Cockermouth Local Development Framework
Transport Study
Modelling Results

Cumbria County Council

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Executive Summary

1. Each Planning Authority in the County must produce a Local Development Framework (LDF). It is important that Cumbria County Council (CCC) and the Planning Authority understand the transport implications of LDF developments. CCC are currently undertaking a Transport Study for Allerdale Borough Council to identify the impact of varying levels and distribution of possible LDF development in Cockermouth. The aim of the study was to establish the amount of LDF development that could be accommodated in Cockermouth. This report summarises the findings of the transport modelling results.

2. Initially, three scenarios were derived to consider varying levels of development types and distribution of potential development. The 2010 Cockermouth Paramics highways micro-simulation model was used to identify junctions on the local highway network that experience congestion in the existing (2010) and future year (2027) scenarios, and the 2027 future year with LDF development traffic.

3. Trip generation was undertaken for both LDF and committed developments using the TRICS database, which estimates trips generated by different types of development.

4. The results identified junctions on the highway network operating within, approaching and over capacity in 2010, 2027 and 2027 with LDF developments. The results show that the existing highway network in Cockermouth already experiences congestion in the AM and PM peak periods at some of the key junctions. In the future year of 2027 the extent of the network experiencing congestion remains constant, but the amount of congestion at the worst-affected locations increases. When the LDF development is considered in 2027 the level of congestion increases further particularly in the PM peak, illustrating that the existing highway network would not be able to accommodate the proposed levels of LDF development without significant increases in congestion.

5. An additional three scenarios were therefore put forward for assessment, which considered a reduced amount of potential LDF development with different distributions in order to establish if this would be sufficient to reduce the impact of the LDF development traffic. Although this alleviated a lot of the congestion that occurred in the initial scenarios, the revised allocation and distribution of development that was assessed still resulted in an increase in congestion at key junctions compared to the base situation.

6. It was concluded that the modelling indicates that scenarios 1-3 result in a level of congestion that suggests that the level and distribution of LDF development assessed in these scenarios would not be appropriate for Cockermouth. The modelling indicates that in scenarios 4-6 the majority of the highway network would operate within capacity with the addition of LDF development traffic. However, the Gote Road/Low Road and Crown Street/Sullart Street junctions are shown to be operating considerably over capacity in the 2027 base situation, and this is compounded by the LDF development traffic. Therefore, even with the reduced level of LDF development represented by scenarios 4-6, these junctions would experience congestion and extensive queuing in the peak periods.
7. The modelling work undertaken in this report illustrated that introducing a large amount of additional employment land use within Cockermouth town centre results in a significant increase in congestion. The Paramics model can be used to assess the potential for locating LDF developments on sites around the edges of Cockermouth. It is recommended that further modelling work is undertaken to look at the impacts of an alternative distribution of LDF development, particularly in relation to the location of potential employment land use. This additional work would help to identify a level and distribution of development that can be accommodated on the network without creating unacceptable levels of congestion.

8. It is considered that due to the constrained nature of the highway network in Cockermouth, it is not feasible to construct substantial highway infrastructure improvements that would mitigate the impact of LDF development. Therefore it is recommended that sustainable transport improvements are considered that would contribute to mitigating the impact of LDF developments by reducing the number of development trips using the highway network. It should be recognised however that such measures are very unlikely to make a significant impact on traffic queues at key junctions.

9. Recognising that key junctions within Cockermouth currently experience congestion that would be exacerbated by any of the levels of development assessed in this study, it is recommended that this is taken into account when considering the distribution of LDF development in Cockermouth and the broader distribution of LDF development within Allerdale. The potential to locate LDF development in locations in Allerdale that do not experience existing congestion should be considered.
1. **Introduction and Background**

1.1 **Summary**

1.1.1 Cumbria County Council (CCC) are currently undertaking a transport study to assist Allerdale Borough Council (ABC) understand the transport implications of their developing Local Development Framework (LDF). The aim of the study was to establish the amount of LDF development that could be accommodated in Cockermouth.

1.1.2 This report summarises the findings of the transport modelling results.

1.1.3 The report aims to assess the impact of potential LDF sites on the highway network. Specifically, the aim of the assessment is to identify junctions that are likely to operate over capacity as a result of the potential LDF developments. The study also aims to identify potential highways improvements and alterations to mitigate the impact of the proposals.

1.1.4 The Study objectives include:

1. To run the Cockermouth Transport Model including identification of the 2010 and 2027 base traffic flows and for sites contained within the emerging LDF evidence base up to 2027.

2. To identify locations on the network that would be over capacity without and with LDF development proposals.

3. To identify potential suitable mitigation measures.

4. To summarise the findings in a report that will inform the ABC Core Strategy DPD.

1.2 **The Local Development Framework (LDF)**

1.2.1 Each local planning authority must produce an LDF. LDF’s contain development plan documents (DPDs) which form the development plan for the area.

1.2.2 The Core Strategy is the main DPD and sets out the overall development strategy for the plan area over the plan period, usually a 15 year time period. The site allocations DPD allocates land required to deliver the development strategy contained within the core strategy. It should guide development to happen in the right place at the right time and in tandem with the necessary new infrastructure.

1.2.3 It is important for the Planning Authority and CCC to understand the transport impacts of the development strategy detailed in the DPDs contained within the LDF. This informs CCC’s Local Transport Plan Strategy and Implementation Plans. This also allows potential future impacts on the highway network and constraints on travel to be identified, which would, without action, make development in a particular location unsustainable.

1.2.4 Mitigation measures to remove these constraints should be proposed, such as junction improvements or walking and cycling route enhancements.
1.3 BACKGROUND

1.3.1 At a meeting between CCC and ABC Officers in July 2011 to discuss the Allerdale LDF, it was identified that some transport modelling work was required to assess the potential for LDF development in Cockermouth.

1.3.2 As part of the evidence base for the Core Strategy, ABC needed to be reasonably sure that there is sufficient land, with the supporting infrastructure, to deliver the level of housing and employment assigned to each town. During the drafting of the Strategic Housing Land Availability Assessment (SHLAA) ABC had initial discussions with key infrastructure providers and consultees. It became apparent that there were potentially significant highway constraints, particularly on the east side of the town, although hard evidence of the scale of the problem was not available.

1.4 CONTENTS

1.4.1 The report includes the following:

- The methodology of the Transport Study;
- The nature of the developments included within the transport model;
- A summary and explanation of the results;
- Identification of potential Improvement Schemes;
- Conclusions and recommendations.
2. Methodology

2.1 Overview

2.1.1 Cumbria County Council’s Paramics model of Cockermouth was created in 2011, with a base year of 2010. This model has been used to assess the impact of the LDF developments on the highway network in Cockermouth in the weekday AM and PM peak periods.

2.1.2 The Paramics model was calibrated to a base year of 2010 using turning count data for key junctions, and subsequently validated using journey time data for the main routes through the town centre collected in 2011.

2.1.3 To assess the impact of LDF development proposals in the transport model, ABC have provided for each site; the location of the development, the type of development including use, class, scale of development and the likely access arrangements for the development.

2.2 Approach

2.2.1 The approach taken to test the impact of the LDF developments in Cockermouth is detailed below.

2.2.2 Estimated development trip generation and likely trip distributions were calculated for each development site based on the information provided by ABC. Further details of the trip generation methodology are included in Section 3.

2.2.3 Committed developments and improvements to transport infrastructure were considered in future year assessments. Further details of these are included in Section 3.

2.2.4 The study uses the Paramics software to assess the routeing of development traffic on the Cockermouth highway network, and to highlight junctions predicted to operate with high levels of congestion in the future.

2.2.5 Paramics is a traffic microsimulation model which models individual vehicles for the entire duration of each vehicle trip, providing the accurate traffic flow information required for the analysis of congested highway networks. This technique is particularly suited to situations such as assessing the effects of road space reallocations, for example following the introduction of a bus lane, or in this case the movement of traffic through bottlenecks created by narrow sections of road.
2.2.6 The Paramics model has assessed the following:

1. 2010 Base Flows
2. 2027 Base Flows
3. 2027 Base Flows with Committed Developments
4. 2027 Base Flows with Committed Development and LDF Developments

2.2.7 The time periods included in the assessment covered the weekday highway AM and PM peak periods. In this assessment, these periods were defined as 08:30 – 09:30 and 17:00 – 18:00.

2.2.8 The Paramics model has been used to identify:

- Junctions that suffer from congestion now and in the future base year of 2027 including committed developments.
- Junctions that will suffer from congestion in 2027 with the additional traffic generated by the potential LDF development sites.

2.2.9 In this assessment, queue length has been used to indicate congestion at key locations on the highway network. A wider indication of the operation of the highway network has been obtained by considering journey times along key routes.

2.2.10 Sustainable mode improvements cannot be tested directly in Paramics as it is a highways model including Cars, LGVs and HGVs. Mitigation measures to increase travel by sustainable modes should be included in the measures to mitigate the impact of LDF developments.

2.2.11 The model only provides an indication of where there is congestion and delays on the highway network. More detailed junction capacity assessments using junction modelling software are required to be undertaken for the base situation in 2027 and for 2027 with LDF developments. These would use flow outputs from the modelling assessment and would provide a more accurate representation of capacity at existing junctions. Any potential junction mitigation measures will also require assessment in junction modelling software to establish whether the suggested measures can mitigate any deterioration in traffic conditions resulting from the addition of the LDF development traffic.
3. Developments

3.1 LOCAL DEVELOPMENT FRAMEWORK LAND ALLOCATIONS

3.1.1 ABC provided a list of potential LDF development sites in Cockermouth, which included the maximum capacity of each site for providing residential, employment or retail land use.

3.1.2 The potential land capacity for these uses up to 2027 includes:

- Employment – Up to 16.2 hectares of net site area for development across 9 development sites. This is a mix of B1 Business, B2 General Industrial and B8 Storage and Distribution. Two of the sites are located to the north east of the town centre, two to the east, four to the south east and one to the north west.

- Residential – Up to 834 residential units across 9 sites. The sites vary in size from 3 to 247 units. The sites are mainly presented as mixed-use developments sharing the same locations as the employment sites, with a few smaller infill sites.

- Retail – Up to 8,360m$^2$ of net site area for retail development on two potential sites. One is located to the north west of the town centre, and the other located within the town centre.

3.1.3 Further details of the sites are illustrated on the LDF Site Plan (2027) and Cockermouth LDF Sites (2027) table in the Appendix. For the purposes of the modelling process, the initial list of potential sites supplied by ABC was simplified into geographic areas containing sites that shared a common point of access onto the modelled highway network.

3.1.4 From this list, an initial three scenarios were derived considering varying levels of development types and distributions of LDF developments in Cockermouth. After these scenarios were tested in the Paramics model, a further three scenarios were then derived to assess the impact of a reduced amount of development. Therefore a total of six scenarios were tested using the Paramics model.

3.1.5 From the overall schedule of potential LDF development, the six scenarios included in the assessment were as shown in Table 3.1.
Table 3.1  LDF Development Scenario Land Use Breakdown Summary

<table>
<thead>
<tr>
<th>LDF Developments</th>
<th>Residential</th>
<th>Employment</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDF Developments 1</td>
<td>700 units</td>
<td>30,000 m2 GFA</td>
<td>8360 m2 GFA</td>
</tr>
<tr>
<td>LDF Developments 2</td>
<td>500 units</td>
<td>21,000 m2 GFA</td>
<td>8360 m2 GFA</td>
</tr>
<tr>
<td>LDF Developments 3*</td>
<td>410 units</td>
<td>30,000 m2 GFA</td>
<td>8360 m2 GFA</td>
</tr>
<tr>
<td>LDF Developments 4</td>
<td>570 units</td>
<td></td>
<td>8360 m2 GFA</td>
</tr>
<tr>
<td>LDF Developments 5</td>
<td>370 units</td>
<td>7,000 m2 GFA</td>
<td>8360 m2 GFA</td>
</tr>
<tr>
<td>LDF Developments 6*</td>
<td>570 units</td>
<td></td>
<td>8360 m2 GFA</td>
</tr>
</tbody>
</table>

*LDF Developments 3 and 6 were considered in combination with the proposed 290-unit residential development at ‘The Fitz’.

3.1.6 The distribution of the residential, employment and retail development in each of the LDF development scenarios is detailed further in the LDF Scenarios table in the Appendix.

3.2 COMMITTED DEVELOPMENTS AND IMPROVEMENTS

3.2.1 The following committed developments have been included in the transport model:

   a) Sullart Street residential development
   b) Cockermouth Community Care centre on land to the north west of Castlegate Drive and Isel Road

3.2.2 A committed improvement to the transport infrastructure, the Cockermouth Main Street Improvement Scheme, was also included in the assessment.

3.2.3 Although not at present a committed development, a proposed 290-unit residential development located at ‘The Fitz’ adjacent to Low road was due at public enquiry in February 2012, with the outcome expected in March 2012. The potential impact of this development was therefore taken into account in scenarios 3 and 6 as shown in table 3.1. It should be noted that at the time the transport modelling was undertaken it was understood that this development would comprise 290 residential units, and the modelling was therefore undertaken on this basis. The current understanding of the development is for 221 residential units.

3.2.4 The locations of the committed developments included in the assessment are illustrated in the LDF Site Plan (2027) in the Appendix.
3.3 TRIP GENERATION

3.3.1 For each development to be included in the assessment, a number of assumptions have been made. These include the amount of trips travelling to and from the development, the distribution of these trips, the choice of travel mode of these trips and the access arrangements.

3.3.2 Trip generations for both the committed developments and LDF development were calculated using the TRICS software. This database contains traffic count surveys from existing developments throughout the UK, and was searched for similar developments to give an estimated trip generation of the proposals.

3.3.3 85th percentile trip rates were calculated for residential, office, retail parks and hotel land uses. These represent a robust level of trips to and from the development which are unlikely to be exceeded. For industrial and warehousing land uses, mean average trip rates were used since there was an insufficient number of sample sites within TRICS to allow a robust calculation of 85th percentile rates. The trip rates used in the assessment are shown in Table 3.2

Table 3.2 LDF Assessment Trip Rates

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Trip Rate Unit</th>
<th>AM</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Arrivals</td>
<td>Departures</td>
</tr>
<tr>
<td>Office</td>
<td>Per 100 m²</td>
<td>2.736</td>
<td>0.498</td>
</tr>
<tr>
<td>Industrial</td>
<td>Per 100 m²</td>
<td>0.308</td>
<td>0.082</td>
</tr>
<tr>
<td>Warehousing</td>
<td>Per 100 m²</td>
<td>0.093</td>
<td>0.053</td>
</tr>
<tr>
<td>Residential</td>
<td>Per unit</td>
<td>0.066</td>
<td>0.541</td>
</tr>
<tr>
<td>Retail</td>
<td>Per 100 m²</td>
<td>3.252</td>
<td>2.072</td>
</tr>
</tbody>
</table>

3.3.4 Since the actual size of the developments located at each potential site varied between scenarios, the total number of trips generated also varied between scenarios. A summary of trips generated by each potential LDF site in each scenario is included in the LDF Scenarios table in the Appendix.

3.3.5 The LDF development trips were then assigned to the appropriate origin zone based on the site location. The trips were then distributed onto the highway network based on the proportion of trips from that origin zone to each destination zone in the base matrices.

3.3.6 Trip generation and distribution for each of the committed development sites were taken from the relevant Transport Assessment for each development.
4. Highways Assessment

4.1 INTRODUCTION

4.1.1 The LDF scenarios were tested in Cumbria County Council’s Cockermouth Paramics model. The assessment included a consideration of committed developments which would also impact on the level of traffic within Cockermouth in the future assessment year of 2027.

4.1.2 The Paramics model produced output to indicate which of the key junctions included in the assessment would operate above capacity in the base year of 2010 and 2027 and as a result of the LDF development traffic in 2027. In all, 8 scenarios were tested:

1. 2010 Base Flows
2. 2027 Base Flows with Committed Developments
3. 2027 Base Flows with Committed Development and LDF1
4. 2027 Base Flows with Committed Development and LDF2
5. 2027 Base Flows with Committed Development and LDF3
6. 2027 Base Flows with Committed Development and LDF4
7. 2027 Base Flows with Committed Development and LDF5
8. 2027 Base Flows with Committed Development and LDF6

4.1.3 The assessment considers 10 key junctions in Cockermouth. These are illustrated on the Cockermouth Junctions plan in the Appendix and are as follows:

1. Gote Road/Low Road
2. Crown Street/Sullart Street
3. Station Road/Gallowbarrow
4. Lorton Street/Station Road
5. South Street/Station Street
6. Main Street/Station Street
7. Victoria Road/Lorton Road
8. Kirkgate/Windmill Lane
9. Kirkgate/Market Place
10. Market Place/Castlegate

4.1.4 The output from the Paramics model has been presented in terms of the Average Queue Length in metres for each arm of each key junction, as well as average journey times along key routes. The key journey time routes are illustrated on the Cockermouth Journey Time Routes plan in the Appendix and are as follows:

1. Gote Road to Castlegate
2. Castlegate to Gote Road
3. Low road to Station Road
4. Station Road to Low Road
5. Castlegate to Station Road
6. Station Road to Castlegate
7. Main Street to Lorton Road
8. Lorton Road to Main Street
9. Lorton Road to Station Road
10. Station Road to Lorton Road

4.1.5 To provide a better understanding of the exact operation of a given junction, more detailed individual junction modelling was also undertaken, based on the future year traffic conditions predicted by the Paramics model output. This provided a figure for the Ratio of Flow to Capacity (RFC) at each junction. This is the ratio of the volume of traffic on each approach to the theoretical capacity of that approach. An RFC of 100% indicates that an approach is operating at maximum capacity. However, where the RFC is greater than 90% an approach is likely to begin to experience congestion as there is insufficient spare capacity to cope with fluctuations in traffic flow.

4.1.6 It should be noted that these figures only provide an indication of whether each junction is operating within capacity or not, but are not a measure of the overall operation of the junction. For example, a high RFC at a priority junction may reflect congestion on the minor arm, while the main road may be free-flowing.

4.1.7 Furthermore, and particularly in the case of a congested network such as Cockermouth, these results do not take into account the impact of queuing back from downstream junctions. This will reduce the rate at which vehicles can exit the junction during peak periods, which in turn will lead to potentially increased queue lengths than those indicated by an individual junction model. For this reason, the RFC figures should be read in conjunction with the queue length and journey time outputs from the Paramics model, in order to gain a more complete picture of the operation of the highway network.

4.1.8 The Paramics model output for AM and PM average journey times for the AM and PM peak periods is summarised in the Appendix as Figures 1 and 2, illustrating the average journey time in seconds. The output for average queue lengths for the same periods is included as Figures 3 and 4, illustrating the average queue length in metres. In the summary text below, the average queue length has also been described in terms of passenger car-equivalent units (PCUs). One PCU is the equivalent of a standard car approximately 6 metres in length.

4.1.9 The results of the individual junction modelling are summarised in the Transport Modelling Results plans in the Appendix.

4.2 ASSESSMENT RESULTS: EXISTING SITUATION

4.2.1 The 2010 base flows reflect the current situation on the local highway network in Cockermouth. The model results indicate that in the 2010 AM peak only the Crown Street/Sullart Street mini-roundabout is shown as having a maximum RFC greater than 100%. In the 2010 PM peak, two junctions, the Crown Street/Sullart Street and Gote Road/Low Road mini-roundabouts, are shown to have an RFC greater than 100%.

4.2.2 The Paramics model output indicates that in the AM peak, the average queue length on the most congested approach – the Crown Street eastbound approach to the Crown Street/Sullart Street junction (Junction 2) – was only approximately 15 metres (2.5 PCU). This compares to the longest average in that period of approximately 26 metres (4.5 PCU), recorded at the Station Road/Gallowbarrow signalised junction (Junction 3).
4.2.3 In the PM peak, the average queue length on the Crown Street eastbound approach was approximately 22 metres (3.5 PCU), the same average queue length as recorded on the Gote Road southbound approach to the Gote Road/Low Road junction (Junction 1). This was the only other approach shown as having an RFC greater than 100% in 2010. As in the AM peak, longer average queues were recorded at both signalised junctions.

4.2.4 The baseline average journey times in the 2010 AM peak ranged from around 60 seconds (between Lorton Road and Main Street via Kirkgate) to approximately 2 minutes (between Station Road and Castlegate via Main Street). In the 2010 PM peak, the average journey times are generally between 5 and 10 seconds longer than in the AM peak, reflecting the greater number of trips on the highway network.

4.3 OVERALL IMPACT OF LDF DEVELOPMENTS

4.3.1 The 2027 base flows were estimated by applying TEMPRO average growth rates to the 2010 base flows. TEMPRO growth rates represent the level of ‘natural’ growth and include an assumed increase in the number of households and jobs. Trips generated by committed developments were then added to the 2027 base flows.

4.3.2 In order to avoid double-counting the impact of potential developments, the 2027 LDF assessment was created by adding the expected trips generated by the LDF developments directly to the 2010 base flows and committed development trips without using the TEMPRO growth rates.

4.3.3 This methodology highlighted a considerable difference between the growth anticipated by TEMPRO and the growth represented by the potential level of LDF development. The TEMPRO growth rate for cars between 2010 and 2027 was 10.0% for the AM peak and 11.1% for the PM peak. By contrast the maximum potential level of LDF development (Scenario 1) represents growth of 34.6% in the AM peak and 40.7% in the PM peak, an additional 24% and 30% growth in the AM and PM respectively.

4.3.4 The LDF developments in Scenario 1 add an extra 925 trips (20% more) in the AM peak, and an extra 1400 trips (25% more) in the PM peak compared to the 2027 base flows.

4.4 ASSESSMENT RESULTS: 2027 BASE FLOWS

4.4.1 The 2027 base flows (including committed developments) represents the future year base situation. The model results indicate that two junctions will operate over capacity in both the AM and PM peak periods. As in the 2010 situation, the Crown Street/Sullart Street and Gote Road/Low Road mini-roundabouts are shown to have an RFC greater than 100%. The impact of the future year growth rates is to increase the RFC on the Crown Street eastbound approach to Crown Street/Sullart Street (Junction 2) by 18% in both peak periods. On the Gote Road southbound arm of the Low Road/Gote Road junction (Junction 1) the PM peak RFC is increased by 23% compared to the 2010 PM peak.

4.4.2 The Paramics model output indicates that this increase in RFC translates to an increase average queue lengths of less than 12 metres (or two PCUs) on both of the most congested approaches. This reflects the fact that the congestion at the mini-roundabouts is caused more by a continuous stream of slow-moving vehicles rather than a standing queue of traffic as occurs at signalised junctions.
4.4.3 Compared to the 2010 situation, the 2027 baseline represents an increase in average journey times of 15 seconds, approximately 17% on average in the AM peak. In the PM peak the average increase is 10 seconds, approximately 22%.

4.4.4 The greatest increases in journey times as a result of background traffic growth and committed development trips were seen on the routes between Lorton Road and Main Street (Route 8), and Lorton Road and Station Street (Route 9) in the AM peak. Route 8 shows an increase in journey time of approximately 45 seconds, from approximately 60 seconds in 2010 to 105 seconds in 2027. Route 9 shows an increase of approximately 35 seconds, from approximately 115 seconds to approximately 150 seconds. This is likely to be a reflection of traffic re-routing along Castlegate to avoid Victoria Road and Station Road.

4.4.5 In the PM peak, the greatest increases were seen on the routes between Gote Road and Castlegate (Route 1), and Low Road and Station Road (Route 3). Route 1 shows an increase of approximately 40 seconds, and Route 3 an increase of approximately 32 seconds. The increase in journey times on these routes reflects the additional congestion at the mini-roundabouts and the extra time taken for vehicles to clear these junctions.

4.4.6 These changes in queue lengths and journey times in 2027 with the addition of committed developments relative to the 2010 situation represent the baseline future situation in Cockermouth. The impact of the LDF development scenarios was assessed in relation to this baseline, and for ease of reference the 2027 base plus committed developments situation will be noted as the 2027 base.

4.5 ASSESSMENT RESULTS: IMPACT OF LDF DEVELOPMENTS SCENARIOS 1-3

4.5.1 The LDF development scenarios were assessed in two stages. Initially, a high level of development was tested in the LDF1, LDF2 and LDF3 scenarios. Following this, and directed by the initial results as described below, a more moderate level of development was tested in the LDF4, LDF5 and LDF6 scenarios.

4.5.2 Overall, the introduction of LDF development trips in all scenarios does not result in a significant increase in congestion in the AM peak. The only junctions shown to have a maximum RFC greater than 100% are Junctions 1 and 2, which were already shown to be at or over capacity in the 2027 base situation. The most significant impact of the LDF development trips at these junctions in the AM peak was in the LDF3 scenario, which showed an increase of approximately 23 metres (4 PCU) on the Gote Road approach at Junction 1, and 12 metres (2 PCU) on the Crown Street approach at Junction 2. In the AM peak, in all scenarios the LDF development does not result in previously uncongested junctions to go over capacity.

4.5.3 The greatest impact of the LDF development traffic was seen in the PM peak period. In the LDF Developments 1 scenario, in addition to greatly increasing the maximum RFC at junctions 1 and 2, Junctions 3 and 10 were also shown to have a maximum RFC greater than 100%. Junction 10 also had a maximum RFC greater than 100% in the LDF 2 and LDF3 scenarios. Junction 4, however, had a maximum RFC below 100% in these scenarios, although it was still greater than 90%.
4.5.4 The LDF traffic causes significant increases in queue lengths at the majority of key junctions, with the impact being greatest in the LDF1 scenario in the PM peak. The main impact appears to be caused by traffic travelling westbound from Lorton Road. In the LDF1 PM peak, the average queue lengths are approximately 103 metres (17 PCU) on both the Lorton Street approach at Junction 4, and the Lorton Road approach at Junction 7. This compares to approximately 28 metres (4.5 PCU) and 24 metres (4 PCU) in the 2027 base. Other significant increases are seen on the Low Road and Gote Road approaches at Junction 1, which show an increase in average queue length of approximately 66 metres (11 PCU) and 73 (12 PCU) metres respectively. LDF development traffic also results in an average queue length of approximately 50 metres (8 PCU) northbound on Kirkgate, where previously there had been no queuing at all.

4.5.5 Journey times for vehicles travelling between Lorton Road and Station Road (Route 9) increase from approximately 2 minutes 35 seconds in the 2027 base, to over 11 minutes in LDF1. There is also a significant increase in the average journey time on Route 7, from approximately 68 seconds in the 2027 base to over 5 minutes in LDF1.

4.5.6 The main cause of congestion appears to result from the increase in trips related to the development sites along Lorton Road. This increase in trips results in queues forming on the westbound approaches to the signals at Junctions 3 and 4. This in turn causes a large number of vehicles to re-route along Kirkgate. Due to the amount of vehicles travelling east to Lorton Road, there are insufficient gaps for right-turners into Kirkgate, resulting in extensive queuing along Lorton Road. Also, as a consequence of the increase in northbound traffic along Kirkgate, there is a subsequent delay for traffic travelling southbound on Kirkgate.

4.5.7 The other main concentration of potential LDF development sites in these scenarios was located off Castlegate Drive. In terms of journeys westbound from Castlegate, the additional LDF traffic does not significantly impact on either journey times or queue lengths. In the LDF1 scenario, the average journey times for Routes 2 and 5 increased by approximately 15 seconds and 35 seconds respectively. The slightly greater increase in time along Route 5 reflects the increased queuing on the Gallowbarrow approach to Junction 3. The average journey times for traffic travelling to Castlegate does show an increase of approximately 70 seconds in the LDF1 PM peak compared to the 2027 base situation, but this is likely to be mainly due to the impact of traffic travelling along Main Street to reach Lorton Street.

4.5.8 Compared to the LDF1 scenario, the LDF2 scenario represents an overall reduction in the level of proposed LDF residential and employment development of approximately 30%, which equates to approximately 20% fewer development trips. In particular this results in approximately 35% fewer trips to and from the proposed development sites on Lorton Road. The main impact of this reduction in trips is a reduction in average queue lengths of approximately 20 metres on the Lorton Street approach to Junction 4, and 45 metres on the Lorton Road westbound approach to Junction 7. This in turn results in a reduction in average journey time of approximately 3 minutes along Route 9 and 2 minutes along Route 8 compared to LDF 1. Subsequently this leads to approximately halving the average journey time along Route 8 as there is less conflicting traffic on Kirkgate.
4.5.9 The LDF 3 scenario represents the same level of development as LDF1, but with approximately 40% of the housing allocation relocated to ‘The Fitz’. This development site lies outside the modelled network area, although those trips from the development which enter the modelled network were included in the assessment. As with LDF 2, this reduces the overall number of development trips, but only by approximately 10% overall. In general this does not significantly reduce the average queue lengths at any of the key junctions compared to LDF1. However, there is a general reduction in average journey times, particularly on Routes 7, 8 and 9. Routes 2 and 4, in contrast, show an increase in average journey time of approximately 30 seconds compared to LDF1.

4.6 ASSESSMENT RESULTS: IMPACT OF LDF DEVELOPMENTS SCENARIOS 4-6

4.6.1 As described above, the addition of LDF development trips in all three of the initial scenarios resulted in extensive and significant increases in both average queue lengths and journey times within the study area.

4.6.2 These initial results were presented to ABC officers, and it was agreed that the quantities and locations of LDF developments tested caused congestion and delays that were not appropriate for Cockermouth. An additional three scenarios were therefore put forward for assessment, which considered a reduced amount of potential LDF development with different distributions.

4.6.3 Overall, with the reduction of LDF development trips in scenarios 4-6, in the AM peak period the key junctions are shown to operate at a similar level to the 2027 base scenario. The only junction shown to have a maximum RFC greater than 100% is Junction 2, and in all cases the maximum RFC at this junction was equal to or lower than that in the 2027 base situation.

4.6.4 In the PM peak period, the main impact of the revised LDF Development scenarios is at Junctions 1 and 2. The maximum RFC at these junctions is approximately 140% at Junction 1 and 150% at junction 2, compared to approximately 150% and 155% respectively in scenarios 1-3, and approximately 130% at both junctions in the 2027 base situation. The only other junction with a maximum RFC greater than 100% was Junction 10, in the LDF5 scenario, although this junction has a maximum RFC greater than 90% in LDF4 and LDF6.

4.6.5 The revised LDF scenarios assess a similar amount of potential development, but with a slightly varied distribution in each case. This is reflected in the Paramics model output, which indicates that no one scenario can be said to cause the greatest impact on the highway network.

4.6.6 In terms of queue lengths, there is no significant difference in average queue lengths in LDF scenarios 4-6 at the two most congested junctions, Junctions 1 and 2. In the PM peak period, compared to the 2027 Base situation the average queue lengths are approximately 50 metres (8.5 PCU) longer on the Low Road arm at Junction 1, and 45 metres (7.5 PCU) longer on the Gote Road arm. This does not represent a significant reduction in queue lengths at these junctions compared to the LDF scenarios 1-3.
4.6.7 However, the revised LDF scenarios do show a significant improvement in average queue lengths compared to the LDF scenarios 1-3 at the Lorton Road westbound approach to 7, and the Lorton Street approach to Junction 4. At Junction 7, the average queue length in LDF 4 is approximately 30 metres (5 PCU) on Lorton Road and approximately 60 metres (10 PCU) on Lorton Street, compared to approximately 100 metres (16.5 PCU) at both locations in LDF1. LDF scenario 6 indicates a slightly longer average queue length at Junction 4 of approximately 70 metres (11.5 PCU).

4.6.8 The average journey time output indicates that LDF scenarios 4-6 have generally similar average journey times. Overall, these represent significant shorter journey times than LDF scenarios 1-3, particularly on Routes 7, 8 and 9. In the PM peak period, the average journey time on Route 9 is approximately 5 minutes longer in LDF1 than LDF 4-6, while the difference is approximately 3 minutes on Routes 7 and 8.

4.7 SUMMARY

4.7.1 The overall impact of the LDF development is highlighted in Tables 4.1-4.5.

4.7.2 Table 4.1 shows the number of junctions that show an RFC of 90% or more with the LDF development in place, compared to the 2010 and 2027 base situations.

Table 4.1 Number of junctions with RFC >90%

<table>
<thead>
<tr>
<th>AM Peak</th>
<th>2010</th>
<th>2027</th>
<th>2027 + LDF1</th>
<th>2027 + LDF2</th>
<th>2027 + LDF3</th>
<th>2027 + LDF4</th>
<th>2027 + LDF5</th>
<th>2027 + LDF6</th>
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<td>4</td>
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</table>

4.7.3 Tables 4.2 and 4.3 summarise the maximum RFC value at each of the key junctions in the AM and PM peak in each scenario, compared to the 2010 and 2027 base situations.

Table 4.2 Summary of Maximum RFC at Key Junctions – AM Peak

<table>
<thead>
<tr>
<th>Junction</th>
<th>2010</th>
<th>2027</th>
<th>2027 + LDF1</th>
<th>2027 + LDF2</th>
<th>2027 + LDF3</th>
<th>2027 + LDF4</th>
<th>2027 + LDF5</th>
<th>2027 + LDF6</th>
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</thead>
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<td>72%</td>
<td>75%</td>
<td>77%</td>
<td>73%</td>
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### Table 4.3  Summary of Maximum RFC at Key Junctions – PM Peak

<table>
<thead>
<tr>
<th>Junction</th>
<th>2010</th>
<th>2027</th>
<th>2027 + LDF1</th>
<th>2027 + LDF2</th>
<th>2027 + LDF3</th>
<th>2027 + LDF4</th>
<th>2027 + LDF5</th>
<th>2027 + LDF6</th>
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<td>151%</td>
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</table>

4.7.4  Tables 4.4 and 4.5 provide a summary of the average journey times recorded in each route in the AM and PM peak in each scenario compared to the 2010 and 2027 base situations.

### Table 4.4  Average Journey Time Summary – AM Peak

<table>
<thead>
<tr>
<th>Route</th>
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<th>2027 + LDF1</th>
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<th>2027 + LDF3</th>
<th>2027 + LDF4</th>
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<td>2’31”</td>
<td>2’24”</td>
<td>2’46”</td>
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<td>1’57”</td>
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<td>1’55”</td>
<td>1’54”</td>
</tr>
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<td>1’24”</td>
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</tr>
<tr>
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<td>1’27”</td>
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<td>1’29”</td>
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<td>1’24”</td>
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</tr>
<tr>
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<tr>
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<td>1’11”</td>
<td>1’56”</td>
<td>2’01”</td>
<td>1’53”</td>
<td>1’45”</td>
<td>1’42”</td>
<td>1’35”</td>
</tr>
<tr>
<td>8</td>
<td>1’02”</td>
<td>1’45”</td>
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<td>2’54”</td>
<td>3’08”</td>
<td>2’59”</td>
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</tr>
<tr>
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<td>2’32”</td>
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<td>3’31”</td>
<td>4’03”</td>
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<td>1’33”</td>
<td>1’38”</td>
<td>1’38”</td>
<td>1’36”</td>
<td>1’37”</td>
<td>1’39”</td>
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</tr>
</tbody>
</table>

### Table 4.5  Average Journey Time Summary – PM Peak

<table>
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<tr>
<th>Route</th>
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<th>2027 + LDF1</th>
<th>2027 + LDF2</th>
<th>2027 + LDF3</th>
<th>2027 + LDF4</th>
<th>2027 + LDF5</th>
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<td>2’28”</td>
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</tr>
<tr>
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<td>3’44”</td>
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</tr>
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<td>1’03”</td>
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<td>1’38”</td>
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<td>4’26”</td>
<td>3’22”</td>
<td>3’11”</td>
<td>3’36”</td>
</tr>
<tr>
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<td>1’09”</td>
<td>5’19”</td>
<td>2’26”</td>
<td>4’21”</td>
<td>1’55”</td>
<td>1’56”</td>
<td>1’32”</td>
</tr>
<tr>
<td>8</td>
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<td>1’34”</td>
<td>6’01”</td>
<td>4’06”</td>
<td>4’23”</td>
<td>3’06”</td>
<td>2’57”</td>
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</tr>
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<td>11’21”</td>
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<td>9’45”</td>
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<td>1’51”</td>
<td>1’44”</td>
<td>1’51”</td>
<td>1’45”</td>
</tr>
</tbody>
</table>
4.7.5 The impact of the LDF scenarios is more apparent in the PM peak compared to the AM peak hour. Compared to the 2027 base situation, in the AM peak hour all the LDF scenarios result in increased congestion at junctions that were already congested in the base situation, but do not result in previously uncongested junctions going over capacity. However, as illustrated in Table 4.4, the LDF development does result in generally increased journey times with the LDF development traffic compared to the 2027 base situation.

4.7.6 While Table 4.1 appears to show little variation in the number of junctions operating above 90% RFC in the PM peak with the addition of LDF development traffic compared to the 2027 base situation, the overall performance of the network is significantly worse than the base, particularly in the LDF 1-3 scenarios, as shown in Table 4.3. The extent of the increase in congestion at the junctions which have an RFC greater than 90% resulted in greatly increased queue lengths and journey times throughout the network, including those junctions where the RFC remained below 90%.

4.7.7 This situation was also true for the LDF 4-6 scenarios. The model output indicated that queue lengths and journey times in these scenarios were still generally higher than those in the 2027 base situation. Therefore although these scenarios show less impact on the highway network compared to the LDF 1-3 scenarios, they still result in an increase in congestion in comparison to the 2027 base situation.
5. Mitigation

5.1 Potential Infrastructure Mitigation Measures

5.1.1 A meeting was held in October 2011 to discuss the findings of the transport modelling with representatives of ABC and the CCC Allerdale office.

5.1.2 At this meeting a number of potential improvements to the highway network were discussed, with the aim of mitigating the impact of LDF development traffic.

5.1.3 Some of the measures discussed included:

- Optimising the signal timings at Junction 4 Station Road/Lorton Street and Junction 3 Station Road/Gallowbarrow.
- Junction improvement at Junction 3 Station Road/Gallowbarrow signals, involving widening and introduction of right-turn stabling lane to enable Lorton Road and Station Road phases to run in same stage.
- Possible implementation of Compact MOVA at Junctions 3 and 4. The estimated cost of this would be approximately £20,000 per site.
- Conversion of signalised junctions 3 and 4 to mini-roundabouts.

5.1.4 Due to the constrained nature of the highway network in Cockermouth, it was concluded that infrastructure improvements were unlikely to be feasible.

5.2 Sustainable Transport Mitigation Measures

5.2.1 As a result, it is recommended that sustainable transport improvements are considered in order to mitigate the impact of LDF developments by reducing the number of development trips using the highway network.

5.2.2 Table 5.1 outlines potential sustainable transport improvements that could be considered.

<table>
<thead>
<tr>
<th>Transport Improvements</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation of shared use path</td>
<td>Greenway to Cockermouth High School (via potential sites at Strawberry How Road, Windmill Lane, Highfield Road and St. Helens Street)</td>
</tr>
<tr>
<td>Signing and advisory cycle lanes on both sides of carriageway</td>
<td>Windmill Lane to Cockermouth School</td>
</tr>
<tr>
<td>Signing of cycle link</td>
<td>Market Place to Cockermouth School</td>
</tr>
<tr>
<td>Surfacing of C2C</td>
<td>Pontinscale to Memorial Bridge</td>
</tr>
<tr>
<td>Pedestrian phase at traffic signals</td>
<td>Station Street/Lorton Street</td>
</tr>
</tbody>
</table>
6. Conclusions

6.1 MODELLING RESULTS

6.1.1 The results show that the existing highway network in Cockermouth already experiences congestion in the AM and PM peak periods at the Gote Road/Low Road and Crown Street/Sullart Street junctions. Beyond this, however, the results indicate that the highway network operates within capacity in the 2010 base. This continues to be the case in the future year of 2027 (including committed development traffic), although the extent of the congestion is increased.

6.1.2 When the initial LDF development scenarios are considered in 2027 the level of congestion increases, particularly in the PM peak, demonstrating that the existing highway network would not be able to accommodate the proposed levels of LDF development without significant and unacceptable increases in congestion. In addition to increased congestion at Gote Road/Low road and Crown Street/Sullart Street, the LDF development results in the Station Road/Gallowbarrow, Lorton Street/Station Road and Market Place/Castlegate junctions becoming at or over capacity.

6.1.3 The principal reason for the congestion is the predominance of potential LDF development located off Lorton Road. The increase in trips, particularly those associated with employment development, travelling away from this area in the PM peak results in extensive queuing on the westbound route along Victoria Road, Lorton Street and Station road. This in turn results in re-routing along Kirkgate, which has two consequences. Firstly, the increase in northbound traffic on Kirkgate causes queuing on Market Place at the Market Place/Castlegate junction, which blocks back to Kirkgate causing delays for southbound traffic. Secondly, there are insufficient gaps in eastbound traffic at the Lorton road/Kirkgate junction to allow for traffic turning right into Kirkgate, resulting in lengthy queues along Lorton Road.

6.1.4 An alternative set of scenarios which considered a reduced amount of potential LDF development with different distributions were also assessed. With a reduced amount of development located off Lorton road, the model results indicated that a lot of the congestion that occurred in the initial scenarios was alleviated, particularly around Kirkgate. However, even reducing the amount of development did not fully mitigate the congestion. A number of the congested junctions have highway boundary constraints which limit the feasibility of improvement options.

6.1.5 The assessment of the revised scenarios 4-6 indicates that the majority of the highway network would operate within capacity with the addition of LDF development traffic. However, the Gote Road/Low Road and Crown Street/Sullart Street junctions are shown to be operating considerably over capacity in the 2027 base situation, and this is compounded by the LDF development traffic. Therefore, even with the reduced level of LDF development represented by scenarios 4-6, these junctions would experience congestion and extensive queuing in the peak periods.
6.2 RECOMMENDATIONS

6.2.1 The modelling work undertaken in this report illustrated that introducing a large amount of additional employment land use within Cockermouth town centre results in a significant increase in congestion. The Paramics model can be used to assess the potential for locating LDF developments on accessible sites around the edges of Cockermouth. It is recommended that further modelling work is undertaken to look at the impact of an alternative distribution of LDF development, particularly in relation to the location of potential employment land use. This additional work would help to identify a level and distribution of development that can be accommodated on the network without creating unacceptable levels of congestion.

6.2.2 It is considered that due to the constrained nature of the highway network in Cockermouth, it is not feasible to construct substantial highway infrastructure improvements that would mitigate the impact of LDF development. Therefore it is recommended that sustainable transport improvements are considered that would contribute to mitigating the impact of LDF developments by reducing the number of development trips using the highway network. It should be recognised however that such measures are very unlikely to make a significant impact on traffic queues at key junctions.

6.2.3 Recognising that key junctions within Cockermouth currently experience congestion that would be exacerbated by any of the levels of development assessed in this study, it is recommended that this is taken into account when considering the distribution of LDF development in Cockermouth and the broader distribution of LDF development within Allerdale. The potential to locate LDF development in locations in Allerdale that do not experience existing congestion should be considered.
APPENDIX
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Cumbria Highways
Cumbria County Council
Parkhouse Building
Kingsmoor Business Park
Carlisle
CA6 4SJ

Cockermouth
LDF Site Plan (2027)

Key
Location ID
- A - North East
- B - East
- C - South East
- D - South East
- E - West
- F - Central
- G - North West

Site ID
1 Highfield Road
2 St Helens Street
3 Castlegate Drive
4 Windmill Lane
5 Strawberry How Road
6 Land off Towers Lane
7 Land at Sunnyside
8 Land off Brigham Rd
9 Fire Station
10 Land at Lorton Road South
11 Land at Voilet Bank
12 Land at Low Road
13 Land at Lorton Road North
14 Sullart Street Residential Development
15 Cockermouth Community Care Centre
16 Residential Development at the Fitz, Low Road

Committed Developments

Potential Developments

²

Capacity
299 Units
44 Units
146 Units
340 Units
122 Units
130 Units
3 Units
27 Units
31 Units
15.00 ha
3.16 ha
1.04 ha
1.43 ha
3 Units
27 Units
31 Units
15.00 ha
3.16 ha
1.04 ha
1.43 ha
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<th>Employment Capacity</th>
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<th>Mixed Capacity - Residential (units)</th>
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### Cockermouth LDF - LDF Scenarios

#### Employment Mix:

- **B1** 70%
- **LDF Developments 1** 15%
- **B2** 15%
- **B8** 15%

#### Location ID | Location Description | Access | Site ID(s) | Residential (Units) | Employment (m² GFA) | Retail (m² GFA) | Arrivals (AM) | Departures (AM) | Arrivals (PM) | Departures (PM) |
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#### LDF Developments 5

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<td>87</td>
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#### LDF Developments 6*

#### Location ID | Location Description | Access | Site ID(s) | Residential (Units) | Employment (m² GFA) | Retail (m² GFA) | Arrivals (AM) | Departures (AM) | Arrivals (PM) | Departures (PM) |
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### Committed Developments

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<th>Size</th>
<th>Arrivals (AM)</th>
<th>Departures (AM)</th>
<th>Arrivals (PM)</th>
<th>Departures (PM)</th>
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<td>Residential Development, Sullart Street</td>
<td>Sullart Street</td>
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<td>Community Care Centre</td>
<td>Sullart Street</td>
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<td>16*</td>
<td>Residential Development, 'The Fitz'</td>
<td>Low Road</td>
<td>290 units</td>
<td>20</td>
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</table>

*Development at 'The Fitz' only included in Scenarios 3 and 6.*
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Cumbria Highways
Cumbria County Council
Parkhouse Building
Kingmoor Business Park
Carlisle
CA6 4SJ

KEY

No.  Junction
1.  Gote Road / Low Road
2.  Crown Street / Sullart Street
3.  Station Road / Gallowbarrow
4.  Lorton Street / Station Road
5.  South Street / Station Street
6.  Main Street / Station Street
7.  Victoria Road / Lorton Road
8.  Kirkgate / Windmill Lane
9.  Kirkgate / Market Place
10. Market Place / Castlegate

Cockermouth Junctions
Cumbria Highways
Cumbria County Council
Parkhouse Building
Kingmoor Business Park
Carlisle
CAG 451

Cockermouth
Journey Time Routes

KEY
Journey Time Routes
Name
- Castlegate to Gote Road
- Castlegate to Station Road
- Gote Road to Castlegate
- Lorton Road to Main Street
- Lorton Road to Station Road
- Low Road to Station Road
- Main Street to Lorton Road
- Station Road to Castlegate
- Station Road to Lorton Road
- Station Road to Low Road
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Cumbria County Council
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CA6 4SJ

Cockermouth
Transport Modelling Results (AM Peak)
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Cumbria Highways  
Cumbria County Council  
Parkhouse Building  
Kingmoor Business Park  
Carlisle  
CA6 4SJ

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6. Main Street / Station Street  
7. Victoria Road / Lorton Road  
8. Kirkgate / Windmill Lane  
9. Kirkgate / Market Place  
10. Market Place / Castlegate

Cockermouth  
Transport Modelling Results (PM Peak)
Figure 1: Cockermouth LDF Transport Study – Average Journey Times, AM Peak

AM (08:30-09:30) Average Journey Times (s)

Journey Time Route

1. Gote Rd to Castlegate
2. Castlegate to Gote Rd
3. Low Rd to Station Rd
4. Station Rd to Low Rd
5. Castlegate to Station Rd
6. Station Rd to Castlegate
7. Main St to Lorton Rd
8. Lorton Rd to Main St
9. Lorton Rd to Station Rd
10. Station Rd to Lorton Rd

Average Journey time (s)

- Base 2010
- Base 2027
- B+C 2027
- LDF1 2027
- LDF2 2027
- LDF3 2027
- LDF4 2027
- LDF5 2027
- LDF6 2027
Figure 2: Cockermouth LDF Transport Study – Average Journey Times, PM Peak
Figure 3: Cockermouth LDF Transport Study – Average Queue Lengths, AM Peak
Figure 4: Cockermouth LDF Transport Study – Average Queue Lengths, PM Peak