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A prosperous island of 10 million people

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Strategic partners

MAXOL Fane Valley

“Efficient movement of people, capital, goods and services is crucial to an effective, competitive and modern economy.”

Introduction

The All-Island Investment Project (AIIP) is an initiative launched by the Joint Business Council (JBC) of Ibec and CBI Northern Ireland in 2015. Its purpose is to scope the infrastructure needed to enhance connectivity for an island of 10 million people by 2050. This initiative has developed a fresh and inclusive economic vision from the business community on the island of Ireland, aiming to spread the benefits across society, sectors and regions.

Efficient movement of people, capital, goods and services is crucial to an effective, competitive and modern economy. Failure to invest in transport infrastructure affects quality of life, exacerbates peripherality and stifles opportunities for economic growth, as global connectivity continues to improve. Current transport infrastructure on both sides of the border is characterised by insufficient capacity and management.

The AIIP's proposal for a comprehensive all-island motorway/dual carriageway network is an ambitious and compelling opportunity to deliver enhanced connectivity in land transportation including creating the business opportunities and jobs and prosperity for a population of 10 million people.

The economic and population growth currently underway on the island of Ireland, with growing demand on the network being created by more people, goods and services moving around the island, creates a compelling case for consideration this proposal as an immediate strategic investment priority.

Enhancing transport infrastructure across the island is a priority for advancing and protecting interests on both sides of the border, post-Brexit. There is now an immediate urgency to ensure that interests across the island of Ireland are protected and advanced, as we move towards formal exit negotiations.

The following document is the result of the scoping exercise on all-island connectivity by JBC: *Completing a comprehensive all-island motorway/dual carriageway network*. For full summary and overview of the scoping of this proposal, *see Appendix A.*

This key strategic proposal will be shared in the first instance with those whose direct responsibility, in-depth knowledge and applicable expertise enable them to consider its early adoption so that detailed planning for the phased completion of the network can begin in 2017.

Finally Ibec and CBI NI wish to acknowledge those who contributed to this ambitious JBC project: our members who contributed their time insights and expertise and especially our Strategic Partners- Maxol Group and Fane Valley; Mary Rose Burke (Ibec) and Nigel Smyth (CBI NI) who are jointly managing the AIIP Project; Andrew Ennis, Iain Hoy and David Fry who were Research Assistants, and the Programme Lead Michael D'Arcy.

Section 1

Background and context

1.1 Transporting people and goods

The efficient, timely and cost effective movement of people and goods within, to and from this island is highly dependent on the quality of island's road transport network. A comprehensive inter-urban network is vital to achieving the transport connectivity needed to underpin sustainable growth and prosperity on the island of Ireland.

Users of the existing inter-urban motorway or high-grade dual carriageway network experience its benefits. They are also aware of the cost in time or potential frustration when travelling between major urban centres not connected by motorway/dual carriageways or when having to endure congestion and bottlenecks.

1.2 A comprehensive approach

Requirements for this proposal include a phased completion by 2050, capacity for a total population of 10 million and a design which incorporates rapidly developing innovation in transport. The AIIP recommends planning for this project should begin immediately.

1.3 Completing the project

Motorway construction began on the island in the late 1960s in Northern Ireland and substantial progress towards a comprehensive network has been made, most recently in the Republic. However, the Republic's Transport Infrastructure Ireland (previously NRA) correctly observed as far back as 1998:

> *As traffic increases, an increasing percentage of the network will fail to meet the specified level of service objective without on-going improvements to the network*

As economic and demographic growth continues to generate more traffic, the capacity originally planned for is becoming increasingly inadequate. The resulting congestion and the need to redevelop connections make further investment inevitable.

There are projects currently underway and plans for extending and/or enhancing the existing network in both Northern Ireland and the Republic. These initiatives have not, as of yet, been merged within an overall plan to provide a genuinely comprehensive island-wide motorway/dual carriageway network.

1.4 The AIIP's proposal

This proposal has been developed with the assistance and support of a wide range of participants from the sector including members of Ibec and CBI NI.

The paper is structured as follows: Section Two: An all-island network for 10 million people considers what a comprehensive network should look like; Section Three: Designing the network outlines what the map illustrates and its phased delivery; Section Four: Funding, finance and costs provides an initial scoping of these critical aspects; Section Five: The broader picture and potential obstacles completes this exercise by including some important indirect effects and obstacles likely to be encountered during implementation.

1. Going Places: National Roads Needs Study 1998, NRA

Section 2

An all-island network for 10 million people

By planning for a mid-century population of 10 million people now, we can take advantage of the historically low cost of finance, long lead in times and the economic potential of the regions. The scale of this growth is an enabling factor that will allow the island to compete for international business at a new level. The economies that this proposal will drive will enhance economic prosperity and job creation to service the growing domestic and international markets.

2.1 The current network

The current All Island motorway and dual carriageway network stands at an estimated length of 1450km. This is broken down to over 1000km of motorway and over 400km of dual carriageway. The rest of the network is made up of single carriageway roads. When single carriageway roads are peeled back we can see in the figure below the lack of meaningful connectivity throughout most of the Island. In the subsequent figure displaying the scale of ambition envisioned in this paper, we see a comprehensively connected network with adequate access to our cities, ports and airports.

2.2 Demographic demand

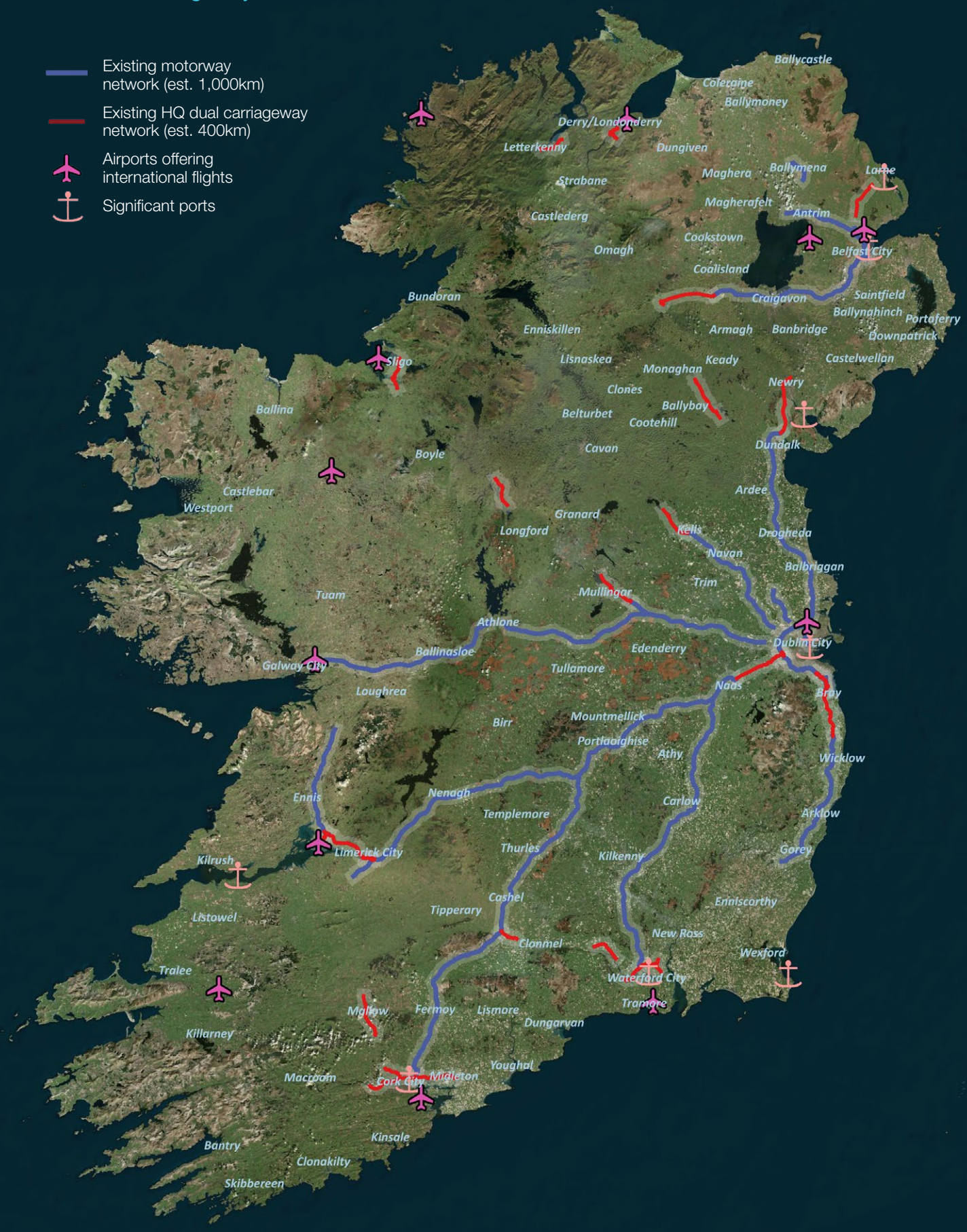
The most recent figures from the 2016 census in the Republic of Ireland show that the population of Ireland has reached 4.76 million people.[2] This has meant that in the past 20 years, population grew by 30%, the fastest rate of any other European country (bar Luxembourg). Initially, this strong population growth was driven by high immigration. More recently however, high birth rates were driving this growth. These rates were so high that they kept the population growing despite the high level of emigration during that period. This means that the Republic now has the youngest population in the EU, with more than half the population under 35 years of age.

On an all island basis, the population now stands at 6.6 million people. In the coming years, this population will continue to grow by 25%, one of the fastest rates in Europe. This will bring the total number of people living on this island up to 8.25 million people by 2040. This population growth will be higher in the Republic (as it is expected to grow by at least 30%) but will also be high by European comparisons in Northern Ireland (which should grow by 10%).

An effective response will need to embrace new ways of thinking, planning, investing and regulating. Spatial and transport planning will need to adopt a strategic and overarching, yet practical and future-orientated approach to building on success already achieved in changing the public's approach to transport. In this scenario a great many people will wish to see all modes work in unison rather than in competition.

2. http://www.cso.ie/en/releasesandpublications/ep/p-cpr/censusofpopulation2016-preliminaryresults/

Figure 1: Current motorway and dual carriageway network



Placement and category of roads for illustrative purposes only. Data source: CSO, NISRA.
'High quality (HQ) dual carriageway' is an all purpose two lane road built to motorway standard, without motorway classification and restrictions.

A vision for transport on an island of 10 million people that includes inter-urban public transport needs to move beyond current definitions of planning, funding, provision and regulation of same.

2.3 Comparing 18th and 21st century networks

By 1729 Ireland had its first (tolled) network of paved 'turnpike' routes. Their modern equivalents are motorways and dual carriageways. So how does the 21st century network compare with that of the 18th century?

Remarkably, as the following maps illustrate, they are strikingly similar in their limited extent. It is not an exaggeration to say that the island's motorway network in 2015 is broadly the same as that of the turnpike roads constructed by 1739 *(see Figures 2 & 3 below)*.

Figure 2: Early turnpike routes (1729-1739)

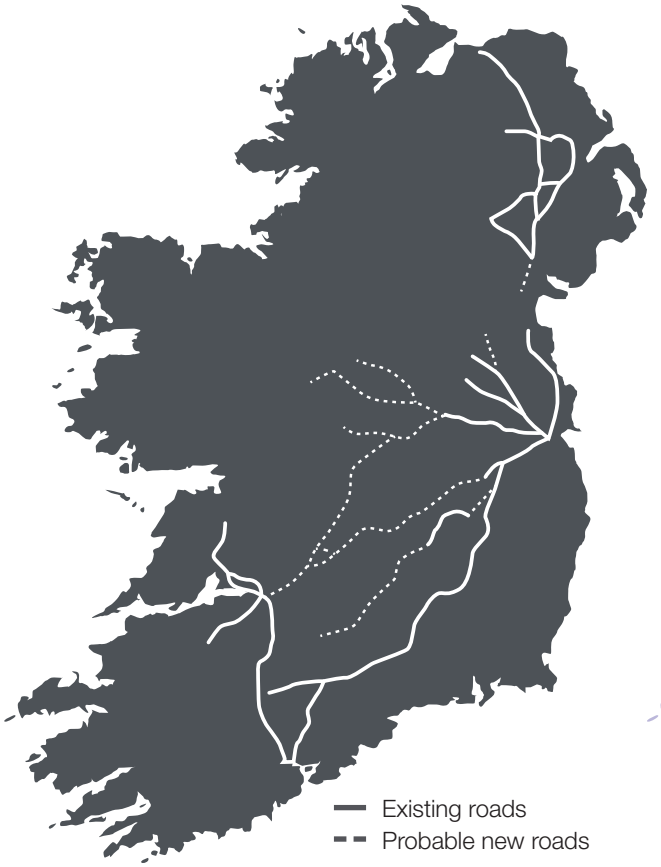
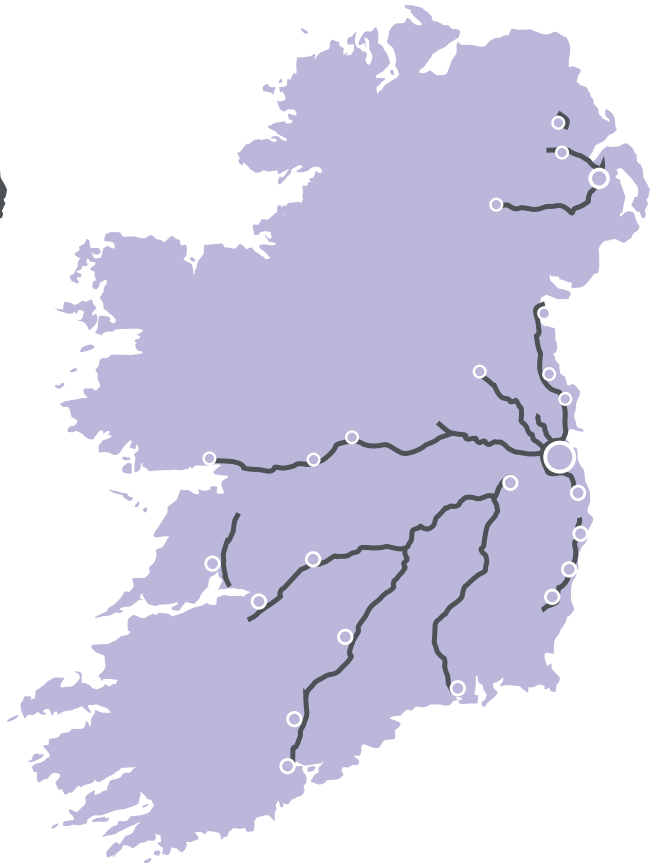


Figure 3: Current motorway network (2015)



Placement and category of roads for illustrative purposes only.
Data source: CSO, NISRA.

2.4 Planning a comprehensive all island network

Both jurisdictions currently have lists of individual upgrades to sections of various national and regional routes, not all of which are planned to be motorways or indeed dual carriageways. There are also plans being advanced to remove the most chronic congestion points.

However, none of these plans are based on comprehensively eliminating the deficit in the current transport network or catering for a projected overall population of 10 million prosperous people.

Furthermore, existing planning does not take account of the additional impact associated with tourism and business visitors which is becoming increasingly evident right throughout the year.[3] Most importantly, an all-island plan has yet to be developed.

2.5 Towards a European standard

The rail network of 1920 provides the only reasonably comparable model for a comprehensive 21st century transport network *(see Figure 3)*.

Almost 100 years of predominantly private sector investment and development had provided extensive connectivity via rail links to every part of the island of Ireland. With the advent of partition, as well as a declining not prosperous population, rail links ceased to be operated on an all-island basis, resulting in a more limited network – one that bears a striking resemblance to the current sub optimal motorway network *(see Figure 2)*.

The first rail lines in Ireland were built in the 1830s. As the network expanded they became the principle infrastructure supporting the movement of people and goods, replacing the canals and then the (private) Bianconi Mail Coach Service. By 1920, with 3,500 miles of track across the island, it was estimated that there was no town more than 10 miles from a station. But by the 1990s further population decline, reduced demand and government decisions had closed down a considerable number of links on this network, and the biggest impact was felt in Ulster.

Therefore, except for a short period from the 1920s to 1940s, this island of Ireland has never had a comprehensive and contemporary European standard transport infrastructure. As replacing the entire 1920 rail network is not economically viable, the road network must be completed instead. *(See Appendix A re. history of the rail network development).*

The only remaining shared service on the network, and on the sole all-island link, is the Belfast/Dublin line. However, despite a recent and overdue upgrade to the rolling stock and facilities offered to users, the service remains sub optimal in terms of modern inter-city rail connections. Immediate measures that can be taken by Irish Rail and Translink to improve this vital inter-city service include: an hourly service between Belfast and Dublin for the short term (by 2020 latest) and a high speed train service from Belfast to Dublin (and on to Cork) for the longer term.

2.6 Connecting all of the island's urban centres

In considering why an extensive network of links matters, the AIIP identified a wide range of significant and measureable added value benefits including:[4]

- Spreading economic and population growth which is currently concentrated on the island's east coast, around the entire coastline via a C ring road;
- Supporting attraction and growth of FDI and indigenous investment;
- Enhancing supply chain efficiency for business wherever it may be located;
- Attracting migrants back to Ireland by enhancing quality of life;
- Assisting businesses of all sizes by linking them more directly with major population centres and transport hubs;
- Driving growth in tourism by providing greater access for tourists to services, products and locations during their visit, as is already happening around the existing network[5];

3. **The Tourism Ireland visitor number for the island of Ireland in 2015 is 9.3 million.** This figure is up from 8.6 million in 2014. With Dublin Airport now serving as the island's principal airport hub, especially for global connectivity, which includes over 20 flights to the US each day, it is vital the supporting ground transport infrastructure effectively keeps pace with the needs of its 25 million passengers in 2015. Tourism Ireland predicts these numbers will be exceeded again in 2016 for another record year.
4. Possible economic benefits from comprehensive all island motorway network were highlighted by Dr Edgar Morgenroth, FAcSS FeRSA Associate Research Professor at the Esri in Dublin in his 2014 Background Paper on the *'the Regional Development Impacts of Transport Infrastructure'* for the Republic's Dept of Transport's *'Investment in our Transport Future: A strategic Framework for Investment in Land Transport'*. The above list includes a number of his conclusions. See: http://www.dttas.ie/sites/default/files/publications/corporate/english/public-consultation-investing-our-transport-future/sfilt-background-paper-7-regional-development-impacts-transport-infastructure.pdf
5. Visitor numbers to the Cliffs of Moher in Co Clare have increased since the motorway linked Ennis to Dublin and Titanic Centre visitor numbers have been boosted by being accessible for day trips from Dublin.

Figure 3 The railway network, 1920

Data source: CSO, NISRA.

Figure 4 The modern railway network

Data source: CSO, NISRA.

Figure 5: An all-island motorway and HQ dual carriageway network

Network demonstrates scale of ambition. Placement and category of roads for illustrative purposes only. Data source: CSO, NISRA.
'High quality (HQ) dual carriageway' is an all purpose two lane road built to motorway standard, without motorway classification and restrictions.

- Enhanced access to public services such as healthcare for citizens and communities;
- Enhanced social interaction;
- Preventing and removing costly infrastructure bottlenecks inevitably created by renewed expansion of the economy, especially in the Republic, and population growth;
- Easing chronic congestion already occurring (e.g. M50 and York Gate interchange)[6].

2.7 Completing the network

In Northern Ireland, motorway construction began in the late 1960s but a comprehensive local network has not been completed. However, a number of routes have been improved in parts of the province and a number of upgrades to high spec dual carriageway standard are planned and budgeted for. By 2020 primary inter-urban routes with minimum grade separations for their entire length should be completed. However, no new motorway is currently planned, even between the first and second cities of Belfast and Derry/Londonderry.

In the Republic, motorway construction has recommenced with the post-economic downturn recovery. There are a number of officially adopted projects most of which have no delivery deadline. In 2014 the NRA did present a 'TEN-T Comprehensive Network Upgrades' proposal.[7] However, there is no jointly agreed overall plan for a completed network as needed for the entire island. The connection between GDP growth and increased traffic volume has been re-established in the greater Dublin area and the result is increasingly evident to most drivers and commuters (eg, on the M50).

The AIIP advocates a co-ordinated approach to tackling the clear requirement for enhanced connectivity through infrastructure investment. It has also established that there are possible and significant mutual benefits to adopting such an approach and having a scale of investment that will accelerate the pace of delivery.

2.8 Benefits of a comprehensive network

Modern comprehensive networks are now so embedded across all other advanced economies that that they are largely taken for granted. This is not the case on this island as the network remains incomplete, with a less urgent need for further investment.

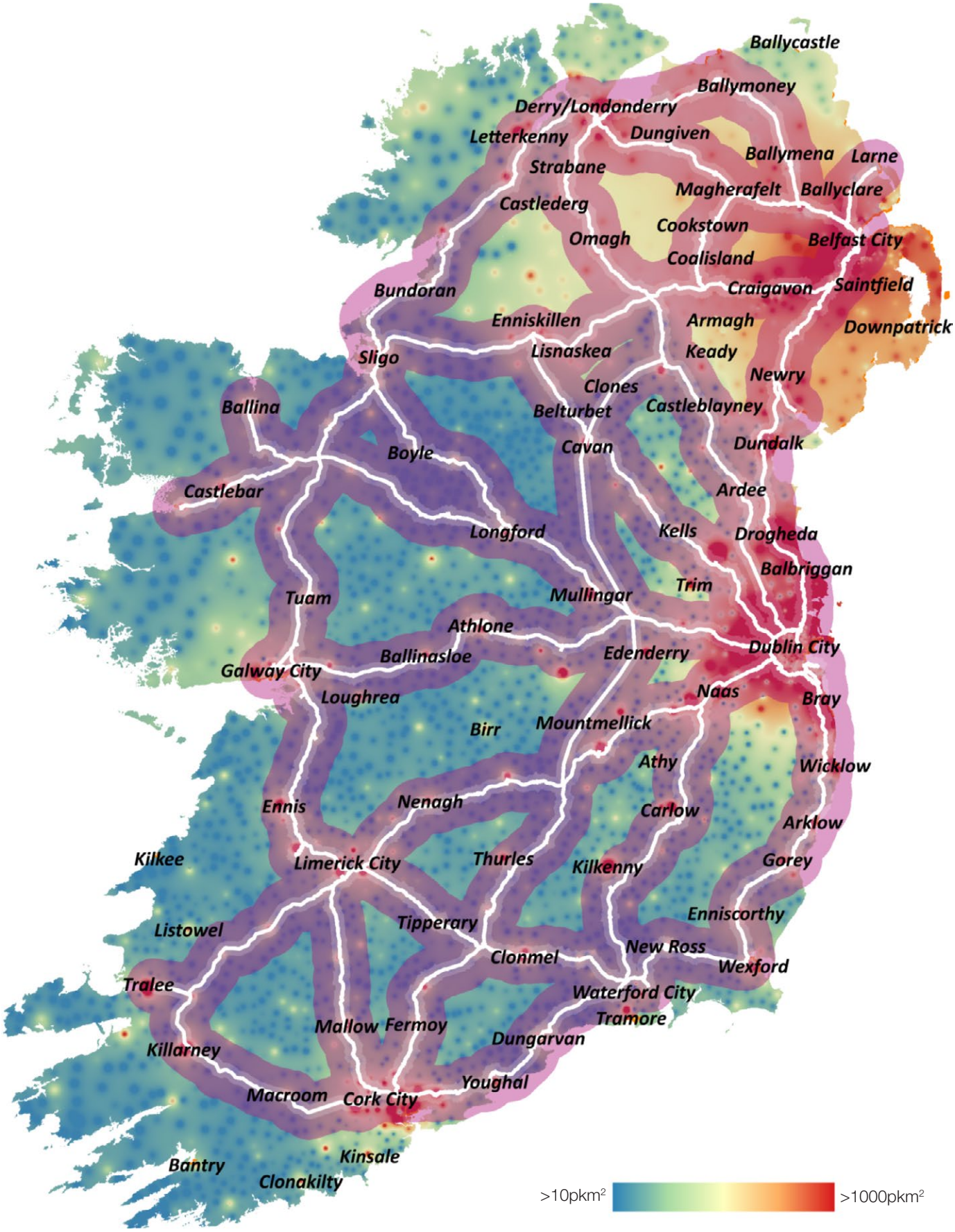
For this reason, it is important to highlight some of the benefits for business, public services and society in general of a modern transport infrastructure that reliably and efficiently moves people and goods between primary urban centres.

- **Work:** can increasingly be conducted remotely, but working from home for an organisation in another part of the island is considerably more convenient if getting there and back is manageable.
- **Reliability:** being able to predict how long a journey should take is vital when time is valuable and scarce.
- **Access:** to services both public and private is significantly improved due to ease of travel.
- **Proximity**: families and communities are brought closer to one another through reductions in journey times.
- **Safety:** motorways and dual carriage ways are the safest means of land transport and have helped to significantly reduce road deaths in the Republic since their construction.
- **Health:** there are many issues challenging our health services, and reforms should include provision of a comprehensive motorway network.
- **Innovation:** a new era of car transportation is emerging with the now rapid development of driverless cars, electronic vehicles and car sharing (eg, Uber).

This last point merits special attention in the context of having an ambition with global relevance. The proposed network will deliver enhanced competitiveness for all businesses but especially for exporters. Completing the proposed network will also be an exciting opportunity for this island to move to the forefront of innovation in how these new services and/or technologies can improve the quality of working and living.

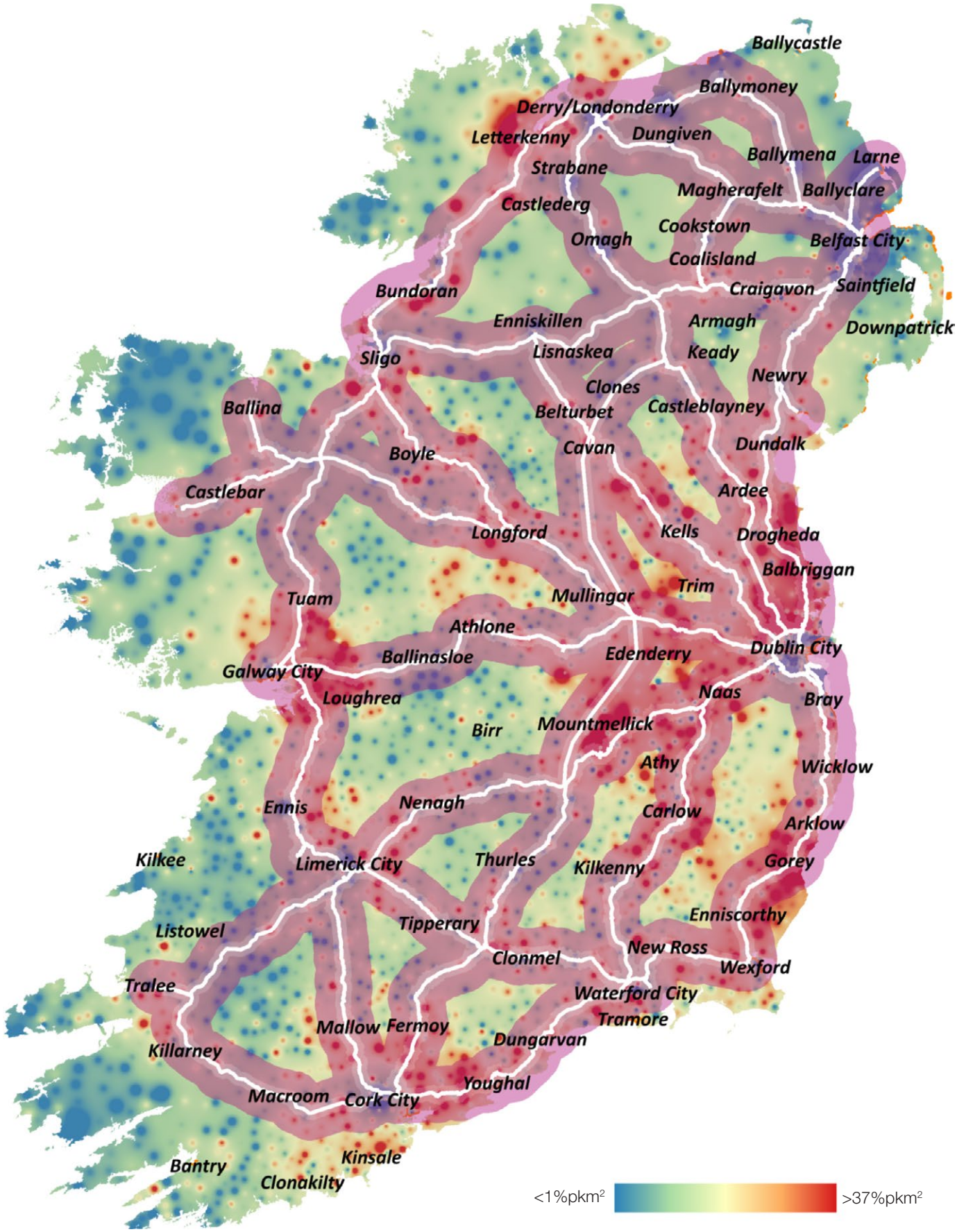
6. The AIIP understands for example that the volume of traffic on the M50 around Dublin did not decrease during the recession as capacity had caught up with pre crash demand. But now volume is growing as result of GDP growth, and congestion is once again a significant problem, especially at peak travel times.
7. In March 2014 a presentation on Strategic Plans for a National Road Network was given by then NRA CEO Fred Barry.

Figure 6: How over 85% of the current island population live within 10km of the illustrative network



Placement and category of roads for illustrative purposes only. Data source: CSO, NISRA.

Figure 7: Population growth 2011-2016



Placement and category of roads for illustrative purposes only. Data source: CSO, NISRA.

2.9 Public or private transport provision

It is important to highlight that nothing in the scoping exercise suggested prioritising private over public transport. Both are rapidly evolving in potentially mutually supportive ways in response to the seminal technological developments currently underway. Indeed, almost every aspect of transport is on the cusp of some degree of change. This includes vehicles and how they are driven, powered and used by individuals, organisations and society to provide personal and third-party movement by road.

One consequence of this process of change is that assumptions regarding what constitutes 'public' and 'private' transport are becoming outdated, if not actually redundant. For example, as the maps used in this paper clearly show, the largely 19th and early 20th century comprehensive rail infrastructure that still underpins inter-urban public transport provision in the rest of Europe no longer exists on this island. Planners and policy makers must therefore, take account of how technology and innovation are reshaping how individuals think about and organise their transport for work, social and recreational purposes. Innovation is creating a variety of opportunities for a seamless mix of various forms of public transport.

2.10 The comprehensive network

The AIIP has concluded that immediate prioritisation of planning, contracting and construction of a comprehensive all-island motorway and/or dual carriageway will be of mutual benefit to Northern Ireland and the Republic.

The network that the AIIP is proposing will be comprehensive and widely accessible because up to 85% of the population will live within 10k of their nearest route. This is comparable to the benefits that were delivered by the railway network in the 1920s when it could be universally accessed via a 'nearby' local station. The following original AIIP maps illustrate:

- The network envisaged *(figure 5)*;
- Universal accessibility *(figure 6)*;
- Reflects current population growth *(figure 7)*.

Section 3

Designing the network

We must be smart in planning both the scale of this network, and its connective potential. The scale of the network must ensure the significant majority of businesses and consumers have access to high quality, reliable land transport infrastructure. Taking advantage of smart transport systems will also help increase capacity and contribute to carbon emissions targets on both sides of the border.

3.1 Demand

There is overwhelming evidence that an all-island population of 10 million will live predominantly in or near major cities. This is already happening along the east coast and especially in and around Dublin. Completion of the proposed network will allow for a more balanced distribution of population growth between the island's urban centres.

3.2 Designing the network

Incorporating and improving what has already been built or planned for, along with adding new stretches to eliminate missing links, is the single most innovative and value adding element of this proposal. This is because, as shown in Section Two, after three hundred years of 'modern' road building on the island, it is finally proposed to extend the network beyond a radial model dominated by getting to and from Dublin and/or Belfast. In practice, this means having a motorway/high quality dual carriageway ring road around the island to deliver equivalent joined up access to all urban centres. That is a C ring from Belfast to Wexford via the north, west and south coasts with multiple link roads in between.

3.3 Progressive policy

Adequate links will be created by a future-orientated policy aimed at delivering:

- Connecting journeys of 20 minutes or less to reach the network for the 85% of the population who will live within 10k of it;
- Additional capacity for the busiest sections, especially where chronic shortages are already evident or usage exceeds the capacity for which that section of road was originally designed;
- On-going maintenance so that routes remain efficient and safe and do not deteriorate unduly over time (i.e., road surfaces, sewerage, drainage, ducts, etc.).

3.4 Smart systems

Intelligent transport systems are being developed to ensure more effective management of traffic flows. Early examples already in use on a small number of the most used routes include travel time prediction and temporary speed limit restriction signage.

8. With a population of 10 million across the island, it is highly likely that 4 million people will live along the eastern sea board.

However, there are far more sophisticated systems now being developed and/or trialled that will dramatically enhance the capacity of all network operators, and the governments and local authorities they work on behalf of, to manage a wider range of functions. These include:

- Electronic variable and differential road charging (i.e. on a tag or pre-paid basis);
- More flexible and innovative public service transport provision;
- Real time data and demand management;
- Vehicle-to-vehicle communication to reduce accidents;
- Variable speed limits to keep traffic moving at peak times;
- Express lanes guaranteed to move quicker where entry is paid digitally.

3.5 Smart communications

Communications density is critical to modern connectivity and has multiple dimensions in the case of a modern 21st century motorway/dual carriageway network, including:

- Using the extensive capacity of fibre optic cable ducts along the motorway;
- Provision of seamless, universal and adequate mobile coverage throughout the network;
- Enabling driverless cars to be 'connected' and to operate safely.

3.6 Multi-purpose connectivity

Transport hubs for people have tended to focus on large multimodal operations, predominantly designed to connect car drivers with other modes of transport (e.g., public buses, trams or commuter trains). Emerging lifestyle and working patterns indicate that a broader perspective is needed to meet future needs such as:

- Multi-purpose interchanges to seamlessly connect inter urban with intra urban transport networks of buses, trains, hire cars, bikes and walk ways;
- Online planning apps and tools;
- Siting of these facilities where they are most needed (e.g., central Belfast's new multi modal transport hub)
- Inclusive, efficient and adaptable management.

3.7 Carbon reduction

Technology advances to diesel and electric powered trains have significantly improved rail's carbon footprint. Today we are seeing the early moves towards equivalent improvements in fuel technologies used in road transport vehicles. This will take market share away from traditional fossil fuels over the next 20 to 25 years.

There are sufficient data and advancements in vehicle technology to provide conclusive evidence that when fully built, the AIIP's comprehensive network will not result in higher pollution levels. In fact, as a percentage, emissions from vehicles will be lower relative to the size of the population.

In the wake of the Paris Climate Conference Agreement the challenge to reduce vehicle emissions is especially important due to the critical role that transport plays in achieving Europe's societal and economic ambitions. To achieve the EU's long-term climate goals, a substantial reduction in transport greenhouse gas emissions and the dependence on fossil fuel imports is required. In October 2014 the European Council agreed on the climate and energy policy framework for the EU. Transport greenhouse gas emissions are covered by the 2030 Climate and Energy package and fall into two categories: 1) CO2 emissions covered by the Emission Trading System (aviation and electricity used by rail); 2) the non-ETS sectors (road, diesel rail, inland waterway).

The non-ETS sector is required to reduce its emissions by 30% compared to 2005.[9] Since almost one third of greenhouse gas emissions in the non-ETS sector originate from transport, there are three key areas where there will be substantial reductions: switching towards carbon-free or less carbon intensive fuels; improving vehicle efficiency; and managing transport demand.

3.8 Market response: fuels

There will continue to be a market for liquid transport fuels for the foreseeable future. However, in the short term (to 2025), improvements in the fuel efficiency of conventional vehicles will more than offset increased transport demand. In the medium term (2025 – 2035), alternative fuels will capture an increasing share of the light-duty fuel market: electricity via electrically powered cars; compressed natural gas (CNG) and second-generation biofuels such as hydrogenated vegetable oil (HVO), a renewable biodiesel.

9. http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52014DC0015
10. Telsa Model 3 pre orders are reported as likely to have been double the volume of electric cars sold by GM, Toyota, Ford, BMW, or VW in the past five years.

Therefore, the industry is working towards demand for conventional fuel falling back to 2000 levels between now and 2025. For a more detailed discussion on this, *see Appendix B*.

3.9 Market response: vehicles

Major technological advances are now taking place in road transportation and they will accelerate the drive to carbon reduction. Telsa Motors now exclusively manufactures electric vehicles and is rivalling its neighbour Apple in popularity with consumers.[10]

Google is leading the race to develop and build driverless vehicles. Having commenced in 2009 it now has working prototypes that are being road tested in the US and Germany. And Uber, which is already 'disrupting' the taxi market, includes driverless vehicles in its vision for the future.

Technology through which road users can contribute to carbon reduction is already on the market. This reinforces the AIIP conclusion that the function of the new comprehensive all island motorway/dual carriageway network being proposed will be maintained and enhanced far into this century.

A network used predominantly by electric and driverless cars by 2050 is an achievable goal. This will place the island of Ireland among the world's leaders in transport infrastructure development and carbon reduction.

3.10 Phased delivery

It can take a decade or more from the detailed planning stage to the delivery of a new motorway or high-spec dual carriageway. Within this context, a phased approach to completion is proposed.

- **Phase One:** Preparation and planning to be completed with contracts 'tender ready' or already issued for 75% of the comprehensive network not yet built (by 2022).
- **Phase Two:** Preparation and planning to be completed with contracts already issued or 'tender ready' for 100% of the network programme to be constructed (by 2030).
- **Phase Three:** the all-island comprehensive motorway/dual carriageway network to be complete with planning for continuous maintenance and management upgrade improvements well into the second half of this century (by 2040).

Section 4

Funding, finance and costs

The proposed scale of the network envisioned is eminently affordable through considerable economies of scale, the enhanced tax base, and the economic multiplier effect of infrastructure investment. In the long run this will mean the network could ultimately pay for itself through economic growth. This section explores some of the funding options and revenue raising mechanisms available to policy makers.

4.1 Current challenges

The AIIP appreciates that both governments are unlikely to fund this ambitious proposal exclusively through conventional methods, even if it is essential to meet the requirements of global competitiveness.

This section provides an initial overview on tackling the challenge of finding alternative ways of generating funding. However, the constraints on government borrowing for infrastructure investment remain.

4.2 Funding mechanisms

Private finance is likely to be needed to support the development of this proposal. In an international market and EU institutional context, there is increased availability of such finance to fund infrastructure projects. Furthermore, the cost of private sector funding for strategic infrastructure investment has decreased, *and is at historic lows*, as institutional investors and traditional banks view infrastructure as an attractive asset class.

The AIIP project, together with those who are expert in these matters in both the public and private sectors, should continue to seek appropriate models, including off-balance sheet finance and within the respective rules governing public borrowing and expenditure by means of:

- **Traditional debt and institutional finance** – explore avenues and sources that are proven to be a good fit with motorway completion;
- **Strategic investment funds**: set up to finance infrastructure projects (eg, the Northern Ireland Strategic Investment Fund in NI and Ireland Strategic Investment Fund in the Republic);
- **The European Investment Bank (EIB)** is obviously a major source of funding which should be availed of (including either EIB commercial debt or financial instruments such as the EIB Project Bond Credit Enhancement product);
- **The Juncker Fund** may become a lead project in its development and introduction.

4.3 EU support

Funding for strategic infrastructure investment is supported at a European level. The funding model the EU has adopted is referred to as the 'Juncker Package' after its chief architect, Commission President Jean-Claude Juncker. A regulatory framework has been put in place to implement this plan and it is being introduced by member states. How it will assist investment has been summarised as follows by Alessandro Carano, a senior advisor on economic and financial affairs (Quoted in EurActive.com, June 2015):

The EU is open, it is not up to the Commission and EIB to decide the financial mix (of the projects chosen by investors as), it is the region or country or private company that promotes the project that will decide.

This scoping exercise has found no lack of awareness or appreciation of the potential benefit of securing capital for public infrastructure investment via the markets at the current historic low interest rates. However, it has also identified that there is some concern in the public sector that private finance could be 'on balance sheet'.

Therefore, it is suggested that (a) even under the current rules, well-structured projects are capable of achieving 'off-balance sheet treatment' from an EU perspective and (b) given the need for strategic infrastructure investment, the EU rules that govern this whole debate can and will be changed to be more flexible and responsive to the need for additional infrastructure investment across the EU. Putting this case to Brussels, in a post-Brexit reality is more challenging than a co-ordinated approach from Belfast, Dublin and London. While the AIIP appreciates this would be a complex challenge it is surely possible to achieve with sufficient effort.

The completion of the network will provide compelling evidence of the benefits that would flow from such rule changes. The Fresh Start Agreement N/S Infrastructure Group provides an appropriate mechanism to develop the supporting arguments on a co-ordinated basis. The AIIP envisages this Group playing a central role in completion of the network.

4.4 Shared needs

As has already been noted, the challenge of funding necessary transport network upgrades is not unique to this island. Where it does differ to other modern European economies is that this island does not have an existing, extensive network and therefore, faces the twin challenges of funding new infrastructure and upgrading the existing network (and in NI that includes routes built in the late 1960s).

4.5 Raising revenue

While the challenge of securing alternative revenue to 'reserved (government) funds' or similar is being debated in many areas other than transport, usage charges have been firmly established in the transport arena for some time across categories including:

- **Public transport:** where any journey on a train, bus, or tram incurs a charge;
- **Moving goods:** where every item from a container to a parcel or letter incurs a charge;
- **Taxing vehicles:** where their use of any road is illegal unless the liable motor tax is paid;
- **Using tolled roads:** where every vehicle using that stretch of the network incurs a charge;
- **EU TENS T funding:** for qualifying parts of the network.

A comprehensive, modern network will be the predominant inter-city mover of goods and people all around this island. It will include public transport and exit and entry to the island. The AIIP offers two propositions for discussion in greater detail in relation to securing the finance required for completion:

- Technology-based methods to raise revenue to fund the construction, maintenance and management of this essential network;
- Online transport payment systems: so that users can pay when accessing all elements of the island's transport infrastructure.[11]

Going down this route would require a parallel review and reform of the current charging system (ie, of tolls and how they are structured/applied in the Republic along with motor tax in both jurisdictions). It will also require discussion of detailed points in the rules and criteria used by Eurostat and the UK Office for National Statistics (ONS) for classifying transport spending, which have implications for using privately-sourced funding for this project.

On the income side, this is a particularly appropriate time to consider reform as such revenues are increasing as a direct result of economic growth.

11. For example, in Austria a system of 'road tax disks' that can be used to pay tolls is successfully operating, and with the switch to on line payments combined with transport use being increasingly multimodal, especially for younger generations of commuters, and often for the same journey, why not have one pre-paid payment State approved 'card' that can be used for ('publically regulated) buses, trains, cars and bikes?

4.6 Cost estimates

The AIIP has established that there is a depth of experience, expertise and evidential data available in both the public and private sectors to progress early stage project development and include costings of the AIIP's proposals, given that the approach to do so would be taken by both governments and on a joined up basis.

To provide indicative estimates on how affordable or otherwise these proposals are, the AIIP engaged in discussion with participants from the sector who provided figures based on their experience to date and combined these with figures already in the public domain. The following is a high level initial indicative exercise done on a notably conservative basis using these individual elements and their total estimated cost. It is understood that significant variances will arise:

- 180km to be built as motorway and 1,400km as high quality dual carriageway/motorway;
- For a motorway build on a green field site with no significant bridges or tunnels the per km cost used is c. €10/£8.4m per km. This is the estimate being used for the M20 upgrade;
- To upgrade to HQ dual carriageway is then roughly €5/£4.2m per km;
- The cost of maintaining and operating a motorway estimated to be c. €40.£33.6k per km per annum (not including operations of toll plazas or for the management costs of a PPP project);
- The finance could be raised as a long term bond, with a currently achievable fixed interest rate of 2.5%;
- The repayment cost can be spread across a population of 10 million of whom 4 million are working (i.e. the current percentage in employment of 43% is roughly maintained).

The cost that is most variable across the island is that of land acquisition. To date it can be noted that the motorways already built have been predominantly in the most populated and/or through the most productive land. Nevertheless, collective discussion with landowners can be anticipated and this may result in a substantial impact on the overall cost.[13]

Planning, design and approval costs can also vary depending on the structure of the contract, the process encountered and where they reside (ie, whole or in part with a private contractor and/or the state). It was also highlighted that when a project does not proceed despite being prepared and possibly even tendered for, this cost is lost and largely not recouped by either party.

Finally, what could be more influential and is not taken into account is the scale of a project. For example, if completion of the entire C Ring from Belfast to Cork was to be tendered for as a single, co-ordinated project, economies of scale would be secured.

Therefore, based on all of the above factors, the following are the AIIP's outline initial estimates:

- The investment required to upgrade to high quality dual carriageway/motorway (1400km x €5/£4.2m per km) is approximately **€9.8/£8.2 bn**;
- The investment required to build new motorway (180km x €10/£8.4m per km) is approximately **€1.8/£1.5 bn**;
- Total required investment to complete network is approximately **€11.6/£9.7 bn**;
- The interest or servicing cost is **€290/£243m per annum**;
- ***The cost would then be €72.5/£60.8 per annum per person working***.

To further test this affordability, the cost estimate used to construct and maintain the completion of the network was increased to just over €15/£12.6 bn. **This higher estimate results in the investment required being €375/£315m or €94/79 per annum, or €1.68/£1.41 per week per employed person.** This is also an affordable and, therefore, achievable cost. (€1/£0.84- 19/07/16).

In addition, a doubling of economic activity on the island in the first twenty years of the repayment period is likely, so the debt itself would then be a mere few percentages points of GDP.

The most likely variable requiring management attention is acquiring the necessary land; assuming inflation remains within central bank targets, the interest rate is locked in at today's historically low rates and tender processes ensure serious prices inflation is avoided.

12. Bridges or tunnels are major landscape features.
13. Minimising this cost can be done by compulsory purchase order (CPO). A Forfas Report in 2011 on 'The cost effective delivery of Essential Infrastructure' identified that, of the €8 billion overall cost of the existing motorway network, €1.46 billion, or 18.5% of the total, was spent acquiring 7,800 hectares required for 1,000km of motorway. This is equivalent to €187,000 per hectare or €76,000 per acre.

4.7 Immediate start

Because the lead time to tender is five to six years, it makes sense to start to design the completion of the network immediately. Doing so will create a practical context within which to consider the complexities created by government borrowing restrictions and the demands for a rapid increase in infrastructure investment, including 'off balance sheet'. As there will be change during this period, discussion can explore appropriate flexibility to develop current budgetary practices while adhering to the respective rules governing public expenditure in both jurisdictions.

4.8 Possible co-ordination:

The commitment in the *Fresh Start: Stormont Agreement Implementation Plan* to the introduction of a 12.5% corporation tax rate in Northern Ireland by April 2018 should be accompanied by the acceleration of investment in supporting infrastructure.

The Fresh Start Agreement also established a north/south Infrastructure group to:

> *meet regularly to maintain a strategic overview of economic and infrastructural investment, with regard to the projects set out in this Section....(and)... also consider opportunities for sourcing further investment for all-island infrastructure projects for mutual benefit, including through PPPs, EU funding and other non-Exchequer sources. (Section E 6.1)*

The Fresh Start Agreement N/S Infrastructure Group provides an appropriate mechanism through which to develop the necessary supporting arguments to put this case on a co-ordinated basis. Among the opportunities this Group could consider in some depth are payment-based road projects where there are no tolls and/or exploring funding options with the EIB.

Section 5

The broader picture and potential obstacles

Investment in an all-island network will deliver several key benefits, both directly and indirectly. The island will enjoy smart, joined up spatial planning, helping it stand out in the global marketplace as a great place in which to live and do business. The indirect benefits may also be significant in terms of reducing rural isolation and changing some of the migratory behaviours characteristic of the 19th and 20th centuries. However, there are obstacles to delivering this scale of ambition.

5.1 Spatial planning opportunity

Global connectivity will drive essential growth and job creation in, around and between the island's two largest urban centres. A comprehensive inter-urban transport infrastructure will be needed to enable and facilitate the benefits generated by these core growth drivers extending to the regions. In addition, congestion on critical intra urban links also encumbers inter urban movement (e.g, being held up at York Gate intersection coming from Dublin or on the M50 travelling around Dublin).

Therefore, choosing between inter and intra urban transport networks to upscale investment is not an option. Both are needed. Within this context, the AIIP proposes the development of an all-island strategic spatial framework to achieve mutual added value from the proposed network.

The AIIP proposal seeks to balance migration to Belfast and Dublin with the already evident risk that economic growth in other regions lags further behind. These major business hubs already have costly international connectivity, so constructing the proposed network in the next three decades will enhance the possibility of the exceptional growth occurring in Dublin and that being planned for Belfast, being spread to include other regions.

5.2 Spatial planning benefits

The benefits that will follow from the completion of the network will include:

- Reduction in relative peripherality (from faster/ shorter travel times);
- Increased commercial and business links (e.g., supply chains/cluster development);

14. The efficient movement of people and goods is the very life blood of a functioning, effective and successful modern economy. The result of government's not prioritising sufficient and timely investment is insufficient transport capacity, management and provision. Consequently, the economic and population growth currently occurring on this island, and the neighbouring island, creates a compelling case to consider the AIIP Proposals as an immediate strategic investment priority. And when doing so the impact of expanding demand created by more people goods and services moving around the island and the increased global connectivity driving it must be taken into account of when projecting use (eg tourism exports and imports).

- Additional cost-effective opportunities for (re)locating public facilities (e.g., social/health care).

It should be noted that roads, of themselves, do not generate these or the other social and economic benefits set out in this paper. The opportunities which enhanced connectivity will offer, will allow choices to be made which can deliver these other benefits.[14] Viewed objectively therefore, these challenges are surmountable given that the right decisions are taken by both administrations, ideally on a c-ordinated basis.

5.3 Secondary benefits

While capital investment in infrastructure has reduced in the wake of the global financial crisis, its benefits remain clear (and have been summarised above). However, this exercise has not extended its scoping work to include the entire additional and wide ranging secondary benefits that could and would flow from completing the transport network proposed in this paper.

5.4 International benchmark

The latest update of annual transport infrastructure investment and maintenance data collected by the International Transport Forum at the OECD shows that the continued economic crisis has had an impact on transport infrastructure investment.

- Investment in land transport infrastructure, as a share of GDP, has declined from a peak in 2009 to a record low (0.8%) in the OECD while the volume of investment has fallen back to 1995 levels.
- Investment levels in Central and Eastern European countries have nearly halved since 2009 in real terms, accounting for 1% of GDP in 2013 (compared with 1.9% in 2009).
- Western European and North American economies invest increasingly in rail while in Central and Eastern European countries the focus continues to be on roads.

Based on its research findings, the OECD concludes that investment requirements for transport infrastructure depend on a number of factors, including:

- Quality and age of the existing infrastructure;
- Geography of the country (including exposure to geological and meteorological risks);
- Transport-intensity of the country's productive sector.

The OECD believes that the fact that the share of GDP dedicated to transport infrastructure has tended to remain constant (but declined more recently) in many countries suggests investment levels are also affected by factors other than real investment needs, such as institutional budget allocation procedures or budgetary constraints. Therefore, the impact of government policy can also be identified, as for example in Australia and Canada where the share of inland infrastructure investment in GDP has remained relatively high, above 1.0%, partly as a result of long-term political commitment for transport infrastructure spending.

The evidence presented by the AIIP in its proposal points to adopting the high level investment policies of Australia and Canada in the context of economic and population growth and a legacy of under investment.[15] For more on this point, *see Appendix C*.

5.5 Possible obstacles

Having pointed out the possible benefits it would be remiss to omit those issues which can create obstacles that delay and so add to the delivery costs of road projects. The following is a list of the most common and potentially costly obstacles along with suggestions as to how they can be avoided.

- **Planning:** should be expedited for necessary consultation and approval by submitting a combined plan for much or the entire network rather than a series of staggered individual projects.
- **Process:** should be effective, coherent and less complex and costly because both administrations have jointly agreed and presented a model contract to the construction, operational management and capital markets for completing the network.
- **Structure:** should be designed to take account of the fact that the provider of the finance to fund the initial development and construction of the project, including the risks of exceptional additional costs due to not proceeding or extended delays, may not then be the long-term operator that maintains and manages the route (i.e., as once up and running it will then be an attractive proposition for pension funds).
- **Scale:** can be leveraged by combining and bundling large sections of the proposed network.
- **Return:** should be clear and fully transparent to the contracting, and contracted parties, and have in-built provision to adapt to/adopt new forms of collection such as electronic road charging.

15. International Transport Forum: Statistics Brief, July 2015, Infrastructure Investment. OECD, Paris

- **Sequencing:** should be planned by having a phased construction process built into a contract that envisages over the lifetime of the contract the entire Network/its additional functionality being constructed (e.g. to install Intelligent Transport Systems on built/ managed routes).
- **Selection:** should ensure a clear, robust and time-defined road map resulting in a coherent process where a deadline is set that both administrations can respect.

5 key targets for an all-island network

1 Planning for a population of 10 million

The immediate prioritisation of an ambitious investment plan is needed for connecting a prosperous island of 10 million people by 2050.

2 Connecting 85% of population within 10km of their nearest route

The proposed network allows for 85% of the island's population to live within 10km of their nearest inter-urban route.

3 Towards a European standard

Except for a short period from the 1920s to 1940s, this island has never had a comprehensive and contemporary European standard transport infrastructure.

4 Inter-urban connectivity

Infrastructure is the backbone of everyday life, underpinning economic activity. A major upgrade of the island's road network is needed because it will remain the most important means of connecting key urban centres.

5 New funding streams

The cost to upgrade the transport network is affordable, but the funding sources need to be agreed and sources other than public investment needed for this vital investment.

Appendices

Appendix A

Summary

This ambitious strategic JBC/AIIP scoping exercise is being undertaken jointly by Ibec and CBI Northern Ireland to:

- **Support sustained growth, job creation and prosperity** by investment in strategic connectivity, with provision for a projected all-island population of 10m by 2050.
- **Consider if there is mutual benefit** in all-island transport coordination/collaboration to maximise the benefit to businesses, employees and citizens across the island of Ireland.
- **Highlight motorway/high-quality dual carriageway upgrades** are universally approved when completed. Charges for using them are paid at the site where they are used.
- **Provide high level proposals** for delivery on the vision of *'Completing a comprehensive all-island motorway/dual carriageway network'*.

Scope

Paper One, the first in a series, explores a number of key considerations listed below.

- **The strategic challenges** posed by a 'comprehensive' 21st century inter urban transport network for an island with a population of ten million. Is there a new balance achievable between 100% (severely constrained) State funding and 100% revenue/cost recovery from a payment mechanism based on usage? Can public private partnerships be developed to deliver what is proposed?
- **How should cost, benefits and return on investment** of this required infrastructure upgrade be approached and assessed in Northern Ireland and the Republic?
- **Although public finances are currently constrained** it is prudent to plan now in anticipation of an easing of such constraints at both UK and EU level, and given the long lead times for projects of this scale and complexity.
- **Is the proposed network**, including as it does, provision for public transport infrastructure, which accommodates a wide variety of transport modes and users, what it"s really necessary to plan for?
- **Co-ordinating spatial planning and carbon reduction** and assessing the potential which the proposed network offers for optimal results on both of these fronts.

Proposal

The proposals provided by JBC/AIIP for consideration are listed below.

- **85% of the 10 million population** will live within 10km of the motorway network when completed.
- **A projected investment** of €15/£12.6 billion to complete the network is affordable. Based on an estimated all-island working population of four million, it would cost €375/£315m or €94/79 per annum, or €1.68/£1.41 per week per employed person, repaid over 20 years at current interest rates.[16]
- **Upgrades to existing motorways** which currently pending should be completed on a phased basis and include maintenance and new technology-driven traffic management.
- **Innovative technologies in relation to payment, fuels and capacity** including hybrid, electric and driverless vehicles will deliver long-term reduction in carbon emissions when the network is up and running.

16. May 2016.

Rationale

The rationale underpinning the conclusions of this element of the AIIP scoping exercise is summarised below.

- **The impact and implications** of economic and demographic growth mean that it is a question of when rather than if this network will be constructed.
- **An all-island approach** will assist in selecting complimentary investments, which will accelerate returns, and in the provision of infrastructure required by business and wider society to meet 21st century requirements.
- **Failure to provide this transport infrastructure will compromise** the introduction of high-speed broadband, energy and other associated infrastructure and will generally limit the scope for regional development.
- **Ibec and CBI NI believe that the AIIP's joined-up approach** will help experts in both administrations to consider in more detail how best to progress these necessary investments.

Benefits

Relative to the projected costs, some of the principal benefits of the proposal are given below.

Business benefits

- Enhancing the island's global connectivity by linking with international ports and airports.
- Improving the attractiveness of the island for international investment.
- Time-efficient market access will benefit local enterprise.

Exchequer benefit

- More people working will provide increased revenue with which to meet the requirements set out in this paper.
- Relatively low-cost preparatory work could/should be started now so that those projects which are prioritised will be 'contract award' ready by 2022.

Funding options

- Some form of 'user pays' principle is desirable given constraints on 100% public funding.
- Innovative road charging mechanisms are being used successfully elsewhere.

Spatial strategy

- The AIIP is highlighting the need for and benefits deriving from connecting major conurbations all around the island.
- The AIIP is advocating transition to low-carbon technologies (e.g. electric/driverless vehicles).

Fresh thinking

- ***Technology/innovation:*** driving adaption and change via digital, fuel and other possibilities.
- I***mproved competitiveness:*** from new infrastructure delivering reliability and reduced costs.
- ***Tourism/Sport:*** efficiently moving people all around the island (eg, for a Rugby World Cup).
- ***All island N/S interaction:*** improved connectivity will facilitate this across multiple sectors.

Overview

Infrastructure is the backbone of everyday life, underpinning economic activity. There is no activity that does not rely on infrastructure in some form. Conversely, inadequacies in infrastructure are quickly felt....power outages...(and)... decrepit roads adversely affect people's quality of life and present significant barriers to the operation of firms
(IMF Sept 2014)[17]

The AIIP scoping exercise outlines investment proposals for strategic infrastructure to enhance all-island connectivity. The result will be a much improved transport 'backbone' that measurably improves everyday life and underpins economic activity, investment and more jobs across the island of Ireland. This takes on added importance when account is taken of a projected population of 10 million by 2050.

In selecting and developing its proposals, the AIIP used a number of criteria, listed below.

Achieving job creation and growth through the attraction of additional investment resulting in world-class connectivity and greater competitiveness.

17. http://www.imf.org/external/pubs/ft/survey/so/2014/RES093014A.htm

Encouraging more investment in infrastructure

- Supporting the growth of indigenous firms and attracting Foreign Direct Investment (FDI).
- Encouraging those who leave to study or work elsewhere to return.
- Enabling business to prosper and create jobs throughout the island.
- Facilitating enhanced access for citizens to essential public services like intensive health care.
- Removing and/or avoiding, costly infrastructure bottlenecks inevitably created by renewed expansion of the economy and population growth.
- Progress the design of how best to fund and coordinate construction, maintenance and management of the island's road network.

Availing of new opportunities

- Strong economic growth, restoration of the public finances and initiatives like *Fresh Start: the Stormont House Agreement Implementation Plan* are all positive developments that can be sustained with:
  - Infrastructure to *"unlock"* the potential for mutual all-island benefit;
  - An all-island corporate tax rate of 12.5% from April 2018 generating additional investment and growth;
  - Historically low financing costs;
  - The NI Executive and Irish Government having a shared strategic overview of economic and infrastructure investment.

Injection of private sector capital and capacity to secure long-term finance from the markets at current historically low interest rates.

Ensuring that the proposals are affordable by providing credible indicative estimates and choosing investments that are mutually reinforcing, thereby improving social return (ie, transport, digital and energy infrastructure influence firm location, job creation and public service provision).

Progression of projects on a phased basis by first identifying the long-term goal and setting out how it can be achieved in a practical and affordable plan that is endorsed by experts, providers and advisors.

Development of a plan to co-ordinate and/or collaborate so as to progress and deliver the AIIP proposal and/or initiative by using a template that includes:

- Costing in each project initially within the context of an overall population of 10 million;
- Calculating repayments based on a workforce of four million by mid-century;
- Benchmarking each upgrade cost benefit and returns with EU and island-wide examples;
- Structuring capital repayments with long-term contracts/instruments spread over 20 years;
- Anticipating economic growth on the island doubling during the next twenty years;
- Carefully and precisely identifying where Northern Ireland and the Republic can mitigate and reduce their respective costs by ensuring synergies in planning and improving the investment return.

A recognition that this island is not unique in currently having historically low levels of infrastructure investment. This is because, according to the OECD's International Transport Forum, spending by governments on infrastructure and its maintenance shows the most recent economic crisis has had a very significant and severe negative impact.

Government decision makers can now choose to secure early mover advantage for Northern Ireland and the Republic in restoring, and then exceeding, pre-crash investment levels in strategic infrastructure to meet immediate and long-term goals.

Overcoming obstacles to progress in a thorough, proactive and collaborative approach to expediting planning and commencement of mutually beneficial projects.

Paper 1 is the first in the AIIP scoping exercise series. It sets out proposals that meet the criteria for 'completing a comprehensive all-island motorway/dual carriageway network'.

Appendix B

In the first half of the 19th century the railways were built to serve a population of over 8 million. And up to the late 1880's their construction was financed by the private sector as a worthwhile investment opportunity. But in 1889 the 'Light Rail (Ireland) Act' for the first time provided government grants for the construction of railways. This and subsequent Acts of 1890 and 1896 extended the railway network to the more remote, thinly populated districts which were considered commercially non-viable by the railway companies. ***£1,553,967 was spent to construct fifteen separate lines.***

Any additional money needed was provided by railway companies and local funds. These lines were mostly in what were considered to be the 'distressed districts' of Donegal, Mayo, Connemara and Kerry. They were energetically sought by local interests to support economic growth especially through tourism. And this part of the development of a comprehensive railway network resonated in AIIP debates on extending the motorway network all the way down the western seaboard to create an all island C ring! For more see History Ireland: http://www.historyireland.com/20th-century-contemporary-history/the-connemara-railway-1895-1935/

Appendix C

In April 2016 the Northern Ireland business community including the Confederation of British Industries (CBI), Royal Institution of Chartered Surveyors (RICS) Institute of Civil Engineers (ICE), and Construction Employers Federation (CEF) identified the infrastructure priorities for the 2016-21 Assembly mandate. The following strategic road projects were selected as priorities.

1. **A6 upgrade** – deliver approved schemes to dual the A6 between Randalstown to Castledawson & Derry/ Londonderry to Dungiven as a priority, as it is vital to enhancing connectivity between the two pillars of future economic growth in NI – Belfast & Derry/Londonderry – and to opening up the possibility of increased investment in Derry and its economic hinterland.

2. **A5 upgrade** – deliver as announced the go ahead of schemes to dual the A5 between Newbuildings to Strabane & Omagh to Ballygawley as it is a crucial artery of the AIIP's proposed comprehensive all island Network and is currently unfit for purpose.

3. **York Street Interchange Scheme** – it is vital that this pivotal road transport infrastructure bottleneck in Belfast is alleviated by 2021 and ahead of the additional traffic that will be generated as a result of the investment and jobs attracted by the reduction in Corporation tax in 2017 adding to the existing pressure of more and more people attempting to travel into or through this essential transport artery each day. And without it the return on investment from improving the A6 will be seriously undermined by vehicles reach the bottleneck at York Street faster – creating an even bigger bottleneck.

4. **M1/A1 Sprucefield bypass** – Plan to complete a continuous motorway between Dublin and Belfast by progressing this to be either underway or shovel ready with the money identified and committed by the end of the next Assembly mandate thereby putting in place a key element of the optimal transport connectivity along the eastern corridor between Belfast and Dublin and whicih is a primary focus for future economic growth on the island.

The following are equivalent strategic infrastructure deficits that Ibec has identified in the Republic to be completed and/or commenced as priorities:

- N20 Cork-Limerick
- Dublin M50 capacity Upgrade
- N15 linking Letterkenny- Sligo
- A5 linkage completion and linkage to Letterkenny
- N17 Galway-Sligo (Tuam section)
- N24 linking Limerick to Waterford
- N25 Cork-Waterford

Appendix D

Improved vehicle efficiency

Conventional vehicles are likely to dominate the Irish passenger-car sales for at least the next decade, and probably until 2035. However, a significant reduction in the real-world CO2 emissions (and therefore fuel consumption) of new cars is likely in the period to 2025.

This is particularly true for gasoline-powered cars, which have greater potential for improvement than their diesel counterparts. Vehicle light-weighting, engine downsizing, and improved' 48 Volt' electrics that provide more efficient energy recuperation and start/stop functionality, have the potential to reduce real-world CO2 emissions of a 2025 petrol car by 30%-40% relative to today's equivalent. The corresponding reduction potential for a 2025 diesel car is probably 20%-30%.

Low carbon fuels

CNG

CNG is a renewable, indigenous, low-carbon transport fuel and there is considerable support at EU level for increased use of natural gas in transport, as demonstrated in the recently-approved Alternative Fuels Infrastructure Directive.

1.2 million primarily light commercial vehicles across Europe run on natural gas. CNG is an attractive fuel as it is particularly suitable for these vehicles whose daily transporting of sometimes heavy goods make them unsuitable for electrification. CNG is readily available, especially in urban areas, as it can be supplied to filling stations connected to the gas transmission and distribution network.

Biofuels

The EU Renewable Energy Directive (2009/28/EC) sets out mandatory national overall targets and measures for the use of energy from renewable sources for all EU Member States. Each Member State is obligated to ensure that the share of energy from renewable sources in all forms of transport from 2020 is at least 10%.

As a result Member States have introduced an obligation on suppliers of mineral oil to ensure that motor fuels (generally Gasoline and Motor Diesel) contain a percentage of biofuels produced from renewable sources, e.g. Ethanol and Biodiesel. The percentage is 6% in the Republic (increasing to 8% from January 2017) and 4.75% in the UK.

Current biofuels are predominantly '1st Generation' biofuels. Current vehicle technology limits the use of these fuels to 10% in the case of petrol and 7% in the case of biodiesel. However second generation biofuels such as Hydrogenated Vegetable Oil (HVO), a renewable biodiesel, are not constrained to a blend limit. Post 2020 the incorporation of increasing quantities of biodiesel is likely as is the phase out of FAME by 2030.

Electric Vehicles

Vehicle batteries, and charging infrastructure, are the critical elements linking transport to the electricity grid. Both are going through a period of rapid change, with further significant developments likely over the coming decade.

In the last decade the cost of battery pack has fallen very sharply (by a factor of three) and further substantial reductions in cost are expected in the decade to come. Since the battery constitutes a very substantial element of the cost of electric vehicles, this ongoing reduction increases the attractiveness of electric vehicles. Notwithstanding progress in batteries, the fact remains that storing energy in a battery will always take more time than is required to fill a tank with liquid fuels. The ultimate constraint lies not in the batteries or vehicles, but in the capacity of the grid to deliver electricity at the required rate.

CharIN e.V. (Charging Interface Initiative) – an alliance between Audi, BMW, Daimler, Opel, Porsche and Volkswagen is working towards the development of a fast-charging infrastructure with a charge capability of 350 kW which practically eliminate the delays associated with charging electric cars. This development is particularly relevant to motorway driving as it addresses 'range anxiety' by providing the opportunity to recharge on route and enhances the attractiveness of electric cars for intercity and long distance travel.

18. http://www.seai.ie/Publications/Statistics_Publications/SEAI_2050_Energy_Roadmaps/Electric_Vehicle_Roadmap.pdf

While no electricity grid is powered exclusively from renewable sources the renewable element continues to increase. For example the Republic is expected to generate 40% of its electricity from renewables by 2020, up from 5% in 2000 (SEAI, 2015).

The EU Energy Roadmap 2050 (European Commission, 2011) anticipates that the EU electricity system will need to be 60% decarbonised by 2030, and 98% decarbonised by 2050.

SEAI 2050 energy road map

The Sustainable Energy Association of Ireland (SEAI) predicts that the Republic's Passenger Car Fleet will increase to 2.9 million vehicles by 2050 (a 57% on 2011). However, as a result of electrification, transport fossil fuel imports will reduce by up to 50% (equating to a reduction in fossil fuel imports of 800,000toe per annum for the passenger car segment).

According to their predictions CO2 emissions for the passenger car fleet reduce by about 80% with respect to 2011 emissions, despite a significantly larger fleet size in 2050, and renewable energy in the passenger vehicle segment increases by up to 50% by 2050

While separate figure for NI are not available it is reasonable to assume over such a long period trends will be similar across the entire Island.

Appendix E

International comparisons

The gross fixed capital formation (investment) in inland transport infrastructure as a percentage of Gross Domestic Product (GDP) has declined to below 0.8% according to research by the OECD. This is the lowest figure over the period since 1995. However they suggest the continued economic crisis has resulted in a broader decline in transport infrastructure spending, measured in real terms, across OECD countries.

In fact the GDP share of investment in inland transport infrastructure has been falling since 2009 dropping to 0.7% of GDP in 2013. However trends for developing and transition economies differ markedly from those in developed economies. For example in Central and Eastern European countries (CEECs), which until 2002 had remained at around 1.0% of GDP, grew sharply to 2009, reaching 2.0%. According to the most recent data, investment levels have nearly halved since 2009 in real terms, accounting for only around 1.0% of GDP in 2013.

The share of rail investment has increased from 17% to 26% for the OECD total from 1995 to 2013, according to the OECD estimate. This trend is mainly determined by developments in Japan, North America and Europe. The positive trend observed for Western Europe is partly a reflection of political commitment to development of railways and the recent data does not seem to indicate any change in policy. Central and Eastern European countries are investing more heavily in roads

Interestingly OECD data also suggests that while there are quite significant cyclical variations, the balance between road maintenance and investment has been relatively constant over time in many regions. For example they estimate the share of maintenance in total road expenditure to be between 25% and 40% in Western European, North American and Central and Eastern European countries. However, there are significant differences between internal regions.

For further information

Ibec represents Irish business; home grown, multinational, big and small, spanning every sector of the economy. The organisation and its sector associations, work with government and policy makers nationally and internationally, to shape business conditions and drive economic growth. It also provides a wide range of professional services direct to members:

Across the UK, the **CBI** speaks on behalf of 190,000 businesses of all sizes and sectors which together employ nearly 7 million people, about one third of the private sector-employed workforce. The CBI in Northern Ireland represents around one third of the private sector workforce, and more than 60% of the largest employers in Northern Ireland. It is the leading business organisation influencing the policies of the Northern Ireland Executive and Assembly.

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