Chapter 5 Traffic Modelling, Traffic Impacts and Economic Analysis

5.1 Introduction

This chapter provides an overview of the traffic and economic assessment undertaken in support of the proposed N9 Kilcullen to Powerstown Scheme. The assessment covers a number of distinct elements outlined below.

Traffic Modelling

The development of a TRIPS traffic assignment model to allow assessment of the impacts of changes to the study area network, such as the provision of the proposed N9 Kilcullen to Powerstown Scheme.

Traffic Impacts

An assessment of the specific traffic impacts through the study area resulting from the proposed scheme. The assessment examines forecast flows on the proposed route, and the impact on reducing traffic flows along parallel routes.

Economic Analysis

Assessment of the Costs and Benefits of the proposed scheme over the 30 year design horizon, quantification of these costs and benefits according to COBA10 (a cost benefit tool designed by the UK Highways Agency), and determination of the Benefit Cost Ratio and Internal Rate of Return.

5.2 Methodology

The traffic and economic assessment for the N9 / N10 Kilcullen and Waterford Scheme has been based on a traffic assignment model developed for the purpose of the study, and supplemented by an economic assessment using COBA10. The model was based on traffic surveys and planning assumptions to maximise the robustness of the output.

The traffic and economic assessment incorporated the following key tasks:

- Assessment of existing data and modelling tools. This has been described above;
- Data collection, incorporating traffic surveys, journey time surveys and roadside interviews;
- Develop assumptions regarding growth and development through the study area;
- Identify future road schemes for inclusion in the do-minimum assessments;
- Development and calibration of the traffic models;
- Assessment of traffic impacts;
- Assessment of economic costs and benefits; and
- Conclusion on the viability of the proposed scheme.

The model for the study area was constructed to provide an appropriate level of detail and thereby allow the application of a fully up-to-date tool for the assessment.

The Traffic Model covers the whole length of the scheme from Kilcullen to Waterford.

The development of the model was undertaken in two stages due to the availability of data and the timescale attached to the project. The model is effectively a cordoned area of the national model, incorporating a course 144 zoning system. The Stage II model was produced by further refining the Stage I model with additional survey data and expansion to 184 zones.

The traffic model network includes all National Primary and Secondary roads in the study area along with those Regional roads that may be used by scheme traffic depending on the junction strategy adopted. The N11 and N8 are not included in the model network. However, the possible transfer of traffic from these corridors to the proposed route was estimated by inspection of origin-destination data collected on the N11 at Camolin (between Enniscorthy and Gorey) and on the N8 at Abbeyleix.

Stage I Traffic Model

The most influential factor affecting the amount of traffic attracted to various route options was considered to be the junction strategy adopted, and not congestion. The model was therefore developed to assign traffic to routes on an all-or-nothing basis using generalised costs calculated on weighted values of time and distance. Where there were two closely competing routes traffic was allocated to each route.

For the Stage I model of the N9 / N10 Kilcullen to Waterford Scheme, interchanges were considered at;

- Kilcullen, with connections to existing M9, N9 and N78;
- Interchange to serve Athy to the west and Baltinglass to the east;
- Carlow Town, with connections to the existing N9 and N80;
- Paulstown, with connections to the existing N9, the N10 to Kilkenny and the R724 to the east;
- Thomastown, with connections to the existing N9 and N10 and the R700 to connect to New Ross;
- Waterford, with connections to the proposed N25 Waterford Bypass, N24 to Clonmel and to the existing N9;

Using the data available in 2000, a trip matrix was constructed covering the study area, with a number of further zones representing external links into the study area. Existing data from origin-destination surveys, carried out at six locations during 1997 and 1998 were used to provide a base year trip matrix. The trip matrices were developed for the assignment process to include all traffic which might be assigned to the proposed route. Using this data and a skeletal network representing the road network in the corridor, a simple traffic assignment model was developed using SATURN (buffer network) and TRIPS suite of programs.

Forecasting of traffic growth was carried out in accordance with the methods used in the National Road Needs Study for a design year of 2022, and taking into account the potential for significant planned developments in the corridor. In addition, an estimate was made of the potential transfer of longer distance trips to the N9 / N10 corridor from other parallel corridors, following construction of the scheme. A number of initial routes were tested. These routes included routes close to the N9 and N78 and bypasses to the east and west of Carlow.

The analyses undertaken in Stage I provided sufficiently robust results on which route selection could be made. The economic assessment of the route options was suitable for ranking purposes, and was included in the overall assessment to identify the Preferred Route Corridor.

Stage II Traffic Model

The Stage II model involved updating of the trip matrices developed in Stage I to include origin / destination data collected in March / April 2001 on the N9 between Waterford and Kilkenny and on the N78 between Kilkenny and Athy, to add the following movements;

- Waterford to M9 / Dublin / beyond via the N78
- Waterford to Kilkenny
- Waterford to Athy via the N9 / N10 / N78
- Kilkenny to M9 / Dublin / beyond via the N78
- Clonmel to M9 / Dublin / beyond (Partial observation via N76 / N78)

The analyses undertaken in Stage II were used to confirm the route selection made in Stage I, to provide information for the outline design of the scheme, and to provide a more rigorous economic assessment of the preferred route.

The economic benefits of the route options were identified using the UK COBA (Cost Benefit Analysis) program using default parameters calculated for Irish conditions. The results were used to compare the relative economic performance of the various options.

5.3 Data Collection

As the assessment exercise required the development of a new traffic model, an extensive data collection procedure was necessary. The data collection comprised three key elements, each of which is described below.

The data collection refers to Stages I and II of the data collection process. Stage I information describes the survey data made available which was used for the development of the national model. Stage II information describes the additional information collected in order to refine the Stage I model and produce the Stage II model.

5.3.1 Roadside Interview Surveys

The roadside interview (RSI's) provided the backbone of the traffic data collection exercise, allowing the construction of an origin-destination matrix specific to the N9 / N10 corridor. RSI sites were established at a number of locations as follows:

Stage I information made available:	*Survey Date*
• M9 Kilcullen	1997
• N11 Camolin	1997
• N8 Abbeyleix	1997

Stage II information collected:	*Survey Date*
• N10 Stoneyford	2001
• N78 Athy	2001

- R417 Athy 2001
- N9 / R418 Castledermot 2001
- N81 Baltinglass 2001
- N9 / R700 Thomastown 2001

The RSI surveys allowed origin destination and trip purpose information to be compiled. Where there was an overlap of such information between the 1997 and 2001 surveys, the 2001 surveys took precedence in the development of the final matrices. Each RSI site was supplemented by a classified vehicular count.

5.3.2 Traffic Count Surveys

The traffic counts were collected in support of the RSI information in order to provide control totals such that a representative origin-destination matrix could be developed. Traffic counts were collected at the following locations:

Stage I information made available:	*Survey Date*
• N9 Carlow Town	1998
• N9 Thomastown	1998
• N11/N30 Enniscorthy	1998

Stage II information collected:	*Survey Date*
• N10 between Stonyford and N9	2001
• N78 between Athy and N80	2001
• R417 between Athy and Carlow	2001
• N9 between Castledermot and Carlow	2001
• R418 between Castledermot and Tullow	2001
• N81 between Baltinglass and Rathvilly	2001
• N9 between Thomastown and N10	2001
• R700 between Thomastown and New Ross	2001

The inclusion of the Stage I and Stage II surveys allowed the development of east-west screen lines through both the northern and southern section of the study area.

5.3.3 Journey Time Surveys

The requirement for journey time surveys was twofold. Firstly, the journey time information allowed verification of end-to-end journey times as predicted by the traffic model, providing an additional tool for calibration of the base year model. Secondly, the journey time information is an important input to the Economic Assessment, as it assists in the determination of the appropriate speed-flow function for each road link, and hence the improvements in journey times on existing roads as a result of reassignment of traffic onto the proposed route.

The journey time surveys were collected on all links throughout the modelled network, and included the following information:

- At least 6 measurements during the morning peak with a further 6 during the afternoon peak and off peak giving a total of 18 measurements along each link;
- Corresponding count of opposing link flows during the period of the journey time surveys, to verify results against actual traffic conditions.

All journey time surveys were undertaken over a 2 week period on a Tuesday, Wednesday and Thursday in February 2003.

The journey time surveys measured journey time and delay. Journey time is defined as the point to point time taken for undertaking a journey, while delay is defined as the time spent stationary while undertaking that journey as a result of traffic congestion or signals.

5.4 Traffic Growth

As the traffic model is relatively strategic in nature, the effect of individual developments would have limited impact on the model. Instead, the model development has been based on the forecast levels of growth in individual regions throughout the study area.

The forecast level of traffic growth has been based on the National Road Needs Study (NRNS), published in July 1998. The NRNS which represents only a single input into the NDP, has provided a basis upon which policy decisions for the development of the National Roads Network have been made for the period to 2019. The National Roads Authority (NRA) also recommends that it should form the basis of traffic forecasts to be used in current scheme appraisals.

Annex 2 of the report outlines growth projections along the Kilcullen to Waterford Corridor. Although projected growth rates for National Secondary routes are lower, Athy has been designated as a growth / development centre as part of the Strategic Planning Guidelines and the 1999 Kildare County Development Plan. This has led to the conclusion that growth on secondary routes within the Study Area will be higher than projected national rates and likely to be more in line with those on National Primary Routes. It has therefore been assumed that matrix growth factors for the N9 / N10 corridor can be derived from National Primary Road forecasts only. These are summarised below in Table 5.1.

Table 5.1 Traffic Growth Factors Adopted

Period	Light Vehicles (LV)	Heavy Commercial Vehicles (HCV)
1998	100	100
2000	110	109
2007	146	134
2022	187	162
2037	191	165

It is accepted that the adoption of the above growth rates can have a notable effect on the model output. Nevertheless, it is reasonable to assume continued strong levels of growth throughout the study area as the policies of the National Spatial Strategy are adopted, as transport links by road and rail improve, and as a result of increased pressure on land and housing in the capital.

5.5 Other Transport Links

Irrespective of the proposed route, it is understood that a number of relevant road schemes are likely to be adopted within the lifetime of the scheme. It is therefore

important that these links are incorporated into the study, such that the full impact of the proposed alignment can be appreciated. Key road links are included below:

- Carlow Southern Ring Road
- Carlow Inner Relief Road
- N25 Waterford Bypass

The above schemes have been included in all Do-Minimum and Do-Something future year scenarios. They have, however, been omitted from the base year assessment in order to reflect actual conditions.

5.6 Model Building and Calibration

The base year model was constructed as a 184 zone model, representing an increase over the corresponding cordoned national highway model which had 144 zones. This addition of 40 zones provided the required level of additional detail for the undertaking of a sufficiently robust assessment. The final network and 184 zone matrix were used for the base year assignment, which was subsequently calibrated in accordance with the UK DMRB guidelines.

The development of the traffic model addressed the potential for increased competition with the N8 and N11 corridors, and the possibility of traffic transfer from these parallel routes. The extent of such transfer would depend on:

- The ultimate origin and destination of trips;
- The level of service on the proposed route; and
- The competition of other committed and proposed road improvements on parallel routes.

From the OD surveys, it was possible to identify key origin-destination flows associated with the N9 / N10 corridor, but which are currently using an alternative parallel route. An estimate was made of the percentage trips which would reassign to the N9 / N10 corridor and this was found to be in the region of 10% to 20%. The net transfer from parallel routes was estimated to be in the region of 400 vehicles AADT (Annual Average Daily Traffic).

One important feature in the final model is the inclusion of 'preloads'. Following calibration, a residual shortfall in link flows is generally expected. This is essentially as a result of the omission of local trips from the model, which are difficult to achieve for a model of this scale. The base year preload is added to modelled link flows to represent this shortfall, and allows observed link flows to be reported from the model.

Future year models were developed by applying the relevant factors to the trip matrices and reassigning onto the future year road networks. Future year preloads on individual links are also estimated based on NRNS growth factors described earlier in this section.

5.7 N9 Kilcullen to Powerstown Scheme

The assessment of traffic for the full N9 / N10 Kilcullen to Waterford Scheme has been undertaken in two sections:

- For the whole N9 / N10 Kilcullen to Waterford Scheme, and

- For the N9 from Kilcullen to Powerstown.

The discussion of the development of the Traffic Model in the following sections relates to the scheme from Kilcullen to Powerstown. The base year (1998) and all future years were tested for the preferred N9 Kilcullen to Powerstown scheme, referred to as Route 9c31. The key findings of the analysis are summarised below.

5.7.1 Base Year 1998

The results of the 1998 Do-Minimum were included as part of the Traffic Assessment in order to provide a template for the assessment of the impacts of traffic growth through the study area. Do-Minimum flows for 1998 are included as a comparison for each future year. (See Figure 5.1 at end of chapter).

5.7.2 Opening Year 2007

A summary of traffic flows on key links for 2007 Opening Year is shown in Table 5.2. (See Figure 5.2 and 5.3 at end of chapter).

Table 5.2 Link Flows for 2007 Opening Year

	Link	1998 Existing	2007 Do-Minimum	2007 Do-Something
1	**J1 – J2**	0	0	19,405
2	**J2 – J3**	0	0	15,870
3	**J3 – J4**	0	0	10,430
4	**J4 – J5**	0	0	7,840
5	**N78: J1 to R415**	5,360	8,130	875
6	**N78: R415 to Athy**	5,300	8,085	590
7	**N78: Athy to N80**	5,060	8,020	5,540
8	**R417: Athy to Carlow**	3,400	4,660	4,550
9	**Athy Link**	0	0	4,930
10	**R418: Athy to Castledermot**	1,650	2,380	2,380
11	**Old N9: J1 to R415**	9,390	13,225	1,645
12	**Old N9: R747 to Castledermot**	9,700	13,635	1,050
13	**Old N9: Castledermot to J3**	9,340	13,145	3,455
14	**Old N9: J3 to Carlow**	9,700	13,145	8,895
15	**Old N9: Carlow to J5**	10,810	15,025	10,225
16	**N80: Carlow to J4**	5,100	7,375	7,725

The summary shows a notable impact of the scheme on traffic flows along the corridor. The main impacts are summarised below:

- A significant reduction on trips along the N78, where flows between Junction 1 and Athy decrease by the order of 90%, and transfer onto the proposed N9;
- A notable reduction on the existing N9 between Junction 1 and Junction 3, where a decrease of about 90% is experienced. The net effect is a reassignment of almost 19,000 vehicles onto the new road, with the maximum diversion occurring between junctions 1 and 2;
- Limited or no impact on the R417 from Athy to Carlow, and on the R418 from Athy to Castledermot;

- A reduction of approximately 43% on the N9 between Junction 3 and Junction 5 via Carlow. This is indicative of the availability of a bypass for the town, but also of the strength of Carlow as a trip attractor, which ensures that a high volume of residual trips remain on the old N9; and
- A slight increase on the link from Carlow to Junction 4. Although providing a link to the proposed road, the key access to Carlow will be from Junctions 3 and 5, and hence only a slight increase through Junction 4 would be expected.

In summary, the key effects appear to be a major shift from the N78 and existing N9 onto the proposed route between Junction 1 and 3. South of Junction 3, the impacts are more limited, as the existing N9 would be used as an access onto the proposed road for traffic from Carlow via Junctions 3 and 5.

The limited impact on Athy to Castledermot and Athy to Carlow trips suggests that the competition with these roads introduced by the proposed route is minimal, and that the roads cater for predominantly east-west flows.

Table 5.2 also shows that there is significant traffic growth expected over the period 1998 to 2007, accounting for an increase to the order of 50% on existing roads. This is in line with NRNS forecasts, which describe an exponential growth pattern with the greatest growth rates in the early years of the assessment.

5.7.3 Design Year 2022

A summary of traffic flows on key links for 2022 Design Year is shown in Table 5.3. (See Figure 5.4 and 5.5 at end of chapter)

Table 5.3 Link Flows for 2022 Design Year

	Link	1998 Existing	2022 Do-Minimum	2022 Do-Something
1	**J1 – J2**	0	0	24,745
2	**J2 – J3**	0	0	20,180
3	**J3 – J4**	0	0	13,215
4	**J4 – J5**	0	0	9,920
5	**N78: J1 to R415**	5,360	10,415	1,115
6	**N78; R415 to Athy**	5,300	10,420	780
7	**N78: Athy to N80**	5,060	10,275	7,110
8	**R417: Athy to Carlow**	3,400	6,030	5,845
9	**Athy Link**	0	0	6,310
10	**R418: Athy to Castledermot**	1,650	3,040	3,040
11	**Old N9: J1 to R415**	9,390	16,810	2,100
12	**Old N9: R747 to Castledermot**	9,700	17,275	1,335
13	**Old N9: Castledermot to J3**	9,340	16,680	4,420
14	**Old N9: J3 to Carlow**	9,700	16,680	11,385
15	**Old N9: Carlow to J5**	10,810	19,085	13,010
16	**N80: Carlow to J4**	5,100	9,410	9,855

The summary shows a similar impact as described for 2007. The table again demonstrates a decrease of up to of 90% along the N78, and on sections of the old N9, both similar to the findings for 2007. The impact throughout the network is in fact extremely similar for 2007 and 2022, suggesting that additional traffic growth is not adversely impacting on route choice. The traffic growth expected over the period 1998 to 2022 is, however, relatively significant, accounting for an increase to the order of 90% on existing roads when compared with 1998. Further increases on the proposed scheme between Years 2022 and 2027 will be of the order of 2%.

In summary, the proposed route is successful in attracting significant volumes of trips from existing parallel routes such as the old N9 and the N78, as well as marginal additional volumes from the N8 and N11. The result is a significant decrease on the alternative routes, leading to obvious accident savings along with the travel time improvements arising out of the proposed route.

A summary of total network vehicle hours and kilometres in Table 5.4 shows, as expected, a reduction in total network hours, with a marginal increase in network kilometres. This pattern is common with such a scheme, as drivers change their route to take advantage of faster, less congested roads, albeit there would be a minor increase in journey distance.

Table 5.4 Network Summary

Scenario	(10^6 VEH KM)	(10^3 VEH HRS)
2007 Do-Minimum	2.168	28.773
2007 Do-Something	2.196	27.938
2022 Do- Minimum	2.762	37.407
2022 Do-Something	2.796	36.418

5.8 Economic Assessment

5.8.1 COBA Parameters

A broad economic Cost Benefit assessment was undertaken during the route selection study and provided a key input to the selection of the preferred route option. The Cost Benefit exercise has, however, been repeated following the selection of the preferred route in order to provide an assessment of the 'Value for Money' provided by the scheme.

The Economic Assessment, undertaken on the basis of a Cost Benefit Analysis (COBA), provides a comparison of costs and benefits arising out of the construction, maintenance and use of the scheme that accrue to the community each year over the life of a scheme. Costs are expressed in 1996 prices and assume a discount rate of 5%. This allows the identification of all costs and benefits, the cost benefit ratio, and the Net Present Value of the scheme.

The assessment has used COBA10 in line with NRA guidelines. A number of adjustments have been made to the COBA input parameters to reflect Irish conditions. These parameters have been referenced from other studies on National Road schemes and have been modified for use in the N9 Kilcullen to Powerstown Scheme in consultation with the NRA. Amendments have also been made where appropriate to COBA10 default parameters such as to reflect actual

observed data collected during the traffic surveys. The main parameters are summarised below:

Scheme Years — It is assumed that construction will begin in 2004 / 2005. Construction is expected to last about 3 years, and hence opening year would be 2007. The evaluation has been undertaken assuming a 30-year horizon to 2036. The Present Value Year is taken as 1996.

Network — The network is classed as TNB (Non Built up Trunk Roads), with traffic input being as 2022 AADT. Accidents were calculated from existing road accident statistics.

Growth — Economic growth rates have been referenced from NRA assumptions regarding growth and reflect the rapid growth in the late 1990's. Economic growth rates are presented in Table5.5.

Table 5.5 Real Growth in Value of Time

Time Period	Assumed Annual Growth of Real Value of Time
1997 – 1999	8% p.a.
2000 – 2005	5% p.a.
2006 – 2036	2% p.a.

Seasonality Index — This index is the relationship between August daily flows and AADT. A seasonality index of 1.08 was applied from examination of NRA permanent count data on the N9.

Traffic Growth — Traffic growth has been interpreted from the National Road Needs Study growth rates for National Primary Routes as reproduced in Table 5.1.

Discount Rate — The discount rate of 5% has been applied.

Operating Costs — Vehicle operating costs have been referenced from previous schemes undertaken for the NRA in 2002 / 2003.

The resource cost of fuel consumption using the following function:

$C = (a + b/V + cV^2)(1 + mH + nH^2)$

Where C = cost in cent per kilometre per vehicle
V = average link speed in kilometres per hour
H = average link hilliness m/km
a, b, c, m and n are parameters defined for each vehicle category

The non-fuel elements of marginal resource are combined in the following formula:

$C = a^1 + b^1/V$

Where

C and V are defined as above, and

a1 and b1 are parameters defined for each vehicle category.

The parameters (in 1996 prices and values) used in this assessment are contained in Table 5.6.

Table 5.6 Operating Costs for COBA Vehicle Categories

Vehicle Type		COBA Operating Cost Parameters (€)				
		a (a')	b (b')	c	m	n
Car	Fuel Non-Fuel	0.881 (9.680)	45.940 (0)	0.000113	-0.0020	0.00010
LGV	Fuel Non-Fuel	1.370 (9.680)	58.830 (0)	0.000151	-0.0013	0.00007
OGV1	Fuel Non-Fuel	3.670 (25.810)	51.840 (0)	0.000227	0.00346	0.00005
OGV2	Fuel Non-Fuel	6.950 (25.810)	98.070 (0)	0.000431	0.00346	0.00005
PSV	Fuel Non-Fuel	5.420 (25.810)	87.380 (0)	0.000257	0.00346	0.00005

Fuel Cost Growth

No fuel cost growth has been incorporated into the COBA assessment relative to average costs.

Values of Time

The assessment uses €14.22 per person as a value of time in 1996 prices for working time, and €5.72 per person for non-working time. These values apply to both cars and HCV's and are agreed with the NRA.

Accident Rates

The assessment uses COBA default accident rates per million vehicle kilometres in order to determine a likely reduction in the number of accidents and the consequential saving. These are specified in the input files as a function of the road class.

Although COBA10 default accident rates have been used in the assessment, it is noted that the assessment uses the net reduction in accidents for the calculation of benefits, and hence the use of actual data is not imperative. Nevertheless, a comparison of COBA defaults with actual rates demonstrated that the default values reflected observed accident activity on the N9 / N10 corridor.

Flow Groups

The assessment assumes a distribution of the AADT into off-peak, adjacent-to-peak, and peak flow groups. These were derived from Automatic Traffic Count (ATC) information on the existing N9, north of Castledermot

Traffic Classes

A proportional split for vehicle types has been derived for the network based on the results of survey information. The analysis assumes 73% of vehicles to be category 1 (Car), 15% category 2 (LGV), 4% category 3 (OGV1), 7% category 4

(OGV2) with the remaining 1% category 5 (PSV). This is assumed throughout the assessment years.

Vehicle Occupancy

Agreed occupancy rates for different vehicle types for working and non-working time are primarily based on the results of the roadside interview surveys. No change in vehicle occupancy is applied throughout the period of the assessment. Table 5.7 identifies the vehicle occupancies for each mode and flow group.

Table 5.7 Vehicle Occupancy per COBA Vehicle Class

Vehicle Category	Time Mode	Occupancy
Car	Working	1.480
	Non-Working	1.630
LGV	Working	1.310
OGV1	Working	1.200
OGV2	Working	1.300
PSV	Working	1.000
	Non-Working	15.000

Time Proportions

The assessment assumes 35% of cars travel in time mode 1 (working time) while the remaining 65% travel during time mode 2 (non-working time), which again corresponds with the roadside interview data. All other vehicle categories are assumed travel entirely in mode 1 (working time).

Construction Costs

The Construction Cost is given as €443m in 2003 values with expenditure spread over the period from 2001 to 2008. The following list indicates the cost breakdown in Q1 of 2003 values for the N9 Kilcullen to Powerstown Scheme. The preliminary figures in current day prices (with the years in which these costs are incurred presented in parenthesis) are:

Project Office Costs	€4.2 million	(2001-2008)
Design Office Fees	€10.7 million	(2001-2008)
Pre-Construction Contract	€24.5 million	(2002-2005)
Land Costs and Legal Fees	€58.8 million	(2004-2006)
Construction Costs	€341.1 million	(2005-2008)
Supervision of Construction	€3.9 million	(2005-2008)

All costs and values have been input as Euro (€).

The assessment has produced the following results discounted to 1996 values and prices:

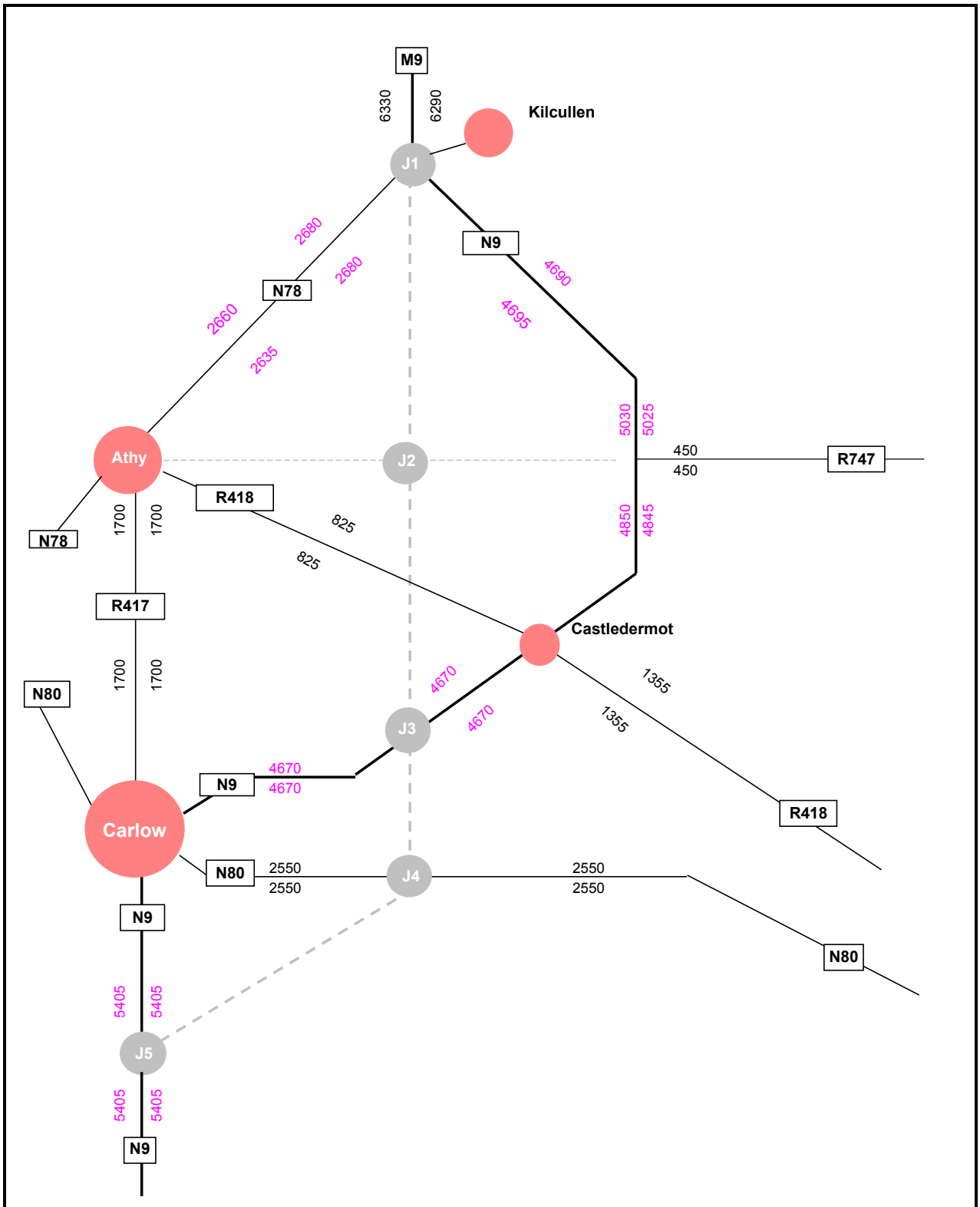
Net Present Value of Benefits (NPVB)	€321m
Net Present Value of Costs (NPVC)	€242m
Net Present Value (NPV)	€79m
Benefit:Cost Ratio	1.33
Internal Rate of Return	7.1%

5.9 Conclusions

The Traffic Assessment has demonstrated that the proposed scheme is a robust proposal, in terms of it's ability to attract traffic from existing North-South routes between Kilcullen and Powerstown, and its ability to provide improved access to Athy, Kilcullen, Castledermot, Carlow and Kilkenny without unduly increasing traffic on any unsuitable routes.

An assessment of the proposed scheme indicates link operation Levels of Service no lower than "C" in the 2022 design year, with a LoS of "B" over much of its length. The operational assessments of the junctions with the proposed scheme indicate all to be operating well within capacity during the 2022 forecast year.

The scheme also returns a reasonable Benefit : Cost Ratio indicating that the scheme will provide value for money. The analysis has been based on a thorough exercise which has resourced extensive background data, collected additional survey information, and made reference to accepted documentation, such as the National Road Needs Study, for the generation of demand forecasting.



Project Title: N9/N10 KILCULLEN TO WATERFORD SCHEME
KILCULLEN TO POWERSTOWN

NRA National Roads Authority
Project No. KE-99-140

Kildare County Council
National Roads Design Office

Roughan & O'Donovan - FaberMaunsell Alliance
Consulting Engineers

Roughan & O'Donovan
FABER MAUNSELL

Title: 1998 Base Year AADT

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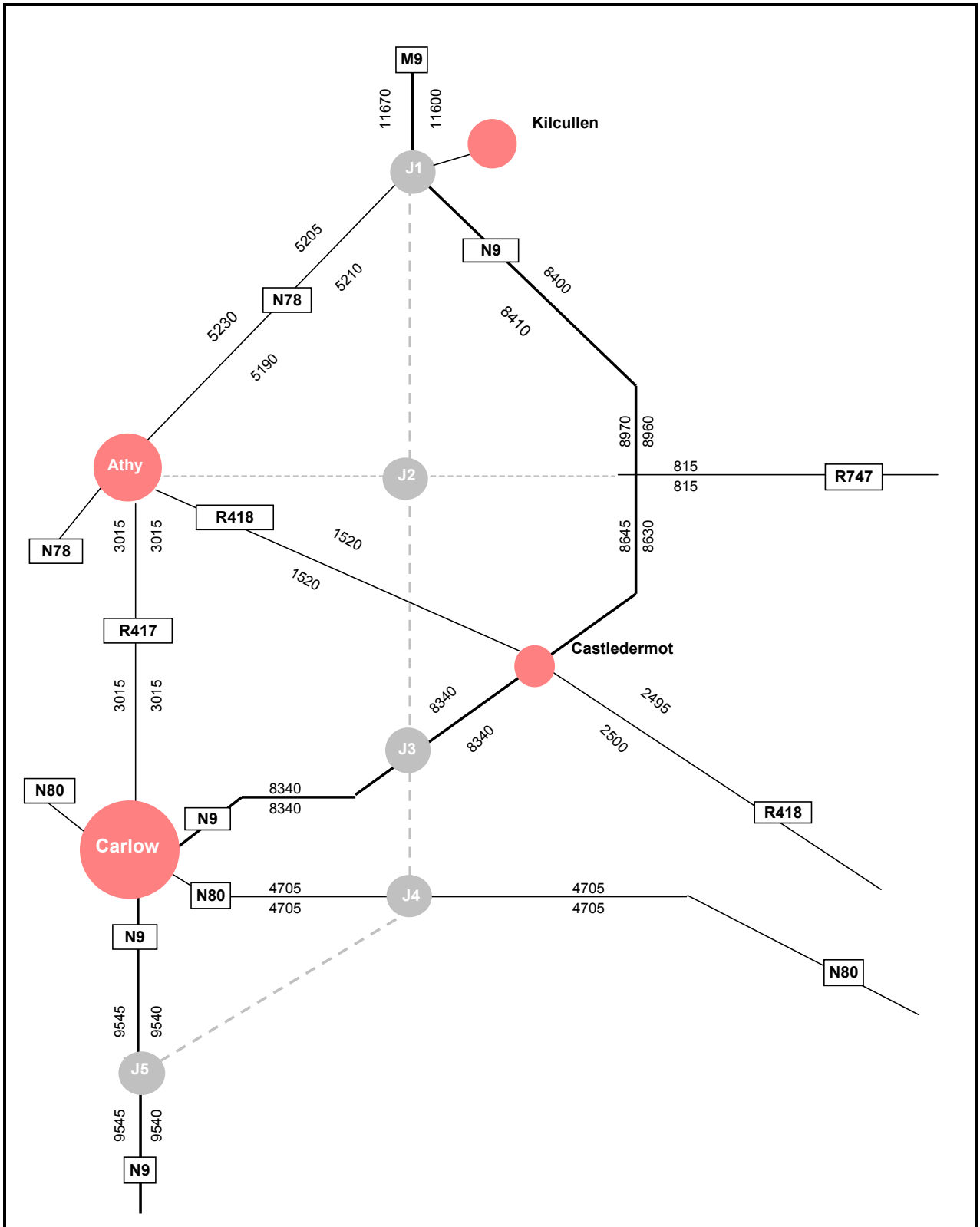

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KILCULLEN TO POWERSTOWN

NRA National Roads Authority
An tÚdarás um Bóithre Náisiúnta
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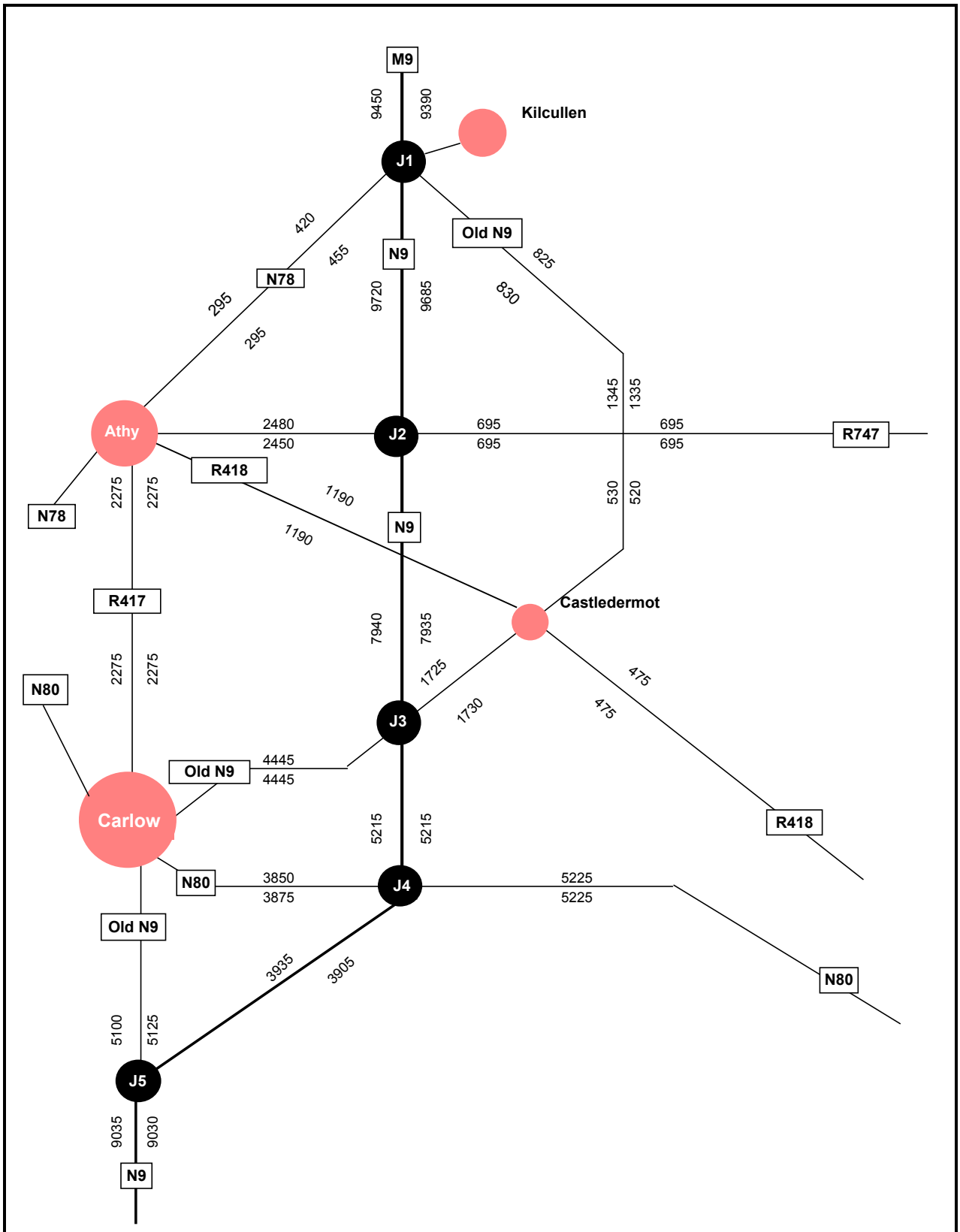
Checked: AOB	Scale NTS		
Approved: TM	Date Sept '03	Fig. 5.4	Rev.



Project Title: N9/N10 KILCULLEN TO WATERFORD SCHEME
KILCULLEN TO POWERSTOWN

NRA National Roads Authority
An tÚdarás um Bóithre Náisiúnta
Project No. KE-99-140

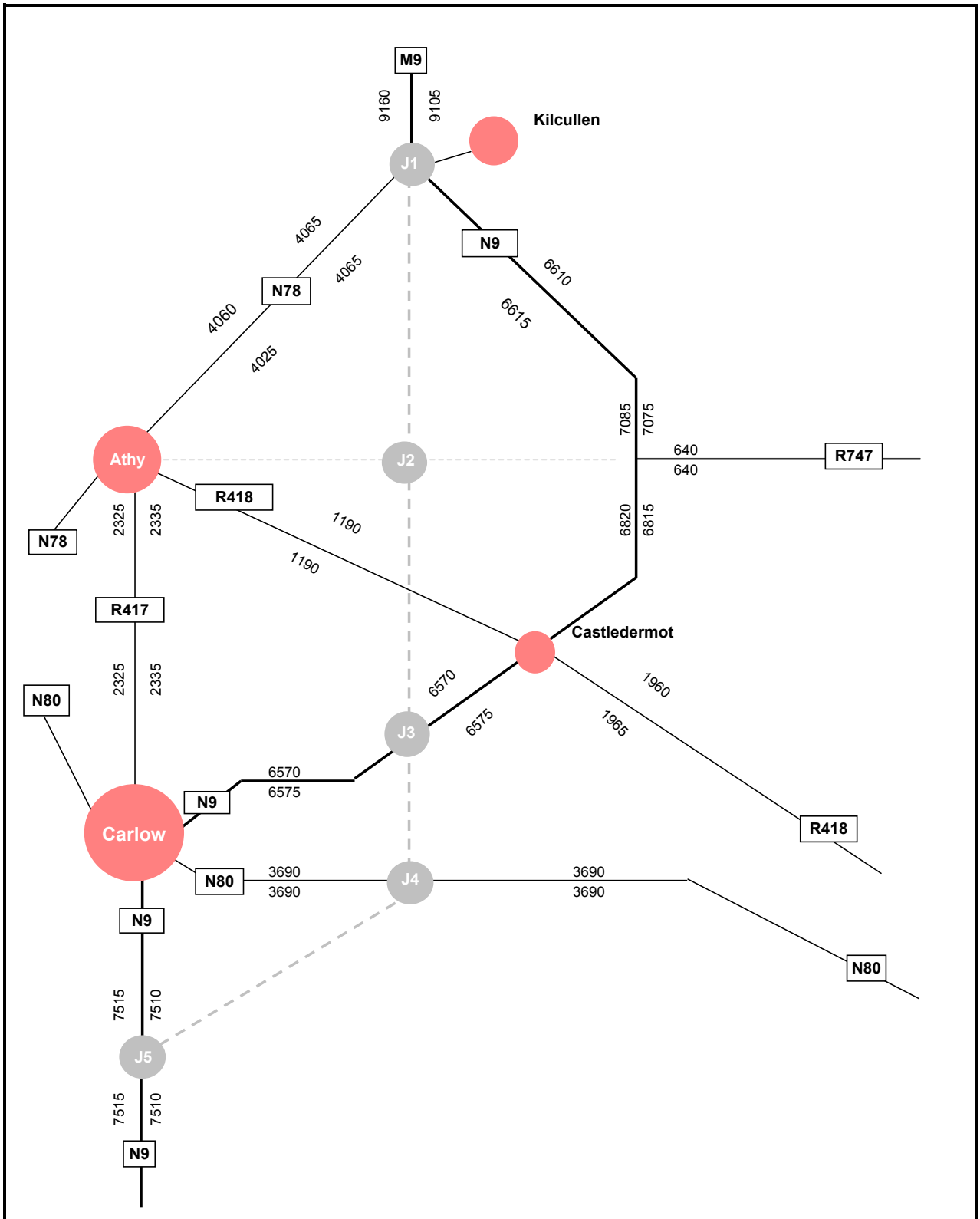
Kildare County Council
National Roads Design Office

Roughan & O'Donovan - FaberMaunsell Alliance
Consulting Engineers

Roughan & O'Donovan
FABER MAUNSELL

Title: 2007 Do-Something AADT

Designed: DPP	Job No. 00229	Status	EIS
Checked: AOB	Scale NTS	Fig.	5.3
Approved: TM	Date Sept '03	Rev.	



Project Title: N9/N10 KILCULLEN TO WATERFORD SCHEME
KILCULLEN TO POWERSTOWN

NRA National Roads Authority
Project No. KE-99-140

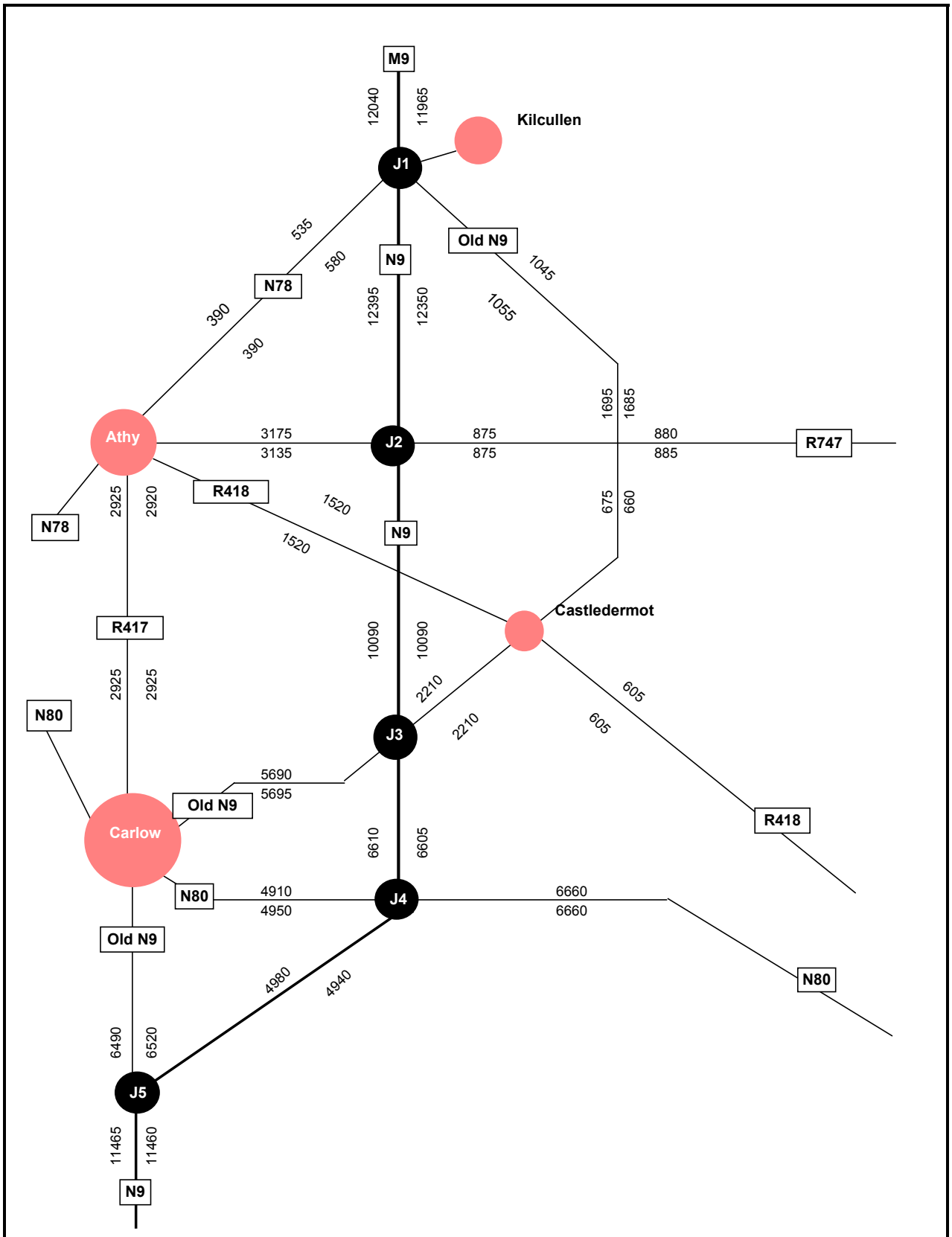
Kildare County Council
National Roads Design Office

Roughan & O'Donovan - FaberMaunsell Alliance
Consulting Engineers

Roughan & O'Donovan
FABER MAUNSELL

Title 2007 Do-Minimum AADT

Designed: DPP	Job No. 00229	Status EIS	
Checked: AOB	Scale NTS	Fig. 5.2	Rev.
Approved: TM	Date Sept '03		



Project Title: N9/N10 KILCULLEN TO WATERFORD SCHEME
KILCULLEN TO POWERSTOWN

NRA National Roads Authority
An tÚdarás um Bóithre Náisiúnta
Project No. KE-99-140

Kildare County Council
National Roads Design Office

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Title 2022 Do-Something
AADT

Designed: DPP	Job No. 00229	Status EIS	
Checked: AOB	Scale NTS	Fig. 5.5	Rev.
Approved: TM	Date Sept '03		