National Investment Framework for Transport in Ireland

Background Paper 9: Climate Adaptation

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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

As part of the National Investment Framework for Transport in Ireland (NIFTI), four areas relating to the management of the current transport network are being analysed. These are:

1. Protection and Renewal;
2. Maintenance Investment Priorities;
3. International Benchmarking; and,
4. Climate Adaptation.

This paper considers the fourth of these areas, climate adaptation, and identifies what actions and strategies need to be implemented to protect areas of the transport network at risk from climate-related weather events. This paper also sets out the policy background for climate adaptation and how to ensure that the appropriate investments required for increased network resilience to climate change are in place. The paper presents these issues in conjunction with the transport objectives set out in the National Planning Framework (NPF) (Government of Ireland, 2018b).

NIFTI Background Paper 1 provides a detailed overview of how Project Ireland 2040 relates to the transport sector. Climate adaptation will need to be incorporated into several elements of transport planning to ensure that the sector supports the delivery of this overarching vision.

Summary

- The effects of climate change from human activity cannot be fully mitigated or reversed. Severe weather events illustrate how the transport network could be adversely impacted by climate change.
- Future planning for transport must include climate adaptation policies, which encourage taking appropriate action to prevent or minimise the damage caused by climate change.
- While acknowledging that climate adaptation requires a cross-cutting approach across many sectors, it is important to recognise the unique challenges and risks faced by the Irish transport network in relation to climate change.
- Transport network adaptation measures include: technological and engineering activities, such as improved drainage, road enhancements, elevating rail and road corridors, etc., as well as actions that seek to utilise ecological resources, such as afforestation and the creation of green spaces to enable better management of urban micro-climates.
- The Sectoral Adaptation Plan for Transport Infrastructure recommends 21 adaptation actions which aim to:
  - Identify key vulnerabilities, risks and opportunities
  - Identify information on the costs and benefits of adaptation
  - Build capacity to cope with climate change and improve resilience
  - Improve coordination with the local government sector
  - Develop appropriate monitoring and verification systems and identify and address key knowledge gaps
- Future protection and renewal costs should also include an amount to adapt the transport network to be more resilient to climate impacts.
2. Climate Adaptation

2.1 Irish Weather Trends

Changes to Ireland’s climate are likely to see severe weather events (e.g., coastal and inland flooding) becoming more frequent and more severe. The Department of Communications, Climate Action and Environment (DCCAE) has identified research carried out at national level (“A Summary of the State of Knowledge on Climate Change Impacts for Ireland (2010–2016)” Report 11, University College Cork, 2017) which has shown that changes in Ireland’s climate are in line with global trends, i.e., the average temperature in the country is rising. This means that climate change impacts are expected to increase over the coming decades and could include: a rise in sea levels; more intense storms and rainfall events; and, increased likelihood and magnitude of river and coastal flooding.

Analysis undertaken by World Weather Attribution (WWA), an international coalition of scientists that calculates the role of climate change in extreme weather events, concluded that the record-breaking temperatures observed in most of Western Europe in June 2017 would become the norm over the coming decades (World Weather Attribution, 2017). Regardless of mitigation measures, there will be changes to Ireland’s climate in the coming decades. Therefore, early, well-planned adaptation strategies, incorporated into overarching national planning policies, are integral to retaining and protecting Ireland’s transport network.

2.2 Potential Impact of Climate Change on the Transport Network

Climate change has the potential to cause severe and wide-ranging damage to the transport network. Developing Resilience to Climate Change in the Irish Transport Sector, on adaptation planning, noted that “changing weather patterns and violent extremes can cause infrastructure damage and deterioration, disruptions to transport operations and unsafe conditions.” The paper also emphasises the need for adaptation measures, stating, “it will be vital to future-proof the efficient functioning of our transport system now so that Ireland can continue to accrue the many benefits of transport to the economy and society in general” (DTTaS, 2017).

The European Environment Agency has highlighted how the complexity and multifaceted nature of transport networks can exacerbate the impact of climate change. The complexity of transport systems has an “amplifying effect” on climate change impacts: “if disruptions affect critical sections of the network, transport flows may be delayed or stopped many kilometres away from the area originally affected”. The paper also notes that if vulnerable pieces of transport infrastructure “are serving regions with already limited accessibility alternatives, they [climate change impacts] could compromise [the region’s] development prospects” (EEA, 2014).

2.3 What is Climate Adaptation?

DCCAE has described climate adaptation as “how we plan for the negative effects of climate change and taking suitable action to prevent or minimise damage caused by climate change. It also includes consideration of where we might avail of potential positive opportunities that may arise from climate change.”

In terms of policy, DCCAE notes that climate adaptation can be described as "a policy approach which seeks to protect people, buildings, infrastructure, businesses and ecosystems against the negative impacts of climate change, but also build resilience to that change, allowing society to take advantage of any opportunities that it
might bring.” Early and well-planned interventions that promote and implement adaptation measures can safeguard Ireland against the societal and material cost associated with climate change.

Adaptation measures can be categorised as grey or green. Grey measures typically involve technical or engineering-oriented responses to climatic impacts (e.g., the construction of sea walls in response to a sea-level rise). Green measures seek to use ecological properties to enhance the resilience of human and natural systems in the face of climate change (e.g., the creation of green spaces and parks to enable better management of urban micro-climates).

### Climate Adaptation Example

The eastern rail corridor between Dublin and Rosslare has previously been identified as a piece of transport infrastructure that is vulnerable to severe weather events given sections of the rail line are in close proximity to areas facing coastal erosion and beach recession. Any significant changes in Ireland’s climate in a relatively short period of time could greatly accelerate these adverse conditions and destroy or greatly damage the rail line.

Potential adaptation measures to guard this infrastructure from anticipated climate change impacts include: engineering actions to counteract the erosion and recession of coastal areas surrounding the rail line; elevating or realigning of sections of the rail line to ensure that it can continue to run after a rise in sea levels; and/or, a regeneration of coastal areas.

#### 2.4 National Policy Framework

Ireland’s first statutory National Adaptation Framework (NAF), which sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts, was published in January 2018 (DCCAE, 2018). The NAF was developed under the Climate Action and Low Carbon Development Act 2015 and built on work previously carried out under the 2012 National Climate Change Adaptation Framework\(^1\) (NCCAF).

Under the NAF, Government Departments were required to prepare Sectoral Adaptation Plans to set out the adaptation measures they intend to take in areas under their remit. In total, 12 Sectoral Adaptation plans were prepared for the following areas:

- Agriculture
- Biodiversity
- Built and Archaeological Heritage
- Communications Networks
- Electricity and Gas Networks
- Flood Risk Management
- Forestry

\(^1\) In 2017, the Department of Transport, Tourism and Sport published an adaptation paper (‘Developing Resilience to Climate Change in the Irish Transport Sector’) under the non-statutory NCCAF. This paper outlines the likely impacts of climate change on the transport sector, identifies vulnerabilities and establishes measures to meet these challenges.
Each Plan identifies the key risks faced across the sector and the approach being taken to address these risks and build climate resilience for the future.

2.5 Sectoral Adaptation Plan for Transport Infrastructure

In line with its requirements under the NAF, the Department of Transport prepared a Transport Climate Change Sectoral Adaptation Plan which was approved by Government in October 2019. The plan identifies key road, rail, air and maritime transport networks and assesses their vulnerability to specific risks such as sea level rise, coastal erosion and extreme weather events.

As well as identifying the key sectoral risks and priorities, the Sectoral Plan recommends 21 adaptation actions. These aim to increase knowledge and understanding of the likely impacts of climate change on the sector, support stakeholders in identifying and prioritising risks, and assist in the implementation of adaptation measures to improve resilience across the sector.

2.6 Project Ireland 2040

Project Ireland 2040 notes the need for action to both adapt to and mitigate the effects of climate change and how existing national policies area must be incorporated into future planning and land-use strategies. The National Planning Framework includes objectives that seek to:

1. Address the effects of climate change (i.e., sea level changes, coastal flooding and erosion) by supporting the implementation of adaptation responses in vulnerable areas; and,
2. Reduce Ireland's carbon footprint by integrating climate action into the planning system in support of national targets for climate policy mitigation and adaptation objectives.

The National Development Plan 2018-2027 (NDP) notes that climate mitigation and adaptation are cross-cutting priorities and that "a number of vital directions for public investment by relevant sectoral Departments and Local Authorities to underpin Ireland’s response to global climate change will be prioritised and accelerated over the lifetime of the NDP". The NDP has also identified the need to make the road network more resilient to the effects of climate change. This might include improved road drainage systems, strengthened road pavements and bridges, and elevating of roads in certain locations to prevent roads becoming impassable after heavy rainfall.
3. Investment Requirements

Many adaptation measures include considerable engineering and construction undertakings that alter or amend transport infrastructure and the surrounding environment. As a result, the costs associated with adaptation measures can be high. The Department of Transport’s 2017 paper on developing sectoral resilience notes that a “funding model may need to be considered in the context of addressing such vulnerabilities as part of a long-term adaptive strategy for transport in Ireland” (DTTaS, 2017).

The following sections will outline some of the costs associated with climate adaptation and estimate the potential scale of costs associated with the required adaptation measures.

### Case Study: Donegal Flooding 2017

On 22 August 2017, a severe weather event occurred in the north-west of Ireland with over 63mm of rain falling in a six-hour period. This overwhelmed drainage systems, leading to wide-spread flooding. The intensity of the rain during that period was such that large sections of the area’s road network were deeply affected, with the Inishowen peninsula experiencing the worst of the damage.

€15m worth of road repairs were required as over 600 issues were identified along the 1,500km road network. These works included repairs to 115 damaged bridges. Moreover, over 50 families were displaced, and at least 60 other families required financial assistance. Hundreds of homes, community amenities, farmland and other properties were also destroyed.

### 3.1 Costs Associated with Severe Weather Events

As the 2017 Donegal example shows, severe weather events can produce substantial material and societal costs. The main tangible cost to the transport sector is associated with the repair and reconstruction of infrastructure. This is a complex undertaking given the level of urgency involved, the logistics in prioritising and applying limited resources, and ensuring that the infrastructure has been repaired or rebuilt to the required standard. Repairs and reconstruction actions may also need to incorporate some level of adaptation or safeguarding to ensure improved resilience against future weather events, and this can increase up-front costs even more.

In addition to the ‘reactive’ costs linked to repairs and reconstruction, there are ‘preventative’ costs associated with actions and strategies that seek to prevent or mitigate damage from severe weather events before they happen. This includes improving drainage, reinforcing bridges and elevating road and rail lines.

Moreover, damage to the transport network does not just sustain costs related to repairs and reconstruction of infrastructure, but there is also a knock-on effect for a region’s economy and accessibility as journeys are disrupted, delayed or cancelled.

### 3.2 Likely Scale of Future Adaptation Costs

It is difficult to accurately estimate the full cost of implementing an effective adaptation strategy for the whole country. However, it can be expected that the costs associated with early and well-planned adaptation will be a
fraction of those incurred if no adaptation measures are introduced. As noted above, severe weather events not only damage the infrastructure but also generate wider costs to the economy and society in general.

The NDP has allocated €940m towards flood defences out of €21.8bn allocated to the “Transition to a Low-Carbon and Climate-Resilient Society” National Strategic Outcome (Government of Ireland, 2018a). Further investment from the NDP will be “prioritised and accelerated” based upon direction from the relevant sectoral Departments and Local Authorities.

In order to support adaptation planning in the transport sector, the Sectoral Adaptation Plan outlines essential adaptation actions and strategies that must be implemented, and identifies the costs and benefits of putting these actions and strategies in place.

This NIFTI paper will seek to inform future land-use planning strategies by highlighting the importance of integrating Climate Adaptation into how we maintain, enhance and develop our transport network while also meeting other transport objectives, particularly sustainability.

3.3 Implications for Protection and Renewal Investment

Protection and renewal expenditure is the investment required to maintain, manage and renew the existing land transport network to keep it in an adequate condition, together with contractual commitments such as public-private partnership payments. Research conducted as part of the Strategic Investment Framework for Land Transport estimated that protection and renewal—or, steady state—funding requirements amounted to approximately €1.3bn for the Department of Transport annually (DTTaS, 2015).

Protection and renewal estimates should also incorporate climate adaptation requirements for the land transport network into the methodology. This will require the development of a robust methodology for calculating the additional maintenance and renewal investment requirements for the land transport network to capture the annual cost of safeguarding against severe weather events. This methodology may entail calculating the additional costs by extrapolating from previous road and rail adaptation measures, or from incorporating research undertaken as part of the Sectoral Adaptation Plan to identify and collect information on the costs and benefits of adaptation.

In the long term, the need for targeted investment in the transport system will increase as the sector seeks to respond to the impacts of climate change, particularly those impacts that could be exacerbated by any existing vulnerabilities in our road and rail infrastructure. Some of these costs should be included in future protection and renewal analysis, to derive investment requirements for the maintenance and safeguarding of the land transport network. This would allow for climate adaptation actions to become part of an essential and pre-existing process that strengthens and renews vital parts of the transport network.

3.4 Incorporating Adaptation into Transport Project Appraisal

The evaluation and appraisal process which is used to inform decisions regarding new transport projects and programmes must begin to include a climate adaptation element. Future investment in transport services and networks will need to follow the trajectory of overarching policies in the NPF and NDP which seek to transition Ireland to a more climate resilient society.
Transport projects and programmes that require detailed appraisals should incorporate into their quantification of costs and benefits and risk analysis a climate adaptation component which would be factored into the overall merit of the project. This would ensure that those involved in developing and proposing transport projects or programmes are cognisant of how these projects will fit in with overarching climate adaptation strategies. This amendment to appraisal processes will require updates to existing appraisal guidance documents (e.g., the Common Appraisal Framework, TII Transport Appraisal Guidance, etc.).

An example of how climate adaptation considerations can be addressed through the appraisal process can be seen in the updated Public Spending Code, which notes that for specific projects longer time horizons may be used to incorporate long-term impacts and costs such as those arising from climate change (DPER, 2019).
4. Conclusions

Some of the effects of climate change cannot be fully mitigated or reversed. Severe weather events, such as flooding in Donegal in 2017, illustrate how the transport network can be adversely impacted by climate change. However, incorporating climate adaptation into future transport planning can help minimise the damage caused.

In order to enhance the resilience of the transport sector the Department of Transport prepared a Transport Climate Change Sectoral Adaptation Plan. The plan identifies key transport networks and assesses their vulnerability to specific risks. As well as identifying the key sectoral risks and priorities, the Sectoral Plan recommends 21 adaptation actions. These aim to increase knowledge and understanding of the likely impacts of climate change on the sector, support stakeholders in identifying and prioritising risks, and assist in the implementation of adaptation measures to improve resilience across the sector.

These adaptation measures include considerable engineering and construction undertakings that alter or amend transport infrastructure and the surrounding environment. As a result, they can be costly. However, it can be expected that the costs associated with early and well-planned adaptation will be a fraction of those incurred if no adaptation measures are introduced.
5. References


Department of Transport, Tourism and Sport (DTTaS) (2017). Developing Resilience to Climate Change in the Irish Transport Sector.


University College Cork (2017). A Summary of the State of Knowledge on Climate Change Impacts for Ireland (2010-2016)