Disclaimer

This Background Paper has been prepared as part of the supporting analysis for the National Investment Framework for Transport in Ireland. It 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 or the Minister for Transport.
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1. Introduction

On 16 February 2018 Government launched Project Ireland 2040 with the publication of the National Planning Framework (NPF) and National Development Plan (NDP). The aim of this policy initiative is to guide planning and infrastructure investment over coming decades in order to cater for a projected population increase of one million people in a balanced and sustainable manner. To support this vision, the NDP sets out a €116bn public capital investment programme to cover the first decade of the NPF to 2027. Major transport projects to be delivered include BusConnects, MetroLink and the M20 Cork to Limerick.

The National Investment Framework for Transport in Ireland (NIFTI) is the Department of Transport’s contribution to Project Ireland 2040. NIFTI’s objective is to develop a transport investment framework which delivers a land transport network that meets the travel needs of the population in the coming decades and which supports the realisation of the Project Ireland 2040 National Strategic Outcomes. As part of the development of this framework, five areas relating to the future transport network have been analysed. These are:

- Protecting access to transport in rural Ireland will be an important enabler of the Project Ireland 2040 National Strategic Objectives, supporting rural Ireland as an attractive place to live and work and leveraging the capacity of rural areas to contribute to the Irish economy.
- Priorities for the rural and regional transport network include:
  - Enabling a high level of service for all users by protecting the existing extensive network of rural roads;
  - Protecting areas with vulnerable transport networks by identifying and prioritising ‘lifeline’ infrastructure;
  - Leveraging rural Ireland’s economic potential by preserving access to urban centres of scale; and,
  - Supporting the adaptation of rural infrastructure to extreme weather events caused by climate change.
- Ireland’s road network is among the longest per capita in Europe. Maintaining and protecting this existing infrastructure is a key element of providing a land transport network that delivers an appropriate level of service to residents of rural Ireland.
- The most appropriate methodology for protecting accessibility in rural Ireland will depend on factors including the proximity of the nearest major settlement and local geographic constraints. In some areas it may be appropriate for ‘lifeline’ roads to be prioritised for maintenance, while in others the overall maintenance of the network will provide alternative routes.
- The National Development Plan is expected to maintain current journey times from rural Ireland to the nearest urban centre of scale. However, maintaining rural accessibility must be considered in the context of the entire system and network-wide impacts such as congestion on interurban routes or in urban areas.
- Climate change will likely cause more frequent and severe extreme weather events in future which will threaten accessibility in some rural areas. The amount of investment required for protection and renewal in rural areas must be considered in this context.

Summary

- Protecting access to transport in rural Ireland will be an important enabler of the Project Ireland 2040 National Strategic Objectives, supporting rural Ireland as an attractive place to live and work and leveraging the capacity of rural areas to contribute to the Irish economy.
- Priorities for the rural and regional transport network include:
  - Enabling a high level of service for all users by protecting the existing extensive network of rural roads;
  - Protecting areas with vulnerable transport networks by identifying and prioritising ‘lifeline’ infrastructure;
  - Leveraging rural Ireland’s economic potential by preserving access to urban centres of scale; and,
  - Supporting the adaptation of rural infrastructure to extreme weather events caused by climate change.
- Ireland’s road network is among the longest per capita in Europe. Maintaining and protecting this existing infrastructure is a key element of providing a land transport network that delivers an appropriate level of service to residents of rural Ireland.
- The most appropriate methodology for protecting accessibility in rural Ireland will depend on factors including the proximity of the nearest major settlement and local geographic constraints. In some areas it may be appropriate for ‘lifeline’ roads to be prioritised for maintenance, while in others the overall maintenance of the network will provide alternative routes.
- The National Development Plan is expected to maintain current journey times from rural Ireland to the nearest urban centre of scale. However, maintaining rural accessibility must be considered in the context of the entire system and network-wide impacts such as congestion on interurban routes or in urban areas.
- Climate change will likely cause more frequent and severe extreme weather events in future which will threaten accessibility in some rural areas. The amount of investment required for protection and renewal in rural areas must be considered in this context.
1. Compact growth;
2. Interurban connectivity;
3. Rural and regional accessibility;
4. Supporting international connectivity; and,
5. Alternative demand scenarios.

This background paper looks at the third of these themes, regional and rural accessibility.

Project Ireland 2040 has highlighted the importance of the strategic development of rural communities and regional towns for the full potential of a broad range of other National Strategic Outcomes (NSO) to be realised. In the 2016 census, 37.3% of people in Ireland lived in rural areas. While the NPF envisages the majority of population growth taking place in urban areas, people living in rural areas will remain a significant portion of the population. As such, effective application of the NPF in rural areas will be essential for the National Strategic Outcomes to be fully achieved.

Investment in Strengthening Rural Economies and Communities (NSO 3) protects rural Ireland as a place to live and work and will support rural Ireland’s contribution to a range of National Strategic Outcomes and National Policy Objectives. Transport will play a key enabling role in the achievement of this NSO, aiming to ensure that our rural areas and regional towns are attractive places to live, capable of supporting vibrant local communities and dynamic, innovative businesses that can compete on a national and international level.

Unless specified otherwise, this paper applies the CSO’s definition of rural areas of areas outside a settlement of over 1,500 people.

The remainder of this paper is structured as follows:

- Section 2 discusses the need for prioritisation of investment in rural transport infrastructure and considers why access to transport can be considered a key enabler for developing strong rural communities and economies.
- Section 3 considers the current policy framework for rural Ireland, the Government’s high-level goals and vision for rural areas and the strategies governing these objectives.
- Section 4 provides an overview of the current delivery of transport access in rural areas of and existing mechanisms of oversight and prioritisation for the development of transport infrastructure in rural areas.
- Section 5 contains analysis and projections of transport needs in rural Ireland to 2040 and other factors that will drive investment demand.
- Section 6 discusses how investment in rural infrastructure can support the National Strategic Outcomes and how delivery of Project Ireland 2040 can be measured in relation to rural transport.
- Section 7 concludes with a summary of key points.

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1 This is defined by the CSO as a cluster of 1,500 or more residents.
2. Why Rural Transport Matters

A fundamental goal Project Ireland 2040 is the balanced development of Ireland's regions. The NPF forecasts an increase in population of 1 million people by 2040. The NPF aims for half of this population growth to occur in the existing five cities and their suburbs. The remaining half million increase in population will occur in smaller urban centres, rural towns and rural areas. Based on the patterns of growth that occurred between the 2011 and 2016 Censuses, development consistent with the National Planning Framework's targeted growth has been taking place, in aggregate, in the existing five cities. However, the remaining growth in population is dominated by other urban centres.

Table 2.1: Urban-Rural Breakdown of Irish Population, 2011 and 2016

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2016</th>
<th>2011 to 2016 change</th>
</tr>
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<tbody>
<tr>
<td>Total Population</td>
<td>4,588,252</td>
<td>4,761,865</td>
<td></td>
</tr>
<tr>
<td>Total Urban Population</td>
<td>2,846,882</td>
<td>2,985,781</td>
<td></td>
</tr>
<tr>
<td>Total City Population</td>
<td>1,528,960</td>
<td>1,609,478</td>
<td></td>
</tr>
<tr>
<td>Total Non-City Urban (&gt;1500) Population</td>
<td>1,317,922</td>
<td>1,376,303</td>
<td></td>
</tr>
<tr>
<td>Total Rural</td>
<td>1,741,370</td>
<td>1,776,084</td>
<td></td>
</tr>
<tr>
<td>Rural Settlement (&lt;1500) Population</td>
<td>326,264</td>
<td>344,360</td>
<td></td>
</tr>
<tr>
<td>Population Outside Settlements</td>
<td>1,415,106</td>
<td>1,431,724</td>
<td></td>
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Source: CSO

On a national level, the distribution of population is heavily influenced by proximity to urban areas, with the greatest increases in population occurring in the regions surrounding the cities and decreases in population more common in areas that are further from the cities. These patterns of settlement suggest that access to the services and employment opportunities found in a city can be an important driver of the decision to settle in an area, even if people choose not to settle within the city itself.

If National Policy Objectives relating to the vibrancy of rural Ireland are to be achieved, then rural Ireland must be an attractive place to live and work, with reasonable access to services and amenities. As rural areas are, by definition, less densely populated than urban areas, efficient, reliable and robust access to transport is integral to the provision of services and amenities at a reasonable per capita cost.

A background report to the National Spatial Strategy notes that remote rural areas see lower employment growth than rural areas with greater access to large population centres areas (Walsh, 2000).\(^2\)\(^3\) This was true for areas that were geographically closer to urban areas and for areas where increased accessibility was enabled via proximity to national roads. While some areas will inevitably be more remote than others, effective means of transport can reduce the relative level of isolation. The report also notes that less populated rural areas perform worse in average employment growth rates than larger ones. By reducing travel times, transport investment can increase the footprint of services in these areas and allows them to cover a greater share of the population.

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\(^2\) The report defines rural areas as District Electoral Divisions with no population centre above 1,500 people, with a population density below 150 per km\(^2\) and which are not part of an urban district or borough.

\(^3\) The average employment growth rate of the three most remote groupings of agricultural areas was approximately 1 percentage point per annum lower than that of the two less remote groups.
Agglomeration benefits are the gains that occur when firms and people are easily accessible to one another. Traditionally, this has been applied to the benefits that arise in relation to geographic proximity. However, a 2016 Frontier Economics report prepared for the UK National Infrastructure Commission noted that, “transport can stimulate the economy by bringing people, firms and places effectively closer together through reductions in travel time and generate ‘agglomeration benefits’” (Frontier Economics, 2016). These benefits include the direct gains from the increased productivity of existing firms and workers and the indirect benefits from affected areas becoming more attractive to workers and for investment. These benefits agglomeration are additional to the direct benefits, such as time savings, experienced by the transport users.

Research into the benefits of investment in transport infrastructure in remote areas of rural Scotland indicates that these benefits can be significant in rural areas (Laird & Mackie, 2014). Benefits can be realised through a number of channels, including increased output, a wider labour market increasing the ability of employees to seek jobs and giving employers a greater pool of potential employees, and greater accessibility to different service providers increasing competition and weakening monopolies in rural areas.

However, investment must be strategically targeted to generate a net benefit. Research on the impact of the interstate highway system on rural areas of the United States suggests that, while areas directly adjacent to investment saw increased economic activity, this was cancelled out by decreases in other nearby areas (Chandra & Thompson, 2000). The net benefit was limited as economic activity was displaced from rural areas further from the infrastructure to areas closer to it, rather than actually stimulating new economic activity.
3. Policy Context

Project Ireland 2040, in the form of the NPF and NDP, is Government’s overarching strategic plan to shape the sustainable development of Ireland in the coming decades. The Government has also published a strategy for rural development, *Realising our Rural Potential: Action Plan for Rural Development* (Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, 2017). This cross-cutting strategy was launched in January 2017 and contains a wide variety of objectives focussed on increasing access to local employment and public services in rural Ireland.

3.1 Project Ireland 2040

The National Planning Framework recognises the importance of rural areas to Ireland’s identity and their contribution to Ireland’s national economic, social and cultural development. In the context of rural Ireland, the National Planning Framework places a major focus on:

- Strengthening Ireland’s rural fabric and supporting the communities that live there;
- Planning for the future growth and development of rural areas, including addressing decline, with a special focus on activating the potential for the renewal and development of smaller towns and villages;
- Putting in place planning and investment policies to support job creation in the rural economy;
- Addressing connectivity gaps; and,
- Improving coordination of existing investment programmes dealing with social inclusion, rural development and town and village renewal.

Building on these themes, the third National Strategic Outcome (NSO) of the National Development Plan, Strengthened Rural Economies and Communities, recognises the importance of the strategic development of rural areas to realising Project Ireland 2040. NSO 2, Enhanced Regional Accessibility, will improve accessibility between urban centres of population and their regions. Improvements to the road network developed as part of this objective will support transport on a national level. While the primary focus on of this network is linking Ireland’s urban areas, it will also enable access on a national level, with many rural areas able to access the network relatively quickly. To link less densely populated rural areas into the road network and to support transport within rural areas, the NDP has earmarked €4.5bn for the development of regional and local roads. Examples of road projects which support transport access in rural areas include the Coonagh to Knockalisheen road and the R498 Nenagh/Thurles realignment.

Another key investment action of the NDP will be protecting the quality and value of past investment actions. The Department of Transport’s Strategic Investment Framework for Land Transport (SIFLT) estimated that the annual cost to the Department of protecting and renewing the existing transport system, or meeting ‘steady state’ investment requirements, was €1.3bn. NIFTI Background Paper 6 has refreshed this analysis and it is now estimated that the average level of annual Departmental investment required to protect and renew the national, regional and local road networks is €874 million. Given Ireland’s relatively dense road network, this will be a key element of maintaining transport access for rural Ireland.

3.2 Realising our Rural Potential: Action Plan for Rural Development

While noting the challenges facing rural Ireland, the Action Plan for Rural Development also notes the contribution of rural areas to the economic and cultural life of the country and the capacity to harness the
potential of rural areas to support and develop thriving communities. The strategy has a range of key targets in a number of areas including employment, access to services, provision of social and cultural facilities and rural transport provision. Improved rural transport links are recognised as an important element in achieving these targets and enabling rural Ireland to achieve its full potential.

One of the pillars of this strategy is 'Improving Rural Infrastructure and Connectivity' with the key objectives of improving rural transport links and improving access to information technology in rural Ireland. The pillar also recognises the particular importance of protecting existing infrastructure and places an emphasis on flood defences where required, particularly in the context of a changing climate.

The Action Plan includes actions to progress capital investment and examine the scope for additional investment in the regional roads network in future capital plans. This is reflected in the provision of funding for regional and local roads in the NDP.
4. Transport in Rural Areas

Population density in rural Ireland is lower than for the State as a whole, at 27 people per km\(^2\) compared to 70 people per km\(^2\).\(^4\) Due to this low population density, the primary mode of transport in rural areas is, by a significant margin, private vehicles. Figure 4.1 highlights the primacy of private motor vehicles in the provision of transport services in rural Ireland. Their use is 18 percentage points higher than in urban areas. Furthermore, the public transport which is available is heavily roads based, with buses accounting for 94% of public transport in rural areas. It is also worth noting that given the dispersed nature of rural populations and the greater distances often involved, it is likely that there is less potential for changing transport mode in rural areas. Significantly expanding the provision of alternative public transport services is unlikely to be financially viable and active travel measures are likely to be impractical for longer journeys.

Given these constraints, it is clear that the capital investment supporting the provision of transport in rural Ireland will be primarily concentrated on protecting and developing the road network and supporting the adoption of less carbon intensive private vehicles, rather than seeking to develop alternate transport modes.

![Figure 4.1: Means of Travel to Work or College, 2016](source: CSO, Census 2016)

4.1 Public Transport in Rural Ireland

A number of dedicated rural transport services are in operation, although these are generally funded through current expenditure rather than capital. As such, they do not fall within the scope of this paper. However, this section will provide a brief overview of these services as context for the subsequent analysis. Public transport

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\(^4\) Census 2016 - Profile 2 Population Distribution and Movements
services in rural areas are primarily supported by the Department of Transport through two programmes. These are Public Service Obligation (PSO) contracts and the Rural Transport Programme.

The PSO scheme seeks to support the provision of public transport services in areas where it might not be commercially viable to provide. The PSO scheme supports transport in rural, interurban and urban contexts. This subsidy is a key part of the funding for Ireland’s public transport system, particularly for rural areas where the low population densities makes providing public transport less financially viable and, by extension, less likely to be provided in the absence of subsidy. Of PSO recipients, the principle provider of public transport services in rural areas is Bus Éireann. The difference in footprint between rail and bus services is evident in Figure 4.2 and Figure 4.3.

Bus Éireann receives support for the provision of rural services, intercity services, and services in the cities other than Dublin. Rural and intercity services are essential elements of the provision of transport in rural areas. While rural services receive support from the PSO scheme, intercity routes are run on a commercial basis and are open to competition from private operators. Intercity routes play an important role in providing public transport services to towns and villages, which often act as hubs for their hinterlands to access the wider public transport network. Bus Éireann was responsible for 35.3m PSO-supported journeys in 2018. This includes rural services and public transport services in the regional cities. The cost of the PSO subvention for these services was approximately €54.3m.

The Rural Transport Programme, or LocalLink, provides public transport services to rural areas that are not served by Bus Éireann routes. Its mission statement is “to provide a quality nationwide community based public transport
system in rural Ireland which responds to local needs. It provides a mix of regular timetabled services and demand responsive services. It is funded by the Department of Transport via the National Transport Authority, with some additional funding provided by the Department of Employment Affairs and Social Protection through the Free Travel Pass programme. In 2018, the Rural Transport Programme provided 2m passenger journey and was allocated €18.6m in funding (National Transport Authority, 2019).

4.2 Rural Roads

Given the reliance of rural areas on private cars and bus-based public transport, the provision of suitable roads infrastructure is essential to providing accessibility for inhabitants of rural areas. While the National Primary Roads network serves large parts of rural Ireland, this is a function of its primary purpose of linking towns and cities on Ireland’s interurban network. The interurban road and rail network is considered in more detail in NIFTI Background Paper 11. The National Secondary, and Regional and Local Roads networks are important infrastructure that support mobility within rural areas and provide access to the national interurban road network.

Responsibility for the maintenance and upgrading of National Secondary, Regional and Local roads is divided between Transport Infrastructure Ireland (TII) and the Local Authorities. TII is responsible for National Secondary network, while Local Authorities are responsible for the regional and local road network. The majority of the management of the National Secondary road network is undertaken by the Local Authorities on behalf of TII.

The protection and renewal of roads represents a major expense to Local Authorities. The Local Authority budgets for 2020 forecast expenditure of €769m on National Secondary, regional and local roads, which represents 14% of total Local Authority projected expenditure of €5.5bn in 2020 (Department of Housing, Planning and Local Government, 2020). This investment is funded via grants from the Department of Transport and Local Authorities’ own resources.

The Irish road network is among the densest in Europe. In 2016, Ireland had 20.7km of road per 1,000 inhabitants (Department of Transport, Tourism and Sport, 2020). This is the fifth highest road density in the EU and more than twice the average of 9.6km per 1,000 inhabitants. This is likely a function of Ireland’s low “lived density” and widely dispersed settlement pattern.

Given the density of the road network, maintaining accessibility in rural Ireland will largely require protecting and renewing existing infrastructure rather than expanding the network through new projects. Modelling conducted by TII indicates that the vast majority of Secondary National Roads are capable of delivering a high level of service and are forecast to remain capable of doing so in 2040 without substantial new investment, even given National Planning Framework population and settlement targets.

This is shown in Figure 4.4, which indicates the level of service available on National Secondary Roads at the AM peak. With the exception of roads that feed into large urban areas, these roads maintain a free flow state, even during their busiest periods. While some of the National Secondary network is somewhat overcapacity, these tend to be concentrated around urban areas. This pattern continues to 2040, even in the Do-Nothing scenario where the population grows and the transport network remains as it is in the base scenario. This suggests that congestion is not be a constraint on rural accessibility and that increasing the capacity of rural roads should not be a priority.
Figure 4.4: Service Levels on National Secondary Road Network, Base Scenario and Do-Nothing Scenario

Figure 4.5: Percentage Change in Annualised Average Daily Traffic between 2017 and 2040

Source: Transport Infrastructure Ireland
Figure 4.5 highlights the limited projected increase in traffic on many parts of the National Secondary Network. In particular, there are limited increases on the south and west coasts.

The implications of the limited traffic increases are evident in Figure 4.6. Many roads in rural and remote areas will remain under capacity, even in the 2040 Do-Nothing Scenario. Given the pressures on other parts of the network and the relatively low traffic volumes, there is likely to be limited benefit to improving the capacity on many of these routes.

Figure 4.6: Volume-Capacity Ratios on National Secondary Roads, 2017 and 2040

<table>
<thead>
<tr>
<th>2017</th>
<th>2040 Do Nothing</th>
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4.2.1 Regional and Local Roads
Regional and local roads serve an important economic role in the local context and also have valuable social and community functions. These roads are often the sole means of access for local economic activity. The Road Management Office estimates that the Regional and Local Road Network carries approximately 55% of national traffic. However, while this is a significant volume of traffic, the network is disproportionately long relative to the traffic that it carries. The Regional road network is 13,120km long and the Local road network is 80,472km long. Together, they account for 94%, by length, of the road network (Department of Transport, Tourism and Sport, 2020). It should also be noted that the Regional and Local road network does not solely carry rural traffic as it also includes roads in urban areas.

Local and regional roads have a high variance in Pavement Surface Condition Index (PSCI) ratings. The National Oversight and Audit Commission’s 2018 Local Authority Performance Indicator Report highlighted this variance (National Transport Authority, 2018). South Dublin County Council had the lowest proportion of regional roads

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5 The PSCI rating is a 10 point scale developed by the Road Management Office for evaluating the standard of roads.
with structural distress at 2% of the network. In contrast, 16% of regional roads in Offaly County Council are considered to be in structural distress. Conversely, only 14% of Cork City Council’s regional roads are rated as “few or no defects”, compared to 58% in County Roscommon.

The maintenance of these roads is the responsibility of Local Authorities and is primarily funded by grants provided by the Department of Transport. In 2018, €417m was provided by the Department in grants to support the improvement and maintenance of regional and local roads. This is supplemented by material contributions from Local Authorities. In some Local Authority areas, with high Local Property Tax (LPT) yields relative to their needs, Departmental funding is replaced by excess LPT. The National Development Plan has committed to a €4.5bn investment over the lifetime of the plan in the Regional and Local Road network.
5. Analysis and Projections

The following section considers transport accessibility in rural areas. Drive time to the nearest major settlement and the vulnerability of local infrastructure is discussed, along with illustrative case studies of the Dingle Peninsula and the Athlone-Roscommon region assuming localised damage to key transport infrastructure.

5.1 Travel Time for Rural Residents

While Project Ireland 2040 seeks to build resilient communities in rural Ireland with high-quality services to rural residents, these will not always be delivered appropriately on a local level. To maximise the agglomeration benefits of denser populations and make services available to the greatest number of people, some services are most effectively delivered in urban areas of varying sizes. This concept is recognised in the National Planning Framework’s Hierarchy of Settlements and Related Infrastructure, as shown in Figure 5.1.

Figure 5.1: Hierarchy of Settlements and Related Infrastructure
This structure of service delivery is essential to the provision of high-quality public services in a cost-effective manner. However, ensuring that these services reach rural areas relies on an effective and efficient transport system. Due to the reliance of rural areas on private cars for transport, the accessibility these services to rural areas can be abstracted as the drive time from a rural area to a major settlement.

While travel times within local areas will, for the most part, remain a function of local infrastructure, a reliance on urban areas for the provision of some services means that developments which impact the national transport network will impact rural Ireland. Increased congestion on routes to urban centres will effectively increase the cost of accessing services delivered in urban settlements for inhabitants of rural Ireland.

Analysis of drive times for inhabitants of rural Ireland to their nearest major settlement of over 10,000 people has been carried out on by TII for three scenarios: a Base Scenario, a 2040 Do-Nothing Scenario, and a 2040 Do-Minimum Scenario. The Base Scenario represents conditions on the network as they currently exist. The 2040 Do-Nothing Scenario assumes that the transport network continues to exist in its current form in 2040, but that the population increases in line with the NPF. Finally, the 2040 Do-Minimum Scenario assumes population growth in line with the NPF as well as the delivery of all committed infrastructure in the NDP to the end of 2027.

**Figure 5.2: Rural Population by Drive Time to Major Settlement**

The results of this analysis are outlined in Figure 5.2. It should be noted that while this analysis does account for increased demand due a projected increase in population, the results are depicted in terms of the impacted 2016 population. This disaggregates the impact of an increase in population from the results of the analysis. The results show that in all the cases the proportion of the population within each driving time band in terms of access to a
major settlement decreases between the Base and 2040 Do-Nothing scenarios. Thus, a number of rural areas will see a reduction in accessibility to a main settlement if actions to improve the situation are not taken.

The 2040 Do-Minimum scenario has improved accessibility for rural areas relative to the Do-Nothing scenario. In all time bands, NDP investment results in a positive impact on accessibility for the rural population. Overall, the analysis indicates that 95.8% (1,402,568 people) of the total rural population are living in rural areas within 60 minutes of a major settlement in the Do-Minimum Scenario compared with 95.2% (1,392,684 people) in the Do-Nothing scenario. However, even with the NDP schemes in place, rural accessibility in the Do-Minimum Scenario is worse than in the Base Scenario for three of the four time bands, with the exception of the 60 minute time band which does marginally improve.

The profile of the results highlights the fact that interurban schemes tend to have limited impacts on the suburban areas that are likely to make up a lot of the areas within 15 minutes of main settlements as these journeys remain relatively local. In contrast, the population density decreases as distance increases from main settlements, reducing the impact of additional investment in isolated areas.

These points highlight the role of investment in urban transport networks as enablers of rural accessibility, as reduced congestion within and on routes into major settlements increases the accessibility of these places to rural residents. It also emphasises the challenge in enabling and improving access to transport for rural residents. As distances from major settlements increase, the rural population becomes more dispersed. While the cost of providing infrastructure stays relatively constant between areas, the number of people who can benefit from it is drastically reduced in more remote areas. A consequence of this can be that the benefit-cost ratio of investment in rural areas is lower than in more densely populated areas, making these projects less likely to be cleared under current appraisal guidance and to appear less attractive than those with higher benefit-cost ratios in more urban and densely populated regions.

5.2 Vulnerability and Resilience of Transport Networks

Traditional research on transport has focused on the direct performance of the network. Metrics such as the safety of the network, the volume of traffic it can sustainably accommodate and the journey times it enables are key performance indicators of transport networks. Questions such as these are traditionally what are considered when evaluating a proposed new investment in the transport network.

Another metric that is assessed is the reliability of the network. This considers the probability that the network can provide the required level of performance in light of conditions such as heavy congestion. This is especially important in urban areas where congestion can result in highly variable performance levels. In contrast, vulnerability considers the potential impact of the severing of a limited number of key links to significantly disrupt the operation the network and the accessibility of certain places.

Taylor and D’Este define an area as vulnerable if the loss or substantial degradation of a small number of links significantly reduces the accessibility of the area (2003). This can be expressed by considering the difference between the best route from the area in question to another and the second or third best options. If this difference is significant, the area may be highly dependent on that route and would be vulnerable to any
disruption to it. This substantially raises the cost of the failure of this link relative to a link with minimal difference between the best and second best options.

If the alternate routes are sufficiently limited, it may render an area unviable as a place to live, work or base a business. Rather than an increase in journey time and a marginal decrease in the number of journeys taken, the failure of the link may result in a large proportion of journeys (and the planned outcomes of these journeys) not taking place at all. In this sense, some links can be considered critical to the areas they serve.

Rural road networks with areas of significant vulnerability can present a challenge for the calculation of the benefit-cost ratios of improvements to vulnerable links. Overall usage of the link will often be relatively low and the likelihood of failure will be low. However, while this limits the direct cost, the wider impact of the failure of a vulnerable point will have far-reaching implications for an affected community. The failure of these links will severely limit the ability of communities to access services and the benefits derived from these services. Due to their rareness, it is difficult to accurately monetise the benefits of averting the failure of a vulnerable link and to accurately factor them in a cost-benefit analysis, especially compared to projects with more clearly defined benefits.

5.2.1 ‘Lifeline’ National Secondary Roads

As part of the analysis for their forthcoming National Roads 2040 strategy, TII have undertaken research into the National Secondary Road network. As part of this project, they have developed a classification system to further categorise National Secondary roads. TII’s analysis considers the level of traffic on each National Secondary road and the availability of alternative routes with similar journey times to determine a road’s ‘influence’. Figure 5.3 maps the influence of each National Secondary road in the network. It is noticeable that, likely due to the greater population density and corresponding increase in journeys, many of the roads with the greatest influence are concentrated around urban areas.

TII have also conducted analysis focusing on the influence on journeys not adjusted to reflect demand. This isolates the availability of alternative routes to a particular road in an area from the number of trips made on the road to highlight areas that could be considered to have vulnerable transport networks. This highlights National Secondary roads that would leave the communities they serve particularly exposed to severe disruption and increases in journey times if they were to fail.

Figure 5.4 applies this methodology to the Secondary National road network. While some routes into urban areas remain influential, there are a number of routes in rural areas which are highly influential. These Secondary roads are vital links for rural areas to access services and if they were to fail the accessibility of these areas would significantly worsen. This analysis highlights parts of the Secondary Network that are critical to their local areas. If these roads were to become inoperable journey times to and from the area would be significantly increased. The nature of the failure would determine the impact on communities and businesses near the relevant link. At a minimum, the failure of a critical link would require immediate repairs, which is often much more expensive then timely maintenance. If the section of road remains in a heavily damaged state, transport costs for local residents and businesses would see sharp increases either through significant increases in journey time when using alternative routes or in increased wear on vehicles. The increased wear on vehicles would also act as a

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5 The relative costs of repairing and maintaining road infrastructure is discussed in more detail in NIFTI Background Paper 6.
disincentive for freight and passenger service operators to continue serving the region. This increase in the cost of accessing goods and services and reduced accessibility would be damaging to the National Planning Framework's focus on strengthening Ireland's rural fabric and supporting job creation in the rural economy.

**Figure 5.3: Influence of National Secondary Roads**

**Figure 5.4: Relative Influence of National Secondary Roads (unweighted by demand)**

### 5.3 Regional Impacts

Areas that are dependent on individual 'lifeline' roads are particularly exposed to the failure of links in the local infrastructure and should be a priority for supporting and ensuring accessibility. Other areas that are less vulnerable will have a wider election of appropriate routes which are less likely to all fail simultaneously. This cannot be discounted as a risk entirely, however, as the probability of a piece of infrastructure failing will be influenced by events that may impact other links in the region. For example, storms or other extreme weather events will have a footprint that will impact on a region's entire transport infrastructure.

As discussed in NIFTI Background Paper 9, changes to Ireland's climate are likely to see severe weather events becoming more frequent and more severe. Research carried out at national level has shown that changes in Ireland's climate are in line with global trends, i.e. the average temperature in the country is rising (Desmond, et al., 2017). This means that climate change impacts are expected to increase over the coming decades and could include rising sea levels, more intense storms and rainfall events, and increased likelihood and magnitude of flooding. This increased prevalence of extreme weather events can cause systematic risks to accessibility for isolated rural areas.
The European Environment Agency, in their *Adaptation of Transport in Europe to Climate Change* report, notes the risk that in "regions with already limited accessibility alternatives" severe disruption of vulnerable infrastructure could "compromise their development prospects" and highlights the networked, interconnected nature of transport systems such that disruptions in critical parts of the network can cause delays or stoppages over a wide area (European Environment Agency, 2014).

Analysis has been carried out on behalf of TII by AECOM in relation to rural accessibility on the regional unavailability of certain vulnerable road types and the relatively vulnerability of areas. This approach divides Ireland into grid comprised of 10km² areas and analyses the impact of closing access to these areas on a grid by grid basis (Figure 5.5).

*Figure 5.5: 10x10 km grid of Ireland and selected study areas*

Analysis on this basis has been undertaken in two case study areas: the Dingle Peninsula and the Roscommon–Athlone area. The analysis considers the reliance on other areas for access to employment, goods and services, and the vulnerability of the area in terms of transport connections to other areas and the overall resilience of the network. Census data is used to understand existing travel patterns and TII’s National Transport Model has been used to conduct micro-analysis of the relative influence of the links in an area.
Table 5.1: Information on Study Areas

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Area (km²)</th>
<th>Population</th>
<th>Households</th>
<th>Employed</th>
<th>Unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dingle Peninsula</td>
<td>652</td>
<td>10,236</td>
<td>3,931</td>
<td>4,595</td>
<td>461</td>
</tr>
<tr>
<td>Roscommon–Athlone</td>
<td>623</td>
<td>37,146</td>
<td>13,631</td>
<td>15,156</td>
<td>2,168</td>
</tr>
</tbody>
</table>

5.3.1 The Dingle Peninsula

The Dingle Peninsula was chosen for one of these studies as it is served by one of the most influential ‘lifeline’ roads in the national secondary network. Analysis of POWSCAR\(^7\) indicates that 74% of trips made by those within this area are local trips within the Dingle Peninsula, with the majority of the remainder of trips being to Tralee.

This is higher than the other rural areas given the large concentration of employment in the tourism industry in the region. While this may increase the number of journeys made within the region for employment purposes, these positions are reliant on journeys made by tourists into the region and, as such, are still vulnerable to shocks to the transport network. Furthermore, in the region of 600 LGVs and 200 HGVs bring goods to and from the Dingle Peninsula on a daily basis, the closure of access roads would likely lead to shortages given the reliance on goods being imported to the area. The Dingle Peninsula is also reliant on other areas for services such as hospitals and airports.

\(^7\) Place of Work, School or College—Census of Anonymised Records
Residents of the Dingle Peninsula are therefore highly dependent on the availability of roads, in particular the N86 and R561 which provide the only access on or off the peninsula. However, the close proximity of both roads, with less than 10km distance between them, suggests that in the case of an area-wide weather event, the redundancy that each road has for the other is likely to be compromised, which increases the vulnerability of the area. The analysis suggests that an incident response to the Dingle Peninsula should be a priority in the event of an area-wide event.

The National Transport Model was used to calculate the relative influence on all links including Secondary, Regional and Local links. To understand the difference in the impact of a single road closure and area-wide closure two separate tests were conducted. The results of these tests are displayed in Figure 5.7. The left hand image depicts the journey travel time impact on a zone by zone basis of the closure of the N86, which provides the main access to the peninsula, and the right hand image depicts the impact of the closure (or unavailability) of all roads on the Peninsula.

Figure 5.7: Impact of Closure of N86 and Area-wide Closures Compared

While there are some differences between the two outputs, their similarity highlights the importance of the N86 in delivering access to and from the Dingle Peninsula. In particular, the severity of the impact of the N86 alone being out of commission is relatively similar to the impact of the wider network being impacted. This suggests that the N86 is an essential piece of infrastructure for the community it serves. Geographic constraints limit the potential for introducing redundancy into the system. This suggests that maintaining as close to 100% operability as possible on the N86 is essential to preserving and strengthening the living and working communities on the Dingle Peninsula.
5.3.2 Athlone-Roscommon Area

The Athlone-Roscommon area was chosen for one of these studies as an area which, while still significantly rural, was less isolated and geographically constrained than the Dingle Peninsula. However, it is still an area which is served by a road with an element of lifeline status, the N61 connecting Athlone and Roscommon. Analysis of POWSCAR indicates that 68% of trips for work and education taken by those living in the area remain within the region. The remainder of trips are far more geographically dispersed than in Dingle.

The importance of Athlone for access to employment, education and services is apparent from the concentration of journeys made to Athlone (Figure 5.8). Furthermore, as a major town, Athlone is a key node on Ireland’s interurban travel network.

Figure 5.8: Work and School Destination for Athlone-Roscommon Study Area Residents

The Study Area contains a number of important roads, including the N61 connecting Athlone and Roscommon which carries an average of 850 LGVs and 450 HGVs on a daily basis. The closure of roads such as the N61 would lead to a significant impact on the journey time of goods into, and through, the affected area. Access to airports and other international gateways would also be significantly impacted upon.

Analysis was also carried out for the Athlone-Roscommon area using the National Transport Model to compare the impact of the failure of the N61 with a more general failure of the road network in the Athlone-Roscommon area. The result of this analysis is depicted in Figure 5.9. The left hand image depicts the journey travel time impact on a zone-by-zone basis of the closure of the N61, the main road linking Roscommon and Athlone, and the right hand image depicts the impact of the closure (or unavailability) of all roads in the area.
The difference in impact is noticeable, particularly compared to the analysis carried out on the Dingle Peninsula. Due to the higher number of route options, the Athlone-Roscommon area has a greater level of redundancy in their road network, with no individual piece of infrastructure having a critical role to the network. In this case preserving a variety of routes may serve to better protect the system from severe disruption caused by extreme weather events or other such incidents.
6. Supporting the National Strategic Outcomes

The Project Ireland 2040 National Strategic Outcomes are a single vision and shared set of goals for every community in Ireland. In some cases transport's role in realising these outcomes is explicit, such as delivering sustainable mobility, while in others transport has a facilitating role, such as access to high-quality childcare, education and health services. In support of Project Ireland 2040, transport investment can deliver positive outcomes in the following areas:

1. Delivering clean, low-carbon and environmentally sustainable mobility

A sustainable transport system is one which can meet the needs of the population today without compromising its ability to meet the needs of the population tomorrow. In terms of environmental sustainability, the reduction in greenhouse gas emissions is a foremost priority. This is reflected in National Strategic Outcome 8, which is the transition to a low-carbon and climate resilient society. It is also a national objective to achieve a low-carbon, economically competitive and environmentally sustainable economy by 2050. As the second largest source of greenhouse gas emissions in Ireland, the transport sector has a key role to play in achieving these objectives.

2. Supporting successful places and vibrant communities

The National Planning Framework estimates that the population of Ireland will grow by one million over the next twenty years to almost six million people. Where this population lives and works will be a key factor in how Ireland develops, socially and economically, and the National Planning Framework has set the objective of accommodating one quarter of the growth in Dublin, one quarter in the other four cities, and the remaining half in towns and rural areas. The provision of appropriate transport infrastructure will play a crucial enabling role in the delivery of this objective and supporting quality of life for all Ireland's inhabitants.

3. Facilitating safe, accessible, reliable and efficient travel on the network

Delivering a high level of service means the provision of a transport network that is safe, reliable, efficient and accessible. The growth in population forecast between now and 2040 will result in a significant increase in trips, for both people and goods. Investment in the land transport network must enable this growth without compromising on service levels. Moreover, investment must be financially sustainable, and among other things this means ensuring that the transport network is appropriate to the population's needs rather than delivering high levels of excess capacity.

4. Promoting a strong and balanced economy

Ireland is a small open economy, dependent on high-quality international connectivity. The land transport network plays a key role in our economy by providing access to both national and international markets, the latter through our airports, ports and links with Northern Ireland. Within our towns and cities, the transport network can ensure equitable access to jobs and opportunities for our population.

These headings provide a framework for discussing how transport investment can help to realise Project Ireland 2040 in rural areas.
6.1 Delivering clean, low-carbon and environmentally sustainable mobility

The high level of private car usage in rural areas will require a wider technological shift away from internal combustion vehicles to significantly lower carbon emissions. The opportunities for modal shift in rural Ireland are limited by the longer journey distances and challenges related to providing cost effective public transport in areas of low population density. The transition to low-emission vehicles will require a suite of measures to offset the upfront cost of purchasing a vehicle and measures to support the development of enabling infrastructure such as fast charging points on the national network and home chargers. The development of this enabling infrastructure is being led by the Department of Communications, Climate Action and the Environment and the Department of Housing, Planning and Local Government.

While the immediate ability of Government capital investment in transport to lower emissions in rural areas is limited, the impact of climate change in rural areas will be increasingly significant in coming years. Climate change has the potential to hamper a region’s development prospects and contribute to rural isolation, as changing environmental conditions threatens to degrade existing infrastructure serving communities with already limited accessibility to alternative forms of transport. This will require the identification of critical links in rural areas, the failure of which would threaten the viability of communities. The impact of climate change on creating newly vulnerable links must also be considered. There must be an appropriate allocation of funding for the protection and renewal of the existing road network in light of more extreme requirements imposed by climate change in addition to the normal costs of maintenance.
6.2 Supporting successful places and vibrant communities

Project Ireland 2040 seeks to “strengthen Ireland’s rural fabric” and prioritises “supporting the communities who live there”. Furthermore, the NPF highlights the need for “planning for the future growth and development of rural areas, including addressing decline”.

Areas that have been identified as relying on ‘lifeline’ roads are particularly vulnerable to relative or absolute decline. If the failure rate of these links were to rise, even at relatively low levels, it would threaten the sustainable growth of rural communities in these areas. This could weaken these areas as living and working communities for businesses or for people with regular commutes to places outside these areas. Hollowing out this portion of the community from these areas would further threaten the remaining residents, as the decline in population may lead to a further withdrawal of services and businesses form the area.

The severe social and economic cost of the failure of ‘lifeline’ roads on local communities obliges Government to consider their operability rates a high priority. This may require the maintenance of roads categorised as ‘lifeline’ to be considered separately from the general upkeep of the road network. In other areas, the larger number of alternate routes may make the maintenance of the local network as a unit a higher priority so as to maintain redundancy for local communities.

6.3 Facilitating safe, accessible, reliable and efficient travel on the network

As discussed in Section 4, the primary enabler of transport access in rural Ireland is the road network. In general, the dense nature of the rural road network and low usage of rural roads suggests that expanding the network or upgrading the capacity of the rural road network will not be required to deliver a high level of service to Ireland’s rural population.

The length of the network suggests that the priority for investment in rural transport is the protection and renewal of existing infrastructure. This would protect and, given the shortfalls of investment in maintenance during the downturn, improve transport access in rural Ireland by remedying issues that had arisen as a result of the deferring maintenance. Metrics such as the Pavement Surface Condition Index ratings applied to rural and regional roads will be a key measurement of the progress on this priority.

6.4 Promoting a strong and balanced economy

The NPF recognises that an important enabler of Ireland’s economic competitiveness is the economic potential in Ireland’s rural communities. Rural areas of Ireland have significant competitive advantages in a range of industries such as agri-food, tourism and forestry. Furthermore, the vibrancy and cultural distinctiveness of Ireland’s rural communities make them attractive places to live.

Fully leveraging this potential requires access to markets and employees for businesses and to a wide range of employment options for employees to allow them to best utilise their skills. While rural areas will tend to be relatively less accessible than more densely populated areas, preserving their access to the nearest major settlement is an important element of rural viability. Furthermore, through access to major settlements, rural areas will be able to benefit from the investments that have been made in the National Primary Network to improve their connectivity and the investments in Ireland’s strategic international links to increase international access.
An enabler of accessibility for rural Ireland will be the ability to access the nearest major settlement with a population of over 10,000. A key metric for this priority will be drive time from rural areas to these settlements. Investment to protect this accessibility should be considered in a holistic manner and may take many forms, from investment in the interurban network to improve average speeds to measures to manage traffic demand in the immediate hinterlands and outlying areas of major settlements.
7. Conclusions

A transport network that provides reliable access to urban centres of scale is a key enabler of a rural Ireland that is a vibrant and attractive place to live and work. Realising Project Ireland 2040 requires that people living in rural Ireland can access the services in more densely populated areas and that businesses in rural areas can readily access employees and consumers at a reasonable cost.

The NDP prioritises protecting the quality and value of past investments. The NDP also notes the need for additional investment to rectify the cumulative impact of several years underinvestment in maintenance. Given Ireland’s existing extensive road network, meeting protection and renewal investment requirements will be a key element of supporting accessibility in rural Ireland.

Future investment in transport must consider the priorities assigned to road maintenance to guarantee, as far as practicable, connectivity for rural areas to the national network and local urban centres. Areas which are vulnerable to isolation on the failure of a limited number of roads should be identified and prioritised for the inspection and maintenance of ‘lifeline’ routes, while the standard of roads serving other areas should be maintained so as to provide redundancy where feasible.

The impact of policy interventions in urban areas and on the interurban network should also be considered for their downstream impact on the accessibility of rural areas. Increasing interurban connectivity will also improve the accessibility of rural areas. However, if compact urban growth is not delivered, increased congestion on the periphery of Ireland’s urban areas will lead to an effective reduction in the accessibility of these areas, and the services based in them, to rural Ireland.

Protecting access to isolated rural communities is likely to become a more salient issue in the coming years as extreme weather events become more common due to climate change. A framework should be developed for identifying areas requiring additional investment to protect their accessibility and to detect areas which may become newly vulnerable as a result of the changing climate.
8. References


