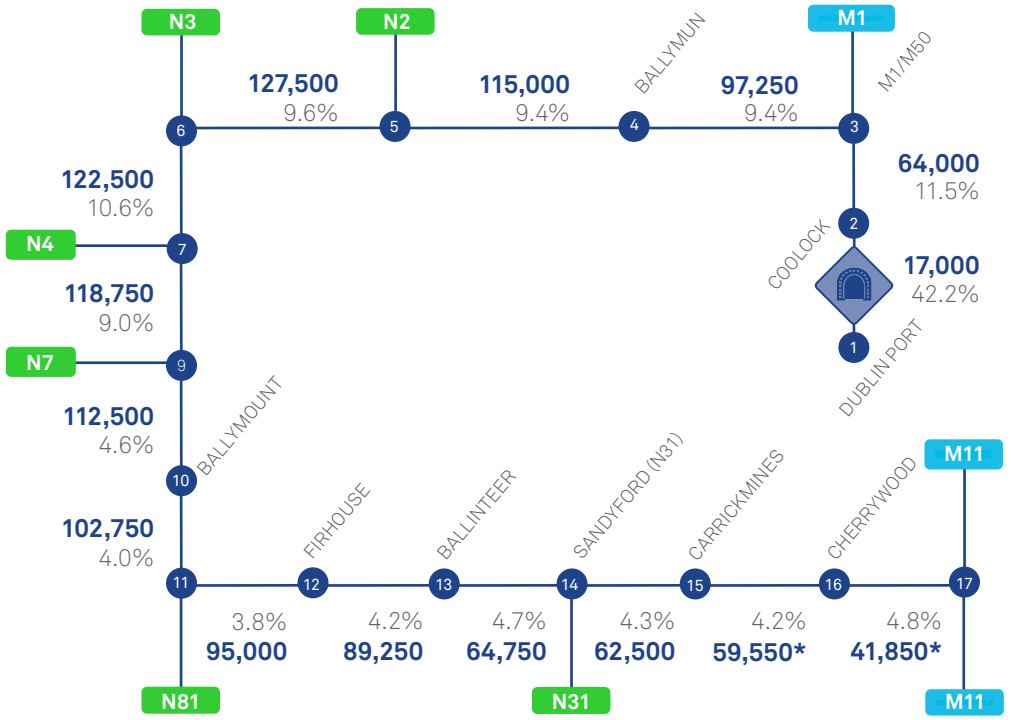
Average Response Time

16:00 - 17:00

Peak Incident Time

32 minutes

Median Duration of Incidents



M50 Schematic Layout

2021 Annual Average Daily Traffic (%HGV) on M50

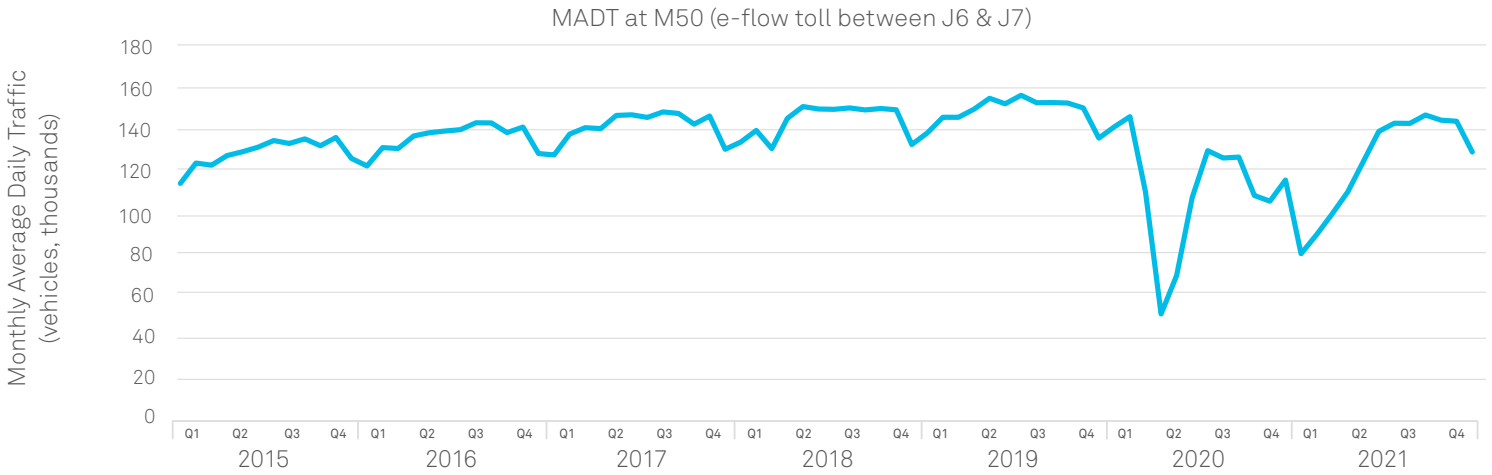
** Data at M50 traffic monitoring unit sites J15-J16 and J16-J17 from August to December 2021 is missing due to engineering works associated with the M50 eMOS project. AADT figures displayed here are estimated based on available data.*

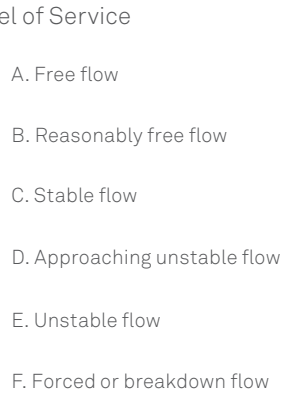
D2: M50 PERFORMANCE SUMMARY

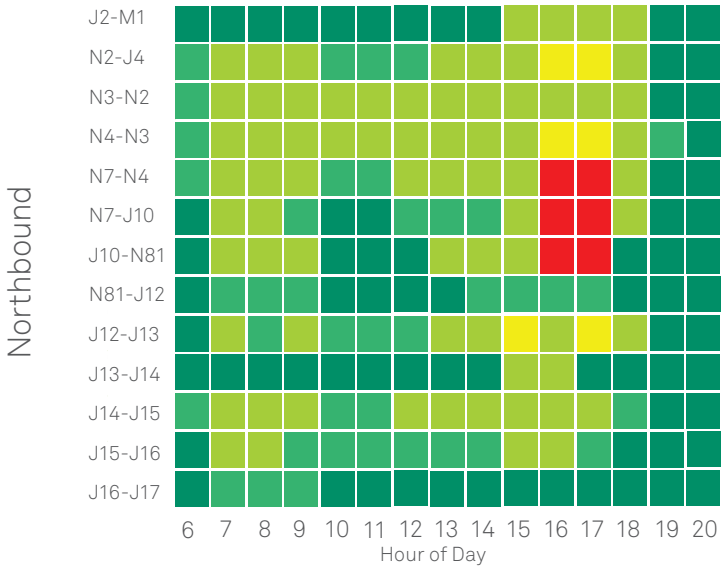
Traffic growth and typical working day conditions represented by level of service

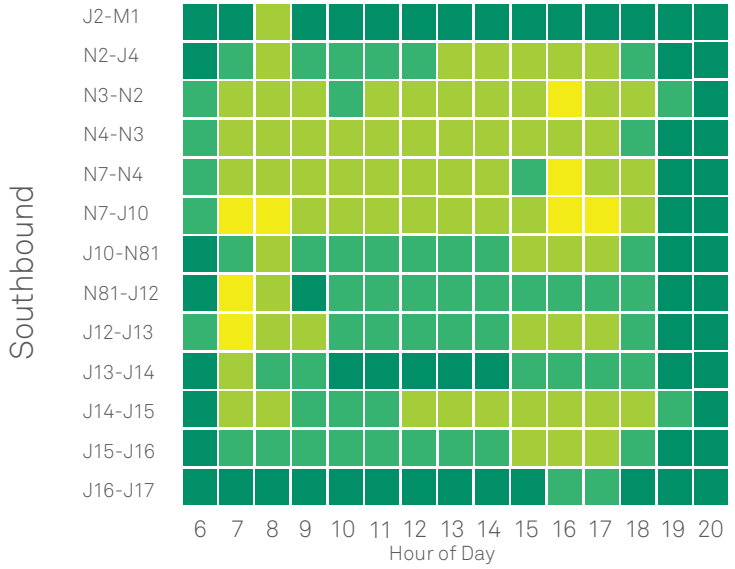
The level of service (LOS) provided by roads may be assessed using recognised international standards. LOS is a quality measure describing operational conditions within a traffic stream.

Average hourly levels of service for the full year were analysed from TII Traffic Monitoring Units which give an indication of what the busiest times of a typical day were, and what sections of the M50 were most congested in 2021. A typical working day in 2021 refers to all weekdays excluding school holidays and public holidays.









D3: N40 PERFORMANCE SUMMARY
2021 Key network statistics

Several sections of the N40 Cork Southern Ring Road carry in excess of 70,000 vehicles on an average day

7,309
Highest hourly flow recorded on the Kinsale Rd - Douglas section between 8am and 9am on 21st October

11 minutes
Average Response Time

91
Total No. of Incidents of which **12** were Traffic Collisions

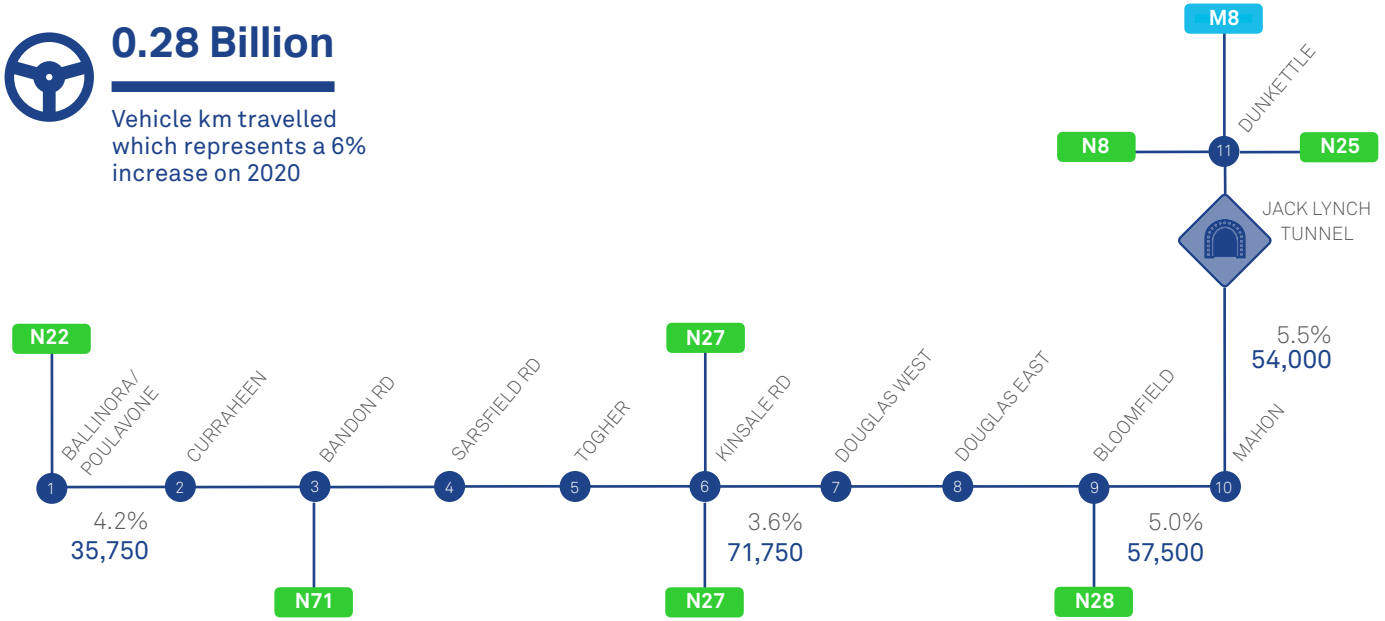
94,411
Highest Daily Flow Recorded on the Kinsale Rd - Douglas section

0.28 Billion
Vehicle km travelled which represents a 6% increase on 2020

FRIDAY
Busiest Typical Day

08:00 - 09:00
Peak Incident Time

35 minutes
Median Duration of Incidents



N40 Schematic Layout
2020 Annual Average Daily Traffic (%HGV) on N40

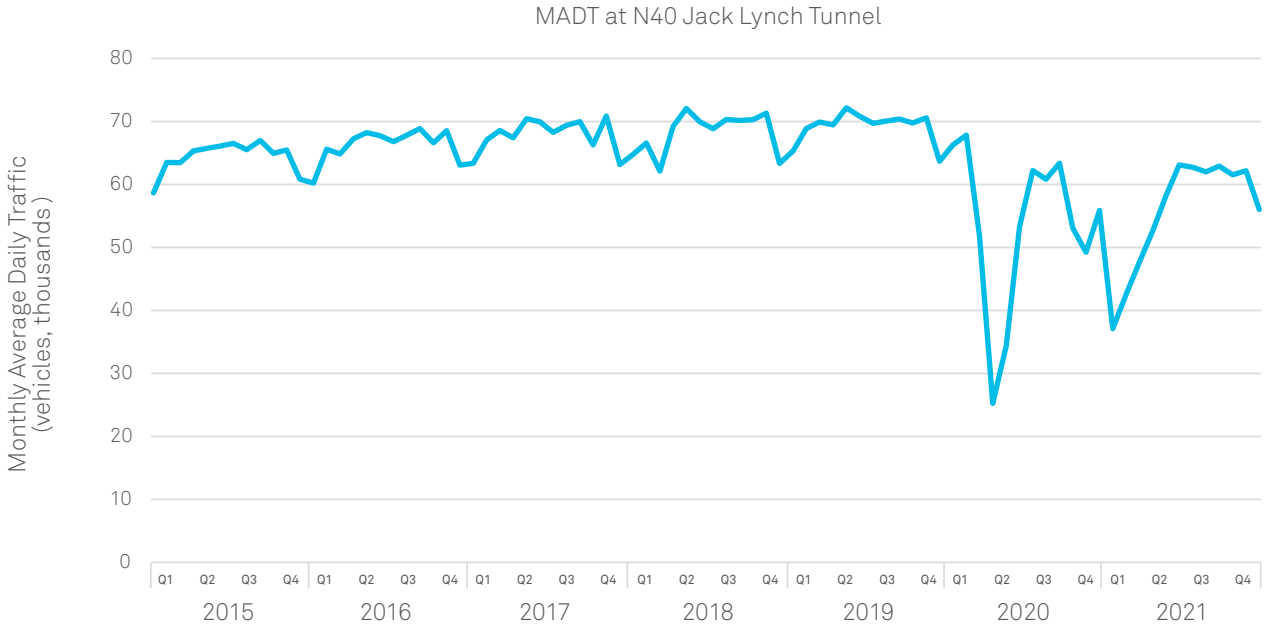
D4: N40 OPERATIONAL PERFORMANCE

Traffic growth and typical working day conditions represented by level of service

The level of service (LOS) provided by roads may be assessed using recognised international standards.

LOS is a quality measure describing operational conditions within a traffic stream.

Average hourly levels of service for the full year were analysed from TII Traffic Monitoring Units which give an indication of what the busiest times of a typical day were, and what sections of the N40 were most congested in 2021. A typical working day in 2021 refers to all weekdays excluding school holidays and public holidays.



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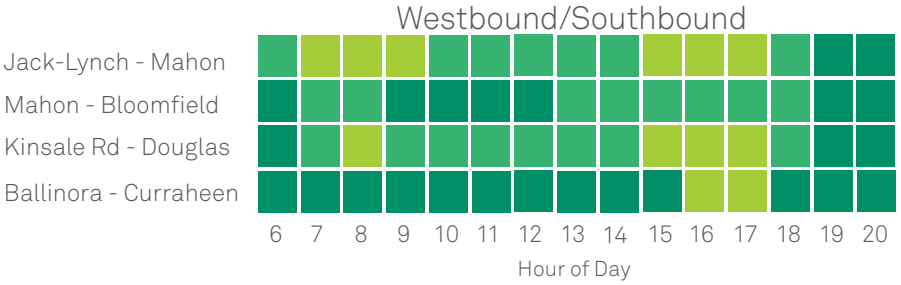
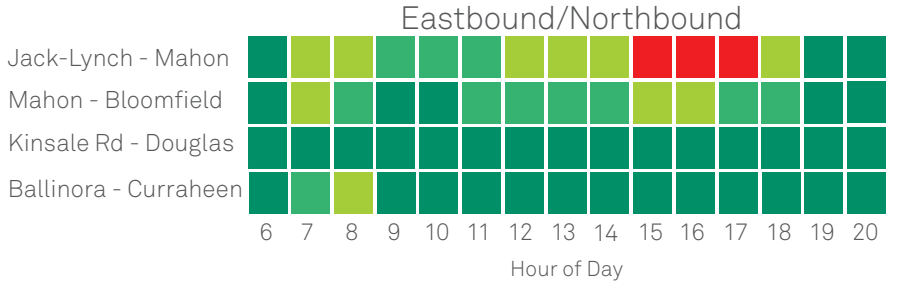




D5: DUBLIN RADIALS PERFORMANCE SUMMARY

Traffic growth and typical working day conditions represented by level of service

The Dublin Radials represent a system of routes providing access to the Dublin Area, converging onto the M50. They are made up of National Primary Routes designated M1 to M11 as one travels anticlockwise around the M50.

The Dublin Radial Routes consisting of the M1, N2, N3, N4, N7, N81 and M11 are some of the busiest routes in the country. The schematic on the right contains AADT data of these routes for 2021 from the Traffic Monitoring Units which are displayed as inner and outer cordons on the map of the Greater Dublin Area. Generally there is a very significant drop off in traffic demand between the inner and outer cordons as you would expect as the population and job densities decrease.

The M7 shows significant traffic demand at the outer cordon. Traffic demand at the M1,M4 and N11 outer cordon locations is lower than the M7 but still remains reasonably high.

Oct 15 — **114,910**

Highest Daily Flow Recorded on the M4 between the M50 andLiffey Valley

Oct 22 — **145,665**

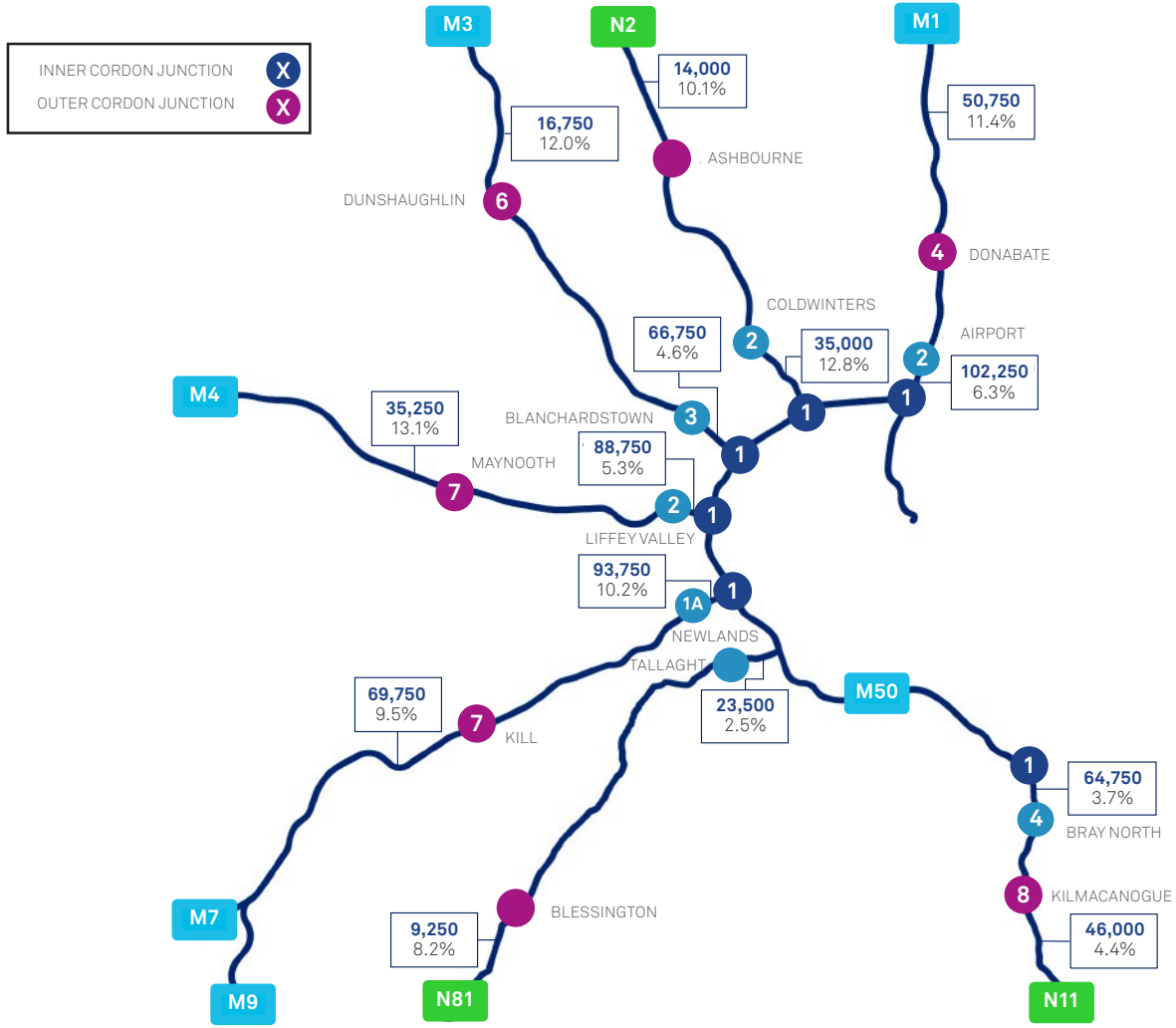
Highest Daily Flow Recorded on the M1 between the M50 and Dublin Airport

Oct 15 — **126,381**

Highest Daily Flow Recorded on the N7 between the M50 and Newlands

Jul 21 — **89,484**

Highest Daily Flow Recorded on the M11 between the M50 and Bray North



Dublin Radials Schematic Layout

2021 Annual Average Daily Traffic (%HGV) on Dublin Radials

Transport Infrastructure Ireland
National Roads Network Indicators 2021

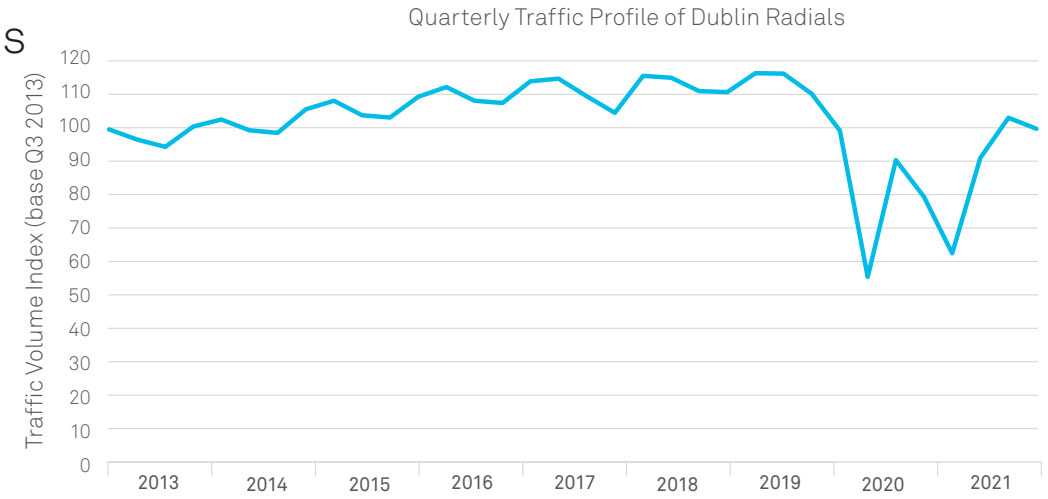
D6: DUBLIN RADIALS PERFORMANCE SUMMARY

Traffic growth and typical working day conditions represented by level of service

The level of service (LOS) provided by roads may be assessed using recognised international standards. LOS is a quality measure describing operational conditions within a traffic stream.

Average hourly levels of service for the full year were analysed from TII Traffic Monitoring Units which give an indication of what the busiest times of a typical day were, and what sections of the Dublin radial routes were most congested in 2021. A typical working day in 2021 refers to all weekdays excluding school holidays and public holidays.

The LOS figures show congestion occuring at inner cordon locations during the peak periods. Congestion at the outer cordon location is limited to the evening peak at specific locations where TII currently have schemes at the construction/design stage.



Level of Service

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- B. Reasonably free flow
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- E. Unstable flow
- F. Forced or breakdown flow

Inner Cordon

M1-M50 to Airport

N2-M50 to Coldwinters

N3-M50 Blanchardstown to Clonee

N4-M50 to Liffey Valley

N7-M50 to Newlands

N81-M50 to Tallaght

M11-M50 to Bray North

Outer Cordon

M1- Donabate to Balbriggan

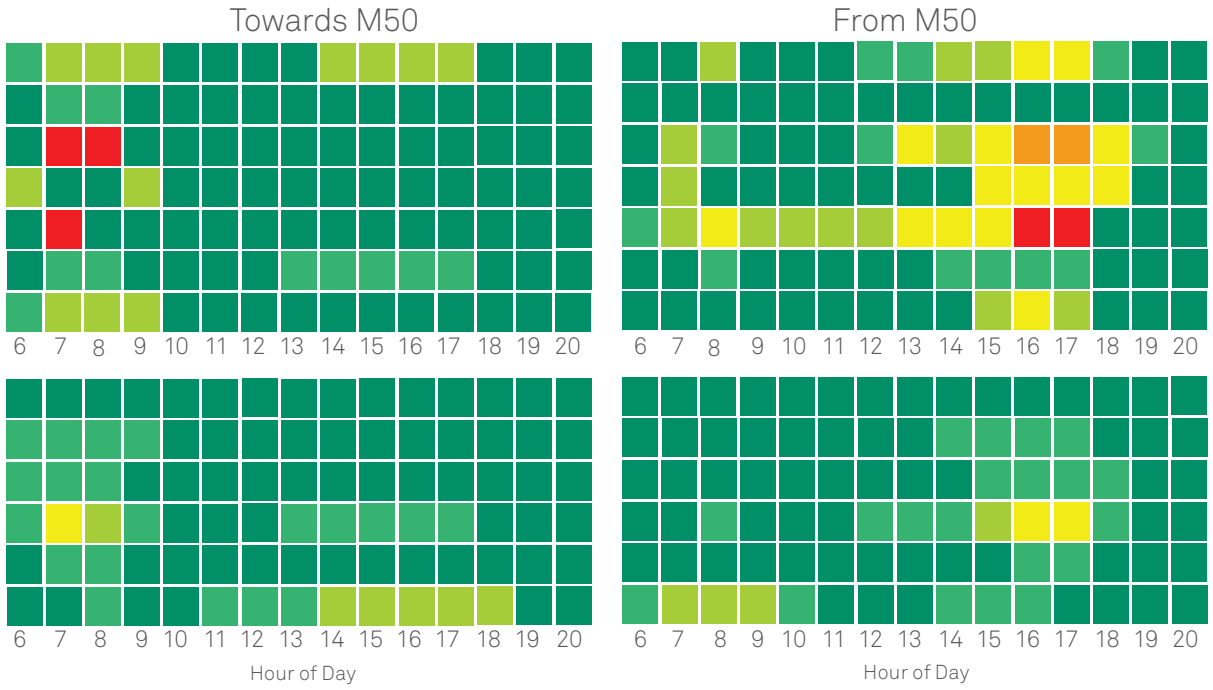
N2- Ashbourne to Slane

M4- Maynooth to Kilcock

N7- Kill to Johnstown

N81- Tallaght to Blessington

N11- Kilmacanogue to Glen of the Downs

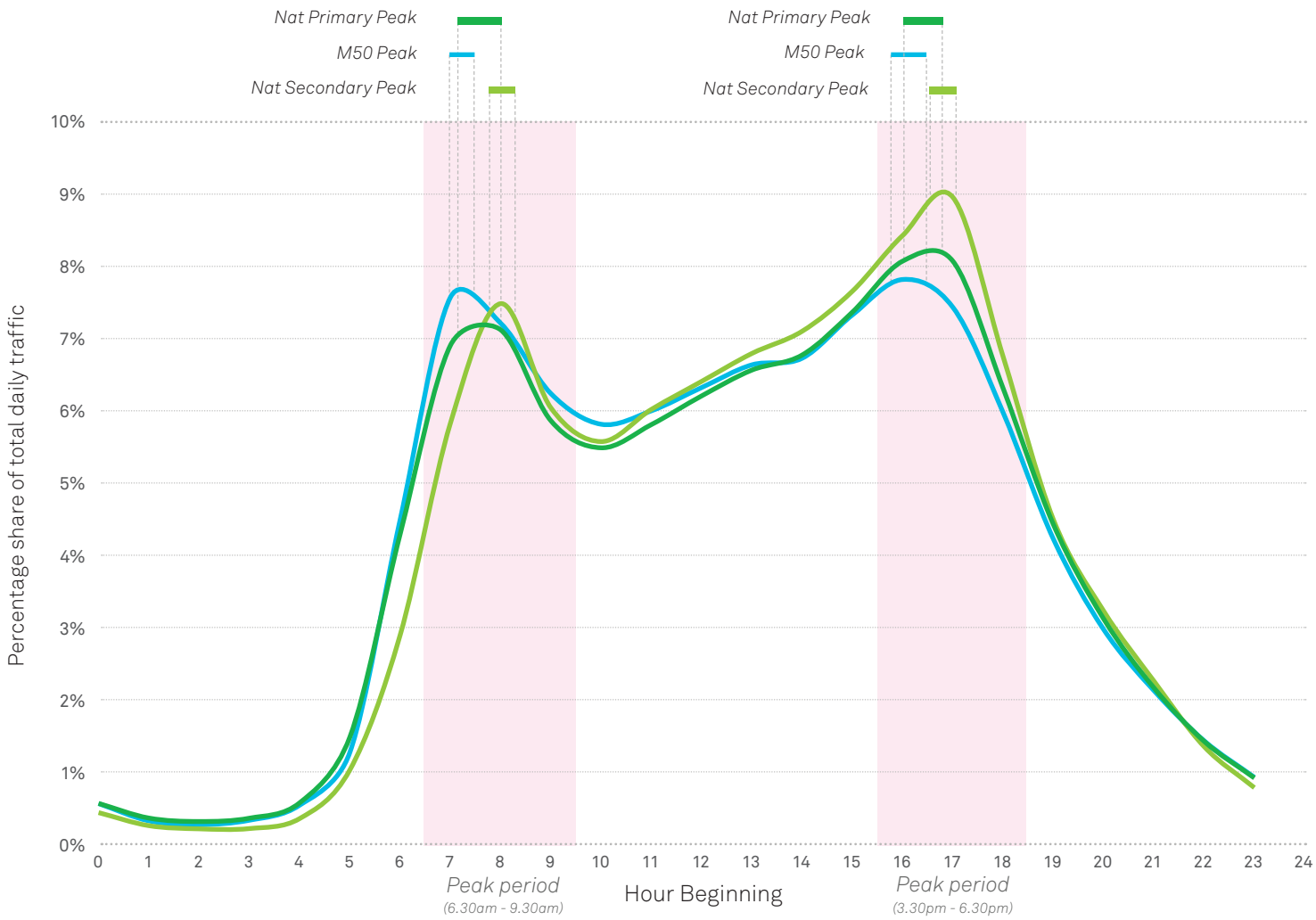


E: ROADS USAGE OVER THE DAY

Profile of the usage of the National Roads network by time of day

The peak periods on our National Roads are extending outwards due to increased demand and congestion.

In the morning, the peak period lasts between 6.30am and 9.30am whilst in in the evening, the peak covers the period between 3:30pm and 6:30pm. Peak traffic hours have a level of traffic some 30% to 50% above off-peak levels. The M50 is the most used road in the country with daily weekday traffic of up to 150,000 along its busiest sections. The peaks on the M50 are more prolonged than other roads with significant traffic flows being maintained during inter-peak periods.



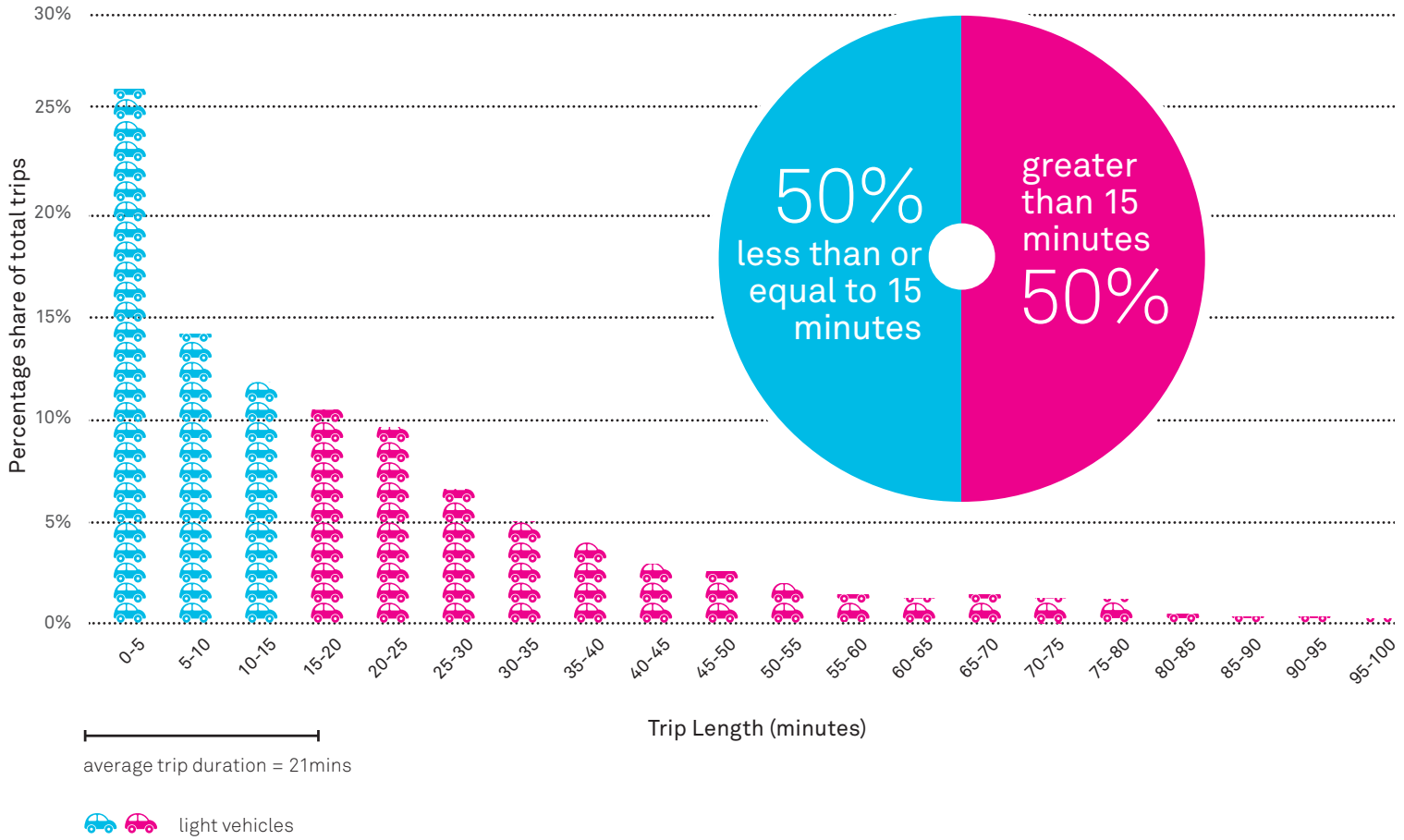
Source: TII TMU data

F: TRIP DURATION

NATIONAL ROADS AND REGIONAL ROADS - AM PEAK

Profile of the trips made on the National and Regional Roads network by their duration

Across the road network, a significant portion of trips that people make are of short duration. In total, 50% of trips are of 15 minutes duration or less. The average trip duration is 21 minutes.



Source: TII National Transport Model, 2021

G: ANNUAL TRAFFIC GROWTH RATES

Annual Traffic Growth 2020-2021

Traffic growth was 15.4% across the network in 2021 compared to 2020, although it was still down 17.0% compared to 2019.

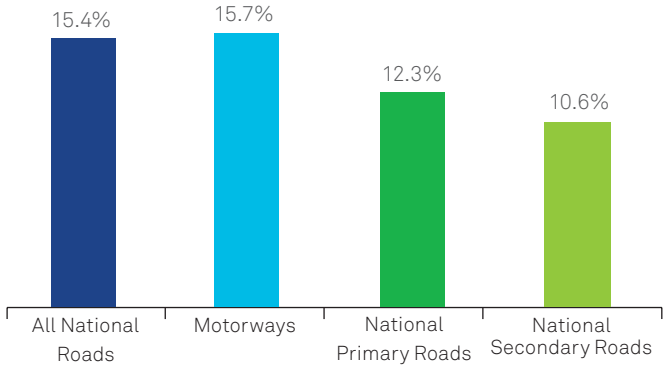
The highest regional growth recorded in 2021 was in the West region with 14.9% for the year. The Border and Mid-West also experienced significant growth of 14.0% and 14.5% relative to 2020.

For HGVs the West recorded the highest regional growth at 8.7%. Dublin recorded the lowest levels of HGV growth at 0.8%.

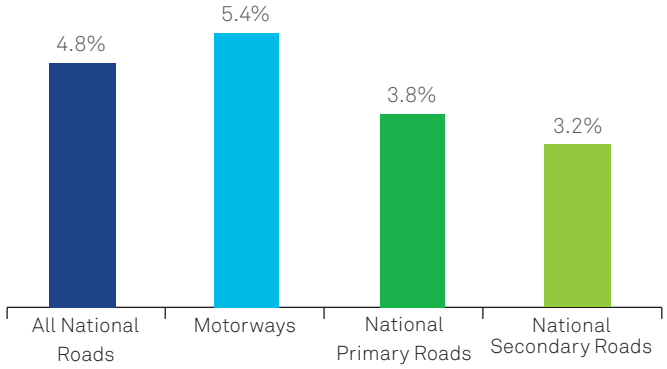
The greatest year on year traffic growth for all vehicles by road type was recorded on motorways; where traffic increased 15.7%.

For HGVs, the highest growth by road type was also on Motorways with a growth of 5.4%.

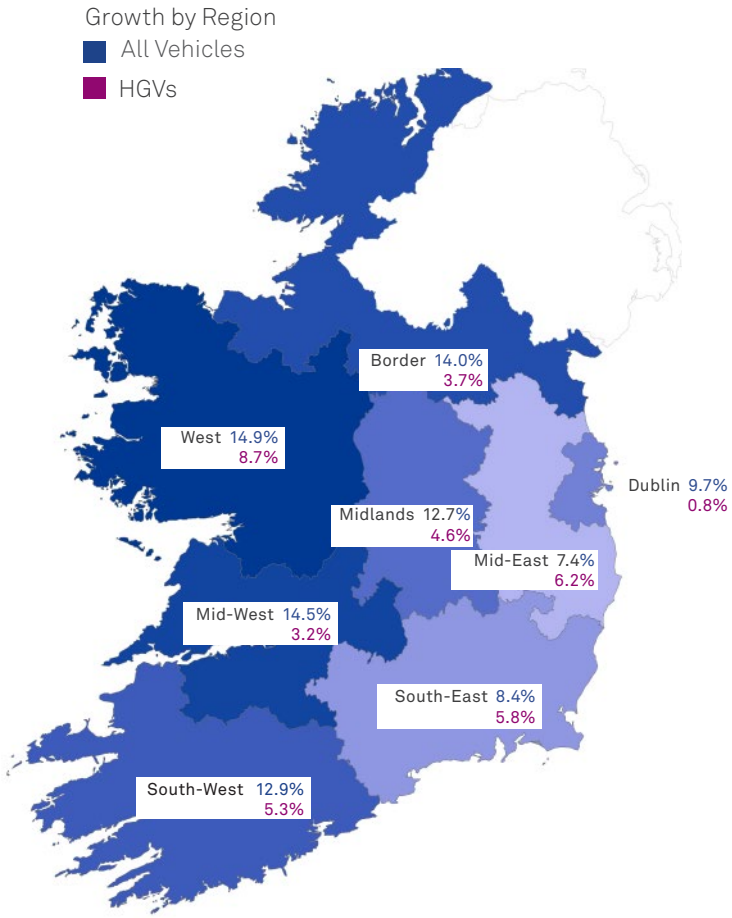
Growth by Road Type (All Vehicles)



Growth by Road Type (HGVs)



Growth by Region

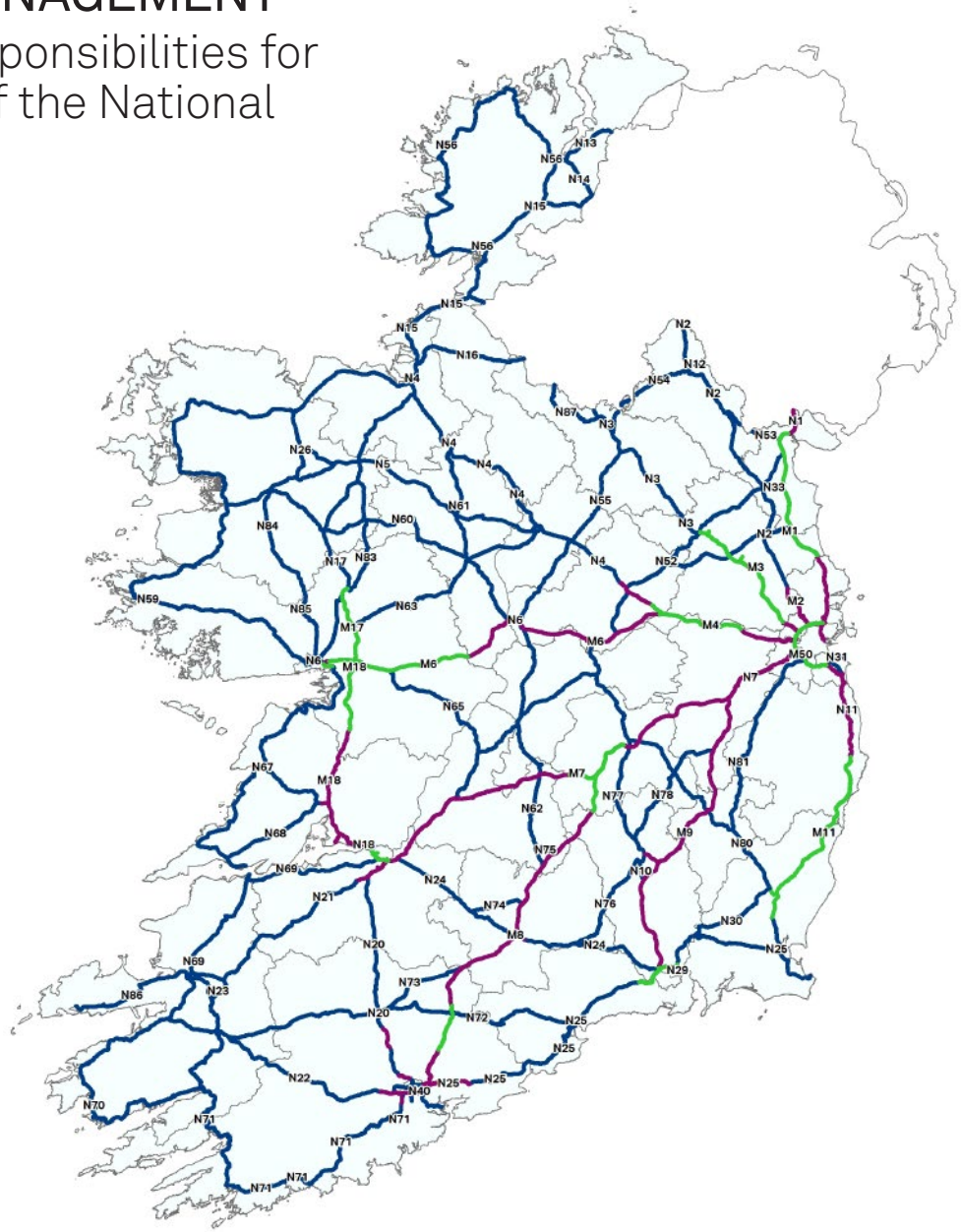


Source: TII Traffic Monitoring Units

H: NETWORK MANAGEMENT

Overview of the responsibilities for the Management of the National Roads network

The management of the National Roads network is assigned to a number of bodies with the majority share of National Primary and National Secondary roads being managed by Local Authorities. Motorways are managed under the Motorway Maintenance and Renewal Contracts (MMaRCs) or by PPP Concession companies. In total there are 3,299 bridges on the National Roads network, of which PPP concession companies manage a total of 622 of these bridges.



Routes managed by:

- MMaRC
- PPP
- Local Authority

Key facts:

327
demountable snow ploughs

Our winter service fleet consists of:

388
salt spreaders

56,637
tonnes of salt were used on National Roads Network in 2021

10,835
all emergency calls received by Motorway Traffic Control Centre including SOS phones

1,450
SOS phones in the country

72
nights in 2021 where the temperature reached below zero

114
weather stations in operation on the National Roads Network

TWO: ECONOMIC

A: ECONOMICS TRENDS AND TRANSPORT

Modified Domestic Demand grew by 6.5% in 2021 while total traffic volumes increased by 15.4%.

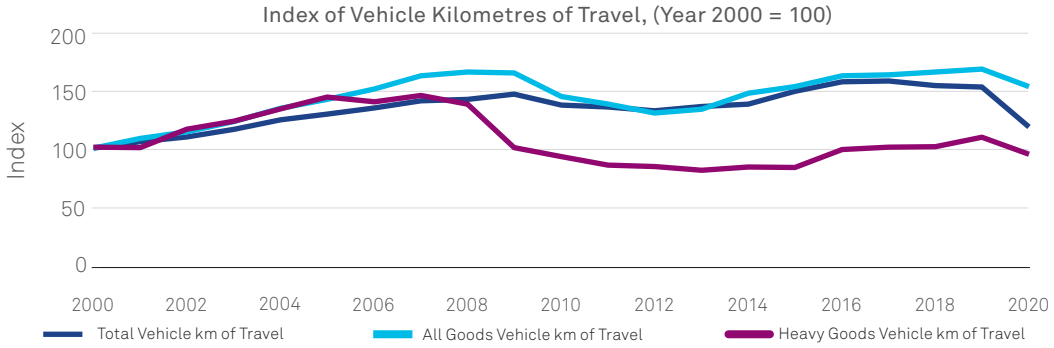
Traditionally total transport demand in Ireland is closely related to national economic performance. When the economic and financial crisis occurred, vehicle kilometres of travel in total declined by 10% and goods traffic by 22% between 2009 and 2012. Economic growth began to recover in a sustained way in 2012 and employment levels a year later. By 2015, vehicle kilometres of travel had returned to its pre-crisis level.

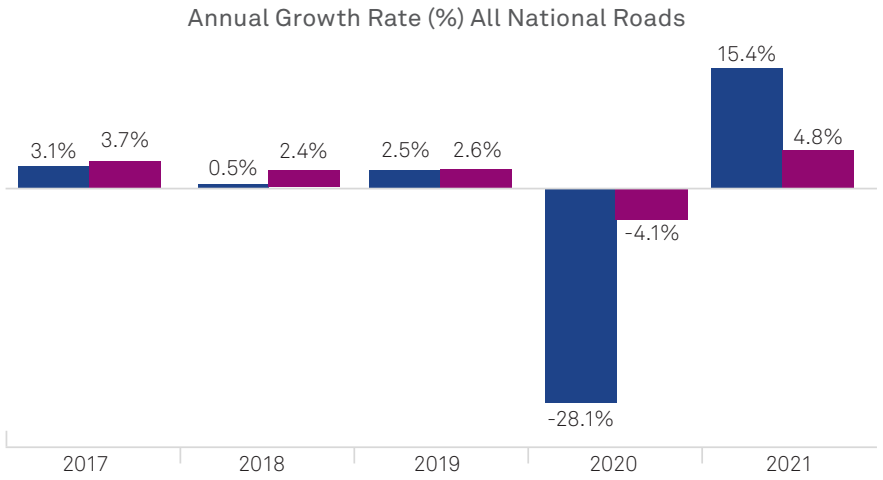
With regard to personal travel, overall employment in the economy influences commuting traffic and personal incomes are the major determinant of non-commuting traffic. Regarding the carriage of goods, economic output is traditionally the major determinant, particularly the output of the building and construction sector which is very transport intensive.

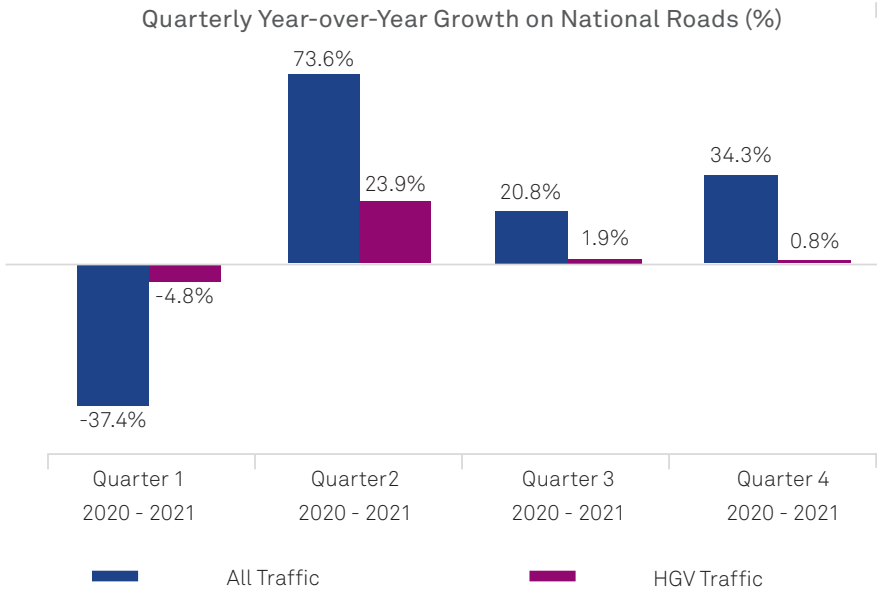
While COVID-19 continued to impact travel patterns in 2021, national economic performance appeared to bounce back with an increase in Modified Domestic Demand (MDD) of 6.5% to stand above the pre-COVID-19 level by the end of 2021.

The MDD indicator excludes globalisation effects such as trade in intellectual property and trade in aircraft by leasing companies and is an important indicator of underlying demand.

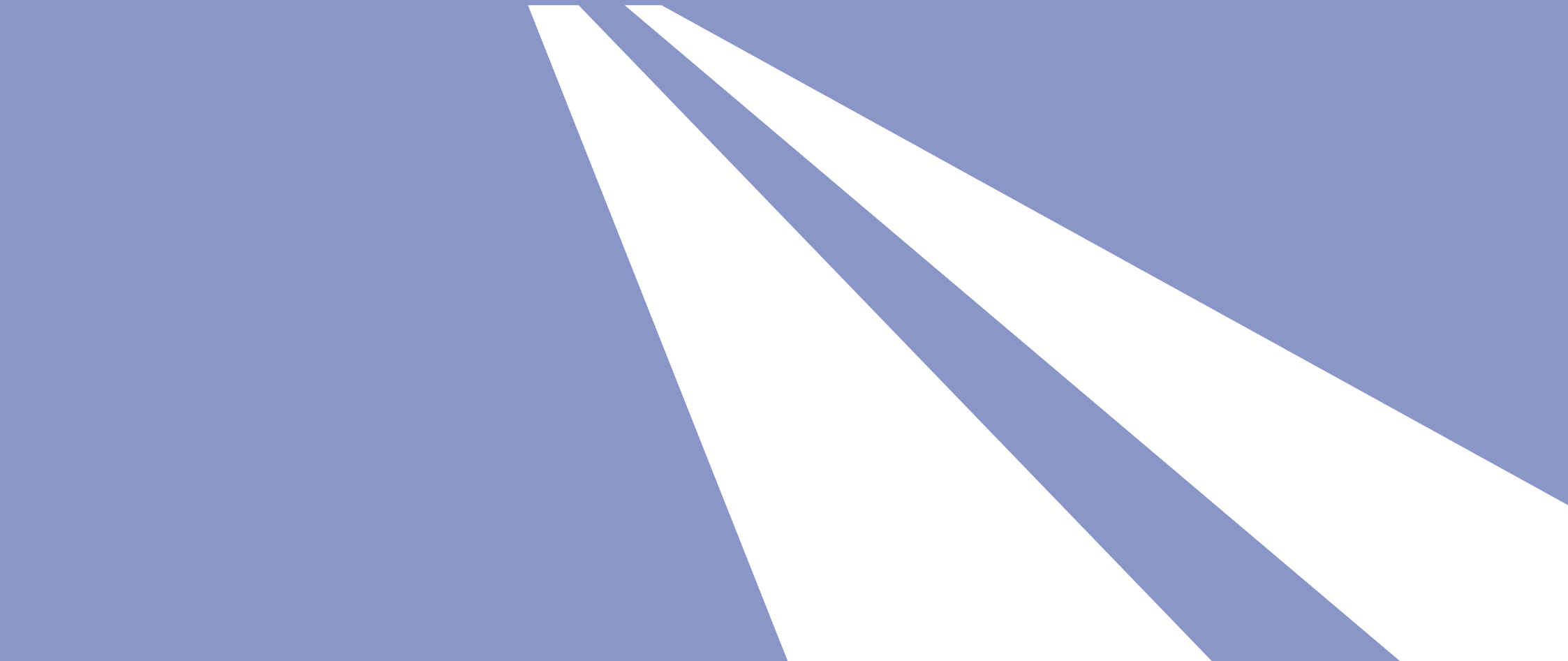
Overall traffic volumes on the National Roads Network increased by 15.4% in 2021, but still remain below 2019 levels by 17.0%. This is likely driven by personal travel restrictions, as well as changes to commuting patterns based on increased numbers of people working from home. Overall freight traffic increased by 4.8% in 2021 on the National Roads Network, bringing it to just above 2019 levels.







THREE: ROAD CONDITION



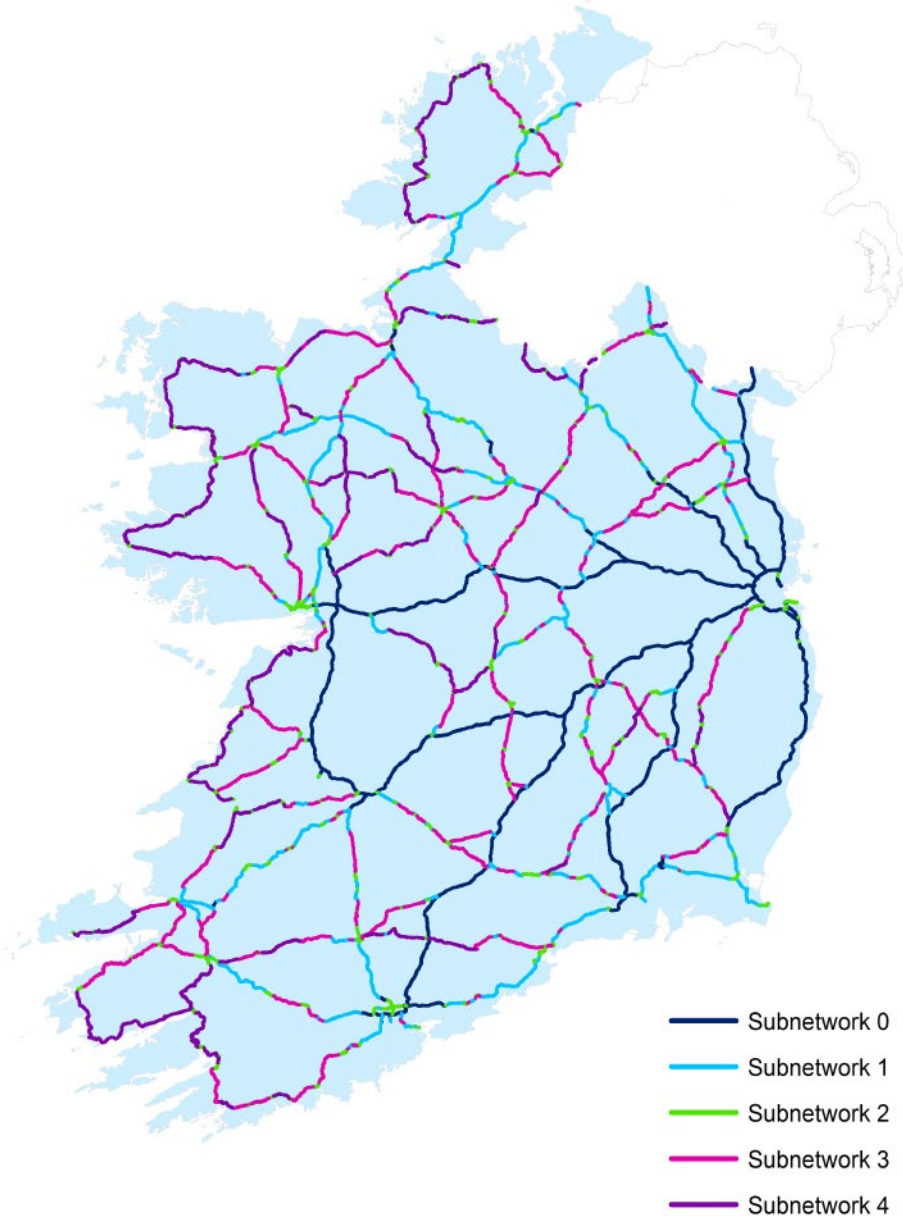
A1: PAVEMENT MAINTENANCE

Overview of subnetwork classification of National Roads network

The National Roads network consists of over 5,300 kilometres of road pavements. There is a very significant variation across the TII network in terms of pavement construction, pavement age, carriageway width, lane width, geometric design and traffic volumes carried.

In order to effectively manage this diverse network, a series of 5 subnetwork types were defined to manage and identify the variation in pavement condition, traffic and construction type within each subnetwork.
The breakdown of subnetworks and map to the right are shown for 2021 when the Pavement Condition Report was published.

Subnetwork		Classification	% of Network
0	Motorways + dual carriageways	High speed, high volumes pavement, made up of Motorway and Dual Carriageway sections of the network.	23%
1	Engineered pavement	Significant geometric and pavement design has taken place in the construction and/or rehabilitation of the pavement sections. Typically carry reasonably large volumes of traffic, and are identified by presence of hard shoulders adjacent to the carriageway.	22%
2	Urban Areas	Low to medium speed, typically short sections through towns that are not bypassed, also includes longer sections within the cities and larger towns where National Roads start and end.	13%
3	Legacy pavement – high traffic	Legacy subnetwork, typically constructed without formal geometric or pavement design. Typically carries traffic volumes less than 10,000 AADT.	24%
4	Legacy pavement – low traffic	Legacy subnetwork, typically constructed without formal geometric or pavement design. Typically carries traffic volumes less than 5000 AADT.	18%



Source: TII Pavement Condition Report 2021

A2: MEASURING PERFORMANCE OF PAVEMENTS ON NATIONAL ROADS NETWORK

Overview of the strategic indicators used across the National Roads network pavement sub networks

Road pavement condition is a critical element in ensuring the safety and efficiency of the National Roads network. In order to maintain acceptable performance levels of road pavement significant investment is required annually.

Road pavements are made up of different layers. The surface layer is key in the road-wheel interface and influences both the safety and overall condition of the pavement. Timely upgrade of the pavement surface can prolong the lifecycle of the sub-surface / structural layers of the pavement.

Various engineering parameters are used to measure the performance of aspects of the pavement but these do not give an understanding of overall performance of the pavements on the network.

TII has therefore developed strategic level performance indicators which address three key characteristics – Pavement Surface Health; Pavement Surface Safety; and Pavement Structural Health.

Within the pavement sub networks, pavement condition is ranked on a five point scale:
Very Poor, Poor, Fair, Good , Very Good.

TII research indicates that on average it takes approximately 7 years for a pavement to transition between points on the scale.

To ensure the safety and efficiency of the network TII have set performance targets for each of the subnetwork categories under each of the performance indicators.

Pavement Surface Health

Pavement Surface Safety

Pavement Structural Health

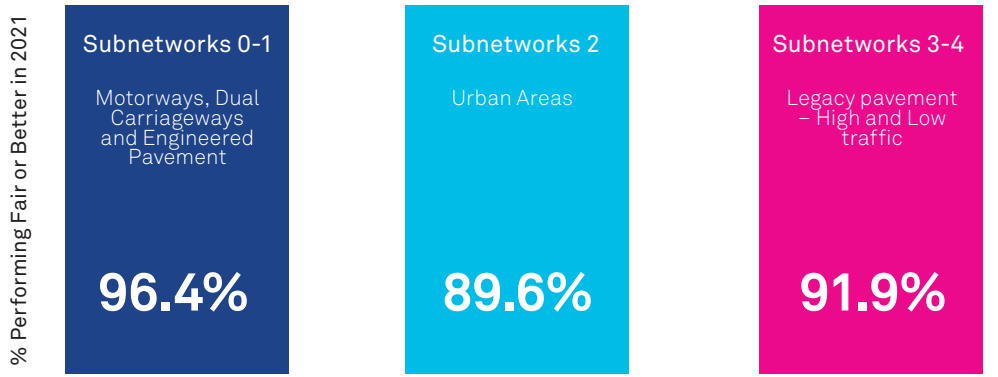
Source: TII Pavement Condition Report 2021

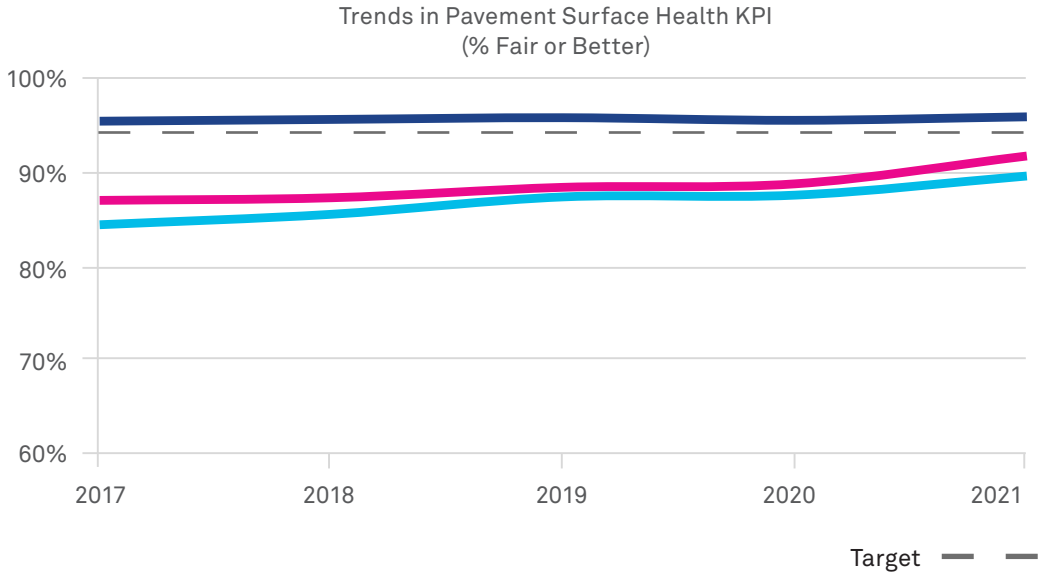
B1: CURRENT STATUS OF THE ROADS PAVEMENT CONDITION

Pavement Surface Health

The Engineered pavement subnetworks are consistently above the target level over the five year analysis period. The remainder of the network is at a higher KPI level than the Pavement Structural Health parameter, but the rate of improvement in performance is lower than that seen with Structural Health. An increased investment in the Legacy Subnetworks shows an improved upward trend line.

TII target 95% performing fair or better for all sub-networks





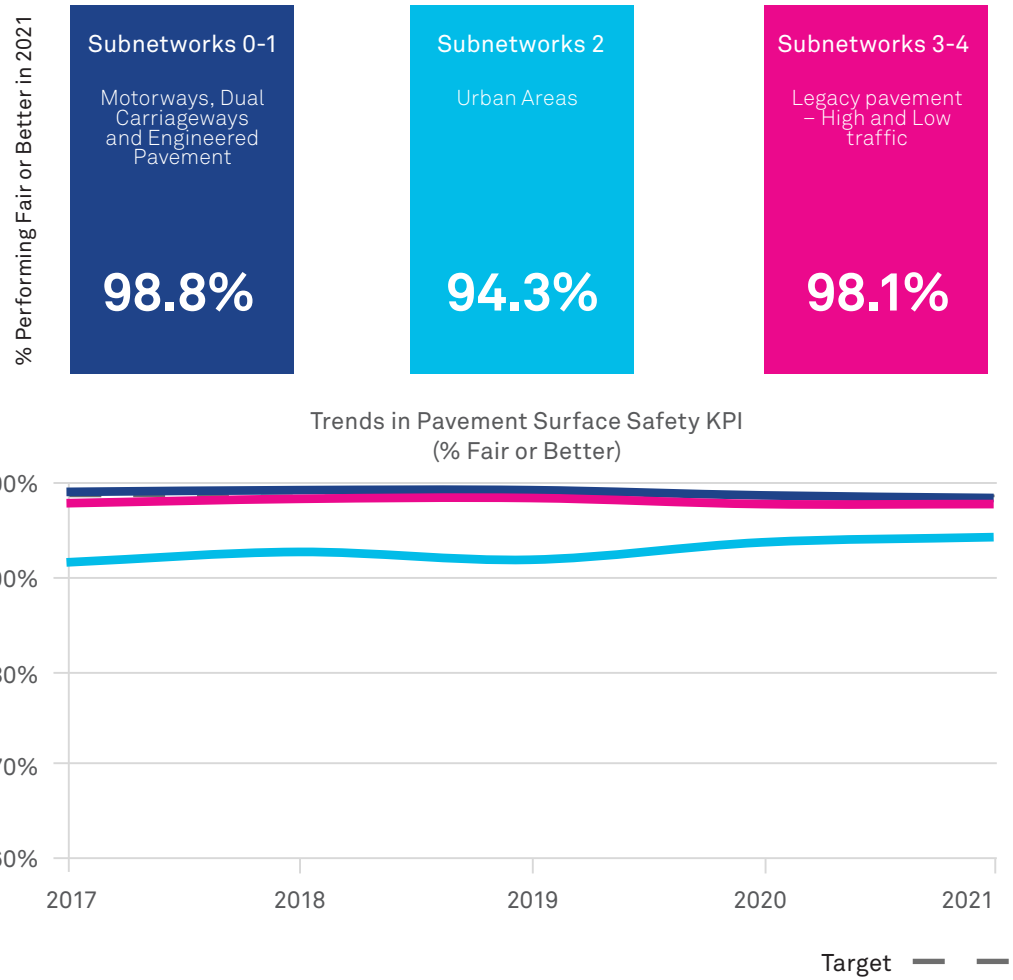
Source: TII Pavement Condition Report 2021

B2: CURRENT STATUS OF THE ROADS PAVEMENT CONDITION

Pavement Surface Safety

This KPI is derived from network level Skid Resistance surveys. The target level is set to have 99% of the network in a safe condition based on annual skid resistance measurements. This has been consistently achieved on the Engineered Subnetworks (0 and 1) over the 5 year period as seen by the trend line. The Legacy Subnetworks are below but close to the target line, the trend line is generally flat. The Urban subnetwork is considerably below the remainder of the network. There has been an increased emphasis on treatment within urban areas in the past few years, and this has produced an improvement in the KPI level.

TII target 99% performing fair or better for all sub-networks



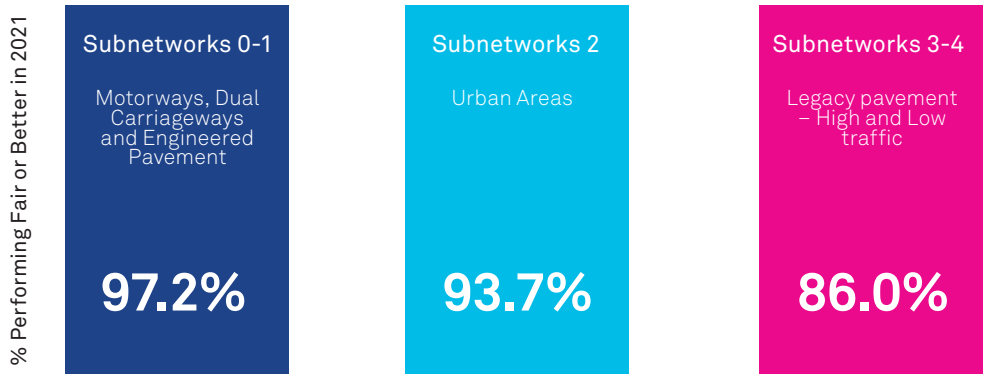
Source: TII Pavement Condition Report 2021

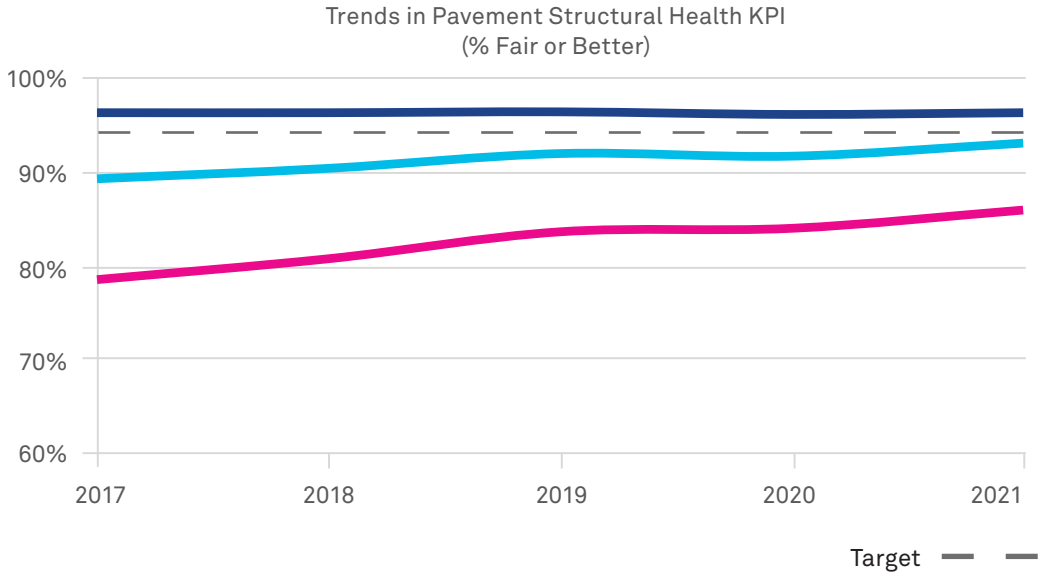
B3: CURRENT STATUS OF THE ROADS PAVEMENT CONDITION

Pavement Structural Health

There is a very clear difference between Subnets 0 and 1 (Engineered Pavements) and the remainder of the network. Subnet 0-1 is consistently above the target of 95% in Fair or Better condition, reflecting the relatively new age profile of the majority of the road sections in this category. The Urban subnetwork (Subnet 2) is in significantly better condition than the Legacy Subnetworks (subnets 3 and 4). The 5 year trend lines show an overall upward trend, reflecting a concentration on improving the worst-performing sections over the five year period.

TII target 95% performing fair or better for all sub-networks





Source: TII Pavement Condition Report 2021

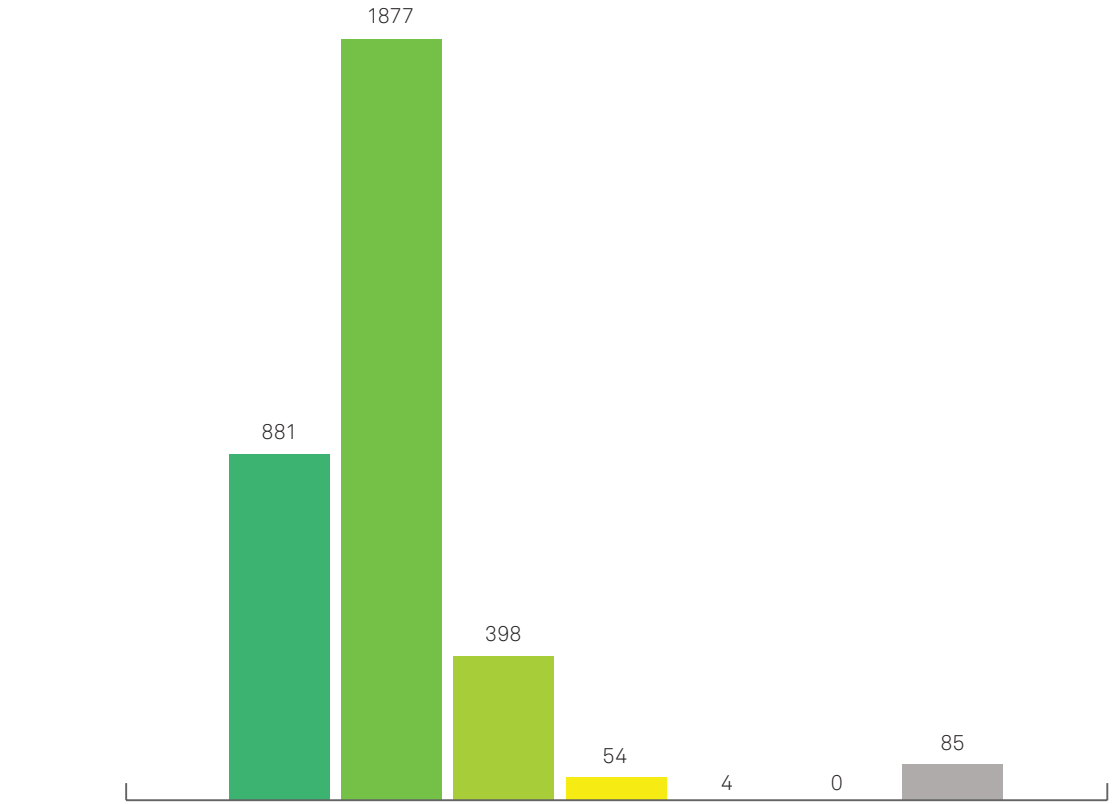
C: NATIONAL ROAD BRIDGE STRUCTURES

Overview of the quantum and condition of bridge structures on the National Roads network

Bridges are key elements of the National Roads system and maintenance and rehabilitation of bridges is a key part of the TII's asset management strategy.

The National Roads network includes 3,299 bridge structures of which 622 are on roads provided by public private partnerships.

Bridges are inspected on a regular cycle. Bridge components which are allocated a condition rating of 0 or 1 do not require repair work, whereas those assigned a rating of 2 or higher are scheduled for future repair.



FOUR: SAFETY

A: FATAL COLLISIONS ON THE NATIONAL ROADS NETWORK:

Key Statistics* for 2021 are presented. For further details on road safety and national trends please see *www.rsa.ie*

According to the Safe Systems approach, death and serious injury in road accidents are largely preventable. It should be a shared responsibility at all levels to ensure that road collisions do not lead to serious or fatal injuries. The Directive 2008/96/EC on road infrastructure safety management was amended by the Directive (EU) 2019/1936.

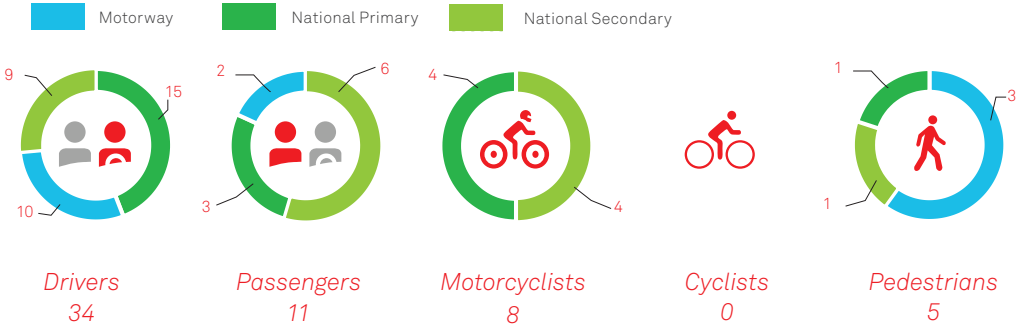
However, the amended Directive includes the strategic goal to move close to zero fatalities by 2050.

Summary of reported fatalities 2021

58 fatalities across all road user groups

13 vulnerable road user fatalities

5 non-motorised road user fatalities



Drivers	*Passengers*	*Motorcyclists*	*Cyclists*	*Pedestrians*
34	*11*	*8*	*0*	*5*

2021 Reported figures for National Roads

Fatal Collisions	*Fatalities*	*Percentage Fatalities*
49	58	72.4 / 27.6

Percentage of fatalities by Collision Category

Head-On	*Vehicle to Vehicle*	*Single vehicle*	*Non-motorised*	*All Other*
43.1%	*22.4%*	*20.7%*	*6.9%*	*6.9%*

2021 Count of fatalities by Collision Category

Head-On	Vehicle to Vehicle	Single Vehicle	Non Motorised	All other vehicle on vehicle
25	13	12	4	4
68.0% male	76.9% male	75.0% male	75.0% male	75.0% male
32.0% female	23.1% female	25.0% female	25.0% female	25.0% female

** Due to an internal change in processing collision records, some differences in totals and subtotals have been noted. TII is aware of these differences and understands the factors behind them.*

B: SERIOUS INJURIES ARISING FROM COLLISIONS ON THE NATIONAL ROADS NETWORK

Key Statistics* for 2021 are presented. For further details on road safety and national trends please see *www.rsa.ie*

According to the Safe Systems approach, death and serious injury in road accidents are largely preventable. It should be a shared responsibility at all levels to ensure that road collisions do not lead to serious or fatal injuries. The Directive 2008/96/EC on road infrastructure safety management was amended by the Directive (EU) 2019/1936.

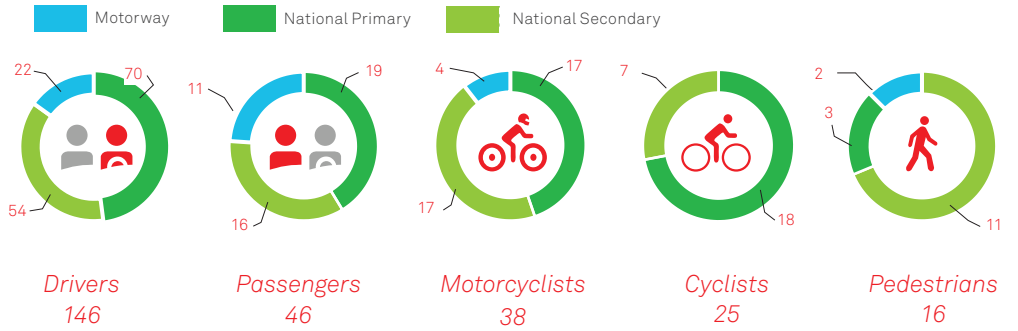
These amendments included a new interim target of halving the number of serious injuries by 2030 compared with 2020.

Summary of reported Serious Injuries 2021

271 serious injuries across all road user groups

79 vulnerable road user serious injuries

41 non-motorised road user serious injuries



Drivers 146 | *Passengers* 46 | *Motorcyclists* 38 | *Cyclists* 25 | *Pedestrians* 16

2021 Reported figures for National Roads

Serious Injury Collisions: 225

Serious Injuries: 271

Percentage Fatalities: 63.3 | 36.7

Percentage of fatalities by Collision Category

Vehicle to Vehicle 32.1% | *Single vehicle* 24.4% | *Head-On* 24.0% | *Non-motorised* 13.6% | *All Other* 5.9%

2021 Count of Serious Injuries by Collision Category

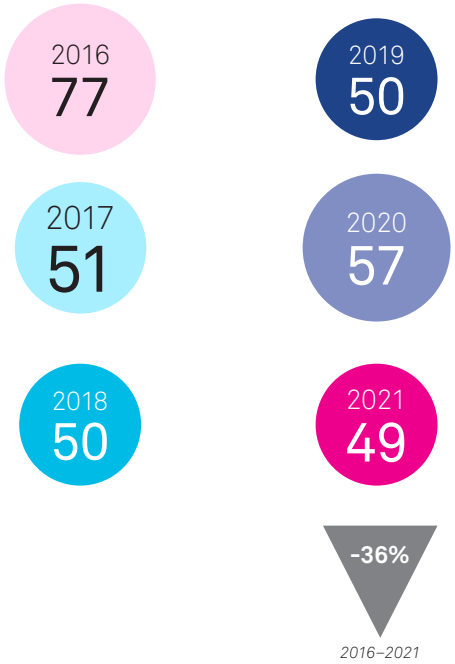
Vehicle to Vehicle	Single Vehicle	Head-On	Non Motorised	All other vehicle on vehicle
87	66	65	37	16
62.1% male	72.3% male	47.7% male	67.6% male	87.5% male
37.9% female	27.7% female	52.3% female	32.4% female	12.5% female

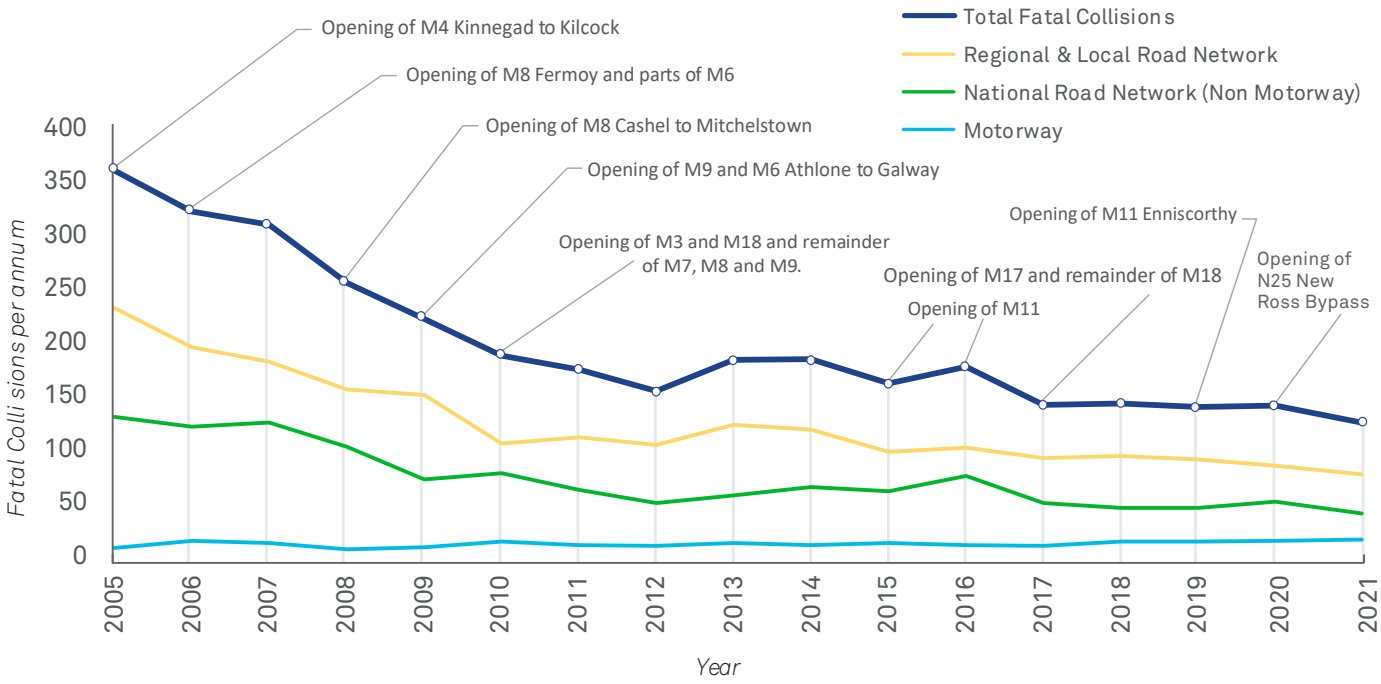
** Due to an internal change in processing collision records, some differences in totals and subtotals have been noted. TII is aware of these differences and understands the factors behind them.*

C: TRENDS ON NATIONAL ROADS NETWORK

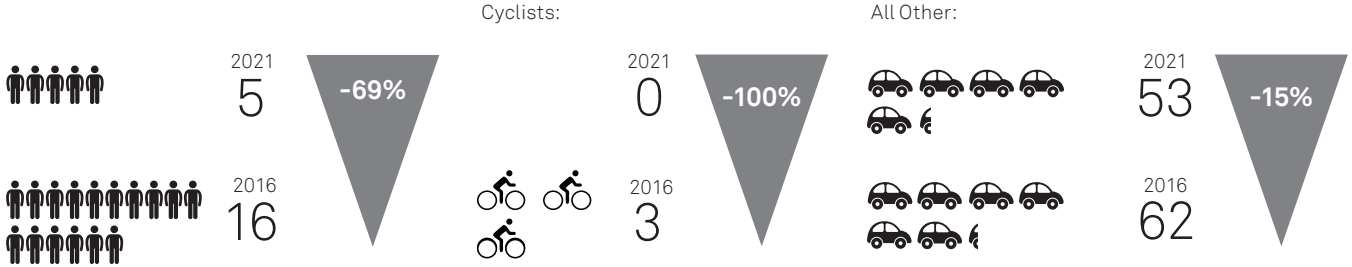
Trends in fatal collisions nationally by road type and collision type*

Total fatal collisions on National Roads:





Recent trends in total fatalities on National Roads:*



** Fatal collisions 2016 - 2021: An Garda Síochána data*

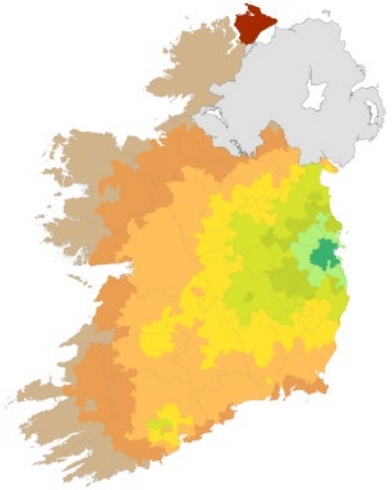
FIVE: ACCESSIBILITY + ENVIRONMENT

A1: IMPACT OF ROAD INVESTMENT ON EMPLOYMENT ACCESSIBILITY

Key milestones in the development of the National Roads network

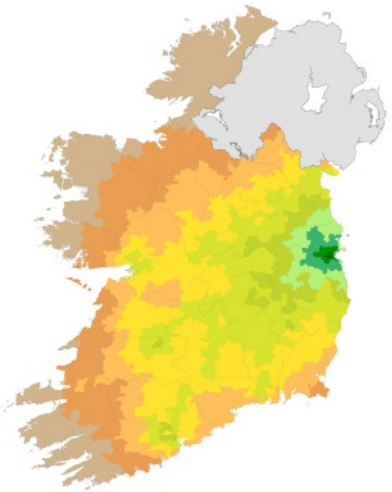
Building on the methodology put forward within the TII Transport Research and Information Note: Impact of Improvements in the Road Network on the Accessibility & Economic Potential of Counties, Urban Areas, Gateways & Hubs, 2012; TII has plotted accessibility to jobs for a number of key milestones in the development of the National Roads Network.

Employment Accessibility Score by NTM Zone



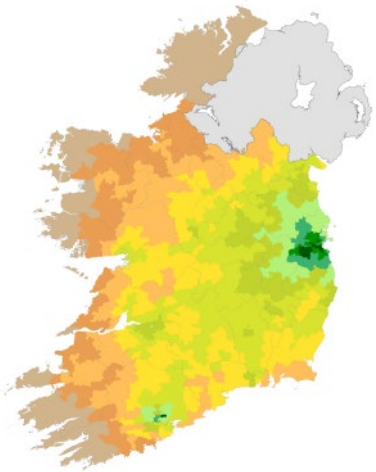
2006

In 2006, prior to the completion of the Major Inter Urban (MIU) corridors linking Dublin to the other cities; accessibility to jobs within peripheral regions was weak.



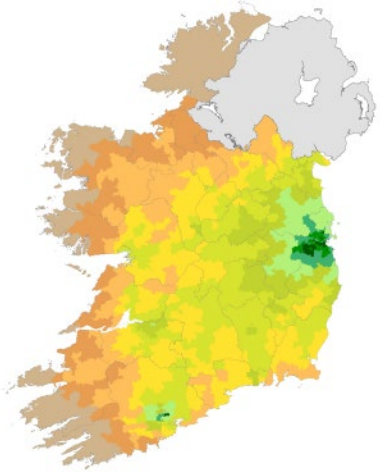
2010

By 2010 the development of the MIUs delivered significant improvements in terms of accessibility to jobs in some of the more peripheral areas.



2016

Since 2016, there are only subtle changes in accessibility, related to the reduced capital spend on National Roads infrastructure during that time.



2021

The M17/M18, M11 Gorey to Enniscorthy and N25 New Ross Bypass projects were completed since 2016. These projects have enhanced accessibility in the West and South-East of the country.

A2: IMPACT OF ROAD INVESTMENT ON EMPLOYMENT ACCESSIBILITY

2016 versus 2021

A significant proportion of the road capital spend from 2016 to 2021 was within the west and south-east of the country and this has resulted in improved employment accessibility for these areas.

Difference in Accessibility:

+10%

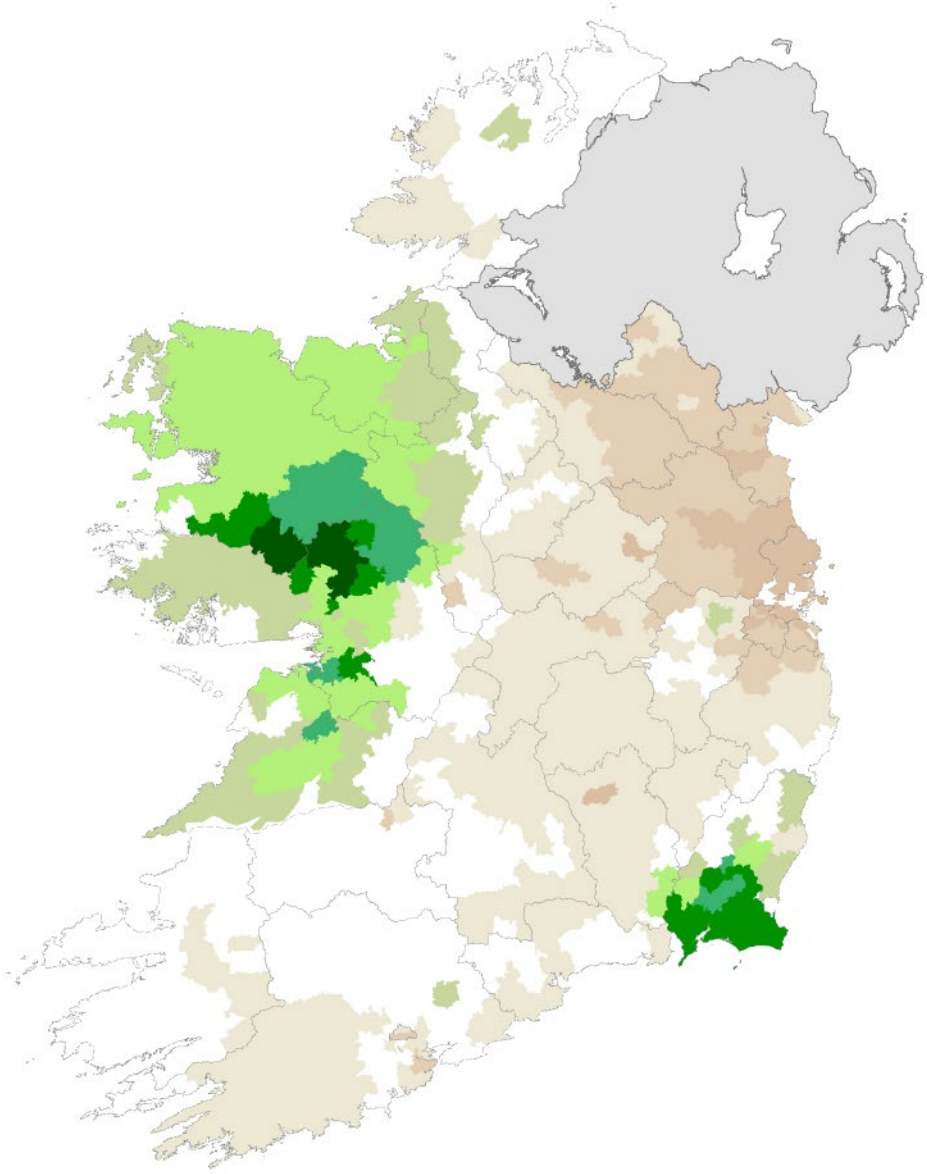
-2%

The image compares accessibility to jobs between 2016 and 2021 (relative percentage change), and effectively presents two stories:

1) Improvements in accessibility to jobs in the West and South-East related to the completion of the M17/18, M11 Gorey to Enniscorthy and N25 New Ross Bypass projects, and N4 Collooney to Castlebaldwin projects

2) Ongoing traffic growth in the east, particularly on the routes into Dublin has contributed to increased journey times and in turn slight reductions in accessibility to jobs in the Greater Dublin Area.

Despite the above, peripheral areas in North-West, West and South-West and South-East still tend to suffer from poor accessibility to jobs as shown on Accessibility + Environment - A1.



**Assessment based on the change in accessibility to employment only as a result of the network investment. Employment levels have been held constant at 2016 levels as part of the assessment.*

SIX: EMISSIONS

A1: Vehicle Emissions on the National Roads Network

Vehicle emissions associated with travel on the National Roads Network from 2018 onwards can be estimated using the TII Road Emissions Model.

Methodology

The TII National Transport Model provides up-to-date estimates of traffic volumes and speeds on the National Roads Network. TII also profiles the emissions of Nitrogen Oxides (NO_x), Particulate Matter (PM_{10}) and Carbon Dioxide (CO_2e)[1] from the vehicle fleet on a county basis. This is done using existing fleet information[2], projections concerning the vehicle fleet[3], and standard emission rates[4,5] . This information is combined to generate estimates of emissions for all links on the National Roads Network.

The key factors affecting emissions from year to year are the make-up of the vehicle fleet, e.g. proportions of light and heavy vehicles, the emissions standards of vehicles in the fleet, the type of fuel consumed, the total vehicle kilometres travelled and the speed at which these vehicles travel on the network.

A bespoke fleet projection was used, based on an intermediate case interpolated between Business as Usual and Climate Action Plan projections as a cautious approach.

Emissions in 2021

In 2021 vehicle kilometres travelled were higher than the previous year which resulted in an increase in emissions of NO_X, PM_{10} and CO_2e compared to 2020, but still lower than 2019. The total km travelled by all vehicles (vkm) increased from 2018 to 2019 and decreased significantly in 2020 due to COVID-19, before then rebounding again slightly in 2021. In particular, the proportion of heavy vehicles decreased slightly from 8.2% in 2020 to 7.9% in 2021, with a corresponding increase in car use as travel restrictions were relaxed.

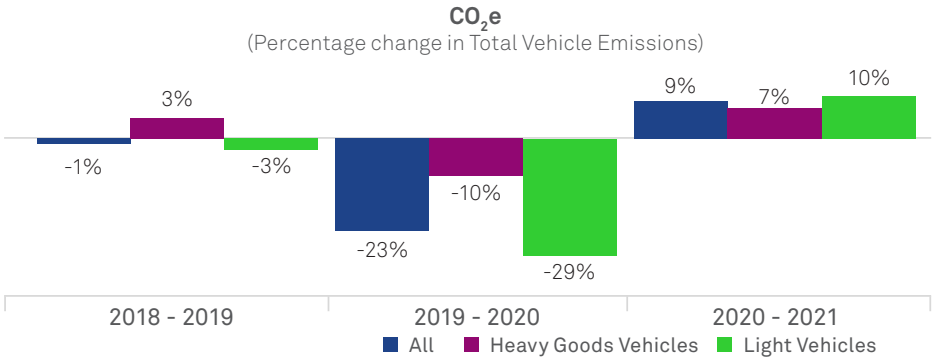
Greenhouse Gases

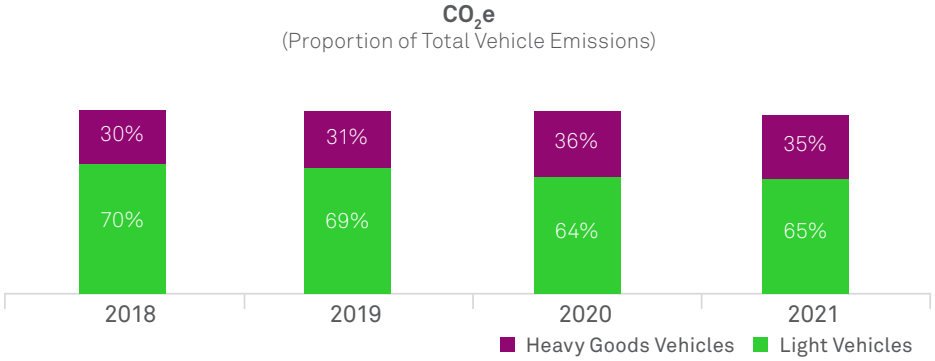
Total greenhouse gas emissions from travel on the National Roads Network were relatively stable between 2018 and 2019. The change in personal travel in 2020 led to a reduction of 23% in greenhouse gas emissions represented by CO_2e, but an increase in 2021 as the economy recovered and restrictions lifted – although 2021 levels remained lower than 2019 levels.

The changes in CO_2e emissions year to year primarily reflect the changes in vkm travelled and to a lesser extent fleet turnover. Between 2020 and 2021 an increase in CO_2e of 10% for light vehicles has been identified. This is due to increased use of the National Roads Network by drivers associated with reduced COVID-19 disruption in 2021 compared to 2020.

Total emissions from HGVs were significant compared to the distance travelled, as they represented approx. 10-20% of the km travelled in 2021, but contributed 30-35% of the emissions.

We can see that in 2021, light vehicles (i.e. cars and vans) represent 65% of the total CO2e emissions on the National Roads Network. The increased importance of HGV emissions of CO2e is a trend that can be observed from 2018 onwards.





[1] *CO_2e: Carbon dioxide equivalent (CO_2e) is a term for describing different direct greenhouse gases in a common unit. For any quantity and type of greenhouse gas,*

[2] *Central Statistics Office data search https://data.cso.ie/#*

[3] *University College Cork (2021) Irish Car Stock Model v2.1*

[4] *COPERT EU standard vehicle emissions calculator. Available from: https://www.eea.europa.eu/themes/air/links/guidance-and-tools/copert4-road-transport-emissions-model*

[5] *Emissions Factors Toolkit v10.1 https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html*

A2: Vehicle Emissions on the National Roads Network

Emissions of local pollutants affecting air quality, Oxides of Nitrogen (NO_x) and particulate matter (PM_{10}), increased slightly in 2021 as the country rebounded from the very low emissions and reduced distance travelled in 2020 due to COVID-19.

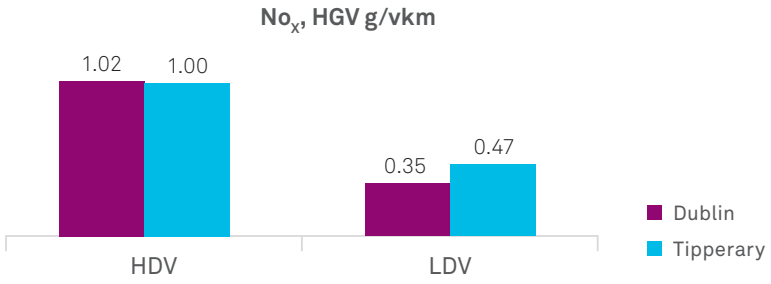
Air Quality Emissions include Oxide of Nitrogen (NO_x) and particulate matter (PM_{10}) are of local and national concern for human health and/or ecosystems.

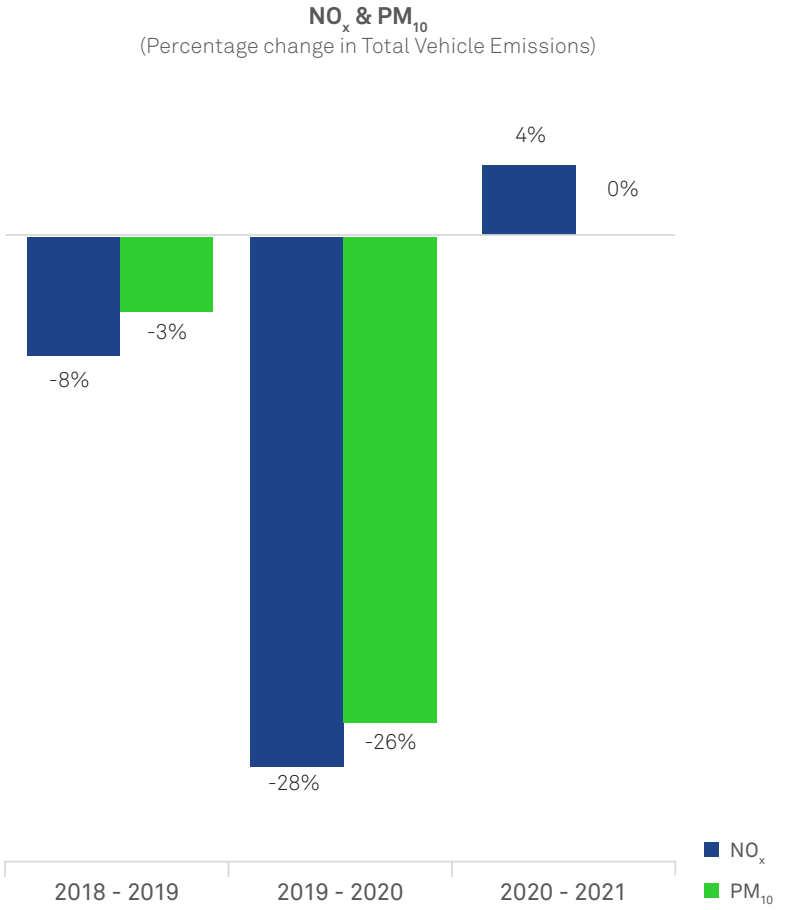
Total emissions of NO_x and PM_{10} decreased year-on-year with a 7.7% and 3.2% reduction respectively between 2018 and 2019, whilst in 2020 NO_x and PM_{10} reduced by 28.1% and 25.8% respectively compared to 2019 due to COVID-19. Emissions of NO_x increased again by 3.7% in 2021 compared to 2020 whilst PM_{10} emissions decrease by a further 0.2%, with NO_x emissions remaining 31.2% lower in 2021 than in 2018 and PM_{10} emissions 28.3% lower.

Case Study

In urban areas trips are being made with a larger proportion of newer vehicles and more petrol and alternative fuel cars compared to more rural counties, whilst vehicle speeds also influence emissions rates where relatively fast, free-flowing traffic tends to have lower emissions than slower, congested traffic.

We can compare the more urban county of Dublin with Tipperary as an example of a more rural county to demonstrate this. Average annual NO_x emissions per vehicle per kilometre travelled are approx. 25% lower for LDVs (cars and vans) and approx. 2% higher for HGVs (lorries) in the urban area compared to the rural area.





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