An Roinn Iompair Turasóireachta agus Spóirt

Department of Transport, Tourism and Sport

Investing In Our Transport Future: A Strategic Framework for Investment in Land Transport

Background Paper Eight

Impact of Previous Transport Investment in Ireland

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Background Paper

Impacts of Previous Major Projects

Over the last decade land transport investment in Ireland formed a key part of programmes for government and development strategies. These strategies[1] prioritised significant investment in roads and public transport. The main drivers of this investment were reducing travel times, improving environmental conditions, increasing safety and the obvious links between transport investment and economic growth[2] - in particular in terms of increasing our competitiveness.

These priorities saw transport investment increase from an average of 1.02% of GDP (1953 - 1997) to an average of 1.43% of GDP (1998 - 2008). In real terms this meant the scale of capital formation increasing from, for example, €838m (2012 prices) in 1996 to €2.6bn (2012 Prices) by 2006. A great deal of this increased investment came as a result of the National Development Plans 2000-2006 and 2007-2012.

The following sections give an overview of some of the major transport infrastructure projects that have been completed in the past decade. A brief summary of major projects under the categories of road, heavy rail, light rail and bus are provided. Following this, there will be an in-depth analysis of two major infrastructure projects; the M4/M6 and the LUAS.

1. Road

A key part of transport strategy was to upgrade the road network, particularly national roads, as illustrated by investment in this area of approximately €9.1 billion between 2006 and 2010. The main developments on the network in past years came in the form of improvements to the major inter-urban network primarily through the completion of the M1, M2, M3, M4/M6, M7/M8, M9 and the upgrade of several sections of the Atlantic corridor (M18, N25/N27 interchange, N7 Limerick Tunnel and N18 Ennis bypass). The other major investment on the motorway network was the M50 upgrade, it was delivered over 3 phases the final of which was completed in 2010. There was also significant investment that

[1] Action Programme for the Millennium, 1998, An agreed Programme for Government, 2002; Programme for Government, 2006.

[2] Background Paper: Transport Infrastructure Investment and Economic Growth - A Review of the Evidence, 2013

aimed to reduce congestion such as N21 Castleisland bypass, N15 Ballyshannon - Bundoran bypass, N77 Kilkenny ring road extension and the N52 Tullamore Bypass.

These projects have brought about significant travel time savings, safety benefits and improved local environments. The table below details a sample for the time savings achieved on the network as a result of the most recent investment. For example, the M7/M8 has resulted in a travel time saving of 77 minutes from Dublin to Cork.

Table 1: Sample of journey time savings as a result of investment (Midweek Off Peak), Minutes

Route	1999	2013	Journey time saving
N01 : M50 – Border	79	48	31
N04/N06 : M50 - Galway	157	104	53
N07: M50 - Limerick	145	105	40
N07/N08: M50 - Cork	205	128	77
N07/N09: M50 - Waterford	125	86	39

Dublin Port Tunnel is a further example of a major road infrastructure investment which has yielded positive benefits. In particular, the tunnel has met its objective of removing heavy goods vehicles (HGVs) from Dublin city centre. Engineers Ireland estimates[3] that around 9,000 HGVs have been removed from the city centre per weekday. This has yielded great benefits in terms of reducing congestion, improving safety, lessening environmental impacts and enhancing productivity.

In addition to the benefits outlined above, there is evidence that these road improvements have led to additional productivity benefits as a result of increasing the effective density of

[3] Presentation on Dublin Port Tunnel, November 2007. http://www.engineersireland.ie/EngineersIreland/media/SiteMedia/groups/Divisions/civil/Dublin-Port-Tunnel-Operations-and-Maintenance1.pdf?ext=.pdf

the country as a whole. Effective density refers to how close a given urban area is to all other areas, weighted by an indicator of economic activity in those areas, the economic indicator in this case is accessibility to employment.

Studies in the UK and New Zealand have shown that for every 1% increase in effective density, there is an associated productivity increase of 0.05%. Analysis by the NRA[4] states that road investment has increased density in Ireland by 6.9%. Thus, it is estimated that road investment has increased productivity in Ireland by 0.35%.

To give an example of the benefits achieved through investment in road infrastructure, a detailed case study has been undertaken on the M4/M6 to consider the level of outturn costs and benefits associated with a major road investment. The results of this analysis are outlined in section 3.1.

2. Public Transport

Over the last decade public transport investment has centred on the delivery of higher quality transport assets with a particular focus on service quality, accessibility, safety, and reliability. Customer-facing intelligent transport systems have been rolled out on a number of public transport modes, including the introduction of the leap card and real time passenger information. These interventions have enabled public transport users to interact with the current systems in a more efficient and productive way. It is important to note that while approximately €3.2 billion was invested in public transport between 2006 and 2010, there has been an investment of around €9.1 billion in roads over the same period.

2.1. Rail

Between 2006 and 2010, approximately €1.7 billion was invested in Ireland's heavy rail network. While this investment did bring about service improvements, it is important to note that a large portion of the expenditure was spent on bringing the existing network up to an appropriate safety standard.

The railway safety programme was the primary channel of expenditure on safety. The objectives of this scheme were to ensure the continued safe operation of the network.

[4] Transport Research &Information Note: Impact of Improvements in the Road network on the Accessibility & Economic Potential of Counties, Urban Areas, Gateways & Hubs, March 2012

These investments have led to an improvement on some of the safety indicators on the network including total Signal Passed at Danger (SPADs) and total numbers of derailments.

From 2007 to 2009, 184 inter urban rail carriages were replaced on seven[5] of the main lines. Among the benefits of these investments were improved accessibility, frequency, reliability, capacity, safety, environmental standards and comfort. A further 51 rail cars were ordered in 2009 and delivered over 2011 and 2012. In addition to these rail car investments, there were also considerable station and line upgrades. The line upgrades that these investments delivered were:

- Western Rail corridor phase 1;
- Navan rail line phase 1;
- Kildare rail project;
- Cork-Midleton rail line.

Over this period a number of new stations were developed, these included Portlaise traincare depot[6], Parkwest & Cherry Orchard station, Clondalkin Fonthill station, Hazelhatch & Cellbridge station as well as a number of upgrades to stations to improve customer experience and accessibility (i.e. Ennis bus and train station).

In addition to this investment in the national rail network, the DART system was also targeted for development. The DART was extended southwards from Bray to Greystones while on the northern end of the DART three new stations were added; Portmarnock, Malahide and Clongriffen.

Notwithstanding this investment, it must be recognised that rail demand has declined significantly since 2008 and future demand growth will be essential to the realisation of the full benefit from these investments.

2.2. Light Rail

As part of improvements in public transport provision, a light-rail system for the Greater Dublin Area was developed in the form of the LUAS and both the Green and Red Lines

[5] Dublin-Belfast, Dublin-Cork, Dublin-Galway, Dublin-Westport, Dublin-Sligo, Dublin-Waterford and Dublin-Wexford

[6] The € 65 Million purpose built facility brings an estimated 51 jobs to the Portlaoise area- source http://www.laois.ie/Business/EconomicDevelopment/Projects/PortlaoiseInterchangeProject/CIEIarnroidEireannTraincareDepot/

opened in 2004. There were further investments in LUAS to provide increased capacity through a 10 meter extension of the original 26 red line trams (phase 1 – 2008) and through the purchase of eight additional trams for the red and green lies (phase 2 - 2009). LUAS lines were also extended to the Docklands (2007), Cherrywood (2010) and Citywest (2011), these improvements brought more of the population closer to light rail public transport in the GDA. The overall investment in the LUAS system was over €1 billion with the majority being incurred between 2000 and 2004. While demand on the DART and inter-urban rail network has been in decline, LUAS passenger numbers have remained robust and indeed grown significantly since 2009.

As part of this process a detailed case study on the original LUAS has been carried out to gauge the outturn costs and benefits of a relatively large urban transport project which has attracted very good patronage levels. This is detailed in section 3.2.

2.3. Bus

Between 2006 and 2010, the public bus fleet received 539 new buses; this was made up of 339 new buses for Bus Eireann and 100 new buses to Dublin Bus. A large proportion of these vehicles were used to replace and update the original stock and this investment resulted in an increase in reliability, accessibility[7], fuel efficiency and reduced emissions.

Bus priority corridors were delivered in the form of 16 Quality Bus Corridors in the Greater Dublin Area. As of 2011, 6 out of the 16 QBCs average bus journey times were faster than the corresponding car journey times in the morning peak for the extent of the QBC. Of these 6 QBCs, 4 of them reported average bus journey times in excess of 10% lower than the corresponding car journey times. Of the 10 QBC's where car journey times were faster, bus journey times were within 10 minutes of the equivalent car journey times in the case of 5 of these. Only one QBC reported bus times that were more than 12 minutes slower than car journey times[8].

[7] Bus Eireann fleet and Dublin Bus fleet are now 100% wheelchair accessible.
[8] http://www.nationaltransport.ie/wp-content/uploads/2013/10/QBC-Monitoring-2011-Report.pdf.

3. Case Study Analysis

In-depth case study analyses of the M4/M6 and LUAS projects were carried out by the Department of Transport, Tourism and Sport and AECOM to provide further evidence of the effect of major projects. In both cases the original business cases were analysed and extended to account for known outturn costs and known extra benefits such as traffic volume and travel times. It is important to note from the outset that this analysis is an extension of the original cases rather than a final analysis. The details of these case studies are outlined below.

3.1 Case Study: M4/M6

Over the course of the 1990s, traffic volumes on the N4/N6 route rose at a fast rate increasing congestion, travel times and environmental costs. In particular this led to significant sections of the route, mainly focused around towns, experiencing excessive traffic build-ups and delays. The National Development Plan (2000-2006) put in place a plan to develop strategic national routes to motorway/high quality dual carriageway standard. The N4/N6 Dublin Galway route was one of five major inter-urban routes identified in the plan. For planning purposes, the route was divided into the following sections:

Table 3: Outline of M4/M6

Section	Length (km)	Completion Date
Kilcock to Kinnegad	39	December 2005
Kinnegad to Kilbeggan	28	May 2007
Kilbeggan to Athlone	29	July 2008
Athlone to Ballinasloe	19	July 2009
Ballinasloe to Galway	56	December 2009

The original business cases for each section of the road indicated that the project would bring about significant economic benefits from the investment through improved travel times and other benefits. The total estimated benefit was €2.1 billion and the expected cost was €1.2 billion (all 2002 prices). If these expected values were realised the project would have delivered a Net Present Value (NPV) of €952 million (2002 prices) and a Benefit to Cost Ratio (BCR) of 1.8. Full details of this ex-ante business case are detailed in table 4.

Table 4: Original Ex-Ante CBA for M4/M6

	Kilcock - Kinnegad	**Kinnegad - Kilbeggan**	**Kilbeggan - Athlone**	**Athlone - Ballinasloe**	**Ballinasloe - Galway**	**Total M4/M6**
Benefits						
Travel Time Savings	366	350	485	143	446	
Vehicle Operating Costs	-21	-19	-18	-7	-14	
Accident Benefits	71	67	91	65	137	
Total	416	399	558	200	568	**2141**
Costs	214	191	180	141	463	**1189**
NPV	202	208	378	59	106	**952**
BCR	1.94	2.09	3.10	1.42	1.23	**1.80**

Note: All Present Value, 2002 Prices, €m

As part of this analysis, the Department of Transport, Tourism and Sport, with support from AECOM, produced an updated ex-post business case including known costs and updated benefits. This analysis took the following factors into account:

- Known outturn costs
- Lifetime maintenance cost estimates

- Better than expected travel time savings
- Updated traffic volumes

It is important to note that this exercise is a basic extension of the original business case for the M4/M6 project rather than a comprehensive economic evaluation. As an aside, it is likely that the BCR and NPV are somewhat larger than reported here as all significant costs have been included while the main information missing is wider benefits such as environmental externalities and wider economic impacts. The work detailed in table 5 thus gives a general indication of the economic return generated by the project.

As table 5 details the full outturn cost of the M4/M6 was €1.7 billion while the estimated benefits are €2.6 billion (all 2002 prices). This gives the project a NPV of €932m (2002 prices) and a BCR of 1.56. This basic analysis shows that the project yielded a good return on investment. It is also worth noting the significant variance of return on each section of the road.

Table 5: Updated Ex-Post CBA for M4/M6

	Kilcock - Kinnegad	**Kinnegad - Kilbeggan**	**Kilbeggan - Athlone**	**Athlone - Ballinasloe**	**Ballinasloe - Galway**	**Total M4/M6**
Benefits	760	451	631	222	521	**2585**
Costs	431	220	221	161	619	**1653**
NPV	329	231	410	61	-98	**932**
BCR	1.76	2.05	2.85	1.38	0.84	**1.56**

Note: All Present Value, 2002 Prices, €m

3.2 Case Study: LUAS

In 2004, following an iterative development, planning and policy process, the LUAS light-rail system opened in Dublin. The proposal for a light-rail system stemmed from work on the Dublin Transport Initiative (DTI) by the Dublin Transport Review Group who were appointed by the Minister for Environment. The LUAS was developed as the best option to deal with Dublin's increasing level of transport demand.

Table 6: Outline of LUAS

Section	Length (km)	Completion Date
Line A – Tallaght to Middle Abbey Street	15	September 2004
Line B – Sandyford to Stephens Green	10	June 2004
Line C – Abbey Street to Connolly	1.6	2004

As table 6 reveals, the original CBA for the LUAS system estimated benefits to be €1.6 billion and costs to be €358 million (all 1998 prices). This would have given the project a NPV of €1.3 billion (1998 prices) and a BCR of 4.51. However, the final outturn cost of the project was almost three times larger than the estimate given increases in construction costs.

Table 7: Original Ex-Ante CBA for LUAS

	Line A - Tallaght Middle Abbey Street	Line B - Sandyford Stephens Green	Line C - Abbey Street Connolly	LUAS as opened 2005
Benefits				
User Time Savings	818	391	78	1287
Non User Time Savings Cars	-91	259	-18	150
Non User Time Savings HGVs	10	2	2	14
VOC Savings	69	22	12	103
Accident Savings	38	14	7	59
Total	**844**	**688**	**81**	**1613**
Costs	**204**	**126**	**28**	**358**
NPV	**640**	**562**	**53**	**1255**
BCR	**4.14**	**5.46**	**2.89**	**4.51**

Note: All Present Value, 1998 Prices, €m

As table 7 shows outturn costs came in at €991 million. To balance this out somewhat benefits were also greater than expected, at €2.9 billion due to higher productivity gains and ahead of target traffic on the system. This gave the project an ex-ante NPV of €1.9 billion (1998 prices) and a BCR of 2.96. Despite having a lower BCR than expected the LUAS still offers an excellent return on investment. It is important to note that this exercise amounts to a basic extension of the original business case using known outturn costs and accounting for the increased level of passenger use. The analysis does however give a clear indication of the positive economic impact that the LUAS has had and how this major transport infrastructure project was extremely good value for money.

Table 8: Updated Ex-Post CBA for LUAS

	Line A - Tallaght Middle Abbey Street	Line B - Sandyford Stephens Green	Line C - Abbey Street Connolly	LUAS as opened 2005
Benefits	1,536	1,252	147	2,936
Costs	524	390	77	991
NPV	1,013	863	70	**1,946**
BCR	2.93	3.22	1.91	**2.96**

Note: All Present Value, 1998 Prices, €m

4. Conclusions

A significant amount of investment over recent times has delivered a more efficient and reliable transport infrastructure and service. Road infrastructure experienced a marked improvement with the reduction of congestion and greater reliability throughout the network. The improvement in the motorway network has increased effective density, which in effect has reduced factor input costs. According to the NRA, productivity has increased by 0.35% as a result of road infrastructure investment between 2006 and 2010. Public transport investment has delivered a refreshed fleet of buses and trains, as well as extensions to heavy and light rail lines. These investments have led to improvements in reliability, comfort, emissions, accessibility, frequency and safety. It should be noted that while much of this investment has led to improvements in service quality, demand for public transport has been declining over the same period, with the exception of LUAS.

The ex-post cost-benefit analysis shows that the M4/M6 project provided a good return on investment. The project's total cost was €1.6 billion while it garnered €2.6 billion in benefits.

This means that the project had an overall benefit-cost ratio of 1.56. In addition, the LUAS case study presented here reveals that it was excellent value for money. The LUAS project had a benefit-cost ratio of 2.96 as its benefits, €2.9 billion, outweighed its costs, €991 million. This paper details the scale of investment made in transport infrastructure in the last decade and shows that these projects have provided a good return on investment.