A31 Magherafelt Bypass

Stage 2 Scheme Assessment Report

Route Options Report

720336/B/R/9004 Version 3.0

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Contents

Executive Summary

Introduction and Purpose of the Report

In 2006 Mouchel (formally known as Mouchel Parkman) were commissioned to assist Roads Service Western Division in the progression of a Magherafelt Bypass scheme through to the completion of statutory procedures including an Environmental Statement, Direction Order and Vesting Order.

The purpose of this report is to identify the environmental, engineering, economic and traffic advantages and disadvantages and constraints associated with broadly defined improvement strategies in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 5 Section 1 TD37/93- Scheme Assessment Reporting. This report is the second step, known as a Stage 2 Scheme Assessment Report (SAR2) - Route Options Report and is part of a process of Scheme Assessments which will progress plans for a bypass around Magherafelt. This report recommends a preferred road improvement strategy.

Magherafelt and the A31

Magherafelt is a small but growing market town located to the north-west of Lough Neagh in Northern Ireland. It is strongly linked economically and historically to the farming sector and is surrounded by agricultural lands and small farms. As well as being at the centre of a network of small B and C class roads which serve the adjacent areas, it is located on the A31, an important strategic route for traffic from the west of Lough Neagh travelling to and from the main A6 Belfast to Londonderry Road.

Traffic entering and passing through Magherafelt converges in the town centre at what is known as the “Diamond”. The result of this convergence of through traffic and local traffic conflict, creates traffic congestion in the centre and at junctions in the town.

A31 Magherafelt Bypass – a brief history

Plans for a new road to relieve town centre congestion and reduce delays for through traffic have been in existence for some years, and were included in the 1976-1996 Magherafelt Area Plan, in the form of a bypass running on the eastern side of the town. A section of the planned relief road, Meadowbank Road, was constructed to local distributor standards by a developer to enable access for residential development. This historical route is included in the Magherafelt Area Plan 2015 – Draft Plan.

A31 Magherafelt Bypass – recent traffic studies and current status

The Department of Regional Development, Roads Service, hereafter referred to as Roads Service, commissioned Faber Maunsell to prepare a number of traffic related studies in Magherafelt which included a Bypass Options study completed in 2002 and updated in 2005. This report was based on the New Approach to Appraisal; it considered 4 possible

route options and concluded with the historical route. On the basis of the resulting Economic Appraisal, an A31 Bypass for Magherafelt was included in the Regional Strategic Transport Network Transport Plan (RSTN TP) 2015 as a major scheme to be added to the 10 year forward planning schedule. Within this plan the A31 between Castledawson and Moneymore is classified as a Trunk Road.

Methodology and Findings Summary

Roads Service has requested that Mouchel assess the scheme using DMRB: TD 37/93 Volume 5 Section 1 Part 2 'Scheme Assessment Reporting' to ensure that all plausible constraints are considered. The assessment looks at all aspects of the scheme in detail incorporating Engineering, Environment, Safety, Economy, Accessibility and Integration.

Three route options have been evaluated: the Blue Route; the historic Road Service Eastern Bypass route and the route proposed in the Magherafelt Area Plan 2015 Draft Plan. The Purple Route; which avoids the worst of the potential congestion to the north of Magherafelt, and the Pink Route; which provides a direct link to the Castledawson Roundabout.

Engineering Assessment

Preliminary consideration of the topography and land use, geology and geomorphology, hydrology and drainage and public utilities within the alternative corridors has been prepared. The key results include:

- *Design Constraints*

The Purple and Pink Routes allow for a design speed for 100kph. The Blue Route will require a reduction in design speed from 100kph to 80kph for the majority of its length due to buildability issues and 50kph along Meadowbank Road due to the area being significantly constrained by existing developments.

- *Geotechnical Assessment*

The Blue Route will have a lower volume of earthworks due to its shorter length of 3.4km when compared to the 4.9km of the Purple Route and the Pink Route which is 5.8km in length. The Blue Route will require retaining structures.

- *Hydrology and Drainage Assessment*

The Blue Route has the least road runoff and the least number of watercourse crossings out of the proposed options.

Environmental Assessment

Key constraints and features associated with the proposed corridors have been identified as part of the assessment against the twelve DMRB environment topics areas. Some of the key findings included:

- *Land Use*

All of the route options cut through Best and Most Versatile (BMV) land upon connection to the A31 Moneymore Road. The Blue Route has the least impact on BMV land for the length of its route, followed by the Pink Route and the Purple Route has the greatest impact. The Pink and Purple Routes predominately traverse a farmland landscape and will result in varying degrees of severance of viable agricultural units and field boundaries, creating accessibility issues and possibly creating disturbance related impacts upon livestock and/or crop management.

- *Ecology and Nature*

The habitats contained within the three route options included cattle grazed pasture bordered by hedgerows, broad-leaved semi natural woodlands, plantation woodlands, watercourses, farmyards and ponds.

The invertebrate survey found no rare or protected species along in the study area, and no white-clawed crayfish were found in the area.

- *Landscape*

The Pink Route is the longest of the three options and will have the greatest impact upon the landscape, it severs more fields and has the greatest earthwork requirement impacting upon landscape pattern. A total of 62 hedgerows will be severed and 11 watercourse crossings will be required.

Both the Pink and Purple will have similar visual impacts as they are both set within the landscape to the east with existing vegetation providing a screen for local receptors. Although the Pink Route is the only one of the three options which does not encroach on any areas designated as Local Landscape Policy Areas, with the Blue having the greatest impact on this resource.

Traffic and Economy Assessment

Though forecast shows that any of the three proposed routes will offer significant benefits to the traffic, Pink Route will have more benefits as compared to the Blue Route or Purple Route.

Pink Route will not only reduce traffic from the town centre but will also reduce traffic for a longer section of the existing A31, in particular the A31 Castledawson Road. Whereas with Blue or Purple Route, A31 Castledawson Road will become more heavily congested.

Pink Route will also provide a better alternative route for the strategic (long distance) traffic which is currently passing through Magherafelt Town Centre.

Additionally Pink Route will have the highest savings from accident reductions and will also have the highest NPV (net present value of benefits).

Conclusion

The Pink Route is the best option from a traffic point of view, providing a direct link to the A6 Castledawson Roundabout and the highest savings from accident reductions and highest NPV (net present value of benefits) when compared to the other options (excluding the cost and benefits of the A31 Castledawson Road Dualling). The Pink Route will also only require the demolition of one property, a constraint that may be removed at preferred route stage.

The Pink Route is therefore recommended to be progressed to Stage 3 – development of preferred option and Statutory Orders.

1 Introduction

1.1 Magherafelt and the A31

Magherafelt is a small but growing market town located to the north-west of Lough Neagh in Northern Ireland. It is strongly linked economically and historically to the farming sector and is surrounded by agricultural lands and small farms. As well as being at the centre of a network of small B and C class roads which serve the adjacent areas, it is located on the A31, an important strategic route for traffic from the west of Lough Neagh travelling to and from the main A6 Belfast to Londonderry Road. Traffic entering and passing through Magherafelt converges in the town centre at what is known as the "Diamond". The result of this convergence, of through traffic and local traffic conflict, creates traffic congestion in the centre and at junctions in the town.

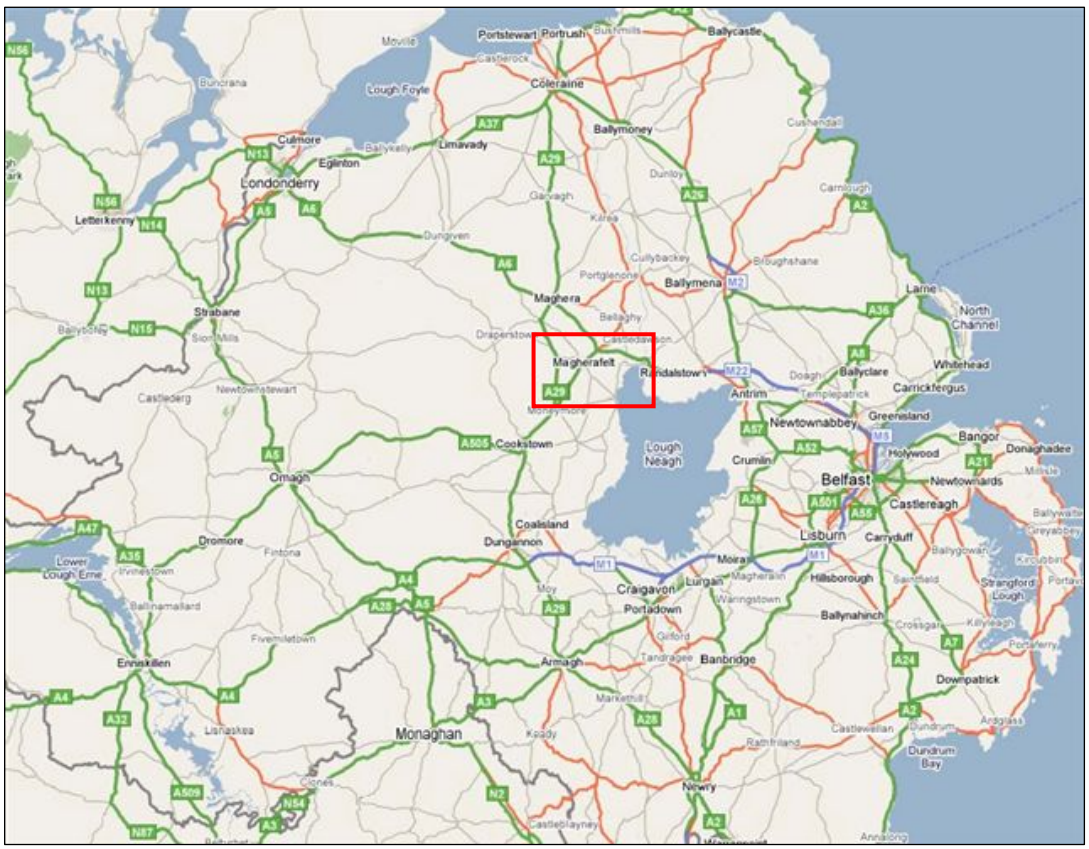


Figure 1.1 Map of Northern Ireland highlighting the location of Magherafelt

Plans for a road to relieve town centre congestion and reduce delays for through traffic have been in existence for many years and were included in the 1976-1996 Magherafelt Area Plan (adopted 1st January 1981). A section of the planned road was constructed to local distributor standards by a developer to enable access to their residential development. This section is called Meadowbank Road. Furthermore Roads Service commissioned Faber Maunsell to undertake a number of traffic related studies in Magherafelt which

included a Bypass Options study completed in 2002 and updated in 2005, in which a list of options were examined including public transport proposals. However, after examination of the appropriateness of the public transport proposals, no options were taken further. In addition to these transport proposals there were four possible bypass route options investigated those within the progressed improvement corridor, namely the Blue, Red and Green Routes formed some of the initial proposed route options.

As a result of the FM studies the A31 Bypass for Magherafelt was included in the Magherafelt Area Plan 2015 - Draft Plan and the Regional Strategic Transport Network Transport Plan (RSTN TP) 2015. Within the RSTN TP 2015 the A31 between Castledawson and Moneymore has been classified as a Trunk Road.

1.2 Format of Report

Following the Introduction, Section 2 presents the Scheme Brief, Section 3 describes the Existing Situation and Section 4 details the Description of Alternative Route Options with Section 5 presenting the Engineering Assessment of Route Options including preliminary scheme cost estimates and Section 6 describes the Land Use. Section 7 presents the Environmental Assessment of Route Options; Section 8 presents the Traffic Assessment Summary, Section 9 presents the Existing A31 Castledawson Road Dualling and Section 10 presents the Summary of Findings / Conclusions of the report.

1.3 Focus of Assessment

The primary focus of this assessment is to confirm a Preferred Route that can be developed and progressed through the statutory orders.

The key objectives of the proposed Magherafelt bypass are:

- to improve road safety
- to relieve traffic
- to improve the quality of life for residents
- to reduce journey times along the A31 Corridor
- to improve the road network between the north and south of the Province
- to minimise the impact on the natural and built environment
- to achieve a positive return on a financial investment.

2 Scheme Brief

In 2006 Mouchel (formally known as Mouchel Parkman) were commissioned to assist Roads Service, Western Division in the progression of a Magherafelt Bypass. The Scheme brief included the following tasks:

- review existing information
- recommend a preferred route improvement corridor
- recommend preferred road improvement strategy and prepare an Economic Appraisal
- prepare Environmental Statement for the preferred road improvement strategy and revise the economic appraisal
- advance the scheme through Statutory Orders.

This report presents the review of the preferred improvement corridor constraints, presents route options and recommends a preferred road improvement strategy.

3 Existing Situation

3.1 Introduction

This section summarises the existing engineering, traffic and environmental conditions in relation to the existing highway network including any special features which can be identified at this stage. Reference is also made to changes for the future.

3.1.1 Description of Current Network

Magherafelt is situated in County Londonderry with an estimated population of 8,300 in 2001. The town is the local hub for shopping and has a large mix of schools and colleges. **Figure 3.1** shows a map of Magherafelt and surrounding area identifying the main roads entering the town.

Figure 3.1 Main roads entering Magherafelt

The town lies approximately 35 miles from Belfast and is situated to the north west of Lough Neagh. It is served by the A31 trunk road which splits the settlement almost in half on a north east - south west axis.

Appendix A Figure 3.2 shows a map of Magherafelt highlighting the existing situation. The main arterial routes converging in the town clockwise from the north include the:

- A31 - A6 and Castledawson Road
- C560 – Aughrim Road
- B160 – Ballyronan Road
- A31 - Moneymore Road
- B40 – Desertmartin Road
- B42 – Tobermore Road.

3.2 Existing Engineering Condition

The A31 is a single carriageway trunk road with one lane in each direction. It runs from the A6 at Castledawson Roundabout in a south-westerly direction passing through the town of Magherafelt, to the A29 at Moneymore. In Magherafelt, there are four roundabouts, three of which are mini-roundabouts together with several side roads and numerous vehicular access points. Along the main trunk road through the town, on-street parking is permitted on Church Street, Broad Street and Queens Street.

Faber Maunsell conducted a Parking Study in April 2005 and recommended a series of proposed traffic engineering and traffic management solutions to provide short to medium term improvements for Magherafelt and alleviate existing traffic problems in the interim period until the construction of a bypass around the town. These include the introduction of time restricted parking along King Street and pay and display for Broad Street, Rainey Street, Queen Street and Market Street. The Sub-Regional Transport Plan 2015 – Technical Supplement for Magherafelt District Council proposes converting both the Broad Street / Rainey Street / Market Street and Broad Street / Union Street junctions to traffic signal control junctions and the inclusion of pedestrian facilities at each. The plan also recommends junction improvements at the Castledawson Road / Station Road, Church Street / King Street and Hospital Road / Garden Street / Union Road junctions.

A number of watercourses flow through the Magherafelt study area, the predominant flow is from west to east; the undesignated drains to the west flow through the town to become minor watercourses on the east side. To the east of the town, the flow is from south east to north east, converging to meet the River Moyola north east of the study area. None of these drains require significant crossings, but to the south east of the town, low points without any access to a watercourse are vulnerable to localised pooling of water.

The Magherafelt district is dominated by several hills namely: the Mullaghboy Hill; a substantial rocky hill which rises steeply to the west of the town, Irish Hill; a hill with rock

close to the surface and a thin covering of peat, located north of the town close to Station Road. Donnelly's Hill; a clay rise to the north, adjoining Station Road and Nicholas Hill; a clay hill to the north, east of Aghagaskin Road. Finally Windmill Hill; is a gravel mound to the east of the town close to Pound Lane with Killowen and Crockthomas Hill; a clay hill to the south of the town.

In addition to these prominent hills, there are a number of low hills present: Farm Hill; a clay hill which rises to the north east at Castledawson Roundabout, Bells Hill; a clay hill to the south of the A6 on the Bells Road, and Castle Hill; a clay hill extending between Bells Road and Annaghmore Road.

3.3 Existing Traffic Conditions

There are a number of strategic roads in the vicinity of Magherafelt, including the A6, the A29 and the A31. The A31 travels directly through Magherafelt Town Centre and carries the major regional traffic flow generated on the west side of Lough Neagh on a north-south route with an average daily traffic flow of approximately 17,500 vehicles at Church Street. This has led to considerable delays and congestion being experienced through Magherafelt over the last decade. The capacity of the A31 is severely restricted by roundabouts, side roads and on-street parking, causing congestion along the route, particularly in the weekday AM and PM peak periods. This is further compounded by a combination of through and school run traffic competing for road space within the town centre. Many other roads in the town centre also experience considerable congestion, including Rainey Street with an average daily traffic of approximately 12,000 and Ballyronan Road with an average daily traffic of approximately 10,000. The Ballyronan and Aughrim Roads are also used to provide a gateway to the east of the province, linking with the B18 outside Magherafelt town.

Anecdotal evidence suggests that through traffic manages to avoid the congestion in the town, either bypassing the town centre using a combination of side roads within the town, or using the B18 from Toome via Ballyronan to Moneymore.

The local Magherafelt road network was surveyed extensively using various types of traffic counts, the results of which were analysed and it was found that the AM peak hour for the whole network occurs from 08:15 – 09:15, and the PM peak hour lies between 17:00 and 18:00. The Inter-peak is an average of the hours between 10:00 and 16:00.

The relevant survey data which provides us with information on the current traffic conditions is explained in Sections 3.3.1 to 3.3.5.

3.3.1 Roadside Interviews (RSIs) and Associated Link Counts

The Roadside Interviews were undertaken at eight locations in the town centre, shown in **Appendix A Figure 3.3** and **Appendix A Figure 3.4** over a two week period in May 2007. They were conducted to provide Origin-Destination data for input into a detailed TRIPS transport

model, as were the link counts carried out at the same time and location. Using this information, we can calculate the percentage of strategic traffic that currently travels through Magherafelt unnecessarily en route elsewhere, approximately 26% in the AM peak, 17% in the Inter-peak and 26% in the PM peak.

As the survey period of the link counts was minimal in comparison to the ATCs, 12 hours as opposed to five weeks, and they occurred during abnormal traffic flows, while the RSI's were being conducted, the flow data from the ATCs, presented in Section 3.3.2, are considered a better representation of existing traffic flows in the area.

3.3.2 Automatic Traffic Counters (ATCs)

ATCs were installed for a five week period from 17th April to 20th May 2007 at the eight RSI locations, two of which were along the A31.

Figure 3.5 and **Figure 3.6** depicts the average weekday traffic flows from 07:00 – 19:00 for the A31 Moneymore Road to the south of the town, and the A31 Church Street to the north of the town. The flows in both directions are fairly similar on Moneymore Road but the outbound flow is generally larger then the inbound flow at all times on Church Street. The data suggests that the morning peak hour lies between 07:30 and 09:00 for both directions on the A31, while the evening peak hour is between 17:00 and 18:30, again for both directions.

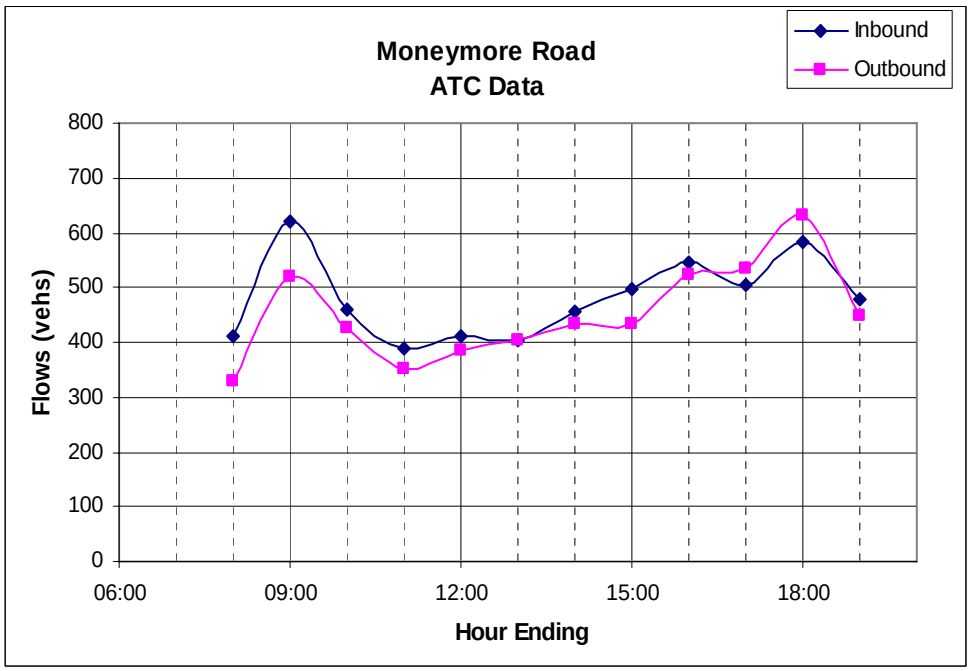


Figure 3-5 Average Weekday 12 hr ATC Data for A31 Moneymore Road

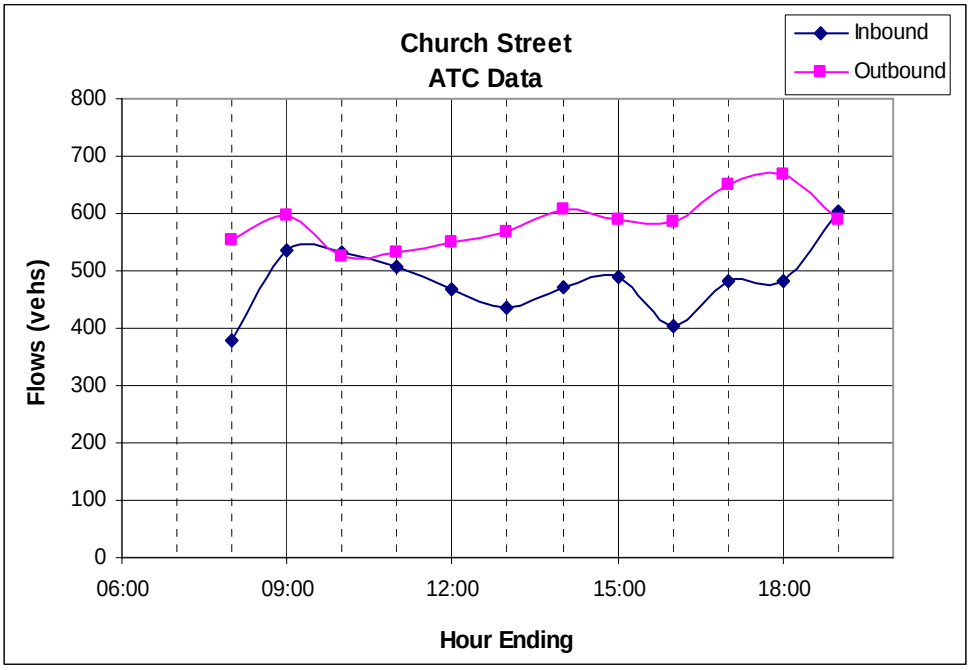


Figure 3.6 Average Weekday 12 hr ATC Data for A 31 Church Street

Figure 3.7 and Figure 3.8 show the average weekday traffic flows along Rainey Street, beside Westland Road, and Ballyronan Road, beside Queens Avenue, respectively.

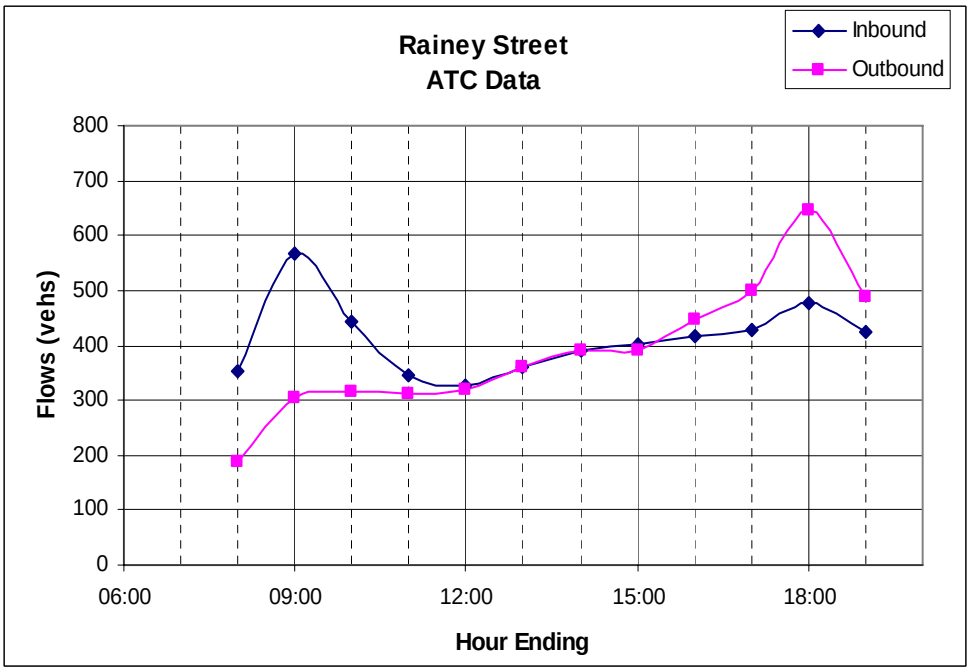


Figure 3.7 Average Weekday 12 hr ATC Data for Rainey Street

Although Rainey Street is clearly less trafficked than the A31, it carries significant flows. The peak AM flow clearly occurs between 08:00 and 09:30, while the PM peak occurs

between 17:00 and 18:00. The flows follow the typical tidal effect with the inbound being greater in the AM peak and the outbound in the PM peak.

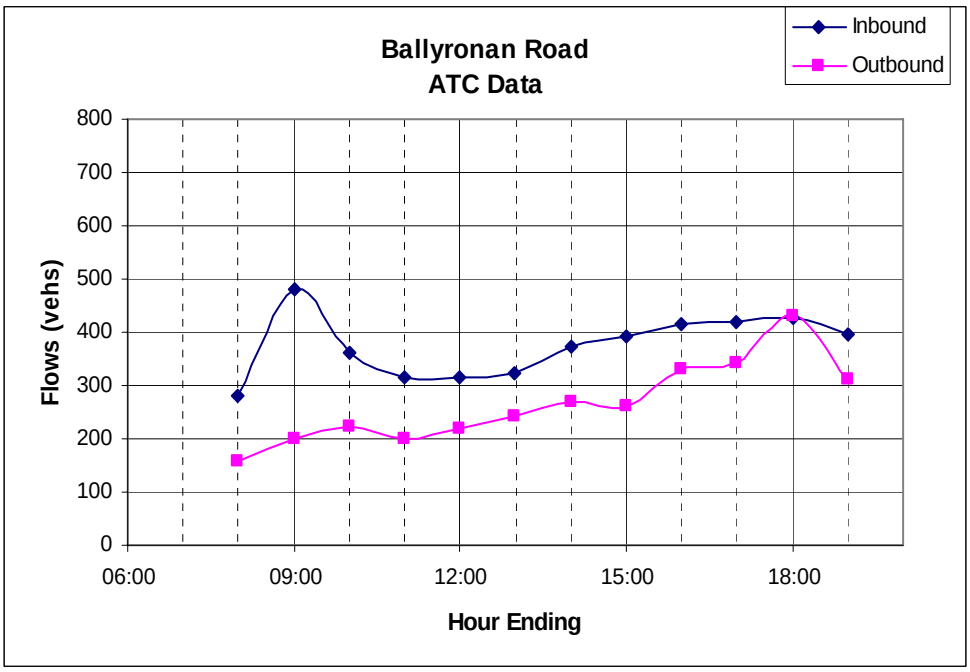


Figure 3.8 Average Weekday 12 hr ATC Data for Ballyronan Road

It can be observed that the magnitude of the traffic flows in the inbound direction is higher at all times which suggest that there is no tidal effect associated with the traffic movements along this route.

It can be seen from the presented graphs that although there are definite AM and PM peaks, the traffic levels remain high throughout the day. This may be due to the traffic generated during the day by the large number of schools and shops in the area.

3.3.3 Turning Count Surveys (TCSs)

Manual classified turning count surveys were undertaken at 18 sites within the study area, for 12 hours, during June 2007. Traffic flow diagrams showing the AM and PM peak flows at six of the larger junctions, and a location plan, is shown in **Appendix A Figure 3.9a, Appendix A Figure 3.9b** and **Appendix A Figure 3.10.**

It is clear from the traffic flow diagrams that the heaviest movements are along the A31 at all points, with heavy traffic also travelling along Rainey Street, Market Street, Ballyronan Road and Aughrim Road.

3.3.4 Journey Time Surveys

Journey Time Surveys were carried out for five routes in the Magherafelt area, shown in **Appendix A Figure 3.11**, one of which, Route 4, runs along the A31. **Figure 3.12** and **Figure 3.13**

below show the average journey time for this route during the AM period (07:30-09:30), PM period (16:30-18:30), Inter-peak period (10:00-16:00) and off peak period (06:30-07:30/20:00-21:00).

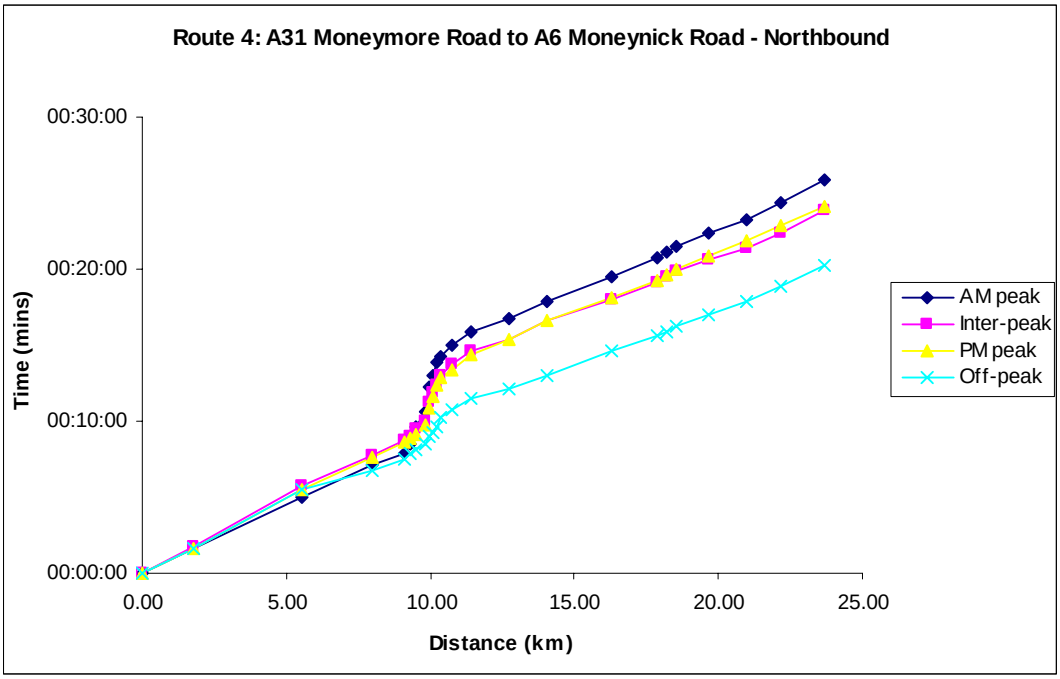


Figure 3.12 Journey Time data - Route 4 - Northbound

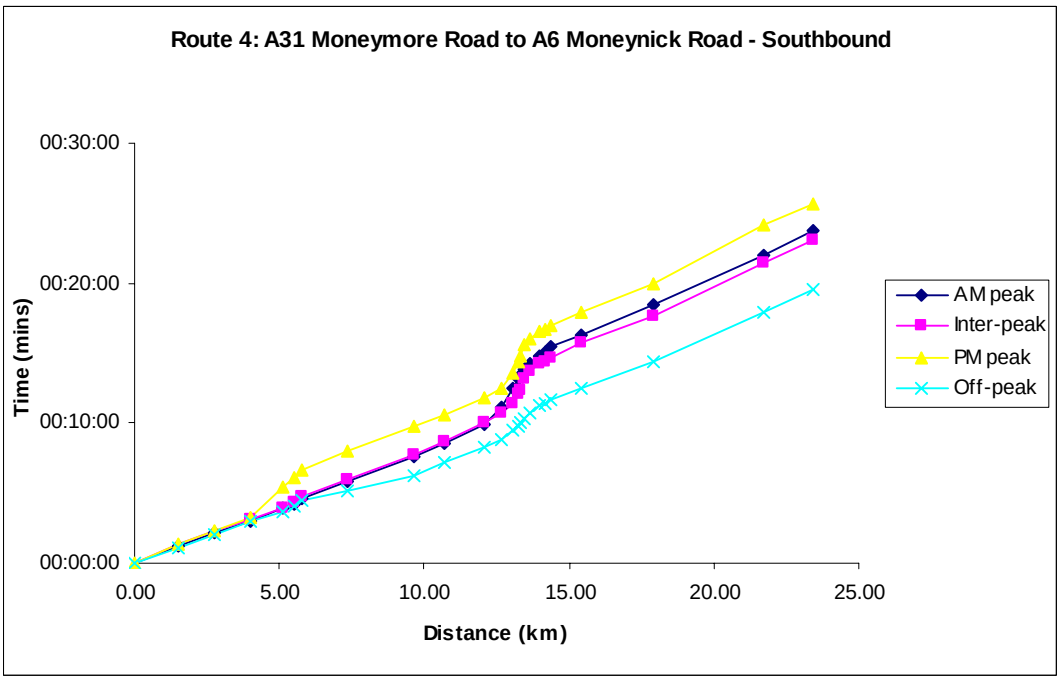


Figure 3.13 Journey Time data – Route 4 - Southbound

It is clear from the graphs that the journey time along the A31 is at its highest during the PM peak in the southbound direction, and during the AM peak in the northbound direction. The journey time on this route does not differ significantly however during the AM, PM or Inter-peak period remaining high throughout, but it is noticeably shorter, by up to five minutes, during the off peak. This suggests congestion problems continually throughout the day with slow moving traffic and queues occurring at all times, except during off peak times. There was considerable queuing experienced during the journey time surveys with an average of 34 seconds spent queuing during the AM peak, 40 seconds during the Inter-peak and 1 minute 20 seconds during the PM peak in the southbound direction. In the northbound direction, an average of 1 minute 10 seconds was spend queuing during the AM peak, 1 minute 10 seconds during the Inter-peak and 1 minute 27 in the PM peak. There was virtually no queuing however during the off peak.

3.3.5 Traffic Accidents

Details of the traffic accidents which took place between 2003 and 2007 on the road network in and around Magherafelt have been collected and correlated. The road network investigated will form the basis of the traffic model for the bypass. **Appendix A Figure 3.14** shows the accidents on the Modelled Road Network – Around Magherafelt and **Appendix A Figure 3.15** shows the accidents within Magherafelt.

3.3.6 Summary

The existing traffic conditions have been analysed in detail and they show there is high traffic flows, and subsequent congestion, experienced along the strategic A31 Corridor during peak periods, and on some of the smaller side roads. This is illustrated by the journey time surveys, which decrease significantly during the off peak and show considerable time spent queuing during the peak times. A considerable percentage of the heavy traffic flows in Magherafelt Town Centre, 26% in the AM peak, is strategic traffic which is travelling though Magherafelt unnecessarily and will therefore use the bypass in the future.

From our analysis, we have established that the AM peak lies between 08:00 and 09:30, depending on the location in the road network, and between 16:45 and 18:00 for the PM peak, again depending on the location. Over the entire network, the AM peak hour occurs from 08:15–09:15 and the PM peak occurs from 17:00–18:00.

3.4 Existing Environmental Conditions

Magherafelt is a Plantation Town, the origins of which date back to around 1425, built around a central Diamond which forms the heart of the town. This legacy is still evident today, with documented evidence suggesting settlement from Early Christian Times (500 AD). The town displays strong historic market town character, expressed by the variety of building materials, development patterns, open spaces and historical / cultural associations. There are a number of listed buildings within the town centre, several of which are on the main A31 trunk road.

The landscape of Magherafelt district is characterised by ridges and shallow hills which occasionally display sharp slope breaks and distinctive conical hills. Several locations in the landscape offer expansive views towards Magherafelt's urban fringe. The area is steeped in history, containing many relics of the past scattered throughout its diverse landscape.

Land use is primarily focused on rural economic activity. Commercial, industrial and residential uses are centrally located in Magherafelt. The majority of agricultural land beyond the town centre is interspersed with woodland, parkland and fragmented settlement. Land to the south-west of Magherafelt remains undeveloped.

Development has emerged along and between main arterial routes which radiate from the town centre. Traffic through Magherafelt currently generates air and noise pollution, especially at peak hours in the town centre and near schools. It is envisaged that the implementation of development growth planned as part of the Magherafelt Area Plan 2015 – Draft Plan will exacerbate these problems.

4 Description of Alternative Route Options

4.1 Route Option Evolution

From the Stage 1 Scheme Assessment Report 1 (SAR1), it was concluded that the Eastern and Eastern Extension Corridors provided the greatest scope for potential improvement strategies; the progressed corridor is shown in **Appendix A Figure 4.1.** Initially five route options were evaluated presented in **Appendix A Figure 4.2**:

- Blue Route ~ the historic Road Service Eastern Bypass route and the route proposed in the Magherafelt Area Plan 2015 - Draft Plan
- Red Route ~ a developer proposed Eastern Bypass
- Green Route ~ between the Red and Blue, a revised Eastern Bypass proposed by Roads Service
- Purple Route ~ which avoids the worst of the potential congestion to the north of Magherafelt
- Pink Route ~ which provides a direct link to the Castledawson Roundabout.

4.1.1 Route Options Workshop

In September 2007, a Route Options Workshop was held to review the constraints data and option development for the A31 Magherafelt Bypass. The workshop was attended by members of the Mouchel design team, Roads Service and independent members of both organisations.

Constraints within the study area were presented and the impact of each route was described. The constraints identified were presented under the topics detailed within DMRB: TD37/93 Volume 5 Section 1 Part 2 'Scheme Assessment Reporting' namely Engineering, Traffic and Economics and Environment. Each of these topics carried an equal weighting. Each participant was asked to score the route options under discipline specific constraints. Each discipline constraint was weighted and a correlation of all the attendee's scores was created. **Appendix B** presents the scoring matrix showing each constraint, its corresponding weighting and the total participant score.

The workshop ranked the routes as follows: 1st Pink
2nd Purple
3rd Red
4th Green
5th Blue (this is the historic route and the route contained with the Magherafelt Area Plan 2015 – Draft Plan).

With the next step in the process being a Public Consultation Day to ascertain the view of the Public and further inform the assessment process, the conclusions of the workshop were as follows:

- to present the Pink, Purple and Blue Routes
- to present 100m wide route corridors rather than an engineered route (as the alignment was not fixed)
- the Pink, Purple and Blue Routes all have the same southern tie-in at Moneymore Road opposite Coolshinney, an alternative Pink Route Corridor tying into Moneymore south of Ballymoghan Road would be presented to allow for additional feedback.

4.1.2 Public Consultation Day

On the 24th of October 2007, the afore mentioned three route corridors were presented to the people of Magherafelt. **Appendix C** shows the brochure provided, which was mirrored by the display at the venue on the day. It was also highlighted to the public that the event was held to receive their input into the design and that if they lived in or had property located anywhere within the study area, then they may still be affected by the project proposals.

Of the three route corridors presented, the Pink Route Corridor was the most well received, as confirmed by the questionnaires provided on the day and subsequently returned. **Appendix D** shows the questionnaire template and a summary of the feedback received.

This information along with the assessments contained within this report and the conclusions of the Route Option Workshop will form the basis of the recommendation of a preferred road improvement strategy.

Please note:

the alternative Pink Route Corridor tying into Moneymore Road south of Ballymoghan Road, will not be assessed within this document, however, if the Pink Route is found to be the preferred route the alternative tie-in will be assessed within the remit of the Scheme Assessment Report 3.

4.2 Route Options

Appendix A Figure 4.3 shows the assessed route options; the Blue and Pink Routes are the extremities of the options, the Blue Route being the closest to the town and the Pink Route being the farthest away, with the Purple Route as an intermediary option.

4.2.1 Blue Route

Commences at the southern end of Magherafelt on the A31 Moneymore Road opposite Coolshinney Road and extends to the east of the town, crossing Killyfaddy Road. The route then links into Meadowbank Road as indicated in the Area Plan, this section is heavily constrained due to residential properties and the Meadowbank Sports Arena. The route then crosses Ballyronan Road and continues north on left hand curve, to meet Aughrim Road.

It then extends north west towards the A31 Castledawson Road, crossing Pound Road and terminating just north of the existing A31 junction with Pound Road, close to Sperrin Integrated College.

The Blue Route is approximately 3.4km.

4.2.2 Purple Route

This begins similarly to the Blue on the A31 Moneymore Road opposite Coolshinney Road and extends easterly towards Killyfaddy Road. It continues in a north-easterly direction towards Ballyronan Road south of the golf club and concrete works. The route then crosses Loves Road through to Aughrim Road. It then extends north-westerly to the A31 Castledawson Road south of Polepatrick Cemetery.

The Purple Route is approximately 4.9km.

4.2.3 Pink Route

Commences at the southern end of Magherafelt on the A31 Moneymore Road opposite Coolshinney Road and extends to the east of the town. The route crosses Killyfaddy Road just south of the Ballymoghan Drain and crosses Ballyronan Road just north of the overhead power lines. It extends north-easterly on a left hand curve crossing Loves Road and Aughrim Road. It then continues north crossing Killyneese Road, west of the Killyneese Water Treatment Works, terminating at the A6 Castledawson Roundabout.

The Pink Route is approximately 5.8km.

4.3 Preliminary Scheme Cost Estimates

4.3.1 Background

In 2005, Faber Maunsell estimated the cost of the bypass at £5.9M based on data provided by Roads Service presented in **Appendix E** (revised May 2003), the estimate was subsequently updated to £8.9M in 2005 to provide input to the Regional Strategic Transport Network Transport Plan which was then published. The estimate was then further revised to £13.1M for inclusion in the Expanded Strategic Road Improvement Programme 2015 consultation document using a revised cost per km of £3.5M in July 2006.

4.3.2 Estimate Rates

Base Rates are presented in current prices in accordance with DMRB: TD37/93 Volume 5 Section 1 Part 2 'Scheme Assessment Reporting'.

4.3.3 Cost Estimates Assumptions

The cost estimates presented are broken down in to the following standard measurement headings, the assumptions made are listed below;

Section	
Site Clearance	General Site Clearance allows for the removal of superficial objects encompassed within each route down to existing ground level.
Fencing	It has been assumed that boundary fencing, including gates, is required for the full length of the each scheme. The composite rate used allows for the provision of timber post and rail type fencing, including stock proofing.
Road Restraint Systems	As it has been assumed that safety fencing is required at lighting columns, traffic signs and structures, an allowance has been included over a proportion of each schemes total length. The composite rate used allows for a combination of both open box and corrugated beam types and includes for posts with concrete footings, terminals and connections.
Drainage and Service Ducts	This is estimated from quantities provided by the drainage team. The composite rate allows for various diameter carrier and filter drains and chambers, gullies, outfalls and petrol interceptors. With the provision for culverts being included in this subtotal.
Earthworks	Bulk earthworks for each route option have been assessed based on cut and fill estimates. It has been assumed that all excavated material is to be deposited in landscape areas on site. An allowance has also been included within the estimates for the importation of capping material laid to a depth of 600mm throughout the extent of full depth carriageway construction.
Pavements	This is spilt into two elements, full pavement construction throughout the majority of each scheme and overlay / inlay at tie-ins to existing carriageways. For this estimate full pavement construction has been assumed to comprise 150mm thick sub-base and 310mm bituminous material in layers. This allowance for overlay / inlay is cold milling varying in thickness from 0 to 100mm, tack coat, regulating material, 60mm binder and 40mm thick surface course.
Kerbs, Footways and Paved areas	It has been assumed that kerbing is only required at roundabouts. The composite rate allows for full height, transition and dropped kerb types.
Traffic Signs and Road Markings	It has been assumed that the footway construction is only required at roundabouts. The rate used

Section	
	allows for a typical construction of sub base, binder and surface course.
Road Lighting and Electrical Works	As it has been assumed that street lighting is only required at roundabouts, an allowance has been included over a proportion of each schemes total length. The composite rate allows for 10m high street lighting columns, trenching, cabling, ducting, draw pits, and feeder pillars.
Accommodation Works	The allowance for this element of the estimates is based on a percentage of the total value for the road works costs and allows for the provision of access tracks and varying types of fencing and gates to land adjacent to each route option. The percentage used was 5%.
Contractor Works for Statutory Undertakers	This allowance is based on a percentage of the total value of roadworks costs and allows for works undertaken by the main contractor in diverting and protecting existing services, and also providing the infrastructure necessary for new services installation by the relevant statutory undertakers. The percentage used was 3%.
Landscape and Ecology	4% of the construction cost was applied for urban areas and 3% in rural areas to allow for environmental mitigation.
Structures	The allowances included within this section have been estimated by applying rates to assumed bridge deck or underpasses / culvert top slab areas. As detailed in Section 5.1.2 Design Constraints
Preliminaries including Traffic Management	The estimated cost for this item has been calculated as a percentage of the total construction cost, in this instance 20% has been applied.
Statutory Undertakers	The estimated cost for this item has been calculated as a percentage of the total value of construction and preliminaries costs, in this instance 5% has been applied.
Construction Cost	Incorporates all of the items listed above; Site Clearance, Fencing, Road Restraint Systems, Drainage and Service Ducts, Earthworks, Pavements, Kerbs, Footways and Paved areas, Traffic Signs and Road Markings, Road Lighting and Electrical Works, Accommodation Works, Contractor Works and Statutory Undertakers, Landscape and Ecology, Structures, Preliminaries including Traffic Management and Statutory Undertakers.
Preparation and Supervision	The estimated cost for this item has been calculated as a percentage of the total value of construction, preliminaries and statutory undertaker costs, in this instance 15% has been applied.
Optimism Bias	Currently a standard default of 44% has been applied to all estimated costs excluding inflation and land and compensation costs.

Section	
Inflation	An allowance of 2.5% per annum has been included from the estimates price base of Q1 2008 to the anticipated start of works on site in 2009.
Land and Compensation Costs	Each area of land is valued according to its use typically; agricultural land, pony paddocks, garden, industrial land, land with potential for residential development and land with potential industrial development, compensation costs such as injurious affection and severance impact are then added if applicable.
Land and Compensation Costs Preparation and Supervision	The estimated cost for this item has been calculated as a percentage of the total value of construction, preliminaries and statutory undertaker costs, in this instance 15% has been applied.
Land and Compensation Costs Optimism Bias	Currently a standard default of 10% has been applied to land and compensation costs.

Table 4.1 Scheme Cost Estimate Assumptions

4.3.4 Route Options, Scheme Cost Estimates

Section	Estimated Value		
	Blue Route	Purple	Pink Route
Site Clearance	£6,883	£10,024	£11,827
Fencing	£266,356	£387,861	£457,662
Road Restraint Systems	£29,540	£44,310	£44,310
Drainage and Service Ducts	£1,146,040	£1,590,678	£1,973,761
Earthworks	£2,205,481	£2,276,574	£3,073,961
Pavements	£1,694,667	£2,464,785	£2,907,193
Kerbs, Footways and Paved areas	£78,100	£39,050	£39,050
Traffic Signs and Road Markings	£98,226	£144,104	£168,775
Road Lighting and Electrical Works	£41,310	£60,155	£70,980
Accommodation Works	£278,330	£350,877	£437,376
Contractor Works for Statutory Undertakers	£166,998	£210,526	£262,426
Landscape and Ecology	£203,432	£232,416	£288,871
Structures	£2,853,530	£2,020,653	£2,933,306
Preliminaries including Traffic Management	£1,813,779	£1,966,402	£2,533,900
Statutory Undertakers	£544,134	£589,921	£760,170
Construction Cost	**£11,426,806**	**£12,388,336**	**£15,963,570**
Preparation and Supervision (15%)	£1,714,021	£1,858,250	£2,394,535
Optimism Bias (44%)	£5,781,964	£6,268,498	£8,077,566
Total Construction Cost, Preparation & Supervision, Optimism Bias.	**£18,922,791**	**£20,515,084**	**£26,435,671**
Inflation (2.5%)	£473,070	£512,877	£660,892
Total Construction Cost, Preparation & Supervision, Optimism Bias and Inflation	**£19,395,861**	**£21,027,961**	**£27,096,563**
Land, Dwellings and Compensation	£14,001,250	£6,888,645	£7,122,168
Preparation and Supervision (15%)	£2,100,188	£1,033,297	£1,068,325
Land Optimism Bias (10%)	£1,400,125	£688,864	£712,217
Total Land Cost (including Optimism Bias & Inflation is Constant)	**£17,501,563**	**£8,610,806**	**£8,902,710**
ROUTE OPTION ESTIMATE TOTAL	**£36,897,423**	**£29,638,767**	**£35,999,273**
Notes;- 1) Estimate date 22 February 2008 (based on current prices).			

Table 4.2 Scheme Cost Estimates

4.3.5 Cost per kilometre

Cost Per km	Estimated Value		
	Blue Route	Purple Route	Pink Route
OVERALL ROUTE OPTIONS TOTAL incl Inflation	£36,897,423	£29,638,767	£35,999,273
Length of Scheme (km)	3.4	4.9	5.8
Cost Per km	£10,852,183	£6,048,728	£6,206,771

Table 4.3 Scheme Cost per Kilometre

5 Engineering Assessment of Route Options

The following section presents the assessment of each route option against the data collected on geotechnics, topography, existing structures and public utilities' installation within the progressed corridors, and the associated design constraints.

The condition of the existing road pavements and highway structures are not considered in detail as the alternatives proposed do not consider an on-line improvement strategy due to the nature of the existing trunk road passing through the town of Magherafelt.

5.1 Engineering Standards

5.1.1 Design Speed Constraints

The Blue Route is constrained by the settlement boundary which means it is only possible to achieve a design speed of 80kph. Where the route is significantly built-up along Meadowbank Road there are three public side road junctions and one private side road junction to the Rugby Club / Meadowbank Sports Arena. The consequential effect of these additional constraints requires a speed limit of 30mph (design speed of 50kph) being imposed throughout the Meadowbank Road to the Ballyronan Road roundabout junction.

Neither the Purple nor the Pink Route encounters a constraint which requires a design speed of less than 100kph.

5.1.2 Summary of Design Constraints

Location plans and sections for the Blue, Purple and Pink Route are shown in **Appendix A Figure 5.1 ~ 5.3**. Below is a summary of the design constraints for each route.

Constraint	Blue	Purple	Pink
Alignment Constraints	80/50kph Speed, R-Turns	100kph Speed	100kph Speed
Services	Pumped Sewer & trunk main crossing. BT / NIE/ NIW on built section (Meadow Bank Road) and crossing existing roads. Asbestos main Moneymore Road & Castledawson Road.	Pumped Sewer & trunk main crossing. BT/ NIE/ NIW where crossing existing roads. Asbestos main Moneymore Road & Castledawson Road.	Pumped Sewer & Trunk main crossing. Close to NIE pylons and BT / NIE / NIW where crossing existing roads. Asbestos main Moneymore Road.
R'abouts	4	4	3
Stopped	1	1	1
Side Roads onto route	4	0	0
Route Length	3.4km	4.9km	5.8km
Overtaking Opportunities	0.9km 2+1	2.8km 2+1	3.5km 2+1
Buildability	Online, Tight	Sensitive	Easy Access

Constraint	Blue	Purple	Pink
Overbridges	2	1	2
Retaining Walls	2/3	1	1

Table 5.1 Design Constraints

5.2 Geotechnical Assessment

5.2.1 Topography

In general, where the route options cross the terrain, the topography is gently undulating with relatively shallow slopes. The most significant topographic features are Killowen Hill affecting the Pink Route in the south, Windmill Hill affecting the Purple Route in the north and Farm Hill which affects the Pink Route in the north, shown **Appendix A Figure 5.4**. Each is between 40m and 25m above the surrounding landscape.

There are additional smaller local areas of high ground immediately south of Ballyronan Road (affecting Purple & Pink Routes) and near the Rugby Club / Killyfaddy Road (affecting the Blue Route).

Several river valleys described in Section 5.2.2 below occupy low-lying ground, and floodplains are potentially associated with softened glacial deposits and poorer ground conditions such as marshland, alluvium and pockets of peat.

The existing road network is predominantly at grade with the exception of the A31 Moneymore Road where a section of shallow cutting exists, (immediately north of the junction with Coolshinney Road) affecting all routes and the A31 Castledawson Road where the road is set in shallow cutting and embankment for short sections (cutting immediately south of Castledawson Roundabout through the lower slopes of Farm Hill, embankment near the Sperrin Integrated College close to the junction with Pound Road) which affects both the Blue and Purple Route.

5.2.2 Hydrology

There are numerous watercourses migrating through the routes, namely Ballymoghan Drain which crosses all of the routes, Coolshinney Road Drain which crosses the Blue, Purple and Pink Routes in the south, Killyfaddy Road Drain, which crosses the Blue Route, Coppies River which crosses the Purple and Pink Routes, Killyneese Drain which crosses the Pink Route and Polepatrick Drain which flows from the west of the study area possibly affecting the Purple Route.

Where the glacial soil cover is thin, flat or undulating areas of (generally) low – lying waterlogged ground are apparent, indicating that the underlying rock acts as an aquiclude. The presence of ponded waters close to Killyneese Road is typical of this, which means that a sustainable (soakaway) drainage approach, may not be suitable and a positive drainage approach into drains and watercourses will have to be developed.

5.2.3 Drift Geology

Appendix A Figure 5.5 presents the Drift Geology of the Magherafelt Area.

Drift deposits within the routes predominantly comprise glacial till with alluvial floodplains associated with the watercourses, as well as rock outcrops and pockets of peat. Drift soils are generally thin (2-4m in thickness) and sometimes absent. The thickness of drift increases in the north east of the area, though where hills are present, these are likely to be largely formed of drift soils.

The Glacial Till (Boulder Clay) comprises of gravelly clay with numerous cobbles and boulders. Boulders can be up to 0.5m diameter. Glacial Till is often moulded into drumlins by moving ice; though drumlins in this area are few or poorly developed, leading to a gently undulating topography, with the exception of the aforementioned hills. Glacial drift soils can be very variable in nature, sometimes very soft with high moisture contents and sometimes dry and stiff clays or sands. The latter can be water bearing.

Alluvial deposits are shown to extend throughout the reaches of the Ballymoghan Drain affecting all routes, as well as Coppies River which affects the Purple and Pink Routes to the north east of Windmill Hill. Killyfaddy Road drain is also associated with alluvium and affects the Blue Route immediately south west of Killyfaddy Hill. Alluvial soils tend to be very variable and contain soft wet clays and loose sands. The most extensive tract of alluvial soil is in the flood plain of the Coppies Drain, affecting the Pink and Purple routes.

Pockets of peat are locally present, predominantly in areas where bedrock is close to the surface or associated with hollows in the ground surface. The most developed of these crosses the Blue Route in the vicinity of Ballyronan Road close to the junction with Meadowbank Road.

Sporadic deposits of sand and gravel are present in all routes, particularly associated with Windmill Hill and potentially Farm Hill. This may have an anisotropic fabric and therefore irregular geotechnical strength.

5.2.4 Topsoil

A review of soil distribution across the study area reveals that the principal soil groups across the routes are; Surface Water Gley, which is derived from the basaltic glacial till and formed by restricted flow of precipitation through the surface layers resulting in an anaerobic environment, and Brown Earth which is a free draining fertile soil usually developing over relatively permeable bedrock or sand and gravel. The approximate percentages of each soil type for each of the routes are indicated below:

- Blue Route – Gley 50%, Urban 50% (the classification of soil within the urban area is unavailable)
- Purple Route – Gley 75% Brown Earth 25%

- Pink Route – Gley 90% Brown Earth 10%.

In general Brown Earths tend to give better quality / more versatile soils than the gleys.

5.2.5 Solid Geology

Solid geology within the routes predominantly comprises rocks of the Lower Antrim Basalt Formation. These rocks are from the Palaeogene (Tertiary) period, dating between 55-26 million years old. The Lower Basalt is a thick sequence of lava flows each varying from 1 to 30m in thickness and separated by a variable thickness of red bole (heavily weathered lava).

Bedrock is shown to lie at or close to the surface in several areas within the routes and is shown to outcrop in the following areas:

- between Killowen Hill & Killyfaddy Road, affecting the Blue and Purple Routes
- around Leckagh House on Killyfaddy Road, affecting the Purple and Pink Routes
- in the vicinity of the A31 Castledawson Road affecting the Blue Route.

5.2.6 Geological Constraints

The underlying solid geology for all proposed routes is Tertiary Lower Antrim Basalt Formation, overlain by a variable thickness of glacial till. Rock is unlikely to affect many of the earthworks, though structures in the south and west are likely to utilise this as a sound foundation layer.

All routes are expected to encounter hills and ridges of glacial material which will probably require 1:3 cut slopes.

Alluvium is likely to prove a difficult foundation medium for earthworks/pavement and be too wet / too variable to yield other than Class 4 (landscape) fill. This will affect all routes to some extent particularly in the vicinity of watercourses, though the Pink Route adjacent to the Killyneese Water Treatment Works is likely to be the most affected.

Deposits of peat are anticipated to be less significant than shown on the geological map, but are shown to be present in the vicinity of the Blue Route north east of Killyfaddy Road. There is no geotechnical data available, but any deposits are likely to be highly compressible, with low strength and high moisture content. Such materials will be unsuitable for use in the works.

A variable thickness of between 1m and 4m of glacial till is expected over much of the scheme. The thickness is likely to be greater in the high ground of the drumlins, or in infilled stream valleys. The thinnest areas are likely to be on relatively low-lying ground around

Sperrin Integrated College or where rock is within close proximity to the surface in the south and west of the scheme, especially south of Ballyronan Road.

The till is anticipated to consist of variable cohesive or granular deposits. Cohesive deposits are predominantly described as brown sandy gravelly clay with a varying degree of cobbles. Granular deposits are largely of medium relative density, fine-coarse sand or gravel.

In general, this should yield a Class 2C (stony cohesive) fill, though the moisture content is likely to be variable, with approximately one third to one half likely to be too wet or too soft for use as Class 2 material unless conditioned to reduce its moisture content. The water table is likely to be high, which will reduce the stability of slopes. Cut slopes steeper than 1:2.5 are unlikely to be feasible and 1:3 should be adopted.

Bedrock consists of Antrim Basalt which is largely massive with few joints, and has been locally worked for aggregate. The basalt is often close to the surface and can be expected to be encountered in any excavation greater than 4m deep. This material is likely to be difficult to excavate and may require blasting, but also may be locally highly weathered. This will increase the cost and environmental impact. Blasted material could generate Class 6 aggregate, whilst the highly weathered material may produce poor quality Class 2 fill.

5.2.7 Contaminated Land

The majority of the routes are situated on greenfield land where there is no evidence to suspect contamination.

A petrol filling station is located on the Ballyronan Road adjacent to the Blue Route, and therefore there is the potential for hydrocarbon contamination in this area.

There are several disused and infilled quarries and gravel pits in the area. None of these quarries are still visible or evident, and given their age and the dates at which they were infilled, it will be expected that the infill material will be substantially inert. Two gravel pits are situated on the alignment of the Pink Route adjacent to Loves Road and at Farm Hill. There are a number of oil storage sites affecting the edge of the town; at the Aughrim Rd Industrial Estate, at Pound Lane and at Castledawson Road, all of which may affect the Blue Route.

The Pink, Blue and Purple Routes cross industrial land, namely the precast concrete yard at the Moneymore Road. This area may be affected by made ground which can contain demolition waste and potentially oil spills.

The extent or absence of contamination at all these sites will need to be assessed as part of a ground investigation.

5.2.8 Description of Ground Conditions and Associated Buildability Issues

There are a number of geo-environmental issues that may have an impact upon the selection of the preferred route and these are discussed overleaf;

Blue Route

Relevant Section	Issues/Risks
Route cuts through edge of concrete works	Potential for contaminated land low, but not negligible.
Route passes through area of high ground at Crockthomas Hill north of concrete works	1:3 cut slope likely to be required. If land take is constrained, local retaining walls may be required.
High embankment approaching Killyfaddy Road	Route crosses road, bridge foundations are likely to be spread on under- lying basalt.
Route cuts through area of high ground north of Killyfaddy Road	1:3 cut slope likely to be required. If land take is constrained, local retaining walls may be required
Use of Meadowbank Road	Tight space constraints from surrounding land. Retaining walls or reinforced earth solutions may be required.
Crossing of Ballyronan Road	Peat shown in area, unlikely to be significant, but will need to be excavated and replaced with suitable engineered fill. Petrol Station is noted at junction, possible contamination issues.
North of Ballyronan Road (rear of Council depot)	Likely to require use of retaining walls to avoid constraints. Risk of contamination from council depot.
Crossing of Aughrim Road	Small area of flood plain which may require excavation and replacement. Potential for contamination from nearby oil storage.
Pound Lane	Alluvium close to drain may lead to problems of differential settlement, either excavate and replace or address in design. Culvert crossing of the drain will be required, likely to be spread foundation. Potential for contamination from nearby oil storage.
Sperrin Integrated College	Route passes through grounds creating access issues. Culvert foundations over drain likely to spread, founded on rock.

Table 5.2 Blue Route Ground Conditions and Associated Buildability Issues

Purple Route

Relevant Section	Issues/Risks
Route cuts through edge of concrete works	Potential for contaminated land low, but not negligible
Route passes through area of high ground at Crockthomas Hill north of concrete works	1:3 cut slope likely to be required. If land take is constrained, local retaining walls may be required
Crossing of Killyfaddy Road	Bridge likely to be founded on rock.
Crossing of drains either side of Killyfaddy Road	Alluvium close to drains may lead to problems of differential settlement, either excavate and replace or address in design. Rock excavation possible north of Killyfaddy Road culvert crossing of the drains will be required, likely to be spread foundation.
Crossing of Ballyronan Road	Peat shown in area, unlikely to be significant, but will need to be excavated and replaced with suitable engineered fill. Ballyronan Road is on embankment at this location.
North east of Ballyronan Road	Area of side long ground. Likely to require asymmetric earthworks.
Crossing of Coppies River	Alluvium close to river may lead to problems of differential settlement, either excavate and replace or address in design. Culvert crossing of the river will be required, likely to be spread foundation.

Table 5.3 Purple Route Ground Conditions and Associated Buildability Issues

Pink Route

Relevant Section	Issues/Risks
Route cuts through edge of concrete works	Potential for contaminated land low, but not negligible
Route passes through area of high ground at Crockthomas north of concrete works	1:3 cut slope likely to be required. If land take is constrained, local retaining walls may be required.
Crossing of Killyfaddy Road	Bridge likely to be founded on rock.
Crossing of drains to the west and east of Killyfaddy Road	Alluvium close to drain may lead to problems of differential settlement, either excavate and replace or address in design. Rock excavation possible north of Killyfaddy Road culvert crossing of the drains will be required, likely to be spread foundation.
Crossing of Ballyronan Road	Peat shown in area, unlikely to be significant, but will need to be excavated and replaced with suitable engineered fill. Road is shown on embankment.

Relevant Section	Issues/Risks
Crossing of small stream between Ballyronan Road and Aughrim Road	Alluvium close to stream may lead to problems of differential settlement, either excavate and replace or address in design. Culvert crossing of the stream will be required, likely to be spread foundation.
Crossing of Aughrim Road	Small area of flood plain which may require excavation and replacement.
Route passes directly through two historical infilled gravel pits	Potential for contaminated ground to be encountered which may need to be treated or removed to registered landfill site. Quantity likely to be small however.
Flood plain adjoining water treatment works	Potential for soft ground resulting in potential settlement of any embankment.
Route cuts through Farm Hill close to the Castledawson Roundabout	1:3 cut slope likely to be required. Will create landscape scar and require significant earthworks. Uncertain foundation conditions for Killyneese Road Crossing.

Table 5.4 Pink Route Ground Conditions and Associated Buildability Issues

5.2.9 Summary

Due to its length the Blue Route has the least length of earthworks. If the Blue Route is progressed there will be less construction required on soft ground than either the Purple or the Pink Route. On the other hand the Blue Route will require retaining structures due to its proximity to existing buildings. The Blue Route is most likely to be affected by the local interaction with potentially contaminated soils.

The Pink and Purple Routes are longer, but as the relief is generally lower away from the town, the height of individual earthworks is likely to be lower.

Geotechnically it is difficult to differentiate between the Purple and Pink Routes, in terms of potential areas of contamination, watercourse crossings etc. although the Pink Route will require greater earthworks due to the alignment crossing Farm Hill.

5.3 Hydrology and Drainage Assessment

Appendix A Figure 5.6 shows the Drainage and Northern Ireland Water Infrastructure Constraints.

5.3.1 Hydrology

There are a number of watercourses flowing through the Magherafelt study area affecting all of the route options. In general, watercourses flow from the west to the east, converging to meet the Moyola River. There are three principal watercourses which affect the route options: the Ballymoghan Drain, the Coppies River and the Burnbunley. A number of abbreviations are used within the following sections:

- AOD ~ Above Ordnance Datum
- U ~ Urban
- MW ~ Minor Watercourse
- EXT ~ Extension.

The Ballymoghan Drain

The source of the Ballymoghan Drain is approximately 4.2 km south west of Magherafelt in the area of Gortagilly Hill, at an elevation of approximately 120m AOD. A number of tributaries discharge to the Ballymoghan Drain and these include: U1908 Killyfaddy Road Drain, U1911 Coolshinney Road Drain, MW1971 Thompsons Hill Drain, MW1975 Gortagilly Drain, MW1976 Woodhill Drain, MW1977 Dunronan Drain and MW1978 Duronan Drain Branch. The Ballymoghan Drain discharges to the Coppies River at Millbrook, approximately 2.7km downstream. In general the Ballymoghan Drain flows in an easterly direction.

The catchment area of the Ballymoghan Drain in its upper reaches is predominately rural, in the vicinity of Magherafelt the watercourse and its associated tributaries accept storm water discharges for residential catchments in the south-eastern and eastern areas. The watercourse gradient varies considerably and is relatively steep in some section with gradients of around 1:40 in some of the surveyed reaches.

The Coppies River

The Coppies River incorporates a number of tributaries and it drains catchments to the south-west and north-west of Magherafelt. The Coppies River tributaries include the MW1912 Ballymoghan Drain and its associated catchment, the MW1902EXT Coppies Extension, the MW1953 Polepatrick Drain, the MW1903 Coppies Drain and the MW1953EXT Killyneese Drain.

The Coppies Extension stretches to the north-west of Magherafelt and generally flows in a south-easterly direction. The watercourse's confluence with the Coppies River is at the Millbrook area of Magherafelt. The catchment area of the Coppies Extension is predominately rural, however, is does include the urban drainage tributaries of U1901 Moneymore Road Drain and the U1901A Moneymore Road Drain Branch which receives storm runoff from the north and west of Magherafelt town.

The Polepatrick Drain stretches north from the Coppies River and generally flows in a south-easterly direction. The catchment area of the Polepatrick Drain is predominately rural.

The Coppies Drain extends to the south of the Coppies River to the Aughrim Road. The watercourse generally flows in a northerly direction and its catchment is rural.

The Killyneese Drain extends to the north of the Coppies River and its confluence with the Coppies River is in the vicinity of the Killyneese Water Treatment Works (WTW) at the Killyneese Road. The watercourse stretches north into the area of Loves Hill (outside the study area) and has a predominately rural catchment.

In general the Coppies River flows in an easterly / south-easterly direction and it discharges to the Moyola River approximately 3.2 km downstream in the vicinity of Lowertown. As detailed above the upstream catchment of the Coppies River is considerably rural, however, it does incorporate the urban catchment of Magherafelt via its upstream tributaries; the Ballymoghan Drain and the Coppies Extension.

The gradient of the Coppies watercourse varies with both steep and shallow sections. The area just upstream of the Killyneese Road is relatively flat and flooding is known to occur here.

The Derrygarve / Burnbunley

The source of the Derrygarve Extension and Burnbunley is in the Ballyronan Road area of Magherafelt. At an elevation of approximately 60m AOD, the Derrygarve Extension is approximately 1 km in length and discharges to the Burnbunley watercourse at Loves Road, Magherafelt. Tributaries of the Derrygarve Extension include the MW1915 Carraloan and a number of undesignated watercourses.

The Burnbunley watercourse is approximately 5.3 km in length from Loves Road, Magherafelt to its point of discharge at the Moyola River near Moyola Waterfoot, Lough Neagh.

In general the Derrygarve Extension and Burnbunley flow in an easterly direction and the catchment area for the watercourse is predominately rural.

The Derrygarve / Burnbunley gradients vary considerably and are relatively steep in some sections with gradients of around 1:30 in some of the surveyed reaches around Loves Road.

5.3.2 Drainage Constraints

Blue Route

The Blue Route is the shortest of the options and **Appendix A Figure 5.7** highlights the five potential discharge locations for runoff drainage; it is proposed that all discharges will be made to the Ballymoghan Drain, it is noted that discharge points 1 and 2 will require approximately 872 m of carrier drain along field boundaries and roads to enable discharge to the watercourse. The estimated runoff discharge to the Ballymoghan Drain is 0.81 m^3/s. Using Flood Estimation Handbook (FEH) techniques the estimated annual flow in the receiving Ballymoghan Drain is 3.6 m^3/s therefore, the Blue Route represents an estimated 23% increase in annual watercourse flow rates.

As the Blue Route is the shortest of the options it requires the least amount of road drainage, approximately 9,640m.

Along the Blue Route there are 4 culverts required to cross watercourses: the Coolshinney Road Drain, Killyfaddy Road Drain and the Ballymoghan Drain at Aughrim Road and Sperrin Integrated College. It is noted that the Ballymoghan watercourse crossing, in the vicinity of the Aughrim Road, is within a zone of slight cutting. Detailed assessment will be required to ensure that culverts are appropriately sized with adequate freeboard. Localised re-grading of the watercourse, upstream and downstream of the crossing, may be required to facilitate the proposed route.

Purple Route

The Purple Route is the mid-length option and **Appendix A Figure 5.8** highlights the six potential discharge locations for runoff drainage; it is proposed that discharges will be made to the existing road drainage at the Moneymore Road, the Ballymoghan Drain, the Burnbunley, the Coppies Drain and the Coppies River. It is noted that discharge point 4 will required approximately 140m of carrier drain along Loves Road to enable discharge to the Burnbunley watercourse. The estimated total runoff of the Purple Route is 1.105 m^3/s.

Using FEH techniques the estimated annual flow for the affected watercourses have been calculated; within the Ballymoghan Drain the estimated annual flow is 3.6m^3/s therefore, the Purple Route represents an estimated 13.5% increase in annual watercourse flow rates. Within the Burnbunley watercourse the estimated annual flow is 0.57 m^3/s, therefore this route represents an estimated 28% increase in annual watercourse flow. Within the Coppies Drain the estimated annual flow is 0.35 m^3/s therefore, within this watercourse the Purple Route represents an estimated 86% increase in annual flow. It is anticipated that retention will be required prior to discharge at this watercourse. Within the Coppies River

the estimated annual flow is 7.7 m^3/s therefore, discharge from the Purple Route will result in an estimated 2% increase in annual watercourse flow rate.

It is estimated that the Purple Route will require approximately 10,445m of road drainage.

Along the Purple Route there are 5 culverts required to cross watercourses: 3 along the Ballymoghan Drain in the vicinity of the Killyfaddy Road, 1 at the Coppies Drain and 1 at the Coppies River. Of the 5 watercourse crossings identified, 1 of these is at grade. Detailed assessment will be required to ensure that culvert is appropriately sized with adequate freeboard. It is further anticipated that localised regrading of the watercourse upstream and downstream of the crossing will be required to facilitate the proposed route crossing.

Pink Route

The Pink Route is the longest of the options and **Appendix A Figure 5.9** highlights the 8 potential discharge locations for runoff drainage. It is proposed that discharges will be made to the existing road drainage at the Moneymore Road, the Ballymoghan Drain, the Derrygarve Extension, the Burnbunley, the Coppies River and the Castle Hill Drain. It is noted that discharge point 6 will require approximately 102m of carrier drain through fields to enable discharge to the Coppies River. The estimated total runoff of the Pink Route is 1.34 m^3/s.

Using FEH techniques the estimated annual flow for the affected watercourses has been calculated; within the Ballymoghan Drain the estimated annual flow is 3.6 m^3/s therefore, the Pink Route represents an estimated 8.5% increase in annual watercourse flow rates. Within the Derrygarve Extension the estimated annual flow is 0.49 m^3/s, the Pink Route results in an estimated 54% increase in annual flow rates. It is anticipated that retention of runoff flows will be required prior to discharge to this watercourse. Within the Burnbunley watercourse the estimated annual flow is 0.57 m^3/s, therefore this route represents an estimated 26% increase in annual watercourse flow. Within the Coppies River the estimated annual flow is 7.7 m^3/s therefore, discharge from the Pink Route will result in an estimated 7% increase in annual watercourse flow rate. At the Castle Hill Drain discharge Drain is made to an existing Rivers Agency culvert, Rivers Agency have advised that they do not foresee any capacity issues arising from additional discharges to this culvert.

It is estimated that the Pink Route will require approximately 16,000m of road drainage.

Along the Pink Route there are 10 culverts required to cross watercourses: 3 along the Ballymoghan Drain in the vicinity of the Killyfaddy Road, 2 at undesignated watercourse between the Killyfaddy Road and the Ballyronan Road, 2 at the Derrygarve Extension, 1 at an undesignated watercourse adjacent to the Derrygarve Extension, 1 at the Burnbunley and 1 at the Coppies River. The Pink Route will also involve crossing 2 existing culverts, along an undesignated watercourse north of the Aughrim Road and at the Killyneese Drain.

It is proposed that a number of watercourse realignments will be required to accommodate the Pink Route and to avoid excessively long culverting, this includes; approximately 90m

of watercourse diversionary works at the Ballymoghan Drain, east of the Killyfaddy Road and approximately 200m of watercourse diversionary works at the Derrygarve Extension, east of the Ballyronan Road. Further engineering works are also likely to be required at the existing culvert on the undesignated watercourse north of the Aughrim Road. It is anticipated that realignment of this drain will be required as road cutting will blight the existing gravity route.

5.3.3 Flooding Constraints

It is identified within the DMRB and Planning Policy Statement (PPS) 15 – Planning and Flood Risk, that development within floodplains should be avoided. Where there is no acceptable alternative, extensive construction within floodplains should be avoided and the design restricted to the shortest possible crossing. It is also advised that, within floodplains, road levels should be above the predicted flood water levels (including appropriate freeboard) and the provision of mitigation measures, such as storage compensation, assessed.

Information relating to floodplains within the study area has been derived from consultations with Rivers Agency, walkover surveys and desktop study of contours and drift geology. The following areas have been identified as possible floodplains and will require detailed flood risk assessments following selection of a preferred route.

Blue Route

Along the Blue Route potential floodplain areas have been identified at the Ballymoghan Drain at Aughrim Road and at Sperrin Integrated College. It is noted that the proposed route at the Aughrim Road is in slight cutting. Detailed assessment will be required to ensure that road levels are above predicted flood water levels and / or that adequate flood defence measures are provided. Any loss of floodplain area may require compensatory storage provision. It is anticipated that options for storage compensation may be limited in the vicinity of Aughrim Road / Pound Road due to the semi urban nature of land use.

Purple Route

Along the Purple Route possible floodplain areas have been identified at the Ballymoghan Drain, east of the Killyfaddy Road, and at the Coppies River. It is noted that the crossing to the west of the Killyfaddy Road is a grade therefore detailed assessment will be required to ensure that road levels are above predicted flood water levels and / or that adequate flood defence measures are provided. Any loss of floodplain area, either at the Coppies River or the Ballymoghan Drain, may require compensatory storage provision.

Pink Route

Along the Pink Route possible floodplain areas have been identified at the Ballymoghan Drain, east of the Killyfaddy Road, at the confluence of the Derrygarve Extension and Carraloan watercourses, east of the Ballyronan Road and at the Coppies River adjacent to Killyneese WTW. The Pink Route at these floodplain locations is on fill. Detailed

assessment will be required to ensure that road levels are above predicted flood water levels. Any loss of floodplain area may require compensatory storage provision.

These possible areas where flood alleviation may be required are highlighted in **Appendix A Figure 5.10**.

5.3.4 Northern Ireland Water Infrastructure (NI Water)

NI Water provided information from digital records of their infrastructure which is principally located within the town boundaries. These are illustrated in **Appendix A Figure 5.6**.

Blue Route

As the Blue Route is the nearest to the town it is most likely to impact existing NI Water infrastructure. The principal NI Water assets likely to be impacted upon by the proposed route are: a 400mm diameter ductile iron pumped trunk watermain along the Moneymore Road, a 18" diameter cast iron pumped trunk watermain at Meadowbank Park, a 300mm diameter foul sewer and a 675mm diameter combined sewer at Sperrin Integrated College and a 9" diameter asbestos cement trunk watermain along the Castledawson Road.

Purple Route

The principal NI Water assets which may be impact by the Purple Route are: a 400mm diameter ductile iron pumped trunk watermain along the Moneymore Road, an 18" diameter cast iron pumped trunk watermain at Waituna House and a 525mm diameter reinforced concrete combined sewer north of the Aughrim Road.

Pink Route

The principal NI Water assets which may be impacted by the Pink Route are: a 400mm diameter ductile iron pumped trunk watermain along the Moneymore Road, an 18" diameter cast iron pumped trunk watermain at the Derrygarve watercourse. It is noted that there is an existing scour valve to the watercourse from the trunk main at this location and a 600mm diameter reinforced concrete combined sewer adjacent to the Killyneese WTW. The Pink Route may also impact NI Water access to Killyneese WTW, which is also a sludge reception centre.

5.3.5 Description of Drainage Constraints and Associated Buildability Issues

There are a number of hydrology and drainage issues which may impact upon the selection of the preferred route and these are detailed in the following:

Blue Route

Relevant Section	Issues/Risks
Moneymore Road	Existing NI Water Infrastructure – 400mm dia ductile iron pumped trunk watermain
Route crosses Coolshinney Road Drain and Killyfaddy Road Drain	2 No. culverts required
Adjacent to the Killyfaddy Road	Carrier drains required for discharge to the Ballymoghan Drain
Meadowbank Park	Existing NI Water Infrastructure - 18" diameter cast iron pumped trunk watermain
Aughrim Road	Culvert required, may require re-grading of watercourse up and downstream. Potential floodplain, possible flood defence structures and mitigation such as storage compensation may be required
Sperrin Integrated College	Culvert required Potential floodplain, mitigation such as storage compensation may be required

Table 5.5 Blue Route Drainage Constraints

Purple Route

Relevant Section	Issues/Risks
Moneymore Road	Existing NI Water Infrastructure – 400mm dia ductile iron pumped trunk watermain
Ballymoghan Drain – West of Killyfaddy Road	2 No. culverts required, 1 No. crossing, may require re-grading of watercourse up and downstream. Potential floodplain, possible flood defence structures and mitigation such as storage compensation may be required
Ballymoghan Drain – East Killyfaddy Road	Culvert required.
Wiatuna House	Existing NI Water Infrastructure - 18" diameter cast iron pumped trunk watermain
Coppies Drain	Culvert required. Potential floodplain, mitigation such as storage compensation may be required Retention of runoff in drainage required.

Relevant Section	Issues/Risks
Coppies River	Culvert required. Potential floodplain, mitigation such as storage compensation may be required
Coppies River	Existing NI Water Infrastructure – 525mm diameter reinforced concrete combined sewer

Table 5.6 Purple Route Drainage Constraints

Pink Route

Relevant Section	Issues/Risks
Moneymore Road	Existing NI Water Infrastructure – 400mm dia ductile iron pumped trunk watermain
Ballymoghan Drain – West of Killyfaddy Road	Culvert required. Potential floodplain, mitigation such as storage compensation may be required
Ballymoghan Drain – East Killyfaddy Road	2 No. culverts required Watercourse realignment may be required Potential floodplain, mitigation such as storage compensation may be required
Derrygarve Extension Watercourse	Existing NI Water Infrastructure - 18” diameter cast iron pumped trunk watermain with scour valve to the Derrygarve Extension watercourse
Derrygarve Extension Watercourse	3 No. culverts required Watercourse realignment required and possible re-grading of existing reaches Potential floodplain, mitigation such as storage compensation may be required
Burnbunley Watercourse	Culvert required
Coppies River	Culvert required Potential floodplain, mitigation such as storage compensation may be required
Coppies River	Existing NI Water Infrastructure – 600mm diameter reinforced concrete combined sewer
Farm Hill	Culvert required
Castledawson Roundabout	Possible drainage connection to existing Rivers Agency culvert

Table 5.7 Pink Route Drainage Constraints

5.3.6 Mitigation

Once the preferred route is chosen, flood risk assessments will be carried out on the affected watercourses. Hydraulic models will be constructed of the watercourses which are deemed to be at risk from flooding or which requiring realignment / regrading works, to determine the extent of the flooding, the predicted flood flows and impacts of purposed engineering works. This will allow the culverts and engineering works to be sized appropriately, and enable full assessment of flood risk and mitigation options.

The levels of the existing sewers, drains and watermains will also need to be surveyed once the preferred route is chosen to understand the full impact that the crossing of this infrastructure will have.

5.3.7 Summary

From a drainage perspective the Blue Route is the most favourable due to its length, approximately 3.4 km when compared to the Purple and Pink, approximately 4.9 km and approximately 5.8 km respectively. The Blue Route has the least impact from estimated discharge volumes, the least impact on floodplains and the least number of watercourse crossings, the Blue Route also only requires localised re-grading of the watercourse, at 1 crossing.

The Pink Route will then be the least favourable option, this route is longer than the Purple or Blue Route, and it requires the most drainage pipework and has the highest discharge volumes. The Pink Route also requires retention of runoff flows prior to discharging to the Derrygarve Extension watercourse. The Pink Route also has the most number of watercourse crossings and requires diversionary works at 2 watercourses and will likely impact on floodplain areas, which may require the provision of compensatory storage.

5.4 Statutory Authorities and Public Utilities Assessment

Statutory Authority / Public Utility	Status of Infrastructure affecting route options		Comments
	Current?	Planned?	
NTL	X	?	NTL did not advise if they have future plans within the study area.
Eircom	X	X	
Phoenix	X	X	
Atkins Telecom (Cable & Wireless)	X	X	
Atkins Telecom (Energis Ireland)	X	X	
BGE	X	X	
Firmus Energy	X	X	
Sustrans	X	X	
Bytel	X	X	
Hutchinson 3G	X	X	
BT	✓		BT infrastructure will be affected by all route options.
NIE	✓		Will affect all routes. Note in particular The 33kv cables which run along Meadowbank Road and affect the Blue Route. The 275kv electricity pylons which run from the substation across Ballymoghan Road, Killyfaddy Road and the Ballyronan Road which affects the Pink Route.
RS Street Lighting	✓		RS advised that there will be street lighting along all 30mph roads and when the preferred route is being developed they will revisit the information.
Clear Channel	X	X	
O_2	X	X	
T-Mobile	X	X	
Vodafone	X	X	

Table 5.8 Statutory Authority and Public Utilities Assessment

The location of the telecommunications infrastructure is illustrated in **Appendix A Figure 5.11**, while the location of the NIE infrastructure affecting the Blue Route is shown in **Appendix A Figure 5.12,** the Purple Route is shown in **Appendix A Figure 5.13** and the Pink Route is shown **Appendix A Figure 5.14.**

6 Land Use

6.1 Introduction

This section of the report looks at the nature of the land use along each of the route options considered for this scheme and also highlights the impacts on that land use that are likely to arise from completion of each of the options.

6.2 Method of Assessment

The landownership details for all of the land within the study area considered for this scheme were obtained from Northern Ireland Land Registry. These details were confirmed on site, with land boundaries checked, ownership details confirmed and land use determined, this process continued at the public consultation.

6.3 Existing Conditions

6.3.1 Blue Route

See **Appendix A Figure 6.1** for the Blue Route Landownership Plans.

Starting at the Moneymore Road junction of the bypass with the existing A31, the following is the sequence and brief description of the holdings impacted by this route option:

- the first property crossed by this route is a concrete works, parcels 01/205 and 01/021a, both industrial, impacting on the product storage yard and the travelling gantry used for moving product around the site in parcel 01/205 and having minimal impact on 01/021a. The adjoining parcel (01/040) on which two residences are sited are also impacted with some severance, in addition to this, the route crosses the access to the two residences. A further parcel in this area (01/045) may have minor land loss to this route

- the next holdings crossed are parcel numbers 01/050 and 01/055 both of which are zoned as residential. Some small severance will result to each of these properties

- the route then enters parcel number 01/160, a 107 acre dairy farm carrying a herd of 100 cows, severing land to the north of the bypass from the main holding

- it then crosses parcel 02/055 which shares a boundary with a number of residential properties, before crossing Killyfaddy Road to parcel number 02/065 and parcel number 02/070, which is zoned for residential development

- from here the route joins the existing Meadowbank Road, where upgrading will be required impacting on the sports arena. Numerous residential properties front onto this road at present

- on crossing Ballyronan Road, the route enters parcel 05/005. This is rough grassland attached to a concrete works at this site. There will also be minor impact on parcel 02/210a which are zoned residential. Kilronan Special Needs School is located on Ballyronan Road, close to the road at this point

- next in line is parcel 02/220 and parcel 03/005 along whose boundary the route runs. The parcel of the former is zoned residential but both are used for agricultural purposes at present

- where the route connects to the Aughrim Road, there are two dwellings under the footprint of the roundabout

- beyond the Aughrim Road to Pound Road, there are numerous residential properties adjacent to the route. There is planning permission for six units on plot 03/050, while on plots 03/090 & 03/125 there is also planning permission for residential development

- on crossing Pound Road the route enters the grounds of Sperrin Integrated College, crossing the avenue to the school on approach to the Castledawson Road. A supermarket occupies the plot on the opposite side of the Castledawson Road from where the new route joins. The Holy Family Primary School and Polepatrick Cemetery are also situated in close proximity to this junction.

The land and compensation cost for the Blue Route is estimated at £17.5 Million.

6.3.2 Purple Route

See **Appendix A Figure 6.2** for the Purple Route Landownership Plans.

Starting at the Moneymore Road junction of the bypass with the existing A31, the following is the sequence and brief description of the holdings impacted by this route option:

- the first property crossed by this route is a concrete works, parcels 01/205 and 01/021a, both industrial, impacting on the product storage yard and the travelling gantry used for moving product around the site in parcel 01/205 and having minimal impact on 01/021a. The adjoining parcel (01/040) on which two residences are sited are also impacted with some severance, in addition to this, the route crosses the access to the two residences. A further parcel in this area (01/045) may have minor land loss to this route

- the adjoining property parcel 01/050 which is zoned residential is crossed causing minor severance

- the route then enters parcel 01/160 a 107 acre dairy farm carrying a herd of 100 cows, severing land to the north of the road from the main holding. Between here

and the Killyfaddy Road, the route crosses parcel 04/005, operated by a dairy farmer and parcel 02/055 severing a small portion from each holding and passing close to a new dwelling on the latter holding

- on crossing Killyfaddy Road, this route cuts the corner of parcel 02/065 before crossing parcel 04/010 to the north of the dwelling and severing a portion of land from the main holding

- it continues through parcel 04/075, severing a portion of land to the north of the road. Two dwellings underlie the footprint of the roundabout at the Ballyronan Road, namely parcel 04/030 and 04/045. On crossing the road it re-enters parcel 04/075 again severing a small portion of land before crossing holding parcel 04/070 leaving the house and farmyard just to the north while severing a sizeable portion of land to the south.

- the route then crosses parcel 05/115 severing a small portion south of the road and again re-enters parcel 04/075 again severing a portion of land. At the crossing with Loves Road, this route will result in the loss of a residence (parcel 05/055). On crossing Loves Road, the route enters parcel 05/060 severing the holding

- the farm holding parcel 05/075 and parcel 05/095 are also split before the route reaches Aughrim Road. Additionally there is a dwelling at this point (parcel 05/096) which underlies the footprint

- on crossing the Aughrim Road, this route crosses a small parcel 05/205 and again re-enters parcel 05/095 exiting through parcel 05/100). The road splits this and the subsequent farm (parcel 03/200). All of the land crossed from that of 04/100 is grass land used for beef farming, before reaching the Castledawson Road

- this route crosses the grounds of Glenbrook House, a listed building set in mature parkland (parcel 03/190) splitting the property, some of the land is used to keep horses

- on terminating at the Castledawson Road the Polepatrick Cemetery and Gaelic Football Ground lie in close proximity.

The land and compensation cost for the Purple Route is estimated at £8.6 Million.

6.3.3 Pink Route

See **Appendix A Figure 6.3** for the Pink Route Landownership Plans.

Starting at the Moneymore Road junction of the bypass with the existing A31, the following is the sequence and brief description of the holdings impacted by this route option:

- the first property crossed by this route is a concrete works, parcels 01/205 and 01/021a, both industrial, impacting on the product storage yard and the travelling gantry used for moving product around the site in parcel 01/205 and having minimal impact on 01/021a. The adjoining parcel (01/040) on which two residences are sited are also impacted with some severance, in addition to this, the route crosses the access to the two residences. A further parcel in this area (01/045) may have minor land loss to this route

- the next holding crossed is parcel 01/050 which is zoned residential. Minor severance will result to this property

- the route then enters parcel 01/160, a 107 acre dairy farm carrying a herd of 100 cows, severing land to the north of the road from the main holding

- the route next enters parcel 04/005, a grass farm used for dairy farming, crossing the Killyfaddy Road and on through this land to the east of the Killyfaddy Road before entering parcel 04/010 which is farmed by a dairy farmer. This results in substantial severance to both holdings

- the route then severs the holdings 04/100, 04/075 and 04/105, all grass farms are used for beef production to the west of Ballyronan Road

- on crossing the Ballyronan Road however the road re-enters the parcel 04/075 severing a considerable portion of this plot south of the road and large portion to the north in addition to small severance to the parcel 04/070

- there is a minor impact on parcel 04/135

- the road then crosses parcel 05/040, a dairy farm, severing land to the north of the road but also crosses the access road to the farm house and yard from Loves Road. The road passes very close to the house on parcel 05/150 at this point also and before crossing Loves Road the route crosses parcel 05/165

- parcel 04/075 stretches between Ballyronan Road and Loves Road, meeting the road just north of the proposed route. Additionally this farmer owns plot 05/035 which joins Loves Road, south of the proposed road, access to which is presently gained along Loves Road

- on crossing Loves Road the road enters the land parcel 05/075, severing a sizeable portion to the south

- the road then enters the land parcel 05/095, crosses Aughrim Road, very close to the access road leading to the residence and furniture retail premises; in addition to

splitting the farm both sides of the new road. It then continues through this land to the north of Aughrim Road

- a dwelling with the parcel reference 05/215 is under the footprint of the road
- in succession the road then crosses through three similar sized parcels: 05/240, 05/100, 05/245 severing portions of each
- The route then crosses 05/235a severing the land and crossing an access track linking out-farm buildings to the main farm yard on the latter holding and outlying fields to the farm yard 05/235b
- from here to the Killyneese Road the route crosses 06/025 causing minor severance
- on crossing Killyneese Road, the route enters parcel 06/100 causing minor severance. All of the farms crossed since parcel 05/040 are grass based and used for beef production. It then enters parcel 06/105 on route to the Castledawson Roundabout. This route will cause major severance to this holding on which operates a pedigree dairy herd.

The land and compensation cost for the Pink Route is estimated at £8.9 Million.

6.3.4 Development Plan Constraints

The Magherafelt Area Plan 2015 – Draft Plan identifies within zones, current land use, future development and associated land use. **Appendix A Figure 6.4** details the development plans for Magherafelt in relation to the three proposed route options.

The Blue Route which is the protected route for the bypass within the Area Plan, skirts the development limit, with sections of the route, for example along Meadowbank Road constrained by the existing development, in particular the new Meadowbank Sports Arena.

All routes impact on the industrially zoned area MT24 and the residential development zone MT14 although the Blue Route has a greater impact on MT14.

6.4 Summary

The Purple Route will require the acquisition of the greatest number of properties, 3 in total, the Blue Route will require the acquisition of 2 properties, whilst the Pink Route will require the acquisition of 1 property.

The Blue Route has the greatest impact on residential properties with its alignment coinciding with the heavily built up Meadowbank Road, due to this and its' proximity to land zoned for development and industry the Blue Route has the highest land and compensation cost.

The Blue Route does however have the least impact on agricultural land as it skirts the development limit and is the shorted in length.

Although the Pink Route has a higher land and compensation cost than the Purple Route, this is due to its additional length. It is difficult to differentiate between these routes from a land use point of view as both of them are outside of the settlement limit and both equally sever agricultural land.

7 Environmental Assessment of Route Options

7.1 Introduction to Environmental Assessment

The three potential route options have been subject to assessment of anticipated environmental impacts.

The environmental assessment has been undertaken in accordance with the guidelines for a Stage 2 Assessment published in the Design Manual for Roads and Bridges (DMRB) Volume 11.

This has involved the establishment of existing environmental resources and receptors associated with the defined study area, and evaluation of the environmental impacts which may result from adoption of each of the three options as the preferred route for the proposed scheme. The assessment for each option has taken into account the potential for mitigation of impacts.

7.1.1 Study Area

The study area comprises of the progressed corridors from Scheme Assessment Report 1 extending approximately 1.5km from the eastern urban edge of Magherafelt Town. It follows an arc from the A31, south of the town, to the A6 as it runs east from the Castledawson Roundabout as shown in **Appendix A Figure 4.1**.

7.1.2 Sources of Information

Statutory Consultees

The following statutory bodies and non-statutory organisations have been consulted during this assessment:

- Department of Agriculture & Rural Development (DARD)
- Department of Environment
- Department of Finance & Personnel
- Environment & Heritage Services (EHS)
- Health and Safety Executive NI
- Magherafelt District Council
- Planning Service
- Rivers Agency

- Northern Ireland Water (NI Water)
- Geological Society of Northern Ireland
- Northern Ireland Badger Group
- Royal Society for the Protection of Birds (RSPB) Northern Ireland
- Ulster Wildlife Trust.

The following data sources have been reviewed:

- Magherafelt Bypass Options Study: Roads Service Western Division, Final Report, June 2006
- A31 Magherafelt: Stage 1 Scheme Assessment Report Constraints Report, v4.0 Feb 2008.

7.2 Air Quality

7.2.1 Baseline

A review of air quality data supplied to Mouchel by Magherafelt District Council has identified that there are exceedences of national mean averages of NO_2 within Magherafelt Town Centre. The desk top review has also shown that there is no Air Quality Management Areas (AQMA's) in place within Magherafelt Town Centre. The high levels of traffic that currently navigate through Magherafelt contribute to the heightened levels of NO_2. The primary sources of industry i.e. concrete works, light industry and recycling centre are located along the eastern urban fringes of Magherafelt.

7.2.2 Impacts

There is anticipated to be a net improvement with the provision of the Blue and Pink Routes which equates to positive impact on local air quality, i.e. negative value in change of exposure to NO_2 and PM_{10} concentrations within 200m of the proposed scheme. The Purple Route is anticipated to have a negative impact on local air quality.

All three routes are considered to lead to a change in Annual Mean PM_{10} and NO_2 concentrations at 20m from the road centre in excess of 1 µg/m3 and 2 µg/m3 respectively.

There is anticipated to be a net improvement with the construction of the Blue Route which has a positive impact (negative value in change of NO_x and carbon emissions within 200m of the proposed scheme). Through modelling it has been identified that the Pink and Purple Routes are anticipated to have a negative impact on regional air quality and greenhouse emissions due to a rise in carbon emissions and key pollutants.

7.2.3 Mitigation

It is recommended that further assessment is undertaken with the application of dispersing modelling which will provide an accurate method of quantifying the impact on properties in the vicinity of the proposed alignment and assist in identifying properties which are likely to experience improvements or deteriorations in air quality.

7.3 Cultural Heritage

7.3.1 Baseline

The study area includes lands extending from Tamnadeese, Carraloan (Glebe) and Polepatrick townlands in the north, through Tullylinkisay, Dunamoney, Killyfaddy and Townparks of Magherafelt, to Leckagh in the south. It is an area of rich undulating countryside. Land use comprises a combination of housing, existing roads, industrial sites and recreational areas on the urban fringe. Beyond the immediate fringe, pastoral agriculture is the dominant activity.

The desk based review undertaken as part of the assessment has identified that there is one historic building associated with the study area; Glenbrook House a Grade 1 listed building, access to the house is via a drive from the A31 750m east of Magherafelt. The frontage of the property including boundary walls, gates and piers are included as part of the listing. The review of existing information and records reveal that there are no buildings, historic parks and gardens and demesnes within the study area at risk. However through consultation and review of existing records, it has been noted that 17 recorded sites are located in the study area and a further seven have been identified during the site walk over survey, shown in **Appendix A Figure 7.1** with **Appendix F** showing the photographs taken, there are also 26 listed buildings located within the town centre of Magherafelt.

7.3.2 Impacts

The assessment has concluded that none of the three options under consideration will directly impact upon any recorded archaeological (SMR) sites, Historic Buildings (HB) or Industrial Heritage Sites identified within the study area. However the Purple Route does impact upon the frontage of Glenbrook House (Site 18) which will require the loss of existing boundary detail and encroachment on the setting of the listed building and potential impact upon extensions to two recorded enclosures (Sites 3 & 4) and one unrecorded enclosure (Site 17).

There is potential impact from the progression of the Pink Route upon two sites identified during the walkover survey, Sites 20 & 21, associated with the flax mil site (Site 14).

The Blue Route will potentially have no significant impacts on features and sites of cultural heritage interest, the Pink Route will have a potentially slight impact on these interests and the Purple Route will have the greatest impact out of the three options.

7.3.3 Mitigation

Route selection should be informed by the principle of avoiding, where possible, known sites of archaeological or built heritage interest. Where it is not possible to avoid a particular feature, a range of mitigation factors should be taken into account in order to minimise impact.

Pre-construction mitigation measures could incorporate the following:

- a programme of phased archaeological investigations should be agreed between the developer and the EHS
- the preferred route should be systematically walked and inspected by a suitably qualified archaeologist to further examine sites of potential interest and to examine for unknown or unrecorded sites of archaeological sites of significance
- a programme of archaeological monitoring should take place during all ground disturbance activities, undertaken by an archaeologist under licence from the EHS to record any archaeological deposits and recover artefacts.

The local archaeologist should possess the authority to halt development if buried archaeological features or finds are unearthed. If direct impact of these features is unavoidable, the EHS may require a full archaeological excavation. Sites which are subject to unavoidable partial or total destruction should be fully recorded to preserve the sites by way of record.

7.4 Disruption Due to Construction

7.4.1 Baseline

The principal sensitive receptors associated with the study area are shown in **Appendix A Figure 7.2**. In addition to the sensitive receptors shown on the map the following was taken in to consideration:

- residents living in properties along the eastern and northern fringes of Magherafelt
- residents living in farmsteads and houses dispersed throughout the study area within the countryside to the east and north east of the town
- visitors, workers and users associated with communal and recreational facilities located to the east and north east of the town including Sperrin Integrated College, Holy Family Primary School, Kilronan Special Needs School, Magherafelt District Council Offices, Meadowbank Sports Arena, Rugby Club and the Gaelic Football Ground on Castledawson Road

- businesses and commercial interests located on the eastern fringe of the town and within the study area (these include farm holdings, a concrete plant and a fabrication plant)

- local watercourses that flow through the study area (the Ballymoghan Drain, Coppies River and associated tributaries)

- recorded and potential sites and features of cultural heritage interest (see Section 7.3)

- Habitats and protected species associated with the combination of urban fringe and countryside within the study area and beyond - these include badgers and bats associated with woodland and hedgerows and also otters associated with the local watercourses. (see Section 7.5).

7.4.2 Impacts

Due to the proximity of the Blue Route to the urban fringe, the Construction related impacts will be potentially be the greatest; it will have the greatest air, noise and visual impact upon the many residential receptors that exist along Meadowbank Road. Incorporating Meadowbank Road into the Blue Route option will require the acquisition of land either side of Meadowbank Road to achieve a suitable highway standard and road speed.

The additional traffic volumes travelling along Meadowbank Road will be problematic for visitors seeking access to Meadowbank Sports Arena whilst creating an unsafe environment for the pupils of Kilronan Special Needs School. The proposed tie-in junction at Castledawson Road between Sperrin Integrated College and Holy Family Primary School also has the potential to have a significant impact upon vehicle travellers and non-vehicle travellers.

The Purple and Pink Routes display similar characteristics and therefore will have a similar order of impacts. Both routes are set to the east of Magherafelt urban fringe and set within pastoral farmland.

The Pink Route has the least order of impacts, having the least air, noise and visual impact. However being the longest in length the Pink Route has the greatest impact upon severance of land and access to land.

7.4.3 Mitigation

Mitigation will be required for all three options, incorporating of statutory and best practice measures related to protection of environmental resources and sensitive receptors within site specific working methods and operational protocols. These will be formalised as part of a **C**onstruction **E**nvironmental **M**anagement **P**lan (CEMP) which will be a mandatory part of any contract for construction of the proposed works. The measures will address

management of construction related traffic, noise and dust suppression, working margins and methods related to historic features, sensitive habitats and species and watercourses.

7.5 Ecology and Nature Conservation

7.5.1 Baseline

No statutorily designated sites have been identified within 2km of the study area. Two such sites are located within 10km of the study area: Lough Neagh and Curran Bog. The study area supports a variety of habitat types ranging from grassland, hedgerows, broad-leaved and semi natural woodland, plantation woodland, scrub, watercourses, introduced scrub and tall ruderal. All of these habitat types are shown in **Appendix A Figure 7.3** and the target notes supporting the Phase 1 habitat map are represented in **Appendix G.**

A series of surveys undertaken as part of the ecology & nature conservation assessment have identified that no rare species of invertebrates have been found, no white clawed crayfish or fresh water pearl mussel live in any of the watercourses. Three ponds are located throughout the study area which could provide potential habitat for smooth newts.

A variety of breeding birds have been identified during the breeding bird survey and through review of records provided by the EHS Conservation Designation Protection Unit, a total of 36 species of birds have been identified during the wintering bird survey, a breakdown of the species identified during both the breeding and wintering birds surveys can be found the Stage 2 Environmental Assessment Report.

The study area does support protected species populations of otter, badger and bats which have been identified during the surveys undertaken in 2007. The Phase 1 Habitat Map and supporting target notes illustrates where these protected species are located, **Appendix A Figure 7.3 and Appendix G.**

A review of records provided by **C**entre for **E**nvironmental **Da**ta and **R**ecording (CEDaR), show that populations of brown trout ***salmo trutta fario*** and Atlantic salmon ***salmo salar*** have been founding the River Moyola to the east of the study area.

7.5.2 Impacts and Mitigation

Potential impacts of the three options on ecological features are scheduled in **Table 7.1**.

Feature	Evaluation	Blue Route Impacts	Purple Route Impacts	Pink Route Impacts	Possible mitigation
Watercourses	Local	4 watercourse crossing points. Increased pollution-laden and sediment-laden runoff	5 watercourse crossing points. Increased pollution-laden and sediment-laden runoff	11 watercourse crossing points. Increased pollution-laden and sediment-laden runoff	Standard pollution control measures
Japanese knotweed and giant hogweed	n/a	Spread during construction	Spread during construction	Spread during construction	Eradication, e.g. through herbicide control
Direct loss and damage of hedgerows	Up to local level	38 sections of hedgerow will be lost or damaged	55 sections of hedgerow will be lost or damaged	62 sections of hedgerow will be lost or damaged	Minimisation of the construction working area
Direct loss and damage of trees and woodland	Local level	Relatively low number of trees will be lost	Relatively high number of trees will be lost and one area of woodland will be directly affected	Relatively high number of trees will be lost and one area of woodland will be directly affected	Minimisation of the construction working area
Habitat fragmentation	n/a	Significant increase in fragmentation; but somewhat limited in severity due to proximity to urban area.	Significant increase in fragmentation	Significant increase in fragmentation	Off-site compensation & underpasses
Smooth newts (if present)	Local	None anticipated	None anticipated	Direct loss of terrestrial habitat; damage of habitats; habitat fragmentation; disturbance and road kill	If present; exclusion through trapping, fingertip searching and drift fencing along with habitat creation
Birds	Local	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; and disturbance during construction and operation and nest damage	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; and disturbance during construction and operation and nest damage	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; and disturbance during construction and operation and nest damage. Disturbance or damage of suspected buzzard nesting site.	Vegetation clearance outside main bird nesting season (March to August inclusive). Licensing of any impacts on buzzard nesting site. If barn owls present, creation of tall hedgerows adjacent to the carriageway to minimise collision rates
Winter birds	Local	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; and disturbance during construction and operation	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; and disturbance during construction and operation	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; and disturbance during construction and operation	-
Otters	Local	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; disturbance of otters;	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; disturbance of otters;	Direct habitat loss; damage of habitats; habitat fragmentation; road kill; disturbance of otters; and possible	Pre-construction check for holts. Fencing. Open span bridge design / otter ledges

Feature	Evaluation	Blue Route Impacts	Purple Route Impacts	Pink Route Impacts	Possible mitigation
		and possible impacts on holts	and possible impacts on holts	impacts on holts	
Badgers	Within immediate zone of influence only	No direct impact on setts predicted. Moderate level of habitat fragmentation; possibly an increased rate of badger mortality through road kill	Direct impact on at least two setts. High level of habitat fragmentation; possibly an increased rate of badger mortality through road kill	Direct impact on at least one sett. High level of habitat fragmentation; possibly an increased rate of badger mortality through road kill	If present, provision of underpasses and badger-proof fencing
Bats	Local	Possible damage/disturbance of roosts if present. Habitat fragmentation and possibly an increased rate of bat mortality through road kill	Possible damage/disturbance of roosts if present. Habitat fragmentation and possibly an increased rate of bat mortality through road kill	Damage/disturbance of at least one roost. Habitat fragmentation and possibly an increased rate of bat mortality through road kill	Provision of alternative roosting opportunities and seasonal timing restrictions; habitat creation and/or creation of 'green roads' over the new road

Table 7.1 Potential Impacts of the Three Options on Ecological Features

7.6 Landscape

7.6.1 Baseline

Appendix A Figure 7.4 shows the Landscape Constraints identify during a desk- review and walkover survey. The study area is dominated by pastoral agricultural farmland supporting varying farming practices from dairy, beef, sheep and arable. The landscape is typified by a rolling landform in which the remnants of drumlins form noticeable high points. The drumlins are frequently wooded and define local views of the adjacent countryside. Killowen Hill in the south of the study located between Moneymore Road and Ballyronan Road is a prominent example of such a feature. The network of small watercourses has etched small local valleys within the soft boulder clay forming significant local valleys.

Small woodlands are sparsely scattered throughout the study area, including typical woodland species of ash, oak, beech, horse chestnut, willow and hazel, some scrub species are also present in bramble, dog rose, hawthorn, holly and blackthorn. Much of the woodland species present appear to be semi-natural in origin there is evidence of past supplementary planting in some areas. These pockets of woodland are considered to be locally valuable and important beyond the study area which supports faunal species including birds, bats and badgers.

The field pattern within the study area comprises generally of medium sized fields which are enclosed and demarcated by mixed species hedgerows. The field pattern to the south of the study area is generally much smaller and enclosed providing for a more intricate field pattern and network of hedgerows. The field pattern to the north of Aughrim Road is characterised by a much more open field pattern and exhibiting a less intricate network of hedgerows with a less undulating landform.

7.6.2 Impacts

The proposed route options cause varying degrees of impact upon the landscape character of the study area, impacting on the landscape pattern and hedgerow network. Due to the undulating landform and landscape features there is a requirement for engineered earthworks for all the routes under consideration.

The Blue Route will have the least impact upon the integrity of the landscape due to it being the shortest of the three routes. Approximately 38 hedgerows will be severed and 4 watercourse crossings will be required. However given the proximity it has to the urban settlement it has the greatest visual impact.

The Purple Route displays similar characteristics as the Pink they follow almost the same path until Aughrim Road where the Purple Route continues northwest to tie-in to Castledawson Road. Approximately 55 hedgerows will be severed; this route will also require 5 watercourse crossings.

The Pink Route is the longest of the three options and will have the greatest impact upon the landscape, it severe the most fields and has the greatest earthwork requirement impacting upon landscape pattern. A total of 62 hedgerows will be severed and 11 watercourse crossings will be required.

Both the Pink and Purple will have similar visual impacts as they are both set within the landscape to the east with existing vegetation providing a screen for local receptors. Although the Pink Route is the only one of the three options which does not encroach on any areas designated as Local Landscape Policy Areas, with the Blue having the greatest impact on this resource, shown in **Appendix A Figure 7.5**.

Further detail on the landscape & visual impacts associated the three routes is referenced in the Stage 2 Environmental Assessment Report.

7.6.3 Mitigation

At this stage of the design process mitigation measures will be considered at a broad level to outline an approach at the detailed design stage. The broad principals that should be applied to all routes are:

- achieving best fit within the existing landform, to minimise the need for engineered embankments and cuttings
- consider opportunities for planting that will integrate the route into the existing landscape framework whilst providing ecological opportunities
- identify hedgerows and field boundaries that will be affected by the proposals and that will require planting to restore local connectivity
- identify opportunities for site specific mitigation to provide screening of significant views e.g. the use of walls, environmental barriers, earth mounding
- develop an approach to hard structures, surface finishes and treatments to better integrate the route into the existing infrastructure framework.

7.7 Land Use

7.7.1 Baseline

Agriculture is the predominant land use within the study area. Farming systems comprise mainly of cattle and sheep rearing, dairy farming and there are a low number of farms producing cereals, general crops or are involved in horticulture. The field pattern surrounding Magherafelt is bound by managed hedgerows and interspersed with pockets of deciduous woodland.

Industrial and commercial activity is located in the western edges of the study area; the eastern periphery of Magherafelt Urban Fringe i.e. concrete works, small number of light industrial units and a small number of businesses are located along Pound Road.

Several areas of land throughout the study area have been designated as 'Land Zoned for Housing' and 'Land Zoned for Industry' (**Appendix A Figure 6.4**). The Local Landscape Policy Areas are primarily located at the northern and south-western urban fringe of Magherafelt and fall within the study area as illustrated on **Appendix A Figure 7.4.**

Data gathered from the DARD indicates that land classification for farmland surrounding Magherafelt comprises a mixture of predominantly Class 2 **B**est and **M**ost **V**ersatile (BMV), Class 3A- BMV and Class 3B-BMV land, with class 3A-BMV dominating in the east on **Appendix A Figure 7.6**.

7.7.2 Impacts

It is anticipated that all three routes will potentially generate effects ranging from medium to high significance on the receiving land use pattern.

All of the route options cut through BMV land upon connection to the A31 Moneymore Road. The Blue Route has the least impact on BMV land for the length of its route, followed by the Pink Route and the Purple Route has the greatest impact. The Pink and Purple Routes predominately traverse a farmland landscape and will result in varying degrees of severance of viable agricultural units and field boundaries, creating accessibility issues and possibly creating disturbance related impacts upon livestock and/or crop management.

It is not possible to accurately determine land take requirements at this stage. The assessment has been based on landownership information and the level of information is not comprehensive enough to encompass all the effects on the agricultural land use in terms of husbandry, access, water supply and drainage. Further site survey work and liaison with landowners will be necessary to assess these effects in more detail.

7.7.3 Mitigation

The route option selection should aim to avoid altering the integrity of the existing land use pattern or result in the loss of valuable land and / or built form. Principles behind successful mitigation to aid proposal integration and minimise land take will include the purchase of severed and underused areas of land for incorporation into the mitigation strategy for the proposals.

7.8 Traffic Noise and Vibration

7.8.1 Baseline

The primary sources of noise within Magherafelt Town Centre are from the high volumes of traffic currently passing through the town, HGV's contribute greatly to experienced noise levels in the town.

Using the Atkins Road Noise software, Do-Minimum noise levels have been predicted for 2027 at potential sensitive receptor locations within 300m of the existing A31 and proposed route options which are likely to be affected. **Table 7.2** contains the predicted noise levels for the Do-Minimum scenario in 2027.

Please Note:

Noise is measured in units referred to as decibels (dB). The decibel is a logarithmic measure of sound pressure i.e. the magnitude of the pressure vibrations in the air. The audible range of sound pressure levels is between 0 dB (the threshold of hearing) to 120 dB (the threshold of pain).

For environmental noise assessments, the 'A-weighted' scale provides the correlation between sound pressure levels (in dB (A)) and typical known activities.

As traffic noise fluctuates continually, it is necessary to define it in a way that can be related to the subjective response of those hearing it. Surveys have shown a relationship between the annoyance caused by road traffic and the sound level exceeded for 10% of the time (between 06:00 and 24:00 hours). The noise level that is exceeded 10% of each hour, of the time for the 18-hour period, is known as the $L_{A10\ 18\ hr}$.

I.D	Receptor	Distance from Blue Route	Distance from Pink Route	Distance from Purple Route	Do-Minimum 2027 Calculated Noise Level $L_{A10\ 18\ hr}$ dB(A)[1]
R01	4 Manor Close	40	300	320	43.1
R02	27 Meadowbank Road	10	660	880	63.6
R03	23 Loves Road	750	130	60	45.0
R04	24 Killyfaddy Road	640	40	200	54.7
R05	98 Moneymore Road	40	30	30	68.0
R06	16 Ballymoghan Road	30	30	30	53.4

[1] Noise level calculated at most exposed façade43.2

I.D	Receptor	Distance from Blue Route	Distance from Pink Route	Distance from Purple Route	Do-Minimum 2027 Calculated Noise Level $L_{A10\ 18\ hr}$ dB(A)[1]
R07	35 Leckagh Drive	140	960	740	48.5
R08	31 Sandy Grove	150	890	1320	45.5
R09	55 Aughrim Road	850	200	30	43.0
R10	46 Magherafelt Road	1600	120	990	59.5
R11	52 Aughrim Road	590	510	190	55.1
R12	10 Love's Road	640	440	0	43.2
R13	2 Ballymoghan Road	250	250	250	60.0
R14	3 Parkmore close	250	810	750	38.2
R15	31 Killyneese Road	1290	270	840	45.0
R16	89 Ballyronan Road	740	110	50	52.4
R17	59 Magherafelt Road	370	1220	240	51.7
R18	71 Ballyronan Road	500	240	400	71.9

Table 7.2 Predicted noise levels for Do-Minimum 2027 scenarios

7.8.2 Impacts

The calculated Do-Something scenario in 2027 noise level at representative properties for each route option is shown in **Table 7.3**. The change compared to the Do-Minimum scenario in 2027 is also shown for each property and route option.

Table 7.3 - Predicted noise levels for Do-Something 2027 scenarios

ID	Receptor	Do-Minimum	Blue Route		Pink Route		Purple Route	
		$L_{A10\ 18\ hr}$ dB(A)	$L_{A10\ 18\ hr}$ dB(A)	Change over Do-Something (dB)	$L_{A10\ 18\ hr}$ dB(A)	Change over Do-Something (dB)	$L_{A10\ 18\ hr}$ dB(A)	Change over Do-Something (dB)
R01	4 Manor Close	43.1	69.6	26.5	58.1	15.0	58.0	14.9
R02	27 Meadowbank Road	63.6	73.3	9.7	61.8	-1.8	62.0	-1.6
R03	23 Loves Road	45.0	45.8	0.8	70.4	25.4	52.7	7.7
R04	24 Killyfaddy Road	54.7	56.8	2.1	72.1	17.4	63.0	8.3
R05	98 Moneymore Road	68.0	64.4	-3.6	66.7	-1.3	65.1	-2.9
R06	16 Ballymoghan Road	53.4	71.4	18.0	68.2	14.8	70.1	16.7
R07	35 Leckagh Drive	48.5	55.5	7.0	50.5	2.0	50.7	2.2
R08	31 Sandy Grove	45.5	59.3	13.8	44.2	-1.3	46.2	0.7
R09	55 Aughrim Road	43.0	44.6	1.6	40.6	-2.4	64.1	21.1
R10	46 Magherafelt Road	59.5	59.4	-0.1	60.1	0.6	59.4	-0.1
R11	52 Aughrim Road	55.1	56.8	1.7	54.0	-1.1	58.7	3.6
R12	10 Loves Road	43.2	44.7	1.5	58.0	14.8	65.0	21.8
R13	2 Ballymoghan Road	60.0	63.9	3.9	61.7	1.7	63.8	3.8
R14	3 Parkmore close	38.2	42.4	4.2	38.1	-0.1	40.3	2.1
R15	31 Killyneese Road	45.0	46.7	1.7	59.3	14.3	51.4	6.4
R16	89 Ballyronan Road	52.4	63.1	10.7	55.5	3.1	73.7	21.3
R17	59 Magherafelt Road	51.7	53.7	2.0	50.1	-1.6	55.4	3.7
R18	71 Ballyronan Road	71.9	72.3	0.4	72.2	0.3	71.2	-0.7

The predicted noise impact in relation to the significance criteria at each property for each route option is shown in **Table 7.4**.

I.D	Receptor	Noise Impact		
		Blue Route	Pink Route	Purple Route
R01	4 Manor Close	Severe Adverse	Severe Adverse	Severe Adverse
R02	27 Meadowbank Road	Substantial Adverse	Slight Beneficial	Slight Beneficial
R03	23 Loves Road	Negligible Adverse	Severe Adverse	Substantial Adverse
R04	24 Killyfaddy Road	Slight Adverse	Severe Adverse	Substantial Adverse
R05	98 Moneymore Road	Moderate Beneficial	Slight Beneficial	Slight Beneficial
R06	16 Ballymoghan Road	Severe Adverse	Severe Adverse	Severe Adverse
R07	35 Leckagh Drive	Substantial Adverse	Slight Adverse	Slight Adverse
R08	31 Sandy Grove	Severe Adverse	Slight Beneficial	Negligible Adverse
R09	55 Aughrim Road	Slight Adverse	Slight Beneficial	Severe Adverse
R10	46 Magherafelt Road	Negligible Beneficial	Negligible Adverse	Negligible Beneficial
R11	52 Aughrim Road	Slight Adverse	Slight Beneficial	Moderate Adverse
R12	10 Loves Road	Slight Adverse	Severe Adverse	Severe Adverse
R13	2 Ballymoghan Road	Moderate Adverse	Slight Adverse	Moderate Adverse
R14	3 Parkmore close	Moderate Adverse	Negligible Beneficial	Slight Adverse
R15	31 Killyneese Road	Slight Adverse	Severe Adverse	Substantial Adverse
R16	89 Ballyronan Road	Severe Adverse	Moderate Adverse	Severe Adverse
R17	59 Magherafelt Road	Slight Adverse	Slight Beneficial	Moderate Adverse
R18	71 Ballyronan Road	Negligible Adverse	Negligible Adverse	Negligible Beneficial

Table 7.4 Predicted noise impact for 2027

7.8.3 Mitigation

Various mitigation measures can be implemented low road noise surfacing can be utilised and a reduction level of 3dB (A) can be achieved. Environmental noise barriers can also be utilised to attenuate noise levels at specific significantly affected properties. Environmental barriers can take the form earth mounds, noise barriers, substantial fences and walls. Noise barriers offer marginally increased attenuation than earth mounds of the same size because the top of an earth mound cannot be located as close to the road as a barrier.

7.9 Pedestrians, Cyclists, Equestrians and Community Effects

7.9.1 Baseline

A desk based review of mapping of the area and an initial walkover survey undertaken confirmed that there are no designated footpaths, bridleways or cycleway provision located within Magherafelt or the study area. However, at the Public Information Events it was highlighted that a track from Ballyronan Road to Killyfaddy Road was used as an unofficial walkway which is shown in **Appendix A Figure 7.7.**

A number of community facilities have been identified to the east of Magherafelt Town Centre that fall within the 500m that was applied for the purposes of this assessment. These include the Meadowbank Sports Arena and Rugby Club, Kilronan Special Needs School, Sperrin Integrated College, Holy Family School, Polepatrick Cemetery, Gaelic Football Ground and the Golf Course.

7.9.2 Impacts

A designated cycle-way exists on the Moneymore Road from Spires Integrated Primary School travelling north-easterly approximately 0.5km and terminating opposite St Pius X School. For each of the proposed bypass options their tie-in with the Moneymore Road would be opposite the Coolshinney Road which is approximately 0.4km south-west of the cycle-way therefore there will be no impact upon the existing cycleway.

In terms of community severance the three routes will have similar impacts and benefits.

All three routes have the potential to improve travel time within and around the town centre by the removal of strategic traffic flows, therefore having a positive impact upon community severance within the town centre.

7.9.3 Mitigation

It is recommended that in order to minimise the impact of building either options and to maximise the opportunity for improvement of the local footpath network and cycle-way provision, the following mitigation measures should be incorporated:

- integrated pedestrian and cyclist facilities, reducing the potential conflict between vehicle users and non-vehicle users
- provision of safe crossing points where the alignment crosses the local roads radiating from the town centre
- provision of access for local landowners severed by the preferred alignment.

7.10 Vehicle Travellers

7.10.1 Baseline

The high volumes of traffic travelling through Magherafelt coupled with inconsistent speeds, frequency of junctions, lack of overtaking opportunities and enforced stopping (e.g. school crossing patrols) contribute to the high levels of driver stress experienced by vehicle travellers travelling through Magherafelt.

7.10.2 Impacts

Whilst the traffic volumes will be reduced by each of the route options; it is anticipated that the reduction in driver stress will be minimal through the town centre for local vehicle travellers due to the speed restrictions within the town. However, drivers using either the Purple or Pink Routes will experience reduced stress levels from high down to moderate as a constant design speed of 100kph is achievable, where as travelling along the Blue Route driver stress levels will remain high due inconsistent travelling speed and potential conflict with other vehicle travellers and non-vehicle travellers seeking access to the community facilities in close proximity to the Blue Route and Meadowbank Residential area.

Travelling along the Purple or Pink Routes vehicle travellers will be offered intermittent and wider views of the wider landscape elements. Further detail on the associated impacts of the proposed routes is detailed in the Stage 2 Environmental Assessment Report.

7.10.3 Mitigation

A number of factors can help with mitigating driver stress, over and above changes in traffic volume and speed. These include the following:

- road layout and geometry
- surface riding characteristics
- junction frequency.

Any solution should aim to offer attractive views across the countryside for vehicle based travellers to mitigate from the road impacts. The assessment findings will provide a

framework to build a landscape mitigation strategy upon, encompassing mitigation for vehicle based views from the road where applicable.

General principles which can be adopted include the following:

- establishment of an overall hard and soft landscape design strategy along the preferred corridor to integrate any proposals into the wider surroundings
- compensatory planting for loss of any important trees and/or hedgerows along the road corridor
- offsite planting by agreement with landowners.

7.11 Road Drainage and the Water Environment

7.11.1 Baseline

There are a number of watercourses and drainage channels throughout the study area they include; the Ballymoghan Drain, the Burnbunley and the Coppies River watercourses which are fed by small tributaries and land drains. Monitoring of the Magherafelt Burn which included both the Ballymoghan Drain and the Burnbunley undertaken by the Water Management Unit of the EHS has revealed that water chemistry and biology is good - very good and fair, respectively.

7.11.2 Impacts & Mitigation

Table 7.5 Impact Assessment Summary Table

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Construction Phase			**Blue**				
Downstream Flooding	Low	Negligible	Neutral	Insignificant increase in impermeable area within each catchment	All discharges to watercourses to be attenuated	Negligible	Neutral
Loss of Ponds	Low	Negligible	Neutral	None- no areas of standing water lost	None as no areas of standing water lost but potential for ponds to the gain	Negligible	Neutral

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Surface Water Quality - Silt	High	Moderate	Moderate Adverse	Excessive silt in the watercourses causing damage to fish aquatic vegetation and aesthetics	Prevent direct discharges to watercourse. Provide settlement ponds and gully traps	Negligible	Neutral
Surface Water Quality – Oils and Hydrocarbons	High	Moderate	Moderate Adverse	Oils and hydrocarbons entering the watercourse will damage the ecology and quality of the environment	Oil interceptors and attenuation ponds installed as part of the site drainage. Produce an environmental management plan	Negligible	Neutral
Groundwater	The impact will be most severe on development completion and is considered in the operational phase only.						
Onsite Flooding	Medium	Minor	Slight Adverse	Road will cross a couple of minor watercourses with narrow historic floodplains	Limit use of floodplain during the construction phase, monitor weather and build road above the flood level	Negligible	Neutral
Operational Phase	**Blue**						
Downstream Flooding	Low	Negligible	Neutral	Insignificant increase in impermeable area within each catchment	All discharges to watercourses to be attenuated	Negligible	Neutral
Surface Water Quality – Oils and Hydrocarbons	Low	Negligible	Neutral	Oils and hydrocarbons entering the watercourse will damage the ecology and quality of the environment	Oil interceptors and attenuation ponds installed as part of the road drainage system	Negligible	Neutral

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Groundwater	Medium	Minor	Slight Adverse	Reduction in infiltration area and possible disruption to groundwater flow paths	Keep impermeable area and construction disturbance to minimum to reduce impact	Negligible	Neutral
Onsite Flooding	Medium	Minor	Slight Adverse	Road will cross a couple of minor watercourses with narrow historic floodplains	Build above flood level & minimise impact on floodplain. Use SUDs to attenuate discharge	Negligible	Neutral

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of Residual Effects	Significance of residual effects	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Construction Phase			**Pink**						**Purple**					
Downstream Flooding	Low	Negligible	Neutral	Insignificant increase in impermeable area within each catchment	All discharges to watercourses to be attenuated	Negligible	Neutral	Low	Negligible	Neutral	Insignificant increase in impermeable area within each catchment	All discharges to watercourses to be attenuated	Negligible	Neutral
Loss of Ponds	Low	Negligible	Neutral	None- no areas of standing water lost	None- no areas of standing water lost but potential for ponds to the gain	Negligible	Neutral	Low	Negligible	Neutral	None- no areas of standing water lost	None - no areas of standing water lost but potential for gaining ponds	Negligible	Neutral
Surface Water Quality - Silt	High	Major	Large Adverse	Excessive silt in the watercourses causing damage to fish aquatic vegetation and aesthetics	Prevent direct discharges to watercourse. Provide settlement ponds and gully traps	Negligible	Neutral	High	Major	Large Adverse	Excessive silt in the watercourses causing damage to fish, aquatic vegetation and aesthetics	Prevent direct discharge to watercourses. Provided settlement ponds and gully traps	Negligible	Neutral

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of Residual Effects	Significance of residual effects	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Surface Water Quality – Oils and Hydrocarbons	High	Major	Large Adverse	Oils and hydrocarbons entering the watercourse will damage the ecology and quality of the environment	Oil interceptors and attenuation ponds installed as part of the site drainage. Produce an environmental management plan	Negligible	Neutral	High	Major	Large Adverse	Oils and hydrocarbons entering the watercourse will damage the ecology and quality of the environment	Oil interceptors and attenuation ponds installed as part of the site drainage. Produce an environmental management plan	Negligible	Neutral
Groundwater	The impact will be most severe on development completion and is considered in the operational phase only.							The impact will be most severe on development completion and is considered in the operational phase only.						
Onsite Flooding	Medium	Minor	Slight Adverse	Road will cross a couple of minor watercourses with narrow historic floodplains	Limit use of floodplain during the construction phase, monitor weather and build road above the flood level	Negligible	Neutral	Medium	Minor	Slight Adverse	Road will cross a couple of minor watercourses with narrow historic floodplains	Limit use of floodplain during the construction phase, monitor weather and build road above the flood level	Negligible	Neutral

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of Residual Effects	Significance of residual effects	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Operational Phase	**Pink**							**Purple**						
Downstream Flooding	Low	Negligible	Neutral	Insignificant increase in impermeable area within each catchment	All discharges to watercourses to be attenuated	Negligible	Neutral	Low	Negligible	Neutral	Minor increase in the surface water runoff due to increase impermeable area	All discharges to watercourses to be attenuated	Negligible	Neutral
Surface Water Quality – Oils and Hydrocarbons	Low	Negligible	Neutral	Oils and hydrocarbons entering the watercourse will damage the ecology and quality of the environment	Oil interceptors and attenuation ponds installed as part of the road drainage system	Negligible	Neutral	Low	Negligible	Neutral	Oils and hydrocarbons entering the watercourse will damage the ecology and quality of the environment	Oil interceptors and attenuation ponds installed as part of the road drainage system	Negligible	Neutral
Groundwater	High	Moderate	Moderate Adverse	Reduction in infiltration area and possible disruption to groundwater flow paths	Keep impermeable area and construction disturbance to minimum to reduce impact	Negligible	Neutral	High	Minor	Moderate Adverse	Reduction in infiltration area and possible disruption to groundwater flow paths	Keep impermeable area and construction disturbance to minimum to reduce impact	Negligible	Neutral

Impacts	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of Residual Effects	Significance of residual effects	Importance	Magnitude of potential impact	Significance of impacts	Impact without mitigation	Suggested Mitigation	Magnitude of residual effects	Significance of residual effects
Onsite Flooding	Medium	Minor	Slight Adverse	Road will cross a small area of flood zone 2 & 3 – flooding of site in bad weather damage road	Build above flood level & minimise impact on floodplain. Use SUDs to attenuate discharge	Negligible	Neutral	Medium	Minor	Slight Adverse	Road will cross a couple of minor watercourses with narrow historic floodplains	Build above flood level & minimise impact on floodplain. Use SUDs to attenuate discharge	Negligible	Neutral

Table 7.6 Impact Assessment Summary Table

7.12 Geology and Soils

7.12.1 Baseline

See Section 3.2 Existing Engineering Conditions & Section 5.2 Topography for details of the existing geology and soils.

7.12.2 Impacts

None of the proposed routes will affect any geological sites of special interest, whilst the impact of contaminated land on the scheme is considered to be relatively low for all routes. The opportunity to remedy any contamination encountered will have a slightly beneficial impact.

7.12.3 Mitigation

In order to minimise the impact of changes to the local landforms, the route selected should avoid areas of significant relief where practicable.

The ground investigation for the scheme should target areas where gravel pits and petrol stations are shown in order to quantify any contamination within these areas. If encountered by any of the routes, contaminated land will be actioned in accordance with the appropriate waste management regulations.

In areas of permeable drift deposits care should be taken, in relation to potentially pollution activities during construction (i.e. refuelling and fuel storage etc.).

The migration potential of contamination or pollution events (if present) to possible groundwater abstractions, including potentially domestic supplies, will need to be established. If domestic and sensitive abstractions are present within the route corridor or immediate surrounding area then investigations should be undertaken to assess the impact of construction. Nevertheless, construction activities will need to implement pollution prevention requirements to minimise the impact on groundwater and local groundwater abstractions.

7.13 Policies and Plans

7.13.1 Baseline

The Regional Development Strategy for Northern Ireland 2025 “Shaping Our Future” formulated in September 2001 provides details of the vision and guiding principles of the objectives, to develop an integrated regional transportation system aimed at supporting economic development whilst caring for the environment. It also lays out plans for spatial development in Northern Ireland at a more local level.

The Regional Transport Strategy for Northern Ireland 2002 – 2012 expatiates on the Regional Development Strategy setting out the transportation vision "to have a modern, sustainable, safe, transportation system which benefits society, the economy and the environment and which actively contributes to social inclusion and everyone's quality of life." This comprises the 10 year plan towards achieving the vision and setting the targets for 2012.

The Magherafelt Area Plan 2015 – Draft Plan, communicates to the general public, statutory bodies, developers and other interested parties the guiding policy framework governing land use proposals and development decisions within the Magherafelt District over the period of 2000 – 2015. It contains objectives aimed at facilitating sustainable growth, economic development, integration between land use planning and transportation while protecting and enhancing the character, quality and biodiversity of natural and man-made environment.

7.13.2 Impacts

The aims of national and regional level transportation policy will be realised by progression of the proposals. Local policy objectives relating to improving transportation provision in Magherafelt will be furthered by the proposals; however, there may be potential for different degrees of policy conflict with the three route options, principally associated with objectives to conserve the natural environment, landscape, built heritage and areas identified for future industrial development.

7.13.3 Mitigation

Route selection should be informed by the relationship of the proposals to existing land use and development planning policy. Mitigation will involve avoidance and / or minimisation of conflicts with local, regional and national policy. As the development of the proposals progresses, more appropriate mitigation strategy development can be undertaken to take account of guidelines and principles embodied within the current planning context.

8 Traffic Assessment Summary

8.1 Background

To facilitate the identification and evaluation of the preferred route for the Magherafelt Bypass, a traffic model was developed for the detailed assessment of the performance of the proposed route options.

The main objective of building the Magherafelt Bypass is to relieve the frequent congestion that occurs in the town centre during peak hours and improve journey times for through traffic. It was agreed to carry out extensive traffic surveys in order to build a new traffic model for Magherafelt to allow a comprehensive review of the proposed route options to be undertaken and to test the various route options using an up-to-date traffic model. The outputs obtained from the traffic model were then used as a major factor in the cost benefit analysis. **Figure 8.1** shows the study area for this project.

Figure 8.1 Traffic Study Area

8.1.1 Modelling

The development and validation of the Base Year model for 2007 was completed and reported in the document titled 'A31 Magherafelt Bypass Traffic Model: Local Model Validation Report', in January 2008.

The A31 Magherafelt traffic model has been developed using the Citilabs CUBE (version 4.1.1) suite of programs. TRIPS (**TR**ansport **I**mprovement **P**lanning **S**ystem), is the module in CUBE which has been used for this project.

8.1.2 Modelled Periods

The Base Year (2007) model was developed for three time periods:

- AM peak hour (AM) (08:15-09:15)
- Average Inter-peak hour (IP) (between 10:00 and 16:00)
- PM peak hour (PM) (17:00-18:00).

The Opening and Design Years for the study were 2012 and 2027 respectively.

8.1.3 Average Annual Daily Traffic (AADT) Conversion Factors

To convert peak hour flows into AADT observed ATC data was used to derive the factors. The resulting factors for the AM and PM Periods were 2.52 and 2.65 respectively. For the Inter-peak period the factor was assumed to be equal to 6 since an average of the six hours consisting the Inter-peak period has been modelled. The process is summarised with the help of equations below:

12-hour Flow = (F_1*AM Hourly Flows + 6*IP Hourly Flows + F_2*PM Hourly Flows)

where:

F_1 = AM **Period** Flows (07:00-10:00) / AM Peak **Hour** Flows (08:15-09:15) = 2.52

F_2 = PM **Period** Flows (16:00-19:00) / PM Peak **Hour** Flows (17:00-18:00) = 2.65.

The formula that is used to derive the AADT flows from the 12 hour flows is as follows:

AADT = (12-hour flows) * F3 * F4

where:

F_3 = observed 24-hour average weekday flows / observed 12-hour (07:00-19:00) average weekday flows = 1.31

F_4 = observed average 24-hour 7-day flows / observed average 24-hour average 5-day flows = 0.95.

The formula that was used to derive the AAWT flows from 12-hour flows is as follows:

$AAWT_{18\ Hr}$ = (12-hour flows) *F_5

where:

F_5 = observed average 18-hour (06:00-24:00) weekday flows / observed 12-hour (07:00-19:00) weekday flows = 1.28.

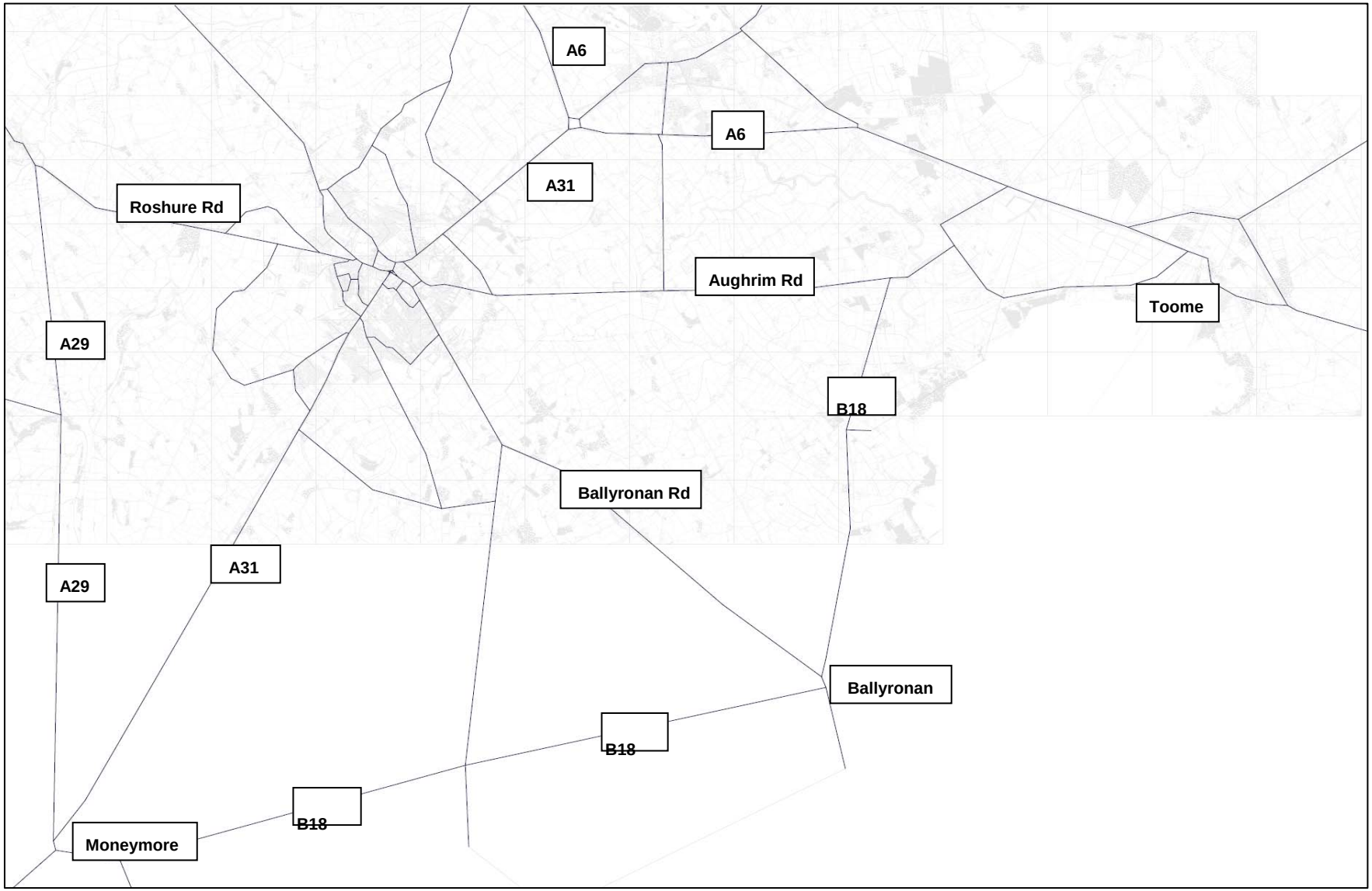
8.1.4 Modelled Highway Network

The study area for the traffic model was defined to ensure that all traffic that could affect the town and the future bypass was included in the traffic model. Within the town centre and in the surrounding area, all local roads were included in the model to ensure that traffic interactions were fully modelled. For the rest of the study area, all A and B class roads were included. The extent of the model is shown in **Figure 8.2**.

8.1.5 Speed Flow Curves

All links have been allocated appropriate speed-flow curves. The speed-flow curves are used to describe a link in terms of its capacity and associated traffic speeds.

Figure 8.2 Modelled Network



8.1.6 Matrix Development

The RSI records were used for the development of the trip matrices which represent the traffic demand in the Base Year. Trips starting and finishing inside the town centre were synthesised using observed trip ends, network costs and a deterrence function.

Two vehicle classes, light vehicles (cars, taxis, vans and minibuses) and heavy vehicles (goods vehicles and buses), have been modelled separately.

8.1.7 Assignment Method

The assignment procedure performs the two basic functions of:

- building paths (or routes) between all pairs of origins and destinations
- loading trips from the matrix onto the network, using the previously calculated paths.

The Burrell technique includes the effect of driver uncertainty about link costs prior to calculating which path was selected for this study. One of the main reasons for selecting this option is the fact that the number of paths built between origin and destination zones can be specified so that the driver behaviour can be sufficiently approximated.

Capacity Restraint is the mechanism by which the model adjusts the link and junction travel times according to the prevailing flows and is used when limitations imposed by the flow capacity of the network materially affect travel speeds through the network. The Capacity Restraint process seeks to achieve a balance (convergence) between assigned flows and speeds using an iterative procedure. TRIPS software provides four methods of Capacity Restraint, namely the Iterative method, the Incremental method, the Volume Averaging method and the Equilibrium method, of which the Volume Averaging Method was selected as the most appropriate for this study.

8.1.8 Model Validation Summary

A summary of link and cordon flow validation is given in **Table 8.1** overleaf, which shows that all the three time period models comfortably meet the DMRB criteria for link and cordon flow validation. On individual link flows, the GEH should be less than 5 on more than 85% of the links and on Screeline Flow Totals, the GEH should be less than 4 on all screenlines.

Table 8.1 Flow Validation Summary Statistics

Time period	% of Links Pass DMRB Criteria		Cordon totals within Criteria
	Flow Criteria	*GEH*	*GEH < 4 Criteria*
AM peak Hour	95.7%	95.7%	All cordons total flows GEH is < 4
PM peak Hour	93.5%	91.3%	All cordons total flows GEH is < 4
Average Inter-peak Hour	93.5%	93.5%	All cordons total flows GEH is < 4

Summary results of observed and modelled journey time comparisons for each route and time period along with percentage differences are given in **Table 8.2**.

Table 8.2 Journey Time Summary Validation Statistics

Route		Route Length (km)	AM Peak Hour				Inter-Peak Hour				PM Peak Hour			
			Observed (mm:ss)	Modelled (mm:ss)	% Diff	Pass DMRB Criteria	Observed (mm:ss)	Modelled (mm:ss)	% Diff	Pass DMRB Criteria	Observed (mm:ss)	Modelled (mm:ss)	% Diff	Pass DMRB Criteria
Route 1: From B40 Draperstown Road to A6 Hillhead Road	EB	15.23	17:09	18:14	6.4%	✓	15:22	16:49	9.5%	✓	17:05	18:18	7.1%	✓
	WB		15:22	16:56	10.1%	✓	15:47	16:37	5.3%	✓	18:44	17:50	-4.8%	✓
Route 2: From A6 Glen Shane Road to A6 Moneynick Road	EB	12.54	11:49	11:56	1.1%	✓	11:00	10:55	-0.8%	✓	11:15	11:16	0.2%	✓
	WB		10:50	11:30	6.1%	✓	10:42	10:53	1.7%	✓	12:24	12:19	-0.7%	✓
Route 3: From B42 Grange Road to B160 Ballyronan Road	SB	10.50	09:47	11:58	22.2%	×	10:47	11:47	9.2%	✓	11:03	12:10	10.0%	✓
	NB		11:08	11:54	6.9%	✓	11:04	11:43	5.7%	✓	11:29	12:10	5.9%	✓
Route 4: From A31 Moneymore Road to A6 Moneynick Road	NB	23.56	25:51	24:16	-6.2%	✓	23:50	22:37	-5.1%	✓	24:08	24:15	0.5%	✓
	SB		23:42	23:32	-0.7%	✓	23:09	22:25	-3.1%	✓	25:43	24:19	-5.4%	✓
Route 5: From A31 Moneymore Road to A6 Moneynick Road	EB	23.12	23:22	23:36	1.0%	✓	23:52	22:25	-6.1%	✓	23:04	24:25	5.8%	✓
	WB		21:06	22:26	6.3%	✓	20:30	21:47	6.2%	✓	21:02	23:11	10.3%	✓
Route 4A: From Coolshinney Road Junction (South) to A6 Castledawson By-pass Roundabout	NB	4.91	09:40	08:41	-10.2%	✓	07:37	08:17	8.8%	✓	07:44	09:07	18.0%	×
	SB		07:49	08:04	3.1%	✓	07:05	07:48	10.0%	✓	07:18	08:08	11.4%	✓
Route 4-1: From A31 Moneymore Road to A6 Hillhead Road	EB	18.41	22:15	21:41	-2.5%	✓	20:04	19:52	-1.0%	✓	20:46	21:57	5.7%	✓
	WB		18:11	19:59	9.9%	✓	18:39	19:26	4.2%	✓	21:01	20:45	-1.3%	✓
Total Number of Routes passing the DMRB Criteria			13 out of 14, i.e. 93% validated				14 out of 14, i.e. 100% validated				13 out of 14, i.e. 93% validated			

8.1.9 Base Year Flows

Figure 8.3 to Figure 8.11present the comparison of the modelled Base Year flows against the observed flows for the AM peak hour, PM peak hour and for the average Inter-peak hour.

Figure 8.3 Modelled vs. Observed AM Peak Hour Flows – Town Centre

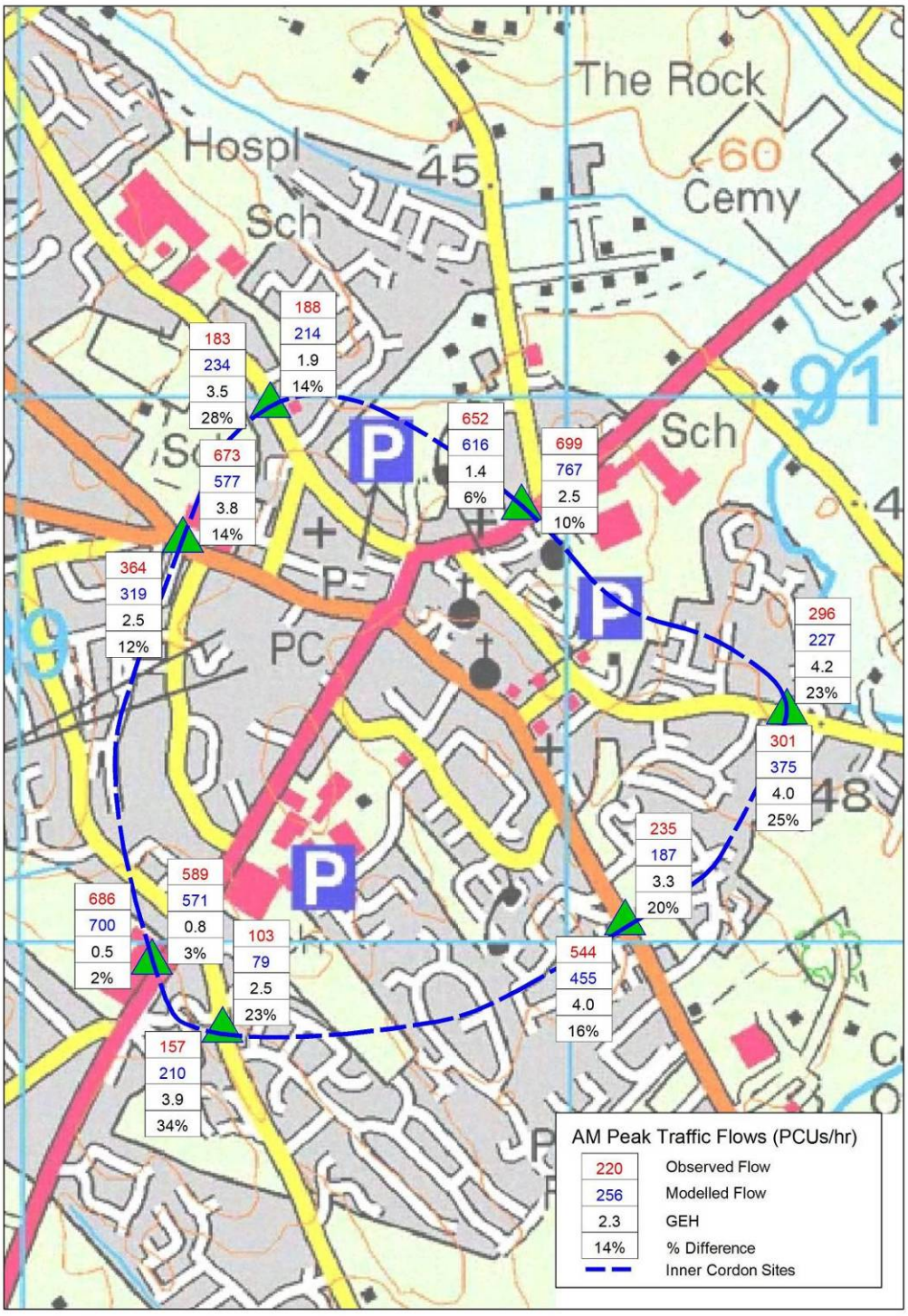


Figure 8.4 Modelled vs. Observed Inter-peak Hour Flows – Town Centre

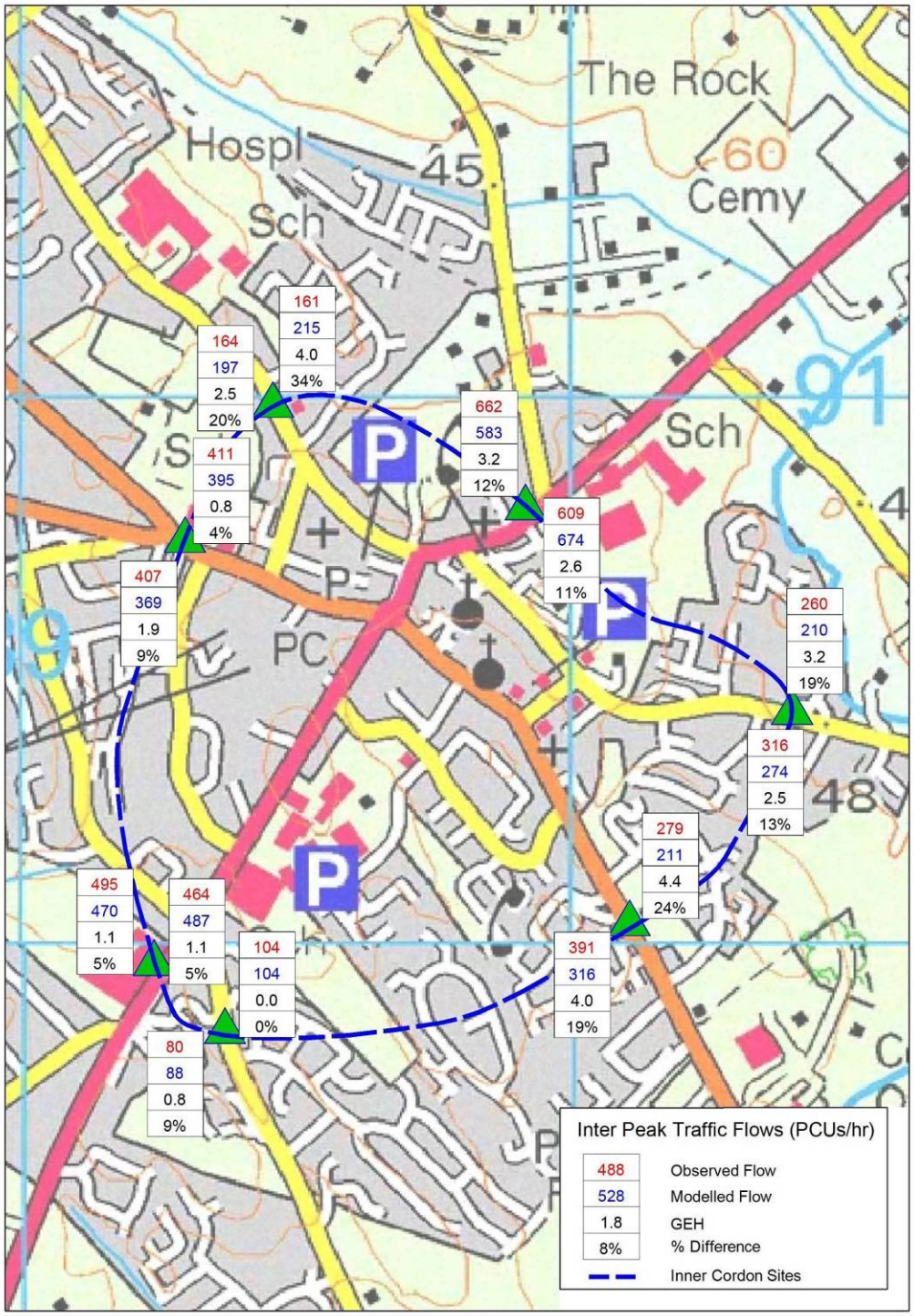


Figure 8.5 Modelled vs. Observed PM Peak Hour Flows – Town Centre

Figure 8.6 Modelled vs. Observed AM Peak Hour Flows - Cordon

Figure 8.7 Modelled vs. Observed Inter-peak Hour Flows - Cordon

Figure 8.8 Modelled vs. Observed PM Peak Hour Flows - Cordon

Figure 8.9 Modelled vs. Observed AM Peak Hour Flows – A6

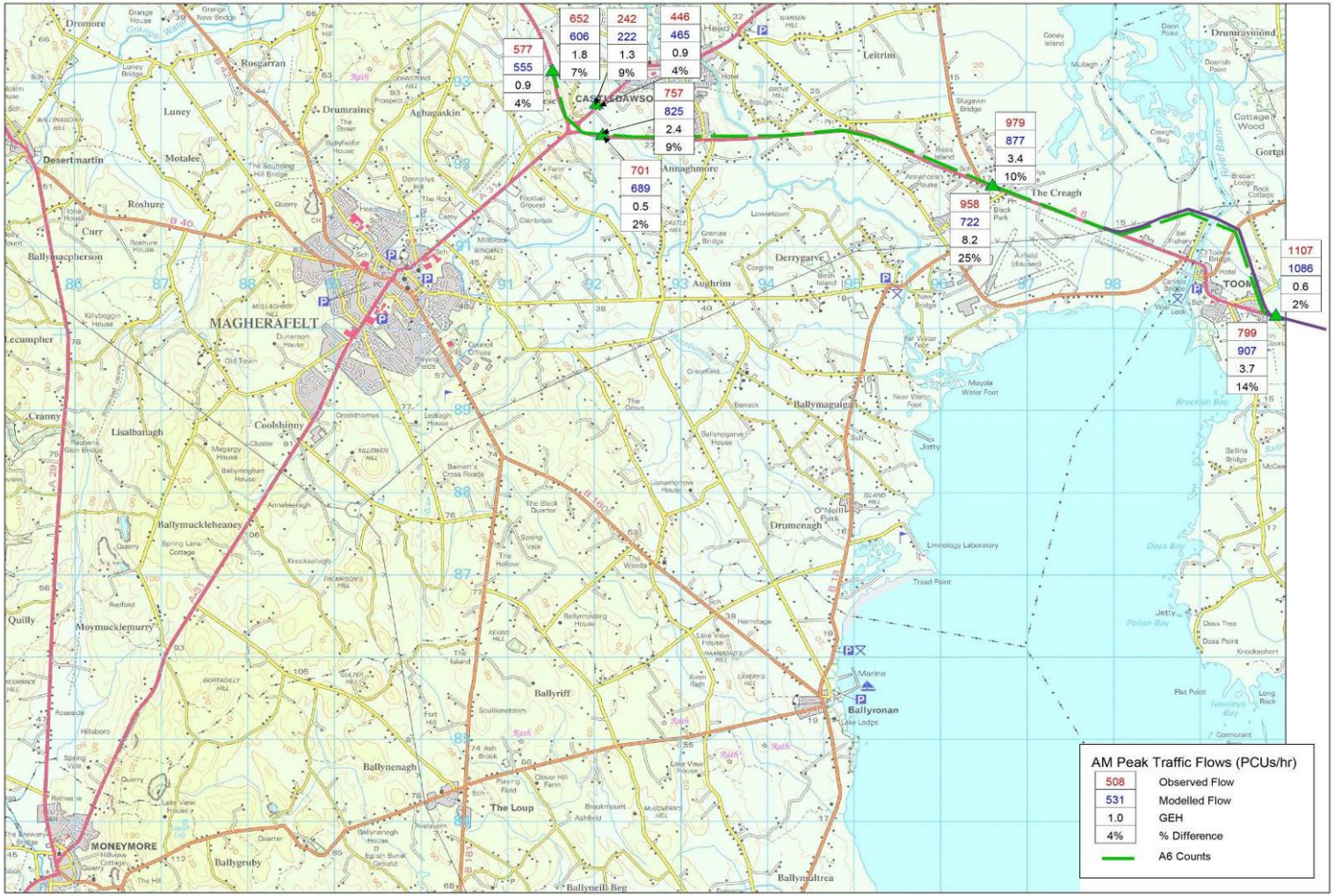
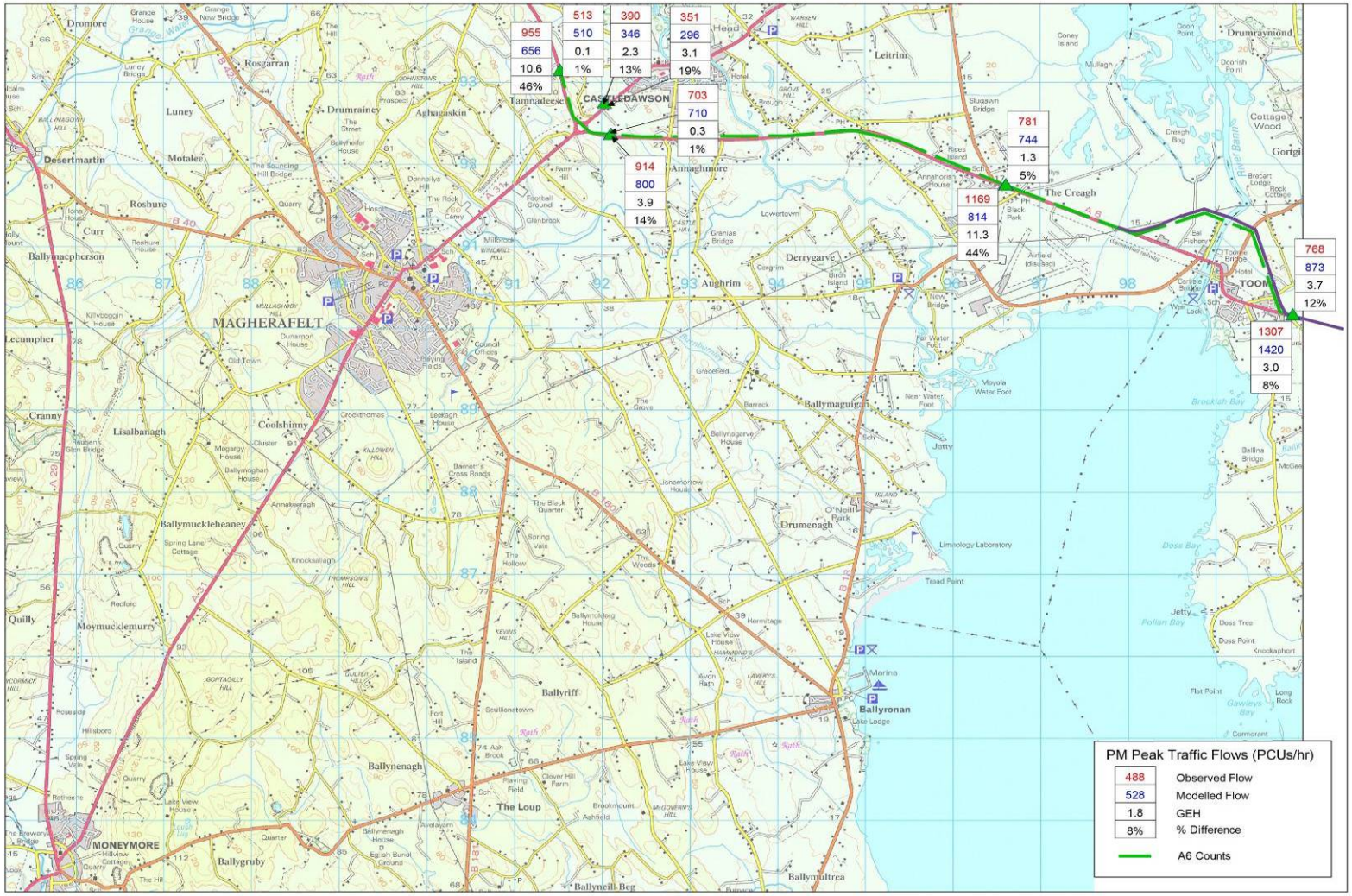


Figure 8.10 Modelled vs. Observed Inter-peak Hour Flows – A6

Figure 8.11 Modelled vs. Observed PM Peak Hour Flows – A6



8.2 Forecasting

8.2.1 Introduction

The principal requirement of the traffic model was the provision of traffic forecasts for the Magherafelt Bypass scheme at their assumed Opening (2012) and Design (2027) Years. Future travel demands at these dates take into account the existing traffic flows together with the effects of traffic growth and the additional traffic due to new development activity.

8.2.2 Derivation of Growth Factors

In November 2007 a technical note entitled 'Growth Factors for Traffic Forecasting' was produced by Mouchel and was submitted to Roads Service. The scope of this technical note was to set out an appropriate methodology for the derivation of growth factors that were applied in the A31 Magherafelt study. The technical note examined the following:

- recent traffic trends in traffic growth, in Great Britain, Northern Ireland and in the vicinity of Magherafelt
- the contribution to growth of new developments
- projected trends, defined by the **N**orthern **I**reland **S**trategic **TR**ansport **M**odel (NISTRM) and the **N**ational **R**oad **T**raffic **F**orecasts (NRTF).

As a result of this exercise two different rates of growth were calculated. Based on the NISTRM forecasts an annual rate of 1.2% per annum was derived, while when adopting a trend based forecast a growth of approximately 2.0% per annum was derived.

It was decided that only the trend based forecast growth of approximately 2.0% per annum should be used in the study.

8.2.3 Magherafelt Area Plan 2025 – Draft Area Plan, Planned Developments

The developments listed by the Magherafelt Area Plan 2015 – Draft Plan were initially examined in order to establish how many of these have already been built since 2004 when the plan was published.

Apart from the proposed developments listed in the Magherafelt Area Plan 2015 – Draft Plan three additional zones were included; these were planned for the development of additional residential properties.

Under these assumptions the resulting number of anticipated household that will be in place by 2012 and 2027 is equal to 624 and 1596 households respectively. With regards to the Industrial developments the total Gross Floor Area expected to be developed by 2012 and 2027 is equal to 25,693 m^2 and 44,021 m^2 respectively.

8.2.4 Estimated Growth

In order to convert the number of anticipated developments into Productions and Attractions, a set of trip rates for developments of similar nature was obtained from the **T**rip **R**ate **I**nformation **C**omputer **S**ystem (TRICS) database which is a computerised database and analysis package for planning and development.

Table 8.3 presents a breakdown of the estimated number of trips for the opening year (2012).

Table 8.4 presents a breakdown of the estimated number of trips for the design year (2027). The Trips are measured in **P**assenger **C**ar **U**nits (PCU), a car is assumed as 1 PCU, heavy good vehicles are assumed as 2 PCUs etc.

Table 8.3 Estimated Trips for 2012

	AM peak	Inter-peak	PM peak
Base year trips total **(PCU)**	7,073	5,850	7,760
Opening year trips total **(PCU)**	7,988	6,626	8,759
% increase from base year	14%	13%	13%
Background Traffic **(PCU)**	7,529	6,318	8,303
Development trips **(PCU)**	459	308	456
Number of Dwellings	626	626	626
Residential Zones - Trip generation **(PCU)**	375	248	383
Industrial zones - Total Area (m^2)	25,693	25,693	25,693
Industrial Zones - Trip generation **(PCU)**	84	60	73

Table 8.4 Estimated Trips for 2027

	AM peak	Inter-peak	PM peak
Base year trips total **(PCU)**	7,037	5,850	7,760
Design year trips total **(PCU)**	11,095	9,052	12,088
% increase from base year	58%	55%	56%
Background Traffic **(PCU)**	9,992	8,307	11,019
Development trips **(PCU)**	1,103	745	1,069
Number of Dwellings	1,598	1,598	1,598
Residential Zones - Trip generation **(PCU)**	945	637	946
Industrial zones - Total Area (m^2)	44,021	44,021	44,021
Industrial Zones - Trip generation **(PCU)**	158	108	123

8.2.5 Do-Minimum Network

The future year traffic models had to take into account the effects of other highway or traffic management schemes that were likely to be in place by the scheme's Opening Year 2012 and the Design Year 2027.

In addition to the Bypass, construction of the A6 Dualling scheme between Castledawson and Toome is programmed for completion by the year 2012. This scheme therefore forms part of what is termed the "Do-Minimum" future highway network for the study area. Additional schemes that were included in the development of the Do-Minimum future network include:

- Annaghmore Road bridged over new road
- new layout at Hillhead Road Junction
- Creagh Grade Separated Junction
- traffic calming on Westland Road, Queens Avenue and Kirk Avenue
- Station Road Junction improvements
- provision of right turn lanes at several sites.

Where new developments are anticipated before the opening and design year, new junctions and accesses had to be incorporated in the Do-Minimum model.

The extent of the modelled study area is presented in **Appendix H**.

8.2.6 Do-Something Network

A number of Do-Something networks were developed by including each of the proposed bypass options in the Do-Minimum networks. Three route options were tested for both 2012 and 2027. These are described in detail in the following sections.

Blue Route

This option was modelled as a 10m wide single carriageway and commences at its southern end with a four arm junction (roundabout) with the A31 Moneymore Road and Coolshinney Road. This option was modelled with a 100 kph speed limit apart from the section where the bypass joins Meadowbank Road where a speed limit of 45kph was introduced for the section of Meadowbank Road between Parkmore Road and Ballyronan Road. The route extends to the east of the town settlement, passing over Killyfaddy Road. It then continues in a north-easterly direction to join Ballyronan Road where a four arm roundabout junction is modelled. The route then intersects Aughrim Road where again a four arm roundabout junction is modelled. The route then extends to the north and joins

A31 Castledawson Road where a new four arm roundabout junction is modelled in close proximity to the existing A31 junction with Pound Road.

The total length of the Blue Route option is 3.4 kilometres.

Purple Route

This option was modelled as a 10m wide single carriageway with a 100 kph speed limit and commences at a junction with the A31 Moneymore Road at the same location as that for the Blue Route and has a four armed roundabout. It then extends in a north-easterly direction where it passes over Killyfaddy Road. The route then continues in a north-easterly direction to join Ballyronan Road where a four arm roundabout junction is modelled. It then continues and intersect Aughrim Road where again a four arm roundabout junction is modelled. The route then extends to existing A31 Castledawson Road where a three arm roundabout junction is modelled.

The total length of the Purple Route is 4.9 kilometres.

Pink Route

This option was modelled as a 10m wide single carriageway with a 100 kph speed limit and commences at its southern end with a four arm junction (roundabout) with the A31 Moneymore Road and Coolshinney Road. The route then extends to the east of the town, passing over but not connecting to Killyfaddy Road. It then continues in a north-easterly direction to join Ballyronan Road where a four arm roundabout junction is modelled. The route then continues and intersects Aughrim Road where again a four arm roundabout junction is modelled. The route then extends in a northerly direction and connects to the Castledawson Roundabout to form a five arm roundabout junction.

The total length of the Pink Route is 5.8 kilometres.

8.3 Forecast Results

8.3.1 Predicted Traffic Flows

The comparison of the forecast AADT flows for each of the three route options against the forecast Do-Minimum flows in the Opening and in the Design Year are presented in **Figure 8.12** to **Figure 8.14.**

Figure 8.12a Blue Route AADT Flows - 2012

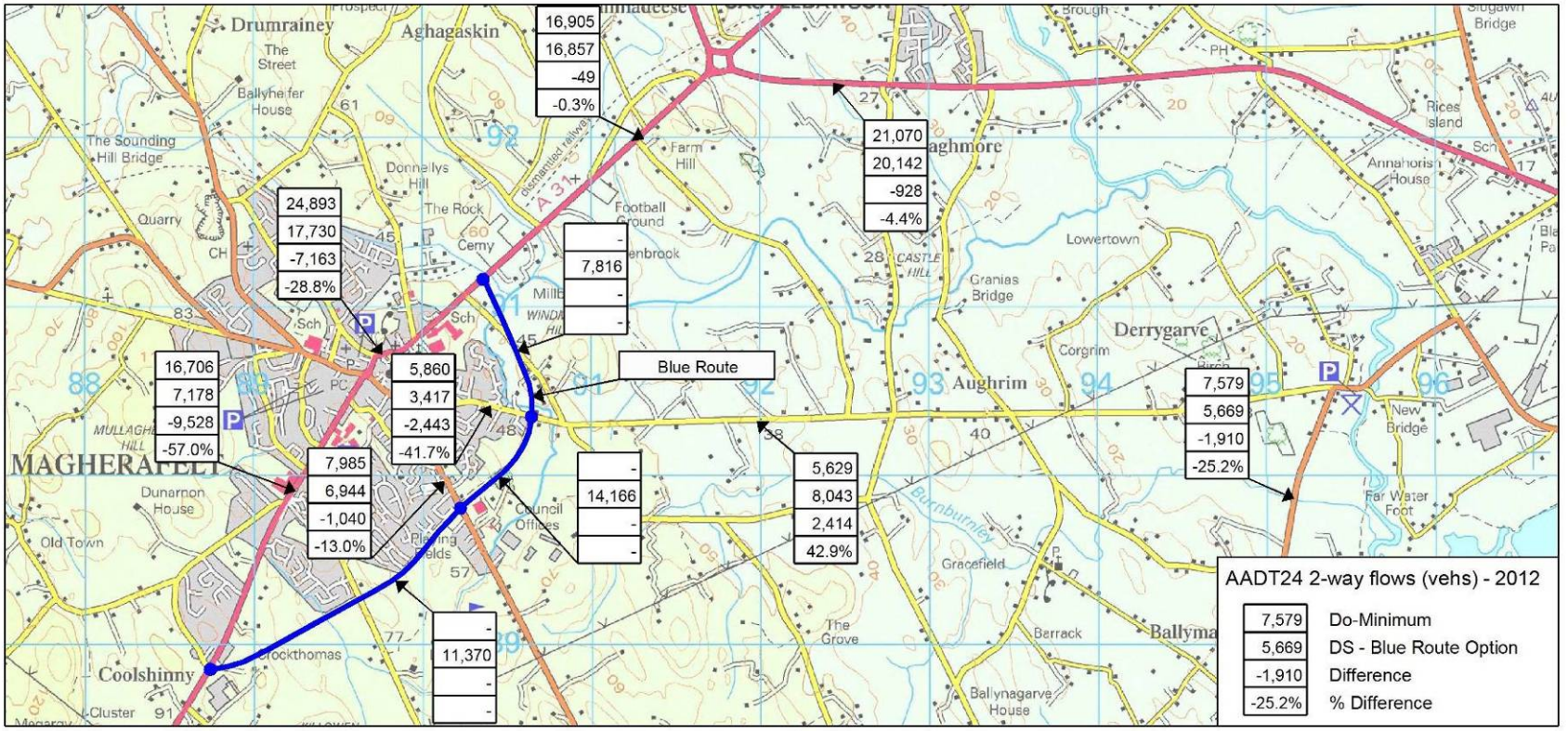


Figure 8.12b Blue Route AADT Flows - 2027

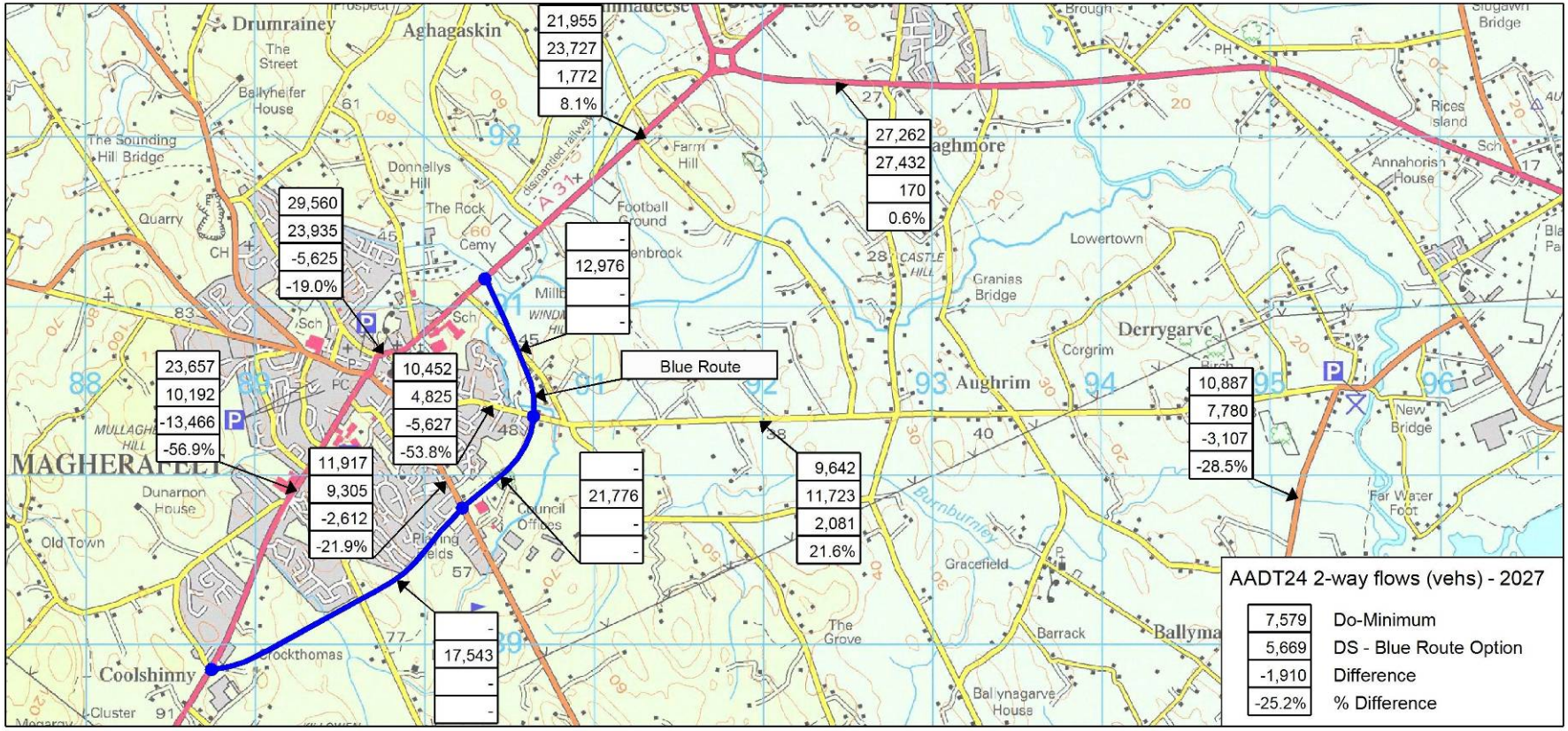


Figure 8.13a Purple Route AADT Flows - 2012

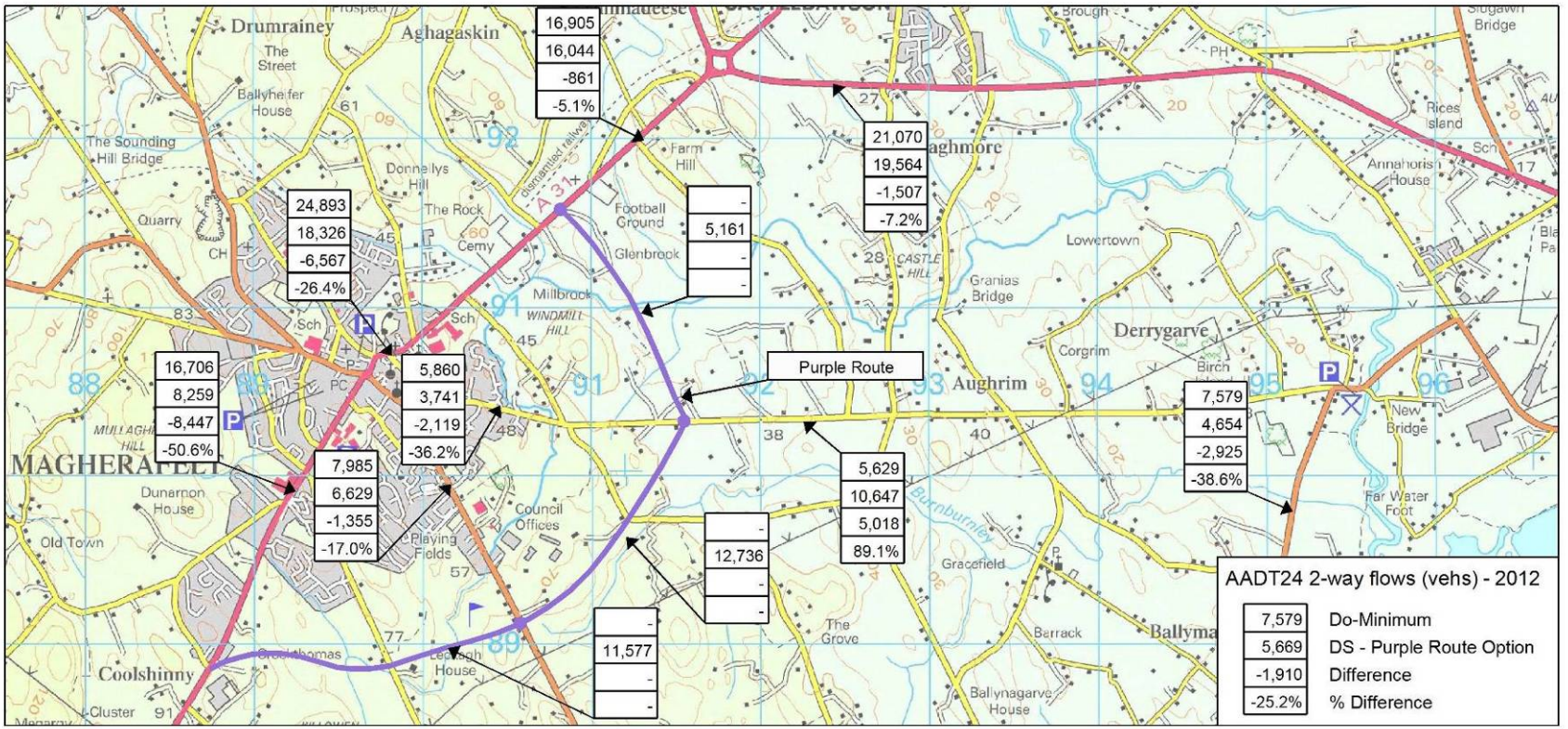


Figure 8.13b Purple Route AADT Flows – 2027

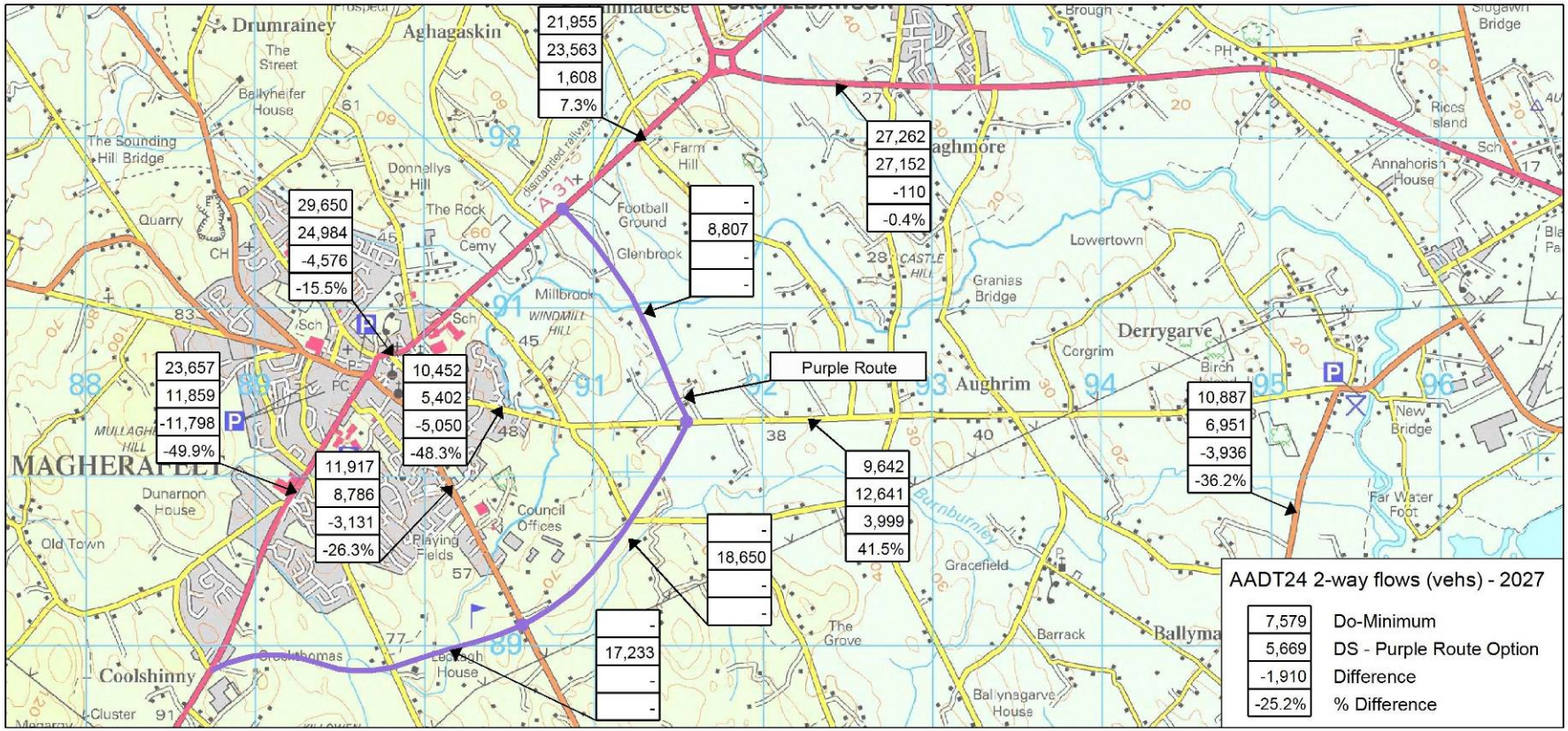


Figure 8.14a Pink Route AADT Flows - 2012

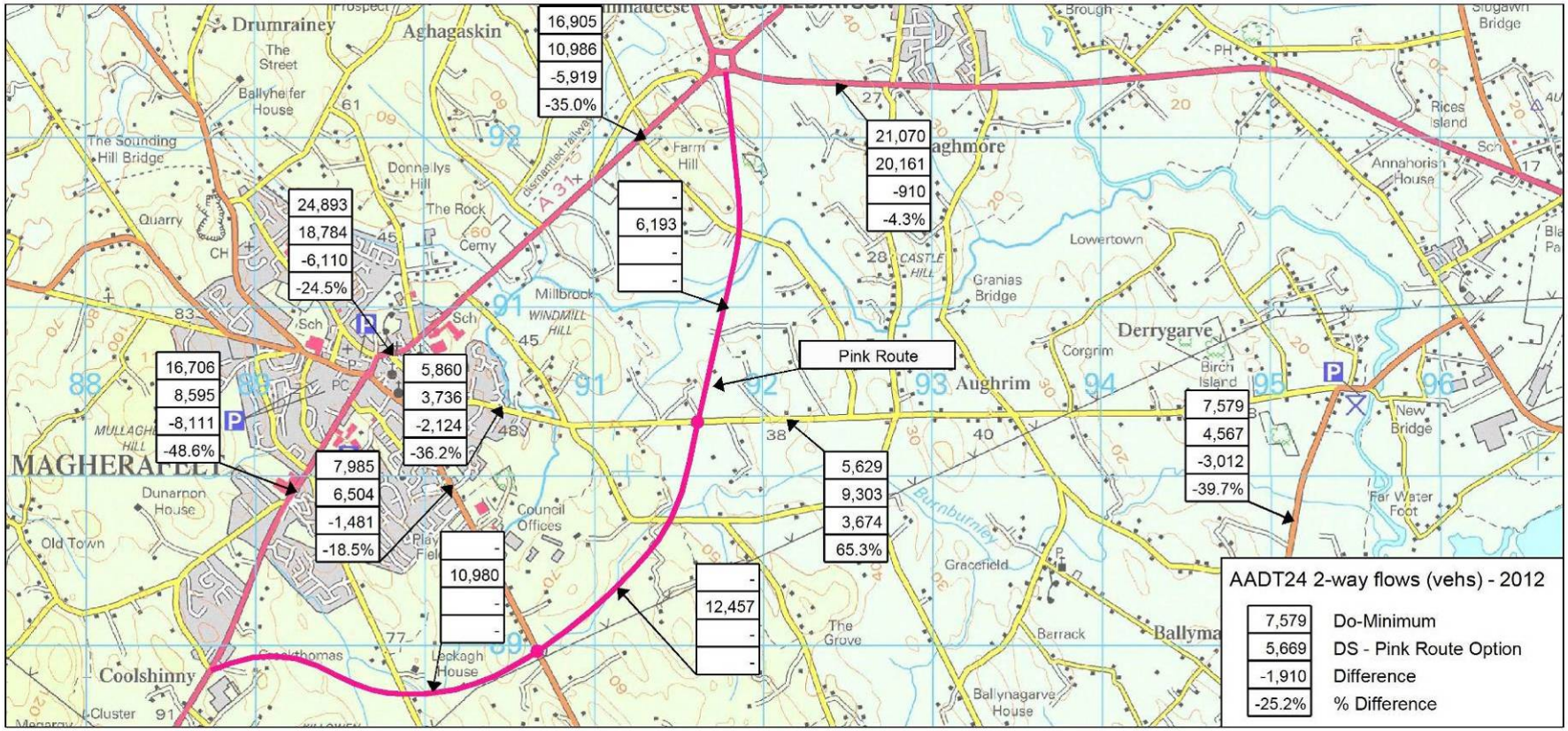
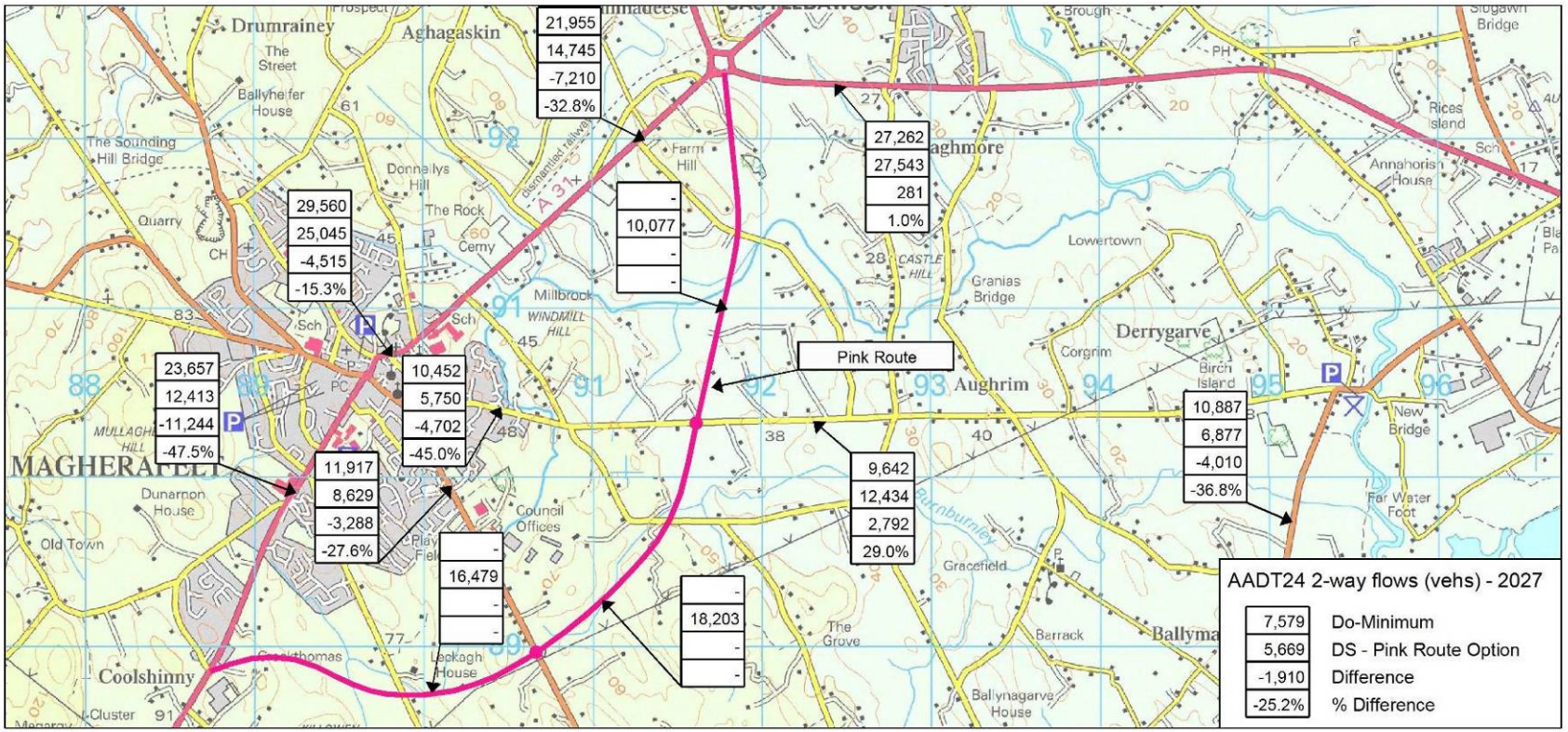


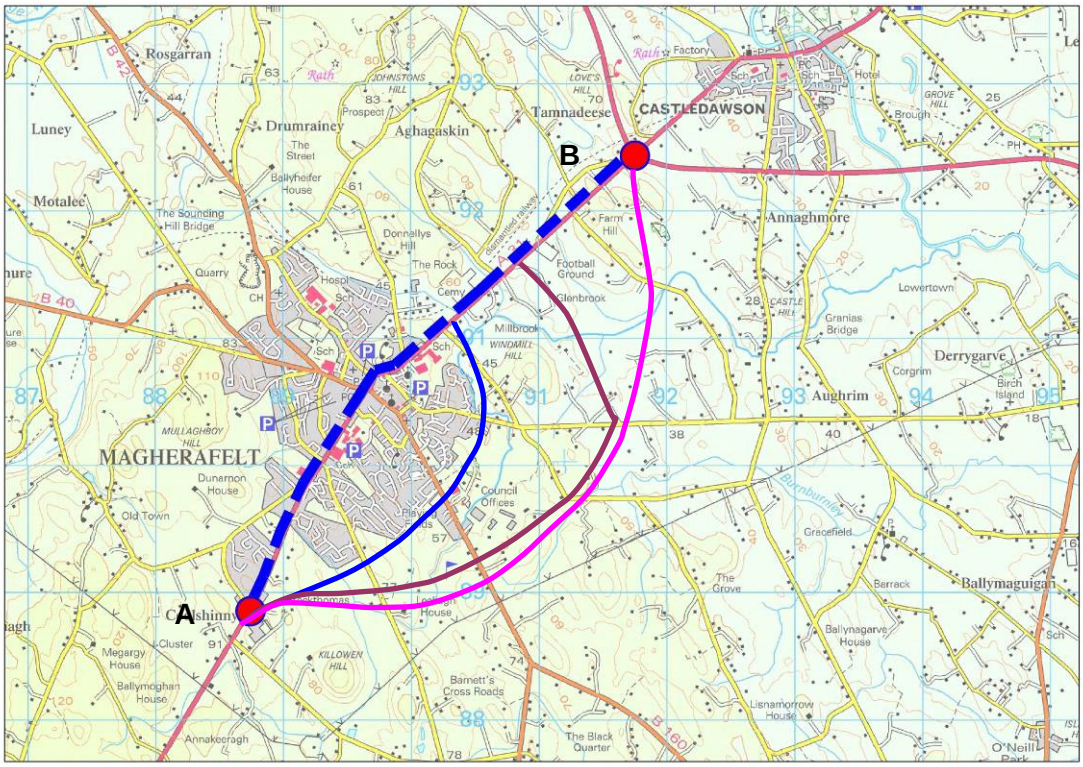
Figure 8.14b Pink Route AADT Flows - 2027



8.3.2 Predicted journey times

The journey time comparisons in the following sections relate to the section of the A31 through the town of Magherafelt indicated by the letters A and B in **Figure 8.15**.

Figure 8.15 Journey Time Route on A31 between Coolshinney Road and Castledawson Roundabout



The summary of the modelled journey times for section AB through the town centre and via each of the proposed options for the opening and the design year is presented in **Table 8.5** and **Table 8.6** respectively.

Table 8.5 2012 Journey Times (mm:ss)

Journey Time Route Description		Do - Minimum	Do-Something		
			Blue Route	Purple Route	Pink Route
Journey Time on A31 through town centre (from Coolshinney Road to Castledawson Roundabout)	NB	08:48	08:06	08:10	08:05
	SB	08:52	07:40	07:42	07:35
Journey Time via the bypass (from Coolshinney Road to Castledawson Roundabout)	NB	-	04:39	04:03	03:38
	SB	-	04:43	04:07	03:40

Table 8.6 2027 Journey Times (mm:ss)

Journey Time Route Description		Do - Minimum	Do-Something		
			Blue Route	Purple Route	Pink Route
Journey Time on A31 through town centre (from Coolshinney Road to Castledawson Roundabout)	NB	11:19	08:54	08:56	08:43
	SB	10:01	08:31	08:35	07:58
Journey Time via the bypass (from Coolshinney Road to Castledawson Roundabout)	NB	-	04:53	04:19	03:46
	SB	-	05:07	04:29	03:45

Figure 8.16 and **Figure 8.17** present the comparison of journey times on the A31 through the town centre (between Coolshinney Road and Castledawson Roundabout).

It can be observed that all three options will result in similar improvements in terms of total journey times. It can also be observed that the most significant reduction in journey times is in the northbound direction and especially for the PM peak hour.

Figure 8.16 Journey Time Comparisons (Northbound) - 2012

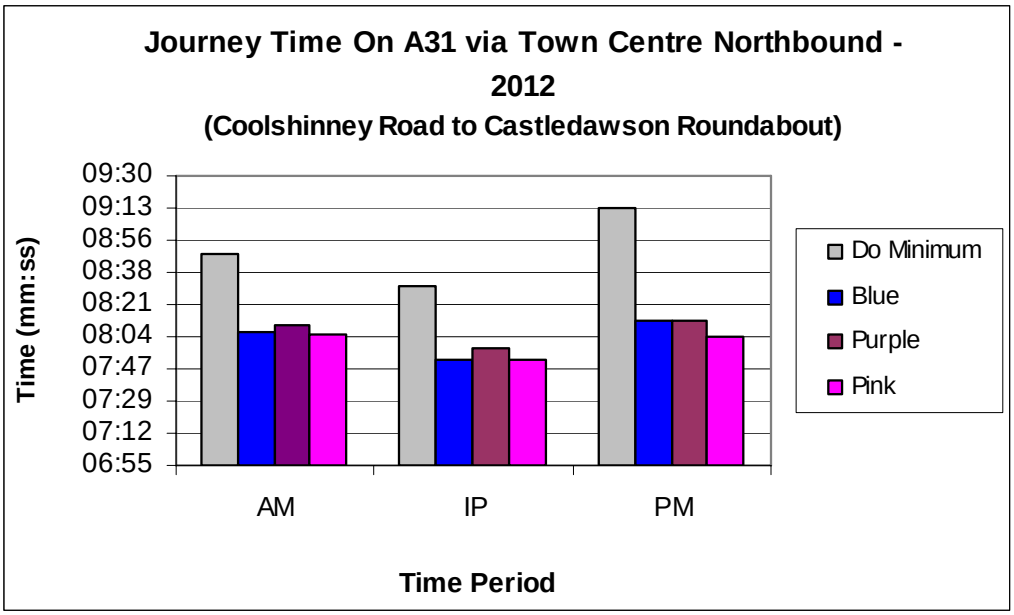


Figure 8.17 Journey Time Comparisons (Southbound) - 2012

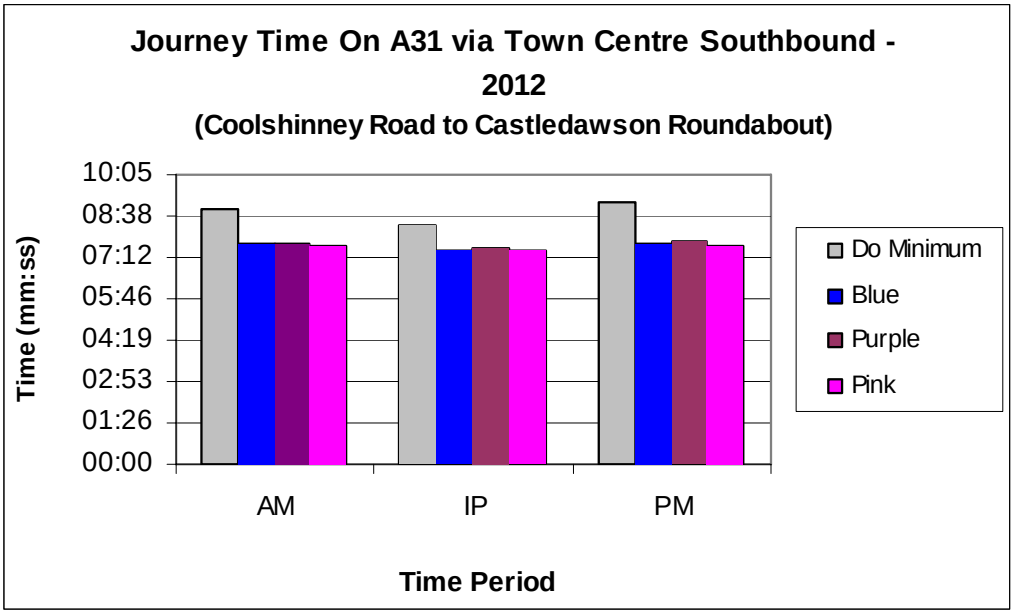


Figure 8.18 and **Figure 8.19** present the comparison of the journey times through the bypass (between Coolshinney Road and Castledawson Roundabout). It can be observed that travel times through the bypass are almost 50% lower when compared to the journey times through the town centre. This is the case for vehicles travelling both northbound and southbound in all three time periods.

Figure 8.18 Journey Time Comparisons (Northbound) - 2012

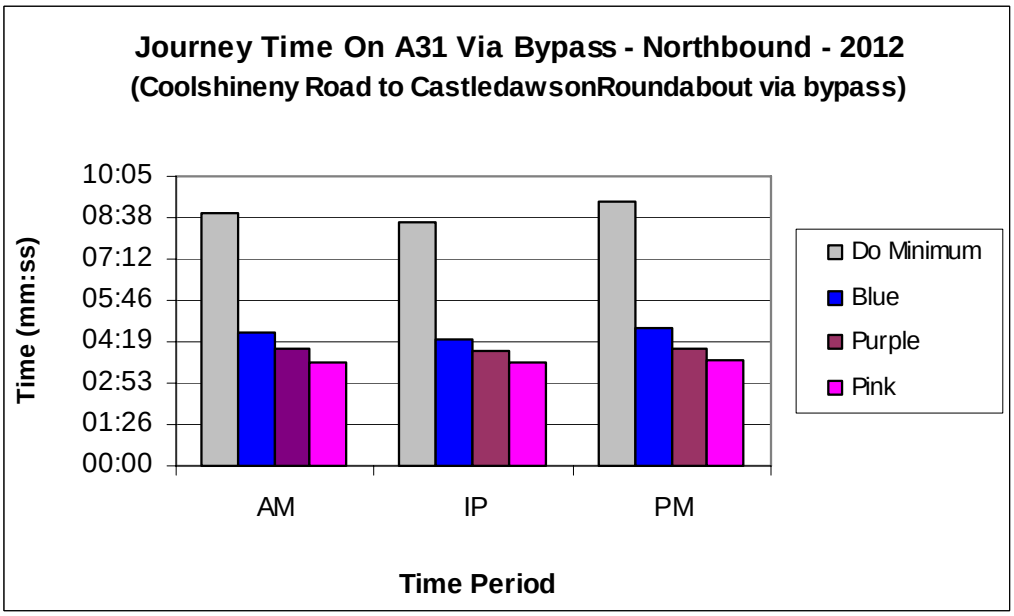


Figure 8.19 Journey Time Comparisons (Southbound) - 2012

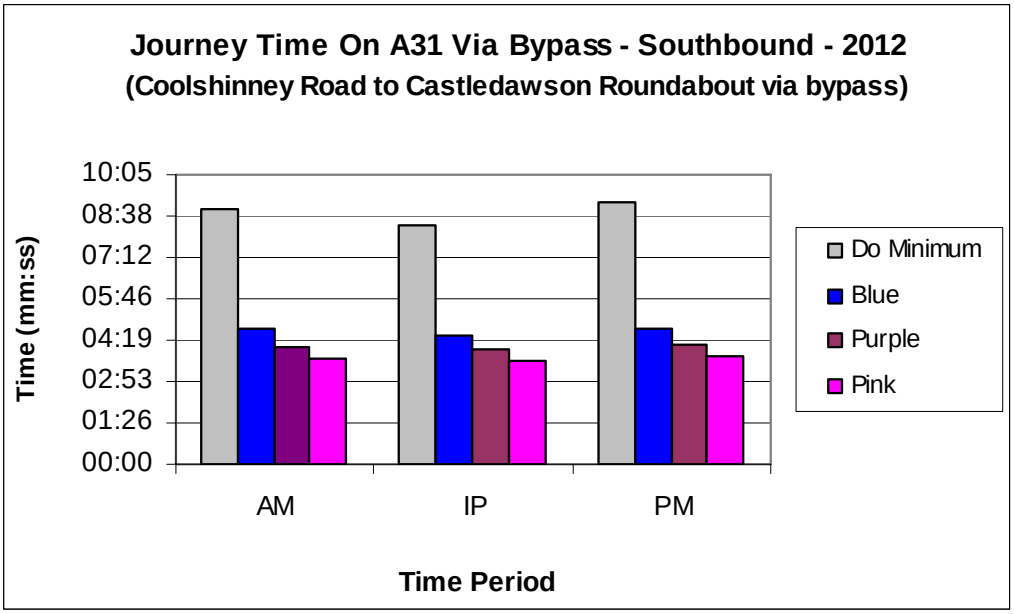


Figure 8.20 and **Figure 8.21** present the comparison of journey times on the A31 through the town centre (between Coolshinney Road and Castledawson Roundabout).

It can be observed that all three options will result in similar improvements in terms of total journey times. It can also be observed that the most significant reduction in terms of journey times is forecast for the vehicles travelling in the northbound direction and especially for the PM peak hour.

Figure 8.20 Journey Time Comparisons (Northbound) - 2027

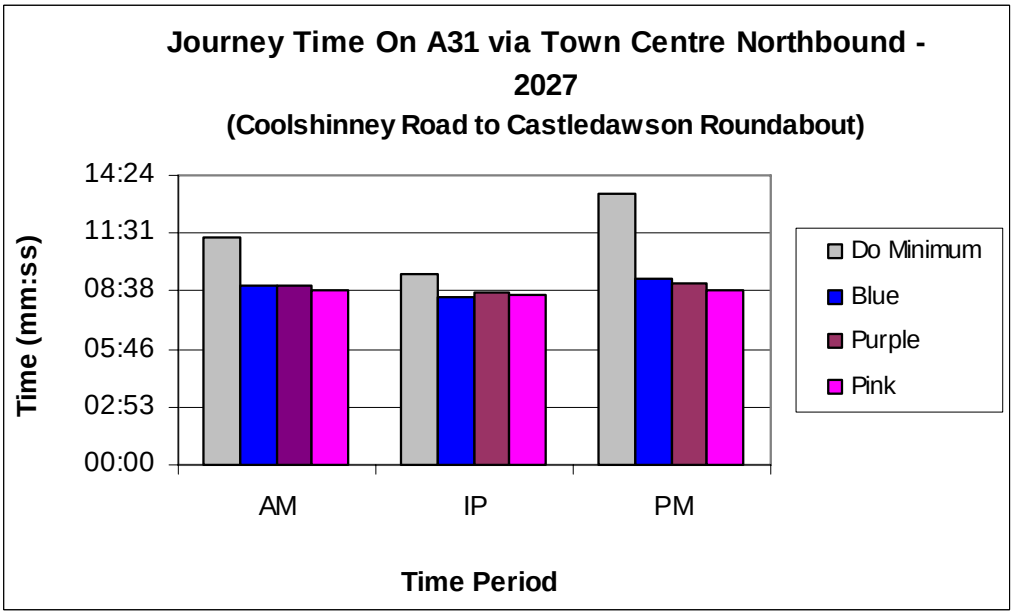


Figure 8.21 Journey Time Comparisons (Southbound) - 2027

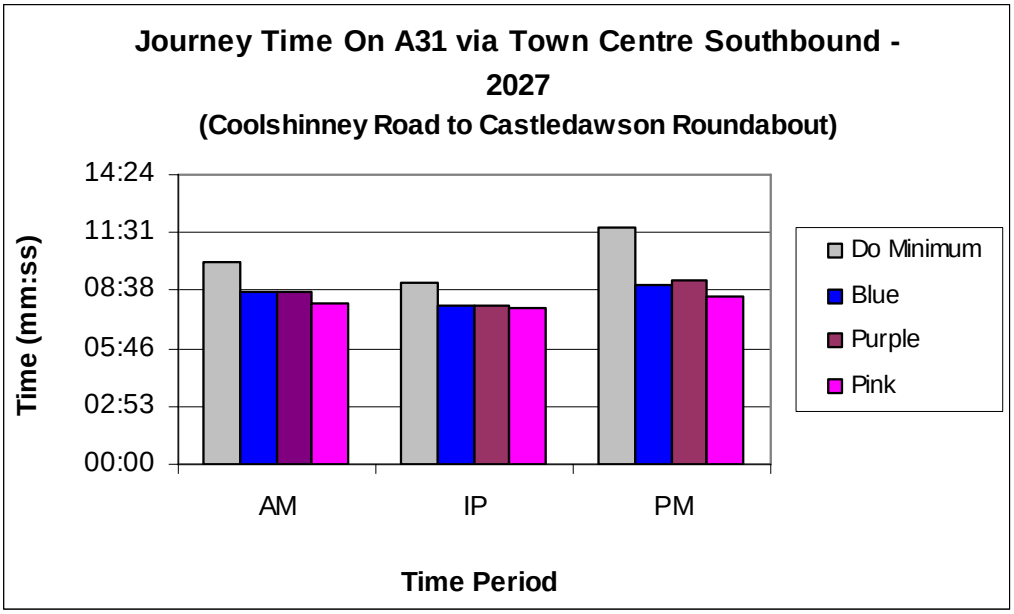


Figure 8.22 and **Figure 8.23** present the comparison of the journey times through the bypass (between Coolshinney Road and Castledawson Roundabout). It can be observed that travel times through the bypass are almost 60% lower when compared to the journey times through the town centre. This is the case for vehicles travelling both northbound and southbound in all three time periods.

Figure 8.22 Journey Time Comparisons (Northbound) - 2027

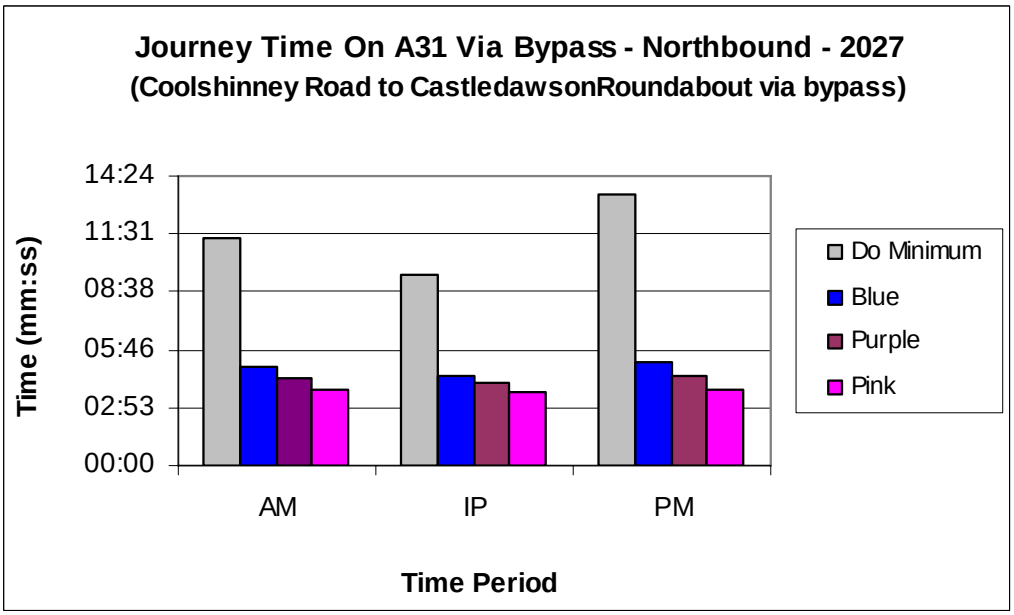
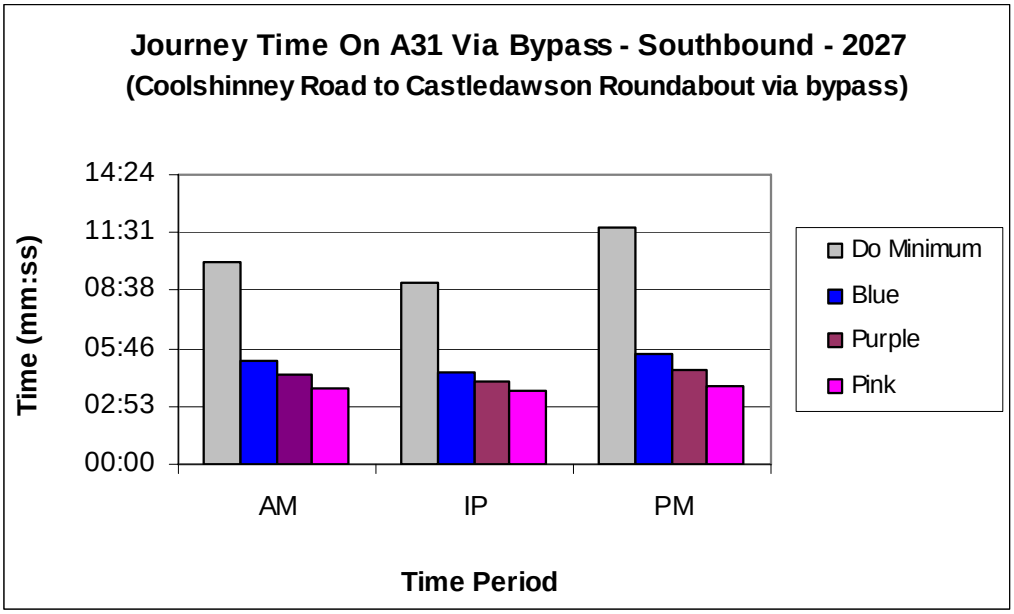


Figure 8.23 Journey Time Comparisons (Southbound) - 2027



8.4 Junction Analysis

Mouchel carried out analysis on the 2027 Design Year traffic flows from the TRIPS model for each route option, it became apparent that the flows on the existing A31 from where the proposed bypass ties-in, to the A6 Castledawson Roundabout will exceed link capacity for both the Blue and Purple Routes. As a result, the possibility of dualling this section of the existing A31 Castledawson Road was taken under consideration to cater for the projected future flows. Upgrading this section of the Castledawson Road to a dual carriageway will require a four lane carriageway with a kerbed central reserve.

The A31 Castledawson Road / proposed bypass roundabout, south of the A6 Castledawson Roundabout, was therefore designed and tested for these two routes, both with and without dualling, in order to assess the impact the addition of dualling will have on the operation of the junction.

For the purpose of this report the section of the existing A31 Castledawson Road to the A6 Castledawson Roundabout without dualling for the Blue Route, will be referred to as Blue Route A and with dualling will be referred to as Blue Route B.

The section of the existing A31 Castledawson Road to the A6 Castledawson Roundabout without dualling for the Purple Route will be referred to as Purple Route A and with dualling will be referred to as Purple Route B.

As the Pink Route ties directly in with the A6 Castledawson Roundabout, dualling of the A31 is not required. Testing of the Castledawson Roundabout, with the Pink Route implemented, was completed however to ensure that this roundabout works within capacity in 2027.

Mouchel carried out junction analysis using the ARCADY (**A**ssessment of **R**oundabout **C**apacity **A**nd **D**ela**y**) programme for the roundabout junctions listed below on the Pink, Blue and Purple Route options for the Design Year of the proposed bypass (2027):

- Blue Route A
- Blue Route B
- Purple Route A
- Purple Route B
- Pink Route tie-in to existing Castledawson Roundabout.

A preliminary design of the dualling has been completed, but it has not yet been modelled in the TRIPS model. As a result, exact flows for this option are not available. Mouchel however felt that applying the flows obtained from the model with no dualling in place will provide a reasonable estimation of how the roundabouts will operate even with dualling.

8.4.1 Blue Routes and Purple Routes ARCADY Results

In ARCADY, the capacity of a junction is determined by the RFC (**R**atio of **F**low to **C**apacity) value. It is defined as the actual flow on a link divided by the capacity of that link. A junction with an RFC of 0.85 is considered to be working at capacity while above 0.85 is considered to be over capacity, that is, it will not have sufficient capacity to cater for the demand traffic flows.

The ‘Max RFC’ refers to the highest RFC value on that link during the peak hour in question. The ‘Max End Queue’ represents the maximum number of queuing vehicles expected at that arm during the peak period at any one time. These two values are shown in the tables below for all roundabouts for the AM Peak (08:15 – 09:15), PM Peak (17:00 – 18:00) and Inter-peak (12:30 – 13:30 for the purpose of this analysis) for the Design Year of 2027.

Blue Route

Blue Route A

The junction arrangement for Blue Route A is shown below in **Figure 8.24**.

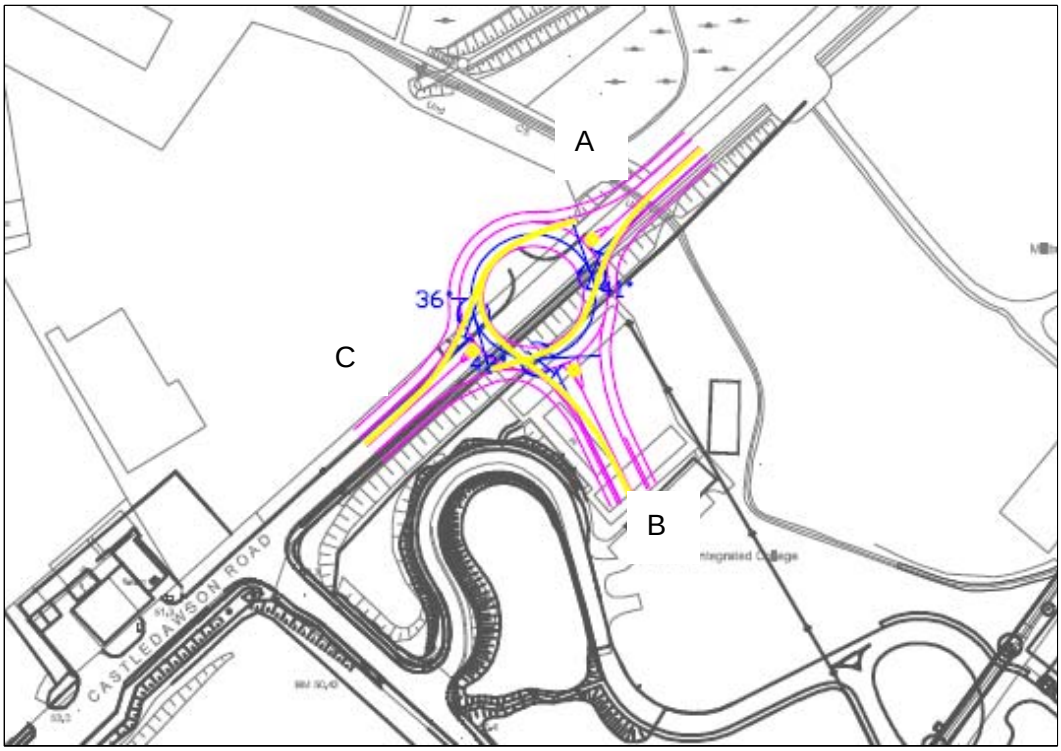


Figure 8.24 Blue Route / Blue Route A Roundabout

The ARCADY results for **Figure 8.24** are summarised below.

Arm	2027 AM		2027 IP		2027 PM	
	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)
A A31 Castledawson Road North	0.94	11.40	0.64	1.80	1.02	34.40
B Blue Route	0.48	0.90	0.25	0.30	0.57	1.30
C A31 Castledawson Road South	0.49	0.90	0.42	0.70	0.61	1.50

Table 8.7 ARCADY results for Blue Route/ Blue Route A Roundabout

Blue Route B

The junction arrangement for Blue Route B is shown below in **Figure 8.25**.

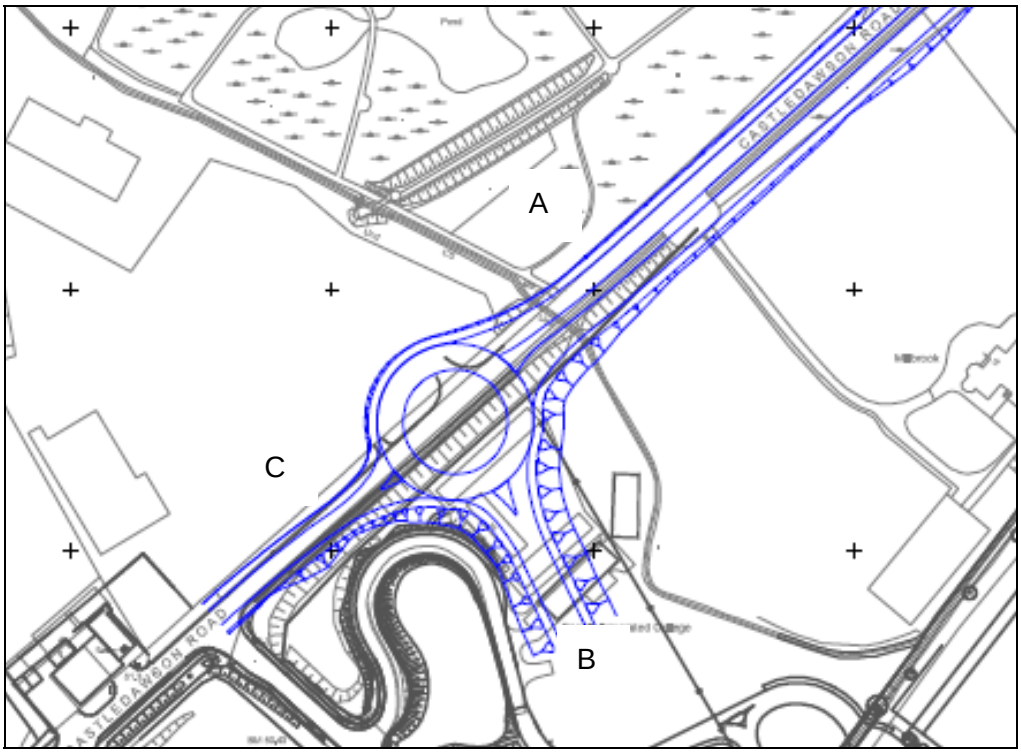


Figure 8.25 Blue Route / Blue Route B Roundabout

The ARCADY results for **Figure 8.25** are summarised below.

Arm	2027 AM		2027 IP		2027 PM	
	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)
A A31 Castledawson Road North	0.53	1.10	0.36	0.60	0.57	1.30
B Blue Route	0.44	0.80	0.23	0.30	0.53	1.10
C A31 Castledawson Road South	0.45	0.80	0.39	0.60	0.55	1.20

Table 8.8 ARCADY results for Blue Route/ Blue Route B Roundabout

Summary

The above results show that the Blue Route / Blue Route A Roundabout fails considerably in the AM and PM peak 2027 without dualling of the A31 carriageway north of the junction. The situation will be very unstable and as a result, significant queues of up to 34 vehicles are predicted.

With the provision of Blue Route B the roundabout works well within capacity in 2027 and there is little queuing expected, with the maximum queue at any one time being approximately one vehicle.

Purple Route

Purple Route A

The junction arrangement for Purple Route A is shown below in **Figure 8.26**.

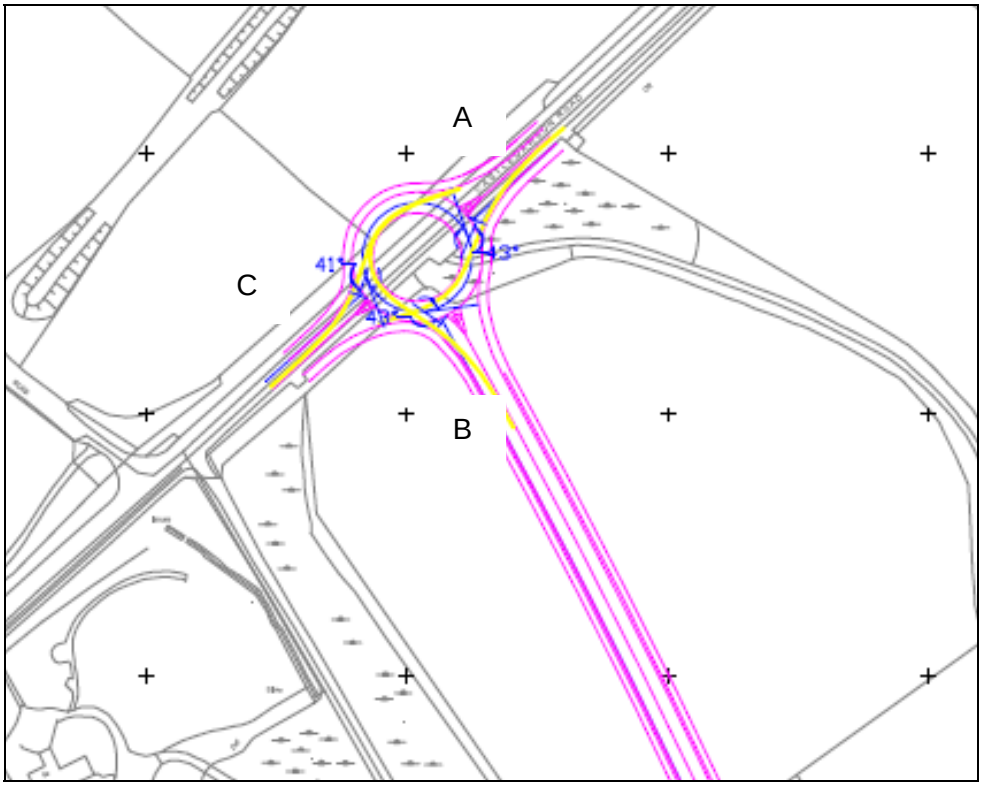


Figure 8.26 Purple Route / Purple Route A Roundabout

The ARCADY results for **Figure 8.26** are summarised below.

Arm	2027 AM		2027 IP		2027 PM	
	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)
A A31 Castledawson Road North	0.80	3.80	0.49	1.00	0.90	8.20
B Purple Route	0.33	0.50	0.14	0.20	0.43	0.80
C A31 Castledawson Road South	0.52	1.10	0.43	0.80	0.57	1.30

Table 8.9 ARCADY results for Purple Route/ Purple Route A Roundabout

Purple Route B

The junction arrangement for Purple Route B is shown below in **Figure 8.27**.

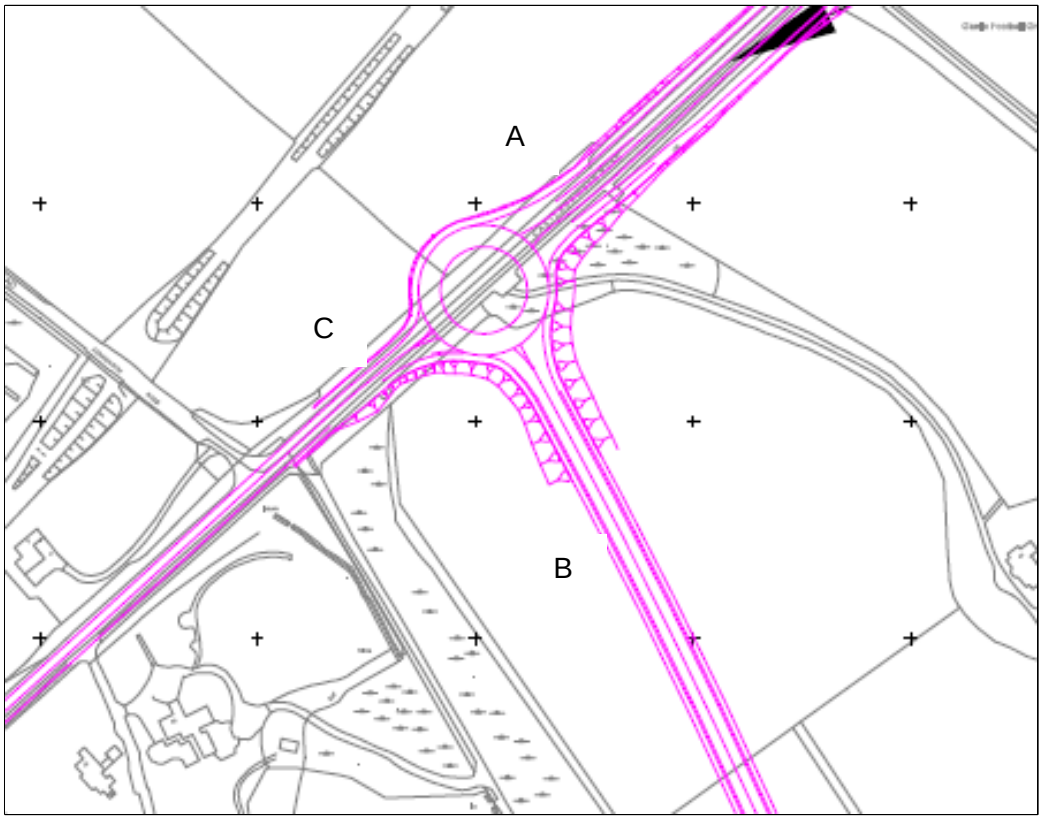


Figure 8.27 Purple Route / Purple Route B Roundabout

The ARCADY results for **Figure 8.27** are summarised below.

Arm	2027 AM		2027 IP		2027 PM	
	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)
A A31 Castledawson Road North	0.52	1.10	0.32	0.50	0.59	1.40
B Purple Route	0.31	0.40	0.14	0.20	0.41	0.70
C A31 Castledawson Road South	0.49	1.00	0.41	0.70	0.54	1.20

Table 8.10 ARCADY results for Purple Route/ Purple Route B Roundabout

Summary

The above results show that the Purple Route/ Purple Route A roundabout fails in the PM peak 2027, with an RFC of 0.9, without dualling of the A31 carriageway north of the junction.

With the provision of the Purple Route B, the roundabout works well within capacity in 2027 and there is little queuing expected with the maximum queue at any one time being approximately one vehicle.

8.4.2 Dual Carriageway Option Flow Analysis

When considering the possibility of providing either Blue Route B or Purple Route B it is important to look at AADT and peak hour flows on this stretch of road, and not the ARCADY results alone. This will give an indication of whether or not the length of road will be over capacity without dualling, – 'For most existing urban roads, the junctions act as the constraint on traffic capacity rather that the links between them. For new roads and improvements, it is important to relate the two' – Transport in the Urban Environment (The Institution of Highways & Transportation).

The flows expected on the A31 Castledawson Road, south of the A6 Castledawson Roundabout and north of Magherafelt Town Centre, for the Design Year 2027 with the Blue and Purple Route options are listed overleaf:

The two-way flow on the Blue Route B:

- AM peak = 2,065 veh. (1,132 veh. southbound, 933 veh. northbound)
- Inter-peak = 1,466 veh. (758 veh. Southbound, 708 veh. northbound)

- PM peak = 2,368 veh. (1,193 veh. southbound,1,175 veh. northbound).

The two-way flow on Purple Route B:

- AM peak = 1,954 veh. (1,071 veh. southbound, 883 veh. northbound)
- Inter-peak = 1,162 veh. (652 veh. southbound, 510 veh. northbound)
- PM peak = 2,268 veh. (1,213 veh. southbound, 1,055 veh. northbound).

According to DMRB: TD20/85 Table A the maximum two-way directional peak hour flow for a 7.3m wide carriageway can cater for is 1,700 vehicles/hour. As 7.3m is the average width of this section of the A31, it is clear that the maximum flow is exceeded considerably in the AM and PM peaks for both the Blue and Purple Route. This indicates that a much wider single carriageway or a dual carriageway road will be required in conjunction with the Blue or Purple Route to cater for the peak hour flows.

With regards to AADT flows, Mouchel consulted DMRB: TA 46/97 Table 2.1, which states the minimum and maximum Opening Year AADT flows for various carriageway standards. This table is summarised below:

Table 8.11 Extract from DMRB: TA 46/97 Table 2.1

Carriageway Standard	Opening Year AADT	
	Minimum	Maximum
S2	Up to 13,000	
WS2	6,000	21,000
D2AP	11,000	39,000

The Blue Route and Purple Route Opening Year (2012) AADT flows are 16,857 vehicles and 16,044 vehicles respectively. These are significantly higher then the maximum ‘single carriageway’ AADT flow, but they do fall comfortably within the range for a ‘wide single carriageway’ and a ‘dual 2 lane all purpose’.

8.4.3 Pink Route ARCADY Results

Pink Route

The junction arrangement for Pink Route is shown below in **Figure 8.28**.

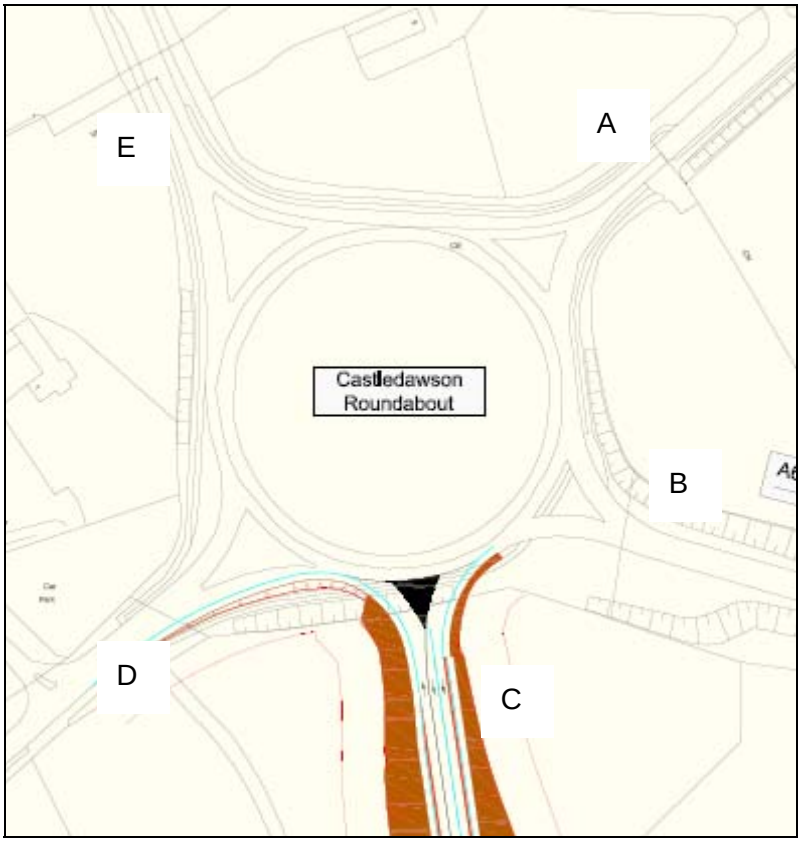


Figure 8.28 Pink Route / Castledawson Roundabout

The ARCADY results for **Figure 8.28** are summarised below.

Arm	2027 AM		2027 IP		2027 PM	
	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)	Max RFC	Max End Queue (Veh)
A A54 Magherafelt Road North	0.58	1.40	0.26	0.40	0.46	0.80
B Castledawson Bypass East	0.15	1.00	0.34	0.50	0.60	1.50
C Pink Route	0.39	0.60	0.13	0.20	0.50	1.00

Arm	2027 AM		2027 IP		2027 PM	
D A31 Magherafelt Road South	0.32	0.50	0.28	0.40	0.37	**0.60**
E A6 Glenshane Road West	0.55	1.20	0.36	0.60	0.47	0.90

Table 8.12 ARCADY results for Pink Route / Castledawson Roundabout

As shown, the 'Max RFC' for all arms during the AM, PM and Inter-peak are below the 0.85 threshold for the Design Year 2027. The 'Max Queue' for all movements is relatively low, with the maximum queue at any one time throughout the day being approximately four vehicles.

This indicates that the A6 Castledawson Roundabout is expected to work well within capacity in 2027 with the Pink Route in place.

8.5 Economic Assessment of Route Options

8.5.1 Assessment Methodology

A full cost benefit assessment was required to allow the comparison of the value for money provided by each of the three route options of the Magherafelt Bypass. The chosen tool for this part of the project was **T**ransport **U**ser **B**enefit **A**ppraisal (TUBA) a computer program developed for the Department of Transport. TUBA undertakes a matrix-based appraisal with either fixed or variable trip matrices, using as inputs trip, time, distance and cost matrices. Cost associated with the Do-Minimum and Do-Something schemes are also used as input to the program. The program compares the costs of operation of the "Do-Minimum" and "Do-Something" scheme network forecasts to compute the value of savings in vehicle travel time and distance. By comparing all construction and associated costs with the stream of traffic benefits over a 60 year assessment period, TUBA provides a **B**enefit **C**ost **R**atio (BCR) which allows comparison of the value for money of each option.

TUBA does not calculate benefits that are due to changes in accident costs and therefore the evaluation of the benefits due to changes in accident costs was performed by means of a spreadsheet that utilised link and node based outputs from the TRIPS model using a methodology similar to that of the **C**ost **B**enefit **A**nalysis (COBA) software.

8.5.2 Scheme Costs

The scheme costs inputted into the TUBA program were subdivided into the following four categories:

- Construction Costs
- Land costs

- Preparation Costs
- Supervision Costs.

Table 8.13 presents the cost estimate for each of the route options, please note the costs presented below differ from the Scheme Cost Estimates presented in **Table 4.3** as the Optimism Bias is spread proportionally between the four categories unless specified otherwise and all costs were then discounted to Q3 2007 to allow the benefits of the scheme to be calculated in TUBA.

Table 8.13 Cost Estimates

Cost Estimation	Blue Route	Purple Route	Pink Route
Construction (£000s)	16,777	18,189	23,438
Land, Dwellings and Compensation (£000s)	17,502	8,611	8,903
Preparation (£000s)	835	906	1,167
Supervision (£000s)	835	906	1,167
Total (£000s)	**35,949**	**28,612**	**34,675**

8.5.3 Forecast Accident Data

Details of the traffic accidents which took place between January 2003 and December 2006 on the road network in and around Magherafelt have been collected and correlated. **Table 8.14** presents a breakdown of the observed accidents for each year according to their severity.

Year	Number of Accidents	Fatal	Serious	Slight Injury
2003	91	2	27	134
2004	91	6	12	132
2005	83	6	20	134
2006	96	2	39	125
2007*	17	0	10	24
Total	378	16	108	549

Table 8.14 Accident Data Breakdown

The change in accident costs has been assessed by comparing the accident costs in the Do-Minimum to the scheme accident costs. The TRIPS model provides flows on each road link for the AM peak, average Inter-peak and PM peak hours for 2012 (Opening Year) and 2027 (Design Year). These have been factored to provide average daily flows. The number of accidents on each link is calculated using the average daily flow, accident rate per km and distance. Summing over all links provides the accident costs for the Do-Something scheme which can be compared to the Do-Minimum accident costs to

determine the accident benefits of the scheme. Accident costs are assessed over a 60-year period, 2012-2071. Accidents costs between 2012 and 2027 have been interpolated. After 2027, it has been assumed that traffic levels are flat and accident rates and values change in line with guidance provided by DMRB Volume 13, Part 2, Chapters 3 and 4.

The number of forecast accidents is presented in **Table 8.15**. It can be observed that the option with the lowest number of accidents per year is the Pink Route. It can also be observed that the number of accidents even for the Do-Minimum option is significantly lower than the yearly average for the period 2003 – 2006. This implies that the introduction of the A6 dualling scheme alone will result in a significant reduction in the number of accidents in the study area.

Table 8.15 Forecast Accidents

Year	Schemes	No. of Accidents	Number of Casualties		
			Fatal	Serious	Slight Injury
2012	Do-Minimum	57	1	10	76
	Blue Route	55	1	10	73
	Purple Route	54	1	10	73
	Pink Route	53	1	9	72
2027	Do-Minimum	77	2	13	103
	Blue Route	72	2	13	97
	Purple Route	71	2	13	95
	Pink Route	70	2	12	94

8.5.4 Economic Assessment Summary

Table 8.16 presents the results of the economic assessment for the three alternative bypass alignments. The Pink Route is the option which over time will provide the highest Net Present Value between the three schemes. The Pink Route also the option that provides the highest accident benefits. Due to the fact that the investments costs for the Pink Route are higher than those for the Purple Route, the BCR for the Pink Route classifies as the second highest amongst the three options.

Table 8.16 Economic Assessment Summary Table

Aspect	Route Options		
	Blue Route	Purple Route	Pink Route
Consumer User Benefits	87,811	82,541	82,774
Business Benefits	99,100	94,160	96,445
Accident Benefits	11,562	13,948	18,062
Present Value of Benefits (PVB)	**197,658**	**189,564**	**195,829**
Investment Cost	27,885	22,136	26,811
Indirect Tax Revenue	-5,756	-7,693	-10,368
Present Value of Cost (PVC)	**22,129**	**14,443**	**16,443**
Carbon Benefits	-815	-1,085	-1,462
Net Present Value (NPV) = PVB - PVC	**175,529**	**175,121**	**179,386**
Benefit to Cost Ratio (BCR) = PVB/PVC	**8.93**	**13.12**	**11.90**

Notes:

1. All Values (except BCR) are in £000
2. Consumer user benefits refer to users who are not in the course of business; for example shopping, going from home to work, returning from work etc.
3. Business benefits refer to users who are in the course of business; for example travelling on business trips, travelling between work places on working time etc.
4. Investment costs refer to the total cost of investment and include construction costs, maintenance costs land costs etc.
5. Indirect tax revenue refers to the extra tax that the consumer pays due to fuel consumption because of the scheme. Positive values indicate that the drivers consume more fuel and thus pay more fuel tax to the government and vice versa.
6. Carbon benefits are part of the vehicle operating costs and refer to benefits of the reduction of vehicle carbon emissions (based on fuel consumption). These benefits are the difference between the Do-Minimum and the Do-Something.

8.6 Summary

The **Traffic Assessment** considered the existing traffic flows and provided details of the methodology for the development of a traffic model for A31 Magherafelt Bypass scheme. It also described inputs to the forecasting methodology including the assumptions applied for the future traffic growth, development activity, model application, traffic forecasting results and economic assessment of the proposed bypass routes. The key results include:

8.6.1 Do-Minimum Forecast

The forecasts indicate an overall increase in traffic demand of over 13% by 2012 and 56% by 2027.

As a result, traffic in Magherafelt study area would experience deterioration in travel conditions during peak travel times, for example:

- average travel speeds across the study area will reduce by approximately 16% to 48 kph in 2027, compared with 57 kph in the Base Year (2007)
- whereas, average travel speeds in the town centre will reduce by 29% to 15 kph in 2027, compared with 21 kph in the Base Year 2007
- journey times on the A31 through the town centre (between Coolshinney Road and the Castledawson Roundabout) over 4.7 km will increase by 32% in the northbound direction and by 47% in the southbound direction.

These forecasts show that continued traffic growth, in the absence of a bypass, will have a severe impact on the existing A31 from South of Magherafelt to Castledawson Roundabout. Magherafelt Town Centre and surrounding roads will also come under increased pressure, where higher flows in the future will cause severe congestion and will significantly reduce traffic speeds and journey times.

8.6.2 Do-Something Forecast

The three proposed routes for Magherafelt Bypass option were tested in what is termed as Do-Something options. The three tested routes are Blue, Purple and Pink. The forecasts produced for each of the three route options show that travel conditions in Magherafelt can be improved through the introduction of a suitable bypass scheme.

Across the study area highway network the forecasts show that, all the three route options will:

- reduce traffic flows in the town centre by at least 25% in 2012 and by 15% in 2027
- reduce total travel time and hence increase the average speed by at least 12% to 54 kph from 48 kph in the Do-Minimum
- whereas, average travel speeds in the town centre will increase by at least 26% to 19 kph in 2027, compared with 15 kph in the Do-Minimum (2027)
- journey time on A31 through the town centre (between Coolshinney and the Castledawson Roundabout) on 4.7 km stretch of road will improve by at least 22% in the northbound direction and at least by 16% in the southbound direction.

Traffic conditions will therefore improve significantly with any of the Magherafelt bypass scheme in place as compared to without any bypass.

The main benefits are reduction in traffic flows in the town centre and the improvement in traffic speed and in journey times offered by each option along the existing A31 through Magherafelt. With any of the schemes in place, journey times not only improve relative to the Do-Minimum, but forecasts indicate that journey time will be close to the same level as were in the Base Year 2007.

8.6.3 Comparison of Blue, Purple and Pink Routes

Though forecast shows that any of the three proposed routes will offer significant benefits to the traffic, the operational performance of each scheme will be different between each option.

There are number of relative differences which, when accumulated over the whole scheme, do enable meaningful comparisons to be made between various schemes.

Blue and Purple Routes are shorter in length than the Pink Route and therefore have most of their benefits around the town centre. The Pink Route will provide benefits not only in the town centre but also in the wider area.

Traffic flows in the town centre will be slightly less with the Blue Route as compared to Purple or Pink Route option.

However, with the Pink Route, traffic flows will be reduced for a longer section of the existing A31 through the town. Traffic flows will be 33% less on A31 Castledawson Road with the Pink Route, whereas with the Blue or Purple Route traffic flows on this section will increase by at least 7%.

The Pink Route provides the lowest journey times to strategic traffic through Magherafelt and via the bypass.

The Blue and Purple Routes will require dualling of the existing A31 to the north of the A31 Castledawson Road / proposed bypass junction to operate in 2027, while with the Pink Route in place, the northern proposed bypass junction at the A6 Castledawson Roundabout, will work well within capacity in 2027.

The Pink Route will require no dualling of the A31 to the north of Magherafelt Town Centre, as it does not connect into the A31 at this point.

8.6.4 Economic Assessment of Scheme Options

The economic assessment for each of the proposed bypass route option has been carried out using the TUBA program. The program estimates costs and benefits by comparing traffic conditions in a Do-Something (DS) scenario against conditions in a Do-Minimum (DM) scenario.

Results of the economic assessment of proposed bypass routes show that there is a strong economic case for the schemes. The BCRs are considerably greater than 1, showing that the monetised benefits of all options exceed their costs.

The highest BCR is for the Purple Route (13), closely followed by the Pink Route (12) and then for the Blue Route (9).

However, the highest NPV (net present value of benefits) is for the Pink Route (£181 M), followed by the Blue Route (£177 M) and then for the Purple Route (£176 M).

The Pink Route also provides the highest benefits from accident savings. For the Pink Route these are (£18 M), followed by the Purple Route (£14 M) and then for the Blue Route (£12 M).

8.7 Conclusions

The forecasts indicate that continued traffic growth, in the absence of a bypass scheme, would have a severe impact on the existing A31 from south of Magherafelt to Castledawson Roundabout. Magherafelt Town Centre and surrounding roads would also come under increased pressure, where higher flows in the future will cause severe congestion and would significantly reduce traffic speeds and journey times.

Forecast results show that any of the proposed route option will help in relieving congestion from Magherafelt Town Centre and will provide increased capacity which will improve speed and journey times within and through the town centre.

Economic assessment of the proposed bypass routes show that any of the bypass scheme will be good value for money and will also help to reduce accidents.

Though forecast shows that any of the three proposed routes will offer significant benefits to the traffic, Pink Route will have more benefits as compared to the Blue Route or Purple Route.

Pink Route will not only reduce traffic from the town centre but will also reduce traffic for a longer section of the existing A31, particularly from A31 Castledawson Road. Whereas with Blue or Purple Route, A31 Castledawson Road will become heavily congested.

Pink Route will also provide a better alternative route for the strategic (long distance) traffic which is currently passing through Magherafelt Town Centre.

Additionally Pink Route will have the highest savings from accident reductions and will also have the highest NPV (net present value of benefits).

Therefore, Pink Route is recommended to be developed as the preferred route for A31 Magherafelt Bypass Scheme from a traffic point of view.

9 Existing A31 Castledawson Road Dualling

9.1 Introduction

The proposed northern tie-in of both the Blue and Purple Routes form a junction with the existing A31 Castledawson Road, as a result the bypass traffic will be added to this already problematic section of road. The existing A31 Castledawson Road will therefore require upgrading. From the predicted flows presented in the previous section, the road will either require widening to allow for a wide single or dual carriageway, as the existing alignment varying in width from 7.3m to 9.1m, which falls within the classification of a wide single, a dual carriageway will therefore be the preferred option to ensure that the route was future proofed until the Design Year of 2027.

9.2 Engineering Assessment

9.2.1 Existing Conditions

The existing A31 Castledawson Road between Magherafelt and the Castledawson Roundabout is a 7.3m to 9.1m wide single carriageway. Access is provided for 9 dwellings, Polepatrick Cemetery, a Church and the Gaelic Football Ground. It also has junctions with Aghagaskin Road, Bowmans Road, and Killyneese Road. The 'park and share' facility, fast food outlet and commercial premises have access on to the Castledawson Road where a right turn pocket has been provided along with a left-out only route towards the A6 Castledawson Roundabout.

The existing horizontal alignment of the A31 carriageway is almost straight, however the vertical alignment has a crest curve which restricts forward visibility. The road is derestricted for the majority of its length until reaching the settlement limit of the town centre where a 30mph limit is imposed. If the existing alignment of the Castledawson Road was assessed using current standards (DMRB TD 9/93), a design speed of 60kph (40mph) will be applied.

9.2.2 Impact of Proposed Works

A design speed of 100kph will be desirable to accord with the design criterion for the bypass routes.

Geotechnical Constraints

The geotechnical constraints are summarised below described from Magherafelt to Castledawson Roundabout:

- the proposed roundabout junction connecting the Blue Route to the existing A31 Castledawson Road is likely to have some impact on the access road to Sperrin College. If the access road is not realigned then a reinforced earth or retaining wall solution will be required increasing the cost of construction

- the Coppies River crosses the A31 Castledawson Road very close to the location of the roundabout with peat and soft/compressible alluvial soils associated with the watercourse. A culvert crossing will be required for the widening which may be complicated by the proximity to the junction

- an area of shallow bedrock is indicated on the geological map between the Coppies River and Polepatrick Drain which may prove difficult to excavate

- the Polepatrick Drain crosses the A31 Castledawson Road at the Aghagaskin Road junction. Wet ground is noted on the OS map which is a possible indicator of weak and compressible alluvial soils and / or the presence of shallow bedrock in the area. A culvert will be required at this location

- the route then passes very close to the edge of the GAA sports ground which may require a retaining wall or reinforced earth structure in order to minimise the impact on this feature. A two metre high retaining structure will also be required on the opposite side of Castledawson Road in order to avoid the earthworks at this location that will require demolition of the house located there

- a culvert crossing will be required at the location of the Killyneese Drain

- the widening at Farm Hill will create a large cut slope as the road falls towards the Castledawson Roundabout. Substantial concrete retaining walls up to 5m high and 100m in length will be required at this location in order to avoid demolition of two houses on the south east side of the road and two house on the north west side.

Design Constraints

Blue Route B

Appendix A Figure 9.1 presents the dualling that will be required if the Blue Route was progressed (Blue Route B). Approximately 1.8km of the existing A31 will require dualling to the south of the Castledawson Roundabout. To comply with current highway design standards, the carriageway extending from the Castledawson Roundabout for a distance of some 700m south will be constructed below the existing carriageway level. This will provide appropriate vertical curvature and visibility on the approach to the Castledawson Roundabout.

This design will have a detrimental effect on No.'s 4, 57 and 59 Castledawson Road along with 80 Magherafelt Road as the highway boundary will be significantly closer to the dwellings. There will be a requirement to demolish No. 47 Magherafelt Road and the neighbouring new build to the south along with No.'s 50 and 78 Magherafelt Road and 4 Killyneese Road to achieve the required alignment.

The Gaelic Football pitch will require “moving” as the highway boundary encroaches on the north western corner of the ground.

The Gaelic Football Ground, Church and Cemetery will require direct access to the dual carriageway. Nine private accesses will be required onto the dual carriageway along with junctions with Killyneese Road, Aghagaskin Road, Bowmans Road and the ‘park and share’ facility. To accommodate the existing junctions and access to the other community facilities a junction strategy will be required. Avoiding the provision of any junction along this relatively short length of dualled carriageway is desirable but may not be practical. A pattern of ‘left in-left out’ junctions are likely to be unpopular supporting the need for right turn facilities, resulting in further widening the highway footprint and promoting safe turning movements.

Purple Route B

Appendix A Figure 9.2 presents the dualling that would be required if the Purple Route was progressed (Purple Route B). Approximately 1.2km of the existing A31 will require dualling to the south of the Castledawson Roundabout. To comply with the DMRB current highway design standards, much of the dual carriageway will be constructed below the existing carriageway level in order to provide appropriate vertical curvature and hence visibility on the approach to Castledawson Roundabout.

This design will have a detrimental effect on 80 Magherafelt Road as the highway boundary would be significantly closer to the dwelling. There would be a requirement to demolish No. 47 Magherafelt Road and the neighbouring new build to the south along with No.’s 50 and 78 Magherafelt Road and 4 Killyneese Road to achieve the required alignment.

The Gaelic Football pitch would require “moving” as the highway boundary encroaches on the north western corner of the ground.

The Gaelic Football Ground, Church and Cemetery will require direct access to the dual carriageway. Six private accesses will be required onto the dual carriageway along with junctions with Killyneese Road and the ‘park and share’ facility. These would be ‘left in left out’ junctions, resulting in further widening the highway footprint and promoting potentially less safe turning movements.

9.2.3 Cost Estimates

Estimate Rates

Base Rates are presented in current prices in accordance with DMRB: TD 37/93 Scheme Assessment Reporting, Volume 5, Section 1, Part 2.

Cost Estimates Assumptions

The cost estimate for the requirement of dualling the existing A31 Castledawson Road if either the Blue or Purple Route were progressed are based on the same assumptions used to cost the main Blue, Purple and Pink Routes discussed in Chapter 4 Preliminary Scheme Cost Estimates, section 4.3.3 Cost Estimate Assumptions.

A31 Dualling Scheme Cost Estimate

Section	Estimated Value	
	Blue Route B	Purple Route B
Site Clearance	£2,497	£1,675
Fencing	£144,929	£97,220
Road Restraint Systems	£13,662	£9,165
Drainage and Service Ducts	£1,129,580	£515,098
Earthworks	£1,332,270	£1,076,911
Pavements	£1,468,870	£660,327
Kerbs, Footways and Paved areas	£3,905	£3,905
Traffic Signs and Road Markings	£105,701	£48,026
Road Lighting and Electrical Works	£31,329	£13,968
Accommodation Works	£211,637	£121,315
Contractor Works for Statutory Undertakers	£126,982	£72,789
Landscape and Ecology	£159,998	£91,714
Structures	£332,400	£166,200
Preliminaries including Traffic Management	£1,012,752	£575,662
Statutory Undertakers	£303,826	£172,699
Construction Cost	**£6,380,338**	**£3,626,673**
Preparation and Supervision (15%)	£957,051	£544,001
Optimism Bias (44%)	£3,228,451	£1,835,096
Total Construction Cost, Preparation & Supervision, Optimism Bias.	**£10,565,840**	**£6,005,770**
Inflation (2.5%)	£264,146	£150,144

Section	Estimated Value	
	Blue Route B	Purple Route B
Total Construction Cost, Preparation & Supervision, Optimism Bias and Inflation	**£10,829,986**	**£6,155,914**
Land, Dwellings and Compensation	£4,000,073	£3,199,752
Preparation and Supervision (15%)	£600,011	£479,963
Land Optimism Bias (10%)	£400,007	£319,975
Total Land Cost (including Optimism Bias & Inflation is Constant)	**£5,000,091**	**£3,999,690**
A31 DUALLING ESTIMATE TOTAL (Construction, Planning & Supervision, Optimism Bias and Land Costs)	**£15,830,077**	**£10,155,604**
Notes;-		
1) Estimate date 22 February 2008 (based on current prices).		

Table 9.1 Scheme Cost Estimates

A31 Dualling Cost per km

Cost per km	Estimated Value	
	Blue Route A	Purple Route A
OVERALL A31 DUALLING TOTAL incl Inflation	£15,830,077	£10,155,604
Length of Scheme (km)	1.9	1.2
Cost Per km	£8,331,619	£7,812,003

Table 9.2 Scheme Cost per Kilometre

Summary of Cost per km for ALL three routes from Moneymore Road to the A6 Castledawson Roundabout

Cost per km	Estimated Value		
	Blue Route	Purple Route	Pink Route
OVERALL ROUTE OPTIONS TOTAL incl Inflation	£52,727,500	£39,794,371	£35,999,273
Length of Scheme (km)	5.3	6.1	5.8
Cost Per km	£9,948,585	£6,418,447	£6,206,771

Table 9.3 Summary of Options Cost per Kilometre for Assessed Options

9.3 Environmental Assessment

9.3.1 Existing Conditions

The A31 is a single carriageway carrying traffic in both directions in and out of Magherafelt; the A31 carries high volumes of local and strategic traffic throughout the day, with traffic becoming further congested and problematic during the AM and PM peak hours where the risk of potential accidents with other vehicle users and non-vehicle users is increased.

Travelling north towards Castledawson Roundabout, the A31 progresses primarily at grade entering and exiting shallow cutting earthworks. Coupled with the intermittent roadside vegetation, vehicle travellers are afforded wider views of the surrounding landscape elements and estate houses and grounds i.e. Glenbrook House, a Grade 1 Listed Building and Millbrook House.

Archaeological surveys and desk top review of the study area has identified that a number of scheduled monuments and archaeological features are located in close proximity to Castledawson Roundabout which can be seen in **Appendix A Figure 7.1**.

Beyond the residential properties and northern urban fringe of Magherafelt town there are several community facilities located along the A31 Castledawson Road i.e. Holy Family Primary School, Sperrin Integrated School, Polepatrick Cemetery, a Church and a Gaelic Football Ground.

A number of businesses are located in close proximity to the A31, a small business park is located at the northern end of the A31 next to the Castledawson Roundabout consisting of a used van sales, a garage, a fast food outlet and a restaurant. To the west of the A31 north of the Church there is a redundant chicken farm; a second business park is located behind a supermarket opposite Sperrin Integrated College, access to this business park is obtained along Station Road. The land use either side of the A31 Castledawson Road is predominantly agriculture.

9.3.2 Impact of Proposed Works

Blue Route B

The dualling of the A31 Castledawson Road from the proposed roundabout junction at Sperrin Integrated College towards Castledawson Roundabout will require the acquisition of land either side of the existing road to facilitate the widening of the carriageway.

The widening of the road will have a detrimental impact upon the setting and integrity of Glenbrook House a Grade 1 Listed Building as it will require the loss of the frontage, vegetation and gates and piers which form part of the listing. The widening of the road will also create access implications for the properties that gain direct access onto the A31. Widening of the road would also have a negative impact upon the setting and integrity of Polepatrick Cemetery, a Church and the Gaelic Football Grounds and would have severe access implications during the construction phase.

There road widening would require a significant loss of mature roadside vegetation in particular the mature trees that front Glenbrook House and the neighbouring property. The proposed deep-cutting to the north will result in a loss of viable agricultural land.

The dualling has been designed to improve traffic capacity; this increase in traffic volume will potentially increase the potential for conflict between vehicle users especially during the AM and PM peak hours. This additional traffic volume will create conflict with the non-mortised users attending Sperrin Integrated College and the other community facilities along located along the A31. Increases in traffic volume will have a direct detrimental impact upon local air quality and noise levels especially for the users of the Gaelic Football Ground.

Purple Route B

The dualling of the A31 Castledawson Road from the proposed roundabout junction at Glenbrook House a Grade 1 listed building to the Castledawson Roundabout will require the acquisition of land either side of the existing road, to facilitate the widening of the carriageway.

The widening of the road and the provision of the roundabout will have a detrimental impact upon the setting and integrity of Glenbrook House a Grade 1 Listed Building as it will

require the loss of the frontage, vegetation and gates and pillars which form part of the listing. The widening of the road will also create access implications for the properties that gain direct access onto the A31.

Widening of the road would also have a negative impact upon the setting and integrity of Polepatrick Cemetery, a Church and the Gaelic Football Grounds and would have severe access implications during the construction phase.

There road widening would require a significant loss of mature roadside vegetation in particular the mature trees that front Glenbrook House and the neighbouring property. The proposed deep-cutting to the north will result in a loss of viable agricultural land.

The dualling has been designed to improve traffic capacity; this increase in traffic volume would potentially increase the potential for conflict between vehicle users especially during the AM and PM peak hours. Increases in traffic volume would have a direct detrimental impact upon local air quality and noise levels, especially for the users of the Gaelic Football Ground.

9.4 Summary

The implementation of online improvements to the A31 will have a detrimental affect to a considerable number of private properties and construction of either option would require the demolition of 5 properties. The dualling will also have a detrimental affect on commercial properties along with community buildings and activities.

The dualling of the existing A31 Castledawson Road will result in an overall adverse impact on local air quality, noise, the setting and integrity of Glenbrook House, Polepatrick Cemetery, a Church and the Gaelic Football Grounds. It will also create access implications particularly during the construction phase albeit they will be temporary and short term in nature.

The junction strategy to accommodate all access and junctions along the route will need developing such that road safety is not jeopardised by right turning vehicles crossing over oncoming two lanes. To provide a left in-left out regime with all junctions / access will not be popular and will create long one-way system.

Dualling from the Blue Route junction will have the greatest impact because of the interactions with Sperrin Integrated College.

It is clear that there is no agricultural severance of land with these alignment options.

Over all the impact of the dualling of the either Blue Route B or Purple Route B will result in a **moderate – large adverse** impact.

The Pink Route allows the bypass to connect directly from the Moneymore Road to the A6 Castledawson Roundabout, to allow the Blue and Purple Routes to reach the same location has significant implications on the cost of each option. The Blue Route increase from approximately £36.9M to £52.7M and the Purple Route from £29.6M to £39.8M with the Pink Route still costing £36M.

10 Summary of Findings / Conclusions

10.1 Summary of Findings

This Stage 2 Scheme Assessment Report has identified the environmental and engineering, advantages, disadvantages and constraints associated with route options.

The study has considered three route options:

- Blue Route ~ the historic Road Service Eastern Bypass route and the route proposed in the Magherafelt Area Plan 2015 - Draft Plan. Total length 3.4km
- Purple Route ~ which avoids the worst of the potential congestion to the north of Magherafelt. Total length 4.9km
- Pink Route ~ which provides a direct link to the Castledawson Roundabout. Total length 5.8km.

10.1.1 Engineering Assessment

The **Engineering Assessment** considered the topography and land use, geology and geomorphology, hydrology and drainage and public utilities within the alternative routes.

The key results include:

Design Constraints

- Blue Route ~ will require a reduction in design speed from 100 kph to 80 kph for the majority of the alignment, with a further reduction along Meadowbank Road to 50kph
- Blue Route ~ has 4 side road along Meadowbank Road which will require the provision of Right-Turning lanes to facilitate existing users
- Blue Route ~ has buildability issues due to the on-line section at Meadowbank Road and the existing development along this section
- Pink Route ~ runs in close proximity to pylons, although the route does not impact on them.

Geotechnical

- Blue Route ~ has the lowest impact on watercourses and has the least volume of earthworks
- Blue Route ~ if progressed there will be less construction required on soft ground than either the Purple or the Pink Route

- Blue Route ~ will require retaining structures due to its proximity to existing buildings
- Blue Route ~ is most likely to be affected by any areas of contaminated land in the district
- difficult to differentiate between the Purple and Pink Routes, in terms of potential areas of contamination, watercourse crossings etc. although the Pink Route will require greater earthworks due to the alignment crossing Farm Hill.

Drainage

- Blue Route ~ has the least impact from estimated discharge volumes, the least impact on floodplains and the least number of watercourse crossings
- Blue Route ~ also only requires localised re-grading of the watercourse, at 1 crossing
- Pink Route ~ will then be the least favourable option, this route is longer than the Purple or Blue Route, it requires the most drainage pipework and has the highest discharge volumes
- Pink Route ~ will also require retention of runoff flows prior to discharging to the Derrygarve Extension watercourse
- Pink Route ~ also has the most number of watercourse crossings and requires diversionary works at 2 watercourses and will likely impact on floodplain areas, which may require the provision of compensatory storage.

Land Use

- Purple Route ~ requires the acquisition of 3 properties
- Blue Route ~ requires the acquisition of 2 properties
- Pink Route ~ requires the acquisition of 1 property
- Blue Route ~ has the greatest impact on residential properties with its alignment coinciding with the heavily built up Meadowbank Road
- Blue Route ~ has the highest land and compensation cost
- although the Pink Route has a higher land and compensation cost than the Purple, this is due to its additional length

- it is difficult to differentiate between Pink and Purple from a land use point of view as both of them are outside of the settlement limit and both equally sever agricultural land.

10.1.2 Environmental Assessment

The **Environmental Assessment** considered the key constraints and features associated with the study area against the twelve DMRB topic areas. Each of the routes has been rated in terms of their impact on each of these topics; see **Table 10.1** which can be found in Section 10.1.4.

Some of the key results of the Environmental Assessment include:

Air Quality

- there is anticipated to be a net improvement with the provision of the Blue and Pink Routes which equates to positive impact on local air quality, i.e. negative value in change of exposure to NO_2 and PM_{10} concentrations within 200m of the proposed scheme
- Purple Route ~ is anticipated to have a negative impact on local air quality
- there is anticipated to be a net improvement with the construction of the Blue Route which has a positive impact (negative value in change of NO_x and carbon emissions within 200m of the proposed scheme)
- Pink and Purple Routes ~ anticipated to have a negative impact on regional air quality and greenhouse emissions due to a rise in carbon emissions and key pollutants.

Cultural Heritage

- Blue Route ~ will potentially have no significant impacts on features and sites of cultural heritage interest
- Pink Route ~ will have a potentially slight impact on these interests
- Purple Route ~ will have the greatest impact out of the three options.

Disruption Due to Construction

- due to the proximity of the Blue Route to the urban fringe, the Construction related impacts will be potentially be the greatest; it will have the greatest air, noise and visual impact upon the many residential receptors that exist along Meadowbank Road

- the additional traffic volumes travelling along Meadowbank Road will be problematic for visitors seeking access to Meadowbank Sports Arena whilst creating an unsafe environment for the pupils of Kilronan Special Needs School

- the proposed tie-in junction at Castledawson Road between Sperrin Integrated College and Holy Family Primary School also has the potential to have a significant impact upon vehicle travellers and non-vehicle travellers

- Purple and Pink Route ~ display similar characteristics and therefore will have a similar order of impacts. Both routes are set to the east of Magherafelt urban fringe and set within pastoral farmland

- Pink Route ~ has the least order of impacts, having the least air, noise and visual impact

- Pink Route ~ has the greatest impact upon severance of land and access to land.

Ecology and Nature

- direct impact on 11 & 5 watercourse crossing points respectively on the Pink and Purple Route

- direct impact on four watercourse crossing points on the Blue Route

- Japanese Knotweed and Giant Hogweed found along all routes

- a high number of hedgerows lost on the Pink (63) and Purple (55) Route

- a moderate number of hedgerows lost on the Blue (38) Route

- direct impacts on winter and breeding birds and otters through habitat loss and fragmentation on all routes

- damage and disturbance of one roost on the Pink Route

- possible damage and disturbance of roosts on the Blue and Purple Routes

- direct impact on badger movements on the Pink and Purple Routes

- no direct impact on badgers on the Blue Route.

Landscape

- Blue Route ~ will have the least impact upon the integrity of the landscape due to it being the shortest of the three routes. However given the proximity it has to the urban settlement it has the greatest visual impact

- Pink Route ~ longest of the three options and will have the greatest impact upon the landscape, it severs the most fields and has the greatest earthwork requirement impacting upon landscape pattern

- Pink Route ~ only option which does not encroach on any areas designated as Local Landscape Policy Areas

- Blue Route ~ greatest impact on Local Landscape Policy Areas.

Land Use

- Blue Route ~ has the least impact on Best and Most Versatile land

- Purple Route ~ has the greatest impact on this resource.

Vehicle Travellers

- whilst the traffic volumes will be reduced by each of the route options; it is anticipated that the reduction in driver stress will be minimal through the town centre for local vehicle travellers due to the speed restrictions within the town

- drivers using either the Purple or Pink Routes will experience reduced stress levels from high down to moderate as a constant design speed of 100kph is achievable

- travelling along the Blue Route driver stress levels will remain high due inconsistent travelling speed and potential conflict with other vehicle travellers and non-vehicle travellers seeking access to the community facilities in close proximity to the Blue Route and Meadowbank Residential area

- travelling along the Purple or Pink Routes vehicle travellers will be offered intermittent and wider views of the wider landscape elements.

10.1.3 Traffic Assessment

The **Traffic Assessment** considered the existing traffic flows and the future year forecast for both the Do-Minimum and Do-Something Scenarios.

The key results include:

- Blue and Purple Route ~ shorter in length than the Pink Route and will therefore have most of their benefits around town centre
- Pink Route ~ will provide benefits not only in the town centre but also in the wider area
- traffic flows in the town centre will be slightly less with the Blue Route as compared to Purple or Pink Route option
- Pink Route ~ traffic flows will be reduced for a longer section of the existing A31 through the town
- traffic flows will be 33% less on A31 Castledawson Road with the Pink Route, whereas with the Blue or Purple Route traffic flows on this section will increase by at least 7%
- Pink Route ~ provides the lowest journey times to strategic traffic through Magherafelt and via the bypass
- Blue and Purple Routes ~ will require dualling of the A31 to the north of the A31 Castledawson Road / proposed bypass junction to operate in 2027, while with the Pink Route in place the northern proposed bypass junction at the A6 Castledawson Roundabout, will work well within capacity in 2027.

10.1.4 Summary of Impact Assessments (exc. A31 Castledawson Road Dualling)

Design Topic Area	Route Options		
	Blue	Purple	Pink
Geotechnical	××	×	0
Drainage	✓✓	✓	0
Buildability	✓	✓✓✓	✓✓✓
Alignment Design	✓	✓✓	✓✓✓
Land Use – affect on (severance)	X	XXX	XXX
Dwellings to be Purchased	XX	XXX	X
Accidents (PVB)	✓✓	✓✓	✓✓✓
Cost Benefits (NPV)	✓✓	✓✓	✓✓✓
Cost Benefit Ratio	✓✓	✓✓✓	✓✓✓
Reliability	✓	✓	✓✓
Wider Economic Impacts	-	-	-
Option Values (PVC)	✓	✓✓✓	✓✓
Environmental Topic Area	**Blue**	**Purple**	**Pink**
Air Quality (Local i.e. Magherafelt town)	✓	x	✓
Air Quality (Regional)	✓	x	x
Cultural Heritage	0	xx	x
Disruption due to Construction	xxx	xx	x
Ecology and Nature Conservation	x	xx	xx
Landscape Effects	x	xx	xx
Land Use	x	xx	x
Traffic Noise and Vibration	xx	✓	✓
Pedestrians, Cyclists, Equestrians and Community Effects	0	0	0
Vehicle Travellers	0	✓	✓
Road Drainage and the Water Environment	0	0	0
Flooding - Floodplains	xx	x	xx
Geology and Soils	0	0	0
Policies and Plans	0	0	0

Table 10.1 Summary of Assessment Findings

Ratings:

✓✓✓ - Major beneficial ✓✓ - Moderate beneficial ✓ - Slight beneficial

× - Slight adverse ×× - Moderate adverse ××× - Major adverse 0 – Neutral

10.1.5 Existing A31 Castledawson Road Dualling

- both Blue Route B and Purple Route B ~ will have a detrimental affect to a considerable number of private properties and construction of either option will require the demolition of 5 properties

- both Blue Route B and Purple Route B ~ will also have a detrimental affect on commercial properties along with community buildings and activities

- both Blue Route B and Purple Route B ~ will result in an overall adverse impact on local air quality, noise, the setting and integrity of Glenbrook House, Polepatrick Cemetery, a Church and the Gaelic Football Grounds

- both Blue Route B and Purple Route B ~ will also create access implications particularly during the construction phase albeit they will be temporary and short term in nature

- to provide a left in-left out regime with all junctions / access will not be popular and will create long one-way system

- Blue Route / Blue Route B junction will have the greatest impact because of the interactions with Sperrin Integrated College

- over all the impact of the dualling of the either Blue Route B or Purple Route B will result in a moderate – large adverse impact

- Pink Route allows the bypass to connect directly from the Moneymore Road to the A6 Castledawson Roundabout, to allow the Blue and Purple Routes to reach the same location has significant implications on the cost of each option. The Blue Route increase from approximately £36.9M to £52.7M and the Purple Route from £29.6M to £39.8M with the Pink Route still costing £36M.

10.2 Conclusions

A variety of assessments have been completed in accordance with the DMRB. The major traffic, environmental and engineering, advantages, disadvantages and constraints associated with three routes have been identified and assessed.

From the evidence presented in this report, it can be concluded that although the Blue Route has merits as a local distributor and the Purple Route has merits as a bypass the necessity to upgrade the existing A31 Castledawson Road makes them costly options both in monetary terms and the impact on the People of Magherafelt.

The provision of the Blue Route (including Blue Route B) will necessitate the potential demolition of 7 houses with the provision of the Purple Route (including Purple Route B) requiring the potential demolition of 8 properties.

The Pink Route is not only the best option from a traffic point of view with it allowing a direct link to the A6 Castledawson Roundabout but it will also provide the highest savings from accident reductions and highest NPV (net present value of benefits) when compared to the other options (excluding the cost and benefits of the A31 Castledawson Road Dualling). The Pink Route will also only require the potential demolition of one property, the necessity of which may be removed at preferred route stage. The Pink Route also provides the greatest improvement to Air Quality within the town centre of the proposed routes.

The Pink Route allows the community of Magherafelt to largely function as it is during construction and when the bypass is in place.

The Pink Route is therefore recommended to be progressed to Stage 3 – development of preferred option and Statutory Orders.

Appendix A - Figures and Drawings

Appendix A

Figure Number	Drawing Number	Description
3.2	720336.B.D.2138	Existing Situation, Magherafelt
3.3	720336.B.D.1020	Location of Road Side Interviews / Postcard Survey Sites, Within Magherafelt Town
3.4	720336.B.D.1021	Location of Road Side Interview / Postcard Survey Site on the B18
3.9a	720336.B.D.1023 Sheet 1 of 2	TCS Locations, Road Network in Magherafelt
3.9b	720336.B.D.1023 Sheet 2 of 2	TCS Flows, Road Network in Magherafelt
3.10	720336.B.D.1024	TCS Locations and Flows, Road Network Around Magherafelt
3.11	720336.B.D.1025	Journey Time Survey Routes
3.14	720336.B.D.1018	Traffic Accident 2003-2007, Around Magherafelt
3.15	720336.B.D.1019	Traffic Accident 2003-2007, In Magherafelt
4.1	720336.B.D.2157	Progressed Corridors
4.2	720336.B.D.2139	Initial Route Options, Location Plan
4.3	720336.B.D.2036	Progressed Route Options, Location Plan
5.1	720336.B.D.2010	Blue Route Plan and Section, Blue Route
5.2	720336.B.D.2013	Purple Route Plan and Section, Purple Route
5.3	720336.B.D.2028	Pink Route Plan and Section, Pink Route
5.4	720336.B.D.5620	Topography and Hydrology
5.5	720336.B.D.5634	Drift Geology
5.6	720336.B.D.4040	Route Options, Drainage and Northern Ireland Water Infrastructure
5.7	720336.B.D.4004	Blue Route Preliminary Drainage Design

Figure Number	Drawing Number	Description
5.8	720336.B.D.4007	Purple Route Preliminary Drainage Design
5.9	720336.B.D.4014	Pink Route Preliminary Drainage Design
5.10	720336.B.D.4042	Possible Areas of Flooding
5.11	720336.B.D.2060	Route Options, Telecommunications
5.12	720336.B.D.2065	Blue Route, Existing NIE Services
5.13	720336.B.D.2068	Purple Route, Existing NIE Services
5.14	720336.B.D.2069	Pink Route, Existing NIE Services
6.1	720336.B.D.6095	Blue Route, Landownership Plan
6.2	720336.B.D.6096	Purple Route, Landownership Plan
6.3	720336.B.D.6097	Pink Route, Landownership Plan
6.4	720336.B.D.2137	Magherafelt Area Plan (Draft), with Route Options
7.1	720336.B.D.3028	Route Options, Environmental Constraints, Cultural Heritage
7.2	720336.B.D.3041	Route Options, Environmental Constraints, Sensitive Receptors
7.3	720336.B.D.3023	Route Options, Environmental Constraints, Ecology and Nature – Habitat Map
7.4	720336.B.D.3008	Route Options, Landscape Constraints
7.5	720336.B.D.3042	LLPA, with Route Options
7.6	720336.B.D.3038	Route Options, Environmental Constraints, Agricultural Land Classification
7.7	720336.B.D.3040	Killyfaddy, Unofficial Walkway
9.1	720336.B.D.2174	Blue Route B, Castledawson Road Dualling
9.2	720336.B.D.2175	Purple Route B, Castledawson Road Dualling

Appendix B – Scoring Matrix

Appendix C – Public Consultation Day Brochure

Appendix D – Public Consultation Day Questionnaire Template and Feedback Summary

Appendix E – Cost Base received from Roads Service

Appendix F – Photographic Record of Archaeological Site Visits

Appendix G – Ecology and Nature Target Notes

Appendix H – Modelled Network