Post Opening Project Evaluation

M6 Carlisle to Guards Mill Improvement

Five Years After Study

July 2015

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Executive Summary

Scheme Description

The M6 Carlisle to Guards Mill Improvement scheme is a Highways England (formerly known as the Highways Agency, HA) major scheme to the north of Carlisle which opened in December 2008. The purpose of the scheme was to address a break in motorway network between the M6 in England and the A74(M) at the Scottish border and improve the safety record and journey time reliability. This section was a dual carriageway, known as the A74, and following scheme implementation the new route is the M6 J44 to J45, with an additional local access road referred to as the All Purpose Route (APR).

Scheme Objectives

Objectives (Non-Technical Summary, February 2005)	Objective Achieved?
Reduce the number of collisions on the route	✓
Provide more carriageway space for emergency services attending collisions	✓
Provide more carriageway space to enable traffic flows to be maintained following a collision	✓
Reduce driver frustration	✓
Improve accessibility for users	✓
Make journey times more predictable	✓

Key Findings

- Journey times along the M6 J44-45 have improved by around 47 seconds in the northbound direction and 31 seconds in the southbound direction compared with the old A74.
- Traffic flows on the new M6 are lower than forecast, with 41,200 vehicles per day (vpd) using the route.
- Collision numbers on the new M6 and APR have decreased by an average of 2.7 collisions per annum in the five years after (FYA) period compared to five years before scheme implementation.
- The scheme delivers a higher than forecast Benefit Cost Ratio (BCR) of 3.6 which is attributable to the higher than forecast safety benefits.
- The majority of the environmental mitigation measures are considered successful.

Summary of Scheme Impacts

Traffic

- Flows on the new M6 are 21,000 vpd (northbound) and 20,900 vpd (southbound) which are slightly lower than flows of 21,400 (northbound) and 21,200 (southbound) on the old A74. These flows are however in line with reductions experienced between M6 J42 to J44 during the same period.
- When the flows on the APR and M6 are combined, the total flows have increased by 1,650 (4%) vehicles per day between the before scheme construction and Five Years After (FYA) periods.
- Traffic flows on the M6 were forecast to increase by 10% across both directions. Observed flows show this forecast to be significantly overestimated, with 16% fewer vehicles than forecast. Observed traffic flows on the APR show the forecast underestimated those flows.

- Journey times have decreased by an average of 47 seconds for northbound traffic and 31 seconds for southbound traffic. The upgrading of the former A74 to motorway standard involved removing direct access points, which alongside the provision of an additional lane will have contributed to improving journey times.
- Journey times are relatively consistent throughout the day in both directions which therefore suggests good journey time reliability. A reduction in collisions and the provision of an additional lane allows traffic flow to be maintained during incidents and therefore, the scheme is likely to have reduced the frequency and length of delays caused by collisions.
- Journey time forecasts were highly accurate and the difference between the observed and forecast journey times is not higher than 7 seconds across the day post opening.

Safety

- Across both the M6 J44-45 and the APR, there has been an annual saving of 2.7 collisions between the before scheme construction and FYA periods. This includes national background reductions in collisions.
- Severity of collisions has reduced by 2% between the before scheme opening and after scheme opening periods.
- Analysis of collision locations shows that collisions at the locations of direct access points from the A74 to local settlements, which have been removed following the upgrade to motorway standard, have reduced at FYA.
- Taking traffic flows into account, on the M6 J44 - 45, the FYA observed collision rate is half that seen during the period prior to the scheme's construction, in line with forecasts.
- As part of the scheme and upgrading of the A74 to the M6, emergency telephones have been installed between J44 and J45, improving personal security along the route.

Environment

- Based on traffic flows, impacts on noise and local air quality are likely to be better than expected.
- There has been an increase in carbon emissions after scheme opening periods due to higher travelling speeds.
- Landscape planting is considered to be establishing well at FYA, although some parts are not as well established as others. Subject to ongoing successful establishment, it should reach its landscape objectives for screening and integration into the local landscape by the design year in most locations.
- New habitats including wet woodland, habitat ponds and reptile sites in Matterdale Forest are considered well established. The overall biodiversity impacts are as expected.
- The APR provides a direct link between Carlisle to Gretna. The route is widely used by cyclists.
- Journey ambience in terms of views from the road, driver stress and traveller care have all been improved as expected.

Accessibility and Integration

- With regards to option values, there have been no changes or improvements to public transport, however, the APR joins to the National Cycle Network Route 7 and 10 and is considered a more attractive and safe route for cyclists compared to the old A74. As a result, the impact of the scheme on options values is determined as slight beneficial.
- The scheme is aligned with local, national and regional policies and receives a score of beneficial.

Summary of Scheme Economic Performance

All monetary figures in 2002 Prices and values		Forecast	Outturn Reforecast
Investment Cost in present value (PVC)		**£41.4m**	**£37.0m**
Journey Time Benefits		£83.4m	£82.4m
Vehicle Operating Costs		-£48.6m	-£46.8m
Safety Benefits		£9.0m	£18.5m
Future Maintenance Benefits		£42.8m	£42.8m
Present Value Benefit		**£86.6m**	**£96.9m**
Indirect Tax		£38.3m	£36.9m
Benefit Cost Ratio (BCR)	**Indirect Tax impact treated as a Cost**	**27.9**	**n/a**
Benefit Cost Ratio (BCR)	**Indirect Tax impact treated as a Benefit**	**3.0**	**3.6**

- Journey time benefits are £82.4 million, 1% less than the £83.4 million forecast.
- Outturn safety benefits are more than double the forecast at £18.5 million. This can be partially attributed to the forecasts predicting higher collision numbers for the before scheme opening period than was observed for the before period at FYA.
- The overall Present Value Benefit (without indirect tax) is £96.9 million, which is 12% higher than the forecast of £86.6 million.
- The total investment cost for the scheme was £103.5 million (2002 prices, not discounted), 18% less than the £125.8 million forecast.
- Had this scheme not been built at this time it would, as a minimum alternative have been necessary to replace the Mossband viaduct where the road crosses the West Coast mainline railway. This means that the net cost of the scheme as reflected in the PVC is much lower than the investment cost of building the full motorway scheme.
- Following the current appraisal approach in which the indirect tax impact is treated as benefit, the outturn BCR of 3.6 is higher than forecast and indicates that the scheme is delivering high value for money.
- With regards to wider economic benefit, the scheme links to the Carlisle Northern Development Route (CNDR) and Kingmoor Park, which are both key strategic economic priorities for Carlisle. Observations from the site visit found that there were vacant units and new businesses moving to Kingmoor Park but no quantifiable data could be acquired regarding occupancy rates since the scheme opened. The scheme has therefore had a neutral impact on wider economic benefits.

1. Introduction

Background

1.1 This report presents a Five Years After (FYA) opening evaluation of the M6 Carlisle to Guards Mill scheme, which opened to traffic in December 2008. The evaluation has been prepared as part of Highways England's (formerly known as the Highways Agency, HA) Post Opening Project Evaluation (POPE) programme. The purpose of this report is to build upon the findings of the One Year After (OYA) published in June 2011.

Scheme Context

1.2 The M6 and A74(M) provide a key transport corridor linking London with Glasgow. The M6 Carlisle to Guards Mill scheme is an integral part of this route, lying to the north of Carlisle within Highways England Area 13.

1.3 Prior to scheme implementation, the A74 dual carriageway, between Junction 44 of the M6 and A74 Guards Mill was the only section of the corridor that was not motorway standard. Colloquially referred to as "the missing link" and the "Cumberland Gap", the route is an important link for heavy goods vehicles travelling between Scotland and England.

1.4 Historically, the A74 was subject to congestion as a result of capacity constraints, which was worsened during incidents with only two lanes, rather than three, available to maintain traffic flow. Safety concerns existed in relation to local traffic accessing the A74 via direct access points along the scheme to small settlements such as Todhills and Rockcliffe. These were considered unsuitable given traffic speeds on the A74 mainline.

1.5 The location of the scheme and all other developments is shown in Figure 1.1.

Scheme Description

1.6 The M6 Carlisle to Guards Mill Improvement scheme extends from M6 Junction 44 to the A74 Guards Mill (5.4 miles). The improved section involved upgrading the A74 from two lane dual carriageway standard to a grade separated three lane motorway to match the motorway standard of M6 and A74, with the link subsequently becoming part of the M6. Following the scheme implementation, there are no longer any direct access points from the M6 to the small settlements.

1.7 On the western side of the motorway an All Purpose Route (APR) has been built for the use of local traffic. Some sections of the APR utilise the existing road. The southern end of the APR is located in the northern outskirts of Carlisle, an area that is primarily industrial in nature, with developments such as Kingmoor Park.

1.8 The APR route commences at the pre-existing Rockcliffe Road, north of Carlisle and extends approximately five miles to Guards Mill, south of Gretna where it forms a junction with the B7076. After approximately 150 metres, the B7076 becomes the A6071, which cross the original, but improved A74 and B7076 junction.

1.9 The scheme implementation also included the following works:

- Demolition of the Mossband viaduct carrying traffic over the West Coast Main Railway Line and its replacement with a new bridge.
- A second bridge over the River Esk alongside the existing one due to the extra width required to widen the motorway and provide the APR (pre-existing bridge carries northbound motorway traffic and the APR, and the new bridge carries southbound motorway traffic).
- A pre-existing Vehicle Operating Services Agency (VOSA) site has been relocated to a site three miles north of its original location. This relocation included soil removal which was used to build embankments at other locations along the scheme.

Scheme History

1.10 A brief history of the events involved in the development of the scheme are provided in Table 1.1.

Table 1.1 Scheme Timeline

Date	Event
1989	The need to upgrade the section between Carlisle and Guards Mill became formally part of the Roads Programme
1990	Public Consultation
1991	Preferred route announced
1996	Public Inquiry
1996 (December)	The Secretary of State for the Environment and Transport accepted the recommendation made by the Inspector to make the published Schemes and Order.
1998	Strategic review of the roads programme indicated that a low cost alternative for the scheme needed to be identified
1999	Study undertaken to identify low-cost options for upgrading the A74 between Carlisle and Guards Mill
2000	Upgrading of the A74 to motorway standard in Scotland completed
2002	Scheme Assessment report produced identifying preferred route
2005 (September)	Public Inquiry
2006 (July)	**Construction begins**
2008 (March)	Completion of the new River Esk Bridge opened to traffic
2008 (June)	Mossband viaduct opened to traffic
2008 (November)	Demolition of the old Mossband viaduct started
2008 (November)	New All Purpose Route (APR) opened to traffic
2008 (December)	**Scheme officially opened**
2011 (June)	**Post Opening Project Evaluation One Year After Report published**

Scheme Objectives

1.11 The primary objectives of the scheme were[1]:

- A reduction in the number of accidents on the route.
- The provision of more carriageway space for emergency vehicles attending accidents.
- The provision of more carriageway space to enable traffic flows to be maintained following an accident.
- A reduction in driver frustration.
- An improvement in accessibility for users.
- More predictable journey times.

[1] The scheme objectives were sourced from the Highways Agency Non-Technical Summary (February 2005).

Nearby Highway and Land Use Schemes

Carlisle Northern Development Route

1.12 The Carlisle Northern Development Route (CNDR, A689) is a single-carriageway bypass just over five miles in length, located to the west of Carlisle. It is the first Private Finance Initiative (PFI), also known as Public Private Partnership (PPP) of its kind for a local authority in the UK. It extends from Wigton Road (A595), to the south west of Carlisle, to Junction 44 of the M6. It has been implemented to[2]:

- Reduce the number of HGVs and other vehicles travelling through the city centre.
- Improve transport links between West Cumbria, Scotland and the North East by connecting the M6, A689, A69, A7 and A595.
- Reduce congestion and shorten journey times in the city.
- Improve economic and employment prospects in the area by helping attract new jobs, particularly at the Kingmoor Park business site.

1.13 The CNDR opened to traffic in February 2012. It was initially planned that the CNDR would be completed before the opening of the Carlisle to Guards Mill improvement scheme, however, it had not opened by the time the one year after (OYA) report was undertaken. The CNDR and associated trips to Kingmoor Park have been included within traffic forecasts for the M6 Carlisle to Guards Mill Improvement scheme, therefore anticipated trips to Kingmoor Park may be closer to forecasts five years after opening (FYA) than OYA.

Kingmoor Park

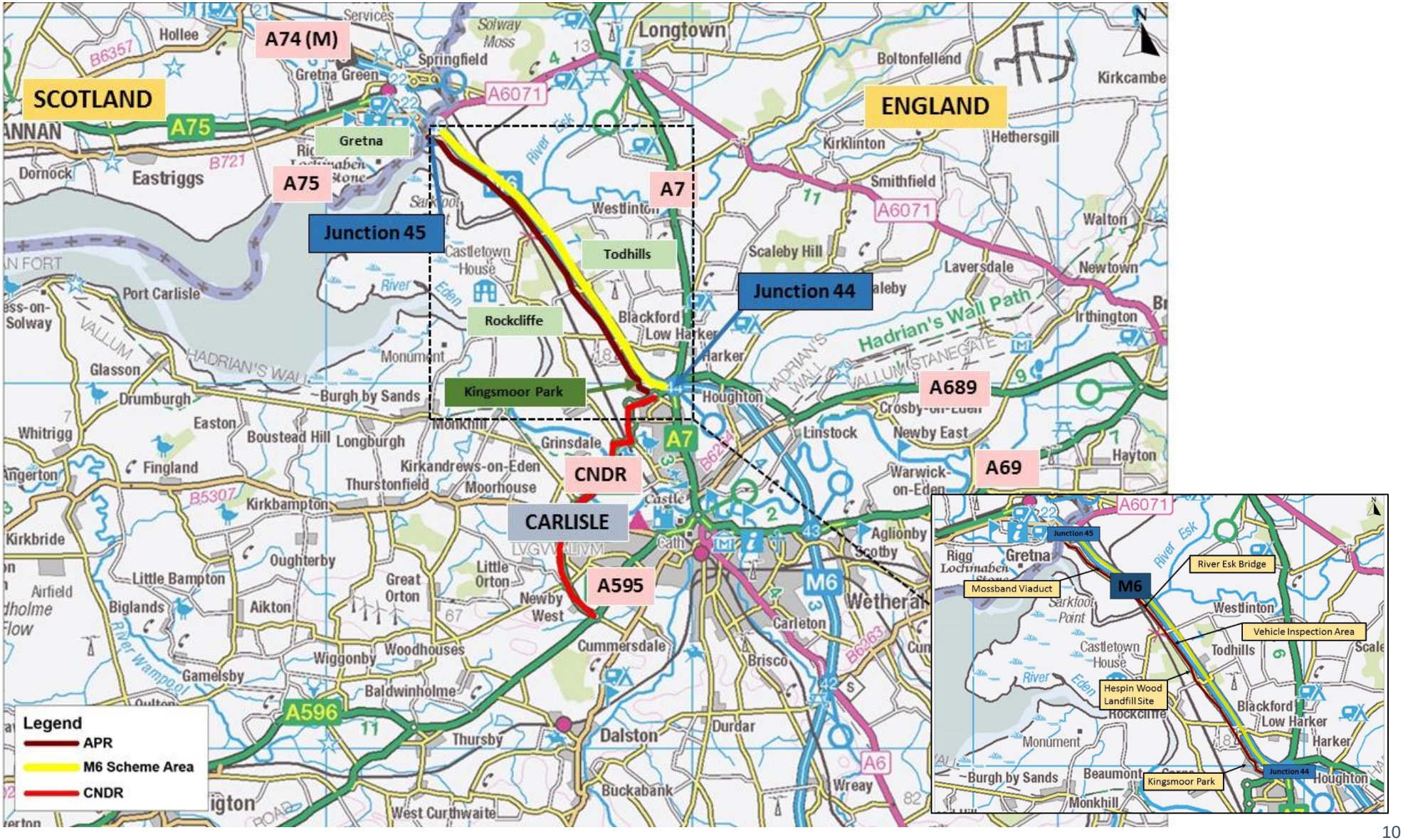
1.14 Kingmoor Park is a key area of economic and business development located to the west of M6 Junction 44 and the APR runs through the area. Developments at the site have taken place continuously throughout the implementation of M6 Carlisle to Guards Mill scheme. The site can be accessed from the M6 Junction 44 via the Carlisle Northern Development Route (A689). An expected increase in the number of trips made to Kingmoor Park was included in the traffic forecast for the scheme.

Hespin Wood Landfill site

1.15 Hespin Wood Landfill site is approximately four miles north of Carlisle and is accessed from the APR. A number of recycling and waste companies operate from the site. Hespin Wood was, however, not explicitly included within the scheme's traffic forecasting.

[2] www.cumbria.gov.uk/roads-transport/highways-pavements/CNDR/cndr.asp

Figure 1.1 Geographical Context of M6 Carlisle to Guards Mill



Post Opening Project Evaluation

Highways England Appraisal Process

1.16 Highways England (formerly known as the Highways Agency) is responsible for improving the strategic highway network (motorways and trunk roads) through the Major Schemes programme. At each key decision stage through the planning process, schemes are subject to a rigorous appraisal process to provide a justification for the project's continued development. When submitting a proposal for a major transport scheme, the Department for Transport (DfT) specifies that an Appraisal Summary Table (AST) is produced which records the degree to which five objectives (Environment, Safety, Economy, Accessibility and Integration[3]) have been achieved. The AST for this scheme is presented in Chapter 7 of this report.

Post Opening Project Evaluation

1.17 POPE studies are undertaken at two stages after all Major Schemes have opened: one year after scheme opening and five years after scheme opening. The purpose of POPE studies is to document outturn impacts, evaluate the strengths and weaknesses of the techniques used for appraising schemes so that informed improvements can be made to the appraisal process in the future. This is achieved by comparing information collected before and after the opening of the scheme to traffic, against predictions made during the planning process. The outturn impacts of a scheme are summarised in an Evaluation Summary Table (EST) which summarises the extent to which the objectives of a scheme have been achieved. The EST for this scheme can be found in Chapter 7.

Summary of the M6 Carlisle to Guards Mill One Year After (OYA) Opening Study

1.18 The purpose of the FYA study is to verify and study in more detail the emerging trends and conclusions presented in the OYA study report. The main conclusions made in the M6 Carlisle to Guards Mill OYA study report were as follows:

- Overall at OYA it was found that all scheme objectives had been achieved.
- Following scheme opening, traffic flows on the M6 reduced as some traffic has transferred to the APR. However, traffic flows in the corridor had experienced very little change since the scheme opened.
- There are lower traffic flows on the M6 than forecast, but slightly higher flows on the APR than forecast.
- Post-opening journey times reduced by approximately 30 seconds. The annual vehicle hours saving was below that forecast, which was attributed to the observed traffic volumes being lower than forecast.
- There was an annual collision saving of five Personal Injury Collisions (PICs) since scheme opening when compared to five years before opening. This collision saving was slightly higher than forecast for the opening year.
- Noise mitigation measures and biodiversity impacts were as expected at OYA. Based on traffic flows, air quality was better than expected for properties adjacent to the motorway. Reforecast carbon emissions were close to the predicted increase.
- Bus stops were installed along the new All Purpose Route (APR) but bus service provision had not altered.

[3] In recent years these have changed, but the evaluation of this scheme in this study will use those defined at the time of its appraisal, namely Environment, Safety, Economy, Accessibility and Integration.

- Non-Motorised User (NMU) facilities were improved due to the provision of the APR as an attractive cycling route. The APR provided a more pleasant direct route for cyclists between Carlisle and Gretna than was available along the existing A74.
- The Present Value Cost (PVC) for the scheme was low due to the essential replacement of Mossband viaduct that was required irrespective of the improvement of the A74 to motorway standard.

1.19 This FYA report will reconsider the status of the above findings and provide further clarity on the longer term effects of the improvements on the immediate area affected by the scheme. This is of particular importance when considering collision and environmental impacts, and longer term economic regeneration effects.

Report Structure

1.20 The remainder of this report is structured as follows:

- Chapter 2 - Traffic Impact Evaluation
- Chapter 3 - Safety
- Chapter 4 - Economy
- Chapter 5 - Environment
- Chapter 6 – Accessibility and Integration
- Chapter 7 – Appraisal Summary Table and Evaluation Summary Table
- Chapter 8 – Conclusions
- Appendix A – Glossary
- Appendix B – Tables and Figures
- Appendix C – COBA Area Collisions
- Appendix D – Environment Information Requested
- Appendix E – Record of Scheme (Before and FYA)
- Appendix F – Record of Scheme (OYA and FYA)
- Appendix G – Predicted impacts, mitigation and evaluation for landscape
- Appendix H – Predicted impacts, mitigation and evaluation for biodiversity

2. Traffic Impact Evaluation

Introduction

2.1 This section examines traffic data from a number of sources to provide a before and after opening comparison of traffic flows and journey times along the M6 from Carlisle to Guards Mill. The same traffic flow analysis will also be undertaken on other routes within the wider area to understand the broader traffic impacts of the scheme. The purpose of this evaluation is to understand whether changes in traffic flows and journey times may be attributable to the scheme.

2.2 This chapter comprises:

- An evaluation of national, regional and local background traffic trends.
- A summary of the sources used to compile data for this analysis.
- A detailed comparison of before, OYA and FYA traffic flows on key routes in the study area likely to be affected by the scheme.
- A comparison of journey times for before scheme construction and FYA stages.
- An evaluation of key differences between forecast and outturn impacts of the scheme in terms of traffic flows and journey times.

Background Changes in Traffic

2.3 Historically in POPE scheme evaluations, the 'before' counts have often been factored to take account of background traffic growth so that they are directly comparable with the 'after' counts. This usually involves the use of National Road Traffic Forecasts (NRTF), with local adjustments made using Local Growth Factors if applicable.

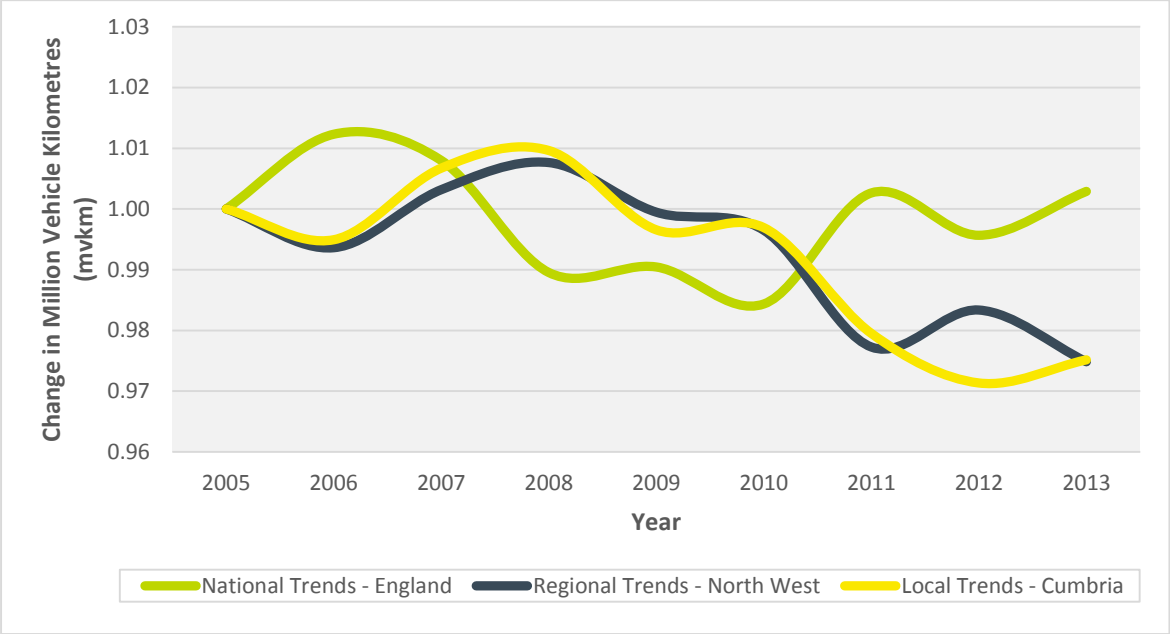
2.4 However, in light of the recent economic climate, and coinciding widespread reductions in motor vehicle travel in the United Kingdom (UK) as a whole since 2008, it is no longer deemed appropriate to use this method of factoring 'before' counts to reflect background changes in traffic. Rather, recent POPE studies have taken a more considered approach in order to assess changes in the vicinity of the scheme, within the context of national, regional and locally observed background changes in traffic.

Local, Regional and National Trends

2.5 The DfT produces observed annual statistics for all motor vehicles by local authority[4]. Data between 2005 (before construction) and 2013 (the latest available) is shown in million vehicle kilometres (mvkm) for Cumbria, the North West Region, and England in Figure 2.1.

[4] Motor vehicle traffic (vehicle kilometres) by region in Great Britain, annual from 1993 to 2013. Table TRA8904 (Department for Transport; accessed June 2014).

Figure 2.1 Local, Regional and National Trends in Million Vehicle Kilometres (mvkm)



2.6 In line with national and regional trends across all areas, local trends show mvkm travelled increased between 2005 and 2007, before falling from 2007 until 2010, with the exception of a small increase between 2008 and 2009, which coincides with the economic recession.

2.7 In 2011, national, regional and local mvkm travelled were approximately 3% lower than 2007. National and regional trends show an increase in vehicle kilometres travelled between 2010 and 2011, with a subsequent decline in their number between 2011 and 2012. This decline is followed by a slight increase from 2012 and 2013. Local Cumbria trends diverge from the national and regional trends by showing a constant increase in vehicle kilometres travelled between 2011 and 2013.

Long Term Traffic Trends on the M6

2.8 Due to limited traffic data availability from the TRADS database, which contains traffic count data for locations on the strategic road network, it has not been possible to obtain data to reveal the long term changes in average weekday traffic (AWT) flows on M6 near to the scheme. Considering traffic flow changes on the M6 beyond J43 – 44 may not be representative of traffic flow changes on the M6 near Carlisle, hence such data was not deemed suitable for use.

Conclusions on Background Changes in Traffic

2.9 Based on the information presented in this section, it has been considered that no annual growth factors should be applied to the data presented in this report. Therefore when reading this report it is important to keep in mind that any decrease in vehicle flows of 1.5 - 2% or less could potentially be attributed to the background reduction across Cumbria, rather than the scheme itself.

Traffic Volume Analysis

Data Sources

2.10 This section uses a variety of data sources to inform the before and after analysis of changes in traffic volumes and journey times for the scheme. To complete this evaluation, data from before construction (March 2006), OYA opening (March 2010) and FYA opening (March/June 2014) is compared. Before and after data has been collected for neutral periods to avoid the impacts of holiday traffic which may be considerable along the M6 between Carlisle to Guards Mill due to it being the main route to Scotland.

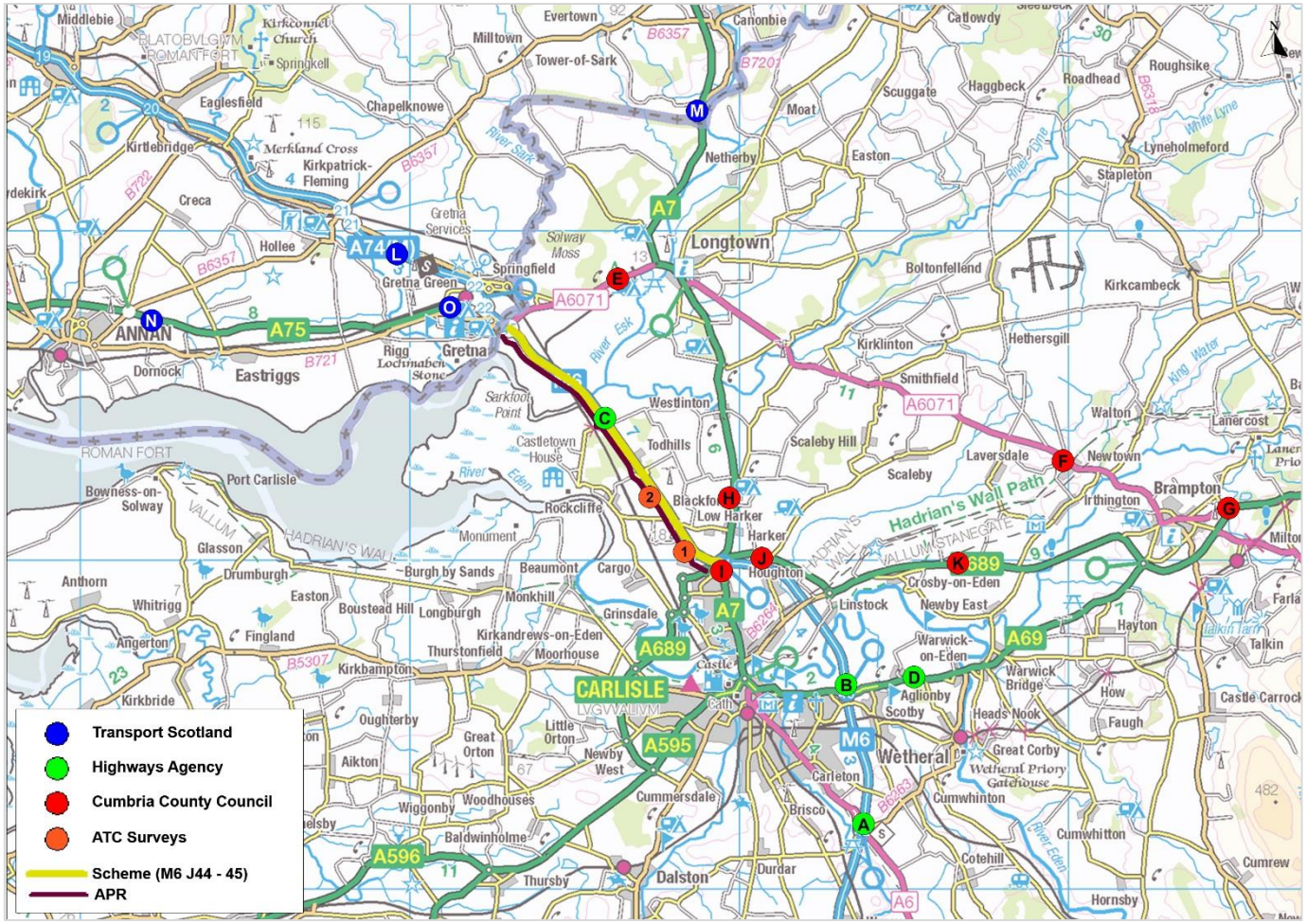
Traffic Count Data Sources

2.11 For the purpose of this evaluation study, the following sources of traffic data have been used:

- Permanent traffic count data obtained from the TRADS database for count locations on Highways England's network for before construction, OYA and FYA.
- Permanent traffic count data supplied by Cumbria County Council and Transport Scotland covering local roads potentially affected by the scheme for before construction, OYA and FYA periods.
- Temporary Automatic Traffic Count (ATCs) data sites were commissioned in two locations on the APR at OYA and in June 2014 (FYA).

2.12 The locations of the traffic count data sites used in this evaluation are summarised in Figure 2.2.

Figure 2.2 Location of Traffic Counts



Site	Source	Location
A	Highways England (TRADS)	M6 J42 (within junction)
B		M6 J43 (within junction)
C		M6 between J44 and J45
D		A69, Warwick Wood
E	Cumbria County Council (permanent)	A6071, West of Smalstown, between Longtown and Gretna
F		A6071, Newtown, North West of Brampton
G		A6071, East of Brampton, approaching the A69 junction
H		A7, North of M6 Junction 44, adjacent to Blackford
I		A7, South of M6 Junction 44, Kingstown Road
J		A689, North West of Houghton
K		A689, Crosbymoor
L	Transport Scotland (TS) (permanent)	A74, South of J21
M		A7, South of Canobie
N		A75, East Riggs
O		A75, Northeast of B721
1	ATCs (temporary)	Parkhouse Road
2		Moss Filling Station

Observed Flows

2.13 Observed Average Weekday Traffic (AWT) flows for the M6 and A74 corridor are presented in Figure **2.3**, and AWT flows for the wider area are displayed in

2.14 Figure **2.4**.

Figure 2.3 Observed before construction, OYA and FYA by direction (AWT) flows

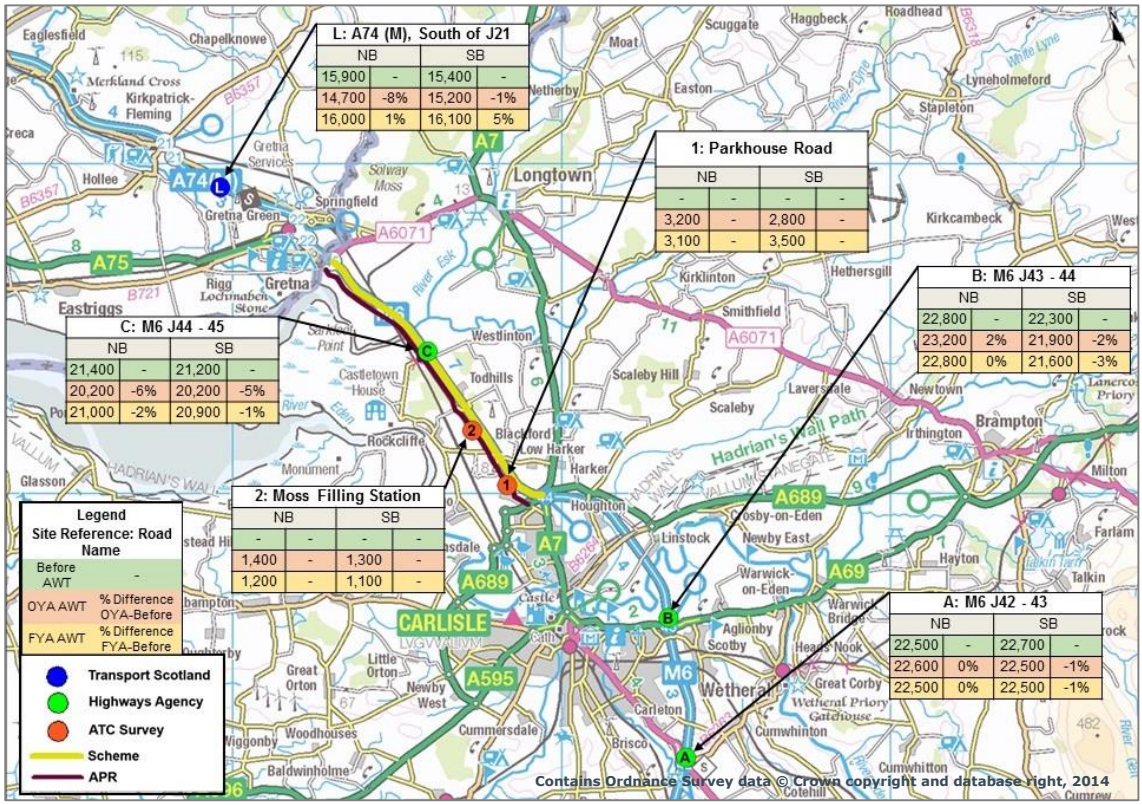
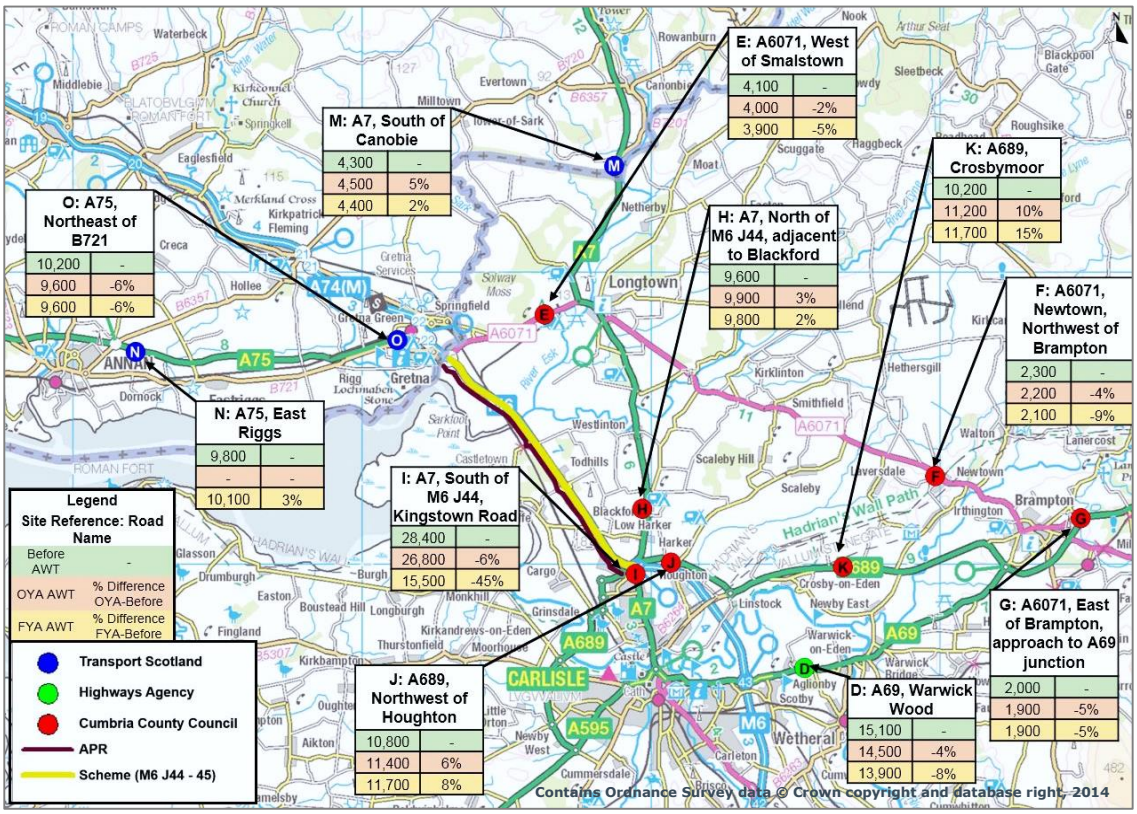


Figure 2.4 Observed before construction, OYA and FYA two way (AWT) Flows



2.15 Figure 2.3 demonstrates that:

- On the M6 J44 – 45 (Site C) scheme section, northbound AWT flows decreased by 2% (400 vehicles) between the before scheme construction and FYA periods, following a 6% decrease (1,200 vehicles) between the before scheme construction and OYA periods. Similarly, southbound flows decreased by 1% between the before scheme construction and FYA period (700 vehicles) following a 5% (1,000 vehicles) decrease between before scheme construction and OYA periods.
- Northbound flows on the M6 J43 – 44 (Site B) have experienced little change, with southbound flows showing a decrease of 3% between the before scheme opening and after scheme opening periods.
- Traffic flows on the A74 southbound (Site L) have increased by 5% following a 1% decrease between before scheme construction and OYA periods. However northbound flows have remained relatively constant between the before scheme construction and FYA periods.
- Between OYA and FYA, northbound traffic flows on the APR at Parkhouse Road (Site 1) decreased by 3% (100 vehicles), in contrast to a 25% (700 vehicles) increase in southbound flows. At Moss Filling Station (Site 2) northbound and southbound flows decreased by 200 vehicles, equating to a 14 and 15% reduction respectively.
- When the flows on APR and scheme section (M6 J44 – 45) are combined, the total corridor two way flow have increased by 4% (1,650 vehicles) between the before scheme construction and FYA periods.

2.16

2.17 Figure **2.4** demonstrates that:

- At the locations where traffic flows between the before scheme construction and OYA periods have decreased, flows at FYA have reduced to levels below those recorded in the before scheme construction period. For instance, flows between the before scheme construction and OYA period on the A6071 (Site E) reduced by 2% (100 vehicles), with 4,000 vehicles observed at OYA. At FYA, the recorded flow of 3,900 vehicles is 5% lower than before scheme construction flows of 4,100.
- Traffic flows on the A7, north of the M6 J44 (Site H and M) increased slightly, countering the national and local flow reduction trend.
- The reduction in AWT flows on the A7 (Site I) is higher between the before scheme construction and FYA period (-45%) than between the before scheme construction and OYA period (-6%). This could be attributed to traffic reassigment from the A7 to the Carlisle Northern Development Route (CNDR), which opened in Feburary 2012.
- Traffic flows have decreased on the A69 (Site D) by 8% (1,200 vehicles) and by 9% (200 vehicles) on the A6071 (Site F). This has occurred alongside increased traffic flows on the A689 (Site K) of 15% (1,500), roughly equivalent to the combined traffic flow reductions on the A69 and A6071.
- The combined impact of the scheme and opening of the CNDR has possibly led to traffic reassignment from the A69 and A6071 to the A689.

2.18 The A689 is also the main route from the east to the west of Carlisle. With the opening of the CNDR in 2012, it is possible that traffic is using the A689 to access west Carlisle using the CNDR, rather than using the A69 and local roads.

2.19 Traffic flow reductions on the M6 are broadly in line with the reductions seen on the UK road network and within Cumbria, two way traffic flow reductions on the A6071, A69 and A75 (Site O) displayed are very slightly above those experienced nationally and within Cumbria, and flows on all other local roads have increased.

Heavy Goods Vehicle (HGV) Flows

2.20 Table 2.1 provides observed HGV[5] flows and the percentage of total flow that this represents along the A74/M6 and the APR respectively. Forecast HGV flows were not provided in the Economic Assessment Report (EAR) or the Traffic Forecasting Report (TFR) and therefore have not been included.

Table 2.1 HGV proportions on the M6 and APR

Road		Before		OYA		FYA	
		Number of HGVS	Percentage of Total Flow	Number of HGVS	Percentage of Total Flow	Number of HGVS	Percentage of Total Flow
A74/M6		13,200	31%	11,800	29%	12,500	30%
APR	**Parkhouse Road**	N/A	N/A	700	12%	400	6%
	Moss Filling Station	N/A	N/A	600	23%	200	10%

2.21 As can be seen from Table 2.1, the proportion of HGVs has remained relatively constant between the before scheme construction and FYA periods on the A74/M6, although the number has reduced in line with overall flow reductions on the route.

2.22 At both sites along the APR, the HGV flows have reduced between OYA and FYA periods, with flows reduced by 45% at Parkhouse Road, and 64% at Moss Filling Station. Furthermore, the HGV proportion has at least halved at both sites. Despite Parkhouse Road having a higher overall number of HGVs than Moss Filling Station at the OYA and FYA periods, HGV proportion remains higher at Moss Filling Station at both the OYA and FYA periods. This could potentially be due to Hespin Wood Landfill site.

2.23 HGV proportions may have decreased along the APR between the OYA and FYA periods due to better routing onto the M6, which may have been supported by the opening of the CNDR.

2.24 When HGV flows on the A74/M6 and at Moss Filling Station are combined and compared to the before construction and FYA period, HGV flows in the corridor have reduced by 3%. However, HGV proportions have remained relatively constant experiencing a minor decrease from 31% to 30%.

Screenline Analysis

2.25 In order to investigate any potential re-routing as a result of the scheme, screenline analysis has been undertaken using screenlines identified in Figure 2.5. Traffic crossing screenlines represents vehicle movements across a wider corridor and can therefore better represent traffic flow changes than studying individual roads in isolation.

2.26 Two strategic screenlines have been selected for this study:

- **Screenline 1: North and South movements**
  - Enables analysis of the traffic flows moving from north to south, and vice versa, following an upgrade of the M6 and construction of the APR.
  - Demonstrates the impact of the M6 upgrade and the construction of the APR on traffic using the A7 to make the same movement.
- **Screenline 2: East and West movements**
  - Enables analysis of traffic moving east to west, and vice versa on the A6071, A689 and A69.

[5] The classification of HGVs along the M6 J44 – 45 is a vehicle over 6.6m in length as in line with HA Guidance. HGVs along the APR are classified as OGV1, PSV and OGV2.

Figure 2.5 Identification of Screenlines

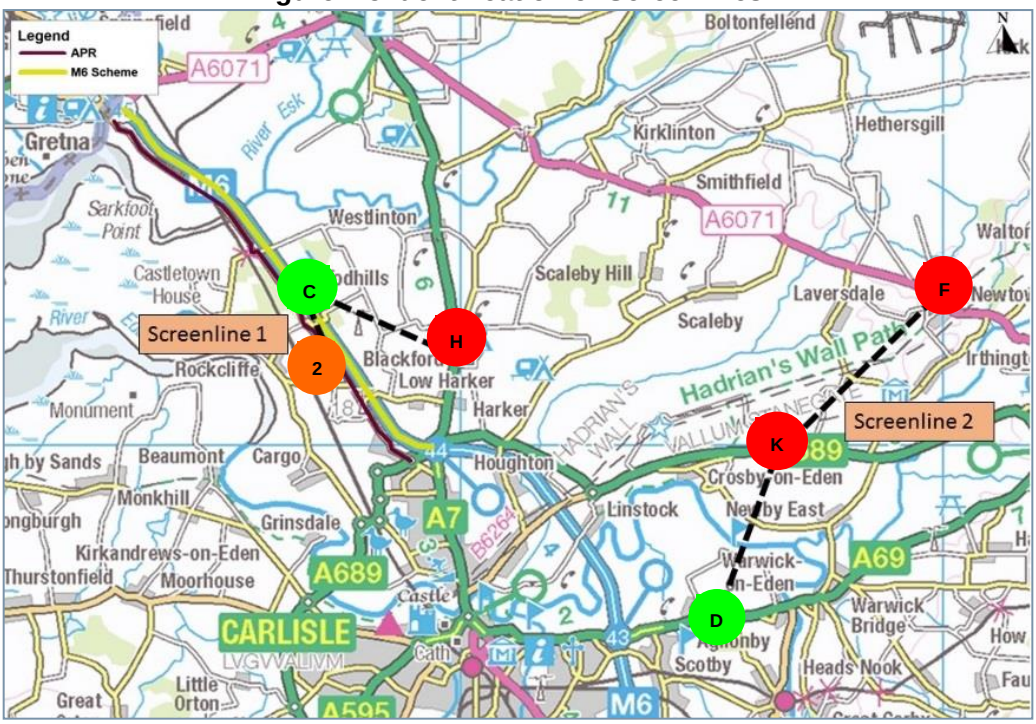


Table 2.2 Two Way Traffic Flows across Screenlines

	Site Ref	Description	Two Way Traffic Flow (AWT)			
			Before (2006)	FYA (2014)	Difference	Percentage Difference
Screenline 1	2	APR - Moss Filling Station	N/A	2,300	2,300	N/A
	C	M6 between Junctions 44 and 45	42,600	41,900	-700	-2%
	H	A7, North of M6, adjacent to Blackford	9,600	9,800	200	2%
	Screenline Total		52,200	54,000	1,800	3%
Screenline 2	F	A6071, Newtown, Northwest of Brampton	2,300	2,100	-200	-9%
	K	A689 Crosbymoor	10,200	11,700	1,500	15%
	D	A69 Warwick Wood	15,100	13,900	-1,200	-8%
	Screenline Total		27,600	27,700	100	0%

2.27 Table 2.2 provides a summary of traffic flows across the screenlines. Key points to note are:

- **Screenline 1: North to South movements**
  - Overall traffic flows across this screenline have only marginally increased (1,800 vehicles). Therefore traffic travelling from north to south and vice versa has not significantly changed.
  - There is no evidence to suggest traffic reassignment has occurred onto the M6.
- **Screenline 2: East to West movements**
  - Traffic flows increases on the A689 alongside flow reductions on the A69 and A6071 suggests reassignment has occurred from the A69 and A6071 onto the A689. This could potentially be due to rerouting to access the CNDR and the scheme, as noted in Section 2.17, although no extra traffic is seen across the screenline.

Forecast and Observed Traffic Impacts

Study Area

2.28 The traffic forecasting for the scheme was initially produced in the Traffic Forecasting Report (TFR) (July 2003). This was updated in August (2005) and the forecasts within this report are therefore taken from the updated Traffic Forecasting Report Addendum (August 2005).

2.29 The TFR indicates that although the area covered by the traffic model was considered to be of a limited geographical scope, it was determined adequate due to there not being any "realistic competing routes to the A74 within the confines of the study area".

2.30 The traffic model includes the following links:

- A74/M6 between Junction 44 and 45 including the junctions
- Some local routes which cross the A74/M6
- The APR
- Short sections of the A7, A74, A6071, A689, A75, B7076 and B721
- A short section of Kingstown Road (located south of the scheme)

Traffic Forecasting

2.31 The Economic Assessment Report (EAR) (October 2003) provided central traffic growth forecasts for only the scheme opening year and not the design year. The Traffic Forecasting Report Addendum (August 2005) however provided low and high growth traffic flows for the anticipated scheme opening (2007) and the design year (2022). Using the forecasting report, it has therefore been possible to calculate central traffic growth forecasts for 2013 and 2014 in which to compare observed traffic flows at FYA.

Growth Forecasts

2.32 The traffic growth factors that were used varied as described below:

- Local Trips – TEMPRO 4.2 (Trip End Modal Programme) and NRTF 97 (National Road Traffic Forecasts)
- Through Trips (NRTF)

2.33 The methodology of using NRTF for through trips is valid, as through trips are likely to be long distance trips, with this approach being in line with Department for Transport (DfT) guidance.

2.34 The scheme was not forecast to increase traffic flows and this has proved to be correct, as observed flow data indicates that there has been no significant change along the M6 scheme section and no notable change along the corridor (M6 and APR flows combined).

Kingmoor Park and the Carlisle Northern Development Route (CNDR)

2.35 The impact of the construction of the CNDR scheme and associated Kingmoor Park development were considered, in addition to the above the TEMPRO forecasts. Trips were therefore manually added to account for the developments. It should be noted that at OYA, development at Kingmoor Park had occurred as expected however the CNDR had not yet opened. Therefore at OYA anticipated trips to Kingmoor Park may not have been as high as expected. Following the CNDR opening in February 2012, it would be expected that observed trips at FYA are similar to that forecast.

Forecast vs. Observed DM and DS Traffic Flows

2.36 In order to identify how accurately the flows predicted for DM compare to the observed post-opening traffic levels, a review has been undertaken of both scenarios. As the APR is part of the scheme, it should be noted that it is not a component of the do minimum

traffic forecasts. The CNDR was included within the DM forecasts as it was not dependent on the scheme.

2.37 Annual Average Daily Traffic (AADT) flows on the M6 have been used in order to make a direct comparison with the AADT Central Growth Forecasts. The figures presented in the following table do therefore not match those presented earlier in this chapter, which were AWT flows.

2.38 As FYA surveys on the APR were undertaken for the duration of a week, it has only been possible to compare Average Daily Traffic (ADT) on the APR to the AADT forecasts.

Do Minimum Scenario

2.39 The forecast flows for the DM scenario and the observed before scheme construction flows are shown in Table 2.3.

Table 2.3 Forecast and observed flows for the Do Minimum Scenario

Site Ref	Location	Forecast AADT (2007)	Observed AADT (2006)	Difference	Percentage Difference
C	M6 J44 - 45 NB	22,700	22,200	-500	-2%
	M6 J44 - 45 SB	22,700	22,100	-600	-3%

2.40 From Table 2.3, it can be seen that the observed traffic flows along the scheme length before opening are 2 - 3% below the central traffic forecast for the DM scenario. This indicates that the forecast is relatively accurate, with traffic growth between the base and opening year overestimated by only 2 – 3%. However, this may be related to the fact the model included additional traffic associated with the Kingmoor Park and the construction of the CNDR, which had been delayed.

Do Something Scenario

2.41 A comparison of the DS forecast traffic flows and those observed on the M6 at FYA are provided in Table 2.4.

Table 2.4 Forecast and Observed Flows for the Do Something Scenario

Site Ref	Location	Forecast (2007)	Observed AADT (2006)	Forecast (2013)	Observed AADT (2013)	FYA Forecast – Observed	
						Difference	% Difference
C	M6 J44 - 45 NB	22,400	22,200	24,500	20,600	3,900	-16%
	M6 J44 - 45 SB	22,200	22,100	24,400	20,600	3,800	-16%

2.42 From Table 2.4 it can be determined that traffic flows were forecast to increase by 9% between 2007 and 2013 in the northbound and southbound directions. Traffic flows between 2007 and 2013 and have increased by 8% in the northbound direction and 7% in the southbound direction.

2.43 Observed traffic flows in 2013 are significantly lower than these forecasts, with 7,700 (16%) fewer vehicles across both directions.

2.44 Given the results presented here, it is arguable that recent economic conditions have had an impact on traffic growth which was not forecast at the appraisal stage, with flows on the M6 J44-45 being considerably lower than forecast. Given the opening of the scheme coincided with the beginning of the recession, it is not surprising that observed traffic is below that forecast

2.45 Forecasting assumptions would have presumed continued growth in traffic, however, as shown in Section 2.8, traffic flows nationally, regionally and locally have decreased by 1.5 – 2% between 2005 and 2013. Therefore the economic recession could be partly attributable for the observed flows being lower than forecast.

2.46 As macro-economic conditions improve, traffic flows can be expected to rise and so the results presented may not be representative of the long term trends in traffic flow on the scheme section.

2.47 Table 2.5 shows the forecast and observed traffic flows on the APR.

Table 2.5 Forecast and Observed Flows for the Do Something Scenario

Site Ref	Location	2014 Forecast	Observed ADT (2014)	Difference	% Difference
1	Parkhouse Road NB	2,400	2,500	100	4%
	Parkhouse Road SB	2,000	2,800	800	29%
2	Moss Filling Station NB	550	1,100	550	50%
	Moss Filling Station SB	550	1,000	450	45%

2.48 From Table 2.5 it can be seen that;

- Observed traffic flows at Moss Filling Station are much higher than forecast. This could be partially attributed to Hespin Wood landfill site, which was not included within the traffic forecasts. There may be a significant volume of traffic making the movement from M6 Junction 45 and Gretna along the APR to Hespin Wood landfill.
- Northbound observed traffic flows at Parkhouse Road are generally in line with the traffic forecast. This is contrary to southbound observed flows, with 800 vehicles (29%) higher than forecast.

2.49 Traffic forecasts predicted that there would be no growth between the DM and DS scenario, which has shown to be correct in section 2.16. Overall it appears that the traffic forecasts underestimated the use of the APR and overestimated the use of the M6 scheme section. Before scheme opening there were a number of direct access points along the A74 at locations such as Todhills. Following the upgrade to the grade separated M6, there are no longer direct accesses to such settlements. The traffic forecasts underestimated the use of the A74 by local traffic and subsequent importance of the direct access points, hence the level of traffic using the APR.

Journey Time Analysis

Scheme Objective: Make journey times more predictable

2.50 Journey time analysis has been undertaken to understand the impact of the scheme on journey times along the M6 Carlisle to Guards Mill section. This assessment is comprised of:

- Analysis of observed before scheme construction and FYA journey times on the M6 for the J44 to 45 scheme section.
- A comparison of forecast and observed FYA journey times on the scheme section.

Journey Time Surveys

2.51 Journey times were surveyed by the moving observed method at the before scheme construction stage (May 2006), and using satellite navigation data for five years after opening (June 2013 – May 2014), with the intention of discovering how the scheme has affected times along the improved route itself. The before scheme construction journey times involved six ‘runs’ in each direction during the following periods:

- Morning peak (07:30 – 09:30)
- Interpeak (10:30 – 12:30)
- Evening peak (16:00 – 18:00)

2.52 The same periods have been used for the FYA journey times. As shown in Figure 2.6, the route included M6 J44 – 45 northbound and southbound.

Figure 2.6 Journey Time Analysis Links M6 J44 - 45

2.53 Forecast journey times have been extracted from the scheme's Cost Benefit Analysis (COBA) model, which predicted journey time savings for the 2008 Central Growth DM and DS scenarios. Journey times along the APR have not been assessed as traffic flows are relatively minor and the APR was primarily delivered to provide local access to settlements.

Journey Time Results

2.54 Table 2.6 presents the before scheme construction and FYA journey time savings along the M6 J44 – 45 scheme section.

Table 2.6 Observed Journey Times Before and After Scheme Opening

Time Period	Direction	Before (mm:ss)	FYA (mm:ss)	Difference (mm:ss)	Difference (percentage)
AM (07.30 - 09.30)	**Northbound**	06:00	05:07	-00:53	-15%
	Southbound	05:42	05:05	-00:37	-11%
Interpeak (10.30 - 12.30)	**Northbound**	05:40	05:05	-00:35	-10%
	Southbound	05:33	05:09	-00:24	-7%
PM (16.00 - 18.00)	**Northbound**	05:55	05:01	-00:54	-15%
	Southbound	05:39	05:06	-00:33	-10%

2.55 The key points from Table 2.6 are as follows:

- Post-opening journey times are lower than the before scheme opening journey times in northbound and southbound directions for all three time periods, by between 7 – 15% (24 to 53 seconds).
- Journey time reductions between the before scheme construction and post-scheme period are greater in the northbound direction that the southbound direction in all time periods.

- Reductions in journey times are higher during the AM and PM period than the interpeak period.
- Journey time variability between the three periods has reduced from the before scheme to post-scheme periods in both the northbound and southbound directions. Before scheme AM and PM journey times were between 6 and 20 seconds higher than the interpeak period, whereas post-scheme AM and PM journey times are 2 to 4 seconds greater than those within the interpeak periods.

2.56 It has not been possible to undertake further analysis of journey time variability through the use of standard deviation calculations due to using different data sources for before-scheme (moving-observer) and post-scheme (satellite navigation) periods. Given that observed journey times in the northbound and southbound directions are similar across all three periods, it can be assumed that day to day journey time variability will have improved.

2.57 Through the provision of an additional lane, in the event of incidents, more lanes can be opened. Therefore Incident Related Journey Time Variability will have decreased as a result of the capacity of the A74 increasing.

Forecast vs. Observed Journey Times

2.58 A comparison between the DM forecast journey times, taken from the COBA model, and the observed journey times has been made, as shown in Table 2.7. Observed journey times for the DM scenario are taken from 2006, before-scheme construction, whilst for the DS scenario, observed journey times are taken from 2013/2014.

Table 2.7 Forecast and Observed Journey Times for Do Minimum and Do Something Scenarios

Time Period	Direction	Scenario	Journey Time		Difference (mm:ss)	Difference (percentage)
			Forecast (mm:ss)	Observed (mm:ss)		
AM	Northbound	Do-Minimum	05:33	06:00	+00:27	8%
		Do-Something	05:07	05:07	00:00	0%
		Difference	**-00:26**	**-00:53**		
	Southbound	Do-Minimum	05:34	05:42	+00:08	2%
		Do-Something	05:03	05:05	+00:02	1%
		Difference	**-00:31**	**-00:37**		
Interpeak	Northbound	Do-Minimum	05:11	05:40	+00:29	9%
		Do-Something	05:08	05:05	-00:03	-1%
		Difference	**-00:03**	**-00:35**		
	Southbound	Do-Minimum	05:09	05:33	+00:24	8%
		Do-Something	05:05	05:09	+00:04	1%
		Difference	**-00:04**	**-00:24**		
PM	Northbound	Do-Minimum	05:45	05:55	+00:10	3%
		Do-Something	05:08	05:01	-00:07	-2%
		Difference	**-00:37**	**-00:54**		
	Southbound	Do-Minimum	05:46	05:39	-00:07	-2%
		Do-Something	05:05	05:06	00:01	0%
		Difference	**-00:41**	**-00:33**		

2.59 From Table 2.7 the following observations can be made:

- Post-scheme opening observed journey times are in line with those forecast, with a maximum difference of 2% (7 seconds). Therefore forecast journey time savings are highly accurate.
- Journey times during the three periods were forecast to reduce by between 3 and 41 seconds, equivalent to 1 – 12%. Observed journey time savings are above those forecast (7 – 15%; 24 to 54 seconds), with the exception of southbound PM journey times.

Journey Time Reliability

Background

2.60 WebTAG guidance uses the measurement of route stress as an appropriate proxy for measuring the reliability sub-objective, with the concept of stress development to provide an indication of the relationship between road volume and capacity. Route stress is the ratio of AADT flow to the Congestion Reference Flow (CRF), which is a definition of capacity[6]. Reliability of journey times reduce as flows approach capacity.

Forecast

2.61 The AST did not provide route stress statistics but the reliability forecast given in the AST is as follows:

> *'Journey times will become more reliable with the provision of D3M, both through easing of congestion as well as a reduction in accidents'*

Observed Route Stress

2.62 Route stress statistics have been calculated for before and after scheme opening as shown in Table 2.8. WebTAG states that where stress values are less than 75% or greater than 125%, values of 75% and 125%, respectively, should be used. However, to demonstrate the extent of the changes in route stress due to the scheme, Table 2.8 incudes the unadjusted route stress.

Table 2.8 Calculation of Route Stress on the M6 J44 - 45

	Calculated Outturn Stress (Adjusted Stress)			
	Before scheme opening		FYA scheme opening	
A75(M) / M6	Unadjusted	Adjusted	Unadjusted	Adjusted
	59%	75%	31%	75%

2.63 Table 2.8 shows that the unadjusted route stress has decreased from 59% to 31%, however, before scheme route stress was low indicating that journeys were reliable. The unadjusted post-opening percentage is lower than before scheme opening and can be attributed to the additional lane provided by upgrading the A74. The adjusted route stress has remained at 75% following scheme opening.

2.64 Following WebTAG guidance, route stress must be assessed based on the adjusted route stress percentage, therefore there has been no change in route stress between the before and after scheme opening periods.

2.65 It must be noted that journey times are consistent through all periods of the day and whilst data is not available for quantitative assessment of reliability, the journey time results suggest that day to day variability in journey times will have reduced. In addition, the annual collision rate has decreased following scheme opening, as shown in Section 3.18. It is therefore expected that journey time delays caused collisions will also have reduced thus improving reliability along the scheme route. As a result, the impact of the scheme on the reliability sub-objective is **'beneficial'**, as forecast.

2.66 Two of the scheme objectives relate to improved capacity and maintaining flows following collisions. Consultation with the Management Representative for the Traffic Officer Service upon completion of the scheme indicated that the provision of an additional lane

[6] The CRF of a link is an estimate of the Annual Average Daily Traffic (AADT) flow at which the carriageway is likely to be 'congested' in the peak periods on an average day.

and the APR creates the following opportunities which were not available before scheme opening:

- Following certain incidents on the M6 J44 - 45, the APR can be used as a diversion route or to maintain flows following a lane closures.
- The additional lane on the M6, as well as the hard shoulder can help to maintain flows following lane closures.

2.67 The comments received from the Traffic Officer Service, and provision of an additional lane and the APR demonstrate that the scheme has achieved the objectives of:

- Providing more carriageway space for emergency services attending collisions.
- Providing more carriageway space to enable traffic flows to be maintained following a collision.

Key Points – Traffic

Traffic Flows

- Weekday traffic flows on the M6 J44 – 45 have remained relatively constant following scheme opening, with the northbound experiencing flow reductions of 2% and southbound, 1%. These flows are in line with traffic flow changes along the M6 between J42 – 43 and J43 – 44 and are representative of the background traffic reduction experienced across the region.
- Overall flows along the APR and M6 J44 – 45 corridor have increased by 4% between the pre-scheme and post-scheme opening periods.
- There has been a 45% reduction in traffic flows on the A7, south of M6 Junction 44 following scheme opening. As OYA flows were 6% lower than before scheme opening, the 45% reduction at FYA may be attributable to the opening of the CNDR in 2012.
- Traffic flow changes on the trunk roads to the east of the scheme vary and this suggests the rerouting may have occurred. Flows on the A69 have reduced by 8% between the before and FYA periods, whereas, flows on the A689 have increased by 8 - 15% between the same period. Screenline analysis demonstrates that rerouting may have occurred through a combination of upgrading of the A74 and the opening of the CNDR in 2012.

Traffic Forecasts

- Traffic flows on the M6 were forecast to increase by 9%. However, observed traffic flows on the M6 J44 – 45 northbound and southbound are 16% less than expected. The forecast model assumed that traffic flows would undergo continuous growth, which has been hindered by the recession. Therefore, at FYA the forecasts are an overestimation.
- Flows on the APR are higher than forecast, with observed flows ranging from 4% to 50% higher than forecast.
- The combined forecast vs. observed results flows for the M6 and APR suggests that the scheme model may have overestimated the level of reassignment from the A74(M)/APR to the M6 and the importance of the direct access points off the A74(M) for local traffic before scheme opening.

Journey Times

- Analysis of journey times shows that there has been a saving of between 24 to 54 seconds between the before-scheme and FYA periods. Journey time savings are higher in the northbound direction and have reduced by 53 seconds during the AM and PM peaks. Southbound journey times have reduced by 37 seconds during the AM peak and by 33 seconds during the PM peak.
- Journey time forecasts for the M6 J44 – 45 both northbound and southbound were highly accurate.

Reliability

- Following WebTAG guidance, there has been no change in journey time reliability since the scheme opened. However, journey times are more consistent across the day implying that day to day variability is low and incident related journey time variability will have decreased as a result of a reduction in collisions. As such, the impact of the scheme on the reliability sub-objective is beneficial.

3. Safety Evaluation

Introduction

3.1 This chapter examines the impact of the scheme on safety. The DfT's objectives for transport set out the principle objectives to reduce collisions and improve security. This includes reducing the loss of life, injuries and damage resulting from transport collisions and crime.

3.2 In order to assess the scheme's impact on collisions, this chapter of the report analyses changes in Personal Injury Collision (PICs) occurring in the five year period before scheme opening and after. Evaluation of the scheme's impact on personal security has also been undertaken through the use of observations made during a site visit.

3.3 Despite the scheme not having an impact on traffic volumes which generally would suggest limited change in collision numbers, for the safety objective, the AST states that:

'Construction to current standards, including the removal of intermediate junctions and the provision of a hard shoulder is expected to lead to reduced numbers of accidents'

3.4 The analysis in this chapter covers two geographical areas. Initially, an assessment of collisions in the Cost Benefit Analysis (COBA) model area is undertaken, covering the scheme section and some local roads. Following this, an examination of collisions on the M6 J44 – 45 and APR only has been undertaken.

Data Sources

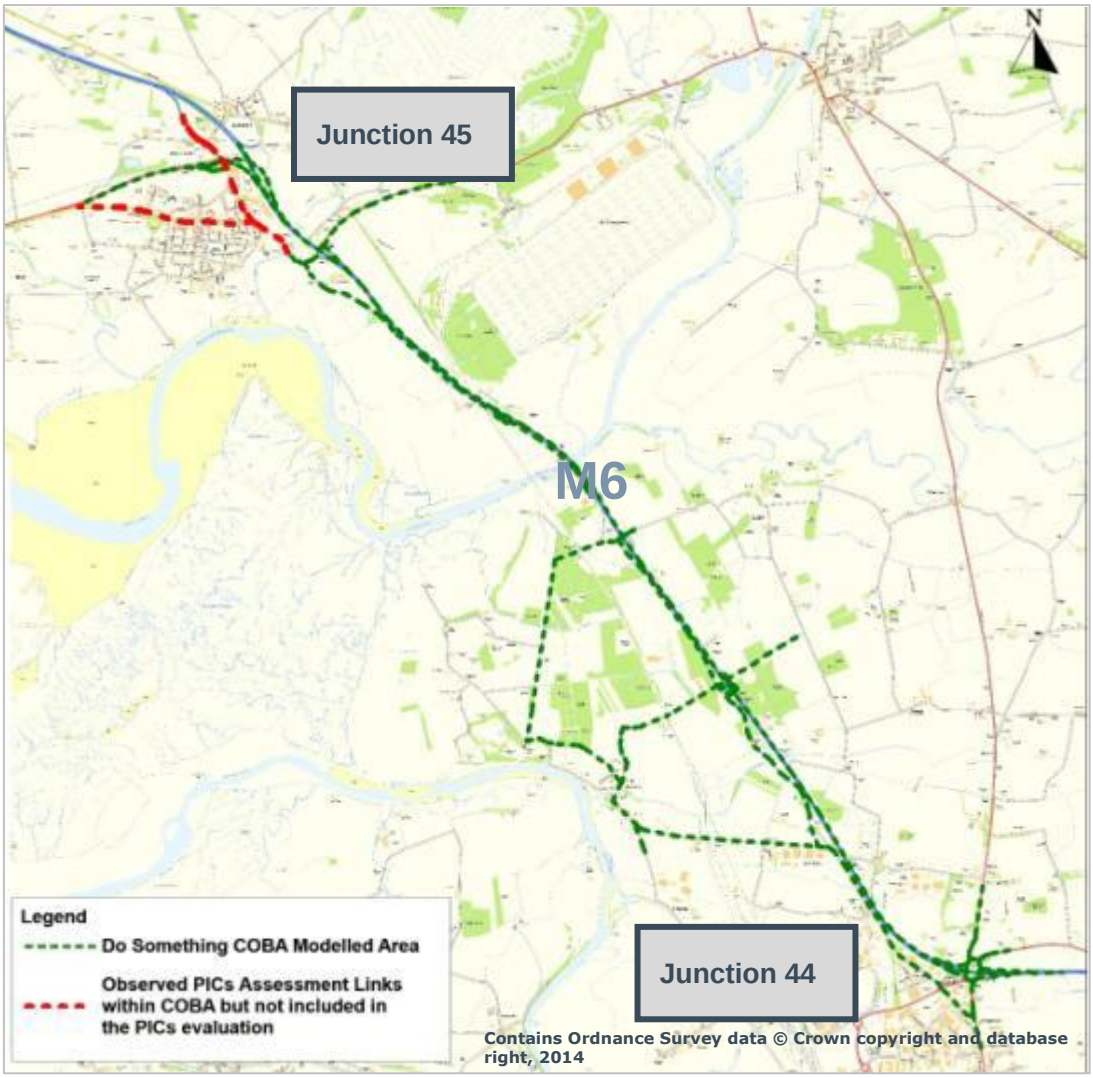
Forecast Data

3.5 The forecast safety benefits for the M6 Carlisle to Guards Mill scheme have been derived from the COBA scheme model, which predicted savings for the opening year and throughout a sixty year appraisal period. The forecast impact on safety is expressed in terms of numbers of personal injury collisions (PICs) saved with a corresponding economic impact. Forecasts of the economic / monetary impact of the forecast change in collisions are evaluated in Chapter 4.

Observed Data

3.6 Due to the COBA area crossing the Scottish border, collision data has been obtained from two sources, Cumbria County Council and Transport Scotland. However, Transport Scotland have only been able to provide collision data for the trunk roads A74 and A75, north of the scheme and the A75. It has therefore not been possible to obtain PIC data for a small section of the COBA area to the north of the scheme. As a result, the COBA forecast area is slightly larger than the area covered in the collision evaluation. Figure 3.1 identifies the COBA area and those links excluded due to limited collision data.

Figure 3.1 Collision Analysis Area



3.7 The data collected from Cumbria County Council and Transport Scotland cover the following date periods:

- Before opening: 1st July 2001 – 30th June 2006 (five years)
- Construction: 1st July 2006 – 30th November 2008
- After opening: 1st December 2008 – 30th November 2013 (five years)

3.8 The collision data is based on the records of PICs (i.e. collisions that may involve injuries to one or more persons) recorded in the STATS19 data collected by the police when attending collisions. Collisions that do not result in injury are not included in this dataset and are thus not considered in this evaluation.

3.9 At this stage, the collision data may have not yet been validated by the DfT. The requirement for up to date data and site specific information necessitated the use of invalidated data, sourced from Cumbria County Council and Transport Scotland. Thus the data is judged to be sufficiently robust for use in this study, but it may be subject to change. However it is not anticipated that this would be significant in terms of the analysis of collisions numbers presented in this report.

Background Changes in Collision Reduction

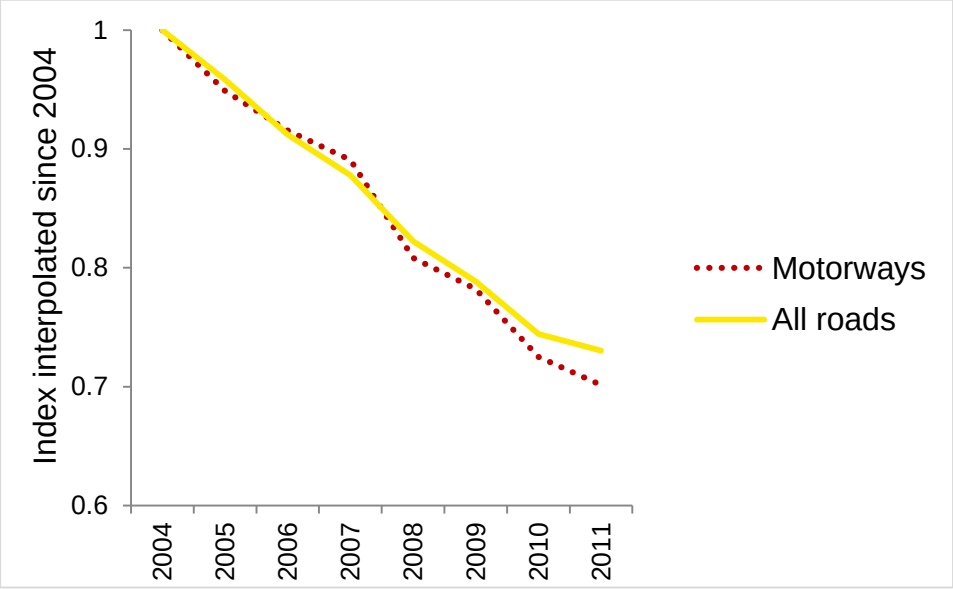
3.10 It is widely recognised that for over a decade there has been a year-on-year reduction in the numbers of personal injury collisions on roads, even against a trend of increasing traffic volumes during much of the same period. The reasons for the reduction are considered to be multi-factorial and include improved safety measures in vehicles and reduced numbers of younger drivers. This background trend needs to be considered when examining the changes in collision numbers. If the scheme had not been built, collision numbers in the area may still have been influenced by wider trends and reduced.

3.11 When comparing the numbers of collisions in this area before and after the scheme was built and associated net change with the scheme, the background reduction needs to be taken account of. The best way to do this is to assume that, if the scheme had not been built, the number of collisions on the roads in the COBA area for the scheme would have dropped at the same rate as they did nationally during the same period. This gives a counterfactual 'without scheme' scenario on a like for like basis with the observed post opening data, which is the 'with scheme' scenario.

3.12 The comparison needed is between the middle year in the after period and the middle of the pre-construction period. As the middle year of the pre-construction period is 2003 which is before the DfT national accident statistics cover, data for this period has been taken from 2004. As a result, the middle year of the after period has also been shifted from 2010 to 2011. The approach is to use national data to calculate changes in the number of collisions in this period occurring on rural 'A roads', which broadly represents the A74 before scheme opening. Figure 3.2 illustrates the changes in collision numbers by road type between 2004 and 2011.

3.13 The difference between the numbers of collisions in these two scenarios can then be attributed to the scheme rather than wider national trends. The result will inform the calculation of monetised safety benefits achieved by the scheme as discussed in the economy chapter of this report.

Figure 3.2 Trends in Injury Collision Numbers



Collision Numbers

3.14 This section analyses observed changes in the number of PICs and the relative severity of collisions following the implementation of the scheme. It has not been possible to analyse changes in the number of casualties as the data obtained from Transport Scotland and Cumbria County Council does not provide casualty details.

Collisions – COBA Area

3.15 The evaluation of before and after opening collision numbers for the COBA modelled area (excluding the links shown in Figure 3.1) using the before scheme construction counterfactual number of collisions, which is an alteration based on the counterfactual scenario is shown in Table 3.1. Figure 3.3 displays the results graphically.

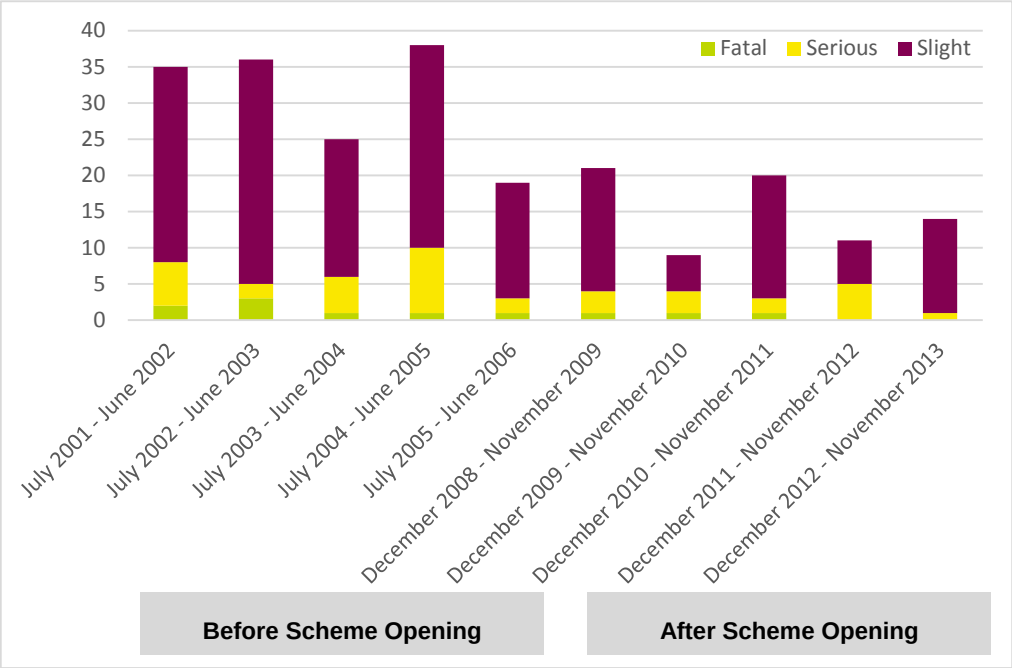
Table 3.1 Number of Collisions by Severity in the M6 J44 - 45 COBA Area

Time Period	Date		Number of Collisions				Annual Average				Average Severity Index
	From	To	Fatal	Serious	Slight	Total	Fatal	Serious	Slight	All	
Before Scheme Opening	July 2001	June 2002	2	6	27	35	1.6	4.8	24.2	30.6	21%
	July 2002	June 2003	3	2	31	36					
	July 2003	June 2004	1	5	19	25					
	July 2004	June 2005	1	9	28	38					
	July 2005	June 2006	1	2	16	19					
Without scheme counterfactual										**22.3**	-
Construction Period	July 2006	June 2007	0	3	19	22	0.3	1.3	13.7	15.3	10%
	July 2007	June 2008	0	0	12	12					
	July 2008	June 2009	1	1	10	12					
After Scheme Opening	Dec 2008	Nov 2009	1	3	17	21	0.6	2.8	11.6	15.0	23%
	Dec 2009	Nov 2010	1	3	5	9					
	Dec 2010	Nov 2011	1	2	17	20					
	Dec 2011	Nov 2012	0	5	6	11					
	Dec 2012	Nov 2013	0	1	13	14					
Total Collision Saving										**7.3**	-

3.16 The results presented in Table 3.1 show:

- The average annual number of PICs occurring within the COBA modelled area has reduced by 49% from 30.6 to 15 following scheme opening, equating to a decrease of 15.6 collisions per annum.
- The without scheme counterfactual collision rate (accounting for the background reduction in collisions over time), is calculated as 22.3 collisions per annum. Comparing this with the post-opening collision rate represents an annual average collision decrease of 7.3 PICs. Statistical significance testing (Section 3.23 provides further details) found the collision benefit to be significant in that it was unlikely to have occurred without the scheme.
- There are collision savings for collisions of all severities, however, the KSI proportion has increased from 21% to 23% between the before opening and post opening periods. This is due the number of slight collisions reducing at rate of 52% between the before scheme construction and post-scheme periods, which is lower than the serious collisions reduction rate of 42% between the same periods.
- Fatal severity collisions have seen the greatest rate reduction of 63% between the before and after scheme opening periods, although these are based on very small numbers and therefore no formal conclusions can be drawn. It should be noted there have been no fatal collisions within the COBA area from December 2011 to November 2013.

Figure 3.3 Number of Collisions in the M6 J44 - 45 COBA Area



Collisions – Key Links (M6 J44 – 45 and APR)

3.17 In addition to considering the collision number changes in the COBA modelled area, analysis has been undertaken covering the M6 Carlisle to Guards Mill scheme, which consists of the M6 J44 – 45 and the APR.

- Table 3.2 presents before and after scheme opening collision numbers by year for the scheme area, and shows the counterfactual without scheme number of collisions. The collision numbers are displayed graphically in Figure 3.4.

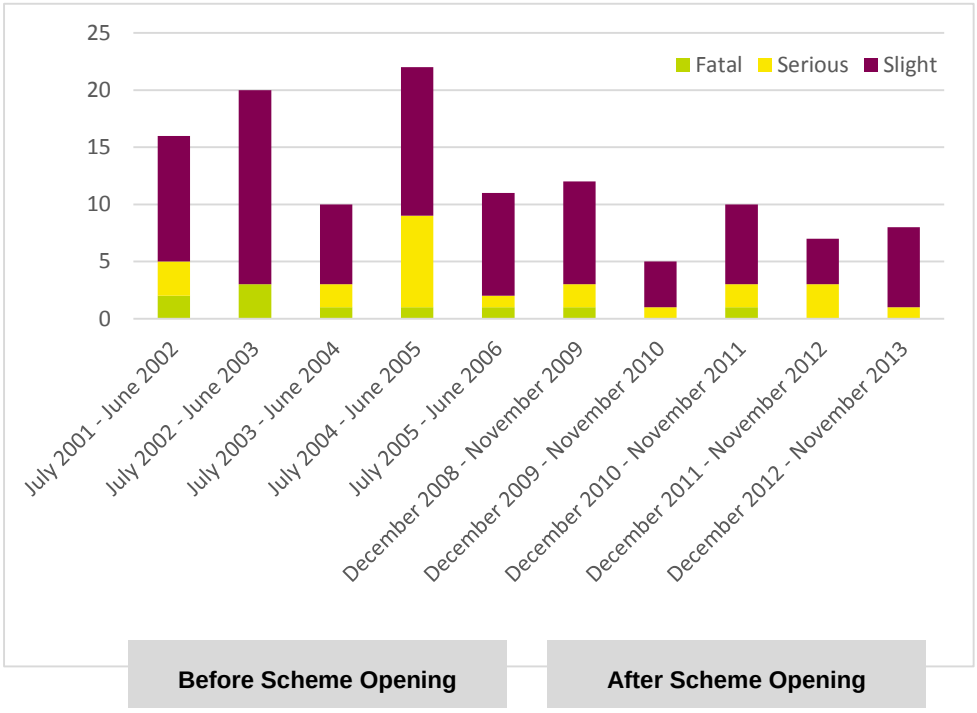
Table 3.2 Number of Collisions on key links (M6 J44 - 45 and APR)

Time Period	Date		Number of Collisions			Annual Average				Average Severity Index
	From	To	Fatal	Serious	Slight	Fatal	Serious	Slight	All	
Before scheme construction	July 2001	June 2002	2	3	11	1.6	2.8	11.4	15.8	28%
	July 2002	June 2003	3	0	17					
	July 2003	June 2004	1	2	7					
	July 2004	June 2005	1	8	13					
	July 2005	June 2006	1	1	9					
Without scheme counterfactual									**11.1**	-
Construction Period	July 2006	June 2007	0	2	11	0.0	0.7	8.0	8.7	8%
	July 2007	June 2008	0	0	7					
	July 2008	June 2009	0	0	6					
Post-scheme	Dec 2008	Nov 2009	1	2	9	0.4	1.8	6.2	8.4	26%
	Dec 2009	Nov 2010	0	1	4					
	Dec 2010	Nov 2011	1	2	7					
	Dec 2011	Nov 2012	0	3	4					
	Dec 2012	Nov 2013	0	1	7					
Total Collision Saving									**2.7**	-

3.18 Key points to note from Table 3.2 are:

- The average annual number of PICs occurring on the M6 J44 – 45 and the APR (key links), have reduced from 15.8 to 8.4, totalling a collision benefit of 7.4 PICs.
- In comparing the without scheme counterfactual calculation of 11.1 PICs/annum to the post-scheme collision rate, there has been an annual collision saving of 2.7 PICs. Statistical significance testing (Section 3.23 provides further details) found the collision benefit to be significant in that it was unlikely to have occurred without the scheme.
- The average annual severity index has decreased from 28% to 26% between the before scheme construction and post-scheme period. This is attributable to the number of slight collisions reducing at rate of 46% between the before scheme construction and post-scheme periods, which is lower than the serious collisions reduction rate of 36% between the same periods.
- Collisions of fatal severity have seen the greatest rate reduction of 75% between the before and after scheme opening periods, which is higher than the rate observed within the COBA area.

Figure 3.4 Number of Collisions on the Key Links



Collision Locations

3.19 The location of collisions occurring within the M6 J44 – 45 COBA area for the before and after scheme opening periods is presented in Appendix C.

3.20 Following the upgrading of the A74 to the M6 J44 – 45, a grade separated motorway, there are no longer any direct access points to local settlements along the route. Observation of collision locations shows that in the post opening period there are fewer collisions on the M6 at the former direct access points such as Todhills, than in the before scheme construction period on the A74.

3.21 In addition, collision numbers on the M6 northbound carriageway near the service area have reduced from 1.0 PIC/annum to 0.2 PICs/annum. Access to the service area has been modified to allow for the widening of the A74 and therefore collision savings at this location are likely to be attributable to the new access layout.

Statistical Significance

3.22 In order to determine whether the changes in collision numbers observed before and after the scheme opened are statistically significant, a Chi-squared test has been undertaken for the COBA area and separately for the key links (M6 J44 – 45 and the APR).

3.23 The test uses the without scheme counterfactual and post-opening number of collisions alongside traffic flows to establish whether the changes are significant and related to the scheme, or are likely to have occurred by chance.

3.24 The results found that the change in collision rate for:

- The key links is significant at the 95% level and unlikely to have occurred by chance alone.
- The COBA area is significant at the 99% level and unlikely to have occurred by chance alone.

Forecast vs. Observed Collision Savings

3.25 This section compares the number of observed collisions with those forecast in the COBA model and separately, the key links. For the observed collisions, the DM figures are based on the annual average of five years of data before scheme construction, whilst the DS figures are based on five years of post-opening data.

Collision Forecasts - COBA Area

3.26 A comparison of the COBA modelled area forecast and observed collisions is presented in Table 3.3. It is important to note that the observed analysis area is slightly smaller than the COBA area, however, the collisions level on the sections excluded is expected to be low.

Table 3.3 Comparison of Opening Year Forecast and Observed Collisions in the COBA Area

COBA Area Forecast (Opening Year Forecast)	Do-Minimum (without scheme)	19.4
	Do-Something (with scheme)	15.2
	Saving	**4.2**
	% change	**22%**
COBA Area Observed	Do-Minimum (before opening)	30.6
	Counterfactual Do-Minimum (without scheme)	22.3
	Do-Something (after opening)	15.0
	Saving	**7.3**
	% Change	**33%**

3.27 Table 3.3 shows that the COBA forecast a reduction of 4.2 PICs in the opening year, a decrease of 22% from the DM scenario. From the observed collisions, it can be seen that a greater collisions saving than forecast has been achieved with 7.3 PICs saved since the scheme opened, equating to a 33% decrease from the DM scenario.

3.28 In examining the actual number of forecast and observed collisions, it can be seen that the COBA forecast model underestimated the annual number of collisions in the DM period, whereas estimations were accurate for the DS period for the COBA area.

Collision Forecasts – Key Links

3.29 Using the same methodology as in Section 3.21, the forecast and observed collisions Table 3.4 for the M6 J44 – 45 and APR are presented in Table 3.4

Table 3.4 Comparison of Opening Year Forecast and Observed Collisions Key Links

Key Links Forecast (Opening Year Forecast)	Do-Minimum (without scheme)	13.7
	Do-Something (with scheme)	8.4
	Saving	**5.3**
	% change	**39%**
Key Links Observed	Do-Minimum (before opening)	15.8
	Counterfactual Do-Minimum (without scheme)	11.1
	Do-Something (after opening)	8.4
	Saving	**2.7**
	% Change	**24%**

3.30 From Table 3.4 it can be seen that collision numbers have reduced by 2.7 PICs between the before opening and after scheme opening period. This is lower than the COBA model forecast, with an observed 24% reduction in collisions opposed to the forecast 39% (5.3 PICs) reduction.

3.31 In examining the actual number of forecast and observed collisions, it can be seen that the COBA forecast model slightly underestimated the annual number of collisions in the DM period, whereas estimations were accurate for the DS period for the scheme, M6 J44 – 45 and APR.

Collision Rates – M6

3.32 The number of collisions along a length of road together with its AADT can be used to calculate a collision rate (calculated as number of collisions per million vehicle kilometres). By looking at the rate it is possible to identify the impact of the roads of interest whilst ignoring the impact of the change in traffic volumes.

3.33 These rates are compared with the forecasts for the same links and junctions. The forecast collision impact in COBA has a built in prediction of collision reduction over time. To make a comparison, details of flows, lengths and collisions numbers from the COBA model output for the selected links along the M6 J44 – 45 and junctions have been extracted to calculate an overall rate. This is compared with the rate calculated from the observed data for the same links, as shown in Table 3.5.

Table 3.5 Collisions Rate on the M6 J44 - 45 Scheme Section

Time Period		Collision Rate (PIC/mvkm)
Forecast	Do-Minimum (without scheme)	0.09
	Do-Something (with scheme)	0.06
	Forecast Saving	0.03 (33%)
Observed	Before scheme opening	0.08
	Before Opening Counterfactual Rate	0.06
	After scheme opening	0.03
	Observed Saving	0.03 (50%)

3.34 From Table 3.5 it can be seen that following scheme opening the collision rate has decreased by 0.03 PIC/mvkm (50%) when compared to the without scheme counterfactual rate. The actual collision rate saving is in line with the forecast saving, however the observed percentage reduction is higher than the forecast (50%) compared to a 33% forecast.

Personal Security

3.35 The aim of this sub-objective is to reflect both changes in security and the likely number of users affected. In terms of roads, security includes the perception of risk from personal injury, damage to or theft of vehicles, and theft of property for individuals or from vehicles in the following areas:

- On the road itself (e.g. being attached whilst broken down).
- In service areas, car parks and so on (e.g. vehicle damaged while parked at a service stations, being attached whilst walking to a parked car).
- At junctions (e.g. smash and grab incidents while queuing at lights).

3.36 The primary indicators for personal security on roads include:

- Surveillance
- Landscaping
- Lighting and visibility
- Emergency call facilities
- Cyclists and pedestrian facilities

Forecast

3.37 The scheme appraisal scored personal security as 'moderate beneficial', stating that:

'Formal surveillance is an important requirement as the areas is sparsely populated with little assistance. Emergency phones every 1km to meet motorway regulations would result in a general increase in security. There are few facilities for pedestrians and cyclists at present but the provision of the APR would improve access to populated areas and therefore improve security'

Evaluation

3.38 There is improved provision in access to the road network for NMUs along the APR in the form of a cycling route. This in itself is not considered a direct indicator for personal security in current guidance[7], although the reduced traffic flows may encourage increased cycle use. In line with guidance, the APR is assessed as having a slight beneficial impact on personal security as less than 500 travellers are affected.

3.39 Along the M6 scheme section and APR, lighting has not been installed, however, emergency phones have been implemented on the M6, as shown in Figure 3.5. The impact of the M6 scheme section on personal security is considered to be large beneficial as more than 10,000 travellers are affected.

Figure 3.5 FYA: emergency phones on the M6 J44 - 45

[7] Based on factors identified in WebTAG guidance (TAG unit 3.4.2, June 2003) at the time of scheme appraisal.

3.40 Overall, the scheme is assessed as having a **'moderate beneficial'** impact on personal security, as expected.

Key Points - Safety

Collisions

- Once national background trends are accounted for, following scheme opening, collision numbers on the M6 and APR combined have reduced post-opening by 76% from 11.1 PICs/annum to 2.7. This reduction is statistically significant and is unlikely to have occurred without the implementation of the scheme.
- The collision rate on the M6 has decreased from 0.06 counterfactual PICs/mvkm before scheme opening to 0.03 PICs/mvkm, which is in line with forecast savings.
- The collision severity has reduced from 28% to 26% on the key links (M6 and APR combined), which includes a 75% reduction in fatal collisions between the before and after scheme opening periods.
- Comparing collisions numbers for the counterfactual before scheme period to the FYA period for the COBA area demonstrates there has been a saving of 7.3 PICs/annum which is statistically significant and unlikely to have occurred by chance alone.

Forecast vs. Observed Collision Savings

- The COBA model forecast a collision saving of 39% (5.3 PICs/annum) on the M6 and APR combined between the DM and DS scenarios, however, a collision reduction of 24% (2.7 PICs/annum) has been achieved following scheme opening. Observed collision rates demonstrate that the COBA model accurately forecast the annual collision rate for the DS scenario. The model underestimated the DM collision rate thus collision savings were not as high as expected for the scheme.
- The COBA model significantly underestimated the pre-scheme collision numbers for the COBA area but accurately forecast the DS collision numbers. As a result, there was an observed collision saving of 33% (7.3 PICs/annum) compared to the 22% (4.2 PICs/annum) forecast.

Personal Security

- As part of the scheme, emergency telephones were installed between M6 J44 – 45.
- There have been no other personal safety measures implemented along the M6 or the APR.
- The personal security sub-objective receives a score of slight beneficial, worse than the 'moderate beneficial' impact expected.

4. Economy

Introduction

4.1 The purpose of this chapter is to evaluate how the scheme is performing against the economy objective, which consists of the following sub-objectives:

- Achieve good value for money in relation to impacts on public accounts.
- Improve Transport Economic Efficiency (TEE) for business users, transport provide and consumer users.
- Improve journey reliability (which has been considered earlier in this report in Chapter 2).
- Provide beneficial wider economic impacts.

4.2 A COBA model was used to undertake evaluation of TEE and safety benefits of the scheme and QUADRO (Queues and Delays at Roadworks) was used to model the economic impacts of construction of the scheme.

4.3 This section provides a comparison between the outturn costs and benefits and the forecast economic impacts, as well as considering the wider economic impacts of the scheme. Outturn journey time and safety economic impacts are based upon the observed results reported in Chapters 2 and 3.

Sources

4.4 The COBA model and following documents have been utilised to inform the post opening evaluation of the scheme benefits:

- Economic Assessment Report (October 2003)
- Economic Assessment Report Addendum (May 2005)
- Traffic Forecasting Report (July 2003)
- Traffic Forecasting Report Addendum (August 2005)
- Outturn Costs from Regional Finance Manager (RFM).

4.5 The reports provide an original appraisal forecast for a 60 year appraisal period based on a 2008 opening year. All costs presented in the COBA and this chapter are in 2002 prices discounted to 2002 unless otherwise stated.

Investment Costs

4.6 This section compares the forecast cost of the scheme with the outturn cost. Scheme costs include the cost to Highways England of constructing the scheme and purchasing land.

4.7 Forecast costs are taken from the Economic Assessment Addendum Report (May 2005). The outturn cost (obtained from the HA (at the time) Regional Finance Manager) presented in Table 4.1 includes the cost of the scheme (including the essential replacement of Mossband viaduct) only as of 31st May 2014.

Table 4.1 Summary of Investment Cost

Forecast Cost	Outturn Cost	Difference
£125.8m	£103.5m	-£22.3m (-18%)

Note: these prices are not discounted to 2002 prices.

4.8 Table 4.1 shows the outturn cost for the M6 Carlisle to Guards Mill Improvement scheme is £103.5 million, 18% lower than forecast.

Present Value Costs (PVC)

4.9 Cost benefit analysis of a major scheme requires all the costs to be considered for the whole of the appraisal period and they need to be expressed on a like-for-like basis with the benefits. This basis is termed Present Value. Present Value is the value today of an amount of money in the future. In cost-benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.

4.10 At the time of appraisal, the impact of indirect tax was included as part of the costs, and as such is presented here within the costs section. However, current appraisal guidance includes the impact of indirect tax as part of the benefits of a scheme; therefore both methods are presented later in this section when calculating the Benefit Cost Ratio (BCR).

4.11 The full PVC for this scheme at the time of appraisal comprised the following costs converted to present value:

- Investment Costs; and
- Impact on Indirect Tax revenues during the scheme life.

Investment Costs in Present Value

4.12 The investment cost of the scheme has been calculated by taking the DS scheme costs minus the DM scheme cost, which is the normal process for calculating this. However, the DM cost for the scheme is significantly higher than for other schemes as it includes the replacement of the Mossband Viaduct (£64.007M), which would have been necessary regardless of the M6 scheme implementation. For the purpose of consistency with the OYA evaluation, at FYA the DM costs have been assumed to be as forecast.

4.13 A comparison of all forecast and outturn costs is presented in Table 4.2.

Table 4.2 Investment Costs in Present Value

Costs in £m 2002 market prices, discounted	Forecast	Reforecast based on FYA Outturn Impacts
Do Something (DS) costs (Carlisle to Guards Mill Improvement scheme)	£105.5m	£101.1m
Do Minimum (DM) costs (replace Mossband Viaduct over railway only)	£64.1m	£64.1m
Net Investment Cost (DS – DM cost)	**£41.4m**	**£37.0m**

4.14 These values for the costs are used in the calculations of the Benefit Cost Ratio (BCR) in Table 4.8.

Indirect Tax (present value)

4.15 Indirect tax revenue impact is the expected change in indirect tax revenue to the Government due to changes in the transport sector as a result of the scheme over the appraisal period. At the appraisal stage, the impact of the scheme on indirect taxation was calculated as part of the costs using COBA.

4.16 For this study, the indirect tax impact is derived primarily from the monetisation of the forecast change in fuel consumption over the 60 year appraisal period. A highway scheme may result in changed fuel consumption due to:

- Changes in speeds resulting in greater or less fuel efficiency for the same trips.

- Changes in the distances travelled.
- Increased road use through induced traffic or the reduction of trip suppression.

4.17 The methodology adopted to evaluate the indirect tax impact from the M6 Carlisle to Guards Mill Improvement scheme has been based on estimating the change in fuel consumption as a result of the scheme opening using observed data. This involves comparing the DM and DS forecast and observed with and without the scheme in order to calculate fuel consumption. This ratio is then used to reforecast the outturn monetary impact. The results for the M6 Carlisle to Guards Mill scheme are shown in Table 4.3.

Table 4.3 Summary of Indirect Taxation Impact (60 years)

	Forecast	Reforecast based on FYA Outturn Impacts
Indirect Tax Generated by the Scheme	£38.3m	£36.9m

Note: 2002 prices discounted to 2002

4.18 The results presented in Table 4.3 show that the scheme has a reforecast outturn impact on indirect taxation of £36.9 million, 3.7% lower than forecast. The reduced tax revenue is due to lower than forecast vehicle flows on the M6 as shown in Section 2.41, however, this impact is slightly offset by the higher than forecast observed speeds on the M6 and APR. If this impact was included within the assessment of the cost to the Treasury, this would reduce the cost of the scheme significantly.

Present Value Benefits

Transport Economic Efficiency

Journey Time Benefits

4.19 The POPE method of evaluating the economic value of the benefits derived from vehicle hour savings is based upon comparing the observed vehicle hour savings, combined with the assumption that the observed vehicle hour saving at the FYA stage can be taken as indicative of that over the remainder 60 year appraisal period. Based on this assumption, comparing the forecast vehicle hour saving with the observed vehicle hour saving enables the calculation of the 60 year outturn monetised benefit.

4.20 In order to establish the proportion of vehicle hours saved compared to the forecast, it was necessary to calculate the observed vehicle hours saved per annum based on the FYA journey times and traffic flows. This was done using a ‘saving per vehicle’ approach.

4.21 Forecast vehicle hour savings have been calculated from the COBA model for the same links.

4.22 It is noted that traffic using the APR will have experienced some benefits following scheme implementation, however, the actual number of vehicles using the APR is significantly less than the number of vehicles using the M6. Therefore journey time benefits have only been calculated for the M6 scheme section.

4.23 The forecast and observed journey time saving and resulting monetary benefit are presented in Table 4.4. The COBA model forecast a vehicle hours saving of 124,000 hours on the M6 in the opening year, with the outturn observed reforecast vehicle hours saving 122,460 vehicle hours.

Table 4.4 Forecast vs. Outturn reforecast Journey Time Benefit

60 Year Monetary Benefit based on Value of Time saved	
Forecast	£83.4m
Reforecast based on FYA Outturn Impacts	£82.4m

4.24 The results presented in Table 4.4 shows that the reforecast 60 year monetary journey time benefit for the scheme of £82.4 million is 1.2% lower than the original forecast and is therefore highly accurate. Given that journey time forecasts have shown to be in line with observed journey times, the observed journey time benefits are as expected.

Vehicle Operating Cost

4.25 WebTAG guidance states that the use of the road system by private cars and lorries gives rise to operating costs for the user. These are fuel and non-fuel costs, where fuel is the majority net cost impact of conventional highways schemes. In the case of this scheme, the forecast changes in Vehicle Operating Cost (VOC) are large and have a considerable impact on the overall TEE benefits. For this reason, it has been necessary to evaluate the impact.

4.26 As with journey time benefits, changes in the VOC impact are forecast by the COBA model, but this cannot be re-run to evaluate the impact. Given that VOC is largely comprised of fuel costs, the alternative approach adopted here is based on calculating the ratio between the AST forecast and POPE re-forecast changes in indirect tax (as presented in Table 4.3). This ratio is applied to the monetary forecast VOC in order to calculate a proxy outturn reforecast value of VOC. The results of this calculation are shown in Table 4.5.

Table 4.5 Summary of Vehicle Operating Costs Benefit

Present Value Benefits (£m 2002 prices, discounted)	**Forecast**	**Reforecast**
Vehicle Operating Cost (VOC)	-£48.6m	-£46.8m

4.27 The results in Table 4.5 demonstrate that the forecast VOC benefit is relatively accurate, with a re-forecast benefit of -£46.8m.

Safety Benefits

Forecast Benefits

4.28 The evaluation of outturn safety benefits is based on the forecast 60 year appraisal period safety benefits and the comparison between the forecast and observed collision saving in the opening year. The economic impact of changes in safety is calculated by assigning monetary benefits to the predicted reduction in the number and severity of personal injury collisions over the appraisal period.

4.29 Forecast collision savings for the M6 Carlisle to Guards Mill scheme are taken from the Economic Assessment Report (EAR), which showed a monetary impact of £9.0 million safety benefits (2002 prices and discounted values), from a 122 collision saving over 60 years.

Outturn Benefits

4.30 Monetisation of safety benefits is shown in Table 4.6 and has been calculated as follows:

- Calculating the net difference between the opening year forecast saving and observed average savings in the first five years the scheme COBA model area.

- Monetising the net difference using the PAR method with values of collisions saved by road type and capitalisation of this saving over 60 years based on expected traffic growth.
- Calculating the 60 year outturn benefits for the COBA model area by combining the forecasts from the AST for the COBA model area with the outturn assessment of the net difference for the key links.

4.31 The outturn collision saving is the difference between the post-scheme observed and the counterfactual DM scenario.

Table 4.6 Economic Evaluation of Safety Benefits

		Traffic Growth Rate[8]	
		0%	50%
Forecast	Forecast Collision Saving (Opening Year)	4.2	
	Collision Benefit for 60 Years (Taken from AST)	£9.0m	
Reforecast	Average Annual Collision Saving in Post-Opening Period (adjusted based on counterfactual)	7.3	
	Net difference between forecast and observed	3.1	
	Monetisation and 60 year capitalisation of net difference using PAR[9]	£6.8m	£9.5m
	Outturn 60 year benefit	**£15.8m**	**£18.5m**

4.32 As shown in Table 4.6, the forecast in the AST stated the scheme would result in a collision benefit of £9.0 million. Based on 50% traffic growth rate, the reforecast safety benefit is £18.5 million, 51% higher than forecast at the appraisal stage and this is due to higher than forecast collision savings.

Construction Delay and Maintenance Benefits

4.33 The DfT's QUADRO program was used to estimate the economic impact of the scheme on road users in terms of journey times and operating costs during the construction phase and future maintenance. The QUADRO forecast a £40.64 million benefit for construction delay and maintenance, comprising of a -£2.18 million construction monetary disbenefit and £42.8 million maintenance benefit.

4.34 The Economic Assessment Report Addendum (May 2005) states that the QUADRO benefits stem from:

'the reduced frequency and extent of work needed on a new road, and the reduced disruption to traffic when a greater available road width enables less disruptive traffic management layouts to be employed'

4.35 During construction it would be expected that some additional traffic delays would occur. It is not possible to undertake an evaluation of the monetary impact of construction as this would have required traffic surveys to be undertaken during periods of roadworks, which is outside the scope of POPE. This report has therefore not undertaken any further evaluation of construction delay.

4.36 However, during periods of maintenance, the extra capacity provided by the M6 J44 – 45 compared to the A74 would offer an improved opportunity to implement traffic

[8] To evaluate the safety benefits of the scheme and in following methodology within PAR 3.3 Guidance, safety benefits have been calculated for 0% and 50% traffic growth forecasts, as shown in Table 4.6. The conservative forecast is to assume there will be no traffic growth over the 60 year period. Given that the COBA model for the scheme and National Road Traffic Forecast (NTRF) predict that traffic flows will increase over the scheme appraisal period, safety benefits have been assessed based on a 50% traffic growth forecast.

[9] Capitalisation factors have been taken from PAR 3.3 which was the current guidance at the time of scheme appraisal.

management measures without adversely affecting the operation of the route. In addition, it expected that over time less work would be required on the upgraded route in comparison to the DM scenario. This report therefore assumes as forecast (£42.8m million benefit) for future maintenance benefits.

Summary of Present Value Benefits

4.37 A comparison of all forecast and outturn benefits, as discussed in previous sections, is presented in Table 4.7. The total benefits include the assessment of PVB inclusive of VOC, but excluding indirect tax, as was the approach for the original appraisal.

4.38 The results show that the reforecast total PVB for the scheme is £96.9million, 12% higher than forecast at the appraisal stage. The difference is due to the safety benefits being more than double the level forecast, as previously shown in Table 4.6.

Table 4.7 Summary of Present Value Benefits

Benefit	Forecast	Reforecast based on FYA Outturn Impact
Journey Time Benefits	£83.4m	£82.4m
Vehicle Operating Cost (VOC) Benefits	-£48.6m	-£46.8m
Future Maintenance benefits	£42.8m	£42.8m
Safety Benefits	£9.0m	£18.5m
Total PVB	**£86.6m**	**£96.9m**

Benefit Cost Ratio (BCR)

4.39 The benefit-cost ratio (BCR) is an indicator used in the cost-benefit analysis of a road scheme that attempts to summarise the overall value for money of a project or proposal. The BCR is the ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms. All benefits and costs are expressed in present values. Projects with a BCR greater than 1 have greater benefits than costs, thus providing positive net benefits.

4.40 At the time of scheme appraisal, Treasury guidance was to include indirect tax impact as part of the cost. However, the most recent guidance on indirect tax impacts recommends that it is included as part of the benefit. This means that when a scheme such as this which leads to increased fuel consumption and hence increases indirect tax revenue, the PVB is increased rather than the PVC being decreased.

4.41 Table 4.8 shows the calculation of the BCR using the costs and benefits presented earlier in this chapter, with consideration made for indirect tax impact as both a benefit and cost.

Table 4.8 Forecast vs. Outturn Reforecast Benefit Cost Ratio

All monetary figures in 2002 prices and values		Forecast	Re-Forecast based on FYA Outturn Impacts
Indirect Tax as a Cost	**PVB**	£86.6m	£96.9m
	PVC	£3.1m	£0.1m
	BCR	**27.9**	**n/a**
Indirect Tax as a Benefit	**PVB**	£124.9m	£133.8m
	PVC	£41.4m	£37.0m
	BCR	**3.0**	**3.6**

4.42 The key points to note from the BCR evaluation are:

- In considering the BCR as it was in the original appraisal (including indirect tax impact), the BCR is 27.9, which is considered very high value for money by the DfT. However, when this approach is applied to the outturn costs, it produces a negligible cost. Therefore a BCR cannot be calculated as it would be meaningless. This result is largely due to the very low net PVC and the amount of indirect tax generated by the scheme.
- In treating indirect tax as a part of the benefits in accordance with current guidance, the BCR is slightly higher than forecast at 3.6, representing a return of £3.60 for every £1 spent. This BCR is considered by the DfT to be of high value for money.

4.43 It should be noted that the BCR ignores non-monetised impacts. Following the former NATA assessment and the replacement Transport Business Case, the impacts on wider objectives such as environmental, accessibility and integration must be assessed, although they are not monetised. These wider objectives are covered in the following chapters.

Wider Economic Impact

4.44 It is inherently difficult to isolate and measure wider economic impacts which could be attributed to the scheme. However, it is important to understand the socio-economic context in which the scheme opened and how the upgrading of the A74 between Carlisle and Guards Mill may have assisted local and regional socio-economic aspirations.

Forecast

4.45 The Economic Assessment Report concluded that Kingmoor Park did not fall into the appropriate wider economic impact categories to warrant a full economic study. As such, the AST forecast that the scheme would have a neutral impact and stated that the scheme:

'Improves access to Kingmoor Park, which is a Regional Strategic Employment site'

Evaluation

4.46 The M6 is an important route providing the only full motorway standard link between England and Scotland and it carries a large proportion of HGV traffic. Since the scheme opened, journey times have reduced by up to 53 seconds and are less variable across the day, providing benefits for freight users.

4.47 The scheme connects to the Carlisle Northern Development Route (CNDR) at Kingmoor Park as shown in Figure 1.1, Chapter 1. The CNDR is a key strategic link providing socio-economic benefits for the west of Carlisle. The M6 scheme can therefore be linked to improving the wider transport network and opening up opportunities for socio-economic development to the west of Carlisle.

4.48 The upgrading of the A74 to motorway standard may have improved the attractiveness of northern Carlisle for development. It has not been possible to evaluate the wider economic implications of the scheme on factors such as employment opportunities and change in occupancy rates at Kingmoor Park since scheme opening. Observations from a site visit found that there were vacant units and recently acquired units, as shown in Figure 4.1.

Figure 4.1 Evidence of economic activity at Kingmoor Park

4.49 The scheme has improved access to Kingmoor Park as stated in the AST but was not a key part of the development conditions and as a result, the impact of the scheme on the wider economy is **'neutral'**, as expected.

Key Points – Economy

Present Value Benefits

- The outturn journey time benefits from the scheme are £82.4 million, 1.2% lower than forecast in the scheme COBA, thus the forecast was highly accurate.
- The forecast stated that the scheme would result in a monetary collision benefit of £9.0 million over the sixty year appraisal period, however, observed reforecast collision benefits total £18.5 million.
- Vehicle Operating Cost benefits were forecast as £48.6 million. Applying the Indirect Tax forecast and observed ratio method, the observed VOC benefits are £46.8 million.
- Overall, the outturn PVB of £96.9 million is 12% higher than the forecast PVB of £86.6 million.

Present Value Costs

- Outturn investment cost was £103.5 million, which is 18% lower than forecast.
- The outturn impact of the scheme on indirect taxation is £36.9 million compared to the £38.3 million forecast, equating to 3.7% lower than forecast. This can be attributed to lower than forecast traffic flows on the M6.

Benefit Cost Ratio

- Taking indirect tax as a benefit to the Treasury, the scheme achieves a BCR of 3.6. This is regarded as high value for money by the DfT.

Wider Economic Impacts

- Whilst there is no evidence to suggest the scheme has directly led to wider economic impacts, such as greater occupancy rates at Kingmoor Park, the scheme does connect to the Carlisle Northern Development Route and Kingmoor Park, but overall the impact is considered 'neutral', as expected.

5. Environment

Scheme Objectives:

- To minimise impact on people and property.
- To minimise impact on the landscape character of the area.
- To minimise impact on sensitive ecological areas.

(Environmental Statement, February 2005)

Introduction

5.1 This chapter documents the evaluation of the environmental sub-objectives contained in the Environmental Statement (ES), focusing on those aspects not fully evaluated at the OYA stage and where suggestions were made for further study. The evaluation is based on the information that is made available to the POPE process; OYA report, ES, Appraisal Summary Table (AST), Construction Environmental Management Plan (CEMP) and consultation with stakeholders.

Summary of OYA Evaluation Findings

The OYA study identified a number of areas for further analysis at the FYA stage to confirm the longer term impacts of the scheme on the environment, which are summarised below.

Landscape

The OYA report stated that landscape should be revisited at FYA to reconsider visual impacts and the establishment of landscape planting and seeding, by which time it was expected that the Handover Environment Management Plan (HEMP) and Landscape Management Plan (LMP) would be available to help inform the evaluation.

Biodiversity

Ecological monitoring undertaken as part of the scheme post construction indicated that impacts were as expected at OYA. It was considered to be too early to draw full conclusions in some instances.

Water

To be revisited at FYA to review the ongoing management of the drainage systems and the results of the monitoring of water quality during construction, which it was understood at OYA were to be included in the HEMP.

Heritage

The OYA report noted that Bents Cottage was subject to archaeological building investigation prior to demolition, although the report was not made available to POPE at OYA. For archaeology it was understood that impacts were as expected, however a copy of the evaluation report was required by POPE.

Physical Fitness

It was noted at OYA that the Post Construction Audit report (2008) prepared for the scheme raised a number of issues with recommendations for action. It was suggested that the remedial measures/suggestions could be considered at FYA with reference to any updated audit report.

5.2 It is the intention of this report to evaluate the effectiveness of the scheme at FYA according to the scheme's objectives, and a number of agreed sub-objectives, as identified in the ES.

5.3 The following environmental sub-objectives were appraised in the ES and in the AST according to the DfT's objectives for transport:

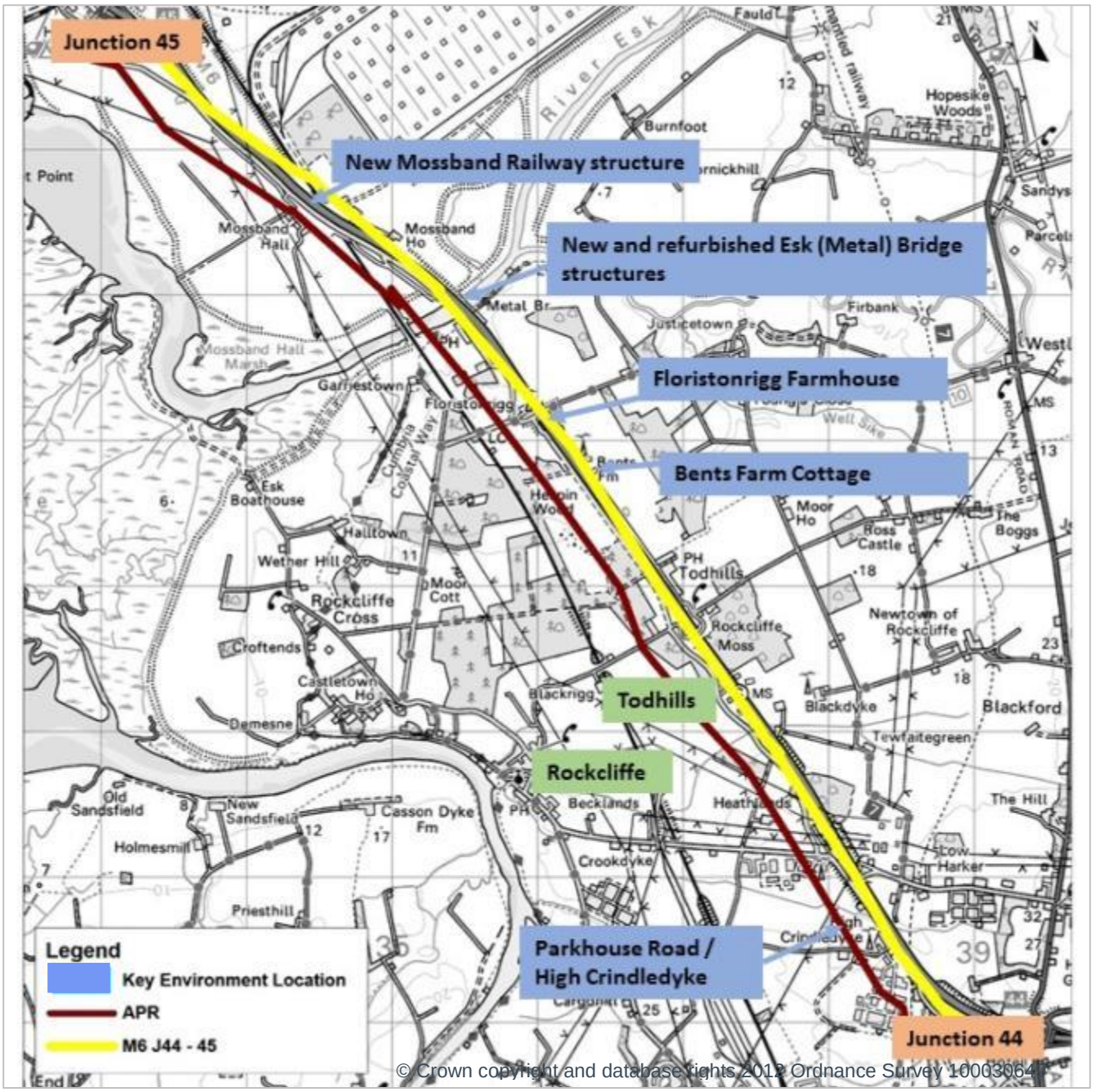
- Noise
- Local Air Quality
- Greenhouse Gases
- Landscape
- Biodiversity
- Cultural Heritage
- Water Environment
- Physical Fitness
- Journey Ambience

5.4 For each of the environmental sub-objectives, the environmental impacts predicted in the AST and ES are assessed against those observed at FYA. This section is based upon findings from the OYA evaluation and new evidence obtained at FYA, including:

- An evaluation of the ongoing effectiveness of the mitigation measures implemented as part of the scheme.
- An updated summary of key impacts against all of the nine WebTAG sub-objectives, with particular focus on assessment of sub-objectives where it was too early to conclude at the OYA evaluation stage.
- Additional analysis relevant to close out issues or areas for further study as identified at the OYA stage to for consideration at the FYA stage.

5.5 Figure 5.1 identifies the location of key sites referenced throughout this chapter.

Figure 5.1 Location of areas of environmental interests
(*Landscape Ecology Management Plan, 2014*)



Methodology

5.6 This section focuses on those aspects not fully evaluated at OYA (or where at OYA, suggestions were made for further study) and also on any issues that have arisen since the OYA evaluation. Although the detail of the OYA evaluation is not repeated here, reference is made to the OYA evaluation where required and key points are incorporated into this FYA report to provide contextual understanding where appropriate.

5.7 No new modelling or survey work has been undertaken for this FYA environmental evaluation.

Data Collection

5.8 The following documents / data have been used for the FYA evaluation:

- Environmental Statement (February 2005)
- Appraisal Summary Table (AST) (September 2005)
- Handover Environmental Management Plan (HEMP) (October 2009)
- Handover Environmental Management Plan (HEMP) (October 2014 – draft only)
- Landscape Management Plan (LMP) (October 2009)
- As Built drawings as part of the Landscape Management Plan (October 2009)
- Landscape and Ecology Aftercare Plan (LEAP) (October 2009 & May 2014)
- Non-Motorised User (NMU) Post Construction Audit (September 2008)
- Ecological Monitoring Report (2009, 2010 & 2013)
- Ecological Monitoring Summary Report (May 2014)

5.9 A full list of the background information requested and received to help with the compilation of this report is included in Appendix D.

Site Inspection

5.10 As part of the FYA evaluation, a site visit was undertaken in June 2014. This included the taking of photographs to provide a comparison with material produced for the ES and at OYA (Appendix E).

Consultation

5.11 Statutory environmental organisations (Natural England, English Heritage and the Environment Agency), Cumbria County Council, Carlisle City Council, Kingmoor Parish Council, Cumbria Wildlife Trust and Eden Rivers Trust were contacted as part of the FYA evaluation regarding their views on the impacts they perceive the scheme has had on the environment. A summary of each consultees' responses are shown in Table 5.1.

Table 5.1 Summary of Environmental Consultation Responses

Organisation	Field of Interest	Comments at OYA	Comments at FYA
Natural England	Biodiversity & Landscape	Limited response as no information available.	As no appropriate assessment was required (for either the River Eden or Solway Flats European sites) and monitoring was not requested, Natural England do not have any information on which to base a response.
English Heritage	Heritage	No unforeseen impacts on historic resources and impacts that did occur were suitably mitigated.	No response has been received at time of report publication.
Environment Agency	Water & Biodiversity	River works at River Esk bridge undertaken in an exemplary manner. Some issues with Rockcliffe Beck culvert, the APR and environmental management.	No issue with flooding, water quality in local watercourse and attenuation of highway run-off to watercourses. Concern regarding impact to otters.
Cumbria County	General	Unable to provide a response for landscape or	Unable to provide response to

Council		biodiversity. Commented on heritage and Public Rights of Ways (PROWs)	biodiversity and landscape. No adverse impact on PROWs and the APR provides a good link to Gretna for cyclists and walkers.
Carlisle City Council	Listed Buildings, Noise, Air Quality & Pollution	Noise, local air quality and pollution as expected. No listed building response received at time of writing.	Local air quality and noise are as expected; no noise related complaints received in the past four years. Views of local landscape from the M6 are restricted by the fencing in places. No issues with biodiversity, cultural heritage, water and PROWs.
Kingmoor Parish Councils	General	No response at time of writing	Road noise is felt to have increased for properties facing the M6 at Crindledyke. The parish council believe there should be measures to mitigate this.
Rockcliffe Parish Council	General	No response	No response has been received at time of report publication.
Kirandrews-on-Esk parish Council	General	Commented on hedges and slip road traffic at M6 J45 causing local traffic problems (considered in the traffic section of OYA report).	No response has been received at time of report publication.
Cumbria Wildlife Trust	Wetlands	No response at time of writing.	No response has been received at time of report publication.
Eden Rivers Trust	Water	Not aware of any impacts on River Eden as a result of the scheme.	No response has been received at time of report publication.

5.12 The Area 13 Managing Agent Contractor (MAC) has also been consulted with regard to animal mortality figures between 2009 and 2014. The MAC provided information on animal mortality for the period from 2002 to 2012. This data is evaluated in Appendix H.

5.13 Some animal mortality information was also provided by the Environment Agency regarding otter deaths on the M6 and the APR.

Traffic Forecast Evaluation

5.14 Three of the environmental sub-objectives (noise, local air quality and greenhouse gases) are directly related to traffic flows. No new noise or air quality surveys have been undertaken for POPE and an assumption is made that the level of traffic, the level of traffic noise and local air quality are related.

5.15 Traffic forecasts and the actual observed figures of the M6 were compared between the ES and FYA. The ES traffic forecasts are not consistent with those provided in the Traffic Forecasting Report (TFR), hence, for the purpose of this part of the evaluation, the FYA

traffic data has been interpolated from the predicted design year (2023) traffic flows in the ES. There were no traffic forecast flows for the APR in the ES. Table 5.2 displays the observed and forecast traffic flows on the M6 at OYA and FYA.

Table 5.2 Forecast and observed traffic flows on the scheme section (M6 J44-45)

M6 Junction 44 - 45	Forecast AADT	Observed AADT	Difference	Percentage Difference
2009 (OYA)	49,230	42,050	-7,180	-15%
2013 (FYA)	53,900	41,200	-12,750	-24%

5.16 As illustrated in Table 5.2, traffic flows on the M6 scheme section at FYA are significantly less than forecasted in the ES. This is believed to be linked to the UK wide economic downturn, which coincides with lower traffic flows and therefore less vehicular trips were made within the evaluation periods. This phenomenon was observed nationally, and hence, the less than predicted traffic flows are not considered a result of the scheme itself.

5.17 It should be noted that combined flows on the corridor (APR and M6) have increased from 42,600 to 44,200, equating to 4%, between the before scheme construction and FYA period. The observed traffic flows on the corridor are therefore below the forecast traffic flows for the M6 only (53,900 vehicles).

5.18 Based on information in the traffic impact evaluation section of this report, traffic speeds have increased slightly since the improvement; 7kph northbound and 5kph southbound on the M6.

5.19 At FYA (2013) the observed Heavy Goods Vehicles (HGVs) proportion on the M6 was 30%, which is similar to the 29% of HGVs reported at OYA.

Five Years After Assessment

5.20 This section includes a brief summary of statements from the AST, ES and OYA evaluations, including a summary of the key issues identified for further reporting at the FYA stage. These key issues have been included to provide the context for the FYA evaluation.

Noise

AST Forecast

5.21 The AST stated that between the DM and the DS situation, there would be significant benefits at the majority of properties in the study area by virtue of noise reductions due to the provision of noise barriers. It was predicted that approximately 14 people would be less annoyed for DS scenario compared to DM.

Environment Statement

5.22 The ES stated that the existing noise climate within the study area was dominated by the presence of the A74, with nearby properties exposed to high noise levels. Properties at High Crindledyke/Parkhouse Road also experienced some noise from traffic on Parkhouse Road. The ES identified 52 residential properties within 100m of the scheme boundary.

5.23 Mitigation measures would be provided in the form of three metre high acoustic barriers at five locations (Mossband, Metal Bridge, Todhills, Parkhouse Road and High Crindledyke) and these were expected to reduce noise levels at 71 residential properties.

5.24 There were likely to be two properties that would qualify for sound insulation under the terms of the Noise Insulation Regulations (1975).

5.25 Low noise surfacing would be used for new carriageways and any sections of the existing A74 not already resurfaced with a low noise surfacing.

OYA Conclusions

5.26 It was confirmed at OYA that three metre high acoustic barriers had been provided at the locations identified in the ES and that the noise barriers at Crindledyke had been extended to provide mitigation for two properties (Crindle Bank and Ghyll Beck). Noise calculations indicated that these properties benefited from a net 1 dB (A) reduction and were therefore not eligible for noise insulation.

5.27 The HEMP (2009) noted that a new noise model was run following construction and found that no properties were experiencing a significant increase in noise. It was also confirmed at that a low noise surface had been provided on the scheme route.

5.28 Traffic flows on the M6 at OYA were 15% less than forecast and although survey results indicated that traffic flows along the whole length of the APR were greater than forecast at OYA, it was considered likely that the overall local noise climate would have improved.

FYA Consultation

5.29 Carlisle City Council were consulted as part of the FYA evaluation and reported that they have not received any noise complaints relating to the M6 and the APR within the past four years.

FYA Evaluation

5.30 Observations from the site visit noted that noise barriers at Mossband, Metal Bridge, Parkhouse Road and High Crindledyke are in good condition as shown in Figure 5.2 and Figure 5.3. Todhills (Figure 5.4) is the only exception as several panels of the noise barriers were missing, however, the HA (at the time) has confirmed that these had been replaced in October 2014 following wind damage.

Figure 5.2 Acoustic Barrier at Todhills

Figure 5.3 Acoustic Barrier at Mossband

Figure 5.4 Missing acoustic barriers at Todhills

5.31 With reference to the OYA report, it was confirmed that low noise surfacing has been provided for the APR and M6. POPE is not aware of any noise survey undertaken for the scheme or adjacent properties.

5.32 Despite the ES not forecasting traffic flows on the APR, the overall flows on the corridor remain significantly below the interpolated ES forecast for the M6, with flows on the M6 only, 24% lower than forecast. It is therefore considered that overall the noise climate is likely to be better than expected and receives a score of **'slight beneficial'**.

Table 5.3 Evaluation Summary: Noise

Sub-Objective	AST	FYA
Noise	Slight Beneficial	Likely to be better than expected

Air Quality

AST Forecast

5.33 The AST stated that there would be no exceedances of air quality objectives as a result of the scheme. The number of properties located within 200m of the scheme would also be reduced.

Environmental Statement

5.34 The ES noted for the baseline there were no Air Quality Management Areas (AQMAs) declared by the local authority for the locality through which the scheme passed and any breaches as a result of the scheme were not expected.

5.35 All changes to air quality concentrations were predicted to be less than 1 ug/m^3 for particulate matter (PM_{10}) and 2 ug/m^3 for nitrogen dioxide (NO_2). It was therefore concluded that there would be no significant impact on air quality for the communities within 200 metres of the road alignment arising from the scheme when compared with the DM. As such, no specific mitigation measures were proposed.

OYA Conclusions

5.36 The OYA stated that traffic flows on the M6 were 15% less than expected, and HGV numbers had decreased. Based on traffic flows it was considered likely that air quality was better than expected for properties adjacent to the motorway.

5.37 The traffic flows along the APR were greater than forecast in the TFR, which indicated that the air quality impact would also be greater than expected in those locations. However, it was concluded that the lower than expected traffic flows along the M6 resulted in an overall better than expected air quality impact along the corridor than expected in the ES.

FYA Consultation

5.38 Carlisle City Council commented that the scheme was not expected to impact adversely on local air quality, and with traffic more free flowing, air quality should have improved. Junction 44 of the M6 abuts an AQMA, however, any effects of the scheme on the AQMA are considered to be insignificant.

FYA Evaluation

5.39 Traffic flows on the M6 between the before and after scheme periods are 24% lower than expected and combined flows on the corridor (APR and M6) remain below the ES forecast flows for the M6 only. It can therefore be concluded that the air quality impact of the scheme is likely to be better than expected.

Table 5.4 Evaluation Summary: Air Quality

Sub-Objective	AST	FYA
Air Quality	Slight Beneficial	Likely to be better than expected

Greenhouse Gases

5.40 The assessment of the impacts of transport schemes on emissions of greenhouse gases is one of the environment sub-objectives. WebTAG notes that carbon dioxide (CO_2) is considered the most important greenhouse gas and it is therefore used as the key indicator for assessing the impacts of transport options on climate change. Changes in CO_2 levels are considered in terms of equivalent tonnes of carbon released as a result of the scheme. Carbon emissions are therefore estimated for the DS and DM scenarios using forecast and observed FYA data.

AST Forecast

5.41 The AST predicted an increase in carbon emissions of 2,760 tonnes of CO_2, which can be explained by the forecast increase in vehicle flows and speeds, however, the size of the area used is unknown.

5.42 Since the scheme was appraised, the approach to presenting the impact on greenhouse gas emissions has changed and it is now considered by tonnes of carbon rather than CO_2. Using WebTAG guidance, the AST forecast tonnes of carbon dioxide (CO_2) has been converted to tonnes of carbon using the standard conversion factor (44/12). This gives 753 tonnes of carbon net increase between the DM and DS scenarios.

FYA Evaluation

5.43 A reforecast of carbon emissions for the DM and DS scenarios at FYA has been calculated on the M6 J44 – 45 and APR using current DMRB methodology. Outturn carbon emissions were calculated using the same methodology for the DM and DS scenarios, using observed traffic flows, HGV proportions and speed data collected for this study. Table 5.5 shows the results from the carbon emission assessment.

Table 5.5 Carbon Emissions DM and DS at FYA

	Carbon Emissions (carbon tonnes/year)	
	Reforecast	Outturn
Do Minimum	16,812	15,037
Do Something	17,199	15,931
Net Change	387	894
	2%	6%

5.44 Table 5.5 demonstrates that outturn carbon emissions show a net increase of 6% between the DM and DS scenarios, equivalent to 894 tonnes of carbon. This result is higher than the reforecast net increase in emissions of 2% between the DM and DS scenarios, equating to 387 tonnes of carbon. The net increase in carbon emissions is due to greater than expected increase in speeds and an increase in traffic flows across the corridor with the scheme in place.

5.45 The lower than forecast outturn carbon emissions for the DM and DS scenarios at FYA can be attributed to the lower than forecast observed traffic flows on the M6 J44 – 45 (as per Section 2.41).

Table 5.6 Evaluation Summary: Greenhouse Gases

Sub-Objective	FYA Score	Evaluation
Greenhouse Gases	894 tonnes of carbon	Worse than expected

Landscape

AST Forecast

5.46 The AST stated that the A74 has an adverse effect on the landscape. Planting would mitigate the majority of landscape and visual impacts. As such, the residual impact of the proposed scheme was assessed as 'neutral'.

5.47 Townscape was not considered in the AST.

Environmental Statement

5.48 The ES stated that the A74 has an adverse effect on the local landscape as well as on views from properties and public right of ways. However, due to its greater visibility/presence in the landscape arising from the loss of existing roadside screen vegetation and the increased extent of roadscape, the scheme had the potential to increase the impact on the landscape and on local views.

5.49 The scheme did not plan for the M6 scheme section and APR to be lit.

5.50 The ES noted that due to the low number of settlements along the A74 and their simple linear form already dominated by the existing A74, the townscape sub-objective was not considered applicable in the context of the scheme.

OYA Conclusions

5.51 The OYA report noted that landscape mitigation measures have generally been implemented as proposed, including earth shaping, cuttings, environmental barriers, retained existing planting and new planting. Subject to successful continued establishment, it was expected that in time the new planting should provide a framework for the scheme and help screen traffic from nearby properties. A five year aftercare period was included in the contract and evidence of maintenance activities was noted from the OYA site visit.

5.52 At OYA, both the HEMP and LMP were being produced. Updates to the plans were expected to be made annually.

5.53 It was suggested that landscape should be revisited at FYA to reconsider visual impacts and the establishment of landscape planting and seeding.

FYA Consultation

5.54 Cumbria County Council was unable to provide any feedback due to lack of resources to monitor the progress of the scheme.

5.55 Carlisle City Council did comment that, although the landscape impact of the scheme is not detrimental, views from the M6 have been restricted by fencings (most likely noise barriers) provided by the scheme.

5.56 No other consultation responses have been received.

FYA Evaluation

5.57 Appendix G: Predicted Impacts, mitigation and evaluation for landscape sub-objective from the ES and evaluation for landscape sub-objectives of the OYA and FYA.

5.58 A HEMP was not produced or updated between the OYA and FYA evaluation. The draft FYA edition of the HEMP was used in writing this report.

5.59 A Landscape Ecology Aftercare Plan (LEAP) was produced in May 2014. The LEAP specified the monitoring, management and maintenance requirements of the landscape and scheme, and will be used by the MAC following the initial five year aftercare periods.

5.60 Observations from the site visit found that overall the landscape mitigation measures are as expected in the ES. Retained vegetation has integrated well with planted vegetation and provides screening of the motorway for residential / business receptors and Non-Motorised Users (NMUs). Although some plots have experienced less successful plant establishment than others, for example the hedgerows on the motorway verge by the new VOSA site (Figure 5.5), in general, the planting provides screening to receptors such as NMUs.

Figure 5.5 Poor establishment of new planting by VOSA site

Figure 5.6 Example of good planting establishment on an embankment

5.61 The environmental barriers appear to be in good condition and provide immediate visual screening from traffic for adjacent properties. Landscape planting helps to integrate the barriers into their settings. Some local residents at Todhills have planted additional shrubs

and climbers to soften the visual appearance of the environmental barriers adjacent to their properties (Figure 5.7).

Figure 5.7 Planting to soften the effect of acoustic barriers at Todhills

5.62 The planting, earth mounds and barriers integrate well with the surrounding landscapes and enhanced the settings of landscape designations, including the Solway Coast Area of Outstanding Natural Beauty and the Hadrian's Wall Military Zone World Heritage Site.

5.63 Appendix E: Record of Scheme Including ES Photomontages before and FYA comparisons.

5.64 Appendix F: Record of Scheme Including OYA and FYA periods visual records of landscape mitigation measures implemented by the scheme and documents the landscape progression across the entire scheme between OYA to FYA.

5.65 Overall, the landscape impacts of the scheme are considered **'neutral'**, as expected. It will be important for future landscape maintenance to continue as per the aftercare requirements set on the LEAP.

Table 5.7 Evaluation Summary: Landscape

Sub-Objective	AST	FYA
Landscape	Neutral	As expected

Biodiversity

AST Forecast

5.66 The AST stated that the overall long term impact on biodiversity of the mitigated M6 extension and APR route were classified as 'neutral'. No significant impacts were predicted to occur on sites of nature conservation value, including the:

- Upper Solway Flats and Marshes Site of Special Scientific Interest (SSSI), Candidate Special Area of Conservation (cSAC), Special Protection Area (SPA) and Ramsar site
- The River Eden SSSI and cSAC
- Rosetrees Moss Country Wildlife Site (CWS)
- Rockcliffe Moss CWS
- Hacker Moss CWS
- Kingmoor Nature Reserve CWS

Environmental Statement

5.67 The ES noted that a number of important sites and habitats were in close proximity to the scheme. Designated sites were expected to be affected and measures were to be implemented to address the impacts as follows:

- The northern part of the scheme would cross the River Esk, which flows into the Upper Solway Flats and Marshes, designated as a SSSI, cSAC, SPA and Ramsar site. The scheme would not cross the area and its effects would be limited to noise and visual disturbance to birds during construction.
- The River Esk crossing would have the potential to have an impact on, amongst other species, migratory fish, fish eating ducks and otters. The new bridge would be sensitively designed and constructed and construction works would be limited to a small area to further reduce the impact.
- The scheme would pass in close proximity to four Country Wildlife Sites; Rosetrees Moss, Rockcliffe Moss, Harker Moss and Kingmoor Nature Reserve. Only Rockcliffe Moss and Harker Moss would be directly affected, losing 2% of their areas from the periphery of the sites. The ES noted that the scheme would offer an opportunity to enhance the quality of these 'mossland' habitats which had dried out by means of raising water levels.
- Several other habitats of local nature conservation value were identified including areas of marshy grassland, 'important' hedgerows and species rich verges. In addition red squirrels, bats, barn owls and reptiles were noted as particularly important species that might be affected by the works.

5.68 Mitigation measures would include;

- Sensitive environmental methods of working during construction
- Badger and otter-proof fencing and associated tunnels
- Provision of bat boxes
- Relocation and compensation habitat for reptiles
- Protection of retained habitats, translocation and replacement habitats
- Creation of new ecology ponds and areas of wet woodland

5.69 A comprehensive programme would be designed to monitor the impacts of the scheme on wildlife and the effectiveness of the compensatory measures proposed.

Scheme update since ES

5.70 During construction, some changes to mitigation measures were implemented. The most notable change involved the relocation of reptiles (adders) to a receptor site in Matterdale Forest with an agreement drawn up between the Secretary of State for Transport and the Forestry Commission. Between March 2007 and March 2012, the Secretary of State would monitor the establishment of successful reptile populations, ensure adequate food supply existed to support the populations and replace any hibernation sites if they ceased to function adequately. Between March 2012 and March 2032, the Forestry Commission will protect the site from any development or management changes which could be detrimental to the reptile populations. The Forestry Commission will manage the site to retain its structural diversity and suitability for reptiles.

OYA Conclusions

5.71 With the evidence provided by the Ecological Monitoring Report, the OYA report concluded that mitigation measures have been provided as expected. There were no significant problems aside from the number of reptiles requiring to be translocated far exceeded the numbers expected and that alternative receptor sites were required, with one in Matterdale being some distance from the scheme. Overall, results from the

ecological monitoring indicated the impacts were as expected at OYA and that further monitoring was to be carried out.

FYA Consultation

5.72 Natural England responded that as the scheme did not require a Habitat Regulations Assessment (Appropriate Assessment), there were no monitoring requirements, and therefore they did not have any comments regarding the scheme.

5.73 The Environment Agency responded that two otter deaths were recorded on the M6 and the APR during the last five years. The EA have not investigated the deaths, however, commented that the deaths could:

'*conceivably be something to do with the M6 culvert/bridge or the combination of culvert/bridges on this road and the M6 that caused the otter to cross the carriageway instead of following the river'.*

5.74 Cumbria County Council was unable to provide any feedback as no sufficient resources were available to monitor and assess whether the mitigation measures have been successful.

FYA Evaluation

5.75 Appendix H: Predicted Impacts, mitigation and evaluation for biodiversity sub-objective.

5.76 The last and final ecological monitoring report for the M6 Carlisle to Guards Mill scheme was issued in November 2013. The ecological monitoring includes the following surveys; aquatic, invertebrate, botanical, reptile, nesting and wintering birds and survey of the mammal crossings. The purpose of the monitoring was to determine whether the scheme has had any long term impacts on ecological receptors and assess the success of the ecological mitigations.

5.77 The findings of ecological monitoring reports undertaken between 2008 and 2013 have been included in Appendix H.

5.78 The Ecological Monitoring Report 2013 noted that the scheme would have a neutral impact on all international designated sites, as predicted by the ES, including Upper Solway Flats and Marshes (SSSI, SPA and Ramsar), the River Eden SSSI/ cSAC. Local Country Wildlife Site (CWS) designations including Rosetree Moss County, Rockcliffe Moss, Harker Moss and Kingmoor Nature Reserve, also have neutral impact as predicted by the ES.

5.79 The majority of the balancing ponds visited on the site visits had medium to large open water bodies (Figure 5.8). Wetland habitats, including reed beds occupied the balancing ponds and could contribute to improving water quality in the becks, which is as expected in the ES.

Figure 5.8 Pond No. 10 with open water and good wetland habitat

Figure 5.9 Wildlife pond adjacent to pond No. 10

5.80 New habitats including wet woodland, habitat ponds, orchid colonies and reptile receptor sites in Matterdale Forest were created to compensate for the loss of habitats. In terms of establishment some are more successful than others, but overall the impacts are as expected by the ES.

5.81 With reference to the Ecological Monitoring Report 2013, the populations and establishment of protected species such as reptiles in verges and habitat enhancement areas are likely to be as expected in the ES.

5.82 As stated in the Ecological Monitoring Summary Report (2013), otter prints were recorded at several of the crossings, entering/exiting the tunnels. The mammal tunnels are shown in Figure 5.10 and Figure 5.11. As it is evident that otters are likely to be using the mammal tunnels, the two otter deaths recorded (Section 5.74) could potentially be related to the ineffectiveness of the mammal proof fences. However, without further investigation, this report considers that the success rate for the mammal tunnels on the APR is inconclusive.

5.83 Badger activities were unknown and no further monitoring was required.

5.84 Overall, it is considered that impacts to mammals are likely to be **'neutral'** as expected.

Figure 5.10 A mammal tunnel by APR

Figure 5.11 Close view of the mammal tunnel

Table 5.8 Evaluation Summary: Biodiversity

Sub-Objective	AST	FYA
Biodiversity	Neutral	As expected

Heritage

AST Forecast

5.85 The AST stated that there were not any unexpected findings from the surveys and as such, the impact of the scheme on the heritage sub-objective was scored as neutral.

Environmental Statement

5.86 The ES noted that no internationally designated sites or their settings would be affected by the scheme. The scheme would have no significant effect on the setting of the Registered Battlefield of Solway Moss with only distant views to and from the scheme.

5.87 The scheme would affect the setting of one listed building, Floristonrigg Farmhouse (Grade 2), located adjacent to the APR.

5.88 With regard to archaeology, the effect was assessed to be neutral. ES Volume 2 included the preliminary palaeoenvironmental assessment and confirmed that the potential of the disturbance was high but there were no results of core sample analysis available.

5.89 The ES Non-Technical Summary (NTS) mentioned that one unlisted building of potential historic interest, Bents Cottage, would be demolished. Full written records, photographs and drawings would be documented prior to demolition.

OYA Conclusions

5.90 The impacts to Floristonrigg Farmhouse (Grade II listed) were considered to be as expected. From the farmhouse, views of the Vehicle Message Signs (VMS) and the APR are both visible. Remediation measures comprised new planting, including the copse, were provided.

5.91 The HEMP at OYA noted that as part of the scheme mitigation, an archaeological building investigation of Bents Farm Cottage was undertaken.

5.92 According to the HEMP at the OYA stage, there were no finds of archaeological importance encountered within the scheme boundary. Scheme mitigation included a palaeoenvironmental assessment of core samples from four environmental archaeological boreholes and watching brief.

5.93 The watching brief noted that very little evidence for archaeological remains were found outside of the Metal Bridge area. The drains and ditches within Metal Bridge were all modern features. A stone-lined drain, pit and gully were most likely related to earlier post-

medieval drainage within the area, however no artefacts were recovered to allow dating of the archaeology.

FYA Consultation

5.94 No comments were received from English Heritage and Cumbria County Council regarding heritage.

5.95 Carlisle City Council has commented that heritage impacts are as expected in the ES.

FYA Evaluation

Listed Buildings

5.96 The visual impacts on Floristonrigg Farmhouse (Grade 2) are considered to be worse than expected as the façade that faces the M6 has full views of the motorway and associated VMSs and screening is considered as insufficient (Figure 5.12). New planting, including the copse had been provided by Floristonrigg House but the establishment rate of the copse is slow and only provides partial screening of the APR from the property (Figure 5.13). However, subject to ongoing establishment, screening is likely to be provided by 2023.

5.97 No report or record was provided to POPE in relation to the documentation for Bent Farm Cottage.

Figure 5.12 View of Floristonrigg Farmhouse from the M6 (Floristonrigg Bridge)

Figure 5.13 View of Floristonrigg Farmhouse from the APR

Archaeology

5.98 The archaeological impact for FYA is as expected in the ES. No finds / disturbances have been noted.

Table 5.9 Evaluation Summary: Archaeology

Sub-Objective	AST	FYA
Heritage	Neutral	As expected

Water

AST Forecasts

5.99 The AST stated that an overall assessment had been made for the surface and ground water environment based on the potential adverse effects of increased runoff and reductions in flood storage volumes, balanced by the beneficial effects of a new drainage system. The impacts were therefore assessed as 'slight beneficial'.

Environmental Statement

5.100 The ES noted that the A74 was situated within the lower reaches of the Eden and Esk river catchments that discharge into the Solway Firth estuary. The ES also recorded the potential for short term adverse impacts on watercourses due to silt run-off or accidental pollution during construction.

5.101 The highway drainage from the existing A74 discharged directly into local watercourses with no pollution control or containment for accidental spillages. As part of the drainage proposals ten new balancing ponds, incorporating vegetative treatment systems would be incorporated into the scheme to attenuate flow and control any pollution incidents prior to discharge to local watercourses. This was expected to result in a net improvement in the quality of the local watercourses.

5.102 The reed beds proposed within the drainage attenuation/treatment ponds along the scheme would take the form of marginal reeds and related species (typically *Iris pseudacorus* and *Sparganium erectum*) and a shallow basin with shallow water reed bed containing typically *Phragmites australis*, *Carex riparia* or *Typha latifolia*.

5.103 Existing culverts would need to be extended at Crindledyke Beck, Rockcliffe Beck, Harker Moss and Rockcliffe Moss.

5.104 The scheme would encroach slightly into an area of floodplain between the River Esk and Guards Mill in the Mossband area, resulting in a minor reduction in the floodplain's overall capacity to store water during a flood event. However, this would be minimal as during a flood water within the floodplain would only be expected to rise by approximately 1cm as a result of the scheme.

5.105 Groundwater was not expected to be affected by the scheme. Rockcliffe and Harker Moss would receive a larger volume of water with improved quality and therefore the overall effect on the groundwater environment was assessed as 'slight beneficial'.

OYA Conclusions

5.106 The OYA report noted that positive drainage measures and balancing ponds attenuate flow and provides pollution control. Tidal flaps have been provided in line with proposals and although there were some issues during construction, these had been resolved appropriately at the OYA stage. It was therefore considered that drainage measures were performing as anticipated.

5.107 It was noted at OYA that monitoring of water quality during construction had been undertaken. It was expected that the results would be included within the HEMP and available at FYA.

FYA Consultation

5.108 The Environment Agency responded and stated that there were no issues with flooding, local water quality and attenuation of highway run-off to watercourses in relation to the scheme.

5.109 Neither Cumbria County Council nor Carlisle City Council were aware of any pollution incidents within or adjacent to the scheme areas.

FYA Evaluation

5.110 As noted from the site visit and consultation with the Environment Agency, highway drainage including balancing ponds appear to be performing in line with the proposals. During the site visit it was noted that marginal planting and reedbeds have fully established (as shown in Figure 5.14 and Figure 5.15). Two of the balancing ponds (Pond No. 2 & 8) visited at FYA were sedimented (Figure 5.16) but appeared to be fully operational. There is no evidence that balancing ponds are not performing as intended.

Figure 5.14 Balancing Pond No. 14 - Good example of open water

Figure 5.15 Balancing Pond No. 9 - Good balance of open water and wild flowers

Figure 5.16 Balancing Pond No. 2

5.111 During the POPE site visit, it was noted that several balancing ponds and culverts were being colonised by injurious weed including Common Ragwort, Spear Thistle and Gorse (Figure 5.17). In response to this, Highways England confirmed that recent maintenance has taken place to remove these noxious weeds with most areas requiring control in the vicinity of Bents Farm. It is noted that the five year aftercare period is complete with the landscape maintenance fully handed over to the MAC.

Figure 5.17 Example of weeds found within balancing ponds and culverts

5.112 It is noted that due to restrictions placed on an access track to ponds 8 and 8A by a landowner, maintenance as required during the aftercare has not being undertaken as required. Highways England has confirmed that this issue has been resolved with works in hand through the MAC to bring these two ponds up to standard through clearing weed growth and replanting in accordance with the works specification.

Figure 5.18 Overgrown vegetation in Rockcliffe Beck culvert

5.113 With the scheme located in a sensitive water environment (see Biodiversity section), the ES expected that the quality of any run-off would be improved due to pollution control measures included in the scheme. Based on responses from the Environment Agency, Carlisle City Council and Cumbria County Council, this is likely to be the case. It was understood at OYA that construction monitoring water quality results would be included in the HEMP but this information was not at the time of writing.

5.114 Overall, impacts to the water environment are likely to be **'neutral'**, as expected.

Table 5.10 Evaluation Summary: Water

Sub-Objective	AST	FYA
Water	Neutral	Likely to be as expected, although improvement on water quality cannot be demonstrated.

Physical Fitness

AST Forecasts

5.115 The AST stated that the scheme would result in a footpath network commodious to the existing network and it was unlikely to increase pedestrian demand in the area. In addition, there would be a minor beneficial impact for cyclist and neutral impact for pedestrians, thus the overall impact was assessed as 'neutral'.

Environmental Statement

5.116 The ES noted that there were some PROWs within the study area.

5.117 With regard to mitigation the ES stated that the APR would provide a suitable non-motorway access contiguous to the proposed M6 mainline and would ensure that local road users, pedestrians, cyclists and equestrians would still be able to access the land and facilities of the surrounding area. The retention of existing over-bridges would ensure that a feeling of further severance between the two sides of the road did not occur.

OYA Conclusions

5.118 The NMU Post-Construction Audit report (2008) report noted that the A74 extension could have been used by NMUs, although due to the high volume and speed of traffic using the road the NMU demand was low. The extended M6 means that due to the motorway regulations, NMUs are not permitted. The new APR is the principal means for NMUs to move between Carlisle and Gretna.

5.119 The audit report noted that:

- Cyclists: The APR is likely to attract mainly leisure cyclists since it forms part of a direct route between Carlisle and Gretna. At the time of OYA there was no segregated provision for cyclists;
- Pedestrians: At the time of OYA there were no footways for pedestrians along the majority of the route. Pedestrians use the carriageway with the option of stepping onto the verge which is considered sufficient for the likely pedestrian demand along the route;
- Equestrians: Share the carriageway with motorised vehicles with the option of using the verges, and this was considerd as acceptable as it is unlikely that there will be a high level of equestrian usage along the APR.

5.120 The OYA report concluded the existing footpath network has not been significantly impacted on by the scheme and remains intact. The APR provides a more pleasant direct route for cyclists between Carlisle and Gretna than was available along the old A74.

FYA Consultation

5.121 Cumbria County Council commented that there is no negative impact to the PROW network and the APR provides a good link to Gretna for cyclists and pedestrians.

FYA Evaluation

5.122 No NMU surveys have been undertaken specifically for POPE which would provide quantifiable data relating to users of NMU facilities. However, observations from the FYA site visit have been used as the one of the information sources of this evaluation.

Cyclists

5.123 During the site visit a number of cyclists were sighted using the APR and it is believed that the majority of the cyclists were using the route for leisure purpose. Direction signs were provided (Figure 5.19) but the APR does not provide marked cycle lanes which may be seen as deterrence by cyclists when using the route. The NMU Post Construction Audit Report suggested that additional signing and white lining could be provided for the APR. The suggestion has not been taken forward. However, Cumbria County Council did comment that the APR provides a good link for cyclists between Carlisle to Gretna, and thus impacts to cyclists are considered as expected.

Figure 5.19 – Signage for cyclists on the APR

Pedestrians

5.124 At the time of the FYA site visit, a low number of pedestrians (group of six people, within a period of five hours) were seen to be walking near Kingstown Industrial Estate, north of Carlisle. It is anticipated that the pedestrian demand of the APR is low as no footpath is provided. However the roadside vegetation along the APR verge consists of tall grass with patches of injurious weeds, which may deter pedestrians from using the verge to avoid traffic.

Equestrians

5.125 No equestrians were sighted during the site visit.

5.126 Overall impacts on physical fitness are considered as 'neutral', better than expected.

Table 5.11 Evaluation Summary: Physical Fitness

Sub-Objective	AST	FYA
Physical Fitness	Neutral	As expected

Journey Ambience

AST Forecasts

5.127 The AST stated that driver stress for a high number of travellers would be reduced and that there would be no long term impact on driver views. Overall the impacts were assessed as large beneficial.

Environmental Statement

5.128 The ES considered view from the road, driver stress and traveller care for vehicle travellers.

View from the road

5.129 Travellers would experience 'slight beneficial' impacts upon scheme opening due to the opening up of pleasant views following vegetation clearance alongside the existing highway to accommodate the widening proposals. As the new screen planting (proposed as landscape mitigation) matured, these views would progressively be lost as the current status quo became re-established and therefore by the design year there would 'no change' to the views.

Driver Stress

5.130 Driver stress was assessed as high for the A74 for a combination of reasons including slow-moving farm traffic and HGVs in the outside lane overtaking slower vehicles, sub-standard local accesses, and narrow lay-bys. The ES noted the following for factors influencing driver stress:

- Frustration would reduce following the removal of slow moving farm traffic from the motorway mainline, closure of access/egress points and the removal of lay-bys. Frustration may also decrease as a result of improved provision of information.
- Fear of potential accidents would be reduce by the removal of farm vehicles from the through traffic on the motorway mainline and by the closure of access points and lay-bys.
- Fear would also increase as a result of increased vehicle speeds and traffic flows.
- Route uncertainty would be improve as a result of positive separation of through-traffic from local traffic and with the provision of adequate signage.

5.131 The ES expected that these factors would contribute to an overall reduction in driver stress compared to the existing situation.

Traveller Care

5.132 The ES noted that the existing service areas on either side of the A74 at Todhills would remain in place, although not to motorway standard. There would be some realignment of the access roads but there would be no changes to the facilities as part of the scheme. Access would only be available from the motorway, not from the new APR, as had previously been the case from the local road.

5.133 Access to the farm shop facilities at Floriston from the motorway would be more circuitous than the existing situation where direct access from the A74 was possible. Local access would remain available from the local roads.

5.134 The existing lay-bys on both northbound and southbound carriageways of the A74 would be removed as a result of widening to motorway standard.

OYA Conclusions

5.135 The OYA report assessed the impacts on journey ambience as expected, with the APR running along the west side of the motorway between Rockcliffe Road, north of Carlisle and Guards Mill, south of Gretna. The APR connects the local road network severed by the new motorway and provides a route for local traffic, buses, farm vehicles, cyclists and walkers away from the high speed motorway traffic.

5.136 At OYA, traffic flows along the whole length of the APR were greater than forecast in 2008. Traffic flow forecasts along the APR, especially at the northern section at OYA, were relatively low. Nevertheless it was concluded that the lower than expected traffic flows along the M6 at OYA had compensated for the greater than expected flow along the APR.

5.137 The OYA report noted traffic on the motorway is free flowing with improved journey times, signage is clear and the route offers a variety of driver views. The APR provides a separate route for local traffic.

FYA Consultation

5.138 Carlisle City Council commented that in certain locations, the environmental barriers provided by the scheme have restricted driver's views.

FYA Evaluation

5.139 A summary of the FYA evaluation of journey ambience can be found in Table 5.12.

Table 5.12 Summary of Journey Ambience Evaluation

Sub-Objective	FYA Score	Evaluation
Views from the Road	Beneficial	Views on the M6 have opened up as a result of vegetation removal, in particular where the road is on embankment. For instance, over the mainline railway and at the river Esk crossing, views from the road extend across the Solway Firth and the high quality estuarine landscape. Where the environmental barriers are located, driver's views will be restricted but that is as expected.
Driver Stress - frustration	Beneficial	Increased lanes, better traffic flow and less traffic volume have all contributed to improved journey times. Clear signage and overhead gantries help reduce driver uncertainty.
Driver Stress – fear of potential collisions	Beneficial	The widening of the A74 to motorway standard and the provision of the APR have improved sight distances and reduced lane conflict. Driver stress and levels of fear are likely to be less when compared to before scheme construction.
Driver Stress – route uncertainty	Beneficial	With the provision of the new VMS and signage on the APR, drivers are now better informed (Figure 5.20).
Traveller Care	As expected	No new facilities have been provided and the existing service areas are accessible from the motorway with improved entry/ exit slip roads. The farm shop is now only accessible from local roads. Lay-bys are not provided on motorways. Other local facilities are easily accessible from Junctions 44 or 45.
Journey Ambience Summary Score	**Beneficial**	**As expected**

Figure 5.20 Large VMS on the M6 to provide better information to travellers

5.140 The APR connects the local route network severed by the new motorway and provides a route for local traffic, buses, farm vehicles, cyclists and walkers away from the high speed

motorway traffic. As a result of the scheme, the M6 provides extra lanes for motorists which reduces driver stress and frustration. With the provision of VMS and gantries, motorists are now better informed which is likely to reduce drivers' stress. Overall, the scheme has had a **'large beneficial'** impact on journey ambience, as expected.

Table 5.13 Evaluation Summary: Journey Ambience

Sub-Objective	AST	FYA
Journey Ambience	Large Beneficial	As expected

Key Points – Environment

Noise

- Traffic flows on the M6 J44 – 45 at FYA (2013) are significantly less (24%) than the traffic forecast as interpolated from the ES. Combined traffic flows on the corridor have marginally increased by 4% between the OYA and FYA periods.
- Noise mitigation such as acoustic barriers are generally in good condition.
- The noise sub-objective receives a score of slight beneficial, which is better than expected.

Air Quality

- The percentage of HGVs present on the motorway and the traffic speeds during the FYA were similar to the OYA.
- With the significantly lower than predicted traffic flows on the M6 and marginal increase (4%) in traffic flows on the corridor, the overall traffic flows are still less than predicted in the ES. It is therefore concluded that the air quality impact of the scheme is slight beneficial, better than expected.

Greenhouse Gases

- There has been an increase in carbon emissions post opening by 894 tonnes which is more than double the 387 tonnes forecast. This increase is due to higher speeds than forecast, and a slight increase in traffic flows across the corridor.

Landscape

- The landscape mitigation measures provided are as expected in the ES. Earth mounds, cuttings, environmental barriers, retained/ new planting have integrated well with the surrounding landscapes, and provides screening of the motorway for residential/ business receptors and non-motorised users.
- Although some vegetation has not established as well as others, it has ultimately helped soften the impacts of the scheme. It is anticipated that by design year the impact would be as expected, subject to on-going establishment of the planting.
- It will be important for future landscape maintenance to continue as per the aftercare requirements set on the LEAP.
- Landscape impacts are considered neutral, as expected.

Biodiversity

- Mitigation measures included reptile relocations, wildlife ponds and mammal crossings have been provided as expected.
- As part of post scheme environmental management, ecological monitoring was undertaken between 2009 and 2013. The results indicate impacts of population to protected species such as reptiles in Matterdale Forest are likely to be as expected.
- Wildlife ponds are well established and occupied by species rich grassland that encourages colonisation of plant and animal species.
- Mammals such as otters use the mammal tunnels as expected, although badger activity is unknown.
- It is considered overall that impacts for biodiversity are neutral, as expected.

Key Points – Environment

Heritage

- The impacts on Floristonrigg Farmhouse (Grade II listed) are likely to be worse than expected. It is noted that new planting, including the copse has been provided but the establishment rate was slow and does not provide full screening of the APR from the property at this time.
- Towards the M6, the tree and shrub planting has poorly established.
- For archaeology, the impacts are as expected.
- Overall, the impacts on heritage are neutral, as expected.

Water

- According to the information provided by consultees and as noted from the site visit, highway drainage including balancing ponds appeared to be performing in line with the proposals. It was noted that two of the balancing ponds were sedimented and some of the culverts have been occupied by injurious weed including Common Ragwort and Gorse.
- At FYA, it is considered that impacts are slight beneficial, as expected, although improvement on water quality cannot be demonstrated.

Physical Fitness

- The APR provides non-motorised users including cyclists, pedestrian and equestrians a direct link between Carlisle and Gretna. The APR is likely to increase cyclists demand in the area.
- Overall the scheme's impact on physical fitness is scored as neutral, as expected.

Journey Ambience

- Journey ambience, in terms of views from the road, driver stress and traveller care have all been improved. Therefore journey ambience receives a score of large beneficial, as expected.

6. Accessibility and Integration

6.1 This chapter evaluates the impact of the scheme in terms of the accessibility and integration objectives; comparing qualitative forecast assessments from the scheme AST with post-opening findings and analysis of policy objectives.

Accessibility

Scheme Objective: An improvement in accessibility for users.

6.2 The accessibility objective is concerned with how the scheme has affected the ability of people in different locations to reach different types of facility, using any mode of transport. The accessibility objective consists of three sub-objectives. These are:

- Option values
- Access to the transport system
- Severance

Option Values

Forecast

6.3 Option values, as defined in WebTAG, relate to the availability of different transport modes within the study area, even if they are not used. For example, a car user may value a bus service along their route even if they never used it because they have the option of another mode should their car become unavailable.

6.4 For the objective regarding option values, the AST states:

'*increased opportunities for non-motorised users'*

6.5 As such the AST forecast a score of slight beneficial for this sub-objective.

6.6 The ES notes that the use of the A74 by equestrians was limited prior to scheme implementation.

6.7 The ES states that within the scheme area there was low demand for pedestrian facilities caused by a lack of community services and existing poor pedestrian facilities.

Evaluation

Public Transport

6.8 The scheme is currently used by two bus services, one provided by Stage Coach Cumbria and the other by Houstons Mini Coaches, with the X75 travelling via the M6 and the 382 using the APR. A summary of these services is provided:

X75 (via M6) – Carlisle to Stranraer

- One service daily leaving Carlisle bus station at 13:10, arriving at Gretna at 13:36
- No Sunday service.
- Duration of journey is approximately 26 minutes.

382 (via APR) – Carlisle to Lockerbie

- Four services a day, approximately every three hours.
- Three Sunday services
- Duration of journey between Carlisle to Gretna is between approximately 23 to 32 minutes.

6.9 There have been some alterations to bus services along the scheme route since the upgrade from dual carriageway to motorway standard. Prior to scheme implementation, three bus services used the A74, the 79, X75 and 382. Table 6.1 summaries the historical and current provision of the services.

Table 6.1 Historical and Current Provision

Service	Summary of Service Provision
79	• Prior to scheme implementation, the service used the A74. • During scheme construction, the service was diverted through Longtown (northeast of M6 Junction 45) which proved to be more profitable. • The service remains on this altered route but this is not a result of the M6 scheme itself.
X75	• Service currently uses the M6 and the service is as detailed in Section 6.6. • As the service uses the M6 it is unable to stop for passengers along the scheme route. • At OYA, Cumbria County Council advised that it was unlikely that it stopped along the A74 due to limited demand. • Improved journey times along the route may have improved this service.
382	• Service was in operation along the A74 before the upgrade to the M6. • It was removed for a short period of time but was reinstated in April 2010. • The service currently travels via the APR. • At OYA it was reported that prior to scheme construction, Todhills was serviced by the service, however, the service has not resumed since scheme opening and Todhill is served by bus on demand (by phone arrangement). • Consultation with Houstons Mini Coaches (August 2014) indicated that passengers wanting to be dropped off or picked up on the APR would be accommodated for, subject to the service being able to stop in a safe location. They indicated that the requirement to do this is infrequent as there are very few passengers on the APR.

6.10 At OYA it was noted that bus stops had been installed along the APR however, bus information signs or formal services had not yet developed. At FYA this situation remains the same, demonstrated by the bus services detailed in Table 6.1 and the bus stops along the route, as shown in Figure 6.1.

Figure 6.1 Bus Stop on the APR

Non-Motorised Users (NMUs)

6.11 There have been no NMU surveys undertaken specifically for POPE which provide quantifiable data relating to NMU facilities due to a lack of before data for comparison.

6.12 The NMU Post-Construction Audit Report (September 2008) has been made available to POPE. It notes that NMUs could have used the A74 but due to the high volume and speed of traffic using the road the NMU demand was low.

6.13 The new APR is the principle means for NMU's to move between Carlisle and Gretna. The APR is generally unlit with no footways or kerbed edges, which is considered appropriate for the level of demand expected along the route.

6.14 There were proposals to divert National Cycle Route 7 northwards along the APR to the B7076 at Gretna (Figure 6.2). The site visit in June 2014 found signing and lining on the B7076 directing cyclists to Route 7. The National Cycle Network Map[10] does not identify the APR as part of Route 7, but the APR does appear to provide a connection between two parts of Route 7.

Figure 6.2 Signing and Lining supporting Route 7

6.15 The proposed extension to National Cycle Route 7, south of the APR, from Harker Bridge through to Kingmoor Park has been implemented, and signs show the existing Cycle Route 10 (Figure 6.3).

Figure 6.3 Signs showing existing Cycle Route

6.16 The Audit Report notes that the APR is likely to attract mainly leisure cyclists since it forms part of a direct route between Carlisle and Gretna. There is no segregated provision for cyclists and the audit report suggested that some additional signing to warn

[10] www.sustrans.org.uk/ncn/map - site accessed August 2014.

of the possible presence of cyclists and 'cycle lane, track or route' road markings should be implemented. The FYA site visit found that Cumbria County Council have installed signs warning of potential cyclists along the route, as shown in Figure 6.4. This suggests that the APR is a frequently used cycling route.

Figure 6.4 Signs warning of potential cyclists

6.17 During the site visit a number of cyclists were observed using the APR, with evidence shown in Figure 6.5.

Figure 6.5 Cyclists on the APR

Pedestrians

6.18 There are no footways for pedestrians along the majority of the APR and pedestrians would need to make use of the carriageway with the option of stepping onto the verge, which is considered sufficient for the likely pedestrian demand along the route. During the FYA site visit, no pedestrians were observed using the APR.

Equestrians

6.19 Equestrians share the APR carriageway with motorised vehicles, with the option of using verges. This level of provision is deemed acceptable as there is unlikely to be a high level of equestrian usage along the APR. Existing bridleways are not expected to have been significantly impacted by the scheme.

6.20 The AST score of '**slight beneficial'**, as expected for option values is considered to be appropriate due to public transport provision remaining largely unchanged and due to an improvement in facilities for NMUs provided by an increase in available cycling routes.

Severance

Forecast

6.21 The AST scored the severance sub-objective as slight beneficial and states:

'Four settlements no longer gain direct access on to the A74 as a result of the scheme. The provision of the APR would provide quick, safe and convenient access and would improve the severance which occurs as a result of the existing A74'

Evaluation

6.22 As the scheme involved upgrading a dual carriageway to motorway standard, the level of severance would be expected to increase due to the increased size of the road and the reduced number of potential crossing points for NMU's. The scheme has, however:

- Retained all existing over-bridges enabling local access for NMU's and motorised users to the APR from either side of the M6.
- Provided motorised local traffic with safer access to the M6 through the removal of the direct access points.
- Created a safer route for NMU's travelling between Carlisle and Gretna.

6.23 A score of **'slight beneficial'** is therefore regarded as appropriate for the impact of the scheme on severance, in line with the AST.

Access to the Transport System

Forecast

6.24 For access to the transport system sub-objective, the AST forecasts a neutral impact and states:

'The proposed scheme would not affect access to the transport system'

Evaluation

6.25 At OYA, consultation with Houstons Mini Coaches indicated that the 382 bus service served local communities along the APR, providing the opportunity for travel between Gretna and Carlisle without using the M6. As discussed in the Options Values section, at FYA, there is no demand along the APR for the 382 service but Houstons Coaches could make provision if demand were to increase.

6.26 As a result of no change in access to the transport system since scheme opening, in line with the AST, the sub-objective receives a **'neutral'** score.

Integration

6.27 The integration objective consists of two main elements:

- Interchange with other transport modes: how the scheme assists different modes of transport in working together and the ease of people moving between them to choose sustainable transport choices.
- Land Use Policy and Other Government Policies: how the scheme integrates with local land use and wider government objectives.

Transport Interchange

Forecast

6.28 The transport interchange objective relates to the extent to which the scheme contributes towards the Government objective of improving transport interchange for passengers and freight. Regarding this, the AST forecast states:

'There will be no impact on any passenger or freight interchanges as a result of the scheme'

6.29 As such the AST forecast a neutral impact for the transport interchange objective.

Evaluation

6.30 There have been no additional public transport services on the M6 and as shown in Table 6.1, bus stops have been provided along the APR but they are not served by a consistent

and planned bus service. As a result, the scheme has not altered the transport interchange options and as such, the AST assessment score of **'neutral'** can be upheld.

Land Use Policy

Forecast

6.31 The AST scored the impact of the scheme on land use policy as beneficial reasoning that:

'The scheme is allocated throughout the hierarchy of development plan and reflected in policies and proposals in the Regional Planning Guidance, Structure Plan and Local Plan'

6.32 The AST also scored other Government policies as beneficial and states:

'The scheme would achieve benefits for both road users and the surrounding areas. The scheme would improve safety for strategic and local road users and therefore provide benefits such as sustainability, accessibility and social inclusion'

Evaluation

6.33 An evaluation of the scheme in relation to policy has been undertaken and is summarised in Table 6.2. The evaluation shows that, as forecast, the scheme has had a beneficial impact on other government policies and land use policies. Given the findings presented, it is considered that the forecast assessment of the scheme on land use policy and other government policies is **'beneficial'**, as expected.

Table 6.2 Scheme Alignment with National, Regional and Local Policy

	Policy/Document	Relevant Policy Objective/Reference	Relevant Scheme Impacts	Alignment
Local and Sub-Regional Policies	**Cumbria and Lake District Joint Structure Plan 2001-2016**	This is a statutory document which provides a strategy and policies for the development and use of land within Cumbria. The M6 Carlisle to Guards Mill upgrade scheme was included within the Joint Structure Plan as a safeguarded transport scheme and the M6 is considered part of the strategic transport network affected by the following policy: • Policy T24: The Strategic Transport Networks - Development should not adversely affect the strategic transport network. Wherever required, development should improve strategic transport networks including cycling and walking networks.	• The APR provides a new cycle route which is safer compared to the old A74. • There are no footways for pedestrians along the majority of the APR and pedestrians are required to walk in the carriageway but the provision is sufficient for the type of road and the demand.	✓
	Cumbria Local Transport Plan 1 (2001 – 2006)	The Local Transport Plan specifically supports improvements to the link to Scotland via the A74. The M6 Carlisle to Guards Mill extension was identified as one of a number of major infrastructure improvements that were a priority for delivery and important to achieving a 'high quality strategic transport network'. • Policy ST8: The City of Carlisle - Opportunities will be taken to strengthen links to employment uses at Kingmoor by all forms of transport. A range of employment opportunities including a Regional Investment Site as Kingmoor will be provided.	• The upgrading of the A74 to form an extension of the M6 has completed the network between England and Scotland to motorway standard. • The scheme connects to Kingmoor Park, a Regional Investment Site. • National Cycle Route 7 has been extended south of the APR from Harker Bridge through to Kingmoor Park.	✓
	Cumbria Local Transport Plan 2 (2006-2011)	When the scheme opened, Cumbria's Local Transport Plan 2 was the local transport policy document. There was no specific mention of the scheme but a number of key priorities are in line with the scheme: • To develop transport infrastructure to support improvements to the Cumbria economy. • To improve accessibility to jobs, education and training, health and other key services. • To reduce the high level of road causalities. • To maintain to a high standard the extensive road network.	• The number of collisions has reduced, particularly at the former direct access points. It has not been possible to evaluate whether the level of road causalities has decreased. • The percentage of KSIs has reduced from 28% to 26%. • The scheme connects to Kingmoor Park, a Regional Investment Site. • The network between England and Scotland is to motorway standard.	✓
	Carlisle District Local Plan (2001 – 2016)	The document refers to the M6 and A74 to Scotland as the Primary Route Network. Within the Local Plan, reference is made to safeguarding land for the M6/M74 extension and the scheme is supported by the following two policies: • Policy DP5 Trunk Roads - Land will be safeguarded for the M6/A74 and APR which has been assessed in terms of its impact on the safe and efficient operation of the trunk road network. • Policy CP16 Public Transport, Pedestrians and Cyclists - New developments should offer a realistic choice of access by public transport, walking and cycling. Priority should be given to the provision for safe and convenient pedestrian and cycle access including secure cycle parking provision facilities, where appropriate, in all new developments accessible to the public.	• The APR provides provision for cyclists and joins to the National Cycle Network Route 7. • The scheme was successfully constructed and opened in 2008.	✓
	Cumbria Local Transport Plan 3 Strategy (2011-2026)	The version of the Local Transport Plan includes prioritising schemes which reduce the need to travel, encourage and promote greater use of buses, trains, taxis, cycling and by foot by residents and visitors. The strategy document makes a specific reference to the M6 extension to the Scottish border as a key highlight of what has been achieved for transport in Carlisle district.	• The M6 extension improves connectivity between England and Scotland. • The APR makes provision for cyclists and NMU access across the M6 has been maintained using bridges thus there has been no detrimental impact to severance.	✓
Regional Policy	**Regional Spatial Strategy (2010)**	Key transport objectives outlines in the RSS include: • Improve journey time reliability, tackle congestion and overcrowding in the region's main transport corridors • Secure safe and efficient access between residential areas and key destinations • Reduce the adverse impacts of transport, in terms of safety hazards, environmental degradation, residential amenity and social exclusion.	• Journey times have improved in the post-opening period. • There has been no impact to route stress between the before scheme construction and post-scheme periods. • Following scheme opening, there have been significant collision savings which are unlikely to have happened by chance. • The APR provides a safer cycling route than the old A74 between Carlisle and Gretna. • A direct and efficient route for local road traffic between Carlisle and Gretna has been provided by the APR.	✓

	Policy/Document	Relevant Policy Objective/Reference	Relevant Scheme Impacts	Alignment
National Policy	**A New Deal for Trunk Roads in England** **(1998)**	The Government's overarching objectives for transport at the time of the appraisals were set out in this document, and include policies to: • Protect and enhance the built and natural environment. • Improve safety for all travellers. • Contribute to an efficient economy, and to support sustainable economic growth in appropriate locations. • Promote accessibility to everyday facilities for all, especially those without a car. • Promote the integration of all forms of transport and land use planning, leading to a better, more efficient transport system.	• The APR makes provision for cyclists between Junction 44 and Gretna, which is considered safer than the old A74. • Collision rates have reduced along the M6 J44 – 45. • Journey times on the M6 between Junction 44 and 45 have reduced since scheme opening. • The M6 improves connectivity between England and Scotland.	✓
	Action for Roads - **A network for the 21st century** **(July 2013)**	• Support the UK economy and drive growth into the future through provision of a well-connected road infrastructure with sufficient capacity; • Push for greater safety, and avoid letting the improvements of recent years breed complacency; and • Ensure transport plays its part in meeting carbon budgets and other environmental targets.	• The scheme has improved journey times along the M6 between Carlisle and Gretna. • Following scheme opening there have been significant collision savings along the scheme section. • Carbon levels were forecast to increase post opening due to higher traffic speeds, however outturn carbon levels are slightly higher than forecast.	✓

Key Points – Accessibility and Integration

Accessibility Impacts

- There are two bus services that travel along the APR (382) and M6 (X75). The X75 is unable to stop on the M6 for passengers and the 382 does not provide a formal service on the APR.
- NMU facilities have been improved along the APR and provide a more attractive and safer cycling route compared to the A74.
- There were no pedestrians observed on the APR during site visits but usage by cyclists has been witnessed.
- All accessibility sub-objectives receive an as expected score.

Integration Impacts

- The scheme has had no impact on access to the transport system, with the EST being scored as neutral.
- A review of Government policy shows the scheme to have had a beneficial impact on achieving local and central government policies. National and local targets to improve road safety have been achieved for the scheme. Accessibility for cyclists has been improved along the APR and the upgrading of the A74 has completed the network between England and Scotland to motorway standard. As such the EST has been scored as beneficial, as expected.
- All integration sub-objectives receive an as expected score.

7. Appraisal Summary Table & Evaluation Summary Table

Appraisal Summary Table

7.1 The AST is a brief summary of the main economic, safety, environmental and social impacts of a highway scheme**.** Table 7.1 presents the AST for the M6 Carlisle to Guards Mill Improvement scheme.

7.2 The AST presents a brief description of the scheme, a statement detailing the problems that the scheme planned to address, and makes an assessment of the scheme's predicted qualitative and quantitative impacts against the following objectives:

- **Environment** – an estimate of the impact of the scheme on factors such as noise, local air quality, landscape, biodiversity, and water;
- **Safety** – measured reduction in the number and severity of collisions and qualitative assessment of impacts on security;
- **Economy** – estimated impact of the scheme upon journey times, vehicle operating costs, scheme costs, journey time reliability and wider economic impact;
- **Accessibility** – a review of scheme impact upon access to the public transport network, community severance, and non-motorised user impact; and
- **Integration** – a description of how a scheme is integrated with wider local planning, regional and national policy objectives.

Evaluation Summary Table

7.3 The EST was devised for the POPE process to record a summary of the outturn impacts against the same objectives, compared to the predictions in the AST.

7.4 Table 7.2 presents the EST for the scheme. An assessment of each of the objectives at the FYA stage is given. Where possible, the format of the EST mirrors the appearance and process of the AST to enable direct comparison between the two.

Table 7.1 - Appraisal Summary Table (AST)

OBJ	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE IMPACT	ASSESSMENT
Environment	**Noise**	In the direct comparison between the scheme and do-minimum situations in year 2023, significant benefits are gained at the majority of properties in the study area by virtue of noise reductions due to the provision of noise barriers.	**Properties experiencing a 1 to 3dB(A) increase in noise levels:** Do Minimum 100 The scheme 8 **Properties benefiting from decreases in noise levels of between 1 to 10dB(A):** The scheme 71	Estimated population annoyed by noise: -14 (i.e. 14 less people annoyed with the scheme as compared to the do-minimum
	Local Air Quality	No exceedances of air quality objectives are predicted. (Results aggregated from 7 settlements along route to reflect different background concentrations). No increases in NO2 > 2 µg/m3 at 20 m from the road centre. No increases in PM10 > 1 µg/m3 at 20 m from the road centre. There is a reduction in properties due to the scheme of 48 properties within 200 m.	Total no of properties where air quality is worsened within 200m of roadside for all routes affected = 0 Number of properties where air quality is improved within 200m or roadside = 0	Differences in PM10 concentrations number of properties in each band in 2008 = -648 Differences in NO2 number of properties in each band in 2008 = -846
	Greenhouse Gases		Present CO2 levels = 43373 tonnes per year. Future CO2 levels = 46133.	+2760 tonnes of CO2 per year
	Landscape	The existing trunk road has an adverse effect on the landscape. Planting would mitigate the majority of landscape and visual impacts and the residual effect of the proposed scheme would be neutral.		Neutral
	Townscape			
	Heritage of Historic Resources	There has been nothing unexpected found during the surveys.	Not applicable	Neutral
	Biodiversity	Overall the impact of the mitigated M6 extension and associated APR route has been classified as having a 'Neutral' long-term impact. No significant effects are predicted on sites of nature conservation value [including the Upper Solway Flats and Marshes SSSI, cSAC, SPA and Ramsar site, the River Eden SSSI and cSAC, Rosetrees Moss County Wildlife Site (CWS), Rockcliffe Moss CWS, Harker Moss CWS and Kingmoor Nature Reserve CWS.	Not applicable	Neutral
	Water Environment	An overall assessment has been made for the surface and ground water environment based on the potential adverse effects of increased run off and reductions in flood storage volumes, balanced by the beneficial effects of a new drainage scheme.	Not applicable	Slight Beneficial
	Physical Fitness	The overall impact of the scheme would result in a footpath network which is equally commodious to the existing network. As a result of this the proposed scheme is unlikely to increase pedestrian demand in the area. Minor Beneficial for cyclists. Neutral for pedestrians.	Not applicable	Neutral
	Journey Ambience	Reduced driver stress, affecting a high number of travellers. No long term impact on driver views.		Large Beneficial
Safety	**Accidents**	Construction to current standards, including the removal of intermediate junctions and the provision of hard shoulder, is expected to lead to reduced numbers of accidents.	Number of collisions saved: Fatal 4, Serious 47 and Slight 43. Total = 122 accidents	PVB = 9.002 (£m)
	Personal Security	Formal surveillance is an important requirement as the area is sparsely populated with little assistance. Emergency phones every 1km to meet motorway regulations would result in a general increase in security. There are few facilities for pedestrians and cyclists at present but the provision of the APR would improve access to populated areas and therefore improve security.	Not applicable	Moderate Beneficial
Economy	**Public Accounts**	The cost of construction is offset by saving the cost of the major viaduct repairs which would otherwise be required, and by changes in tax revenues.		Central Government PVC = 1.63 (£m) Local Government PVC = N/A
	Business Users	Road users make savings in travel time, but these may be partially offset by increases in vehicle operating costs as a result of higher speeds. These effects are evaluated over a 60-year period.		Users PVB = 46.342 (£m) Transport providers PVB = -0.278 (£m) Other PVB = N/A

OBJ	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE IMPACT	ASSESSMENT
	Consumer Users	Road users make savings in travel time, but these may be partially offset by increases in vehicle operating costs as a result of higher speeds. These effects are evaluated over a 60-year period.		Users PVB = 28.989 (£m)
	Reliability	Journey times will be become more reliable with the provision of D3M, both through easing of congestion as well as reduction in accidents.		Beneficial
	Wider Economic Impacts	Improves access to Kingmoor Park, which is a Regional Strategic Employment site.		Neutral
Accessibility	**Option Values**	Increased opportunities for non-motorised users.		Slight Beneficial
	Severance	Four settlements no longer gain direct access on to the A74 as a result of the scheme. The provision of the APR would provide quick, safe and convenient access and would improve the severance which occurs as a result of the existing A74.		Slight Beneficial
	Access to the Transport System	There will no impact on any passenger or freight interchanges as a result of the scheme.		Neutral
Integration	**Transport Interchange**	Scheme does not include any additional public transport provision or freight interchange facilities	Not applicable	Neutral
	Land Use Policy	The scheme is allocated throughout the hierarchy of development plan and reflected in policies and proposals in the RPG, Structure Plan and Local Plan. .	There are nine land policies facilitated by the scheme	Beneficial
	Other Government Policies	The scheme would achieve benefits for both road users and the surrounding areas. The scheme would improve safety for strategic and local road user and therefore provide benefits such as sustainability, accessibility and social inclusion.	Not applicable	Beneficial

Table 7.2 - Evaluation Summary Table (EST)

OBJ	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE IMPACT	ASSESSMENT
Environment	**Noise**	Noise barriers are provided in the locations proposed and in good condition. During the site visit, it was sighted that several panels of acoustic barriers were broken at Todhills. It was believed to be temporary, possibly due maintenance scheme on the local road. Despite the marginal rise in combined traffic flows on the corridor (M6 & APR), traffic flows on the M6 scheme section are 24% less than predicted from the ES. Therefore, the overall noise impacts are likely to be better than expected.	FYA traffic is 24% less than predicted in the ES. Combined traffic traffic (M6 & APR) have increased by 4% between before scheme and FYA.	Likely to be better than expected (slight beneficial)
	Local Air Quality	Based on traffic flows it is likely that local air quality is as expected or better than expected for properties adjacent to the motorway.	FYA traffic is 24% less than predicted in the ES. Combined traffic traffic (M6 & APR) have increased by 4% between before scheme and FYA.	Likely to be better than expected (slight beneficial)
	Greenhouse Gases	Carbon emissions have increased as a result of higher traffic flows across the corridor (M6 and APR combined) and higher speeds.	AST forecast change: + 2760 tonnes of CO_2/year = +753 tonnes/carbon Reforecast change: +1419 tonnes CO_2/year = +387 tonnes/carbon Observed change: -+3278 tonnes of CO_2/year = +894 tonnes/carbon	Worse than expected
	Landscape	Retained planting and new planting have established well together which helped integrate the scheme into the local landscape. Although some new planting is slow to establish it is anticipated that by the design year, impacts should be mitigated as expected.	-	As expected (neutral)
	Heritage of Historic Resources	The report/ record of Bent Farm Cottage building investigation prior to demolition and a copy of the archaeological evaluation report have not been made available to POPE at FYA and no further evaluation is possible.	-	As expected (neutral)
	Biodiversity	New habitats including wet woodland, wildlife ponds, orchid colonies and reptile receptor sites in Matterdale Forest were created to compensate for the loss of habitats. In terms of establishment some are more successful than others but overall, the impacts are as expected.	-	As expected (neutral)
	Water	No information has been provided which would indicate that scheme drainage is performing other than as expected. Consultees responded that they were not aware of any issues with drainage and water quality. As the construction monitoring results for water quality are not available, possible changes or improvement in water quality cannot be confirmed.	-	Likely to be as expected (slight beneficial), although improvement on water environment quality cannot be demonstrated
	Physical Fitness	The APR provides NMUs including local road users, cyclists, pedestrians and equestrians a direct link between Carlisle and Gretna. The route is likely to increase cyclists demand in the area.	-	As expected (neutral)
	Journey Ambience	Journey ambience in terms of views from the road, driver stress and traveller care have all been improved as expected.	-	As expected (large beneficial)
Safety	**Accidents**	Annual average accident saving of 7.3 accidents per annum.	-	Better than expected
	Security	To meet motorway regulations, emergency telephones have been installed on the M6. There has been an improvement in access to the road network for NMUs along the APR, however, these are not measures that will have improved personal security.	In accordance with WebTAG guidance at the time of scheme appraisal, between 500 and 10,000 travellers have been affected hence the score of moderate beneficial.	As expected (moderate beneficial)

OBJ	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE IMPACT	ASSESSMENT
Economy	**Public Accounts**	Scheme costs are lower than expected.	Forecast PVC (without indirect taxation) = £41.1m Observed PVC (without indirect taxation) = £37.0m	Better than expected
	Transport Economic Efficiency	Across the AM, Inter Peak and PM periods, observed Do-Something journey times were in line with forecasts, equating to a journey time saving of an average of 47 seconds in the northbound direction and 31 seconds in the southbound direction.	Journey Time Benefits - £82.4m (Forecast - £83.4m)	As expected
	Reliability	Adjusted route stress has remained the same between the before scheme construction and post-scheme periods, however, unadjusted route stress is lower following scheme opening thus suggesting less day to day variability. Collisions numbers have decreased and therefore incident related variability will have also reduced. Journey times are consistent across all periods of the day.	-	As expected (beneficial)
	Wider Economic Impacts	The scheme has improved access to Kingmoor Park. There is no evidence to determine whether the scheme has led to any inward investment, particularly to Kingmoor Park.	-	As expected (neutral)
Accessibility	**Option Values**	The scheme has not led to any change in public transport services. The APR has however provide a safer route for cyclists compared to the A74 and joins to National Cycle Route 7 and 10.	-	As expected (slight beneficial)
	Severance	There has been some change to severance with the removal of direct access points along the A74 providing a safer means of access to the M6 for motorised users. The provision of the APR also provides a safer route for NMU's, cyclists in particular, travelling between Carlisle and Gretna.	-	Better than expected (slight beneficial)
	Access to the transport system	There has been no change in access to the transport system as a result of the scheme.	-	As expected (neutral)
Integration	**Transport Interchange**	There have been no additional public transport services on the upgraded A74/M6 or APR.	-	As expected (neutral)
	Land Use Policy and Other Government Policies	The scheme has had a beneficial impact on land use policy and other government policies.	-	As expected (beneficial)

8. Conclusions

8.1 To conclude this report, this section summarises how the scheme is meeting its specified objectives.

Scheme Specific Objectives

8.2 Table presents an evaluation of the scheme's objectives using the evidence presented in this study.

Table 8.1 - Success against Scheme Objectives

Objective	Has the scheme objective been achieved?	
Reduce the number of collisions on the route	• There has been an annual saving of 7.3 collisions within the COBA modelled area since scheme opening. • On the M6 J44 – 45 and APR, annual collisions have reduced by 2.7 collisions in the post-opening period.	✓
Provide more carriageway space for emergency services attending collisions	• The scheme has upgraded the A74 to motorway standard which has included the provision of an extra lane.	✓
Provide more carriageway space to enable traffic flows to be maintained following a collision	• The scheme has upgraded the A74 dual carriageway to a three lane motorway. • Journey times have improved since scheme opening and are consistent across all periods of the day at FYA. • The APR and additional lanes on the M6 can be used for incident management.	✓
Reduce driver frustration	• With average traffic speeds unchanged and increased average speeds along the M6, driver stress caused by traffic conditions is expected to have reduced. • Provision of new signage on the M6 and APR reduces driver stress due to route uncertainty.	✓
Improve accessibility for users	• There has been no improvement to severance since scheme opening. • The APR provides a more attractive and safer route for NMUs compared to the old A74. • The scheme was not expected to change access to the transport system and evaluation at FYA can confirm that there have been no changes.	✓
Make journey times more predictable	• Journey times have improved since scheme opening and are consistent across the AM peak, Interpeak and PM peak. • Collision numbers have reduced and therefore delays caused by collisions are likely to have decreased.	✓

9. Appendices

Appendix A: Glossary

Terms	Definition
AADT	**Annual Average Daily Traffic**. Average of 24 hour flows, seven days a week, for all days within a year.
Accessibility	Accessibility can be defined as 'ease of reaching'. The accessibility objective is concerned with increasing the ability with which people in different locations, and with differing availability of transport, can reach different types of facility.
ADT	**Average Daily Traffic**. Average daily flows across a given period.
AONB	**Area of Outstanding Natural Beauty**
APR	**All Purpose Route**
AST	**Appraisal Summary Table**. This records the impacts of the scheme according to the Government's five key objects for transport, as defined in DfT guidance contained on its Transport Analysis Guidance web pages, WebTAG.
ATC	**Automatic Traffic Count**
AAWT	**Annual Average Weekday Traffic**. As AADT but for five days (Monday to Friday) only.
AWT	**Average Weekday Traffic**. As ADT but for five days (Monday to Friday) only.
BCR	**Benefit Cost Ratio**. This is the ratio of benefits to costs when both are expressed in terms of present value i.e. PVB divided by PVC.
CCC	**Cumbria County Council**
cSAC	**Candidate Special Area of Conservation**
CEMP	**Construction Environment Management Plan**
COBA	**Cost Benefit Analysis**. A computer program which compares the costs of providing road schemes with the benefits derived by road users (in terms of time, vehicle operating costs and collisions), and expresses the results in terms of a monetary valuation. The COBA model uses the fixed trip matrix unless it is being used in Collision-only mode.
CWS	**Country Wildlife Site**
DfT	**Department for Transport**
Discount Rate	The percentage rate applied to cash flows to enable comparisons to be made between payments made at different times. The rate quantifies the extent to which a sum of money is worth more to the Government today than the same amount in a year's time.
Discounting	Discounting is a technique used to compare costs and benefits that occur in different time periods and is the process of adjusting future cash flows to their present values to reflect the time value of money, e.g. £1 worth of benefits now is worth more than £1 in the future. A standard base year needs to be used which is 2002 for the appraisal used in this report.
DM	**Do Minimum**. In scheme modelling, this is the scenario which comprises the existing road network plus improvement schemes that have already been committed.
DS	**Do Something**. In scheme modelling, this is the scenario detailing the planned scheme plus improvement schemes that have already been committed.
EA	**Environment Agency**
EAR	**Economic Assessment Report**
ES	**Environmental Statement**
EST	**Evaluation Summary Table**. In POPE studies, this is a summary of the evaluations of the TAG objectives using a similar format to the forecasts in the AST.
FYA	**Five Year After**
HA	**Highways Agency**. An Executive Agency of the DfT, responsible for operating, maintaining and improving the strategic road network in England. As of April 2015 this has

Terms	Definition
	been replaced by Highways England.
HEMP	**Handover Environmental Management Plan**
HGV	**Heavy Goods Vehicle**
Highways England	As of April 2015, responsible for operating, maintaining and improving the strategic road network in England.
KSI	**Killed or Seriously Injured**. KSI is the proportion of casualties who are killed or seriously injured and is used as a measure of collision severity.
LEAP	**Landscape and Ecology Aftercare Plan**
LNS	**Low Noise Surfacing**
LMP	**Landscape Management Plan**
MAC	**Managing Area Contractor** Organisation normally contracted in 5-year terms for undertaking the management of the road network within a Highways England area.
MVKM	**Million Vehicle Kilometres**
NATA	**New Approach to Appraisal**. The basis of the standard DfT appraisal approach when this scheme was appraised. This is now referred to as the DfT's objectives for transport.
NMU	**Non-Motorised User**. A generic term covering pedestrians, cyclists and equestrians.
NRTF	**National Road Traffic Forecasts**. This document defines the latest forecasts produced by the Department of the Environment, Transport and the Regions of the growth in the volume of motor traffic. At the time this scheme was appraised, the most recent one was NRTF97, i.e. dating from 1997.
NTM	**National Transport Model**
NTS	**Non-Technical Summary**
OYA	**One Year After**
PIC	**Personal Injury Collisions**
POPE	**Post Opening Project Evaluation**. The before and after monitoring of all major highway schemes in England.
Present Value	**Present Value**. The value today of an amount of money in the future. In cost benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.
PROW	**Public Right of Way**
PVB	**Present Value Benefits**. Value of a stream of benefits accruing over the appraisal period of a scheme expressed in the value of a present value.
PVC	**Present Value Costs**. As for PVB but for a stream of costs associated with a project
QUADRO	**Queues and Delays at Roadworks**. A software program for calculating the monetary impacts of delays at roadworks.
SPA	**Special Protection Area**
SSSI	**Site of Special Scientific Interest**
TEE	**Transport Economic Efficiency**
TEMPRO	**Trip End Model Program**. This program provides access to the DfT's national Trip End Model projections of growth in travel demand, and the underlying car ownership and planning data projections.
TIS	**Traffic Impact Study**
TRADS	**Traffic Flow Data System**. Database holding information on traffic flows at sites on the strategic network.
UK	**United Kingdom**
VMS	**Variable Message Sign**
webTAG	DfT's website for guidance on the conduct of transport studies at http://www.webtag.org.uk/

Appendix B: Tables and Figures Listed in this report

Appendix C: COBA Area Collisions

Figure 9.1 Collisions in the COBA modelled Area before scheme opening

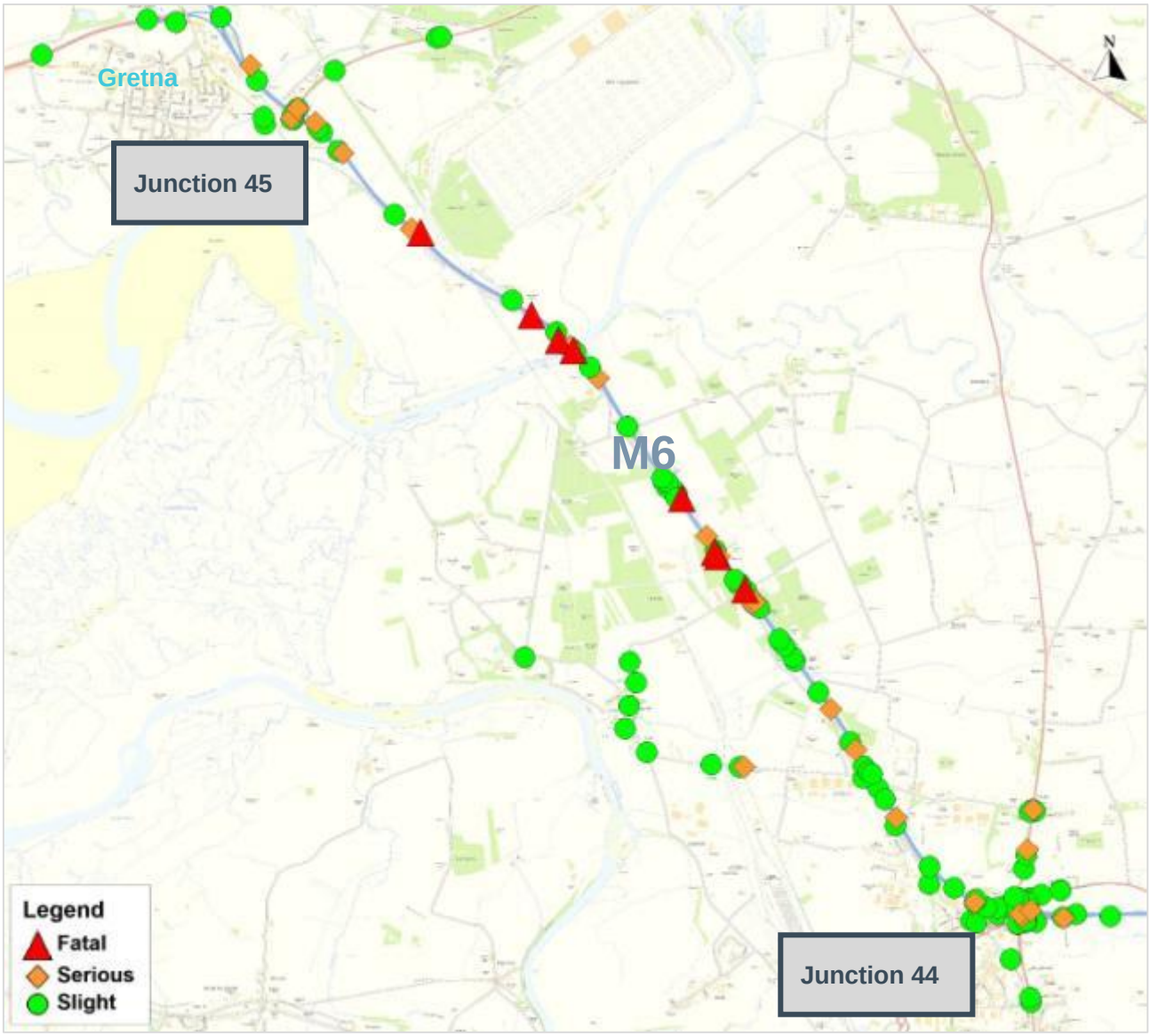
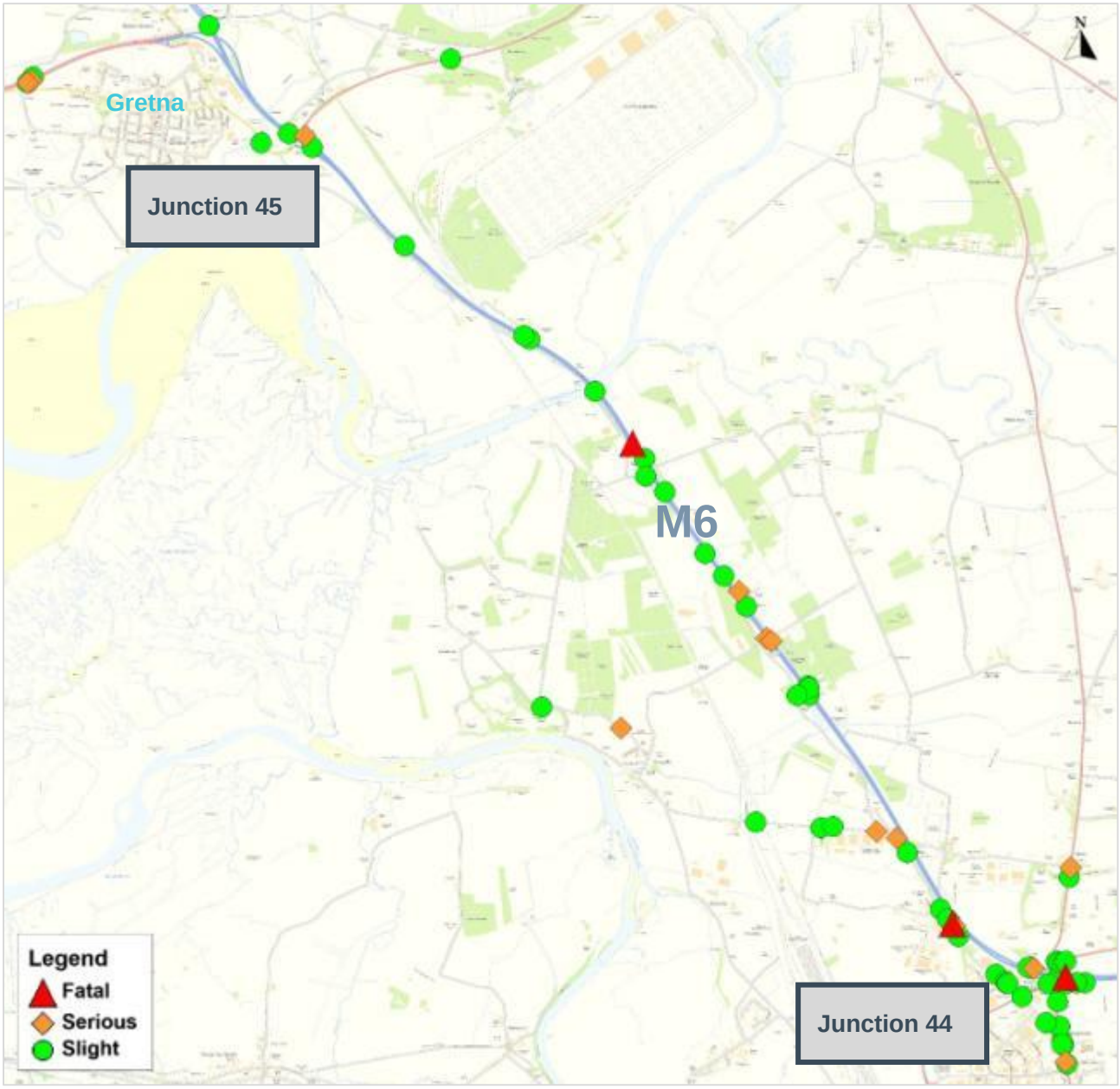


Figure 9.2 Collisions in the COBA modelled Area after scheme opening



Appendix D: Environment Information Requested

Table 9.1 Record of environmental background information requested and received

Requested Information	Response
Environmental Statement	M6 Extension – Carlisle to Guards Mill Environmental Statement February 2005 including main text, appendices, figures and non-technical summary
AST	AST version produced for the PI September 2005
Any amendments/ updates/addendums etc to the ES or any further studies or reports relevant to environmental issues. Have there been any significant changes to the Scheme since the ES.	No major amendments or changes.
'As Built' drawings for landscape, ecological mitigation measures, drainage, fencing, earthworks etc. Preferably electronically or on CD.	Provided
Copies of the H&S File, Construction Environment Management Plan Landscape/Ecology Management Plan, Handover Environmental Management Plans	CEMP Rev 6 May 2008 LEAP October 2009; LEAP May 2014; HEMP October 2009; HEMP October 2014 draft; H&S File Issue 2 Public Inquiry Report, HA Statement of Case June 2005
Contact names for consultation	Provided by Highways England, Cumbria CC and sourced by POPE team
Archaeology - were there any finds etc. Have any Archaeological reports been written either popular or academic and if so are these available?	No finds. Archaeological evaluation report written but not available to POPE at time of writing. Cottage at Bents Farm, Archaeological Building Investigation July 2007 Watching Brief Report Sept 2006 to April 2007 Palaeoenvironmental Assessment Unpublished Report 2007
Have any properties been eligible for noise insulation?	No properties eligible for noise insulation Noise figures recalculated for two properties March 2009
Has any post opening survey or monitoring been carried out e.g. for ecology/biodiversity or water quality and if so would copies of the reports be available?	Ecological Monitoring Report 2010 Ecological Monitoring Report 2013 Ecological Monitoring Summary Report 2014
Animal Mortality Data	Provided by the MAC
Copy of post opening Non-motorised User Survey	NMU Post-Construction Audit September 2008
Any publicity material	Sourced from Highways England webpage
Information may be available regarding environmental enhancements to streetscape/townscape for bypassed settlements	Minor changes at Todhills identified on As Built drawings
Employer's Requirement works Information for environment	Provided

Appendix E: Record of Scheme Including ES Photomontages before and FYA comparisons

Figure 9.3 Before view from dismantled railway on edge of Gretna, looking east

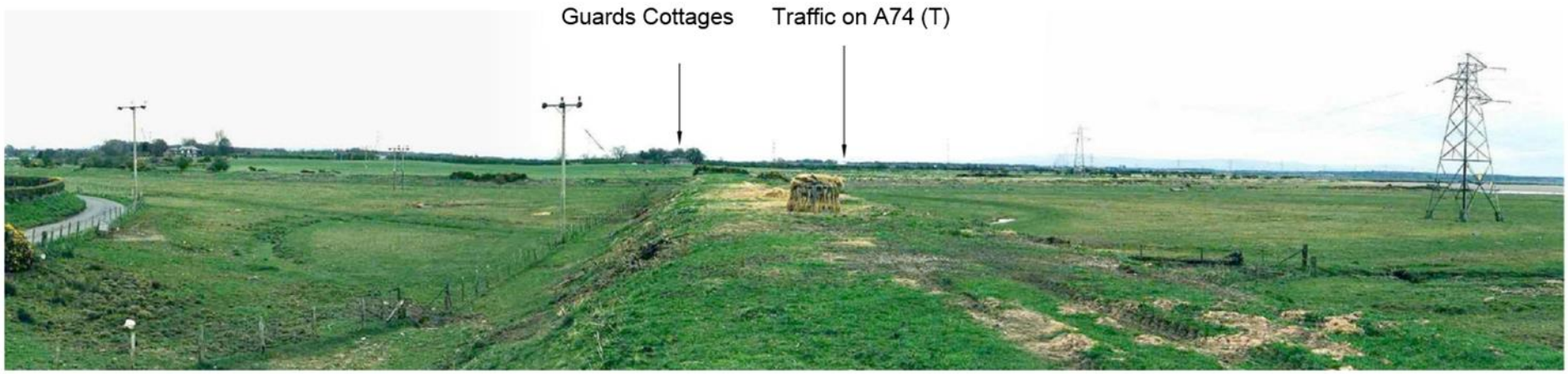


Figure 9.4 OYA distant view from southern edge of Gretna looking eastwards toward the M6

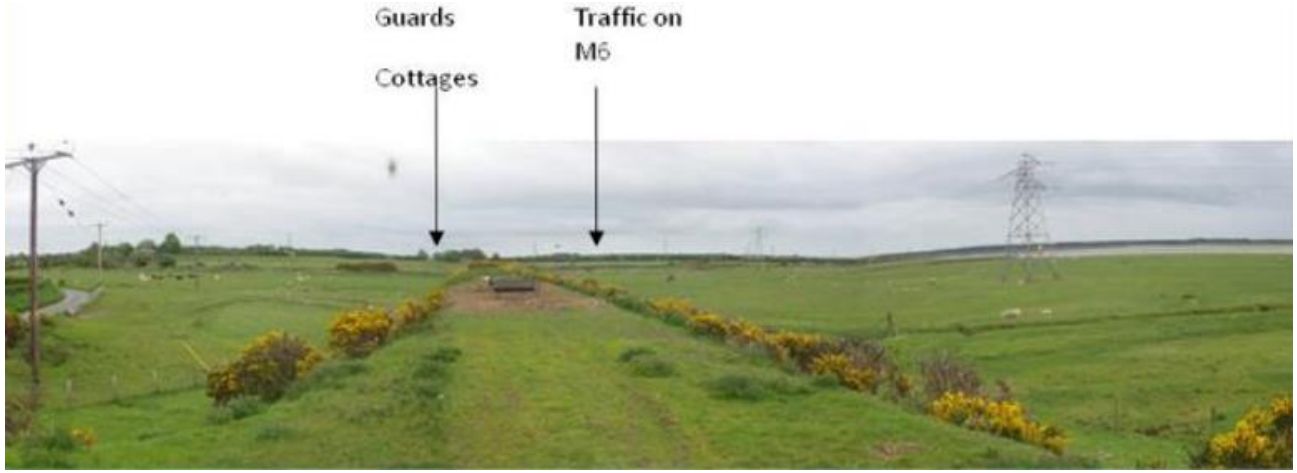


Figure 9.5 FYA distant view from southern edge of Gretna looking eastwards toward the M6

Figure 9.6 Before view from access off the A74 (T) looking north-westwards toward Gretna

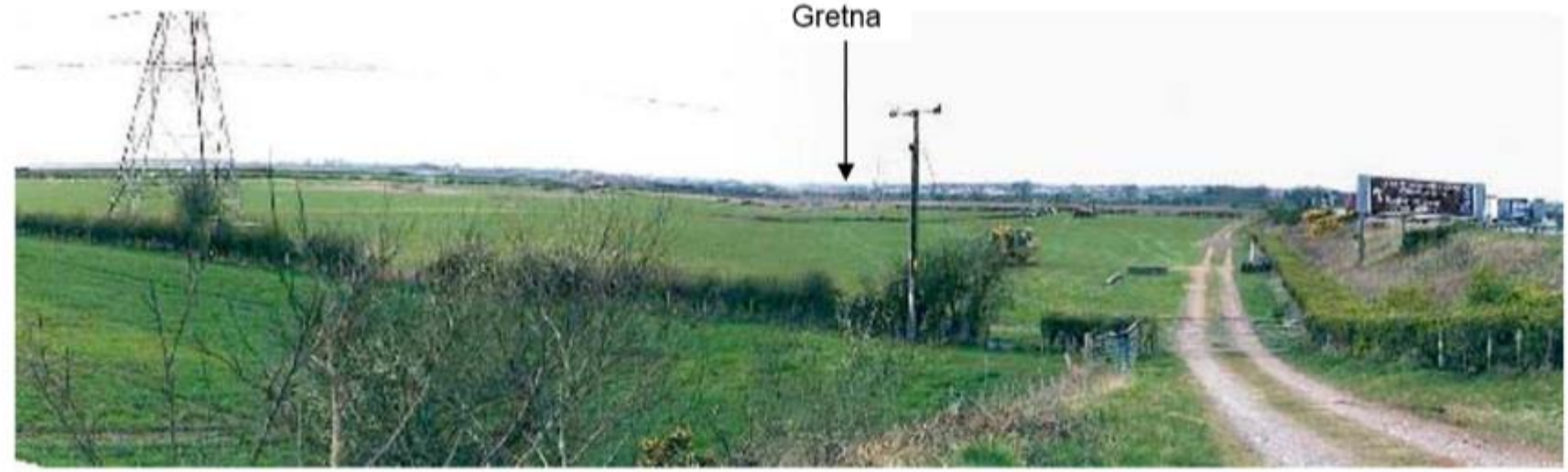


Figure 9.7 OYA view along the new APR with the motorway embankment on right

Figure 9.8 FYA view from the APR looking north-westwards toward Gretna

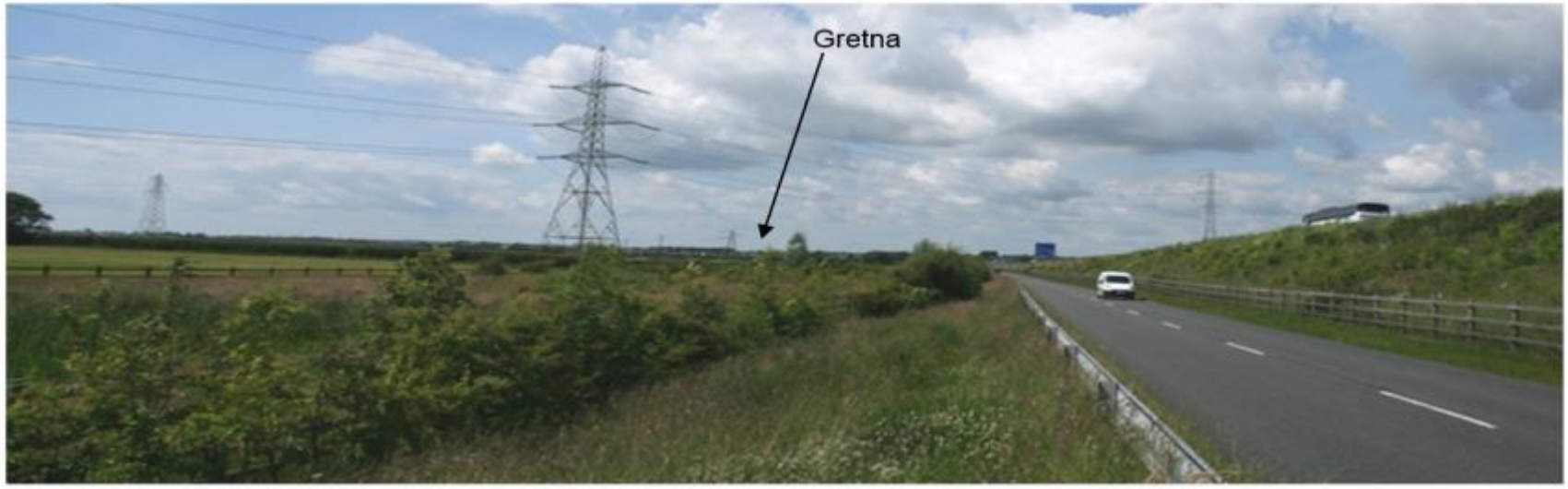


Figure 9.9 Before view from Mossband Viaduct looking south-east

Figure 9.10 OYA view from the APR. Mossband Hall Cottages demolished as part of the scheme

Figure 9.11 FYA view from the APR. Mossband Hall looks onto the vegetated embankment. Mossband Hall Cottage was demolished as part of the original scheme

Figure 9.12 Before view from Cumbria Coastal Way looking west onto the A74 (T)

Figure 9.13 OYA view to the River Esk Bridge carrying southbound traffic

Figure 9.14 FYA view to the River Esk Bridge carrying southbound traffic

Appendix F: Record of Scheme Including OYA and FYA periods

Figure 9.16 OYA and FYA view along the road at Metal Bridge looking north-west

OYA

FYA

Figure 9.15 OYA and FYA view from Floriston Bridge looking north-west

OYA

FYA

Figure 9.18 OYA and FYA view along Todhills looking south-east

OYA

FYA

Existing planting has established and separates the local road from the motorway

Figure 9.17 OYA and FYA view from Todhills Bridge looking north-west

OYA

FYA

New environmental barrier provides screening for Todhills

Figure 9.19 OYA and FYA view from Todhills Bridge looking south-east

OYA

FYA

There is improved access to Service Area.
The APR is separated from the motorway by planting and earth mounds.

Figure 9.20 OYA and FYA view from Harker Bridge looking north-east

OYA

FYA

There is a new VOSA site and retained vegetation helps to integrate the motorway.

Figure 9.22 OYA and FYA view from Harker Bridge looking south-east

Figure 9.21 OYA and FYA acoustic barrier at Mossband

Retained vegetation provides screening of traffic on the motorway.

Figure 9.24 OYA and FYA view from Harker Bridge looking south-east

OYA

New acoustic barrier, retained trees and new planting to left on local road at Todhills.

FYA

Acoustic barrier at FYA and another example of poor planting establishments.

Figure 9.23 OYA and FYA view from Harker Bridge looking south-east

OYA

View south along APR with M6 to left or environmental barrier and Hespin Wood to the right.

FYA

View south from the APR to left of environmental barrier. Vegetation has established well and acts as screening.

Figure 9.25 OYA and FYA bird boxes

OYA

Bird boxes attached to environmental barrier at Todhills

FYA

Bird boxes attached to environmental barrier and screening plating

Figure 9.26 Before view from Parkhouse Road looking north-east

Figure 9.27 FYA views from Parkhouse Road similar to before the Scheme, area of road space has increased as expected

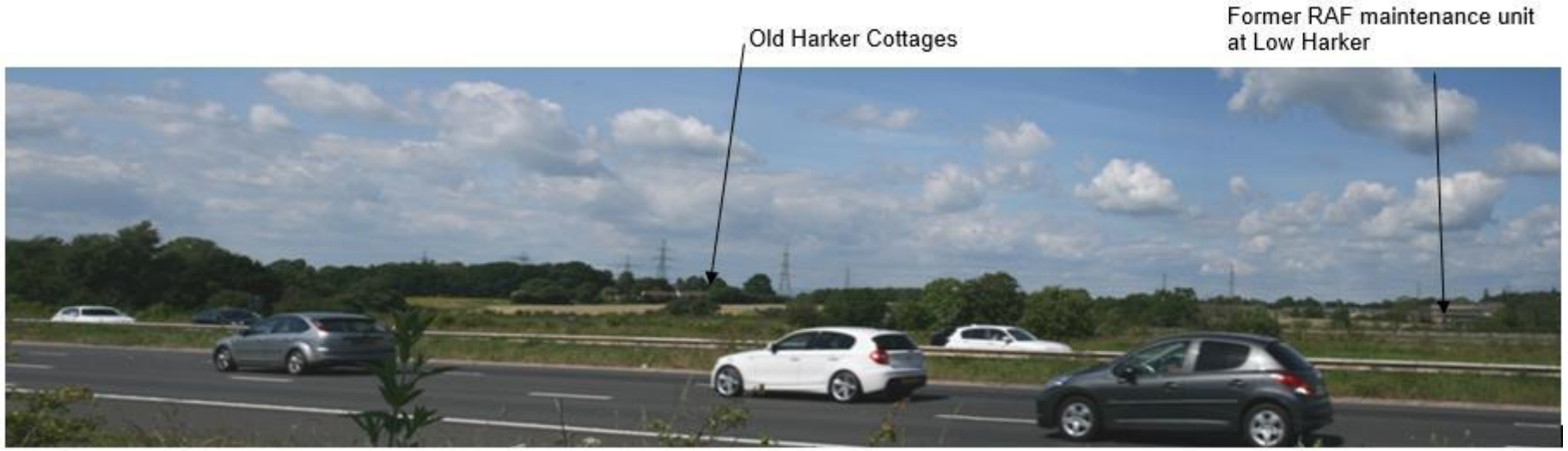


Figure 9.28 Before vew from bridleway near Grearshill looking north-west

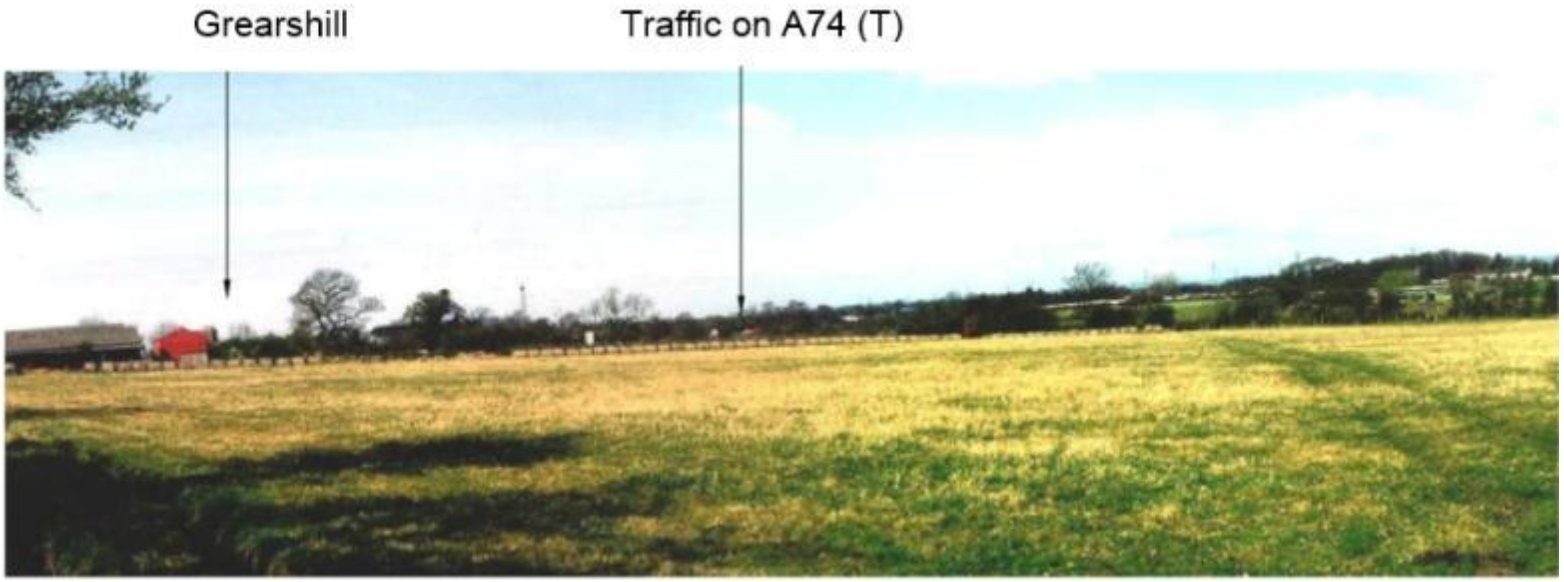


Figure 9.29 FYA - Existing vegetation helps integrate the M6 into the local landscape and views remain similar

Appendix G: Predicted Impacts, mitigation and evaluation for landscape sub-objective

	Effects on Landscape	Proposed Mitigation	Evaluation at OYA	Evaluation at FYA
Landscape character and quality	Loss of woodland, roadside planting, individual trees and lengths of hedgerow (7.3ha planting, 4155m hedgerow)	• Retain existing vegetation where possible. • New planting to create screen belts, woodland blocks and copses, hedgerows and scattered tree groups. Some 85,000 trees and shrubs proposed. • Possible offsite planting by agreement	• Existing vegetation has generally been retained as expected and new planting has been provided. The HA 'Story of Construction' newsletter indicates that 120,000 native species trees and shrubs have been planted. Plants appear to be establishing satisfactorily and subject to ongoing successful establishment should integrate the road into the local landscape and help screen traffic from nearby properties. • Offsite planting was not required.	• The rate of plant establishment varies between plots and most are considered successful and provide good screening for motorists and other receptors, but some are less well established. One of the unsuccessful examples is the new VOSA site, shrub planting to the north of the site was sparse and the height of the shrubs was not as well established as intended to act as screening for motorists on the M6 (see Figure 5.5) . • Overall, vegetation establishment across the scheme is considered likely as expected.
	Disruption to topography due to new road and bridge embankments and cuttings	• Planting to soften earthworks. New Esk bridge design kept low profile similar to existing bridge but would be 1m higher. • Area identified for permanent disposal of surplus excavated material visually enclosed therefore change in level would not be significant in the wider landscape.	• New planting will in time soften earthworks as expected. • The new Esk bridge has been designed with a low profile and blends well with the existing bridge. • It is understood that surplus material was deposited in a field near the West Coast Mainline Railway where embankments visually obscure the raised ground. This was not visited for POPE as the information was not available at the time of the site visit and will be viewed at FYA.	• With reference to the LMP, new planting has consisted of grass, shrub, native hedgerows, and trees which have helped to integrate the new Esk bridge to the river bank; overall the bridge blends in well with the surrounding. • Evidence of false cuttings and mounds along the motorway verges indicate that surplus material was deposited in various locations to soften the landscape and act as visual screening. • It was not possible to access the specific field where surplus soil was identified to be deposited
	Disruption to the field pattern and removal of field boundaries;	• New hedgerows planted along APR to link into existing field boundaries and remnant corners of fields planted to provide small copses.	• Planting of hedgerows and field corners planted as expected.	• Most planted hedgerows have established successfully and now act as field boundaries and habitat corridors for small mammals, which is as expected.
	Decrease in tranquillity as activity encroaches into rural areas;	• Replacement planting and acoustic barriers would in time reduce any impacts on local tranquillity	• The scheme is generally on line widening although the APR does move local traffic further from the mainline corridor although not materially nearer to the defined Tranquil Areas 2km away.	• The impact on tranquillity is as expected.
	Effect on the setting of the Solway Coast AONB;	• The new River Esk bridge would be further from edge AONB than existing bridge (400m) and designed to minimise impact on setting of AONB. • The new Mossband Bridge over the railway would be about 100m closer to edge of AONB than existing Viaduct but at 1.8km away impact would be barely discernable. • New VMS would add vertical elements but would be seen against existing pylons	• Effect considered as expected, changes to the road corridor are barely discernable from distant views as demonstrated in before and after views in ***Appendix D.*** • New VMS are not particularly evident from distant views and seen in the context of existing pylons.	• Effect considered as expected, changes to the road corridor are barely visible from distant views as demonstrated in before and after views in Appendix F: Record of Scheme Including OYA and FYA periods. • VMS are barely detectable from distant views are seen in the context of existing pylons.
	Effect on the setting of the Hadrian's Wall Military Zone World Heritage Site;	• Scheme would not be visible from Hadrian's Wall itself, no effect on the setting buffer zone. • New planting between the highway and the military buffer zone would in time help increase local tranquilly	• New planting has been provided as expected and subject to successful ongoing establishment this should help local tranquillity over time.	• The majority of new planting on the highway verges has established successfully; it provides sufficient and effective screening for the Hadrian's Wall World Heritage Site as well as enhancement on local tranquillity for the designation. Effect is considered as expected.

	Effects on Landscape	Proposed Mitigation	Evaluation at OYA	Evaluation at FYA
Visual impacts	Effect on the setting of listed buildings and historic features;	• New planting in vicinity of Floristonrigg House to protect its setting. Copse planted to reinstate former landscape feature. Linear planting along mainline would help screening	• The new copse has been planted between the APR and Floristonrigg House. Planting alongside the mainline has been provided but it would appear due to space restrictions and proximity to the carriageway this is limited to one row of plants.	• The copse planted between the APR and Floristonrigg House is slow to establish; during the site visit the planted vegetation (shrub and native trees) was sparse and with insufficient height at FYA to provide screening for the listed building. Planting alongside the verge between Floristorigg House and the mainline has been provided; however due to space restriction, the planting was limited to one row of shrub only, which does not provide sufficient screening or softening effect to the listed building, effect on listed building is likely to be worse than expected.
	Effect on local landscape designations;	• No impact on Area of Landscape Improvement, Defined Tranquil Areas, County Landscapes or Areas of Local Landscape Significance	• Considered to be as expected.	• Considered to be as expected.
	Weakening of landscape character and the effect on the distinctiveness and sense of place; effect on scenic quality Increase in the width of the roadscape; introduction of new “lines” into the landscape	• New landscape design would respect local landscape patterns and aim to reinforce existing areas of planting. • Buffer planting provided between the mainline and APR to provide visual separation. • New planting along the route to screen and integrate	• The area of roadscape has increased with the upgrading of the existing dual carriageway to motorway and the APR is visible from the M6 and vice versa. • Buffer planting has been provided and in time this will provide visual separation between the local and motorway traffic. • New planting along the route includes areas of woodland, wet woodland, shrubs, individual trees, scrub, hedgerows, small copses and species rich grassland	• Buffer planting between the motorway and APR has provided some visual separation between the local and motorway traffic, other than when the traffic is visible on Mossband Bridge and Esk Bridge. • At FYA the most predominant plant types are scrub, shrub and species rich grassland. The growth rate of those plants are generally shorter than trees and hence the reason they are the predominant plant types along the route.
	Loss of roadside planting which screens existing views of the A74; Increased width of the transport corridor with increased number of lanes; Reduction in distance between viewpoints and new carriageway increasing visual impact;	• Retain existing vegetation where possible. • New planting proposed to integrate Scheme into local landscape and mitigate effects of visual impact. • Environmental barriers provided at various locations (3m high) would provide immediate screening and improve on the existing situation e.g. at Metal Bridge and Todhills dominated by existing A74. • Moderate adverse in year one for Guards Cottages, Cumbria Coastal Way, Metal Bridge Inn and properties in Metal Bridge, Floristonrigg House, and 5 in Todhills, Travelodge at Todhills southbound service area, Lough Head , 5 properties in Harker Road End. • Significant adverse in year one for Mossband Hall Farmhouse, Wood View, the Telephone Exchange (not residential),	• Existing vegetation has been retained where possible. • New landscape planting has been provided which appears to be establishing satisfactorily and in time will help screen traffic on the motorway and APR. • 3m high environmental barriers have been provided and these give immediate visual screening from traffic for adjacent properties. Planting to soften the barriers is in place, although it will take some time to become effective. • Neither the Motorway or APR is lit – as expected. • The removal of some existing vegetation where necessary to construct the scheme and increase road space has opened up views to the motorway and associated signs; visual impacts are considered as expected. This should be reconsidered at FYA when new planting should be more mature and beginning to provide screening of traffic.	• Most landscape planting has appeared to establish satisfactorily and helped screen traffic on the motorway and the APR. • The environmental barriers appear to be in good condition and do provide immediate visual screening from traffic for adjacent properties. Landscape planting has also helped to integrate the barriers into their settings. Some local residents at Todhills have planted additional shrubs and climbers to soften the visual appearance of the environmental barriers adjacent to their properties (Figure 5.7). • During the FYA evaluation, visual impact to Guards Cottages, Cumbria Coastal Way, Metal Bridge Inn, properties in Metal Bridge, Floristonrigg House, and properties in Harker Road End are as expected in the ES. In general, planting does provide some screening to the properties. In design year the screening by planting to receptors mentioned above will be as expected. • Visual impact to Mossband Hall Farmhouse and Wood View is likely to be as expected; planting has provided limited visual screening but not enough to compensate for the increased visual impact. By design year, the visual impact may be lessened by further integration and softening by plant establishment.
	Intrusion caused by new structures, embankments and signage; Visual effects of motorway signage, acoustic barriers and antidazzle screens	• Would form new features in the landscape although some elements would be located within cuttings or near existing area of planting or built form reducing their impact. •	• As expected, the motorway and associated signage, barriers etc is more intrusive than the former A74, the road makes use of existing cutting and earthworks towards Carlisle which reduces any impacts, as does retained planting.	• Considered to be as expected.

	Effects on Landscape	Proposed Mitigation	Evaluation at OYA	Evaluation at FYA
	Intrusion from new VOSA facility	• VOSA site to be cut into hillside which would disrupt topography. VOSA site to be separated visually from existing service area and APR by earth mounding, new planting and drainage pond. Planting also proposed to integrate with existing Willows. Site would be lit	• It is understood that the location of the VOSA site was moved due to unsuitability of the ground conditions. Landscape planting will help soften the area in time, currently it is clearly visible from the motorway and APR. As expected, the site is lit which will impact locally, particularly as neither the motorway nor the APR is lit. The visual impact of the lighting does not appear to be specifically mentioned in the ES.	• As mentioned above, planting along the motorway verge of the VOSA site was considered to be less well established when compared to others, it has provided very little screening for motorists. Pond number 4A (balancing pond) and surrounding planting do separate the VOSA site and the existing service area, however visually the separation is not as anticipated (see Figure 5.5) , The services is visible from the VOSA site and vice versa. Visual impact from VOSA facility is likely to be worse than expected.

Appendix H: Predicted Impacts, mitigation and evaluation for biodiversity sub-objective

Aspect	Predicted Impact	Mitigation Measures	Evaluation at OYA	Evaluation at FYA
Designated Sites International	Upper Solway Flats and Marshes SSSI, cSAC, SPA and Ramsar Site - No direct impact River Eden SSSI and cSAC – no direct impact. Potential for sedimentation during construction or polluted runoff during operation.	Sedimentation and pollution control measures in place during construction and pollution control measures incorporated into scheme design. Neutral impact predicted	• No information has been made available which would indicate that any sedimentation has occurred. • Pollution control measures are provided as expected, including balancing ponds.	• Environment Agency has commented that no pollution incident in relation to sedimentation has occurred. Natural England had no comment regarding the scheme. • During the site visit it was noted that approximately 2 of the balancing ponds (pond 2 & 8) of this scheme are sedimented. The POPE is not aware that all balancing ponds are not preforming as intended.
Designated Sites County/ Regional	Rosetrees Moss County Wildlife Site – no impacts Rockcliffe Moss CWS – loss of 0 .32ha of moss (2%) Harker Moss CWS – loss of 0.19ha of moss (2%) Kingmoor Nature Reserve CWS / local nature reserve – no impacts	• Land take kept to minimum and area fenced to protect retained vegetation. Divert treated run off to Harker Moss (and to limited extent to Rockcliffe Moss) to help restore hydration. Place heather 'faggots' in drainage ditch to slow flow through Harker Moss. • 0.9ha wet woodland planted near Harker Moss to compensate for land lost	• Re-wetting of Harker Moss was not carried out at the request of the landowner. POPE has no other information relating to the mosses. • It is understood that cabling works by National Grid reduced the total area available for wet woodland at Harker Moss but other areas were identified and in total more than 0.9ha wet woodland has been provided as part of the scheme. Ecological Monitoring report results indicate that woodland blocks developing well although some new trees died and these should be replaced with further monitoring in 2013.	• New wet woodland planting was carried out at various suitable locations along the scheme to compensate for the loss of wet woodland at both Rockcliffe and Harker Mosses. Most of this planting was located adjacent to the reptile habitat creation site in Bell's Field. • With reference to the Ecological Monitoring Report 2013, the planting at Bell's Field appeared to struggle to develop but upon closer inspection it was concluded that due to grazing by livestock and/ or browsing by deer, growth above the confines of the tree guards had been prevented. With the slower than expected establishment rate, the report recommended for livestock to be removed from the field until the trees have had time to establish.
Designated sites Regional/ National	River Esk – risk of pollution as result of new bridge construction. Risk of pollution during operation and shadow of the new bridge would lead to permanent degradation of bank-side and in-channel habitats	• Environmentally sensitive approach to construction. River and bank-side environments expected to return to neutral impacts once construction complete	• POPE is not aware that any pollution has occurred. • It is understood that the new bridge was moved closer to the old bridge than originally intended and this has reduced the overall footprint of the works.	• POPE is not aware that any pollution has occurred.
Vegetation	Marshy ground adjacent to River Esk – loss of 6% area and possible effects on hydrology (drying out). Important hedgerows – loss of 90lin m from two hedges (60% of each hedge). Marsh, heath and scrub near railway adjacent to areas earmarked for soil storage and reptile habitat area – unlikely to be long term impacts Species rich verges – loss of some to construction. Small areas marshy grassland – loss 6% area to the scheme.	• Land take kept to the minimum. Orchid colonies translocated to retained grassland and topsoil stored separately for relocating to verges nearby. Compensation replacement wetland planting elsewhere within scheme. • Lengths to be lost translocated to form part of new APR hedges • Fenced off during construction and drainage during operation managed to avoid sediment laden run-off onto this area • Translocate rare plants e.g. orchids and soil for use on new verges. Protect retained verges during construction. Establish new species rich areas and manage existing verges as part of scheme.	• It would appear that soil translocation has taken place generally as expected and locations are identified on landscape plans. Species rich grass mixes have been incorporated into the scheme and locations are identified on landscape plans. It is too soon to evaluate establishment and it is suggested this is considered at FYA. • It is understood that overall less wetland habitat was lost to the scheme than expected. New wetland habitat has only been possible at three of the balancing ponds due to changes in design and land take – overall it is understood there has been a net gain in wetland. • It is understood that hedge translocation was undertaken. Post construction monitoring 2009 indicates that 90% of the hedge is successfully established. 9 large coppiced stools have died and the Ecological Report recommended replanting with large trees to fill the gaps and further monitoring in 2013. • Post-construction botanical monitoring of habitat translocation (important hedgerows and valuable grasslands) and to monitor establishment of habitat creation (wetland habitat and wet woodland) is proposed in the Monitoring Report and Future Proposals report.	• Observations from the site visit found species rich grasslands and wild flowers across all balancing ponds and many wild flowers have established. It is understood that hedge translocation was undertaken. • According to the latest ecological surveys in 2013, it was noticed that several Orchid colonies translocation were successful. Some were found adjacent to ponds and on the APR verges. Approximately 15% of the original translocated coppice stools have died between 2009 and 2013, the remaining trees and shrubs were generally in good health, many with significant growth. Sixty-one of the remaining seventy-two trees and shrub were flowering and/ or had produced seed/ fruit, indicating that the surviving translocated plants were thriving. Loss of large trees has led to gaps in the hedgerow. As a result some of the gaps have been filled by surviving plants, or additional new species (mainly willow species). Additional planting has been recommended to ensure a continuous feature is maintained. Weed growth should be managed at regular intervals to control weed's growth rate. • In comparison to the ecological monitoring reports of 2009 and 2013, Pond A had the most successful establishment rate. Submerged species appeared to be less abundant across all ponds; however, surveying submerged species had limitations so it is possible that they have been overlooked. • The 2013 Ecological Monitoring Report noted that several of the ponds had significant weed growth within the area. Pond 4 had Japanese Knotweed at the entrance; Pond 8 had dock, nettle and soft rushes; Pond 9 was heavily affected by weed so much so that the outer 3m of the pond and remaining area were treated with chemical herbicide and now the weeds have

Aspect	Predicted Impact	Mitigation Measures	Evaluation at OYA	Evaluation at FYA
				returned. Overall, this is likely to be worse than expected as the ES.
Watercourses	Rockcliffe Beck and Crindledyke Beck tributaries to river Eden – potential for polluted discharge to enter watercourses	• Temporary and then permanent balancing ponds created to attenuate flow and control pollution. • Long term ponds should result in improved water quality in the becks as previously A74 discharge was uncontrolled.	• Balancing ponds have been provided as expected and should result in improved water quality in the becks.	Balancing ponds 2 & 4a were designed to control the pollution discharge from the motorway and prevent contamination reaching both Rockcliffe Beck and Crindledyke Beck. During the site visit it was noted that the balancing ponds had medium to large water bodies (as illustrated in Figure 5.8, Figure 5.14 & Figure 5.15). Wet land habitats including reed beds occupied the majority of the balancing ponds and could contribute to improving water quality in the becks, which is as expected in the ES.
Fungi	Fungal assemblage of local importance in Rockcliffe Moss – small scale loss of area, possible effect on hydrology, possible elevated levels exhaust fumes during operation	• Land take kept to minimum and retained areas fenced off. • New wetland planting with deadwood areas would compensate for loss. • New reptile habitat scrub area would buffer fungi from exhaust fumes during operation.	• No specific information available to POPE which would enable evaluation.	No specific information available to POPE which would enable evaluation.
Terrestrial Invertebrates	Rockcliffe Moss and Harker Moss CWSs and land at the WRG Waste Services Ltd landfill site – land lost to the Scheme and potential hydrological effects	• Land take kept to a minimum and protective fencing to protect retained areas. • It would be expected that in time invertebrates would colonise the replacement wet woodland and species rich grassland habitats.	• No specific information has been made available relating to invertebrates but is likely that they will colonise new habitats.	Considered to be as expected
Aquatic macro-invertebrates	Rockcliffe Beck and Crindledyke Beck – some detrimental effect upon the aquatic macro-invertebrate assemblage of these watercourses due to potential for increased sediment and pollution during the construction. Potential for pollution during operation	• Temporary and then permanent balancing ponds created to attenuate flow and control pollution. • Long term ponds should result in improved water quality in the becks as previously A74 discharge was uncontrolled.	• Balancing ponds provided. The CEMP includes a commitment to monitor changes in aquatic macro-invertebrates which gives an indication of pollution and sediment levels within a water course and therefore an index of water quality. • Post construction monitoring 2009 results indicate that water quality at the survey locations is unaffected and the scheme does not appear to have been detrimental. Some sites showed a marginal improvement in water quality.	No aquatic macro-invertebrate monitoring was undertaken between OYA and FYA.
Fish	River Esk crossing could impact on migratory salmonids, including Atlantic salmon and sea trout as well as migratory river and sea lamprey through temporary sedimentation, noise and vibration, lighting. Potential for polluted run-off during operation	• Site specific methodology to protect river during construction developed. • No long term impacts on water quality or river flows. • Balancing ponds provided to control attenuation and polluted run-off.	• Specific methodologies were agreed with interested parties during construction and no information has been made available that would indicate any long term impacts. • Balancing ponds have been provided. It is understood in-channel works took place in winter rather than summer and this was preferable for fish.	As part of the ES specific methodologies were agreed with interested parties during construction and no information has been made available that would indicate any long term impact. Balancing ponds have been provided. No information was available to indicate impact on water quality that affects River Esk.

Aspect	Predicted Impact	Mitigation Measures	Evaluation at OYA	Evaluation at FYA
Birds	Wildfowl and waders – disturbance as a result construction activities and potential to be affected by pollutants entering River Esk Breeding birds – loss of habitat Barn owls – temporary loss of foraging areas and barn owl mortality expected to be similar during operation of road to existing A74. Expected to be reduction in owl mortality	• New habitats created across the site would in time be suitable for use by breeding birds • Mitigation by alignment of new planting, modifying retained planting and vegetation management, to reduce incidences when barn owls foraging or commuting along the verges would be at risk. At regular crossing points attempts to dissuade owls crossing carriageways by creating foraging strips and possibly owl perching posts. • Environmentally sensitive methods during construction to minimise disturbance. New balancing ponds to control run-off would improve quality of water entering river.	• The ecological Monitoring Report and Future Proposals report notes that observations of numbers of birds using the areas close to the scheme indicated that the works had not prevented the birds from using their regular feeding sites. Foraging behaviour of pink-footed geese has been monitored in 2009/10 and the results indicate that the scheme has not impacted on this species which is one of the qualifying features of the Upper Solway Flats and Marshes SPA and Ramsar site. • The POPE site visit noted bird boxes have been provided on the environmental barrier at Todhills (Figure 6.5). Nest box monitoring of three species of Tit indicated that the scheme had not impacted on these species. • New landscape planting will in time provide suitable habitat for breeding birds. Safe foraging corridors have been provided for barn owls and maintenance of these is noted in the LEAP. • MAC wildlife roadkill records indicate 1 swan death on the M6 in 2010 (none were recorded on the A74 between 2002 and 2008). No barn owl deaths have been reported/recorded.	• The POPE site visit noted bird boxes have been provided on the acoustic barrier at Todhills. • New landscape planting and balancing ponds have provided suitable habitats for breeding birds. Safe foraging corridors have been provided for barn owls and maintenance of these was noted in the LEAP. • MAC wildlife mortality records indicated there were 4 swan deaths on the M6 scheme area (Junction 44 to 45) between 2009 and 2012, all of the deaths were by Mossband. There were 3 barn owl deaths between 2009 and 2012. The impact on birds is as expected.
Bats	Loss of potential roosts – 4 trees, Mossband viaduct and Mossband Hall cottages. No significant impact on foraging or commuting routes as on-line widening Mortality due to operational traffic likely to be similar to existing A74.	• Loss of potential roosts compensated for by erecting bat boxes in suitable retained habitat. • Loss of foraging habitat compensated for by environmentally sensitive landscape planting to divert bats away from the new motorway mainline.	• The Ecological Monitoring Report and Future Proposals Report notes that a bat roost will be provided as mitigation for loss of a roosting suite at Mossband viaduct with monitoring a condition of the bat licence. At the time of writing it is not known to POPE whether the roost was provided.	• Bats were not included in the 2013 Ecological Monitoring Report.
Otters/ Water Voles	Otter – potential for habitat degradation to affect foraging resources. Animal mortality due to operational traffic likely to be similar to existing A74. Water voles – no signs of activity recorded within scheme corridor or along watercourses in the vicinity of the scheme although suitable habitat existed.	• Otter resistant fencing provided at each of the watercourse crossed by the scheme directing otters to various safe crossing points comprising existing crossing places and additional tunnels. Sensitive environmental works expected to preserve and enhance habitat. Several otter holts to be provided	• The ecological 'Monitoring Report and Future Proposals' report notes that throughout construction, otters moved freely under the River Esk bridge and within the areas of construction works suggesting that they were relatively unaffected by the works. Mammal tunnels (Fig 6.4) and otter proof fencing have been provided as expected. Post construction monitoring indicates that otters are using the majority of tunnels (6 out of 8, although one was provided as badger mitigation) and tunnels have been successful for this species. No further monitoring of the mammal crossing points is proposed. • POPE is not aware whether otter holts were provided.	• As per paragraph 5.82 there are no sufficient data to determine if the otter deaths on the APR were a result of the scheme.
Red Squirrel	Loss of interconnecting vegetation and 4060m^2 from Hespin Wood reduces vegetation corridors useful to squirrel.	• Prior to construction habitat occupied by red squirrels inspected and any dreys removed. • New planting would be designed to reintroduce planting links for squirrel and species chosen to favour red squirrel avoiding large seeded species which would favour grey squirrels. • New woodland planting at Harker Moss would benefit squirrels.	• Planting in form of hedgerows have been provided and in time it would be expected that these would form linkages between areas of suitable habitat for red squirrels	• In the LEMP, it was anticipated that the planted hedgerows created for the linkage between areas of habitat suitable for red squirrels will not require any routine maintenance for at least 10-15 years.

Aspect	Predicted Impact	Mitigation Measures	Evaluation at OYA	Evaluation at FYA
Badgers	No setts or significant habitat features important to badgers would be affected. Animal mortality expected to reduce as a result of proposed mitigation.	• Badger-resistant highway fencing would be installed along scheme length to divert badgers to safe crossings, including the retained farm underpass already use to the north of the Esk, both sides of Metal Bridge, the new Mossband Bridge and the side road over-bridges. • In places mammal tunnels would be installed to provide safe crossings for both badgers and otters (ledges would be provided in Rockcliffe culvert).	• Fencing and tunnels have been provided. The farm underpass was not retained but a mammal tunnel has been provided. The Ecological Monitoring report states that the success, or otherwise, of the crossings for badgers is difficult to assess since badger activity has decreased along the scheme since the surveys were first undertaken. The two badger setts adjacent to the scheme were only ever used on an ad-hoc basis and show no signs of having been used by badgers recently. The monitoring did not record any badgers using the tunnels. No further monitoring of the mammal crossing is proposed. • MAC animal wildlife roadkill records indicate 3 badger deaths on A74 (2 in 2003 and 2006 pre-construction) and one on M6 since 2008 (in 2009).	• Fencing and mammal tunnels have been provided. The farm underpass was not retained but a mammal tunnel has been provided instead. • The Ecological Monitoring report stated that the success, or otherwise, of the crossings for badgers is difficult to assess since badger activity had decreased along the scheme since the surveys were first undertaken. The two badger setts adjacent to the scheme were only ever used on an ad-hoc basis and show no signs of having been used by badgers recently. The monitoring did not record any badger using the tunnels. No further monitoring of the mammal crossing is proposed. • MAC animal wildlife mortality records indicated one badger death 2003 and 2006 (pre-construction) and one on M6 scheme area between 2009 and 2012 (1 in 2008). The animal mortality rate is similar before and after the scheme.
Reptiles/ Amphibians	Amphibians – some loss of habitat (not significantly valuable). Reptiles (adder and common lizard) – approximately 7ha good quality habitat lost (mostly verges).	• Creation of new ecology ponds would provide potentially new habitat features for amphibians. • Capture and relocation in advance of the works to one of three receptor sites (Mossband, Floristonrigg and adjacent Harker Moss). • Erection of exclusion fences. New habitats to be managed long term to ensure relocated populations are maintained and increase to disperse to colonise the new verges along the scheme. • Relocation sites would not be returned to agriculture.	• Three ecology ponds have been provided. Exclusion, capture and relocation was undertaken. Hibernacula for reptiles have been provided. The Ecological Monitoring report results indicate that ponds are establishing successfully. It was recommended that Bulrush should be removed from Pond A and that sheep should be excluded from access to Pond B. • The proposed receptor site at Floristonrigg was not used and a site in Matterdale Forest (Lake District) was used in agreement with the FC for relocation of 220 adders. It is understood that the landowner objected to CPO for a reptile receptor site on his land. The Ecological Monitoring report results indicates adders have survived and bred, with further monitoring to be carried out in 2010. • Common lizards (280) have been relocated to adjacent areas or other suitable habitats. The Ecological Monitoring Report and Future Proposals report suggests monitoring populations post-construction combined with surveys to monitor colonisation of the new road verges. • Considerably more reptiles were discovered on site and habitat enhancement works to take place at the Caird Environmental site, with a benefit due to habitat improvement.	• The Ecological Monitoring Summary Report 2008- 2013, reported a total of 106 adders were translocated to Matterdale Forest. Four hibernacular were constructed within the receptor sites. After the latest surveys in 2010, no adders were recorded, however it was believed that this was due to the complexity of the habitat and the terrain. A number of additional areas of plantation were clear-felled adjacent to the release site significantly increasing the amount of habitat suitable for adders. A vast expanse of habitat suitable for adders 360° around the release site in Matterdale Forest and extend across a wide area in all directions. Some of the newly clear-felled areas offered more suitable habitat for the adder population than the overgrowing release site. The newly clear-felled areas offered abundant hibernation sites and basking areas as well as optimal foraging habitat and it is therefore highly likely that the adders had dispersed in those areas. It is anticipated that effect to reptiles is as expected.
Deer	Scheme expected to have limited impact on deer populations.	• No mitigation required	• MAC wildlife roadkill records indicate 4 deer deaths on A74 (2002, 2003, 2006 and 2008) and one on M6 since 2008 (in 2010).	• MAC wildlife animal mortality records indicated 5 deer deaths on the M6 scheme area between 2009 and 2012.