Mid West National Road Design Office

Cost Benefit Analysis

Foynes to Limerick Road Improvement Scheme
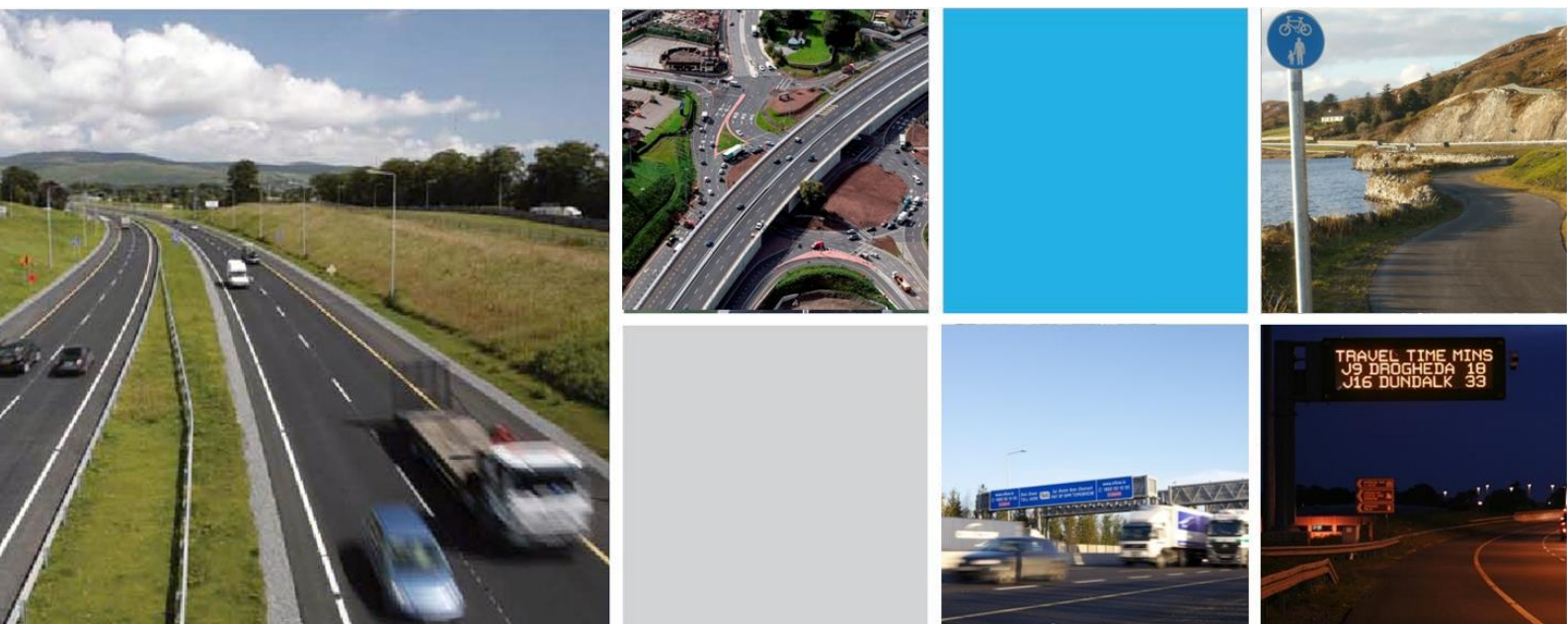
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Phase:	2 - Route Selection
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Foynes to Limerick Road Improvement Scheme
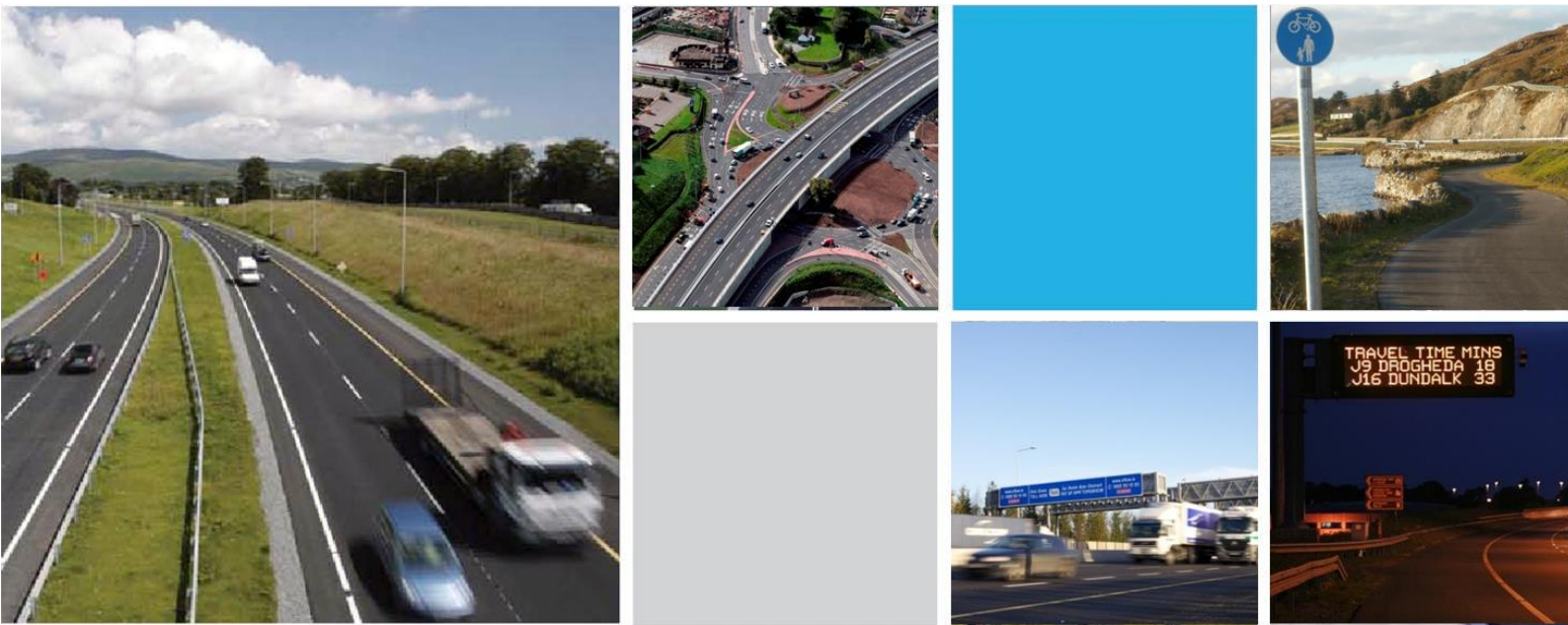
Cost Benefit Analysis

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Chapter 1
Introduction

1   Introduction

1.1   Overview

This report forms the Phase 2 Route Selection Cost Benefit Analysis (CBA) of the Foynes to Limerick Road Improvement Scheme and has been undertaken in accordance with the TII Project Management Guidelines (PMG) 2010 and TII National Road Project Appraisal Guidelines (PAG) 2011. These guidelines are in compliance with the Department of Transport's Common Appraisal Framework for Transport Projects and Programmes (2009).

1.2   Cost Benefit Analysis

Cost Benefit Analysis (CBA) forms one element of the appraisal process for road infrastructure projects. The benefits and costs of the proposed scheme are assessed using agreed traffic growth scenarios. The CBA process compares the "Do-Minimum" scenario with the "Do-Something" scenario (i.e. to progress with the scheme) and determines whether benefits resulting from the provision of the scheme will outweigh the costs of construction and future maintenance.

1.3   Scheme Description

1.3.1   Do-Minimum Network

The Do-Minimum network should include the existing road network plus any committed infrastructure improvements in the study area. For the current scheme, no committed or planned schemes are relevant, and it is therefore assumed that the existing network, properly maintained, forms the Do-Minimum network for the future year. As such, no changes to the Base Year network have been incorporated as part of the Do-Minimum scenario. The extents of Do-Minimum network are illustrated in Figure 1.1.

Figure 1.1 - Do-Minimum Network

1.3.2   Do-Something Options

Four route options have been identified as part of the Stage 2 Route Selection process and are referred to as Option 1, 2, 3 and 4. The options are based on the known natural constraints in the study area and where possible utilise the existing national road infrastructure to the greatest extent possible.

1.3.2.1 Option 1

Commencing at Foynes, Route Option 1 runs parallel to the existing N69 diverting south at Clarina to tie in with the M20 Raheen Junction (J3). The option bypasses all towns and villages on the N69 but provides connections back to the existing N69 road at appropriate locations.
The route is approximately 33km in length and is illustrated in Figure 1.2.

1.3.2.2 Option 2

Route Option 2 connects Foynes Port to Limerick and will bypass the towns of Rathkeale and Adare. The route option connects back onto the existing M20 at Attyflin (Junction 5). The route is shown in Figure 1.3 and is approximately 32 km in length.

1.3.2.3 Option 3

Commencing at Foynes, Route Corridor Option 3 runs parallel to the N69 before heading south of Barrigone and travelling parallel to the Foynes / Limerick Rail line to Rathkeale. From Rathkeale the route runs along the existing N21 before heading in a north easterly direction, bypassing Adare to the north and tying into the N21 before the M20 Attyflin Junction (J5). The route is approximately 33km in length and is highlighted in Figure 1.4.

1.3.2.4 Option 4

Route Corridor Option 4 is approximately 32km long and follows the same route as Route Corridor Option 1 through to Curraghchase before heading in a south easterly direction towards Adare. The Route Corridor Option is shown in Figure 1.5.
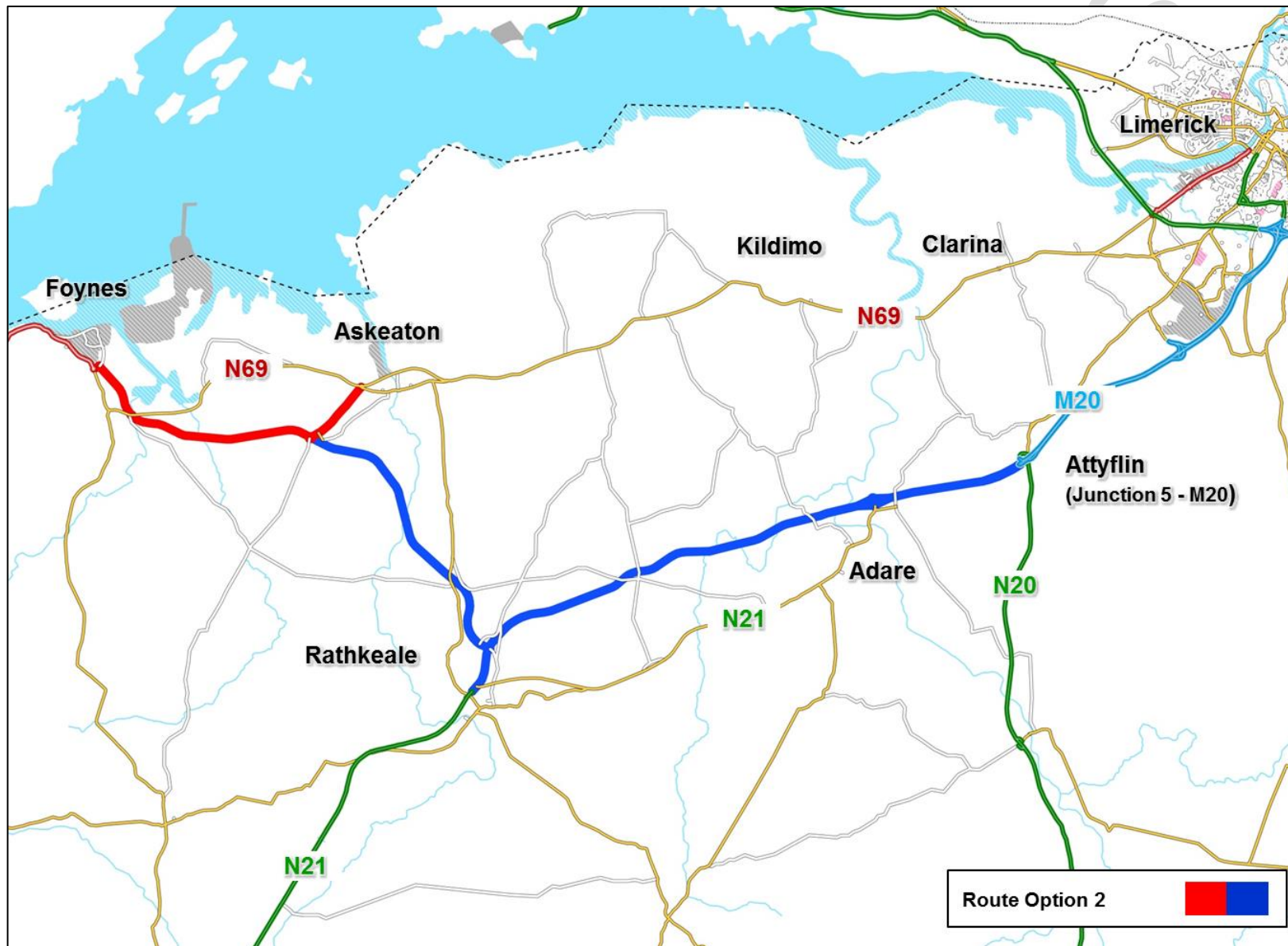
Figure 1.2 - Do-Something Route Option 1

Figure 1.3 - Do-Something Route Option 2
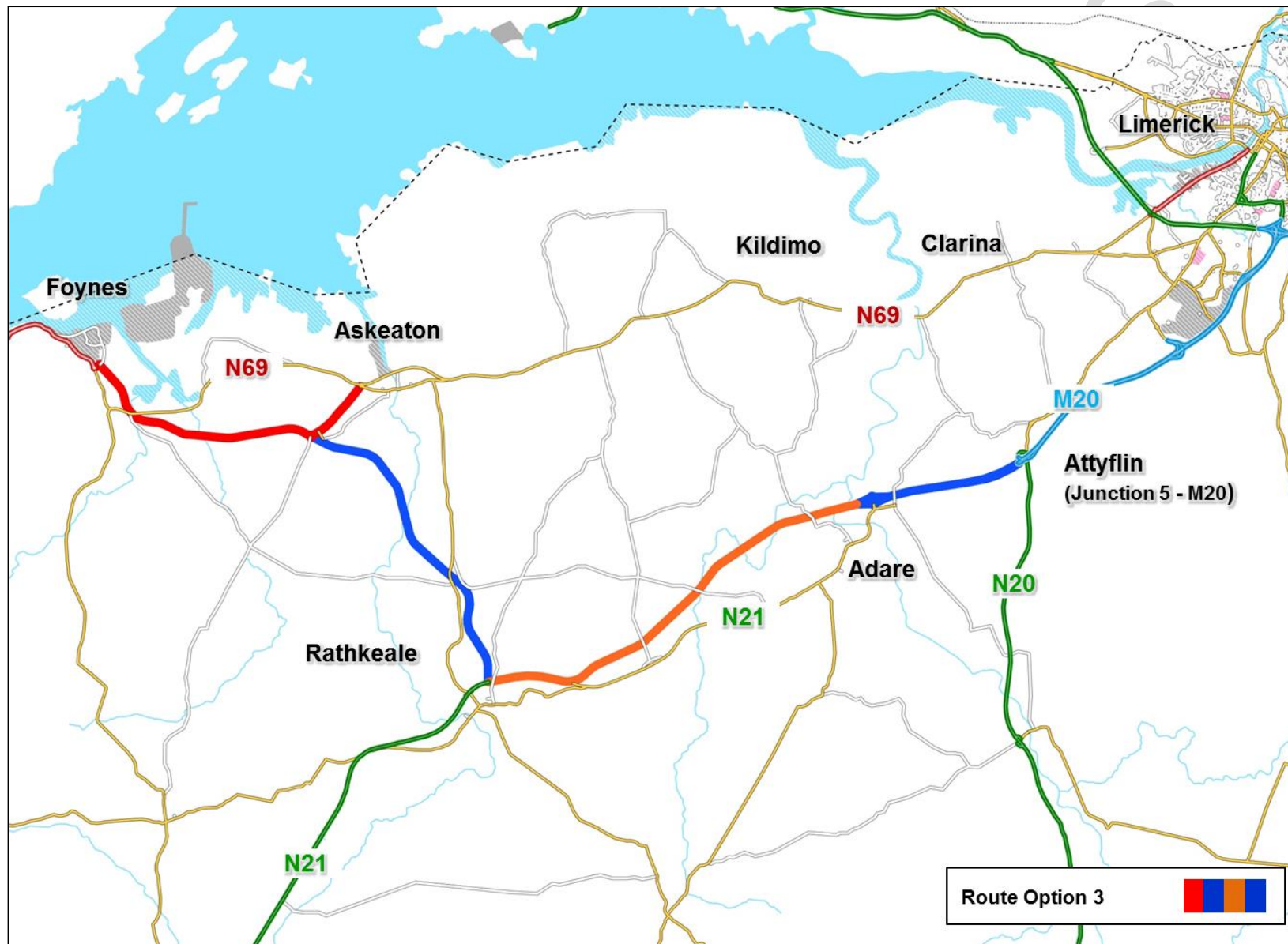
Figure 1.4 - Do-Something Route Option 3
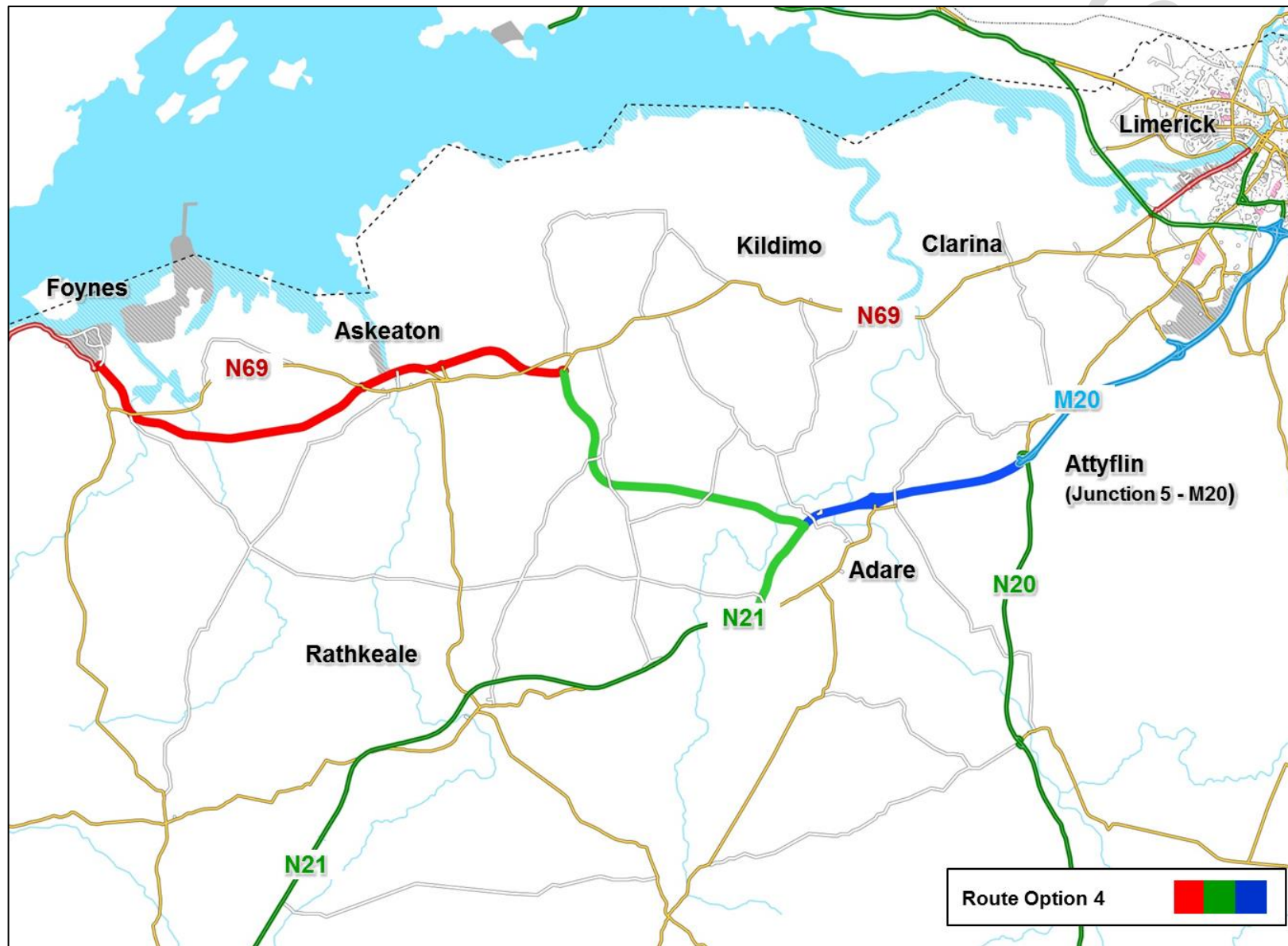
Figure 1.5 - Do-Something Route Option 4

Chapter 2
Software Specification
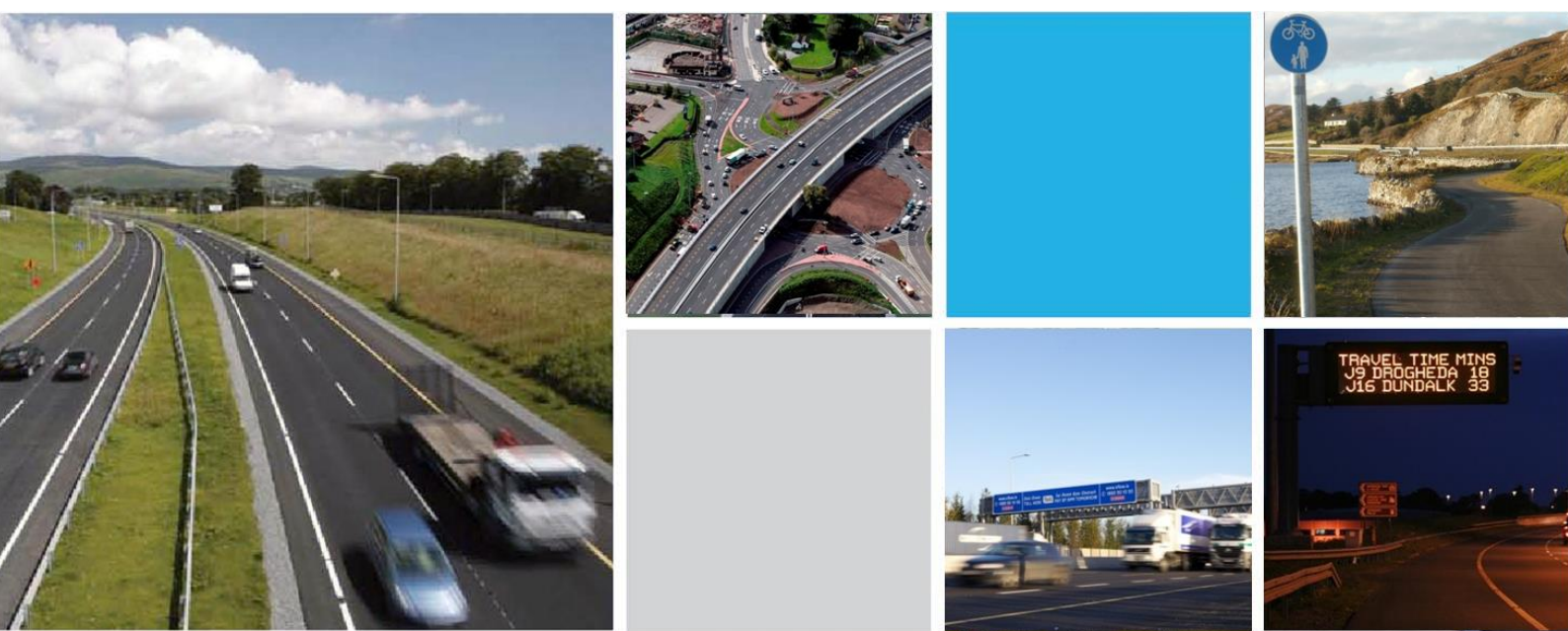
2   Software Specification

2.1   TUBA Specification

This Phase 2 CBA assessment was undertaken using the Transport User Benefit Analysis (TUBA) v1.9 CBA software programme. The CBA assessment assumes a Discount Rate of 5%, with all costs and benefits discounted back to a common base year of 2009. The analysis has been carried out in accordance with TII *PAG Unit 6.5: Guidance on Using TUBA*.

Chapter 3
Traffic Modelling

3   Traffic Modelling

3.1   Overview

In order to calculate the benefits of a proposed scheme, TUBA uses matrix based outputs (demand and travel cost skims) which are generated by the Do-Minimum and Do-Something traffic models.

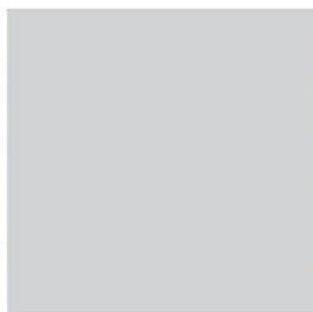The traffic model contains a total of 110 zones; reference should be made to the Phase 2 Foynes to Limerick Road Improvement Scheme Traffic Modelling Report (TMR) for details of the development of the road network and zoning system.

The traffic model zone structure is illustrated in Figure 3.1 and covers the area that may potentially be impacted upon by the introduction of the proposed scheme.
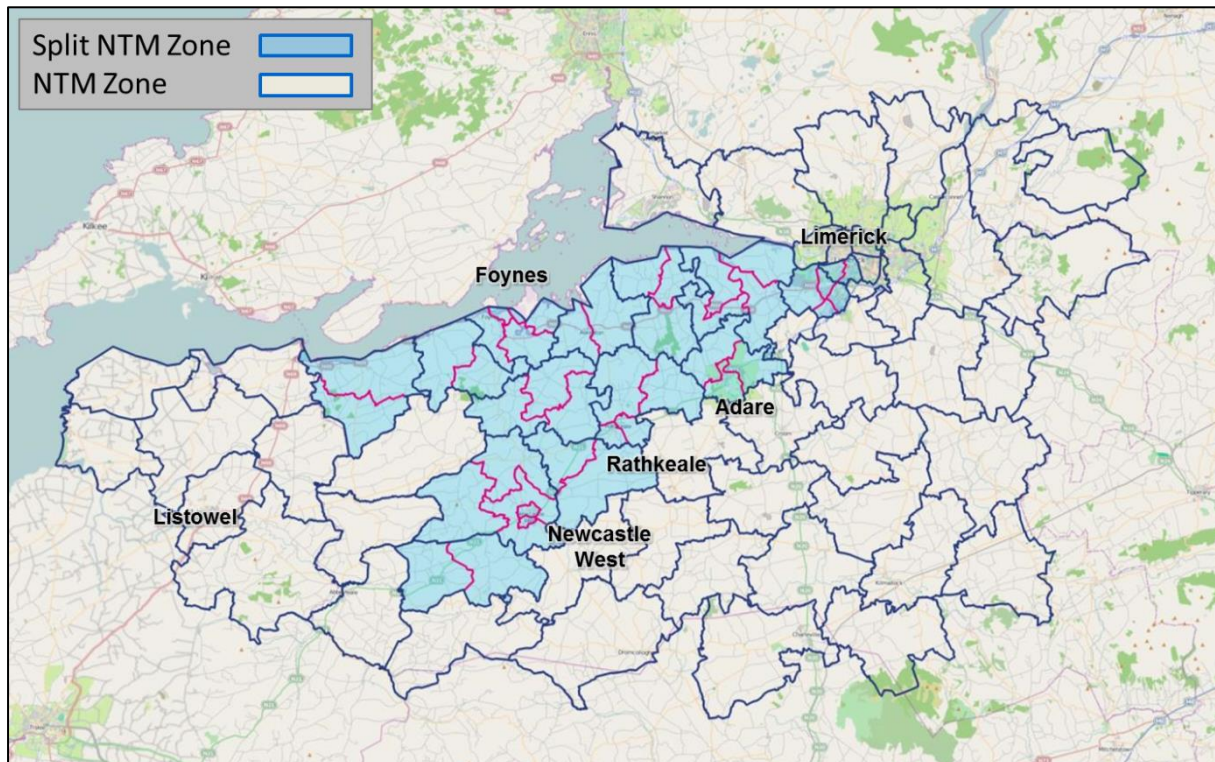
Figure 3.1 - Traffic Model Zone Structure

Chapter 4
Data Collection
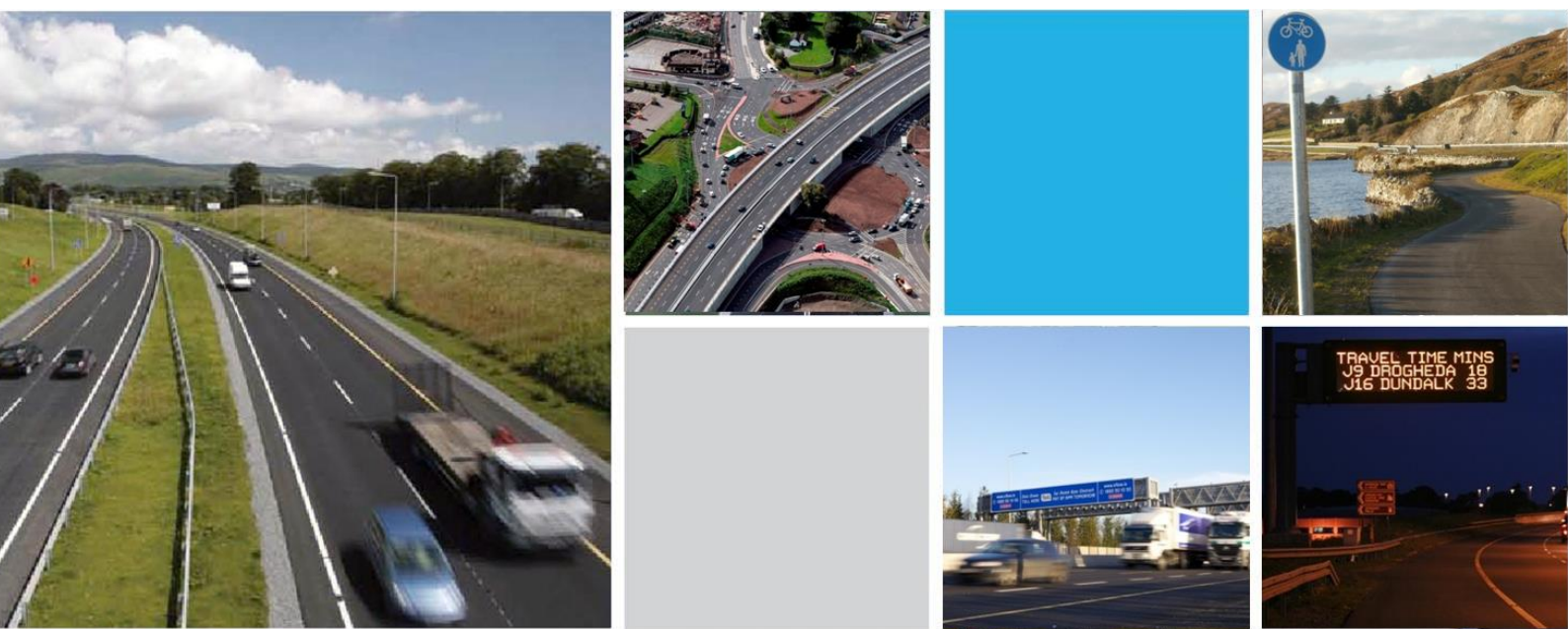
4   Data Collection

4.1   Overview

TUBA uses trip matrices (demand) and travel cost skims (travel time, travel distance and toll costs)[1] extracted directly from the traffic model of the proposed scheme to calculate user benefits. Therefore no additional data was required in order to develop the TUBA model. Reference should be made to the Phase 2 Foynes to Limerick Road Improvement Scheme Traffic Modelling Report (TMR) for details of data collected as part of the development of the traffic model.

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[1] *The toll travel costs generated by the traffic model refer to the existing N18 Limerick Tunnel toll which is included in the traffic model. There are no plans to introduce any additional tolls at this stage.*

Chapter 5
CBA Input Assumptions
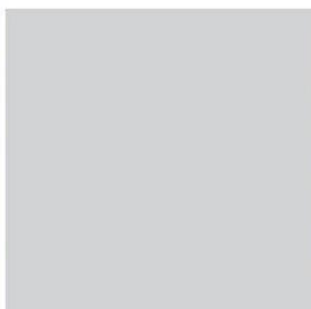
5   CBA Input Assumptions

5.1   Input Parameters

All general parameters such as value of time, value of time growth rates, fuel cost changes, fuel consumption, vehicle operating costs fuel/non fuel, trip purpose distribution, tax rates, change in tax rates, vehicle occupancy rates and vehicle proportions were taken from the TII *PAG Unit 6.11 - National Parameter Values Sheet.*

The applicable discount rate and shadowing pricing factors are taken from the Department of Public Expenditure and Reform (DPER) document "The Public Spending Code".

Fuel efficiency was taken from UK WebTAG guidance as no guidance is currently available in Ireland. Fleet fuel type proportions were available from the Department of Environment; the proportions are given in Table 5.1. The forecasts changes to fleet fuel type were taken from WebTAG as set out in Table 5.2. Data on fuel costs, duty and VAT is provided in Table 5.3 which is sourced from the Revenue Commissioners.

Table 5.1 - Car Fleet Fuel Type Split

Year	Petrol	Diesel
2009		

Table 5.2 - Forecast Change in Car Fleet Fuel Type Split

Start Year	End Year	Vehicle Type	% Change Petrol
2010	2010	1 - Car	
2011	2025	1 - Car	
2026	2080	1 - Car	

Table 5.3 - Fuel Costs (2009 Prices)

Fuel Type	Resource Cost (cents/L)	Duty (cents/L)	VAT (%)*	Carbon (grams/L)
Petrol				
Diesel				

*VAT increased to 23% as and from 1st January 2012

The TUBA Economic Input file is presented in Appendix A of this report, while the TUBA Scheme Input files is provided in Appendix B.

5.2   Options Comparison Estimate

Option Comparison Estimate (OCE) for the four route options was determined in accordance with the TII Cost Management Manual under the following seven expenditure headings.

- Main Contract Construction;
- Main Contract Supervision;

- Archaeology;
- Advance Works & Other Contracts;
- Residual Network;
- Land & Property; and
- Planning & Design.

Total Inflation Allowance and TII Programme Risk were also added to the scheme costs to generate the full OCE. Table 5.4 provides a summary of the total cost for each route option.

Table 5.4 – Option Cost Comparison (2015 prices inclusive of VAT)

Route Option	Option Cost Comparison
Option 1	
Option 2	
Option 3	
Option 4	

5.3   Residual Value

For major transport schemes, the residual value is a measure of the net present value of the infrastructure over a specified period beyond the 30-year appraisal period. In this case a residual value period of 30 years is applied based on the guidance outlined in Table 6.1.2 of *PAG Unit 6.1: Guidance on Conducting CBA*. The residual value is included in the final table of results.

Chapter 6
Safety Benefits

6 Safety Benefits

6.1 Overview

The CBA program TUBA does not calculate safety benefits. Past experience suggests that safety benefits can represent up to 10-20% of major scheme benefits, therefore an assessment of potential safety benefits has been undertaken using the TII software programme COBALT.

6.2 COBALT - Ireland

COBALT (COst and Benefit to Accidents – Light Touch) is a computer program developed by the UK Department for Transport (DfT) to undertake the analysis of the impact on collisions as part of the economic appraisal for a road scheme.

An Irish specific version of the COBALT program was developed by TII for use on road schemes in the Republic of Ireland and is referred to as COBALT – Ireland. COBALT assesses the safety aspects of road schemes using detailed inputs of links that may be impacted by the scheme.

The assessment is based on a comparison of collisions by severity and associated costs across an identified network in 'Without-Scheme' and 'With-Scheme' forecasts, using details of link characteristics, relevant collision rates and costs and forecast traffic volumes.

6.3 Results

The reduction in the total number of collisions as a result of each route option is presented in Table 6.1, alongside the reduction in the number of casualties by severity. The monetised benefits of each route option are presented in Table 6.2.

Table 6.1 – Route Corridor Options Collision/Casualty Reduction

Route Option	Collision Reduction	Casualty Reduction		
		Fatal	**Serious**	**Minor**
1				
2				
3				
4				

Table 6.2 – Route Corridor Options CBA Summary (Safety)

Route Option	Safety Benefits (€m)
1	
2	
3	
4	

6.3.1   Conclusion

Chapter 7
Annualisation Factors
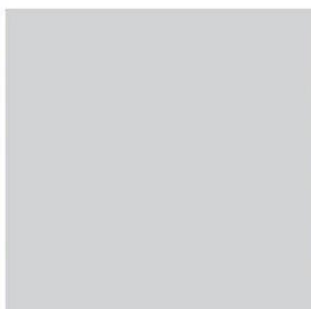
7   Annualisation

7.1   Annualisation Factors

Annualisation factors are used to convert the benefits from the modelled time periods to annual benefits. The benefits in each modelled time period are multiplied by the annualisation factor relevant to the modelled time and then summed to give the total annual benefits. As previously discussed three peak hours were modelled using the scheme traffic models, these are as follows:

- Weekday AM Peak Hour (08:00 – 09:00);
- Weekday Average Inter Peak Hour (Average hour between 12:00 and 14:00); and
- Weekday PM Peak (17:00 – 18:00).

There are a number of steps involved in calculating annualisation factors, these are as follows:

- Calculate daily factors to account from the non-modelled time periods over the full 24hr period;
- Calculate factors to account for weekend traffic; and
- Calculate factors to convert daily benefits to annual benefits.

7.2   Daily Factors

Daily factors reflecting the number of hours during which traffic conditions similar to those in the modelled peak and inter-peak hours are encountered on the modelled network were developed based on the daily profile of traffic distribution from two TII Traffic Monitoring Units (TMU) located within the study area on the N69 and N21 corridors. The average weekday traffic profile recorded by these two TII TMU sites in 2014 is presented in Figure 7.1.
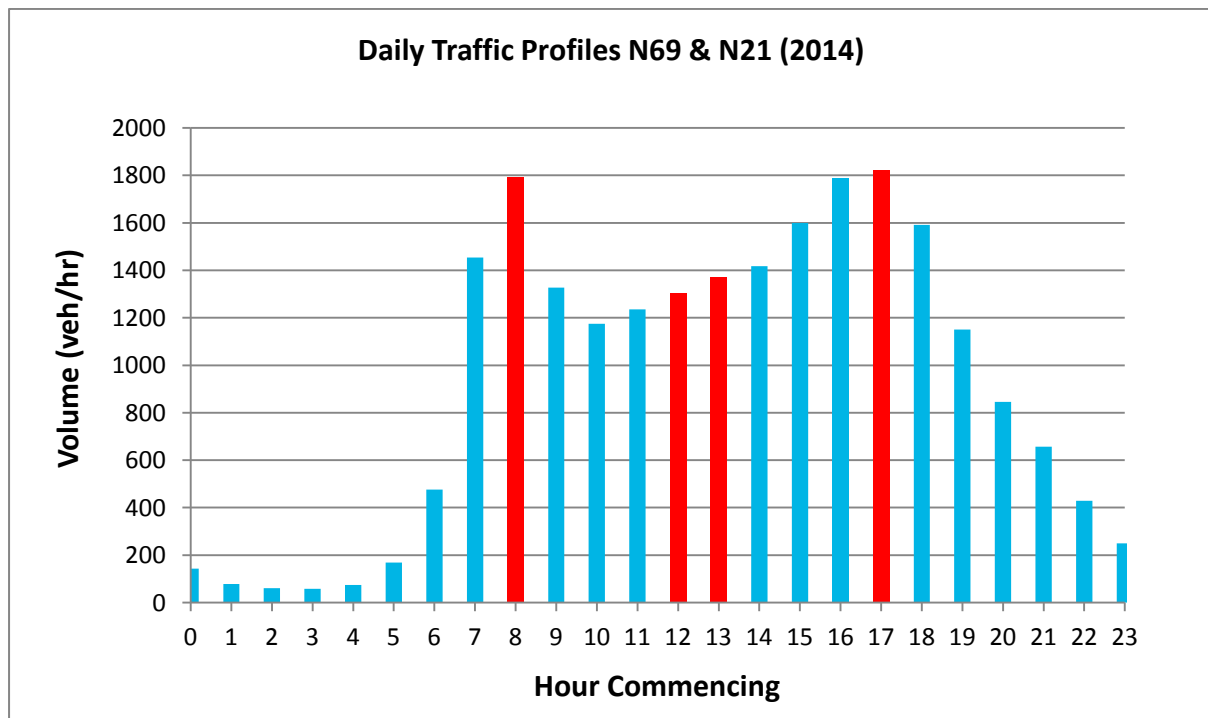

Figure 7.1 – 2014 Weekday Traffic Profile

Delay experienced on sections of the national road network under consideration is related to congestion. Therefore drivers will experience benefits throughout the day when traffic levels are high. To account for the non-modelled time periods the following assumptions are applied:

- Modelled AM Peak Hour Benefits (08:00 – 09:00) can also be applied to the AM Peak Period (07:00 – 10:00) as the trip purposes and vehicle occupancy rates occurring during the AM peak period (08:00 – 09:00) are generally also seen in the AM peak shoulder hours (07:00 to 08:00) and (09:00 to 10:00);
- Modelled PM Peak Hour Benefits (17:00 – 18:00) can also be applied to the PM Peak Period (16:00 – 19:00) as the trip purposes and vehicle occupancy rates occurring during the PM peak period (17:00 – 18:00) are generally also seen in the PM peak shoulder hours (16:00 to 17:00) and (18:00 to 19:00); and
- Modelled Inter Peak Hour Benefits (Average 12:00 – 14:00) can also be applied to the Inter Peak Period (10:00 – 16:00) as the trip purposes and vehicle occupancy rates that occur during these periods are similar throughout the Inter Peak Period (10:00 to 16:00).

Due to significantly lower traffic volumes during the Off-Peak Hours (19:00 – 07:00), benefits during these hours are negligible, and are therefore not accounted for. Based on these assumptions the following daily factors were calculated:

- AM Peak Hour Benefits occur 2.5 times over the AM Peak Period;
- PM Peak Hour Benefits occur 2.9 times over the PM Peak Period; and
- Inter Peak Hour Benefits occur 6.0 times over the Inter Peak Period.

Daily Benefits = 2.5 * AM Peak + 6.0 * Inter Peak + 2.9 * PM Peak

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7.3   Weekend Factors

As discussed above, traffic movements outside of the modelled time periods will also benefit from the proposed highway scheme. This also includes traffic that occurs at weekends. The type of traffic (trip purpose and vehicle occupancy) that occurs during the AM and PM weekdays peaks would not occur at weekends (i.e. commuting). Traffic that occurs at the weekend is more similar in terms of trip purpose and vehicle occupancy to traffic that occurs during the weekday Inter Peak. Therefore weekend benefits are based on weekday Inter Peak benefits.

Figure 7.2 illustrates the profile of traffic across the two TII TMU sites for an average weekday and an average weekend. The figure shows that in general traffic levels at the weekend are similar to those on an average weekday apart from the AM period between 06:00 – 10:00.

Traffic levels during the weekend period between 10:00 – 16:00 are very similar to the traffic levels during the weekday Inter Peak Period. As such, it is assumed the level of benefits generated by the proposed schemes during the weekday Inter Peak period will generated for each of the 7 days of the week.
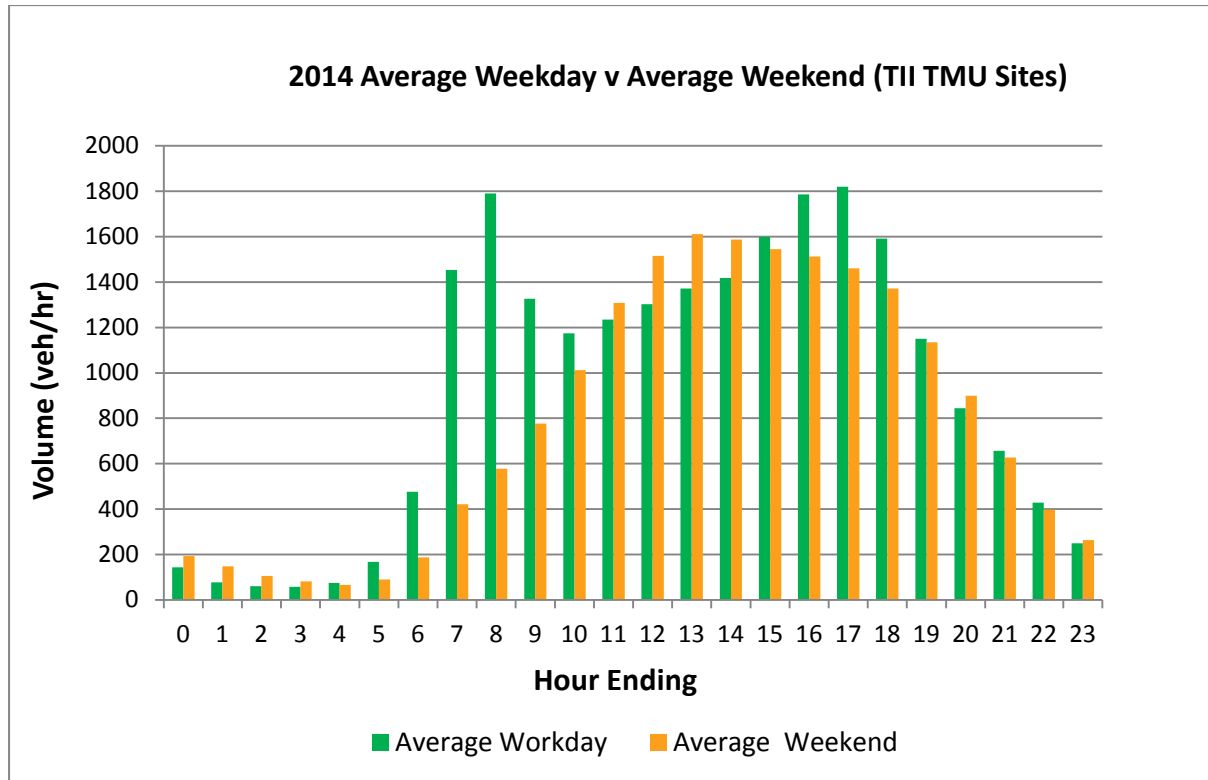
Figure 7.2 – 2014 Weekday versus Weekend Traffic Profile
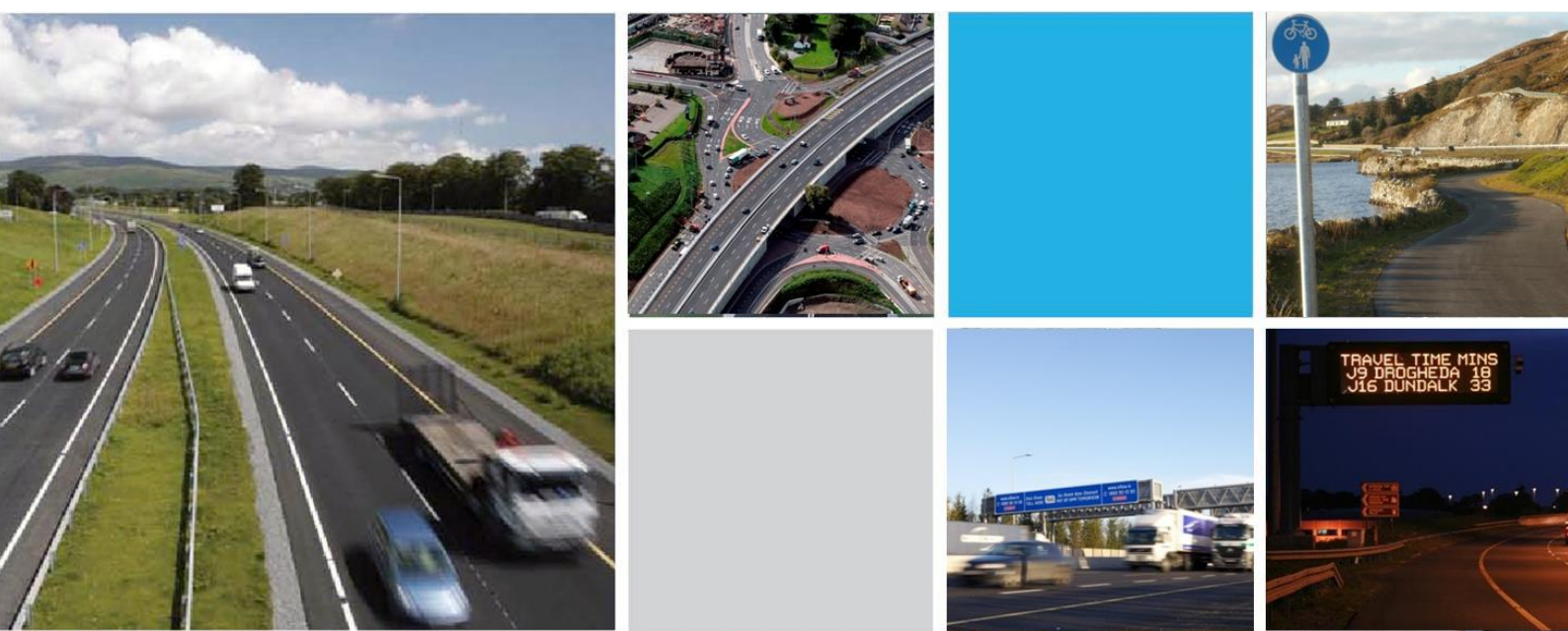
7.4 Annualisation Factors

In general the annualisation factor used to convert daily benefits to annual benefits is 253, as there are 253 peaked weekdays per annum. It is proposed to apply the 253 peaked weekdays to the AM and PM peak periods. However, as outlined above, the weekday Inter Peak benefits are also applied to weekend traffic and are therefore treated differently than that AM and PM Peak period benefits.

The daily Inter Peak benefits are factored by 365 days of the year to account for weekend traffic that also occurs during the Inter Peak Periods between 10:00 – 16:00. Based on the above, the following annual factors are applied to the modelled time periods to generate annual benefits.

- Annual AM Peak Hour Benefit Factor = 633 (253 * 2.5);
- Annual Inter Peak Hour Benefit Factor = 2190 ((365 * 6.0); and
- Annual PM Peak Hour Benefit Factor = 734 (253 * 2.9)

Annual Benefits = 633 * AM Peak + 2190 * Inter Peak + 734 * PM Peak

Chapter 8
CBA Results Summary

8 Cost Benefit Analysis Results

8.1 Overview

The results of the Cost Benefit Analysis are presented below based upon the annualisation factors outlined in Section 7.0. The results take into account scheme safety benefits and the residual value of the scheme option.

8.2 CBA Results Summary

8.2.1 Transport Efficiency & Effectiveness

A Phase 2 Route Selection CBA for the four route corridor options was undertaken using the CBA software programme TUBA. A summary of the economic benefits of the route corridor options calculated in TUBA are presented in Table 8.1 The results are based on the following changes between the Do-Minimum and Do-Something route corridor options:

- Change in journey time;
- Changes in vehicle operating cost;
- Change in CO_2 emissions; and
- Change in indirect taxation.

The benefits of the proposed scheme are based on the TII Central Traffic Growth scenario and take into account the safety benefit of the option and its residual value. Summaries of the TUBA output files are included as Appendix C of this report.

Table 8.1 - CBA Summary (€, 000) – Central Growth Scenario

| Central Growth Scenario	Option 1	Option 2	Option 3	Option 4
Commuting (Time & VOC)				
Other (Time & VOC)				
Business (Time & VOC)				
Indirect Taxation				
Emissions				
Safety				
Residual Value				
Present Value of Benefits (PVB)				
Present Value of Costs (PVC)				
Net Present Value (NPV)				
Benefit to Cost Ratio (BCR)				

The results provided in Table 8.1 above are based on the appraisal parameters as set out in PAG Unit 6.11 National Parameter Values Sheet and the Department of Public Expenditure and

Reform (DPER) document "The Public Spending Code (PSC)"[2]. The following key appraisal parameters were assumed:

- Discount Rate – 5%;
- Shadow Price of Labour – 0.8 (80%); and
- Shadow Price of Public Funds – 1.3 (130%).

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[2] The Public Spending Code, E-Technical References (Table 1 Summary of Appraisal Parameters).

Chapter 9
Conclusions
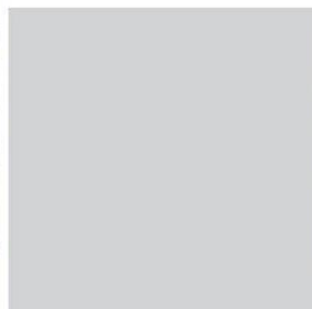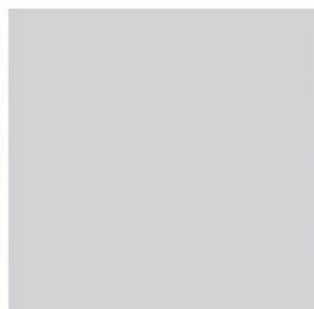
9   Conclusions

9.1   Conclusions

A Cost Benefit Analysis assessment has been undertaken of the four route options identified as part of the Stage 2 Route Selection process. The assessment has been undertaken using the TUBA software programme in accordance with TII Project Appraisal Guidelines (2011) and DPER Public Spending Code (2013). The assessment has demonstrated the following Benefit to Cost Ratio values over a 30-year appraisal period (inclusive of Residual Value):

- Option 1 – ███;
- Option 2 – ███;
- Option 3 – ███; and
- Option 4 – ███

Appendix A
TUBA Economic Input File
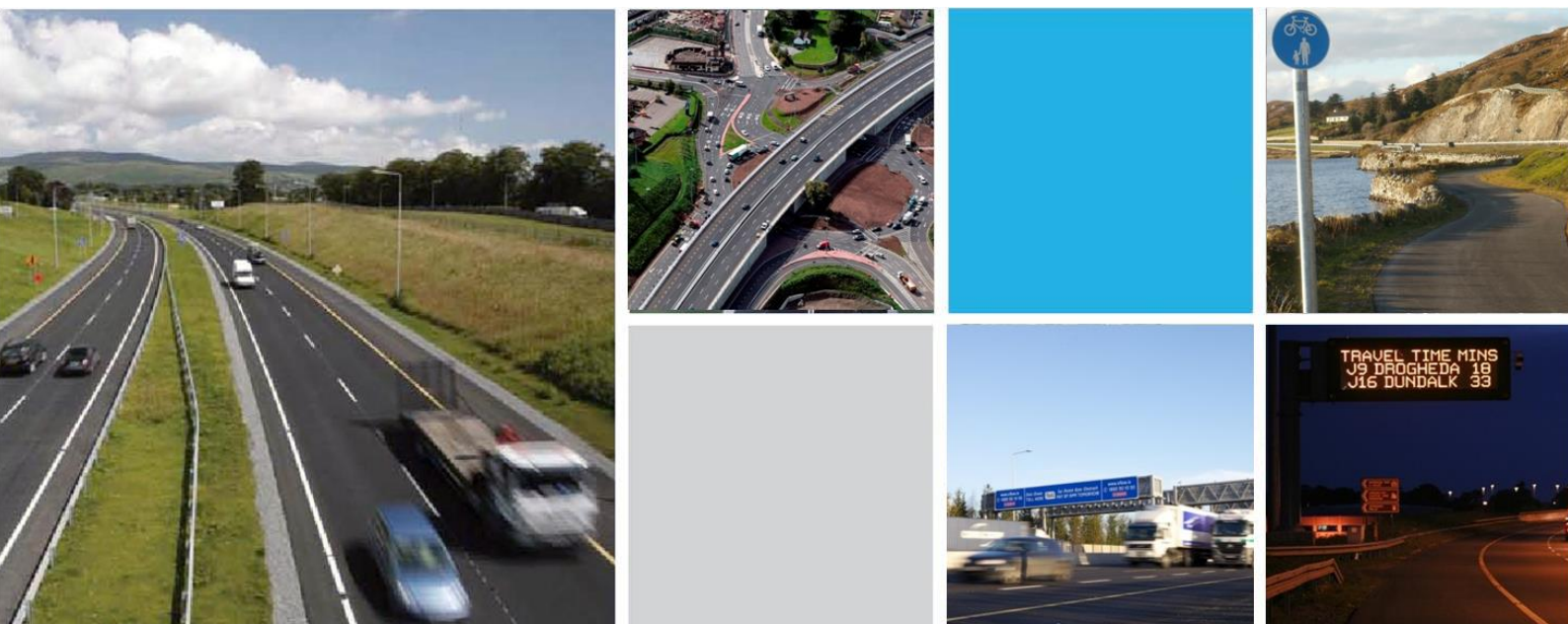
Appendix B
TUBA Scheme Input File

Appendix C
TUBA Output Files Summary