Post Opening Project Evaluation

A23 Handcross to Warninglid One Year After Study

March 2017

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Executive Summary

Scheme Description

The A23 Handcross to Warninglid Widening scheme was a major Highways England project in West Sussex which opened to traffic in October 2014. The purpose of the scheme was to upgrade a 2.4 mile (3.8km) section of the A23 from a dual two lane to a dual three lane carriageway to remove a bottleneck on the strategic road network. All direct private accesses to the A23 along the section were closed, with a local access road provided for access to local residential and commercial properties. Junctions at Handcross and Warninglid were upgraded, and Slaugham junction in the middle of the scheme was closed. The scheme provided a footway and cycleway between Handcross and Warninglid, including a new subway to link existing footpaths on either side of the A23.

Scheme Objectives

Objectives (Client Scheme Requirements 2011)	Objective Achieved?
Provide increased capacity by removing the existing bottleneck on the strategic M23/ A23 route between London and Brighton with associated peak hour delays.	✓
Provide improved journey times and increased safety.	✓
Improve safety for residents and operators by removing all direct private and commercial accesses to A23.	✓
Reduce congestion and improve journey time reliability along the A23 and improve existing junctions at Handcross and Warninglid.	✓
Reduce congestion and improve journey time reliability to and from Gatwick Airport, to and from the key infrastructure element of the Gatwick Diamond economic growth area, and the major new housing allocations in Mid-Sussex, Crawley and Horsham.	✓
Provide improved routes for pedestrians, equestrians and cyclists, and improved junctions at Handcross and Warninglid, thereby improving safety.	✓
Minimise environmental impact and seek opportunities for enhancement taking account of value for money.	✓
Minimise land acquisition, particularly of National Trust land. Minimise effect on Ancient Woodland.	✓

Key Findings

- Average journey times along the A23 corridor have reduced (although not to the level forecast), and an improvement in journey time reliability is seen as a result of reduced congestion.
- Post opening, average weekday traffic flows have increased by 9% along the scheme section, with evidence of reduced traffic on more minor alternative routes.
- Traffic forecasting at the appraisal stage generally overestimated traffic volumes on the A23 and some surrounding roads.
- Collision data indicates a saving of 10.1 (36%) personal injury collisions per year for the modelled area, higher than the forecast saving of 0.7 (2%) per year. When considering just the scheme links, there has been a 73% reduction in personal injury collisions. This indicates that the scheme has had a beneficial impact on safety, even taking into account the background national reduction in collisions over the appraisal period.
- Monetary benefits are lower than expected, with outturn present value benefits of £79.87m compared to a forecast of £213.91m. This is primarily due to the journey savings being lower than forecast.

Summary of Scheme Impacts

Traffic

- Average weekday traffic flows on the A23 scheme section have increased from 71,300 to 77,800 vehicles per day (vpd) since the opening, an increase of 9% (6,400 vehicles per day).
- The improvements on the A23 appear to have increased the attractiveness of the A23 route as total weekday flows north of the scheme have also increased by a similar level (8%, 5,700 vehicles per day).
- Traffic flows have reduced on a number of local roads, reflecting the closure of Slaugham junction. Flows have increased on the remaining two routes accessing the A23 from the west (Handcross and Warninglid), likely to be related to rerouting due to the closure of Slaugham junction.
- Traffic flows were overestimated in the forecasts for the A23 scheme section, with observed flows pre scheme seen to be between 11-16% lower than expected. Observed flows post opening are between 11-15% lower than expected.
- Along the A23 scheme section, average journey times have reduced significantly during all time periods, with greatest savings seen in the peak periods, particularly the AM peak.
- Journey time reliability on the A23 has improved as a result of the scheme opening. This is a result of reduced congestion, improved alignment (including reduced accesses) and reduced collisions along the route.

Safety

- At the one year after opening stage, average collisions have reduced by 17% (13.3 collisions per year) on the A23 indicating that the scheme has had a direct beneficial impact on safety for the A23.
- When local roads are combined with the scheme extent, an annual collision decrease of 10.1 (36%) collisions per year has occurred.
- Collision rates have also decreased, as expected, indicating that the increase in traffic has not resulted in an increase in collisions.
- At this stage, the savings observed on the scheme section are above that forecast (around 14% reduction in annual collisions). When the scheme section and local roads are combined, the collision savings are again higher than the forecast (around 2% annual collision reduction).
- At this early stage, severity of collisions has increased slightly in the wider area (combining local roads and the scheme extent), with the severity index (ratio of the number of serious or fatal collisions to the total number of personal injury collisions) increasing from 20% to 22% post opening. It should be noted that this is based on a small sample size, with data for the opening year only.
- Severity of collisions on the A23 has increased slightly at the one year after opening stage, from 15% to 20% post opening. The number of serious collisions has actually reduced post opening, however slight collisions have reduced at a faster rate hence a slight increase in severity proportions.

Environment

- Based on traffic flows, the noise and local air quality impacts of the scheme are generally as expected, with air quality possibly better than expected.
- Whilst the observed increase in carbon emissions since the scheme opened is higher than forecast, the observed total carbon emissions post-scheme are lower than forecast. This is because the without scheme scenario within the forecasts overestimated carbon emissions, when compared to the observed pre-scheme period.

- The landscape measures are generally in place as expected, although the routine maintenance of replacement planting does not seem to be taking place. Planting is exhibiting slow growth at the one year after evaluation stage. Due to the immaturity of vegetation, the effectiveness of planting as a visual screening cannot be fully determined at this stage. Overall it is considered that the scheme has had a moderate adverse impact on landscape (in line with the scoring in the Environmental Statement), which is worse than expected in the appraisal summary table (slight adverse).
- Biodiversity mitigation measures have been implemented as expected. The effectiveness of these measures cannot be fully evaluated at this one year after opening stage, as monitoring reports were not available to inform the evaluation. The HEMP states that post-construction ecological monitoring will be in place for five years through the post-construction aftercare period for habitat creation areas, alien plant species, great crested newts, dormouse and bat species.
- The impacts on heritage are largely as expected at the one year after opening stage. Additional archaeological reports should be published by the five years after (FYA) stage, allowing for a full assessment of the scheme. Visual screening of affected heritage buildings/ sites, where applicable, should be maturing by the five year after stage allowing for an evaluation of the effectiveness of mitigation.
- No visible issues with water and drainage were found during the one year after opening site visit, therefore it is considered likely that the scheme has had a slight beneficial impact as expected impact on drainage.
- Physical fitness benefits have been largely as expected. Provision of the non-motorised user route and underpass has had a slight beneficial impact, although the widening of the route has impacted on views for non-motorised users.
- Journey quality has improved as expected due to the removal of congestion along the route. The route is generally well sign-posted although the removal of mature trees has impacted on traveller views.

Accessibility and Integration

- The provision of a new underpass assists local communities by reducing severance caused by the A23. Local communities are further benefited by the provision of a high quality route for cyclists and pedestrians alongside the A23.
- The scheme generally aligns with regional and national land use policies through improving safety and reducing congestion. However, the scheme has had a negative impact on the Area of Outstanding Natural Beauty as expected.

Summary of Scheme Economic Performance

All monetary figures in 2002 prices and values		Forecast	Outturn Reforecast
Costs	**PVC**	**£28.3m**	**£33.8m**
Benefits	Journey time benefits	£237.04m	£63.44m
	Safety Benefits	£1.52m	£34.33m
	Vehicle Operating Costs	-£22.37m	-£13.13m
	Carbon benefits	-£2.37m	-£2.37m
	PVB subtotal	**£213.91m**	**£79.87m**
	Indirect Tax	£13.51m	£8.85m
	BCR (with indirect tax in PVC) [1]	**7.07**	**2.36**
	BCR (with indirect tax in PVB)	**5.20**	**1.87**

- Journey time benefits are below that forecast, mainly due to lower traffic levels and an overestimation of journey times in the pre scheme situation.
- Outturn safety benefits of £34.33m are higher than that forecast as the number of observed collisions in the OYA period within the appraisal area are significantly lower than forecast, particularly on the A23.
- Overall the outturn PVB of £79.87m is 37% lower than the forecast.
- The outturn investment costs are 2% higher than forecast.
- The outturn BCR indicates that the scheme is still considered to deliver value for money (medium value for money according to Department for Transport guidelines).
- The study has not identified any firm evidence to suggest that the scheme has had a discernible impact in terms of wider economic impacts, however the improved journey times for A23 traffic has improved access to Gatwick from the south.

1 At the time of scheme appraisal, Treasury guidance was to include indirect tax as a cost. However, the most recent guidance on indirect tax impacts is to include these as a benefit, rather than a reduction in cost, therefore two BCRs are presented here.

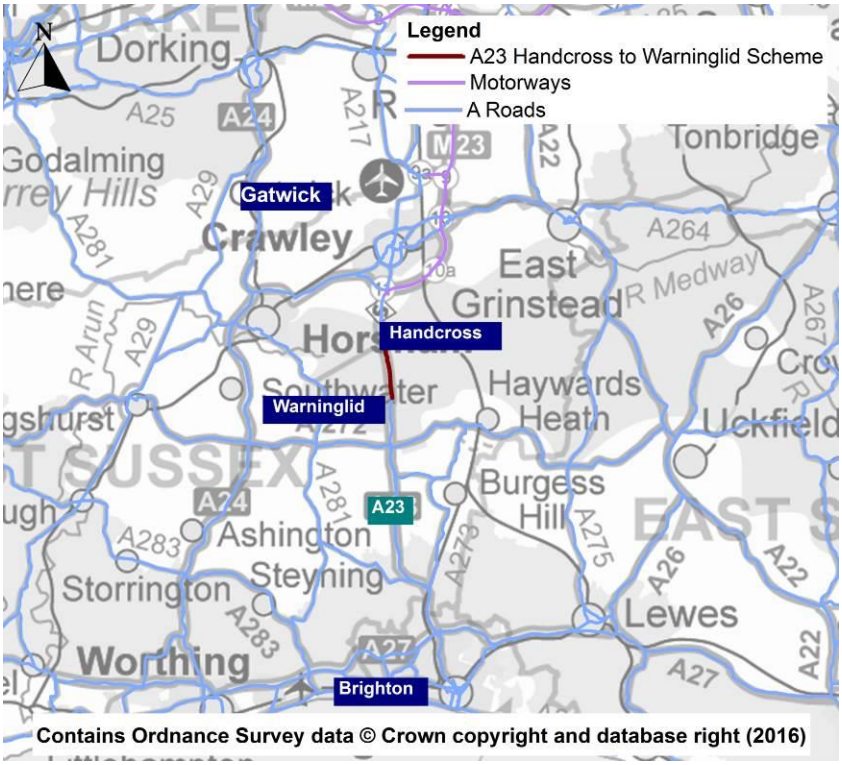
1. Introduction

1.1 This report presents the One Year After (OYA) opening evaluation of the A23 Handcross to Warninglid scheme (hereafter known as 'the scheme') which opened in October 2014. This evaluation has been undertaken as part of Highways England's Post Opening Project Evaluation (POPE) process.

Scheme Context

1.2 The M23/A23 is the principal route between London and Brighton and provides the main road access to Gatwick Airport. It is also an important freight and commuter route. The scheme extent between Handcross to Warninglid is located in West Sussex and lies within the High Weald Area of Outstanding Beauty (AONB). This location is illustrated in Figure 1.1.

Figure 1.1 – Scheme Location



1.3 The Public Inquiry Statement of Case (SoC) (June 2009) notes this section of the A23 carried an average of 69,000 vehicles per day (vpd) in 2006 and was operating at or above capacity at peak times, leading to congestion and delays. The Handcross to Warninglid section was the last remaining part of the A23 to undergo improvement works to alignment and profile. The SoC also notes that 'the long steep gradients between Slaugham and Handcross junctions caused HGVs (particularly travelling northbound), to block the inside lane, effectively creating a single lane bottleneck for other vehicles'.

1.4 The A23 section historically had high collision rates, which was considered to be related to the route's sub-standard horizontal and vertical alignment and poor forward visibility, its substandard junctions and the numerous direct accesses leading on to it (Environment Statement, 2008).

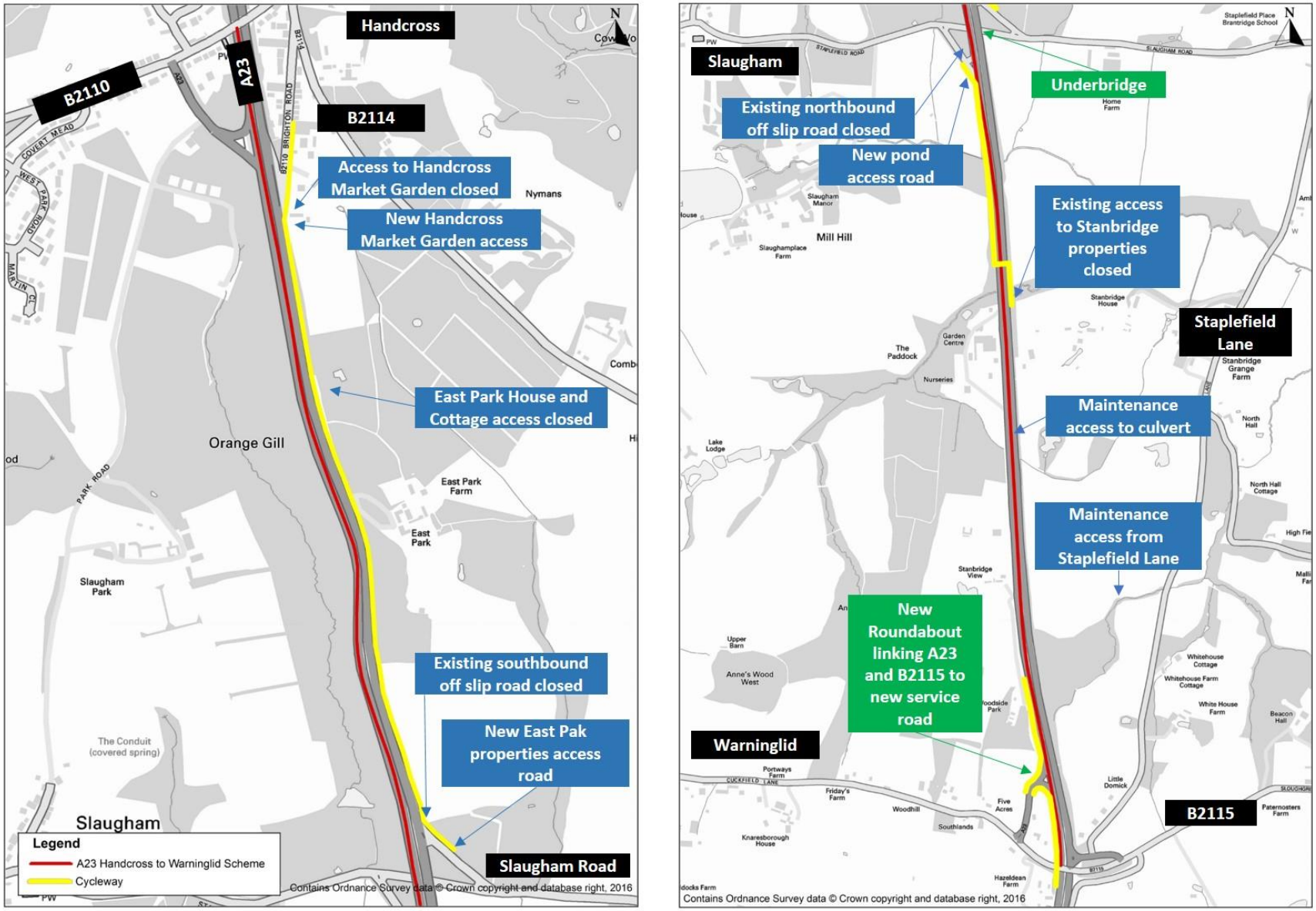
Scheme Description

1.5 The scheme is a major Highways England project involving the upgrading of the existing dual two lane carriageway to dual three lane carriageway over a 3.8km length between Handcross and Warninglid junctions. Other key features of the scheme include:

- The closure of all direct private accesses from the A23 mainline carriageway across the scheme length.
- A two-way service road from Warninglid to provide access to commercial and residential properties on the west side of the A23.
- Revised junction at Handcross, including the rebuilding of the Driver and Vehicle Standards Agency (DVSA) weighbridge.
- Revised junction at Warninglid, including a new roundabout to link the A23 and B2115 to the new two-way service road.
- The closure of the off-slip road for access to Slaugham.
- A footway and cycleway between Handcross and Warninglid, connecting to the local footpath network between Slaugham and Warninglid.
- A new equestrian, cyclist and pedestrian subway to link existing footpaths on either side of the A23.

1.6 The key features of the scheme are shown in Figure 1.2.

Figure 1.2 – Key features of scheme



Objectives

1.7 The objectives of the scheme, as based on the Client Scheme Requirements (June 2011) were to:

- Provide **increased capacity** by removing the existing bottleneck on the strategic M23/ A23 route between London and Brighton with associated peak hour delays.
- Provide **improved journey times** and **increased safety.**
- Improve safety for residents and operators by removing all direct private and commercial accesses to A23.
- **Reduce congestion** and **improve journey time reliability** along the A23 and improve existing junctions at Handcross and Warninglid.
- Reduce congestion and improve journey time reliability to and from Gatwick Airport, to and from the key infrastructure element of the Gatwick Diamond economic growth area, and the major new housing allocations in Mid-Sussex, Crawley and Horsham.
- **Provide improved routes for pedestrians, equestrians and cyclists**, and improved junctions at Handcross and Warninglid, thereby improving safety.
- Minimise environmental impact and seek opportunities for enhancement taking account of value for money.
- Minimise land acquisition, particularly of National Trust land.
- Minimise effect on Ancient Woodland.

Scheme History

1.8 A brief history of the key events involved in the development of the scheme is provided in Table 1-1.

Table 1-1 – History of Key Dates

Date	Activity
1994	Draft orders published
1995	Public inquiry
1997	Scheme withdrawn due to environmental impacts
2001	Scheme revisited, with development of three alternative options
May 2003	Consultation and public exhibition undertaken
May 2004	Minister for Transport announces the inclusion of the scheme in the targeted programme of improvements
Late 2008	Draft orders published
June 2009	Public inquiry
December 2009 - January 2010	Consultation undertaken
15 March 2010	Secretary of State announces scheme changes following consultation
May 2010	Scheme deferred for consideration as part of the Government Comprehensive Spending Review
October 2010	Secretary approves scheme for construction
April 2011	Seasonally sensitive advance environmental work begins
October - November 2011	Start of works (site clearance, with lane closures)
Winter 2011 - June 2012	Environmental mitigation work
June 2012	**Main civil engineering works commenced**
October 2014	**Completion of widening; scheme opens**

Overview of Post Opening Project Evaluation (POPE)

1.9 Highways England is responsible for improving the strategic highway network (motorways and trunk roads) by delivering 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 the five Central Government objectives for Transport[2] (Environment, Safety, Economy, Accessibility and Integration) have been achieved. The AST for this scheme is presented in Appendix A on Page 110.

1.10 POPE studies are carried out for all Major Schemes to evaluate the strengths and weaknesses in the techniques used for appraising schemes. This is so that improvements can be made in the future. For POPE, 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 is contained in Appendix A on Page 110

1.11 POPE of Major Schemes goes beyond monitoring progress against objectives set beforehand. Instead, it provides the opportunity to study which aspects of the intervention and appraisal tools used to evaluate it are performing better or worse than expected, and how they can be made more effective. More specifically the objectives of POPE evaluation reports are to:

- Provide a quantitative and qualitative analysis of scheme impacts consistent with national transport appraisal guidance (WebTAG) and scheme specific objectives.
- Identify discrepancies between forecast and outturn impacts.
- Explain differences between forecast and outturn impacts.
- Identify key issues relating to appraisal methods that will assist the Highways England in ongoing improvement of appraisal approaches and tools used for major schemes.

Contents of this Report

1.12 The remainder of this report is structured as follows:

- **Section 2 – Traffic Impact Evaluation.** This section looks what impacts the scheme had on traffic volumes and journey times on the A23 and surrounding roads;
- **Section 3 – Safety Evaluation.** This section compares the pre and post opening collision numbers and looks at collision rates;
- **Section 4 – Economy Evaluation.** This section compares the monetary value of any changes in journey times and collisions and compares these benefits with the cost.
- **Section 5 – Environment Evaluation.** This section looks at the environmental impacts of the scheme and the success of any mitigation;
- **Section 6 – Accessibility and Integration Evaluation.** This section contains a review of the scheme impacts on accessibility for pedestrians and cyclists and considers the impact of the scheme on local land use and Government Policies;
- **Section 7 – Conclusions.** This section summarises the main findings of this study against the key objectives.

1.13 There are also a number of appendices listed below as follows:

- **Appendix A –** AST and EST
- **Appendix C** – Forecast vs Observed peak flows
- **Appendix C** - List of Tables and Figures presented in this report
- **Appendix D** - Glossary
- **Appendix E** – Information requested for Environmental Evaluation
- **Appendix F** – NMU network images
- **Appendix G** - Photomontages

[2] As of August 2011, this approach has been revised. However, POPE is concerned with evaluation against the appraisal and as such follows the objectives used at that time.

2. Traffic Analysis

Introduction

2.1 The scheme's objectives relating to traffic, as based on the Client Scheme Requirements (2011), were:

- Provide increased capacity by removing the existing bottleneck on the strategic M23/A23 route between London and Brighton with associated peak hour delays.
- Provide improved journey times and increased safety.
- To reduce congestion and improve journey time reliability along the A23 and improve existing junctions at Handcross and Warninglid.
- To reduce congestion and improve journey time reliability to and from Gatwick Airport, to and from the key infrastructure element of the Gatwick Diamond economic growth area, and the major new housing allocations in Mid-Sussex, Crawley and Horsham.

2.2 As the Public Inquiry Statement of Case 2009 noted; 'journey times are variable and unpredictable due to congestion especially in the northbound direction' and 'this section of the A23 also suffers significant delays in peak and summer periods due to volume of traffic'.

2.3 In order to assess the traffic impact of the scheme, this section reports on changes in traffic flows and journey times and how these changes compare with those forecast.

2.4 A Traffic Monitoring Strategy Report was produced in July 2011 as part of the scheme approval agreement) which stated that traffic monitoring should be undertaken in the Slaugham and Warninglid areas, paying particular attention to Coos Lane (site 11) and Slaugham Lane (site 7). The strategy notes that pre-scheme, there were concerns from the residents of Slaugham that the closure of Slaugham junction would result in the higher traffic usage of Coos Lane.

2.5 Traffic flow analysis covers:

- Long term traffic volume trends on the A23 in this area.
- Comparisons of before and after opening for the following traffic data on the A23 and the surrounding road network.
- Comparison of the traffic data forecasts with the observed traffic volumes.

2.6 Journey time analysis covers comparisons of journey times before and after opening on the A23 along the scheme extent (i.e. between Handcross and Warninglid), as well as a wider route on the A23 to capture any potential changes as a result of the removal of the bottleneck.

Background Changes in Traffic

2.7 Historically in POPE scheme evaluations, the before construction period 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 National Transport Model (NTM) Local Growth Factors.

2.8 However, in light of the economic climate, which has led in recent years to widespread reductions in motor vehicle travel in the UK as a whole since 2008, it is no longer deemed appropriate to use this method of factoring before period 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.

2.9 In order to better understand the effects of the recent economic downturn, it is useful to look at the long term trends in traffic nationally, regionally and in the local area of the scheme. Figure 2.1 presents DfT annual statistics for observed change in total distance travelled from 2006 (the base year for traffic forecasting) to 2014 (the latest data available for DfT traffic flow data). The growth rate from TEMPro 5.4, which is based on number of car trip ends from West Sussex for an average weekday is also presented. TEMPro 5.4 was applied in the traffic forecasting at appraisal stage of this scheme.

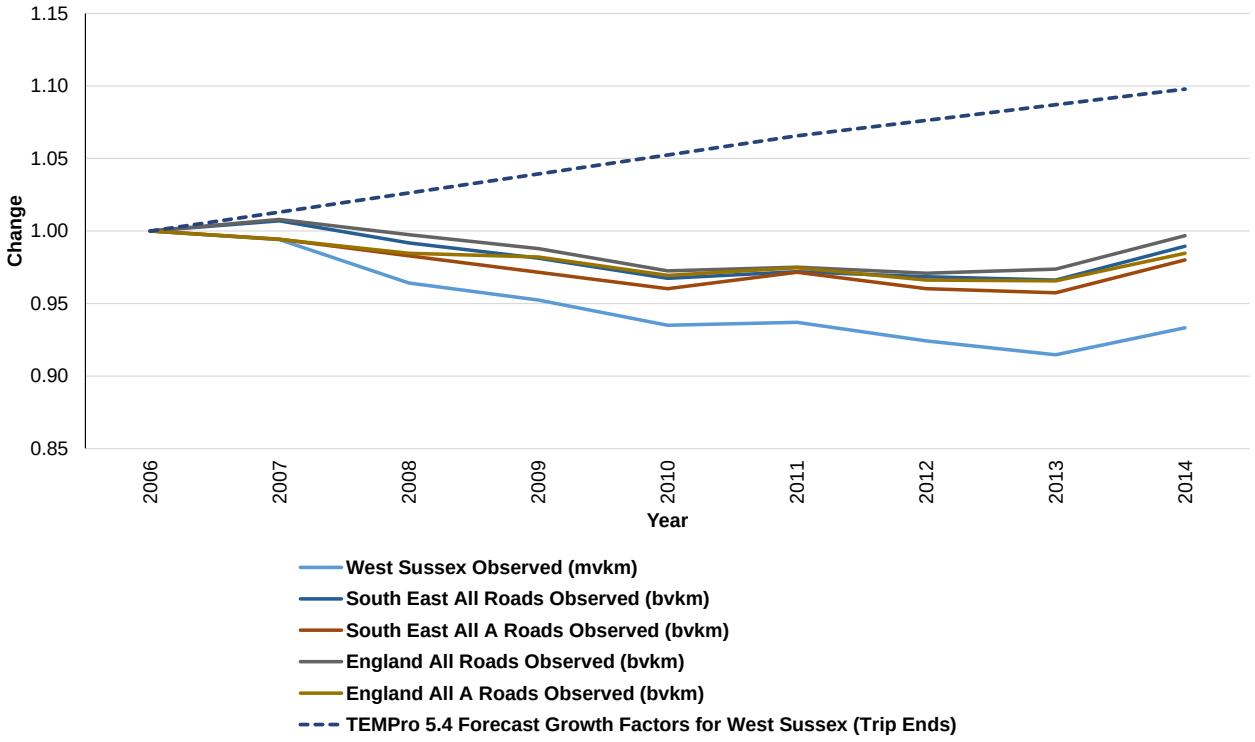
National, regional and local traffic trends

2.10 Figure 2.1 shows that, overall, annual trends in England, the South East and West Sussex during the construction period of the scheme (2012 to 2014) have shown a small increase in traffic flows when all roads are considered, and also when A roads are analysed, with the most prominent increase being between 2013 and 2014.

2.11 Overall, between 2006 and 2014, there has been a small decrease of 2% in national and regional trends for A roads. Local traffic (based on West Sussex information) indicates that there has been a higher decrease in flows, at 7%. Due to the trend shown in these figures, no factors have been applied to observed traffic flows to account for a background change.

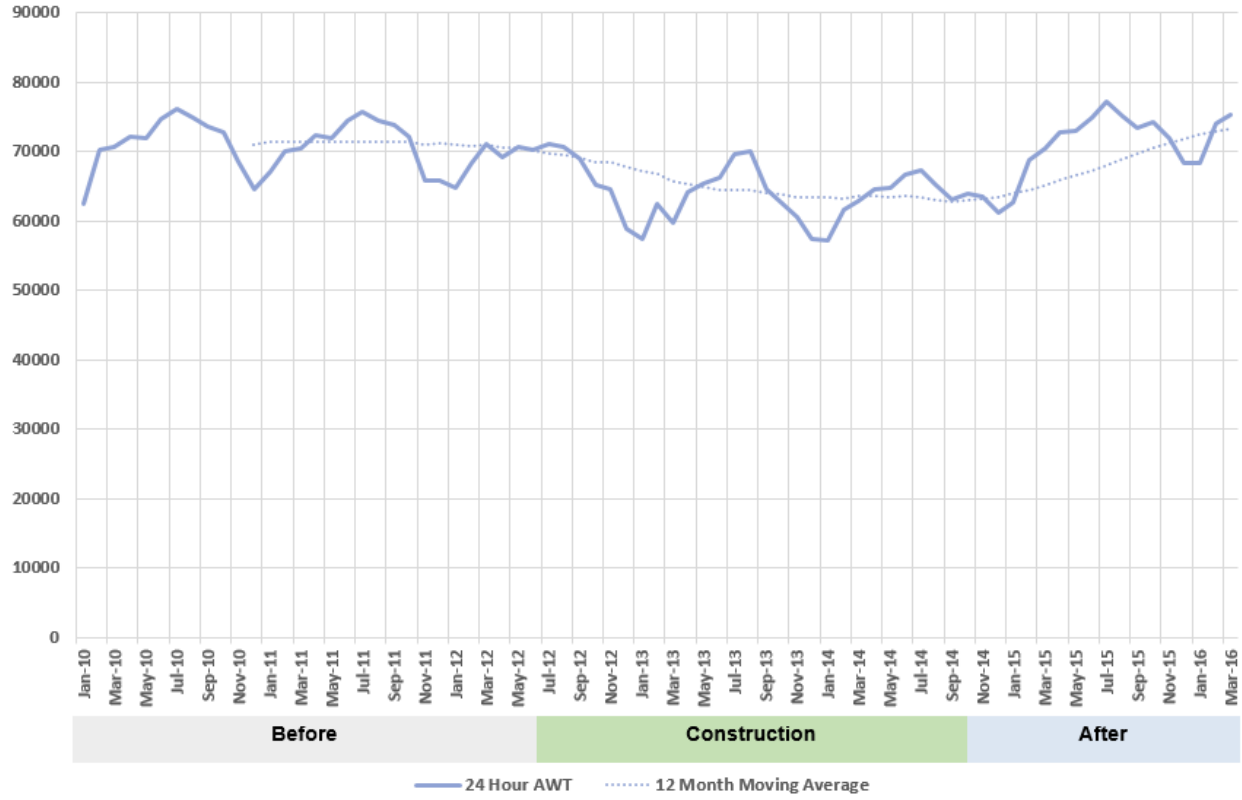
2.12 Figure 2.1 shows that the TEMPro 5.4 growth factors for car trips for West Sussex on an average weekday increase by 10% between 2006 (the forecasting base year) and 2014, which contrasts with the reduction which has occurred in traffic levels. This is largely associated with the economic downturn.

Figure 2.1 – National, Regional and Local Observed Traffic Flow Trends



2.13 Figure 2.2 has been based on Average Weekday Traffic (AWT) of traffic flows at a Highways England ATC location on the A23, north of Handcross (based on two-way flows). The graph shows that during the construction period, there was a decline in traffic on the A23. However, following construction, traffic increased to a level above the pre-scheme level of traffic.

Figure 2.2 Long term trend of traffic flow on A23, before, during and after construction of the scheme



Traffic Volume Analysis

Data sources

2.14 For the purposes of this evaluation, traffic flows have been measured by Automatic Traffic Counters (ATCs). The main sources of data, for the period before construction (March 2012) and one year after opening (November 2015/March 2016), include:

- Highways England permanent ATC sites.
- Traffic count data for local authority ATC sites (supplied by West Sussex Council).

2.15 These traffic counts were monitored pre-scheme and post-scheme, as proposed through the Traffic Monitoring Strategy (July 2011) for this scheme.

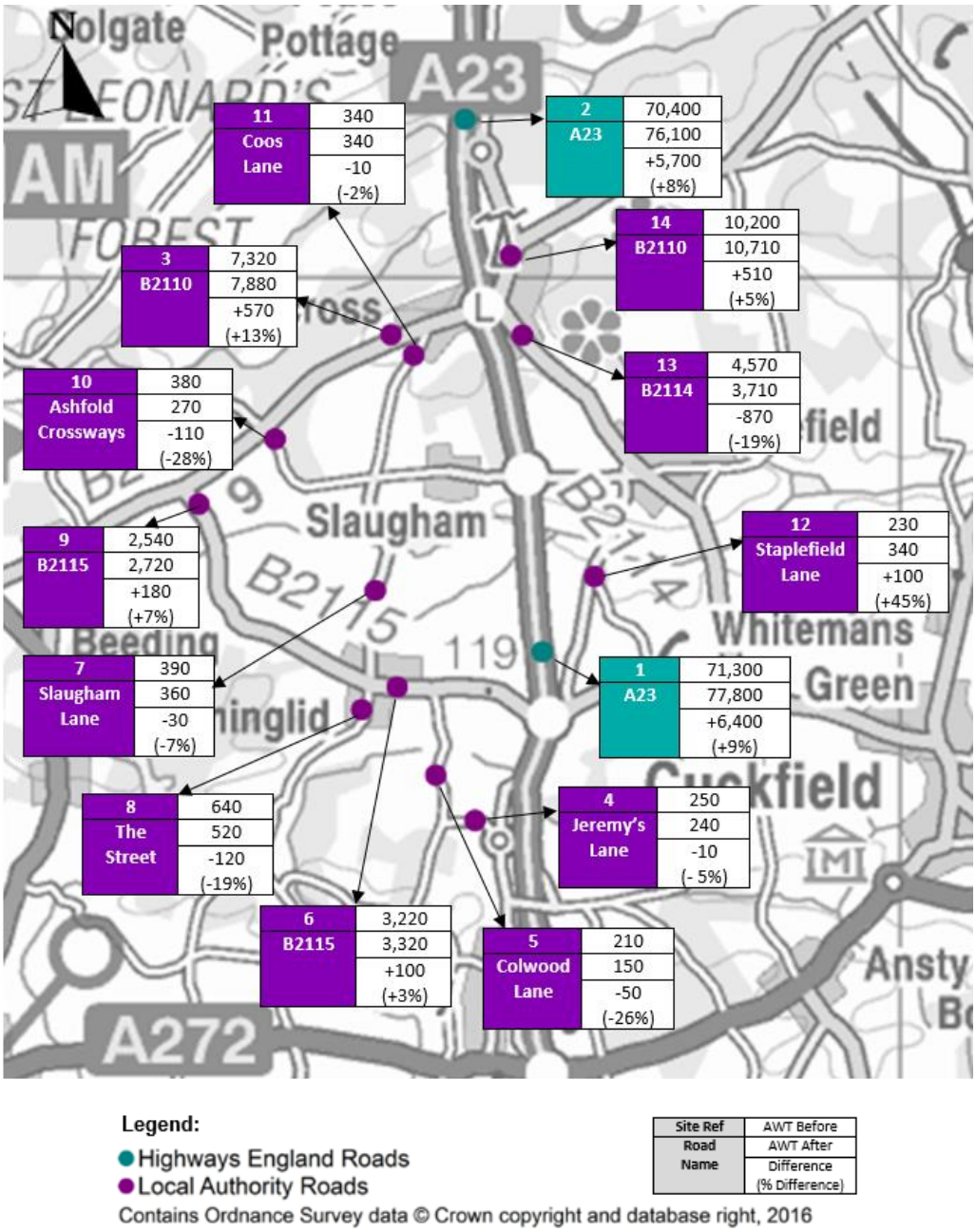
Observed flows

2.16 The locations of the traffic count sites on the scheme extent and surrounding area, as well as their data source, is shown in Figure 2.3. It also shows a geographical comparison of the pre and post opening 24 hour average weekday traffic (AWT) at these locations.

2.17 Pre-scheme, there were permanent traffic count sites on both carriageways of the A23, north of Warninglid, and at Warninglid junction northbound. Post-scheme, flow information for the northbound scheme section is unavailable due to issues with data quality with the count site. Therefore, a proxy flow has been estimated based on known changes in the southbound direction, and forecast impacts on tidality.

2.18 It should be noted that the local authority ATC sites presented in Figure 2.3 have been adjusted for seasonality. Also, the figures presented are rounded, and therefore the percentages may not total.

Figure 2.3 Average Two Way Weekday Traffic Flows (AWT)



2.19 Traffic using the A23 scheme extent (site 1) has shown an increase of 9%, representing 6,400 vehicles. There has also been an increase in the traffic flows on the A23 north of Handcross (site 2), of 8%.

2.20 Pre-scheme, there were also concerns from the residents of Slaugham that the closure of Slaugham junction would result in the higher traffic usage of Coos Lane. As shown, at Slaugham Lane and Coos Lane, traffic has remained relatively consistent at these locations, with a slight decrease in traffic flows.

2.21 At a meeting of Warninglid Residents' Society in December 2009, there were concerns about the re-routing of traffic on to the B2115 Cuckfield Lane (site 6) and The Street (site 8) in Warninglid, which is perceived to be a problem when incidents occur on the A23 (as stated in the Traffic Monitoring Strategy document). The re-routing of northbound traffic from the A23 as a result of the closure of Slaugham junction, would have the greatest impact at B2115 Cuckfield Lane as it is directly connected to the A23 Warninglid junction slip roads (Traffic Monitoring Strategy, July 2011). As can be seen, the B2115 Cuckfield Lane (site 6) has stayed

relatively consistent, showing a slight increase of 3%. However, there has been a decrease in traffic flows at the Street (site 8), of 19%, representing 120 vehicles only.

2.22 At Colwood Lane (site 5), there has been a decrease in traffic of 26%, although this represents 50 vehicles only. The Traffic Monitoring Strategy (July 2011) raised that this location may be used as a 'rat run' to avoid delays or perceived delays on the A23 scheme section and its approaches. The decrease of vehicles at this location may indicate that the perceived issues on the A23 have reduced.

2.23 There was concern from residents during the appraisal stage that drivers may choose to use the High Street (site 14) – B2114 Cuckfield Road (site 13) - Staplefield Lane (site 12) as an alternative route to the A23 during construction. There has been an increase in traffic flows at site 12 and site 14 post-scheme. This may be a reflection of the closure of Slaugham junction, with traffic accessing Staplefield via these roads, as opposed to via the route on the A23 and Staplefield Road which would have been available to vehicles pre-scheme. Site 13 has seen a decrease which may indicate that traffic previously using this route were using it as an alternative route to avoid the A23, and now remain on the A23 for longer.

2.24 Jeremy's Lane (site 4) connects to Cuckfield Lane via Colwood Lane, and to the A23 via off-slips at Wykehurst Park and via the slips at Bolney junction, and therefore the Traffic Monitoring Strategy (July 2011) raised that this could be a potential route for traffic re-routing to/from the A23, to avoid the A23 between Handcross and Bolney. Traffic here has remained relatively consistent between the pre-scheme and post-scheme periods, suggesting that this location has not been used more as a re-routing location post-scheme.

2.25 The B2110 (site 3) has increased in traffic flows by 13% (570 vehicles) between pre-scheme and post-scheme. This may be a reflection of vehicles re-routing to access locations that were previously served via the A23 and Slaugham junction.

2.26 There is an increase in traffic flows of 7% on the B2115 (site 9), which may also be a reflection of more traffic using this re-routing along this route following the closure of the Slaugham junction.

2.27 There has been a decrease in traffic flows at Asfold Crossways (site 10). This could be a reflection of less vehicles using this route to access the A23 from the B2110 via the Slaugham junction.

Heavy Goods Vehicles (HGVs)

2.28 Table 2-1 shows a comparison for the proportion of vehicles greater than 6.6m in length. This is used as a proxy for HGV measurements as data is available on a like-for-like basis for the pre-scheme and post-scheme period. Due to data availability this is based on the A23 north of Handcross (site 2 in Figure 2.3)

Table 2-1 – HGVs as proportion of all weekday traffic

Location	Direction	Before HGV – Weekdays	HGV % of vehicles	After HGV - Weekdays	HGV % of vehicles
A23, North of Handcross	NB	3,070	8.4%	3,130	8.0%
	SB	3,000	8.7%	3,080	8.3%
	Two-Way	6,070	8.5%	6,210	8.2%

2.29 As seen from Table 2-1, prior to the scheme there were 6,080 HGVs using the A23 at this location on an average weekday, accounting for 8.5% of the total traffic. Post-scheme, the total number of HGVs using this route has increased slightly to 6,210. However, this equates

to a slightly lower proportion of 8.2%. It can therefore be seen that that HGVs have increased to a lesser extent than other vehicles post opening

Forecast Traffic Flows

2.30 The pre-scheme appraisal process for the A23 Handcross to Warninglid scheme involved the forecasting of traffic flows for Do-Minimum (DM) and Do-Something (DS) scenarios. The DS scenario includes the scheme, whilst the DM scenario does not. As part of the POPE methodology, these modelled forecast flows are compared with observed flows to ascertain the accuracy of the original predictions.

Sources

2.31 Information relating to the traffic modelling approach, as well as the traffic forecast data has been taken from the Traffic Forecasting Report (December 2009).

Traffic Modelling Approach

2.32 Forecasting was undertaken though a fixed trip matrix approach through SATURN assignment modelling (an elastic assignment approach was deemed not required). The forecast models were developed with the application of TEMPRO, to provide car trip growth factors in district levels within the model area, in the counties of West Sussex, East Sussex, Surrey and the Unitary Authority of Brighton and Hove. Road Traffic Forecasts (ITEA, DfT, December 2008) derived from the National Transport Model as set out in WebTAG (Unit 3.5.6) which was used to provide HGV trip growth factors.

2.33 The base year used in the model was 2006 with an opening year forecast of 2013 and a design year forecast of 2028 (15 years after opening). No detailed revised opening year (2014) traffic forecasts were available therefore for the POPE purposes a proxy opening forecast has been calculated using growth factors to enable comparison with observed.

2.34 In October 2008, the Traffic Forecasting Report was approved. However, in June 2009, at a Public Inquiry into the scheme, Highways England recommended the deletion of the Slaugham junction (which had not been included in the original Traffic Forecasting Report). Following on from this, an updated Traffic Forecasting Report was published in December 2009. This included traffic forecasts for objector's alternatives to the scheme; one such forecast was for the scheme with Slaugham junction removed, which represents the final scheme. The traffic forecasts quoted in this report therefore reflect the forecast figures for this.

2.35 While the Traffic Forecasting Report (December 2009) included a review of proposed schemes in the South East Plan other than the A23 Handcross to Warninglid scheme, none of the sub-regional highway or transport schemes identified were committed schemes and were therefore not included in the forecast Do-Minimum or Do-Something model networks or matrices. The Do-Minimum network in the Saturn model is therefore identical to the Base Year network.

Forecast versus Outturn Traffic Flows – A23

2.36 In the Traffic Forecasting Report (December 2009), details for forecast AADT were provided for two locations along the A23; the scheme extent itself and north of Handcross. Table 2-2 directly compares the do-minimum and observed pre-scheme traffic flows, as well as the Do-Something and post-scheme traffic flows.

2.37 When interpreting this table, it should be considered that the forecast traffic data is Average Annual Daily Traffic (AADT), while the observed traffic data represents Average Daily Traffic (ADT) for March, which is considered a neutral month and therefore comparable.

2.38 It should be noted that the published forecasts were for 2013 while the observed Do-Minimum data was for 2012, and so to make a comparison on a like-for-like basis, proxy forecasts have been created for 2012 using TEMPRO.

Table 2-2 – Traffic flows: forecast AADT versus observed ADT

			Do Minimum Forecast vs Pre-Scheme Observed			Do-Something Forecast vs Post-scheme Observed		
Map Ref	Site Description	Direction	Do-Minimum AADT (adjusted to 2012)	Pre-scheme ADT (adjusted to 2012)	Difference (% Difference)	Do-Something AADT (interpolated to 2016)	Post-scheme ADT (2016)	Difference (% Difference)
1	A23, North of Warninglid	NB	40,300	33,970	-6,330 (-16%)	44,110	37,370	-6,740 (-15%)
		SB	38,480	34,760	-3,720 (-10%)	41,660	36,630	-5,030 (-12%)
		Two-Way	**78,780**	**68,730**	**-10,050 (-13%)**	**85,770**	**73,990**	**-11,780 (-14%)**
2	A23, North of Handcross	NB	40,470	34,710	-5,760 (-14%)	44,380	37,550	-6,830 (-15%)
		SB	36,390	32,390	-4,000 (-11%)	39,240	35,100	-4,140 (-11%)
		Two-Way	**76,850**	**67,100**	**-9,750 (-13%)**	**83,620**	**72,650**	**-10,970 (-13%)**

2.39 It can be seen from Table 2-2 that:

- The forecast flows consistently overestimated the traffic flows for the Do-Minimum and Do-Something scenarios in both directions of the A23, both north of the scheme (site 2) and on the scheme extent itself (site 1). Based on two-way flows, this difference is at a level of between 13 and 14%.
- The difference between the forecast traffic flows and observed traffic flows is consistently higher in the northbound direction than the southbound direction.

2.40 When considering the difference between forecast and observed flows, Figure 2.1 should be referred to. As shown here, the TEMPro (version 5.4) growth factors which were applied during the development of the scheme's forecast models for car trips were substantially higher than the change in traffic levels which has been observed between 2006 and 2014. This is largely related to the economic downturn.

2.41 As shown previously, there are some large differences in the baseline flows for sites on the A23. To add an alternative perspective, Table 2-3 presents the forecast impact for each site in terms of a percentage compared to the observed change.

Table 2-3 – Traffic flows: forecast AADT versus observed ADT (AADT and ADT)

			Forecast			Observed		
Map Ref	Site Description	Direction	Do-Minimum AADT (adjusted to 2012)	Do-Something AADT (interpolated to 2016)	Difference (% Difference)	Pre-scheme ADT (adjusted to 2012)	Post-scheme ADT (2016)	Difference (% Difference)
1	A23, North of Warninglid	NB	40,300	44,110	3,810 (9%)	33,970	37,370	3,400 (10%)
		SB	38,480	41,660	3,180 (8%)	34,760	36,630	1,870 (5%)
		Two-Way	**78,780**	**85,770**	**6,990 (9%)**	**68,730**	**73,990**	**5,260 (8%)**
2	A23, North of Handcross	NB	40,470	44,380	3,910 (10%)	34,710	37,550	2,840 (8%)
		SB	36,390	39,240	2,850 (8%)	32,390	35,100	2,710 (8%)
		Two-Way	**76,850**	**83,620**	**6,770 (9%)**	**67,100**	**72,650**	**5,550 (8%)**

2.42 The key points to make from this table are:

- While the forecast traffic flows have been consistently higher than the observed data, the proportional change between Do-Minimum and Do-Something forecasts, and observed pre and post scheme flows are relatively consistent.
- For the scheme itself, forecast flows were expected to increase by 9%. Post opening flows indicate that there has been an 8% increase in traffic, although a lower figure, reflecting the lower baseline. Traffic growth on the A23 is marginally higher in northbound direction, as expected in the forecasts.

Forecast versus Outturn Traffic Flows – Local Roads

2.43 As well as AADT forecasts for the A23, the Traffic Forecasting Report (December 2009) provides Do-Minimum and Do-Something forecast peak hour flows for the A23 and other local roads in the wider area.

2.44 Flows in most time periods have been overestimated in the baseline and therefore forecast Do-Something flows are generally much higher than observed. Appendix B includes tables (Table 8-3 for the AM peak and Table 8-4 for the PM peak) which directly compare the Do-Minimum and observed pre-scheme flows, as well as the Do-Something and post-scheme traffic flows. Figures higher than 750 have been rounded to the nearest 10, while figures lower than 750 have been rounded to the nearest 5. Therefore, overall changes may not always add up.

Table 2-4 – Traffic flow forecasts versus observed data: AM Peak

			Forecast			Observed		
Map Ref	**Site Description**	**Direction**	**Do-Minimum**	**Do-Something**	**Difference (% Difference)**	**Pre-Scheme Observed**	**Post-Scheme Observed**	**Difference (% Difference)**
1	A23, North of Warninglid	NB	3,730	4,440	710 (19%)	3,010	3,660	650 (22%)
		SB	2,260	2,380	120 (5%)	2,290	2,280	-10 (0%)
		Two-Way	**5,990**	**6,820**	**830 (14%)**	**5,370**	**5,940**	**570 (11%)**
2	A23, North of Handcross	NB	4,090	4,770	680 (17%)	3,320	3,470	150 (5%)
		SB	2,160	2,250	90 (4%)	2,130	2,160	30 (1%)
		Two-Way	**6,260**	**7,020**	**760 (12%)**	**5,450**	**5,630**	**180 (3%)**
3	B2110 Handcross	EB	740	625	-115 (-16%)	440	455	15 (3%)
		WB	250	275	25 (10%)	200	255	55 (28%)
		Two-Way	**990**	**900**	**-90 (9%)**	**635**	**710**	**75 (12%)**
6	B2115 Warninglid	EB	320	330	10 (3%)	125	140	15 (12%)
		WB	230	275	45 (20%)	185	175	-10 (-5%)
		Two-Way	**550**	**605**	**55 (10%)**	**310**	**310**	**0 (0%)**
7	Slaugham Lane	NB	25	45	20 (80%)	20	15	-5 (-25%)
		SB	20	20	0 (0%)	15	15	0 (0%)
		Two-Way	**45**	**65**	**20 (44%)**	**35**	**35**	**0 (0%)**
9	B2115 Plummers Plain	EB	185	180	-5 (-3%)	95	115	20 (21%)
		WB	160	170	10 (6%)	155	155	0 (0%)
		Two-Way	**345**	**350**	**5 (1%)**	**255**	**265**	**10 (4%)**
10	Ashfold Crossways	EB	55	60	5 (9%)	15	10	-5 (-33%)
		WB	50	55	5 (10%)	20	15	-5 (-25%)
		Two-Way	**105**	**110**	**5 (5%)**	**35**	**20**	**-15 (43%)**
11	Coos Lane	NB	15	65	50 (333%)	20	15	-5 (-25%)
		SB	5	10	5 (100%)	15	15	0 (0%)
		Two-Way	**20**	**75**	**55 (275%)**	**35**	**25**	**-10 (-29%)**
12	Staplefield Lane	NB	15	10	-5 (33%)	5	15	10 (200%)
		SB	15	20	5 (33%)	15	15	0 (0%)
		Two-Way	**30**	**25**	**-5 (-17%)**	**20**	**30**	**10 (50%)**
13	B2114 Handcross	NB	275	275	0 (0%)	250	155	-95 (-38%)
		SB	55	50	-5 (-9%)	210	135	-75 (-36%)
		Two-Way	**325**	**330**	**5 (2%)**	**470**	**290**	**-180 (-38%)**
14	B2110 Handcross	NB	515	550	35 (7%)	405	410	5 (1%)
		SB	445	490	45 (10%)	400	430	30 (8%)
		Two-Way	**960**	**1,040**	**80 (8%)**	**805**	**840**	**35 (4%)**

2.45 Table 2-4 shows that:

- As expected, flows have increased more in the northbound direction on the A23 between Warninglid with an increase of 22% (650 vehicles) seen post opening.
- North of Handcross, northbound flows have increased more than southbound flows, although not to the level forecast.
- Flows on the local roads appear to have been less accurately predicted, although in most cases the numbers are very low, e.g. a change of 10 vehicles at site 12 is a 50% change.

- Flows appear to be inaccurately forecasted for sites 3 and 6 (the two routes to the A23 from the east). Forecasts indicated in the AM peak that there would be an increase at site 6 (Warninglid) and a decrease at site 3 (Handcross). Post opening there has been an increase at site 3, but no change at site 6.
- There was forecast to be an increase in traffic on Coos Lane (site 11) post opening due to the closure of Slaugham junction, however post opening flows appear have remained static.

Table 2-5 – Traffic flow forecasts versus observed data: without scheme (PM Peak)

			Forecast			Observed		
Map Ref	**Site Description**	**Direction**	**Do-Minimum**	**Do-Something**	**Difference (% Difference)**	**Pre-scheme observed**	**Post-scheme observed**	**Difference (% Difference)**
1	A23, North of Warninglid	NB	2,490	2,370	-120 (-5%)	2,330	2,350	20 (1%)
		SB	3,360	3,720	360 (11%)	3,280	3,250	-30 (-1%)
		Two-Way	**5,850**	**6,090**	**240 4%**	**5,570**	**5,600**	**30 (1%)**
2	A23, North of Handcross	NB	2,260	2,470	210 9%	2,340	2,410	70 (3%)
		SB	3,380	3,650	270 8%	3,110	3,340	230 (7%)
		Two-Way	**5,650**	**6,110**	**460 8%**	**5,450**	**5,750**	**300 (6%)**
3	B2110 Handcross	EB	245	245	0 (0%)	240	265	25 (10%)
		WB	200	240	40 (20%)	345	350	5 (1%)
		Two-Way	**445**	**485**	**40 (9%)**	**585**	**610**	**25 (4%)**
6	B2115 Warninglid	EB	170	185	15 (9%)	165	175	10 (6%)
		WB	260	300	40 (15%)	120	120	0 (0%)
		Two-Way	**430**	**485**	**55 (13%)**	**285**	**295**	**10 (4%)**
7	Slaugham Lane	NB	5	25	20 (400%)	10	10	0 (0%)
		SB	35	50	15 (43%)	15	15	0 (0%)
		Two-Way	**45**	**75**	**30 (67%)**	**25**	**25**	**0 (0%)**
9	B2115 Plummers Plain	EB	90	95	5 (6%)	150	155	5 (3%)
		WB	170	190	20 (12%)	95	100	5 (5%)
		Two-Way	**260**	**285**	**25 (10%)**	**245**	**255**	**10 (4%)**
10	Ashfold Crossways	EB	65	90	25 (38%)	15	10	-5 (-33%)
		WB	70	40	-30 (-43%)	15	5	-10 (-67%)
		Two-Way	**140**	**130**	**-10 (-7%)**	**35**	**20**	**-15 (-43%)**
11	Coos Lane	NB	5	10	5 (100%)	15	10	-5 (-33%)
		SB	0	10	10 (N/A)	15	15	0 (0%)
		Two-Way	**10**	**20**	**10 (100%)**	**30**	**25**	**-5 (-17%)**
12	Staplefield Lane	NB	15	15	0 (0%)	10	10	0 (0%)
		SB	0	5	5 (N/A)	10	10	0 (0%)
		Two-Way	**10**	**20**	**10 (100%)**	**25**	**20**	**-5 (-20%)**
13	B2114 Handcross	NB	110	95	-15 (-14%)	170	125	-45 (-26%)
		SB	235	235	0 (0%)	170	155	-15 (-9%)
		Two-Way	**340**	**335**	**-5 (-1%)**	**340**	**280**	**-60 (-18%)**
14	B2110 Handcross	NB	370	385	15 (4%)	290	270	-20 (-7%)
		SB	380	445	65 (17%)	510	270	-240 -47%
		Two-Way	**750**	**830**	**80 (11%)**	**800**	**535**	**-265 (-33%)**

2.46 As shown in Table 2-5:

- Compared to the observed data, the traffic flows on the A23 (site 1 and site 2) have been underestimated both for the Do-Minimum scenario and the Do-Something scenario. This is in line with the AADT forecast figures analysed earlier in this section, as well as the trend shown for the AM peak.
- It was expected that there would be a higher proportional increase on the A23 (sites 1 and 2) between pre-scheme and post-scheme than was observed during the PM peak.
- The traffic flows on other local roads in the wider area of the scheme also show a general trend for being underestimated, although there are some exceptions (for example, the observed traffic flows were higher than forecast both for the Do-Minimum and Do-Something scenario).
- On some of the local minor roads in the wider area, there are some differences between the forecast and observed figures. It should be noted that many of these roads have small vehicle numbers and therefore high percentage differences between forecast and observed at some locations often reflect low differences in vehicle numbers.
- At Slaugham Lane (site 7), it was forecast that there would be an increase in traffic flows of 30 vehicles, however, traffic flows at this location remained the same.

Journey Time Analysis

2.47 An important part of the scheme's objectives relate to improving journey times and journey time reliability on the A23. Relevant objectives here include (Client Scheme Requirements, June 2011):

- Provide increased capacity by removing the existing bottleneck on the strategic M23/ A23 route between London and Brighton with associated peak hour delays.
- Provide improved journey times and increased safety.
- Reduce congestion and improve journey time reliability along the A23 and improve existing junctions at Handcross and Warninglid.
- Reduce congestion and improve journey time reliability to and from Gatwick Airport, to and from the key infrastructure element of the Gatwick Diamond economic growth area, and the major new housing allocations in Mid-Sussex, Crawley and Horsham.

2.48 This sub-section examines the evidence for changes in journey times as a result of this scheme. The journey time analysis is split into three components:

- Analysis of pre and post-scheme journey time differences along the scheme.
- A comparison of forecast and outturn journey times along the scheme.
- A comparison of journey time reliability pre-scheme and post-opening.

2.49 Forecast journey times have been taken from the A23 Handcross to Warninglid Widening Traffic Forecasting Report (December 2009).

2.50 Observed journey times for before the scheme's construction and one year after have been sourced through satellite navigation data of vehicles travelling through the route. Motorists who use satellite navigation devices have the option to voluntarily allow anonymous data about their journeys to be collected and used to provide a range of services, including the analysis of historic journey times along specified routes. The data was extracted for March 2012 and March 2016, excluding the school holiday periods.

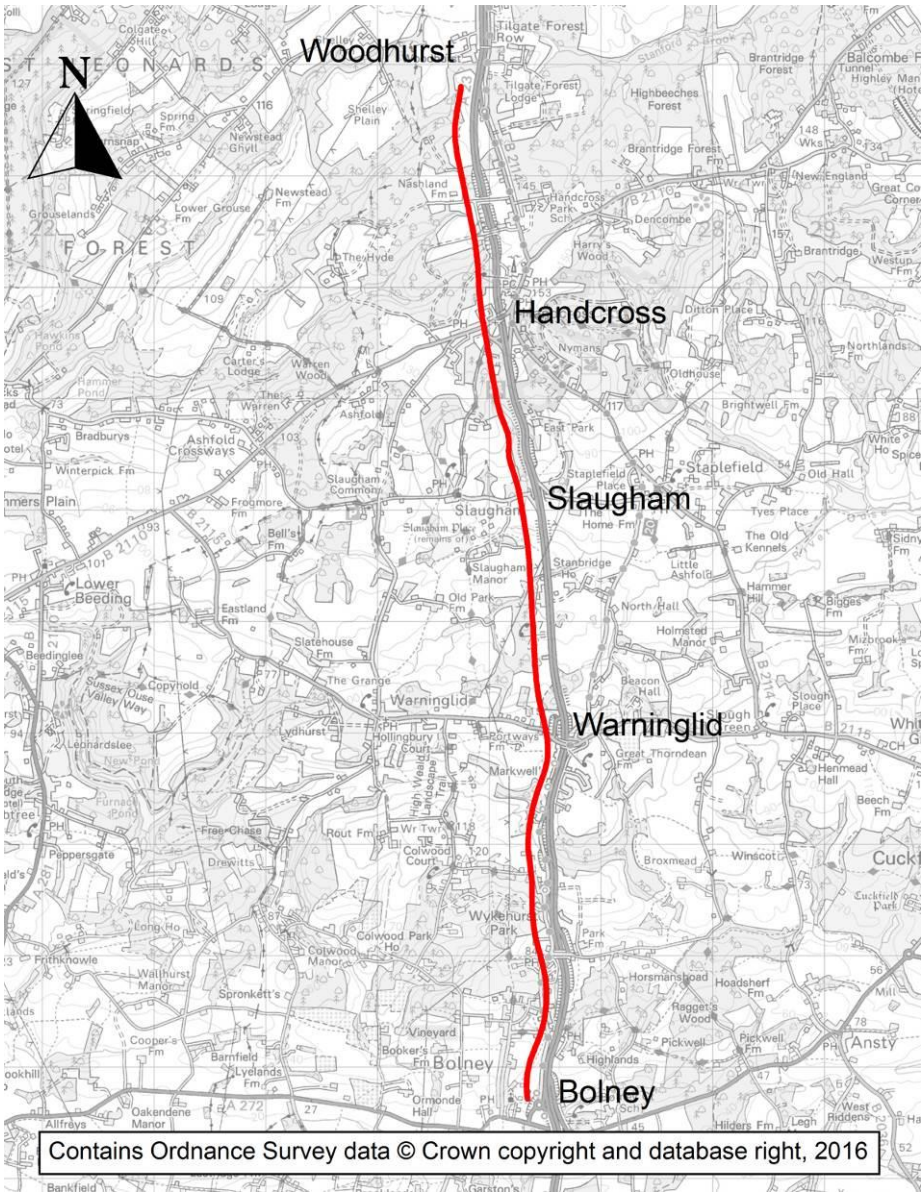
2.51 Journey times were collected for the following periods to enable comparison with the forecast impacts:

- Weekdays AM peak (07:00-10:00)
- Weekdays Interpeak (10:00-16:00)
- Weekdays PM peak (16:00-19:00)

2.52 The data extracted for observed journey time data is presented in Figure 2.4. This extends between a location at south of Woodhurst to Bolney junction. This therefore includes the

scheme extent itself, as well as the A23 directly north and south of the scheme in order to analyse the impacts of the widening of the scheme in these locations, and there has been a reduction of the bottleneck here. A smaller section for the scheme itself between Handcross and Warninglid has also been considered.

Figure 2.4 – Journey Time Route



Observed change in journey times

2.53 This section compared the observed pre-scheme journey times with the observed post-scheme journey times, as collected by satellite navigation data. For the entire route, the changes in journey times is summarised in Table 2-6, for the northbound and southbound directions for the weekday AM peak, Interpeak and PM peak periods.

Table 2-6 – Observed Journey Times- Full Route (mm:ss)

Direction	Time Period	Observed Pre-scheme (2012)	Observed OYA (2016)	Change	% Change
Northbound	AM Peak	06:04	05:14	-00:50	-14%
	Interpeak	05:29	05:17	-00:12	-4%
	PM Peak	05:25	05:12	-00:13	-4%
Southbound	AM Peak	06:13	05:08	-01:05	-17%
	Interpeak	05:31	05:06	-00:25	-8%
	PM Peak	05:27	05:00	-00:27	-8%

2.54 For the scheme itself (between Handcross and Warninglid the changes in journey times are summarised in Table 2-7, for the northbound and southbound directions for the weekday AM peak, Interpeak and PM peak periods.

Table 2-7 – Observed Journey Times – Warninglid to Handcross (mm:ss)

Direction	Time Period	Observed Pre-scheme (2012)	Observed OYA (2016)	Change	% Change
Northbound	AM Peak	02:13	01:49	-00:24	-18%
	Interpeak	01:59	01:49	-00:10	-8%
	PM Peak	01:59	01:47	-00:11	-10%
Southbound	AM Peak	02:22	01:44	-00:37	-26%
	Interpeak	02:02	01:43	-00:19	-16%
	PM Peak	02:01	01:41	-00:20	-17%

2.55 As shown by Table 2-6 and Table 2-7

- For the full route, the largest journey time savings are seen in the AM peak for both the northbound and southbound direction, with a reduction in 50 seconds (14%) in the northbound direction and 65 seconds (17%) in the southbound direction.
- The largest savings in other time periods are seen in the southbound direction where savings of 8% are seen.
- The northbound direction also sees improvements in journey times in the interpeak and PM peak, at 12 seconds and 13 seconds (4%) respectively.
- For the scheme section, the patterns remain the same, with the largest savings in the AM peak in both direction.
- In the interpeak and PM peaks, the savings seen are close to that seen over the full route, indicating that this is as a direct result of the scheme.
- Savings in the AM peak in both directions for the wider route are higher than for the scheme section, indicating that the removal of the bottleneck has had an impact on a longer route.

Forecast versus observed journey time savings

2.56 The A23 Handcross to Warninglid Widening TFR (Dec 2009) included journey time forecasts for Do-Minimum and Do-Something scenarios for 2013. It should be noted that these forecasts were not revised for the change in opening year to 2014.

2.57 The journey time forecasts were provided for the AM peak and PM peak between Bolney and Handcross, broken down into different sections. In order to compare the forecast versus observed journey time changes, it has been possible to breakdown the journey times from the observed satellite navigation data into route sections which are in line with the distances provided in the TFR.

2.58 It should be noted that the distances between forecast journey time sections change between the Do-Minimum and Do-Something scenario, which is related to the change in junctions along the route.

2.59 In order to ensure a like for like comparison with the forecasts is done, this section only considers the section between Bolney and Handcross. Data for the same sections have been included for from the observed data for comparative purposes, although due to slightly different break points, the times here are slightly different than those shown previously.

2.60 The data is summarised in Table 2-8 and Table 2-9.

Table 2-8 – Forecast Accuracy of Journey Times (mm:ss): AM Peak

	AM Peak Forecast						AM Peak Observed				
	Do-Minimum Timing Point	Do-Minimum Distance (km)	Cumulative Do-Minimum Journey Time (mm:ss)	Do-Something Timing Point	Cumulative Do-Something Distance (km)	Cumulative Do-Something Journey Time (mm:ss)	Observed Timing Point	Cumulative Pre-scheme Distance (km)	Cumulative Pre-scheme Journey Time (mm:ss)	Cumulative Post-scheme Distance (km)	Cumulative Post-scheme Journey Time (mm:ss)
Northbound	A23 Bolney on slip	0.0	00:00	A23 Bolney on slip	0.0	00:00	A23 Bolney on slip	0.0	00:00	0.0	00:00
				A23 Warninglid off slip	3.3	02:18	A23 Warninglid	3.6	02:27	3.6	02:02
	A23 Warninglid on slip	3.4	02:24	A23 Warninglid on slip	3.6	02:31					
	A23 Slaugham off slip	5.3	06:17	A23 Slaugham off slip	5.1	03:41	A23 Slaugham	5.4	03:43	5.4	03:03
				A23 Slaugham on slip	5.5	03:58					
	A23 Handcross off slip	6.7	07:54	A23 Handcross off slip	6.6	04:57	A23 Handcross off slip	6.8	04:39	6.8	03:51
	Forecast Journey Time Reduction between Bolney on slip and Handcross off slip:					**- 02:57 (-37%)**	**Observed Journey Time Reduction between Bolney on slip and Handcross off slip:**				**- 00:49 (-18%)**
Southbound	Handcross on slip	0.0	00:00	Handcross on slip	0.0	00:00	A23 Handcross on slip	0.0	00:00	0.0	00:00
	Slaugham off slip	1.1	00:47	Slaugham off slip	1.1	00:40	A23 Slaugham	0.9	01.03	0.9	00:43
				Slaugham on slip	1.3	00:48					
	Warninglid off slip	3.4	02:21	Warninglid off slip	3.1	01:54	A23 Warninglid	3.2	02.22	3.1	01:44
				Warninglid on slip	3.2	01:59					
	Bolney off slip	7.2	04:37	Bolney off slip	7.0	04:12	Bolney off slip	7.1	04:24	7.0	03:45
	Forecast Journey Time Reduction between Handcross on slip and Bolney off slip:					**- 00:25 (-9%)**	**Observed Journey Time Reduction between Handcross on slip and Bolney off slip:**				**- 00:39 (-15%)**

Table 2-9 – Forecast Accuracy of Journey Times (mm:ss): PM Peak

	PM Peak Forecast						PM Peak Observed				
	Do-Minimum Timing Point	Do-Minimum Distance (km)	Cumulative Do-Minimum Journey Time (mm:ss)	Do-Something Timing Point	Cumulative Do-Something Distance (km)	Cumulative Do-Something Journey Time (mm:ss)	Observed Timing Point	Cumulative Pre-scheme Distance (km)	Cumulative Pre-scheme Journey Time (mm:ss)	Cumulative Post-scheme Distance (km)	Cumulative Post-scheme Journey Time (mm:ss)
Northbound	A23 Bolney on slip	0.0	00:00	A23 Bolney on slip	0.0	00:00	A23 Bolney on slip	0.0	00:00	0.0	00:00
				A23 Warninglid off slip	3.3	02:00	A23 Warninglid	3.6	02:03	3.6	02:01
	A23 Warninglid on slip	3.4	02:07	A23 Warninglid on slip	3.6	02:11					
	A23 Slaugham off slip	5.3	03:26	A23 Slaugham off slip	5.1	03:10	A23 Slaugham	5.4	03:08	5.4	03:01
				A23 Slaugham on slip	5.5	03:24					
	A23 Handcross off slip	6.7	04:34	A23 Handcross off slip	6.6	04:12	A23 Handcross off slip	6.8	04:02	6.8	03:49
	Forecast Journey Time Reduction between Bolney on slip and Handcross off slip:					**- 00:22 (-8%)**	**Observed Journey Time Reduction between Bolney on slip and Handcross off slip:**				**- 00:13 (-6%)**
Southbound	Handcross on slip	0.0	00:00	Handcross on slip	0.0	00:00	A23 Handcross on slip	0.0	00:00	0.0	00:00
	Slaugham off slip	1.1	00:59	Slaugham off slip	1.1	00:44	A23 Slaugham	0.9	00:51	0.9	00:42
				Slaugham on slip	1.3	00.52					
	Warninglid off slip	3.4	02:56	Warninglid off slip	3.1	02:04	A23 Warninglid	3.2	02:01	3.1	01:41
				Warninglid on slip	3.2	02:09					
	Bolney off slip	7.2	05:24	Bolney off slip	7.0	04:35	Bolney off slip	6.8	03:59	6.8	03:39
	Forecast Journey Time Reduction between Handcross on slip and Bolney off slip:					**- 00:49 (-15%)**	**Observed Journey Time Reduction between Handcross on slip and Bolney off slip:**				**- 00:19 (-8%)**

2.61 It can be seen from Table 2-8 and Table 2-9 that:

AM Peak

- The largest change to journey times was expected to be during the AM peak in the northbound direction. Forecast Do-Minimum journey times were forecast to be almost 8 minutes, whereas observed pre scheme journey times for the AM peak average 4 minutes 40 seconds.
- Forecasts show that the scheme was expected to save on average 2 minutes 57 seconds (37%), however observed savings are significantly lower with savings of 49 seconds (18%).
- Southbound journey times were forecast to reduce by 9% (25 seconds), but observed journey times show a higher than expected saving of 15% (39 seconds).

PM Peak

- In line with the tidal flows shown previously in this chapter, the largest change in the PM peak was expected to be during the PM peak period with a forecast saving of 49 seconds (15%) in the southbound direction.
- The largest observed saving in the PM peak is in the southbound direction, but only with a saving of 20 seconds (8%).
- Smaller savings were expected in the northbound direction, of 22 seconds (8%). Observed savings indicate that there has been a reduction in journey times of 13 seconds (6%).
- The forecast journey times in both the Do-Minimum and Do-Something situations are higher than observed in all time periods and in both directions.

Reliability

2.62 For reliability, the AST stated that the widening was 'expected to improve journey time reliability by increasing capacity, facilitating overtaking of slow vehicles and by-passing of incidents more easily'. However, reliability was not assessed quantitatively.

Route Stress Approach

2.63 A stress based approach has been used to assess the reliability impacts of this scheme OYA after its opening in order to make a comparison with the pre scheme (no forecast is available).

2.64 The Stress Factor for a particular link is defined as the ratio of the Annual Average Daily Traffic (AADT) flow to the Congestion Reference Flow (CRF). The CRF is expressed as an AADT flow estimate at which a road is likely to be congested in the peak periods on an average day. DfT guidance[3] states that only values between 75% and 125% should be considered and anything outside this range should be adjusted up or down to 75% or 125%. As a result, the adjusted stress figures are included in brackets where applicable.

2.65 The route stress calculation using observed traffic data is shown in Table 2-10**.** The scheme section has been used. It can be seen that route stress has reduced from 77% to an adjusted 75% on the busiest section indicating that the scheme has reduced the level of congestion.

Table 2-10 – Observed Changes in Route Stress

	Observed	
	Before (2012)	OYA (2015/6)
A23 Scheme section	77%	37% (75%)

[3] http://www.dft.gov.uk/pgr/economics/rdg/multimodal/anewdealfortrunkroadsinengla5491?page=7

2.66 The route stress approach doesn't reflect the variance in journey time by different time periods. Therefore reliability is also evaluated based on the impact that the scheme has had on the variability of journey times.

Journey Time Variability

2.67 Variability is the extent to which journey times vary from the expected average journey time on a particular day of the week at the time of day in question. The distribution of journey times is considered to be a good indication of how much journey times vary.

2.68 The satellite navigation data was used to determine the average journey time along the route also provides the distribution of journey times by percentile ranges. Figure 2.5 and Figure 2.6 present the variability in journey times for the different peak periods. The analysis presented is for the route as a whole (this route is presented in Figure 2.4) The nature of traffic flows and congestion issues vary by peak and direction depending on the section of the scheme so, in turn, the variability is greater for individual sections of the scheme.

Figure 2.5 – A23 Journey Time Variability – Northbound

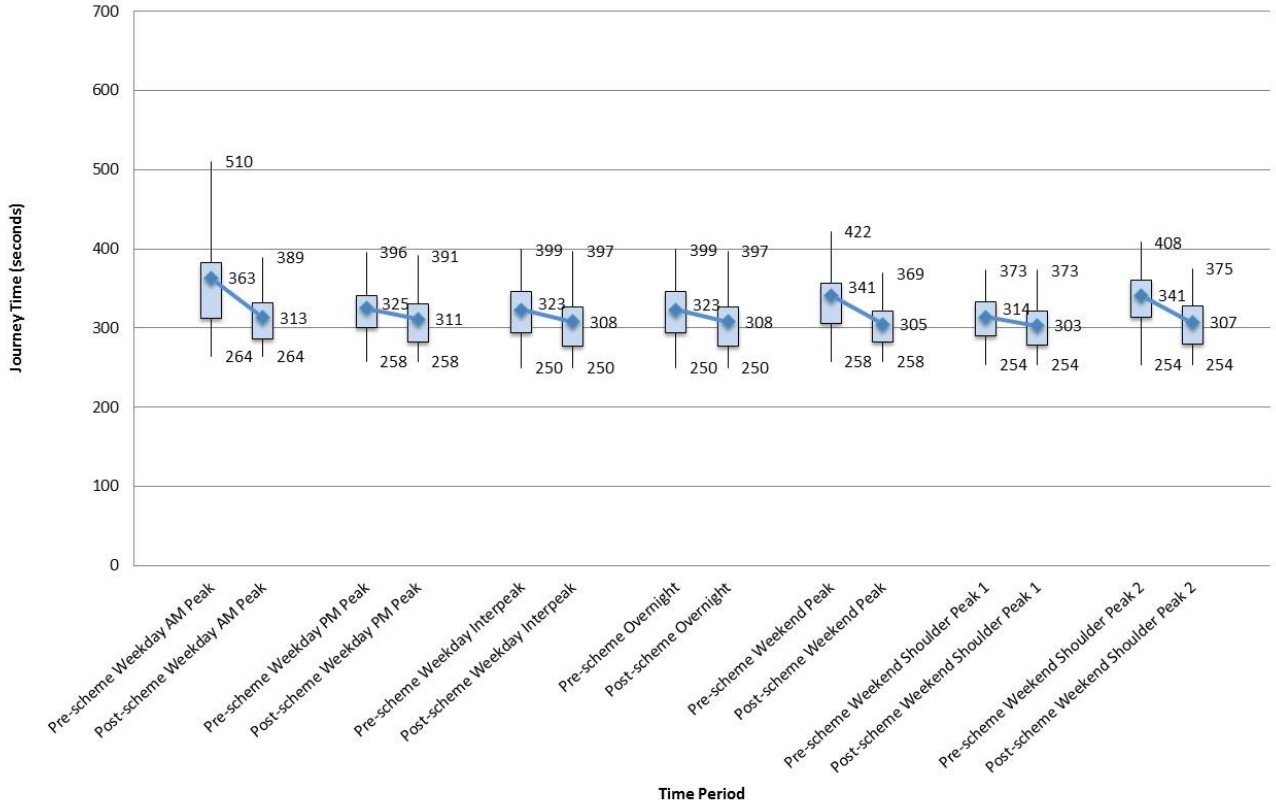
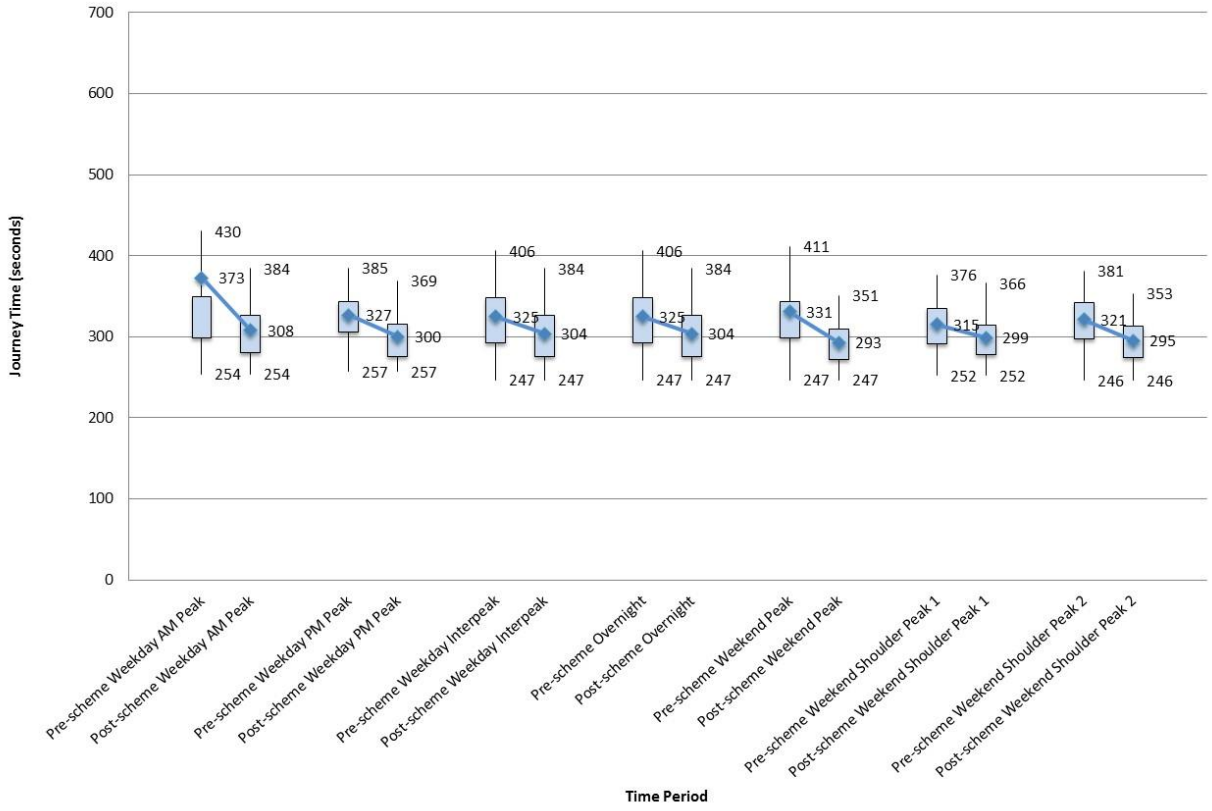


Figure 2.6 – A23 Journey Time Variability – Southbound



2.69 Figure 2.5 and Figure 2.6 show the following key points regarding reliability changes:

- AM peak northbound and southbound show large reductions in mean journey times and improvements in reliability.
- The inter-quartile range has reduced on all days in all time periods and both directions, indicating an improvement to reliability for journeys during all periods.
- The highest inter-quartile ranges by direction in the pre-scheme journeys were in the AM peak northbound and southbound, and both of these showed the largest falls in journey times post-opening.
- The range between the slowest and fastest 5% of journeys have fallen, especially during the weekday AM peak periods.
- The minimum journey times have reduced in all time periods indicating that the improved road layout has increased speeds in times of no congestion.

Planning Time Index (PTI)

2.70 The Planning Time Index (PTI) is a relatively new metric by which reliability is measured. As set out in Highways England's Operation Metrics Manual, this measure is designed to indicate how much additional time road users need to allow to ensure they arrive on time. It highlights roads where very slow journeys are encountered. The planning time index is based on the amount of time road users would need to leave for a journey to be 95% confident of arriving on time, and therefore the measure is the ratio of the 95th percentile journey time to the free flowing journey time. Table 2-10 below shows the PTI for the before and after periods for the northbound and southbound journeys based on the sat-nav journey time data, weighted by flows in the individual time periods.

Table 2-11 – Flow-weighted PTI

	Before	After
A23 Northbound scheme section	1.45	1.32
A23 Southbound scheme section	1.35	1.27

2.71 The PTI figures show that the reliability has improved in the post-opening period in both directions, as indicated by the lower PTI values.

Key points from Traffic Evaluation

Traffic Flow Impacts

- Post opening flows have increased on the scheme section with average weekday flows increasing by 9% (6,400 vpd) from 71,300 vpd to 77,800 vpd.
- The improvements on the A23 appear to have increased the attractiveness of the A23 route as total flows north of the scheme have increased by a similar 8% (5,700vpd).
- There has been a reduction in flows on a number of local roads, reflecting the closure of Slaugham junction.
- Flows have increased on the remaining two routes accessing the A23 from the west of the scheme (B2115 and B2210) indicating that there has been some rerouting due to the closure of Slaugham junction.

Traffic Forecasting

- For the Do-Minimum scenario, flows on the main route were overestimated, with observed flows pre scheme seen to be between 11-14% lower than expected.
- Similarly, the Do-Something scenario is overestimated, with observed flows between 11-15% lower than expected.

Journey Times

- Vehicles using the A23 between Bolney (south of the scheme) and north of Handcross have seen improved journey times as a result of removing the bottleneck. The biggest savings are seen northbound in the AM peak of 50 seconds (14%) and southbound in the AM peak of 65 seconds (17%).
- Savings are also seen in the southbound direction in the interpeak and PM peaks indicating that the improved road layout has increased speeds for all traffic, even at times of no congestion.
- Journey time reliability has improved in most time periods, particularly in the AM weekday peak and weekend peaks northbound.
- Journey time reliability improvements are also seen in the southbound direction, particularly in the AM and PM peak periods.

Journey Time Forecasting

- The pre scheme journey times in both directions appear to have been over estimated in the forecasts, and hence observed savings cannot meet that expected.
- The largest savings were expected in the AM peak northbound with a 2 minute 57 second (37%) saving forecast. The highest observed savings are seen in the AM peak northbound, with a saving of 49 seconds (18%). The largest southbound savings was expected to be in the PM peak, where a saving of 49 seconds (15%) was forecast. Observed savings indicate an 8% (19 seconds) was achieved for equivalent forecast route.

- The largest southbound savings was expected to be in the PM peak, where a saving of 49 seconds (15%) was forecast. Observed data indicate a saving of 8% (19 seconds) was achieved.
- Speeds were forecast to increase from an average of 32mph to 49mph in the AM peak northbound. Observed speeds in the AM peak northbound increased from 54mph to 66mph on average.

3. Safety

Introduction

3.1 This section considers the impact of the scheme in terms of the level of success in improving safety.

3.2 The scheme's objectives relating to safety, as defined in the Client Scheme Requirements (June 2011), were:

- Provide improved journey times and increased safety.
- Improve safety for residents and operators by removing all direct private and commercial accesses to A23.
- Provide improved routes for pedestrians, equestrians and cyclists, and improved junctions at Handcross and Warninglid, thereby improving safety.

3.3 The Environment Statement (2008) for this scheme highlighted the need for the scheme to address accidents:

> '*Between 2003 and 2007, there were seventy accidents involving personal injuries along this section of the A23, three of which were fatal. The poor road layout, substandard junctions and numerous direct private and commercial access on to this section of the A23 are all considered to address accidents'.*

3.4 This section of report assesses how far the scheme has achieved these objectives, based on observed data.

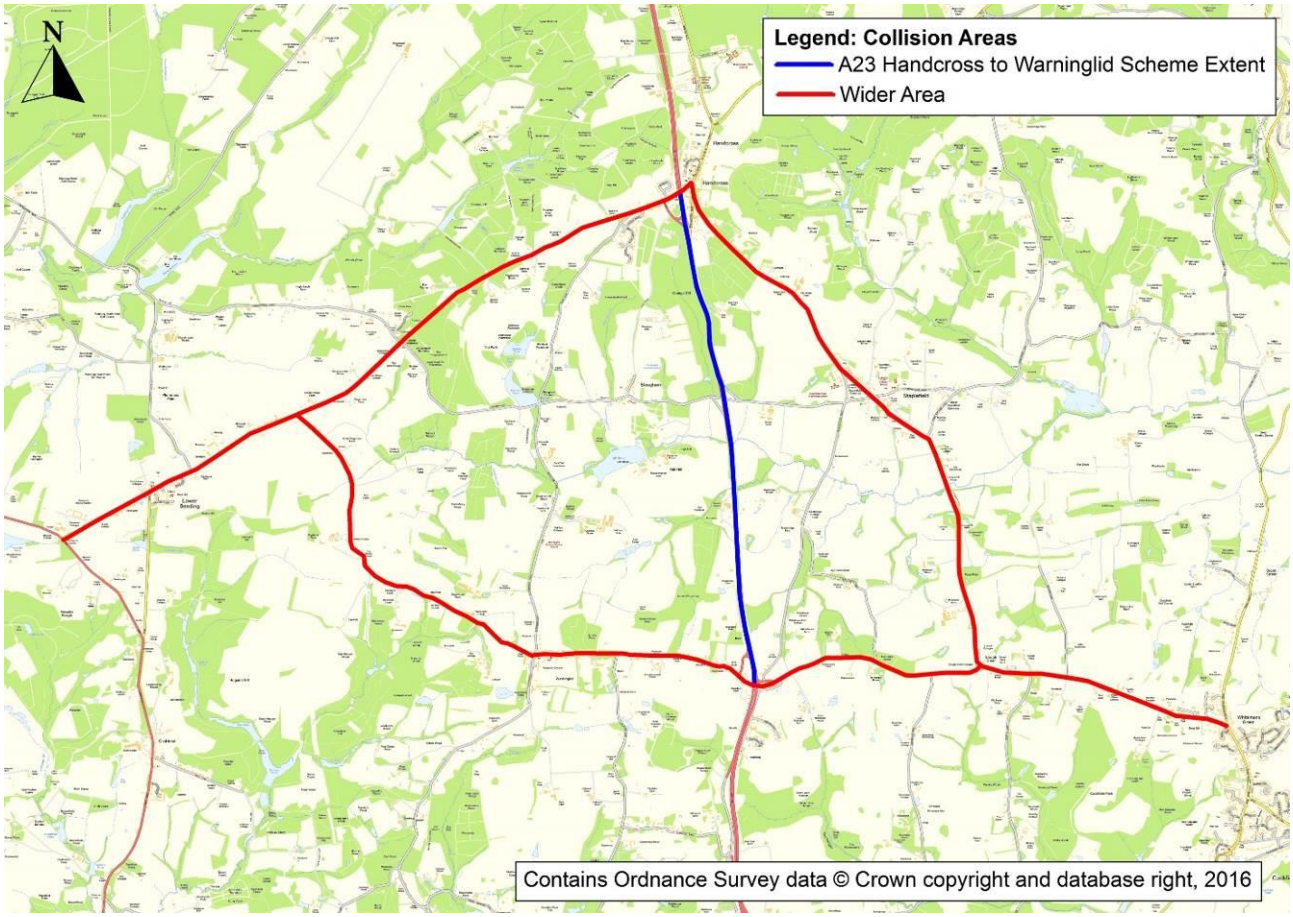
Sources

Forecast

3.5 For the purposes of assessing the collision impacts of the scheme, forecasts were produced for the number of collisions the scheme is expected to save, together with the associated numbers of casualties and the monetary benefit of the savings. At the appraisal stage of the scheme, a spreadsheet model was used for this process, with data for changes in collision rates over time and for collision costs taken from the COBA (COst Benefit Analysis) manual. A forecast saving was calculated for the opening year, and over the scheme appraisal period of 60 years. This section of the study concerns collision numbers; the economic impact of the change in collisions is evaluated later in the Economy section of this report.

3.6 The Economic Assessment Report (EAR) (2010) for the scheme provided collision forecasts for both the scheme extent (on the A23 between Handcross and Warninglid only), as well as local roads where there was expected to be a change in flow due to the closure of direct accesses to the A23. In order to ensure a like-for-like comparison between the predicted and observed collision changes, the overall geographical area of analysis used for this study is based on the description of the area analysed at the appraisal stage. The EAR clearly states that 'slip road accidents were excluded from the accident assessment'. The extent of these areas is shown in Figure 3.1.

Figure 3.1 – Collision Area



Observed Data

3.7 The scheme appraisal was based on observed data for the period 2003 to 2007 inclusive. This OYA report compares the five years prior to the start of construction, with one year of post opening data. The collisions during the construction period are also briefly examined. The periods are as follows:

- Pre-scheme – 1 June 2007 – 31 May 2012 (5 years)
- Construction – 1 June 2012 – 31 October 2014 (2 years, 5 months)
- Post-scheme – 1 November 2014 – 31 October 2015 (1 year)

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. Collision data for this study was obtained from West Sussex County Council.

3.9 It should be noted that at this stage, not all the collision data has yet been validated by the Department for Transport (DfT). The requirement for up to date and site specific information necessitated the use of unvalidated data sourced from the local authority. 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 collision numbers presented in this report.

Background Collision Reduction

3.10 It is widely recognised that, for over a decade, there has been a year-on-year reduction in the number of personal injury collisions on the roads, even against a trend of increasing traffic volumes during much of that period. The reasons for the reduction are considered to be wide

ranging and include improved safety measures in vehicles and reduced numbers of younger drivers. Consideration of this background trend is needed when considering the changes in collision numbers in the scheme area in the before and after periods. If the scheme had not been built, collision numbers in the area are still likely to have been influenced by wider trends and reduced.

3.11 The numbers of collisions in this area in the years before and after the scheme was built are compared. Although the net change is primarily associated with the scheme, this background reduction is taken into account. 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 study area here would have dropped at the same rate as they did nationally during the same time period. This gives what is known as a counterfactual scenario. A comparison can then be made between this data for the counterfactual 'without scheme' scenario on a like-for-like basis and the observed post opening data which is the 'with scheme' scenario.

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

Collision Numbers

A23 Handcross to Warninglid Scheme Extent

Evaluation of Collision Numbers and Severity

3.13 An evaluation of the before and after collision numbers by year for the scheme extent is shown in Table 3-1 and Figure 3.2, enabling a direct comparison with forecast collision savings. The severity of a collision is defined by the most serious injury incurred.

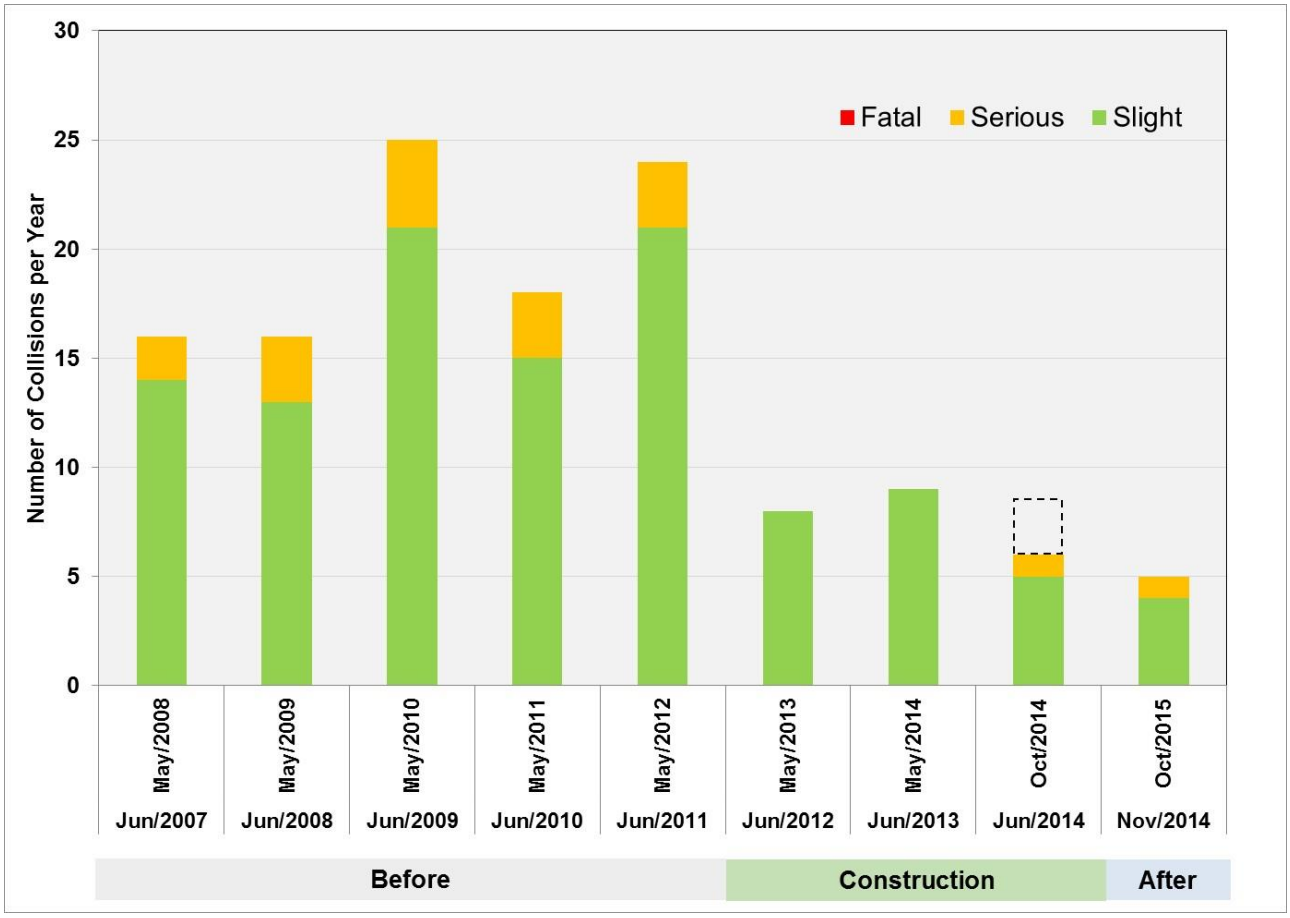
3.14 The table also includes the counterfactual without scheme situation which is comparable to the after data. It should be noted that where periods of less than one year are displayed, the number of collisions for the period has been extrapolated to provide an equivalent number of collisions per year; the number of collisions added as a result of the extrapolation is shown as a dotted bar in Figure 3.2.

Table 3-1 – Number of Collisions by Severity: Scheme Extent

Period	Time Period		Collision Severity			Total	Annual Average
	From	To	Fatal	Serious	Slight		
Pre Scheme	June 2007	May 2008	0	2	14	16	19.8
	June 2008	May 2009	0	3	13	16	
	June 2009	May 2010	0	4	21	25	
	June 2010	May 2011	0	3	15	18	
	June 2011	May 2012	0	3	21	24	
Construction	June 2012	May 2013	0	0	8	8	9.5
	June 2013	May 2014	0	0	9	9	
	June 2014	October 2014	0	1	5	6	
Without Scheme Counterfactual (adjusted for background reduction)[4]							18.3
Post Opening	November 2014	October 2015	0	1	4	5	5.0

[4] Background factor in collision numbers for A roads for 2007-2011 compared with 2014 was 0.926.

Figure 3.2 – Number of Collisions by Severity: Scheme Extent



3.15 From Table 3-1 and Figure 3.2 it can be seen that:

- The 'without scheme' counterfactual collision rate (accounting for the background reduction in collisions over time) is calculated as 18.3 collisions per year. Compared to the post opening period collision number this represents an annual collision saving of 13.3 collisions (a saving of 73%) a year. This saving is statistically significant suggesting that the scheme has had a clear beneficial effect on the frequency of collisions along the A23 between Handcross and Warninglid.
- There were no fatal collisions along the scheme extent either pre-scheme or post-scheme.
- The annual average number of serious collisions has reduced from an average of 3 per year to an average of 1 per year post opening.

3.16 No detailed analysis has been undertaken regarding NMU collisions at this early stage. However it is noted that in the pre scheme years there were no NMU collisions noted, and post opening there has been one occurrence on the A23 where it appears a cyclist travelling at speed on the dual carriageway lost control.

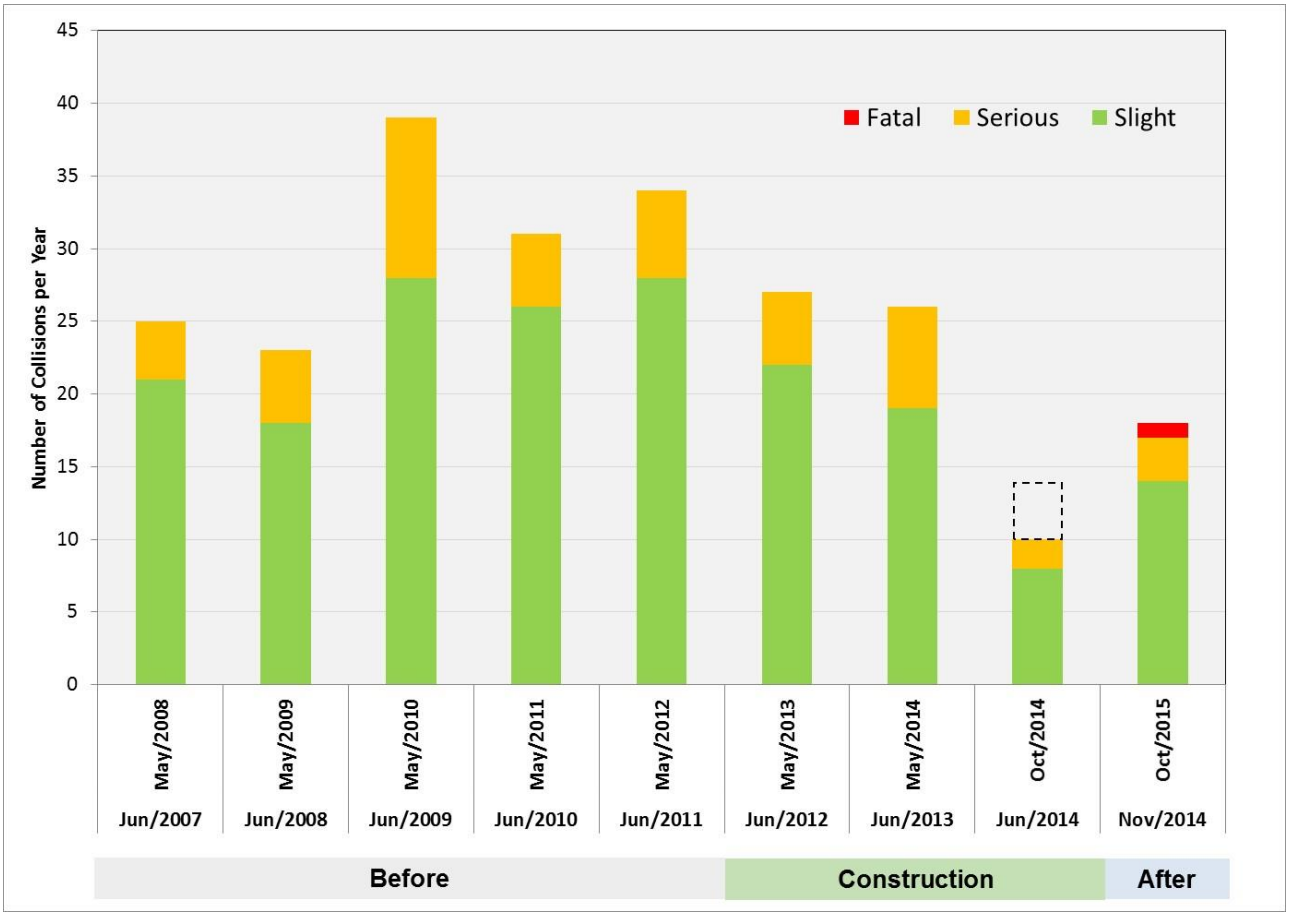
Wider Area (local roads and scheme extent)

3.17 Alongside forecasts for the scheme extent, the Economic Assessment Report (2010) also provided forecasts for local roads where there was expected to be a change in flow due to the closure of accesses to the A23 scheme extent. These are shown in Figure 3.1. Within this section, the forecasts for local roads combined with those for the scheme extent are compared with observed data for these same areas.

Table 3-2 – Number of Collisions by Severity: Wider Area (local roads and scheme extent)

Period	Time Period		Collision Severity			Total	Annual Average
	From	To	Fatal	Serious	Slight		
Pre Scheme	June 2007	May 2008	0	4	21	25	30.4
	June 2008	May 2009	0	5	18	23	
	June 2009	May 2010	0	11	28	39	
	June 2010	May 2011	0	5	26	31	
	June 2011	May 2012	0	6	28	34	
Construction	June 2012	May 2013	0	5	22	27	26.1
	June 2013	May 2014	0	7	19	26	
	June 2014	October 2014	0	2	8	10	
Without Scheme Counterfactual (adjusted for background reduction)[5]							28.1
Post Opening	November 2014	October 2015	1	3	14	18	18.0

Figure 3.3 – Number of Collisions by Severity: Wider Area



3.18 As shown by Table 3-2 and Figure 3.3:

- The average number of collisions recorded post opening in the wider area analysed was 30.4 per year.
- The 'without scheme' counterfactual collision rate (accounting for the background reduction in collisions over time) is calculated as 28.1 collisions per year. Compared to the post opening period collision number, this represents an annual increase in collision numbers of 10.1 collisions a year (a reduction of 36%). The collision reduction is lower than when the scheme section is considered in isolation (see Table 3-1 and Figure 3.2).

[5] Background factor in collision numbers for rural roads for average 2007-2012 compared with 2014 was 0.87.

This reflects that while collisions have reduced along the scheme extent, there has been an increase in collisions on the local roads in the wider area due to the redistribution of traffic.

- The reduction in collisions in the wider area is statistically significant suggesting that the scheme has had a clear beneficial impact on the frequency of collisions when considering the wider collision area.

Collisions involving Non-Motorised Users

3.19 Of the periods analysed, there were no pedestrian collisions noted pre scheme, with one cycle collision post opening on the A23 where a rider lost control.

Other Considerations

3.20 During the OYA site visit several cars were noted apparently mistaking the service road for access onto the A23 having to turn around at the 'dead end'. Anecdotally it is understood that there have been a couple of incidents at night of driver confusion mistaking the service road for the A23 on slip and attempting to join the carriageway at the dead end.

Evaluation of Collision Severity Index

3.21 The collision severity index is the ratio of the number of collisions classed as serious or fatal compared to the total number of collisions. A summary of the before and after opening collision severity indices by year for the wider local roads area, and the A23 scheme section is shown in Table 3-3.

Table 3-3 – Collision and Casualty Severity Index

	A23	Wider Area
Period	Average Collision Severity Index	Average Collision Severity Index
Pre Scheme	15%	20%
Post Opening	20%	22%

- There has been one fatal collision in the wider area post-scheme. The number of serious collisions has reduced by 3.2 (52%) per annum. As a result, the severity index has increased slightly from 20% to 22% post opening within the wider area.
- Slight collisions have reduced at a faster rate than serious collisions on the A23, hence the collision severity index has increased from 15% pre scheme to 20% post opening.
- The decrease in total collisions along the scheme is not fully matched here with the reduction in severity for the scheme section, however, this may be due to the increase in speed for traffic using the improved road resulting in a greater potential for a higher severity collision than previously seen on the lower speed congested section. Limited evaluation can be undertaken given the differences in lengths of time covered by the pre and post scheme period; however initial findings indicate that the scheme has had a beneficial impact.

Fatalities and Weighted Injuries

3.22 The collision rate discussed previously does not take into account the severity of collisions. To analyse this the Fatalities and Weighted Injuries metric (FWI) which is a combined measure of casualties based on the numbers of fatal, serious and slight casualties is also presented here. The FWI for the three years before start of construction and the available after period are shown in Table 3-4. To take into account the increased traffic on the A23 and for comparison with other schemes, the FWI rate per billion vehicle kilometres (bvkm) is also presented. It should be noted that these figures do not include any adjustment for changes in the background reduction in casualties as presented in the counterfactual scenario collision data above.

Table 3-4 – FWI on the A23 between Handcross and Warninglid

	FWI/collision	FWI/year	FWI/bvkm
Pre-scheme	0.022	0.44	4.6
One Year After Opening	0.028	0.14	1.4

3.23 It can be seen from the table that while the FWI metric per collisions has slightly increased, showing that the proportion of collisions which have been serious or fatal has increased. However, the FWI metric per year and per bvkm has reduced, reflecting the reduction in collision numbers overall on the A23 route.

Forecast Versus Observed Change in Collision Numbers

3.24 This section compares the number of observed collisions discussed earlier with those predicted to occur. The predictions have been obtained from the Economic Appraisal Report (EAR) for this scheme. This covers firstly the A23 scheme extent, and secondly local roads which were expected to exhibit a significant change in flow (shown previously in Figure 3.1) in addition to the A23. For the outturn collisions, the annual average before and after the scheme opened are used for the same areas as in the two areas described above.

Table 3-5 – Forecast versus observed opening year collision changes

Forecast			Observed		
Period & Scenario	**Scheme Extent**	**Wider Area (including Scheme Extent)**	**Period**	**Scheme Extent**	**Wider Area (including Scheme Extent)**
Opening Year Do-Minimum	13.1	28.5	Annual Average Pre-scheme	19.8	30.4
			Counterfactual Do-Minimum	18.3	28.1
Opening Year Do-Something	11.3	27.8	Annual Average Post-scheme	5	18.0
Change	- 1.8 (-14%)	- 0.7 (-2%)	Difference Net	-13.3 (-73%)	-10.1 (-36%)

3.25 Table 3-5 shows that:

- It was forecast that there would be a saving in collisions along the scheme extent, of 1.8 collisions, and a saving of 0.7 collisions within the wider area (including the scheme extent).
- The observed reduction in collisions along the scheme extent is substantially higher than forecast, with a saving of 13.3 collisions per annum, as compared to the forecast of 1.8 collisions per annum.
- Across the wider area (including the scheme extent), there has been a collision saving of 10.1 collisions per annum, which is substantially higher than forecast.

Collision Rates

3.26 The number of collisions along a length of road used together with the AADT for the same section can be used to calculate a collision rate, known as PIC/mvkm. This allows comparisons to be made which take into account traffic growth.

3.27 The EAR for this scheme stated that:

The Do Minimum accident rates were calculated using local accident data. For the Do Something (PS and OA1) accident rates, the change in accident rates due to the provision of

a Dual 3 lane carriageway in place of the existing 'old' Dual 2 lane were calculated using COBA default rates, and applied to the local rates. All accident rates used were for "Link and Junction combined".

3.28 The EAR also noted that based on COBA rates, a modern D3 road rate (0.174) would be 77% of a D2 road rate (0.226).The EAR does not include a forecast DM and DS collision rate, however it does state that based on the COBA above:

"This indicates that the provision of a modern road will reduce accidents to 77% of the old D2 accident rate. This factor was applied to the local accident rate to obtain a 'local modern D3 rate'.

3.29 Therefore this percentage decrease has been included as the forecast level of reduction as a result of the scheme.

Table 3-6 – Forecast versus observed collision rates (PIC/mvkm) for scheme extent

Forecast	Do-Minimum (without scheme)	n/a
	Do-Something (with scheme)	n/a
	Forecast saving	**23%**
Observed (pre-scheme versus post-scheme collision rates)	Before opening observed	0.209
	Without scheme (counterfactual for same period as after opening data)	0.192
	After opening observed	0.049
	Observed saving	**0.143 (75%)**

3.30 It can be seen that the scheme was expected to result in a forecast saving of 23% in the opening year, accounting for an increase in traffic, but an improved road standard. Observed information indicates that there has been a statistically significant change in collision rate, indicating that the reduction in collisions is significant even with less traffic than was forecast.

Security

3.31 The aim of this sub-objective is to consider both the changes in security and the likely number of users affected by the changes. For highway schemes, security includes the perception of risk from damage to or theft from vehicles, personal injury or theft of property from individuals or from vehicles. Security issues may arise from the following:

- On the road itself (e.g. being attacked whilst broken down).
- In service areas/car parks/lay-bys (e.g. vehicle damage while parked at a service station, attached whilst walking to a parked car).
- At junctions (e.g. smash and grab incidents while queuing at traffic lights.

3.32 The primary indicators for roads include surveillance, landscaping, lighting and visibility, emergency call facilities and pedestrian and cycling facilities.

Forecast

3.33 Security was not assessed as part of the scheme appraisal, with the AST noting that 'any security impact would be marginal and not quantifiable'.

Evaluation

3.34 The new route follows much of the alignment of the original road. Lighting was provided in areas where it was already present to minimise environmental intrusion into the local area (Environment Statement, 2008), and there were no changes to emergency call facilities or CCTV as part of the scheme. Forward visibility is much improved with the scheme, and increased capacity reduces the likelihood of slow moving traffic in congestion.

3.35 An underpass for non-motorised users was provided as part of the scheme. The ES noted that this would be lit by motion activated lighting to minimise impact on the AONB. On the site visit, it was observed that there was no visible lighting provided, as shown by Figure 3.4.

3.36 The scheme now has no access to local facilities due to closure of direct accesses, except via junctions at either end of the scheme. The short distance the scheme covers, and reduction in congestion as a result of the scheme is considered to outweigh this.

3.37 The overall assessment of the scheme on security is **neutral**.

Figure 3.4 – Non-Motorised User Underpass

Key points from Safety Evaluation

Collisions

- By removing direct private and commercial accesses to the A23, the scheme extent has been made inherently safer.
- Analysis of observed collision data for the scheme section shows a reduction (when compared to the counterfactual) of 13.3 (73%) collisions per year which is statistically significant suggesting that the scheme has had a beneficial impact on the A23.
- Analysis of observed collision data for the wider area shows a reduction (when compared to the counterfactual) of 10.1 (36%) collisions per year, which is statistically significant, suggesting that the scheme has had a beneficial impact at this level.
- The severity of collisions has reduced slightly post opening for the wider roads, where an increase from 20% to 22% is seen. For the A23 links, severity index has increased post opening from 15% to 20%. It should be noted however that severe collisions (there have been no fatal) have reduced 38% (1.2 collisions) post opening, however slight collisions have reduced at a faster rate, hence a seeming negative impact on severity.
- No detailed analysis has been undertaken regarding safety for NMUs at this early stage, however, this will be reconsidered during the five years after evaluation.

Forecast vs. Observed Collisions

- The scheme was forecast to having a saving of 1.8 collisions (14%) in the opening year for the A23 scheme section. When observed data is considered, a much larger saving (compared to the counterfactual) is seen of 13.3 (73%) indicating that the benefit for the scheme section is greater than forecast.
- The scheme was also forecast to have an impact on the local roads due to redistribution of traffic following the closure of Slaugham junction. A small increase was forecast for the opening year of 1.1 collisions (7%). Post opening an increase has been observed, higher than expected at 3.7 (47%).

Collision Rate

- Observed information indicates that there has been a statistically significant change in collision rate, indicating that the reduction in collisions is significant even with less traffic than was forecast.

Security

- Drivers now have no access to local facilities from the scheme, except via junctions at either end. The short distance, and reduction in congestion is considered to outweigh this potential disbenefit. Lighting has only been provided as per the pre scheme situation. Lighting has not been provided on the NMU underpass, although much of the NMU provision is not lit to reduce impact on AONB and the overall assessment of the scheme on security is neutral, as 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 providers and consumer users.
- Improve journey reliability.
- Provide beneficial wider economic impacts.

4.2 The study area for the scheme assessment of the impacts consisted of the A23 between Bolney and Handcross as well as local roads alongside this section (see Figure 2-4).

4.3 TUBA (Transport Users Benefit Appraisal) was used to forecast the economic benefits of the scheme although TUBA is unable to directly analyse collision benefits or user delays. A spreadsheet model based on COBA values was therefore used to appraise the safety benefits of the scheme and added manually to the analysis. The benefits were appraised over a 60 year period in line with current guidance.

4.4 This section provides a comparison between the outturn costs and benefits and the forecast economic impacts. Consideration is also given to the scheme's wider economic impact. Outturn journey time and safety economic impacts are based on the observed results at OYA reported in previous chapters of this report, and reforecast to a 60 year period.

Sources

4.5 The economic forecasts of the scheme have been taken from the Economic Appraisal Report (EAR) revision A7 published in February 2010. This report was an update of the EAR October 2008. The key changes between these two documents are:

- Revised costs.
- Inclusion of the Objectors Alternative 1 (OA1 – Slaugham Junction closed, reflects the built scheme).
- Update with TEMPRO 5.4.

4.6 Forecast scheme costs are taken to be those that were ministerially approved on 1st March 2012.

4.7 The outturn spend for this scheme was obtained from the Highways England Regional Finance Manager in April 2016. All costs presented in this report are in 2002 prices.

4.8 Evaluation of the outturn benefits presented here are based on the traffic and safety observations noted in the previous chapters of this report.

Present Value Benefits

4.9 The appraisal of this scheme considered the economic benefits of this scheme expressed in terms of present value (present value benefits - PVB) for the aspects set out in Table 4-1. This table also sets out the approach taken in this post opening evaluation to the re-forecasting of the long term impacts based on the observed data at this stage, and those which have not been evaluated and have been assumed as forecast. A tick symbol indicates that the element of benefits is considered as part of this evaluation. A cross symbol indicates that the forecast impact from the appraisal will be used in place of a full evaluation at this stage.

4.10 Only forecasts based on central growth estimates were presented in the EAR.

Table 4-1 Economic Benefits of Scheme (2002 prices)

Benefits in 2002 market prices, discounted	Forecast (EAR)	Evaluate?	Evaluation Approach
Journey Time	£237.04m	✓	Outturn journey time impacts in opening year can be calculated from observed data and forecasts.
Vehicle Operating Costs (VOC)	-£19.89m	✓	Ratio between EAR forecast and POPE re-forecast changes in indirect tax as measured by fuel consumption applied to the monetary forecast VOC in order to calculate a proxy outturn re-forecast value of VOC.
Journey time and VOC impacts during construction & future maintenance	-£2.40m	✗	Not known at this stage and not within the remit of POPE to evaluate, so assumed to be as forecast.
Safety	£1.52m	✓	Based on reduction in collision numbers.
Carbon Benefits	-£2.37m	✗	Assume as only small proportion of the overall scheme impacts
Total PVB as in EAR	**£213.91m**		
Indirect tax impact as a benefit	£13.51m	✓	Calculate outturn change in fuel consumption in opening year and use ratio against forecast change to re-forecast 60 year benefit
Total including Indirect Tax Revenue	**£227.41m**		

Evaluation of Journey Time Benefits

4.11 The change in annual vehicle hours over a wide network (including the A23 key links) was used to derive the forecast economic benefits, as these links are the key elements of economic benefit for the whole scheme. It is not possible to use TUBA outputs to create a comparable forecast based on the impacts on this route only as TUBA is matrix based and its output does not give any breakdown of the impacts by link or area.

4.12 Although the economic impacts were based on the benefits in a wider area, for this evaluation, we focus on the route where changes for users can be most clearly identified as being directly linked to the scheme. In this case it is vehicles using the A23 improved section.

4.13 Savings were considered for the weekday AM and PM peak periods only. No forecasts are available for flows or journey times during the interpeak, so have not been included in this outturn assessment.

4.14 During the appraisal it was noted (in the EAR) that '*weekend and bank holiday traffic flows approached or equalled weekday flows for the period from 11:00 to 20:00 both on an average Saturday and average Sunday. Accordingly it was agreed with the HA that it would be appropriate to include these in the economic assessment*'.

4.15 Information used in the TFR for this scheme has been used to create a proxy forecast vehicle hours saving on the A23 scheme section only. The observed vehicle hour savings have been

calculated from the time periods provided for traffic counts and journey time surveys, which are:

- Weekdays AM peak (07:00-10:00)
- Weekdays Interpeak (10:00-16:00)
- Weekdays PM peak (16:00-19:00)

4.16 This method uses the differences between the Do-Minimum and Do-Something values for the following variables:

- Link Distance
- Journey Times
- Traffic Flow

4.17 Additional traffic in the corridor, which is the traffic attracted by the improved A23, has been attributed with half the benefits using the economic principle of rule-of-half in line with WebTAG guidance.

4.18 The opening year observed savings are as shown in Table 4-2 for the scheme section. No forecasts are given in the TFR for journey time impacts on local traffic rerouting following the closure of Slaugham junction.

Table 4-2 Vehicle hour savings - opening year

Route section	Re- Forecast vehicle hour savings AM and PM Peak	Observed Vehicle Hour Saving AM and PM Peak
Scheme (Handcross to Warninglid)	162,833	43,456

Monetised JT benefits

4.19 The evaluation focuses on the A23 between Handcross and Warninglid. The methodology detailed below was applied to obtain a POPE re-forecast for the 60 year journey time benefits as shown in Table 4–3 and Table 4–4 below.

- The total predicted vehicle hours saved in the opening year on the key links was calculated using forecast flows, speeds and journey times from the TFR.
- The predicted monetary vehicle hour benefit was taken from the EAR for the whole appraisal area.
- The actual vehicle hour saving was calculated using observed before and after flows and journey time data.
- The ratio between predicted vehicle savings and actual savings for the same key links and time periods was applied to the total monetised benefit from the full TUBA appraisal. This is based on the assumption that the savings for key links are representative for all links.

Table 4–3 Comparison of Predicted and Observed Vehicle Hours

Opening year Vehicle Hours Saving	
Reforecast scheme key links	162,833
Observed (OYA)	43,456
% difference	**-73%**

4.20 The table shows an observed saving in vehicle hours for the A23 scheme of 43,456 hours in the opening year compares to the reforecast for the same key links of 162,833 hours (73% lower than forecast). Therefore, the observed saving is around 27% of that predicted for the AM and PM Peaks. This is mainly due to journey time savings being lower than forecast, particularly in the AM peak, but also traffic flows are less than forecast for the opening year.

4.21 The EAR states that that the full TUBA assessment showed that the forecast time saving benefits for all appraised time periods for the scheme were just over £237m (2002 prices and values). However the EAR also includes a monetary forecast for 60 years for the AM and PM peak periods alone totalling almost £170m, hence we can deduce a value for the remaining period.

4.22 Using the ratio between the reforecast model of the hours saved on the A23 in the opening year and the observed hours saving and the economic benefit over the whole 60 year appraisal period, gives an outturn benefit of £45.316m, as shown in Table 4–4, just for the peak periods.

4.23 This lower than forecast benefit is mainly due to the lower than expected traffic growth anticipated in the original forecasts, as well as the lower observed journey times.

Table 4–4 Time Benefits comparison

Forecast 60 years		Outturn reforecast 60 years	
Key Links AM and PM Peak 60 years	£169.843m	£45.316m	27%
Non AM or PM Peak 60 years	£67.914m	£18.120m	Assumed at 27%
Scheme TUBA 60 years	£237.037m	£63.436m	27%

4.24 As no forecasts were available (for either traffic flows or speeds), this has not been included in the assessment. Therefore for the purposes of this evaluation, for the remaining impact for the scheme it has been assumed that the benefits were also 27% of the forecast, and this has been added to the outturn AM and PM peaks reforecast.

Evaluation of Safety Benefits

Forecast Safety Benefits

4.25 The forecast safety benefits for this scheme were derived from a spreadsheet model based on the standard COBA manual parameters with the findings detailed in the February 2010 EAR. Observed collision rates were used to forecast collisions for the Do-Minimum scenario, and default COBA collision rates were applied for the A23 scheme section. The EAR notes forecast opening year savings for two areas, the A23 and the local roads affected by the closure of Slaugham junction.

4.26 For the OA1 built scheme, an opening year saving of 1.8 collisions was forecast for the A23, with a 60 year monetary benefit equating to £1.70m (2002 prices discounted to 2002). An opening year increase of 1.1 collisions was forecast for the local roads as a result of the increase in traffic (due to the closure of direct access to A23), and over 60 years there was an overall net disbenefit on the local roads equating to -£0.18m. Therefore the total forecast benefit for this scheme was calculated to be a combined saving of £1.52m over 60 years. These figures are based on a central growth forecast which was considered at the time of the report (2010) as the most likely growth scenario.

4.27 The forecast savings on the A23 were due to be as a result of removing substandard accesses and upgrading the alignment. The removal of Slaugham junction was forecast to increase traffic flows on other local roads, hence a small forecast increase on other roads.

Evaluation of Safety Benefits

4.28 The POPE methodology for the evaluation of the outturn of the economic value of benefits arising from safety improvements is based on the comparison of observed and forecast collision changes at the POPE evaluation stage (in this case one year after opening, and using the pre scheme counterfactual scenario to take background decline in collisions into account). This is then combined with the assumption that the observed safety impact at this stage can be taken as indicative of that over the whole 60 year appraisal period.

4.29 The methodology for calculating benefits is based on the presumption that the forecast ratio of the number of collisions saved in the first year to the forecast 60 year benefits can be used to generate a reforecast economic benefit based on the observed saving in collisions reported in Chapter 3 of this report.

4.30 Monetisation of these savings is calculated by:

- Calculating the net difference between the forecast opening year saving and the opening year observed collision savings including consideration of the counterfactual in the appraised area.
- Monetising the net difference in collision numbers using the PAR method which values collisions by road type and enables capitalisation over 60 years based on expected traffic growth.
- Calculating the 60 year outturn benefits for the whole area by combining the forecast from for the whole study area with the outturn assessment of the net difference.

4.31 The evaluation of the monetary safety benefits is shown in Table 4-5. All monetary values are in 2002 prices discounted to 2002.

Table 4-5 – Comparison of Forecast and Re-forecast Collision benefits

Central Growth Forecast (whole area)	**Forecast Collision Saving (Opening Year)**	**(a)**	**0.7**
	Central growth forecast (60 years)	(b)	£1.52m
Observed impact area	Average Annual Collision Saving in Post-Opening Period (based on adjusted counterfactual)	(c)	10.1
	Net difference between forecast and observed	(d) = (c) – (a)	9.4
	Monetisation of net difference for opening year	(e)	£0.89m
	Monetisation of (d) into 60 year impact of net difference between forecast and observed (using PAR 5 guidance)	(f)	£32.812m
	Outturn 60-year benefit	**(b) + (f)**	**£34.33m**

4.32 Table 4-5 demonstrates that the re-forecast 60 year monetary safety benefits for the appraisal area are substantially higher than originally forecast.

Indirect Tax - Present Value Cost

4.33 Indirect tax 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. For the highways scheme in this study, the tax impact is derived primarily from the monetisation of forecast of the changes in fuel consumption over the 60 years period. A scheme may result in changed fuel consumption due to:

- Changes in speeds resulting in greater or lesser fuel efficiency for the same trips
- Changes in distance travelled
- Increased road use through induced traffic or the reduction of trip suppression

4.34 Note that at the time this scheme was originally appraised, costs were initially taken for the wider costs to public accounts and thus the impact of the scheme on indirect tax was considered within these wider costs. The current guidance[6] (AMCB, Analysis of Monetised Costs and Benefits) considers the costs of this scheme only in terms of the 'broad transport budget' i.e. costs and revenues which directly affect the public budget available for transport and therefore the indirect tax impact is covered within the benefits. Both are compared here.

4.35 Forecasting of the impact of the scheme on indirect tax was done within the TUBA modelling and was based on the whole study area. This showed that the scheme was expected to increase tax revenue over the 60 years appraisal period. To assess the outturn impact we have calculated the impact on the A23 corridor in the opening year compared with the forecast and then used the ratio method between forecast and outturn to extrapolate the impact over the wide area over 60 years.

4.36 The outturn impact is only based on the observed changes on the A23, but as shown previously, some of the additional traffic is reassigned traffic, therefore the outturn impact may be a slight overestimate.

Table 4-6 – Indirect tax as present value

Costs in 2002 market prices, discounted	Forecast	Reforecast
Impact on Indirect tax raised	£13.51m	£8.85m

4.37 This evaluation shows that the scheme will result in an increase of approximately £8.85m in indirect tax, at a level lower than expected. The reduced tax revenue is due to a lower than expected increase in traffic and speed on the A23 improved route. If this impact was included within the assessment of the cost to the Treasury, this would reduce the cost of the scheme significantly.

Vehicle Operating Costs (VOC)

4.38 For most highway schemes including this one, the VOC and indirect tax impacts are both very closely linked to changes in fuel consumption (e.g. changes in speeds) which has similar magnitude of impacts, but from opposite sides of the benefits balance. That is, if there is increased fuel consumption, VOC will increase due to users paying more for fuel (i.e. a disbenefit) and thus more indirect tax will be collected by the Treasury which is considered to be a benefit according to current guidance. For this scheme the ratio used for the reforecast indirect tax calculation has been applied to the monetary value for VOC.

[6] TAG UNIT A1.1 Cost-Benefit Analysis, October 2013

Table 4-7 – Vehicle Operating costs (present value)

Costs in 2002 market prices, discounted	Forecast	Reforecast
Impact on vehicle operating costs	-£19.89m	-£13.13m

4.39 This evaluation shows that the scheme will result in an increase in vehicle operating costs, however, at a level lower than expected. The reduced costs are due to a lower than expected increase in traffic and speed on the A23 improved route.

Carbon Impact

4.40 The impact of the scheme on greenhouse gases (change in carbon outputs) is considered in detail in the next chapter of this report. At the time this scheme was appraised, an output from the TUBA model was a monetary value for the change in carbon emissions, based on a price per tonne.

4.41 As this scheme was appraised using TUBA, this calculation has already be made to estimate that the scheme would result in an increase in carbon, at a cost of -£2.37m over the 60 year appraisal period.

4.42 A proxy change in carbon emissions has been calculated using the forecast and observed journey times and traffic flows along the A23 scheme key links (see Chapter 5). However, as the only detailed forecast information available is for the peak periods, at this early stage, the monetary impact of the scheme on carbon is assumed as forecast.

Scheme Costs

4.43 This section compares the forecast costs of the scheme as of the start of the construction period with the actual spend at the time of this study.

4.44 Costs of the scheme are also considered for the full appraisal period of 60 years so they can be compared with the benefits over the same period. The full costs examined are made up of the following:

- Investment costs: before and during construction
- Maintenance costs; over the 60 years after opening

4.45 Investment costs are considered in terms of a common price base of 2002 for comparison with forecast costs. For comparison with the benefits, overall costs are expressed in terms of present value (PVC).

Investment Costs

4.46 The investment cost is the cost to Highways England of the following:

- costs of construction
- land and property costs
- preparation and supervision costs
- allowance for risk and optimism bias

4.47 The last pre-construction forecast of the investment costs was in March 2012 when the scheme was given the final go-ahead. This was a revision to the forecast costs contained in the EAR in 2010.

4.48 For the purpose of this evaluation, we have determined the forecast scheme cost based on data presented in the SGAR5 form (estimate of 1/3/12) which was an update on the figures presented in the EAR. This gave a total P50 cost for Highways England Major Projects of £76.1m in current prices.

4.49 The outturn spend profile for this scheme (as of April 2016) has been obtained for the purpose of this study and covers the period 2009 – 2016 (spend to date). For the purpose of comparison between forecast and actual, and with other major schemes, prices have been converted to 2002 prices. This figure can then be compared with the forecast cost on a comparable basis.

4.50 Comparison between the forecast and outturn is presented in Table 4-8.

Table 4-8 – Scheme Investment Costs (£m)

Forecast Cost (March 2012)		Outturn Cost (as of April 2016)		% Difference
P50 submission	£76.1m	As spent costs in 2009-2016 years and prices	£78.0m	
Cost in £million 2002 prices, undiscounted	£59.2m	Cost in £million 2002 prices, undiscounted	£60.1m	2%

4.51 The key point to note as shown in the table is that the outturn cost was accurate when compared to forecasts, being only 2% above that forecast.

Cost of Maintenance

4.52 Appraisal of this scheme included the assessment of the net impact of maintenance over the 60 year appraisal period using the software QUADRO. This included:

- The cost of maintenance in the DM and DS scenarios (both periods of resurfacing and more extensive road re-construction.
- Delays and accidents during maintenance in the DM and DS scenarios.

4.53 The net difference between these gave a benefit to the value of £8.9m due to the additional period of road reconstruction that would be required in the DM scenario.

4.54 Future maintenance is not re-evaluated in POPE. It is assumed that the forecast is still valid and thus is included in the PVC unchanged.

Summary of Present Value Costs (PVC)

4.55 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.

4.56 Following current Treasury Green Book guidance, calculation of the present value entails the conversion to market prices, then discounting by year. This uses a rate of 3.5% for the first 30 years and 3% thereafter.

4.57 The full PVC is made up of the following costs converted to present value:

- Investment costs, as above
- Net savings in future maintenance costs
- Indirect Tax Revenues during the lifetime of the scheme

4.58 The final TUBA model (2010) presents the PVC as £30.27m but this is based on an older version of the cost forecast, so we have re-evaluated the present value of the investment cost

shown in Table 4-8 for the final forecast. This revised value presented in Table 4-9. This is the 2002 costs, expressed in market prices discounted at the annual rate of 3.5%. The outturn costs are presented likewise.

Table 4-9 – Investment Costs as Present Value (£m)

Present Value £m (costs in 2002 market prices, discounted)	Forecast	Outturn
Investment Costs	£50.7m	£51.6m
Net Maintenance Costs	-£8.9m	-£8.9m
PVC	**£41.8m**	**£42.7m**
Indirect Tax	-£13.5m	-£8.9m
Total PVC with indirect tax	**£28.3m**	**£33.8m**

Benefit Cost Ratio

4.59 The Benefit Cost Ratio (BCR) is used as an indicator of the overall value for money of the scheme. It is the comparison of the benefits (PVB) and costs (PVC) expressed in terms of present value.

4.60 Projects with a BCR greater than 1 have greater benefits than costs; hence they have positive net benefits. The higher the ratio, the greater the benefits relative to the costs. It is to be noted that the BCR is insensitive to the magnitude of net benefits and therefore may favour projects with small costs and benefits over those with higher net benefits.

4.61 Table 4-10 compares the predicted and outturn costs and benefits.

Table 4-10 – 60 Year BCR Evaluation

		Forecast	Outturn Reforecast
Costs	**PVC**	**£28.3m**	**£33.8m**
Benefits	Journey time benefits	£237.04m	£63.44m
	Journey time and VOC impacts during construction and future maintenance	-£2.40m	-£2.40m
	Safety Benefits	£1.52m	£34.33m
	Vehicle Operating Costs	-£22.37m	-£13.13
	Carbon benefits	-£2.37m	-£2.37m
	PVB subtotal	**£213.91m**	**£79.87m**
	Indirect Tax	£13.51m	£8.85m
	BCR (with indirect tax in PVC)	**7.07**	**2.36**
	BCR (with indirect tax in PVB)[7]	**5.20**	**1.87**

4.62 It can be seen from Table 4-10 that the BCR is lower than forecast mainly due to lower than expected journey time benefits. A BCR of 1.87 is considered medium value for money.

4.63 It should be noted that the BCR ignores non-monetised impacts. In the Transport Business Case guidance, the impacts on wider objectives must be assessed but are not monetised. The evaluations of the wider economic impacts, environmental, accessibility and integration objectives are covered in the following sections of the report.

Wider Economic Impacts

4.64 It is inherently difficult to isolate 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 A23 route between Handcross and Warninglid may have assisted local and regional socio-economic aspirations around Gatwick.

Forecast

4.65 The AST for this scheme forecast that the scheme would have a neutral impact, with a comment stating 'no impact on any regeneration areas therefore an assessment of wider economic impacts is not required'.

Evaluation

4.66 The A23 is a strategically important route for the South East, and the key objectives of this scheme included to remove the bottleneck at this location. Evidence presented in this report demonstrates that journey times along the A23 for the scheme section have reduced significantly, with journey time reliability also improving. This will have benefits for freight and business users who may have improved productivity due to reduced time spent on the road.

[7] At the time of scheme appraisal, Treasury guidance was to include indirect tax as a cost. However, the most recent guidance on indirect tax impacts is to include these as a benefit, rather than a reduction in cost, therefore two BCRs are presented here.

The scheme can therefore be linked to improving the wider transport network for development and employment by reducing the time to reach key urban areas.

4.67 The overall assessment of the impact of the scheme on the wider economy is neutral at this stage. Further assessment of the longer term impact of the scheme on the economy will be considered at the Five Years After POPE stage.

Key Points - Economy

Present Value Benefits

- The outturn journey time benefits of £63.436m are approximately 27% of the forecast. This is mainly due to the observed traffic flows being below that forecast due to lower background traffic growth observed than forecast. Observed journey time savings were also not seen at the level forecast.
- Outturn safety benefits were calculated to be £34.33m compared to a forecast of £1.52m. This difference is due to a higher than expected collision saving in the opening year.
- The disbenefit from vehicle operating costs is less than forecast, due to the observed speeds and traffic flows being lower than forecast.
- Overall the outturn PVB is 37% lower than forecast.

Costs

- Outturn investment costs were very close to the forecast, being only 2% higher than forecast at £60.1m.
- The outturn impact on indirect taxation of £8.85m is lower than forecast due to lower overall traffic levels (compared to forecast), and lower than expected speed changes on the A23.

Benefit Cost Ratio

- When calculated by the method applicable at the time of the appraisal, the scheme achieves a BCR of 2.4 which represents high value for money. When indirect tax is taken as a benefit, as per the current method, the scheme achieves a BCR of 1.9 which shows the scheme is delivering medium value for money.

Wider Economic Impacts

- Due to the inherent difficulty in isolating the wider economic impacts of the scheme, it has not been possible to conclude whether the scheme has had a direct impact on supporting the growth aims of the Gatwick area. However, the increased capacity provided by the scheme has improved journey times and reliability for users, and offers resilience against future growth.

5. Environment

Introduction

Background

5.1 A scheme to widen the route was considered, but abandoned following a Public Inquiry in the 1990s. Further studies to assess the environmental impact were undertaken and a revised on-line widening scheme, which reduced the environmental effects, was developed. The amended scheme was considered at a Public Inquiry in June 2009 and following the Inquiry and subject to modifications the widening scheme was progressed.

5.2 It was expected that improved traffic flows as a result of the scheme would reduce congestion, increase the reliability of journey times and improve safety, whilst supporting the objective to minimise the impact of the trunk road network on both the natural and built environment.

Project Overview

5.3 The ES noted that the A23 between Handcross and Warninglid in West Sussex was the last remaining section of the A23 to undergo improvement works to alignment and profile. It was located within the designated high quality landscape of the High Weald Area of Outstanding Natural Beauty (AONB): which recognises the landscape character of the area as being of National importance. For much of its length, the existing section of the A23 was said to be integrated into the local landscape as it wound its way through the landform, helped by the mature trees within the central reserve which contributed to the integration of the road into the landscape. In addition to being within the AONB, the road abuts ancient woodland, a Site of Nature Conservation Interest (SNCI), National Trust land and crosses two watercourses, the River Ouse and Anne's Wood Stream.

5.4 The Scheme would, as far as possible, be constructed within the existing highway boundary to minimise environmental impact and would widen the road from two to three lanes in each direction, straighten bends and smooth out the gradient making the road safer by improving visibility; close existing direct accesses onto the A23 from properties and side roads and provide safer alternative routes; and improve existing junctions at Handcross, Slaugham and Warninglid.

5.5 It is understood that approximately 4.4 ha of land would also be required temporarily beyond the proposed highway boundary for the site compound, drainage works and for ecological mitigation works. Works in advance of site clearance included the creation of new hedges and management of existing hedges for dormice and bats.

5.6 It was expected that the scheme would;

- Minimise land take from the National Trust (NT) (on the east side) and ancient woodland (on the west side);
- Minimise night-time visual impact;
- Maintain or improve the water quality of the River Ouse and Anne's Wood Stream following completion; and
- Respect the environment.

Assessment

5.7 The Non-Technical summary to the ES expected that the outcome of the Scheme would be:

- Traffic flowing more smoothly along the A23, resulting in fewer accidents, reduced driver stress and more reliable journey times;
- Safer access onto the A23 at junctions;
- Improved pedestrian and cycling facilities, including a pedestrian subway and a new cycleway along the A23; and
- Improved drainage and treatment of road runoff.

5.8 For each of the environmental sub-objectives considered by the ES, the evaluation in this chapter assesses the environmental impacts predicted in the Project's Appraisal Summary Table (AST) and ES against those observed one year after opening.

5.9 In the context of the AST and ES forecasts and using evidence collected one year after (OYA) opening, this chapter presents:

- A record of any significant changes to the Scheme that have taken place since the ES;
- An evaluation of the effectiveness of the mitigation measures implemented as part of the Scheme; and
- A summary of key impacts against all of the ten environmental WebTAG sub-objectives.

Data Collection

5.10 The following documents/data have been used in the compilation of this environmental chapter of the OYA report:

- Appraisal Summary Table (dated 20/04/12 Version 5);
- Environmental Statement Volumes 1A Main Text, 1B Figures and specialist Technical Reports, October 2008;
- Non-Technical Summary to the ES;
- ES Chapter 9 Noise and Vibration, & Technical Report: Noise and Vibration Addendum March 2009 and Further Addendum;
- Health and Safety File July 2015;
- Environmental Site Inspection Reports;
- Pre and Post Scheme Noise Monitoring report March 2015;
- Modifications to Draft Orders December 2009;
- Designers Response to Stage 3 Road Safety Audits on the A23 Mainline February 2015;
- Environmental Masterplan Sheets 1 – 6 (Version P2 dated 7/7/11);
- As Built plans;
- Various ecology survey and monitoring reports for pre and during construction phases;
- Preliminary Handover Environmental Management Plan (HEMP) 17th April 2015;
- Mid Sussex District Council web page links to recent air quality reports;
- Scheme Newsletters.

5.11 A list of the background information specifically requested and received to help with the compilation of this report is included in Appendix E.

Scheme Amendments

Modifications as a result of the Public Inquiry

5.12 Following the Public Inquiry in 2009 the Inspector recommended certain modifications to the proposed scheme in response to objections / representations received and alternative proposals put forward. As a result, further traffic survey work and consultation on the changes was undertaken and it was agreed to delete the proposed Slaugham junction and provide a different access to Handcross Market Garden. The scheme was also amended to include enhanced provision for pedestrians, equestrians and cyclists to that originally suggested.

Revised Noise Assessment

5.13 The ES Noise and Vibration chapter and accompanying Technical Report were superseded and the noise assessment revised (Addendum March 2009) in response to DMRB guidance for noise being updated in August 2008. Subsequently, an error in traffic flow data used in the noise model was identified for the B2110 Horsham Road and a Further Addendum was issued which describes the changes to the noise assessment in the March 2009 Addendum as a consequence of using the corrected traffic flow figures for B2110 Horsham Road. This Further Addendum notes that with the traffic flow data corrected, properties on Horsham Road would continue to experience a reduction in noise level with the Scheme for the design year (2028) compared to the Do-Minimum, however, the predicted reduction would be lower than anticipated in the Addendum March 2009.

Minor amendments to environmental commitments due to scheme delay

5.14 The HEMP notes that some of the details with respect to environmental commitments included within documents prepared during the consultation, design and construction phases of the scheme have been superseded by subsequent events and development of the project on site i.e. that as a result of some 12 months delay in commencement of the works on site, some minor details of previously made agreements with third parties do not reflect subsequently adjusted dates for on-going monitoring and maintenance activities. Where necessary agreements for continued access with affected landowners was being sought, to enable on-going environmental monitoring or maintenance to comply with the programme as agreed with Natural England (NE) and protected species license requirements.

Site Visit

5.15 As part of the OYA evaluation, a site visit was undertaken in early May 2016. The visit included the taking of photographs of the scheme and views for comparison with selected photographs/photomontages included within the ES (included in Appendix F).

Consultation

5.16 Statutory environmental organisations, stakeholders, County/District/Parish councils, and relevant organisations contacted as part of the OYA evaluation regarding their views on the impacts they perceive the Scheme has had on the environment are shown in Table 5-1, below.

Table 5-1 – Summary of Environmental Consultation Responses

Organisation	Field of Interest	Comments at OYA
Natural England	Biodiversity & Landscape	Unable to provide feedback on this occasion due to workload pressures and reduced capacity
Historic England	Heritage	Due to staff changes unable to provide feedback as no detailed knowledge of the Scheme.
Environment Agency	Water	Although would normally be interested in helping with feedback unfortunately, unable to answer questions due to lack of capacity, other priorities and workload pressures.
Mid Sussex District Council	General	There have been no noise based complaints and MSDC has no air quality monitoring station in the vicinity.
West Sussex County Council	General	Provided a response for noise, biodiversity and PRoWs / NMUs
Slaugham Parish Council	General	Did not respond to the invitation to provide feedback
Ansty & Staplefield Parish Council	General	Considers the cycle path to be a great success and that provision of cycle paths should be encouraged as part of all new road schemes. Noise from the A23 has increased and the wildlife monitoring is intrusive and in some instances appears to discourage wildlife from re-establishing.
Lower Beeding Parish Council	General	Did not respond to the invitation to provide feedback
Bolney Parish Council	General	Did not respond to the invitation to provide feedback

Organisation	Field of Interest	Comments at OYA
High Weald AONB[8]	Landscape	Unfortunately on this occasion unable to provide feedback due to time and personnel constraints but welcomed the opportunity to comment and would be interested in being contacted at FYA.
National Trust	Biodiversity	Commented on the wildlife tunnel (understand it has not been a success), loss of woodland adjacent to the A23, introduction of Ash dieback disease and improved quality of retained woodland.
Sussex Wildlife Trust	Biodiversity	Did not respond to the invitation to provide feedback
Sussex Bat Group	General	Did not respond to the invitation to provide feedback

Animal Mortality

5.17 The Managing Agent has also been consulted with regard to animal mortality figures which have been made available for the period from October 2009 to April 2016. These figures are discussed in the biodiversity chapter.

Traffic Forecast Evaluation

5.18 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 are undertaken for POPE and an assumption is made that the level of traffic and the level of traffic noise and local air quality are related.

5.19 The ES states that in 2006, the A23 between Handcross and Warninglid carried an average of 65,000 vehicles per day (vpd) (both directions) of which 6% were heavy goods vehicles. With the proposed Scheme this would result in an increase to 77,000 vpd in 2013 and 94,000 vpd by the design year 2028. The traffic forecasts included within the ES were for the original scheme and took the proposed upgrading of the Slaugham junction into account; because this junction was subsequently deleted it is considered more appropriate to use predicted flows from the 2009 Traffic Forecasting Report (TFR) instead. Table 5-2 below compares forecast and observed traffic flows for the Scheme. It has not been possible to compare HGV numbers pre and post-scheme due to unavailability of comparison data.

5.20 The ES assumed that traffic speeds with the scheme would be 70mph speed limit, the Health and Safety (H&S) File confirms that this is the case.

Table 5-2- DS Traffic flow (AADT): Based on Traffic Forecasting Report 2009

Site Description	Direction	Forecast AADT (Interpolated to 2016)*	Observed Post-scheme ADT (2016)	Difference	% Difference
A23, North of Warninglid	NB	44,110	37,370	-6,740	-15%
	SB	41,660	36,630	-5,030	-12%
	Two-Way	85,770	73,990	-11,780	-14%

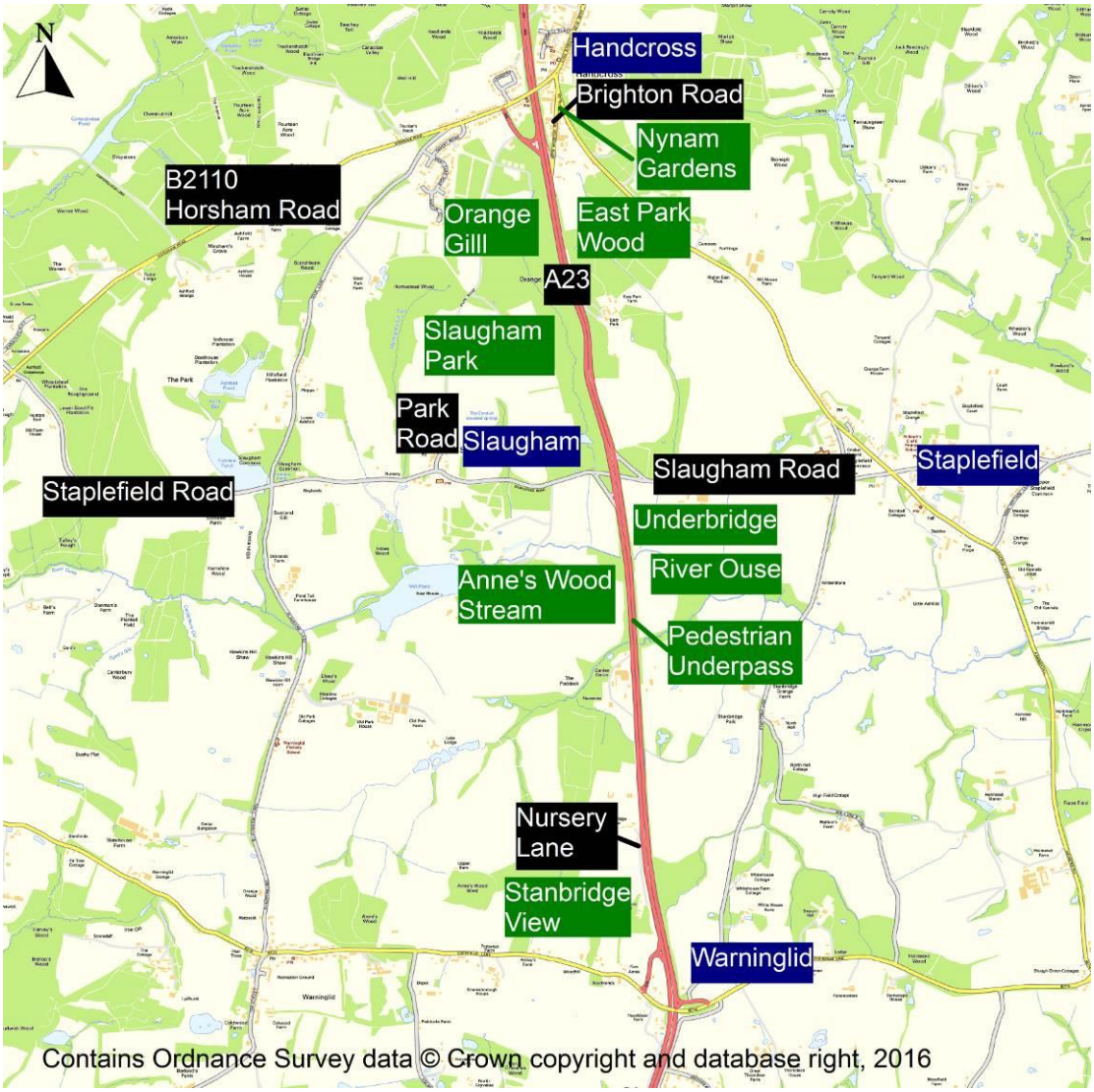
[8] AONB: Area of Outstanding Natural Beauty

One Year After Environmental Assessment

5.21 Included in this section is a brief summary of statements from the AST and ES evaluations which have been included to provide the context for the OYA evaluation.

5.22 The key environmental features that are discussed in this chapter are shown in Figure 5.1 below.

Figure 5.1 – Key Environmental Features



Noise

Forecast

Appraisal Summary Table

5.23 The AST states that in updating the AST the proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, were taken into account – namely a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. Receptors located adjacent to the A23 and associated slip roads in general were predicted to experience a slight increase in noise levels as a result of the proposed Scheme. Overall, there would be a slight increase in population annoyed by noise, as a result of

changes in traffic flow on the local road network and alignment changes to the A23. No residential receptor would experience a noise change >3dB in the design year (when comparing the Do-Minimum 2013 and Do-Something 2028).

5.24 The AST states that the key assumptions are: in the opening year, the do-minimum road surface was assumed to be hot rolled asphalt and the do-something road surface a low noise surface (LNS). In the design year, both do-something and… [AST missing remaining text, but assumed to say 'and do minimum scenarios have been assumed to have low noise surfacing'.]

Environmental Statement Addendum and Further Addendum

5.25 The ES Addendum notes that the proposed scheme passes mainly through low populated areas except at the northern end, with the potential to result in changes in levels of noise and vibration for nearby sensitive receptors. Potential operational impacts would be as a result of changes in traffic volume on the local road network, proposed widening of the A23, junction improvement works and associated earth works.

5.26 With regard to mitigation measures, although environmental barriers and earthworks would be incorporated into the scheme these were not specifically for noise reduction and were therefore not taken into account in the assessment. The ES notes that a low noise surface would be used along the entire length of the scheme. No properties were expected to be eligible for noise insulation.

5.27 The noise assessment identified predicted noise levels at 10 selected representative noise sensitive receivers at the year of opening (2013) and the design year (2028);

- In the opening year the majority of representative receptors were predicted to experience a minor beneficial impact with the Do-Something scenario, due to the effects of the proposed low noise surface. 28 Truggers and Stanbridge Place were predicted to experience a negligible noise level decrease.
- For the design year Gwynfa, Merrivale, Stanbridge View, 28 Truggers, and Jacaranda were predicted to experience negligible adverse impacts as a result of the Scheme. Summer Hill, Nymans Gardens, East Park House, Myrtle Cottage and Stanbridge Place were predicted to experience minor adverse impacts with noise level increases over 1 dB(A) and below 3 dB(A).
- Stanbridge Place was predicted to experience the greatest noise level increase of all noise sensitive receptors within the assessment area in 2028 when compared with the do-minimum scenario, predominately due to a reduction in noise attenuation afforded by an existing two metre wall between the property and the A23, which would be moved further away from the A23 as part of the scheme design.

5.28 In accordance with the DMRB methodology, noise levels were also predicted for all dwellings within 600m of the Scheme. In comparison to the Do-Minimum scenario 2013, the introduction of the proposed Scheme would result in the following in 2028;

- 393 properties experiencing a decrease in noise level and 318 properties experiencing <10% nuisance level decrease
- 76 properties experiencing an increase in noise level, 109 properties experiencing <10% nuisance level increase and 42 properties would experience noise nuisance increases of between 10% and <20% (151 in total).
- For other noise sensitive receptors including Slaugham Place, Handcross Hall, Community All Saints Church and Nymans Gardens (NT):15 would experience a decrease in noise and 2 an increase.
- Vibration nuisance was predicted to reduce at all properties in close proximity of the scheme in 2013. A number of properties (13 of 15) would experience slight increases in vibration nuisance in 2028 when compared to the do minimum scenario, with a maximum increase of 7.7% at Stanbridge Place.

5.29 As noted in the Scheme Amendments (para 1.13 above) a Further Addendum was published to correct traffic flow data for Horsham Road. In summary, the Further Addendum stated that the updating of the noise model with corrected traffic flow data did not result in any properties

in the assessment area being predicted to experience significant noise changes, and no properties would be eligible for noise insulation. The corrected traffic flow did result in a greater number of properties predicted to experience increases in noise (123 rather than 76) and nuisance (198 rather than 151), and less properties predicted to experience decreases in noise (346 rather than 393) and nuisance (271 rather than 318) with the scheme than was previously predicted in the Addendum.

5.30 The long term impact was expected (in the ES) to be Slight Adverse for a small number of receptors.

Consultation

5.31 West Sussex County Council noted that there are four DEFRA Noise Important Areas (NIAs) mapped for this section of the A23 between Handcross and Warninglid, and queried whether the scheme design considered issues in association with these NIAs which, it noted, are under the responsibility of Highways England[9].

5.32 Mid Sussex District Council confirmed that there have been no noise based complaints made to the Council concerning the A23 since the opening of the newly widened section of the A23.

5.33 Ansty and Staplefield PC considers that noise from the A23 has increased.

Evaluation

5.34 No information confirming the Road Surface Influence (RSI) value of the road surfacing or whether any properties have been eligible for noise insulation has been received by POPE.

5.35 Representative post opening noise monitoring at two locations was reported in the 'Pre and Post Scheme Noise Monitoring' report produced in March 2015 which presented measured road traffic noise levels undertaken at East Park House and Stanbridge View for the pre scheme (2006) and post scheme (2015) scenarios.

5.36 In comparing the measured noise levels at East Park House, the report notes that a slight noise reduction has occurred as a result of the scheme, similar to that predicted in the ES. It notes that 'given that this property is representative of others located in close proximity to the A23, it can be inferred that similar reductions would be experienced for such properties'.

5.37 At Stanbridge View the ES predicted a 2dB reduction, however, large reductions in measured noise levels were recorded post opening (-11.2 dB) compared to the pre-scheme noise measurements. The report considered this to be due to the presence of a timber fence constructed between Stanbridge View and the A23, stating that although this is not an acoustic barrier, it will provide attenuation to road traffic noise on the A23.

5.38 With regard to traffic flows, an assumption is made by POPE methodology that noise levels will be as expected if observed traffic flows are within 25% more or 20% less than predicted. As can be seen in Table 5-2 above, the data indicates that the observed two-way traffic flows are 14% lower than forecast and as such, are within the tolerances prescribed by POPE.

5.39 Based on the available information, it is therefore concluded that the effects of the Scheme on the noise climate are likely to be **as expected**.

[9] DfT Strategic road network performance specification 2013-15. Output 11 Environment para 5.4 'The network operator should continue to investigate 'Important Areas', identified by Defra, that are impacted by noise, and treat 'Important Areas with First Priority Locations' as a priority. The network operator should also maintain the practice of taking noise measurements where necessary in the locations of road improvement schemes'.

Table 5-3 –Evaluation Summary: Noise

Sub-Objective	AST	OYA
Noise	• Without scheme: estimated 222 people likely to be annoyed by traffic noise in the longer term • With scheme: estimated 228 people likely to be annoyed by traffic noise in the longer term • Without scheme 2028: 288 people exposed to noise levels in excess of 66dB LAeq. • With scheme 2028: 286 people exposed to noise levels in excess of 66dB LAeq. • With and without scheme: 0 people exposed to noise levels > 80dB LAeq. Net annoyance change: 7	As Expected

Air Quality

Forecast

Appraisal Summary Table

5.40 The AST notes that in updating the AST the proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, were taken into consideration. The marginal changes in the air quality reported in the AST were a result of the minor changes in the traffic flows due to the removal of Slaugham junction and the resulting reassignment of the traffic. All assessed properties would experience deterioration in air quality due to widening of the road. Pollutant concentrations would remain well below Air Quality Objective levels.

Environmental Statement

5.41 The ES noted that the A23 passes mainly through areas of low population except at the northern end where it passes through Handcross. The ES air quality assessment included consideration of:

- Local air quality impacts at representative receptors; Nitrogen dioxide (NO2) concentrations were predicted to increase very slightly (less than 1µg/m3) at a few representative receptor locations. NO_2 and particulate matter (PM_{10}) concentrations would decrease very slightly (less than 1µg/m3) at other receptor locations. These changes would not be measurable and therefore it was considered that overall, the proposed Scheme would have no significant impact on air quality at the selected receptors.

- Local generalised assessment for the population within 200m of the scheme; overall a very slight increase in people's exposure to concentrations of NO_2 and PM_{10} although it was estimated that concentrations would remain well with Air Quality Objectives (AQO) and overall, the proposed Scheme would have no significant impact on human exposure;

- Regional air quality assessment in terms of changes in emissions as a consequence of the scheme; for the majority of pollutants considered there would potentially be a small increase in the total annual mass emissions when comparing the Do-Minimum and Do-Something scenarios for both Opening year and Design year. This change would be due to a slight increase in Average Annual Daily Traffic (AADT) along a number of roads in the local network due to the proposed Scheme. However, this increase would be very slight and the impact was determined to be insignificant.

5.42 Air quality was assessed as potentially being made worse by increased traffic volume but that there would be a counter-balancing beneficial effect from reduced congestion during peak travel times. Overall, the assessment found there would be no significant impact on air quality and the long term impact was expected to be Neutral. No post-construction mitigation was required.

Consultation

5.43 Mid Sussex District Council responded that it does not have any data relating to air quality as there is no air quality monitoring station in the vicinity of the Scheme - the nearest site is located slightly further up the A23 where the road was already widened.

Evaluation

5.44 The main predicted air quality impact arising from the operational phase of the proposed Scheme would be pollutant emissions arising from the changes to traffic flows and speeds and associated pollutant emissions.

5.45 An assumption is made by POPE methodology that local air quality will be as expected if observed traffic flows are within 10% more or 10% less than predicted; as can be seen Table 5-2 above, the data indicates that the observed post-opening two-way traffic flows are lower than expected by 14%. Changes in vehicle numbers are -11,730 AADT and being greater than 1,000 AADT, the percentage differences between the predicted and observed flows are considered likely to be significant indicating improved air quality.

5.46 Based on the information available, it is concluded that the effects of the scheme in terms of local air quality are likely to be **better than expected**.

Table 5-4– Evaluation Summary: Air Quality

Sub-Objective	AST	OYA
Air Quality	• NO2 - Overall Assessment Score: +26.00 • Properties with improvement 41, deterioration 283 • No change 33. • PM10 - Overall Assessment Score: +42.62. • Properties with improvement 41, deterioration 31 • No change 285.	Better than Expected

Greenhouse Gases

5.47 For transport, Carbon Dioxide (CO_2) is considered the most important greenhouse gas therefore it has been used as the key indicator for the purposes of assessing the impacts of a road scheme on climate change. Changes in CO2 levels are considered in terms of equivalent tonnes of Carbon released as a result of the scheme under evaluation.

Forecast

5.48 An A23 Technical Report for Air Quality (2008) was produced as part of the Environmental Statement Assessment was undertaken using the DMRB screening tool 1.03c on a link by link basis for the base year (2006), opening year (2013) and design year (2028). This was based on an older iteration of the scheme which kept Slaugham junction, and was also based on lower traffic flows. (DM 75,360 2013 AADT, DS 2013 77,000 AADT).

5.49 The AST reflects the built scheme, however no information was available regarding DM and DS emissions, rather just a change in the opening year of +743 tonnes of carbon was stated.

Over the 60 year appraisal period the predicted amount of carbon emissions would be more with the proposed scheme compared to the without scheme scenario. This net disbenefit was also monetised, as noted earlier in the economy section of this report.

Evaluation

5.50 The evaluation of the impact of the scheme on carbon emissions has been based on the traffic changes on the A23 within the scheme only, and only at peak times. As this cannot be directly compared with the forecast for the wide area, an alternative forecast has been calculated for the same links using the traffic forecasts from the TFR.

5.51 Emissions have been calculated for 2013 (forecast opening year) with and without the scheme using the DMRB air quality regional assessment spreadsheet and the results are shown in the table below. HGV proportions are based on the observed data for OYA as there is no data on the forecast level and it is reasonable to assume that there is no change in the proportion as a result of the scheme.

Table 5-5 Forecast and Outturn opening year carbon impact (tonnes carbon)

	Re Forecast	Outturn
Do-Minimum/ Without scheme	5,558	5,563
Do-Something / with scheme	7,918	7,015
Net impact	2,360 (42%)	1,452 (26%)

5.52 This evaluation shows that the impact based on the A23 in peak times was expected to be a 42% increase in the first year but the outturn assessment based on the changes on the same links shows an increase of 26%. The increase is due to both increased traffic and increased average daily speeds. There has been less increase in traffic than predicted however vehicles are travelling at faster speeds than forecast.

Landscape

Forecast

Appraisal Summary Table

5.53 The AST stated that the proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, were taken into account in reaching a revised score of **'slight adverse' (compared with 'moderate adverse' previously)**. There was extensive tree cover immediately adjacent to the majority of the route and that the Scheme would result in the loss of the tree-covered central reserve and encroach onto inalienable National Trust land. It would result in local adverse impacts on the High Weald and Ouse Valley Landscape Character areas in the AONB[10] The proposed access to East Park properties and Stanbridge Place, culvert works and pond access would cause localised impacts to landscape outside the road corridor.

Environmental Statement

5.54 The ES noted that the Scheme lies wholly within the High Weald AONB and would result in localised yet significant changes in landscape character to this part of the AONB due to the widened carriageway slightly straightened bends, tree clearance and loss of the grass central reserve. Other landscape designated sites were Nymans Garden (NT) and the Remains of Slaugham Place both registered as Historic Parks and Gardens (HPGs). It was not expected that there would be any change to the setting of these HPGs as due to landform and intervening woodland.

[10] High Weald Area of Outstanding Natural Beauty

5.55 The NT land extends beyond Nymans and the Scheme would encroach on the public access woodland north of East Park causing a marginal loss of trees in a strip up to 13m wide adjacent to the extended southbound on slip from Handcross Junction.

5.56 The existing landscape and visual baseline was summarised as;

- Landscape: The A23 improvements would be within the West Sussex High Weald and Ouse Valley local landscape character areas, identified as being of high landscape value and quality where the rural character quickly dominated once leaving the A23 at Slaugham Junction, partly due to the strong sense of place and enclosure of the High Weald landscape but also because of the minimal use of kerbs, signs, lighting and other infrastructure normally associated with major roads.

- Visual Amenity: The Study Area was said to be rural in character with relatively few visual receptors. Many views of the existing A23 from the wider landscape were screened, or partially screened, by blocks of mature woodland and the undulating landscape. Views of the proposed Scheme would include those from public footpaths, residential properties and commercial sites. Properties adjacent to the A23 had clear views of the road corridor and passing traffic. At the north end the Scheme would pass through the village of Handcross in cutting.

Mitigation

5.57 The general approach to the Scheme design was to minimise land take from the Orange Gill Ancient Woodland and from the National Trust and to improve on severance of impacts from the existing A23. The Scheme would be fully landscaped to integrate into the surrounding landscape and lighting would only be provided in areas where it was already present to minimise environmental intrusion to the local area and within the High Weald AONB surrounding landscape.

- Landscape proposals were designed to reflect the character of the AONB and to reduce visual impact on the wider landscape, properties and public rights of way. In the northern half of the Scheme, the wooded character of the High Weald was expected to help to assimilate the road into the landscape. To the south, the hedges and woodland blocks, characteristic of the Ouse Valley, would be replaced and enhanced where practicable to reflect the valley character and screen undesirable views of the Scheme;

- The stone clad bridges crossing Staplefield Road would be widened with stone clad facades and parapets to match the existing character. Other retaining structures would include reinforced soil slopes and gabion retaining walls. The front face of the gabion baskets would be filled by hand with locally sourced natural stone to resemble drystone walls.

- Water treatment areas would be in keeping with the existing landscape character and context of the AONB area and would be designed to sit subtly within existing contours;

- Visual screens (1.5m high) would be added in the narrow strip between the widened A23 and the proposed service road for properties on the west side between the Slaugham and Warninglid Junctions. A 2m high screen would be used locally near the properties Merrivale, Little Stanbridge and Cottage Tea Rooms.

Summary of effects

5.58 Landscape - the ES considered that the magnitude of impact of the proposed Scheme on the landscape, including landscape character, features and designations would be moderate adverse in the year of completion. Taking into account the quality and sensitivity of the landscape as well as proposed mitigation measures, the significance of the residual impact would remain moderate adverse in the design year.

5.59 Visual - Road widening and resultant loss of existing vegetation would adversely affect views from footpaths and from a few properties near the A23. This effect would be mitigated by replacement planting and for most views from properties and footpaths, the visual impacts

would be reduced to neutral or slight adverse after mitigation. However for Stanbridge View in close proximity and at a higher level to the Scheme, a large visual impact would remain after mitigation.

5.60 Residual visual impacts at All Saints Church in Handcross and four other residential properties (The Cottage, Stanbridge Place, Stanbridge Place (Flat), and Poplar Cottage and Nurseries), together with views from two footpaths (9S and 15S) would be moderate adverse. (NB: a blight notice was submitted for Poplar Cottage and Nurseries, and it was expected that the HA would purchase the land). Impacts would be slight adverse for a further 13 visual receptors.

5.61 The proposed Scheme would restrict increases in road lighting to minimise the impact on the AONB, however, additional lighting at Handcross and at Warninglid roundabout would have slight adverse visual impacts locally.

Consultation

5.62 The National Trust (NT) commented that the widening works and tree removals have left NT woodland more exposed, meaning that more trees have been felled by high winds in the woodland bordering the A23 in recent years, this was probably as expected. However NT considers that it now has a greater woodland margin with diverse structure and the mitigation measures helped NT clear historically dumped materials improving the quality of the woodland.

5.63 NT also notes that tree planting undertaken as advanced works as part of the A23 scheme within East Park Woods unfortunately introduced Chalara fraxinea– Ash dieback. It is understood that FERA[11] was notified by the A23 contractor and the infected stock was eventually destroyed in accordance with recommendations in place at the time, although NT was disappointed it took some time for this to be undertaken and NT does now have confirmed chalara infection in the wider woods on the east side of the Staplefield road but it is not possible to say whether this is connected to the initial infection.

5.64 NT also comment that it was concerned at the time of the works that excavation in close proximity to a mature Turkey Oak near the scheme boundary might have compromised its integrity and requested that it be included within the Tree Condition and Safety Survey being undertaken as part of the scheme requirements. Information relating to this tree was not provided to NT at the time and NT would still like to receive the requested information.

Evaluation

5.65 As expected in the ES the scheme has minimised land take by replacing the existing central reserve with a vertical concrete barrier and utilised the extra width to accommodate the widened carriageway, with some additional areas of land required where the central reserve was insufficient, for improving slip roads and for providing accesses and balancing ponds. As expected, the loss of the existing mature woodland, including from the former central reserve has changed the local landscape character of the route, the road is a prominent feature and views have been opened up. The bridge taking the A23 over Staplefield Road has been widened with stone clad facades to match the existing character as expected. Please see Figure 5.2 and Figure 5.3 below.

[11] FERA Food and Environment Research Agency

Figure 5.2 (left) view south illustrating prominence of A23 within local landscape.

Figure 5.3 (right) stone clad façade to bridge with example of seemingly poor soil / slow establishment of plants protected in spiral guards, many not upright.

5.66 Retaining structures have been built at key locations to limit encroachment on woodland and private property including examples illustrated in Figure 5.4 to Figure 5.6 below; 'green wall' with climbing plants, over-steepened embankment using supported topsoil, retaining wall faced with cladding, gabion baskets.

Figure 5.4 (left) 'green wall' near Orange Gill Wood

Figure 5.5(right) over steepened embankment

Figure 5.6 (left) retaining wall with cladding adjacent Orange Gill Wood

Figure 5.7 gabion baskets at Handcross on slip

5.67 Additionally, south of Handcross bridge and adjacent to the church, cut slopes exposed natural stone which was retained and fitted with a mesh 'curtain' to contain any minor surface erosion illustrated in Figure 5.8 below.

Figure 5.8 natural stone cut slope adjacent to church

5.68 Visual screen environmental barriers have been installed between the mainline and the local access road as expected. Local vernacular style fencing has been used in some locations along the highway boundary adding a sense of place to the route (Figure 5.9 and Figure 5.10).

Figure 5.9 (left) example of vernacular fencing

Figure 5.10 (right) view south to Stanbridge View with environmental barrier in place on boundary with A23

5.69 The as built plans identify offsite planting plots. It is understood from the HEMP that from 2014-2015 onwards general maintenance of off-site planting plots is to be carried out by landowners. However, monitoring and inspections will continue for the remainder of the five year aftercare period as appropriate to comply with license conditions for protected species (e.g. connective habitat for GCN and dormice).

Implementation of Planting Proposals

5.70 The ES expected that new planting would consist of the following planting types:

- Native trees and shrubs to replace lost woodland and woodland edge and maximise linkage with existing habitats (7.2ha).
- Shrub planting.
- Species rich hedge planting (0.6km).
- Native climbers to climb panel fences.
- As diverse species mix grassland as possible on topsoil areas (6ha).
- Species rich grassland on nutrient poor sub-soil areas (1.4ha).

5.71 Based on the HEMP and as built landscape drawings, plant species appear to be broadly as specified and planting areas generally provided as intended including a new belt of woodland planting which replaces that lost due to site clearance along the East Park frontage, and extensive planting to either side of the road corridor. New hedges are in place. Climbers have been planted to soften fences, although a high percentage of failures were observed at OYA.

5.72 The as built landscape plans indicate that three species rich grass seeding mixes have been used across the site; in association with ecological receptor areas provided for translocated woodland material, around the four new balancing ponds, at the Handcross off-slip and the new Warninglid junction. Figure 5.11 and 5.11 illustrate two areas.

Figure 5.11 (left) looking north and Figure 5.12 (right) view south illustrating species rich seeded areas near Pond 2 and habitat creation Receptor Area B

5.73 It is understood from the HEMP that unsafe trees (i.e. damaged by construction activities) have had to be removed following a post-construction arboricultural survey.

Establishment and Condition of Planting

5.74 The preliminary HEMP notes that the five year aftercare period runs to September 2019, with the main planting substantially completed during the winter season 2014-2015. The OYA site visit found that plant growth varied considerably across the scheme and in some areas is slow compared with typical growth expected at this OYA stage. Soils appeared ‘thin’ with a high stone content - more akin to sub-soil than topsoil and it is possible that this could be a contributory factor in slow plant growth. There was evidence of dead plants across the scheme and it would be expected that these should have been replaced during the routine annual winter replacement planting. Many plants were not upright in the ground. There was evidence of rabbit activity and browsing by deer in some plot areas. Figure 5.3 above.

5.75 With regard to weed control; it was noted that individual circles had been sprayed out, but at the time of the OYA site visit weed growth including dock and thistle was evident within grassed areas (Figure 5.13 below). Gorse was noted to be well established in the habitat creation area near pond 2 and evident in other locations. Gorse is invasive and unless controlled will outcompete other desirable species within plots. Although it was noted that

gorse had been cut e.g. at pond 1, this is not a long term solution as Gorse will regrow from the cut base.

5.76 The HEMP includes the Series 3000 Specification Appendices for landscape which indicate that all trees and shrubs (except hedges, and larger size feathered and extra heavy standard trees) would be protected with tree and shrub shelters (200mm diameter x 600mm high) – based on the OYA site visit many of the plants within plots have been fitted with spiral guards – these are not ideal, particularly for shrub species which tend to grow into a 'lollipop' shape as side branches cannot develop within a narrow spiral guard. Some of the spirals were brittle and beginning to degrade; supporting canes were 'lightweight' and some appeared to have rotted/broken which may be a contributory factor in the plants not being maintained in an upright position (another requirement of the aftercare maintenance).

5.77 The specification appendices also state that hedges and individual plant stations would be mulched – there was some evidence of mulch matting in place e.g. for plants at the Warninglid junction and local access road (where growth of planting was noticeably more established than in some other locations) but not generally across the majority of the planting plots.

Figure 5.13 (left) mixed growth, sprayed circles in place and noxious weeds evident
Figure 5.14 (right) shows Gorse at Pond regenerating having been cut but not fully controlled

Figure 5.15 (left) plants in shelters exhibiting more advanced growth, some up-righting required and evidence of rabbit activity on the embankment slope

Figure 5.16 well established hedge with mulch matting in place

5.78 At OYA it was noticed that drainage materials were evident in a field adjacent to Staplefield Lane (east side) – it is presumed that this may have been a site compound area and that the intention is for them to be moved and the area reinstated (as necessary) Figure 5.18. Replacement hedge planting on the field boundary at this location has yet to become established - it is understood the hedge is a replacement for mature trees lost to the Scheme to allow site access Figure 5.17.

Figure 5.17 (Left) Replacement hedge planted under mature trees yet to become established.

Figure 5.18 (Right) Evidence of construction materials in field adjacent to A23

Lighting

5.79 As expected in the ES lighting has been restricted to the Handcross and Warninglid ends of the Scheme, however, based on the as built lighting plans it would appear that at Warninglid lighting columns extend further north than expected – they start at chainage 3050 rather than the 3350 stated in the ES. As mentioned above, some plant growth is slow at OYA and subject to ongoing establishment there is the potential for lighting to be more visible in the wider landscape and for properties in close proximity, than expected. A night time evaluation has not been undertaken for this OYA study, but could be considered at FYA as part of the re-evaluation of the effects of lighting implemented as part of the Scheme.

Summary

5.80 The preliminary HEMP notes that towards the end of the five year aftercare period, in 2019, a final review would be undertaken of the environmental commitments and recommended actions arising from all landscape and ecology reports raised previously. A finalised HEMP would then be produced, confirming actions and identifying relevant routine landscape and ecology-related maintenance activities. It is therefore expected that this version of the HEMP would be available to inform the POPE FYA report.

5.81 Landscape mitigation would appear to have been implemented in line with the proposals. The ES expected that new landscape planting would in time (once matured) re-integrate the scheme with the surrounding wooded landscape; plant establishment at OYA was varied with some plots exhibiting slow growth, and there is the potential that this could compromise the long term screening and integration objectives of the mitigation measures. It is considered too soon to fully evaluate the overall effectiveness of the landscape mitigation and ongoing establishment and visual impacts on local receptors should be reconsidered at FYA.

5.82 Based on the situation observed at OYA it is considered that the ES score of moderate adverse better reflects the impacts of the scheme on the high quality AONB landscape and

the adverse visual impact for a small number of receptors, particularly Stanbridge View (in close proximity and at a higher level) than the revised AST score of slight adverse.

Table 5-6 – Evaluation Summary: Landscape

Sub-Objective	AST	OYA
Landscape	Slight Adverse	Worse than expected at OYA

Townscape

Forecast

Appraisal Summary Table

5.83 The AST stated that the proposed carriageways and enlarged junctions, would not affect townscape character. Overall, the impact of the scheme on townscape was considered to be neutral.

Environmental Statement

5.84 No Townscape specific assessment was undertaken in the ES. Mention was made in the landscape section with regard to the Handcross Urban Conservation Area located to the east of the A23 at the northern end of the Scheme. It was noted that the designation recognised the quality of the townscape and buildings at the centre of Handcross village. It was expected that there would be no loss of features and no views of the Scheme from the conservation area because of existing intervening vegetation and buildings, and that the proximity of the existing A23 corridor would mean that the surrounding landscape setting would not change significantly, with a neutral effect on Townscape.

Consultation

5.85 No responses to consultation requests were received for this sub-objective.

Evaluation

5.86 No changes from the AST regarding Townscape were identified during the site visit, there have been no direct impacts on the Handcross conservation area and the setting remains well separated from the road by other buildings and vegetation and townscape features have not been affected by the A23 widening. It is considered that the effects of the scheme on Townscape are neutral, **as expected**.

Table 5-7 – Evaluation Summary: Townscape

Sub-Objective	AST	OYA
Townscape	Neutral	Neutral as expected

Heritage and Historic Resources

Forecast

Appraisal Summary Table

5.87 The AST stated that there would be direct construction impact on 3 known cultural heritage sites of local importance and 1 site of national importance. The three sites included two sites of geophysical survey features on either side of the road at Slaugham junction. The remaining site was an area of possible prehistoric remains in the River Ouse floodplain. With regard to direct physical impact on a small area of Nymans Gardens, of national importance, the AST noted that the area had already been compromised by the construction of an access track and a structure, and was not representative of the area of Registered Garden. Based on this the impact was considered to be slight.

5.88 It was considered that the proposed changes to the Scheme would neither increase nor diminish the effect of the Scheme. Overall, the AST assessed the impact on the heritage resource as slight adverse.

Environmental Statement

5.89 The ES identified thirteen sites within the Study Area and one site outside the area (Slaugham Place) which could potentially be impacted upon by the Scheme. The sites are listed below;

- Three Grade II Listed Buildings – Stanbridges Farmhouse, Hilbury (domestic residence) and the Royal Oak public house;
- Nymans Grade II* Registered Garden;
- Handcross Village Conservation Area;
- A brickfield and kiln;
- A pre-historic axe find;
- The River Ouse floodplain;
- Three areas identified by geophysical survey;
- A World War II Type FW3/28 Pill Box;
- A set of five World War II anti-tanks blocks; and
- Slaugham Place - Scheduled Monument.

Potential construction impacts

5.90 Although the floodplain associated with the River Ouse was highlighted as an area of archaeological potential, the results of the geo-archaeological assessment undertaken at the time of the ES indicated that the sediments were of limited archaeological interest as the sequences appeared to be recent, possibly dating to the medieval period or the post-Medieval and modern periods. Other potential impacts related to three possible sites identified by geophysical survey that would be directly impacted upon by the Scheme. There was also the potential to impact upon unknown archaeological remains within the Scheme footprint.

Potential operational impacts - noise

5.91 It was considered likely that the cultural heritage sites within the Study Area would not be affected by potentially increased noise levels because a lower noise surface was to be laid and it was possible that all of the built heritage, including Slaugham Place, and Nymans Garden could benefit by a reduction in levels of noise.

Potential operational impacts - visual

5.92 The existing road was within a cutting at Handcross and the ES considered that it would be unlikely that the main element of the proposed Scheme would adversely impact on the visual setting of Nymans Garden (Grade II* Registered Garden), located above the cutting.

5.93 Handcross Conservation Area would also be unlikely to suffer an adverse visual impact from construction or operation of the road because of housing in-between the existing road and edge of the Conservation Area.

5.94 With regard to the three Listed Buildings the ES considered that Hilbury (close to Nymans Garden) and the Royal Oak public house (on the western side of Handcross) were positioned above the road and Stanbridge Farmhouse was set about 200m back from the road with two hedges/wooded boundaries separating the house from the A23 and they would be unlikely to suffer any adverse impact from the proposals.

5.95 The road would pass within 200m of Slaugham Place, a Scheduled Monument and Grade II Registered Park and Garden, however, it was noted that the site lies to the west of a wooded area and would not be subject to a visual impact.

Mitigation

5.96 **Palaeoenvironmental works** - although the ES notes that there was no requirement for further mitigation on the River Ouse floodplain at that stage, pre-construction works would be required on the balancing pond adjacent to the River Ouse (Pond 2). The work would comprise taking up to three window samples or boreholes to establish presence of organic materials or other significant deposits within the alluvial sequence. If suitable deposits were identified it was expected that any eco-factual remains (including pollen samples) would be assessed and analysed. Any samples that could be used for radiocarbon dating would be taken and submitted. It was expected that the results of this work would be incorporated into a final report on the archaeological works along the Scheme.

5.97 **Watching brief** – due to the potential for the survival of archaeological remains within the Scheme footprint a number of areas were identified as requiring a watching brief during construction. Trial trenching, open area excavation or further watching brief in other areas might also be necessary depending upon what, if any, features were found. Any archaeological deposits encountered would be recorded and any finds collected.

5.98 **Built heritage** – the pill box would be recorded to a Level 2 standard[12], including photographs and drawings, prior to its conversion to a bat hibernacula, which it was noted would be a positive impact as the pill box was not being maintained and its condition was likely to deteriorate over time. It is understood that the structure would not require major alterations and as a result its form and context would not be lost; the reuse would create a slight beneficial impact.

5.99 The ES noted that the historic landscape surrounding the Scheme had already been compromised by modern development along the road corridor and the potential impact on the historic landscape was felt to be negligible.

Summary

5.100 The ES considered that whilst there would be minor beneficial impacts to high value cultural heritage sites due to reduced noise levels (Nymans Garden and Slaugham Place), and the reuse of the pill box as bat hibernacula would be a positive impact, the risk to buried archaeology would result in an overall cultural heritage impact of **slight adverse**.

Consultation

5.101 Historic England (HE) was unable to provide feedback as personnel with knowledge of the Scheme are no longer with HE.

Evaluation

5.102 Based on the OYA site visit and as built plans it is considered that the visual impacts on built heritage (Nymans and Slaugham Place, listed buildings and the Handcross conservation area) are as expected – landform and vegetation provide a buffer to the A23 widening. POPE has

[12] English Heritage 2006 Understanding Historic Buildings – a guide to good recording practice

no pre and post opening noise information to be able to confirm whether noise levels at Nymans and Slaugham Place have changed as a result of the scheme.

5.103 It would appear from the OYA site visit that conservation through removal of vegetation and structural consolidation of the WW II pill box has been undertaken, with subsequent adaptation to a bat roost and hibernaculum. (Figure 5.19).

Figure 5.19 Restored WW II pill box converted to bat roost and hibernaculum

5.104 At the time of writing no information relating to archaeology has been received by POPE on which to base an evaluation and it is suggested that this aspect of cultural heritage is revisited at FYA.

Table 5-8– Evaluation Summary: Heritage and Historic Resources

Sub-Objective	AST	OYA
Heritage and Historic Resources	Slight Adverse	Unable to evaluate at OYA and should be revisited at FYA.

Biodiversity

Forecast

Appraisal Summary Table

5.105 The AST stated that the Scheme would result in permanent loss of some woodland and scrub, including a small area of Ancient Woodland. The loss of the wooded central reserve could result in an adverse impact on rare bats (Barbastelle's, Bechstein's and Natterer's) due to potential severance of habitats. There would be a permanent loss of a small area of Orange Gill Wood SNCI[13] and an adverse impact on protected and threatened species due to loss and severance of habitat.

5.106 The Scheme included extensive compensation measures, including a multi-species tunnel, substantial replanting, habitat creation and improved management of retained ancient woodland. The proposed changes to the Scheme were considered likely to reduce the area of habitat affected as a result of the reduced footprint. However this habitat was generally of poorer quality and the scheme as a whole would still result in the loss of the most sensitive habitats. Overall, the AST assessed the impact of the scheme on biodiversity as moderate adverse.

Environmental Statement

5.107 The ES stated that the A23 between Handcross and Warninglid passes through an area of nationally significant ecological interest and nature conservation value. The most important potential ecological impacts of the Scheme would be loss and disturbance of irreplaceable

[13] SNCI Site of Nature Conservation Interest

ancient semi-natural woodland, the loss of hedgerows used as corridors by a number of species of high nature conservation value (such as dormice and bats), and increased severance of habitats due to the loss of the central reserve, causing potential isolation of populations and increased road casualties (particularly for rare bat species).

5.108 A number of protected species had been found to be either present or probably present, including nationally valuable species such as Bechstein's, Barbastelle's and Natterer's bats which would potentially be disturbed. Full impact assessments of all valuable ecological features were provided in the relevant Technical Reports that supported the ES.

Mitigation

5.109 The ES states that comprehensive and detailed mitigation measures were developed for the Scheme including;

- Advance mitigation works prior to construction, including translocation of Great Crested Newts; provision of receptor sites, hibernacula and wildlife boxes; site clearance including tree felling and turf removal and the management of hedges for dormice and bats.
- A purpose built multi-species tunnel (2.1m diameter) under the A23 between East Park Wood and Orange Gill Wood to reduce severance impacts. This would provide a safe route under the A23 for various animal species.
- Where possible like-for-like replacement of habitat lost to the proposed Scheme would be provided. The exception would be ancient woodland which could not be replaced and would be mitigated via ongoing management aimed at improving the function of the remaining woodland.
- Encroachment on valued areas of woodland and ancient woodland (as at Orange Gill Wood) would be minimised through the use of retaining structures and steepened earthwork slopes and through removal of the central reserve.
- Provision of otter and badger exclusion fencing would be provided, as required, along the length of the works.
- Pedestrian activated lighting in the pedestrian tunnel to encourage use by bats and other fauna.
- Provision of wildlife boxes for birds, bats and dormouse.
- Eradication of introduced species (rhododendron and American skunk cabbage) from local woodland.

5.110 The ES predicted that mitigation measures would reduce impacts on designated sites, habitats and species, and there would be beneficial impacts from improved hydrology, reduced risk of water pollution, eradication of alien species, and provision of additional water bodies (e.g. backwaters). However there would be a small permanent loss of ancient semi-natural woodland, impacts on local breeding bird populations, and uncertainties over the severance of commuting routes for rare bat species. Part of the mitigation included a monitoring strategy which identified necessary survey and monitoring to be undertaken before, during and after the proposed construction. The overall residual impact on ecology and nature conservation was assessed to be moderate adverse.

Consultation

5.111 The National Trust (NT) commented that 'our understanding is that the 'wildlife tunnel' that was constructed under the road as mitigation for fragmenting the habitats has not been a success as we believe that no animal activity has been picked up.' NT's understanding is that wildlife surveys have been undertaken from the beginning, especially looking at dormice, great crested newts and bats. Please refer to Table 5-11 for a summary of ecological monitoring commitments, as based on the HEMP. POPE has not received any post-opening survey or monitoring information with regard to any species or habitats.

5.112 Ansty and Staplefield PC consider that the wildlife monitoring is intrusive and in some instances appears to discourage wildlife from re-establishing.

5.113 West Sussex County Council (WSCC) responded that in its view the ES was thorough in terms of identifying ecological impacts. This included surveys of protected species, including dormouse and great crested newt. Much consideration was given to potential impacts on

adjacent ancient woodland, particularly the ghyll woodland (notably Orange Gill SNCI and impacts on streams and other waterbodies).

5.114 The scheme appeared to cause considerable disturbance through noise, lighting, construction traffic, plant, etc during construction. The construction period lasted a long time and on reflection the impacts on wildlife may not have been fully examined and mitigated.

5.115 WSCC felt unable to comment in any detail on the success of mitigation measures for biodiversity as it has not undertaken any post-construction site visits to assess successful implementation of the scheme on the ground; it considers that Post-construction compliance checks are critically important to check that mitigation, compensation and enhancement measures were implemented, that they are fit for purpose and have been appropriately managed. WSCC hopes that this has been undertaken, and will continue to be undertaken, by Highways England. Longer term monitoring, including undertaking repeat surveys of protected species, to monitor the success of mitigation measures are also important.

5.116 Undertaking some mitigation in advance was welcomed, but WSCC wonders whether it might have been possible to implement such advance mitigation at an earlier stage, and also to implement other mitigation, such as improved management of nearby woodlands at an earlier stage. WSCC was pleased to notice the provision of dormouse nest boxes and bird boxes during construction and would be interested to know whether they were monitored and if so rates of occupancy.

5.117 WSCC considers that POPE 'is an excellent idea', and hopes it will identify the significance that should be attached to post-construction monitoring and aftercare for biodiversity and that ideally a critical review should be undertaken of such a scheme as this to assess the success of the biodiversity mitigation (and compensation) measures, including a "snagging list" of issues requiring remedial works. If such a report is produced, WSCC would be most interested in receiving a copy.

Evaluation

5.118 The key environmental issues for ecology and nature conservation were identified as potential loss of part of semi-natural ancient woodland at Orange Gill Wood and East Park Wood; loss of other woodland, trees and hedgerows and impacts on a range of protected species through loss and severance of habitats; potential adverse effects from increased pollution, noise and light disturbance. Mitigation measures have been provided including woodland and grassland habitats replanted and connectivity between habitat blocks maintained.

5.119 Table 5-9 below summarises the proposed mitigation and status at understood by POPE at OYA[14].

[14] Based on ES Ecology and Nature Conservation Chapter 11 *Table 11.10 Summary of proposed mitigation and residual impacts predicted*

Table 5-9 Proposed mitigation and status OYA evaluation

Feature	Proposed mitigation	OYA evaluation
SSSI	• None required.	• Nearest SSSI is Cow and Harry's Wood 250m east of Handcross High Street and not affected as expected.
SNCI	• Minimised land take. • Improved management plan for retained habitat including removal of non-native rhododendron and American skunk cabbage. • Provision of suitable features for water flow from water treatment areas.	• Retaining walls have been utilised to reduce land take. • The HEMP includes a management plan for Orange Gill Wood and confirms works to control non-native species. The 2013 Monitoring of Alien Species Report notes that the extent of infestations had been reduced and recommended ongoing control in 2014, including for Small Balsam beginning to colonise. No further information has been made available to POPE at OYA to confirm ongoing works. • The landscape plans identify woodland integration on water flow attenuation bank in association with woodland gills and drainage mitigation. POPE has no information to confirm whether the Scheme drainage into Orange Gill Wood has successfully maintained wet conditions in the bottom of the valley as was expected.  • Above image shows Orange Gill Wood water attenuation area at OYA.

Feature	Proposed mitigation	OYA evaluation
Ancient semi-natural woodland	• Minimised land take. • Improved management plan for retained habitat. • Translocation of live plant material and soil from semi-natural ancient woodland to suitable receptor areas (including East Park Wood).	• Retaining walls have been utilised to reduce land take. • The HEMP includes a management plan, agreed with the NT, for Receptor Area A East Park Woods, which the HEMP notes, should when completed result in the improvement to the condition of this woodland. • The HEMP confirms advance works undertaken at Receptor Area A: East Park Wood (offsite), Receptor Area B: on site west of A23 adjacent Balancing Pond 2 and Receptor Area C: on site east of A23 adjacent Balancing Pond 3. • Landscape As Built plans show locations for translocated woodland material and soil. Plans also indicate indicative locations for coppiced stools. Hazel and hornbeam coppiced tree stools were viewed at OYA in areas B and C. POPE cannot comment on the number of stools originally translocated; of those viewed most were showing signs of coming into leaf, growth was very variable (previous browsing may be a cause) and a few had not survived the translocation.  • Above image shows coppiced stools in Receptor Area B at OYA. Gorse in flower – becoming established in this habitat creation area.

Feature	Proposed mitigation	OYA evaluation
Hedgerows	• Replacement habitat. • Translocation.	• New hedgerows are identified on the as built plans and those viewed at OYA were noted to be establishing satisfactorily. Hedges lost to the scheme have also been compensated for by planting of new belts of woodland planting, as expected. • The translocation of a mature hedge on Stanbridge Track/ Staplefield Lane appears successful at OYA.  • Above image shows translocated hedge at OYA.
Waterbodies + watercourses	• Improved water quality and pollution security • New balancing ponds • Backwaters at River Ouse and Anne's Wood Stream for habitat diversity	• Water quality and pollution is covered in the Water sub-objective. • Four balancing ponds have been provided, wetland planting was well established at ponds 1 and 2 see Figures in water section. • As built drawings confirm that backwaters have been created on the east side of the A23 only.  • Above image shows Anne's Wood stream backwater (to right of fence in mid picture) at new culvert for watercourse under the A23. View at OYA.

Feature	Proposed mitigation	OYA evaluation
Ephemerum recurvifolium (rare moss)	• Increased disturbance • Reduced shading	• The ES expected improved environmental conditions in Orange Gill Wood, due to increased light penetration through the woodland canopy resulting from woodland management – POPE has no information relating to this species.
Great Crested Newt (GCN)	• Replacement terrestrial habitat • Specific planting and habitat enhancement at GCN receptor sites. • New hibernacula	• The GCN 2011 survey report noted that the results of the survey work undertaken between April and June 2010 showed that GCN were present within 250m to the east of the footprint of the proposed scheme, but absent from the area up to 250m west of the footprint of the proposed scheme and that the proposed ES strategy was appropriate. • It is understood from the HEMP that GCN and reptile trapping and translocation would be carried out in spring (March, April and May) 2012 before construction commenced in summer 2012. No information has been provided to POPE with regard to trapping and translocation. • Evidence of wood pile hibernacula was noted at OYA within Receptor Area C adjacent to balancing pond 3. Other locations are identified in the HEMP. • Hedgerows/woodland strips have been planted to improve connectivity and the HEMP notes that inspection in December 2014 indicated these to be well established. For offsite plots it is understood that general maintenance would be undertaken by landowners from 2015 with inspections on behalf of Highways England until 2019, to ensure maintenance operations comply with the Natural England license conditions. POPE is not aware whether these inspections have taken place.  • Above image shows translocated coppiced stools and hibernacula at Receptor Area.

Feature	Proposed mitigation	OYA evaluation
		 • Above image shows hedgerow at edge of Receptor Area B.
Reptiles	• Replacement habitat • New hibernacula	• Replacement habitat and hibernacula have been provided; no other specific information relating to reptiles has been made available to POPE.
Birds	• Replacement habitat • Nest boxes	• Landscape planting and habitat creation areas are in place. The HEMP confirms that 80 bird nest boxes have been provided.
Badger	• Replacement habitat • Improved connectivity • Fencing	• It is understood that subsequent to the ES fencing was not required. • Replacement planting has been provided; it is likely that connectivity has been improved although planting will take time to become established. As observed at OYA new culverts with mammal ledges and the multi-species tunnel have also been provided. • POPE has no information which would confirm whether badgers are using these tunnels or whether the scheme has impacted on local badger populations. Animal pathways were evident within grassed areas adjacent to Receptor Area B but it is not possible to confirm the species of mammal using the area.

Feature	Proposed mitigation	OYA evaluation
		 • Above image shows evidence of animal pathway at OYA.
Dormouse	• Replacement habitat • Dormouse boxes • Temporary connectivity during construction	• As expected new hedges were planted as advance works to enhance habitat and improve connectivity between existing areas of woodland. • Approximately 80m of existing hedge has been translocated at Stanbridge Track/Stapleford Lane – this was viewed at OYA and appears to have successfully established. • The HEMP notes that dormouse nest boxes / tubes have been provided - examples were noted at several locations at OYA • The HEMP includes for habitat management works for new native tree and shrub planting at Receptor Site B (adjacent to balancing pond 2) and Receptor Site C (adjacent to balancing pond 3) – it is too early in the aftercare period to evaluate the success of these areas as dormouse habitat and they should be reconsidered at FYA. • The 2014 Dormouse Survey Report notes that monitoring in 2013 during construction found evidence of dormouse activity in all but one of the survey locations and high numbers of individual dormice (both adult and juvenile) were recorded across the site. Evidence of breeding activity was high in Orange Gill Wood and East Park Farm Wood. It was noted that the initial construction works did not appear to have had a significant impact on the local dormouse population as only two of the fourteen areas surveyed did not contain any evidence of dormice activity. • No post construction monitoring/survey information has been made available to POPE.

Feature	Proposed mitigation	OYA evaluation
		 • Example of Dormouse tube at OYA.
Bats	• Replacement habitat • New and enhanced safe road crossing points • Bat boxes and hibernaculum • Temporary connectivity during construction	• The HEMP notes that 61 bat roost boxes were to be provided, and As Built plans indicate that bat boxes and roosts have been installed. At OYA various mitigation measures were viewed including the WWII pill box adapted as bat roost and hibernaculum, multi species tunnel between Orange Gill Wood and East Park Wood and oversize culverts. New landscape planting is in place and the design of entrances to the tunnel and culverts appears to be designed to encourage use by bats and other wildlife. • Static monitoring equipment was noted during the OYA site visit including some which required re-fixing into position and may have been vandalised. • The 2014 Bat Monitoring Report notes that monitoring in 2013 (during construction) concluded that; • a) There had been an increase in activity in some bat species at various locations since vegetation clearance commenced and a decrease in the activity of others. Overall activity levels for the entire site were similar to those recorded in 2011. • b) Bat activity along commuting and foraging routes was similar to the pre-construction levels. However, there was noticeably less foraging immediately adjacent to the road where vegetation had been cleared. • c) Emergence and re-entry surveys were undertaken at five trees and one building where previous studies had recorded roosting bats – bats were confirmed at the building and may have emerged/re-entered at three of the trees. • No post construction monitoring information has been made available to POPE.

Feature	Proposed mitigation	OYA evaluation
		 • Example of static bat monitoring equipment on highway boundary fence to east of A23 in proximity to the NMU underpass.  • Image shows bat box at bridge taking A23 over Staplefield Road. 

Feature	Proposed mitigation	OYA evaluation
		• Static monitoring equipment on ground at River Ouse (west).  • Example of static bat monitoring equipment at edge Orange Gill Wood west of A23.
Otter	• Enhanced safe road crossing points • Fencing	• The pre-scheme surveys identified potential for otter to be active within the study area. The multi species tunnel and enhanced, oversize culverts with mammal ledges have been provided as safe crossing points. • It is understood that subsequent to the ES fencing was not required. • No further information regarding Otter has been provided to POPE.  • River Ouse culvert with mammal ledge at OYA.

Feature	Proposed mitigation	OYA evaluation
		 • Multispecies tunnel entrance –west of A23.  • East of A23

Table 5-10 Biodiversity Proposed Mitigation Summary and OYA Evaluation

5.120 The HEMP states that post-construction ecological monitoring will continue for 5 years through the post-construction aftercare period for habitat creation areas, alien plant species, GCN dormouse and bat species, as detailed in Table 5-11 below[15]. It also notes that due to a 12 month delay in commencement of the scheme, ecological surveys during the aftercare period for the whole scheme will now extend to 2019 and that agreements for continued access will be sought with affected landowners to enable on-going environmental monitoring or maintenance to comply with the programme as agreed with Natural England (NE) and protected species license requirements.

Table 5-11 Summary of Ecological Monitoring Commitments (based on HEMP Table 6.1)

Species	Survey type / location	Frequency	Years 2014 to 2019 (Post construction)	Reporting (frequency)
Botanical	Habitat creation areas Area B Slaugham compound only – once, 1 year post planting. (Planting not expected to be complete until end of 2015)	Spring and Summer	2016 (or 2017 subject to establishment)	Once – (contractor /consultant)
Alien species (Japanese Knotweed)	Site wide-annual audit of Japanese Knotweed Management Plan by ECW/Contractor			
Alien species (Rhododendron and American Skunk Cabbage)	Orange Gill Wood	1 visit/annum	2018 / 2035	Annually (landowner) Absence to be confirmed by letter
Great crested newt (GCN)	HSI[16] survey of all historical ponds and 4 new balancing ponds and follow up presence absence (P/A) were required	1HSI (+ 6 P/A visits) Repeat P/A survey	2015 - 2017	2 years as shown (consultant)
	It is understood from the HEMP that there is no on-going commitment to manage and maintain the hibernacula created for reptiles and amphibians as these were provided as temporary structures – they were to be retained and allowed to weather and decay naturally			
Dormouse	Use of nest boxes / tubes	5 visits/annum, May – October / November	2015 - 2019	Annually (consultant)
Dormouse	Cleaning out of nest boxes/tubes	1 visit/annum, April	2015 - 2019	Annually (consultant)
Bat species	Activity: roost emergence	2 visits/annum	2015 - 2019	Annually (consultant)
	Transects	2 visits/annum	2015 - 2019	
	Data logging at crossing points	1 visit/annum	2015 - 2019	

[15] Preliminary HEMP states that the programme of ecological monitoring and reporting was agreed with NE (3 July, 2011). This programme is subject to review in 2017 to determine whether the scope of ecological surveys could be reduced beyond that date. Details supersede the earlier programme provided in Table 11.8 of the ES.

[16] HIS – Habitat Suitability Index survey

Species	Survey type / location	Frequency	Years 2014 to 2019 (Post construction)	Reporting (frequency)
	The need for all bat surveys to be reviewed in 2017 with possible cessation of bat surveys beyond that date (subject to discussion with NE).			
Bat boxes and hibernaculum	Inspect in 2016 & 2018 by ecologist during aftercare period. Ecologist to advice contractor of any repairs needed. Pill box to be inspected including internal inspection if evidence of use by bats.			
Bird nest boxes	Inspect annually on ad hoc basis by ecologist during Aftercare period. Ecologist to advice contractor of any repairs needed.			
East Park Woods Receptor Area A	The management plan requires annual ecological monitoring of the population status of dormice and bats, as per Table above. Main contractor to assess the status of natural regeneration of native broad-leaved woodland species prior to confirming the need (or not, as the case may be) for planting of new native trees and shrub species at this site in 2016. All other aspects of the site will continue to be managed by the NT			
Orange Gill Wood	Access arrangements to be agreed with landowners to enable on-going monitoring surveys by the contractor's consultant annually during the aftercare period until September 2019 for alien plant species, bat species, dormice and the use of wildlife boxes (as per Table above).			

5.121 At the time of writing, apart from feedback comments provided by the National Trust who understands that the multispecies tunnel has not been a success, POPE has not received any post-opening survey or monitoring information with regard to any species or habitats. It is suggested that this aspect should be reconsidered at FYA when it is expected that further information should be available and for a long enough period to be able to identify any emerging trends.

Animal Mortality

5.122 Animal mortality figures have been received for the period between October 2009 and April 2016 and those relevant to the scheme extents are recorded in Table 5-12 below. Only badger, deer and fox have been included in the Table (a dog, ram and 4 'unspecified' have been excluded). There were no recorded incidents for 2009. Numbers are low overall and do not appear to have been particularly affected by the scheme; the highest numbers are for deer, which seem fairly consistent throughout the period. It does not appear that the decision to omit badger / otter fencing from the scheme has impacted on these species.

Table 5-12– Animal Mortality Data, 2010-2016

Animal	2010	2011	2012	2013	2014*	2015	To April 2016
Badgers		1	1			1	
Deer	3		4	3	2	3	1
Fox					1		
TOTALS	**3**	**1**	**5**	**3**	**3**	**4**	**1**

* Project opening

Summary

5.123 Based on the information available to POPE and site visit at OYA it appears that mitigation measures have generally been provided as intended. It is too early in the establishment phase to comment on the effectiveness of habitat creation areas and no post construction information has been made available to POPE which would enable habitats and species to be

evaluated at OYA. Biodiversity should be reconsidered at FYA when it would be hoped that the updated HEMP and information identified in Table 5-11 above would be available.

Table 5-13 – Evaluation Summary: Biodiversity

Sub-Objective	AST	OYA
Biodiversity	Moderate Adverse	Likely to be as expected but further information required to confirm

Water Environment

Forecast

Appraisal Summary Table

5.124 The AST stated that the Scheme crossed two named watercourses, the River Ouse and Anne's Wood Stream with very limited formal pollution control measures used along the section of highway. The Scheme would provide more controlled drainage with a better defined collection and discharge system which would facilitate provision of appropriate pollution control facilities at specific locations including treatment areas, ponds and, prior to treatment areas, oil interceptors. Spillage risk calculations indicated no significant impacts with the Scheme in place but facilities for containment of spillages would be provided. The proposed changes to the Scheme would not alter the mitigation proposed in terms of drainage and river geomorphology and overall slight beneficial effects on the water environment were predicted.

Environmental Statement

5.125 The ES stated there were two named watercourses in the study area; the River Ouse and Anne's Wood Steam both culverted under the existing A23, as well as a number of unnamed watercourses and ponds.

5.126 The ES explained that the existing road drainage system generally discharged onto adjacent land or via pipes to nearby watercourses and that any existing pollution control measures were unlikely to be effective. There were also some informal areas that acted as treatment and attenuation areas over part of Orange Gill Woodland, Nymans Wood and fields / roadside woods on the west side of the existing road.

5.127 The ES noted that adherence to the relevant Environment Agency Pollution Prevention Guidelines would substantially reduce the risk of polluting surface waters and groundwater during construction and there would also be a requirement for a CEMP to be put in place. In stream works within the River Ouse, Anne's Wood steam and other steams would not be carried out between November and mid-June to help to protect any downstream populations of spawning coarse fish, bullhead and brown trout. However the risk of pollution during construction would not be completely eliminated therefore a residual impact of slight adverse would remain.

5.128 Potential impacts during operation of the road would include;

- Discharge of highway drainage water into receiving watercourses e.g. River Ouse, Anne's Wood Stream and other small watercourses;
- Pollution as a result of spillage from road traffic accidents;
- Obstruction and / or loss of floodplain;
- Contribution of additional flows to a watercourse leading to an increase in flood risk downstream;
- Scouring of banksides, loss of sections of bankside / ditches;
- Land take of wetland areas;

- Changes in hydrology due to earthworks and drainage proposals potentially impacting on local ecology and habitats.

5.129 Operational mitigation would include improved pollution control measures to reduce potential impacts on water quality incorporating oil interceptors and attenuation ponds designed with penstocks and bypass pipework. Two vegetated water treatment areas would be constructed in Orange Gill woodland to formalise an existing filtering function within the marshy areas.

5.130 With regard to the balancing ponds, the ES confirmed that the design would be functional but still provide some biodiversity benefit from wetland creation. It was acknowledged that regular maintenance would be required and habitats would be sacrificed to contain pollutants in the event of a spillage, however, ponds would be designed to fit into the local landscape with appropriate planting for surrounding areas and aquatic planting on the margins.

5.131 A new positive drainage system for surface water run-off from the road carriageways would be provided. Filter drains would also be provided to intercept land drainage and to control groundwater. Culverts taking watercourses under the A23 would be extended or replaced as necessary. New crossings would be provided where new access roads would cross existing watercourses and ditches.

5.132 The ES considered that the mitigation measures proposed to protect water quality during operation would also protect fish. Impacts on groundwater were expected to be low. After construction of the new water treatment features it was expected that there would be a Slight Beneficial impact on water quality and drainage.

Consultation

5.133 No responses to consultation requests were received for this sub-objective.

Evaluation

5.134 The managing agent has commented that the balancing ponds provided for highway drainage should not be allowed to become habitats for wildlife. Relating to this comment, it should be noted that the ES acknowledged that the ponds would primarily function as drainage features and also provide some landscape and biodiversity benefits, but that regular maintenance would be required. This design philosophy reflects comments from the EA included in the ES; '*Though appreciating that balancing ponds exist to serve a specific function, EA would seek to see these formed such that they are beneficial for wildlife, and to ensure a fit into the landscape'*.

5.135 Key environmental issues were identified as a requirement to avoid adverse impacts on sensitive receptors including Orange Gill Wood, River Ouse and Anne's Wood Stream arising from surface water runoff and potential pollution incidents. No information which would confirm improved water quality as a result of the Scheme or whether there have been any pollution incidents has been received by POPE.

5.136 The H&S File states that positive drainage systems have been used throughout the Scheme, consisting of pre-cast concrete kerb and gully, combined kerb and drainage units, or slot drains as appropriate. There are pollution controls or water runoff treatment areas at the downstream end of each network to mitigate the risk of pollution reaching watercourses. As expected in the ES new culverts take existing watercourses under the widened A23. The 2.4 and 2.1 diameters take account of the ecological sensitivity of the watercourses and allow for the passage of wildlife – mammal ledges have been provided (see Biodiversity section).

5.137 Four attenuation ponds including pollution control measures have been provided, designed to retain the estimated peak flow from a 1 in 100 year storm event plus an allowance of an extra 20% for climate change for the additional road surface area resulting from the Scheme. It is understood that ongoing management and maintenance of these areas will take account of the potential presence of great crested newts. The HEMP confirms that that backwaters have been created downstream (only) at both the River Ouse and Anne's Wood Stream - the design for the backwaters was amended and built to fit the site conditions. No backwaters have been created up stream.

5.138 Pond 1 – wetland / marginal vegetation establishing well. Pond discharges to an existing ditch along Staplefield Road; this was viewed at OYA (Figure 5.21), vegetation is beginning to recolonise the area but it appears that an area of existing woodland was cleared in order to facilitate the connection Figure 5.21.

Figure 5.20 (left) Pond 1 wetland vegetation well established. Life belt requires re-fixing.

Figure 5.21 (right) Pond 1 discharge connection into existing ditch. New headwall in place.

5.139 Pond 2 – wetland /marginal vegetation establishing well (Figure 5.22). Pond discharges to the realigned River Ouse, scour protection on the approach to the culvert appears to have been dislodged and requires repair (Figure 5.23).

Figure 5.22 Pond 2 with wetland vegetation well established

Figure 5.23 Illustrates realigned River Ouse at new culvert taking watercourse under A23. Scour protection appears to have been dislodged.

5.140 Pond 3 - aquatic vegetation less well advanced. Pond discharges into the ‘old’ channel of Anne’s Wood stream retained as a backwater which links to the main stream (Figure 5.24). POPE is not aware how successful the retention of the backwaters diversity of habitat have proved to be at OYA.

5.141 Pond 4 – aquatic vegetation less well advanced (Figure 5.24). Pond discharges to an existing ditch.

Figure 5.24 (left) Pond 3 and Figure 5.25 (right) Pond 4 where wetland vegetation is yet to become established

5.142 In addition to the ponds, three attenuation and water treatment areas have been provided; two in Orange Gill Wood and one adjacent to the service road (Nursery Lane) near the garden centre (Figure 5.26 and Figure 5.27).

Figure 5.26 Illustrates location of pollution control equipment on Nursery Lane

Figure 5.27 Shows the new headwall and outfall which links into an existing stream at treatment area 3 from the facility in Figure 5.24

5.143 Based on the OYA site visit and as built information it would appear that mitigation measures have been provided in line with those proposed and POPE is not aware that they are functioning other than as expected, it is therefore considered that the effects of the Scheme on water quality and drainage is likely to be as expected, however, further detail would be required to confirm - the HEMP identifies that routine maintenance and inspections are required including to monitor condition and functioning of water treatment areas and related water courses within Orange Gill Wood. The water sub-objective should be reconsidered at FYA when it is hoped that monitoring and inspection data would be available.

Table 5-14 – Evaluation Summary: Water Environment

Sub-Objective	AST	OYA
Water Environment	Slight beneficial	Likely to be beneficial as expected but further information required to confirm benefits.

Physical Activity

Forecast

Appraisal Summary Table

5.144 The AST stated that the existing non-motorised journeys would be shortened by the Scheme due to provision of a crossing point and better cycling/walking routes along the A23. However, as the number of existing journeys was negligible, the impact of the Scheme in terms of physical fitness was considered to be slight beneficial; the subway and new dedicated cycle/pedestrian routes would encourage use of non-motorised modes from an almost zero base level.

Environmental Statement

5.145 Physical Activity was considered in the Pedestrians, Cyclists, Equestrians and Community Effects chapter of the ES which noted that existing cycleway / footpaths along the A23 between Handcross and Warninglid were limited. A footpath was present along London Road on the northern section of the Scheme, however it was not well maintained. There was also a short section of cycleway west of the highway between Warninglid Junction and Stanbridge View. The existing high volumes of traffic with a large number of HGVs on the A23 made walking or cycling an unpleasant experience and discouraged use of the route by NMUs. National Cycle Network on-road route (NR 20) ran along the B2114 and D164 between Handcross and Warninglid.

5.146 The ES identified nine Public Rights of Way (PRoWs) in the vicinity of the Scheme (see Table 5-15 in evaluation section below). Other routes included three long distance walks which would not be impacted on directly and were not considered further in the ES. Although there were no designated equestrian routes crossing the A23, there was evidence of equestrian use of Staplefield Road verges under Slaugham Junction and Park Road.

5.147 There were no crossings provided to link the PRoWs on either side of the road and pedestrians were only able to cross safely at three locations via minor roads which crossed the A23; the B2110 at Handcross; Staplefield Road at Slaugham Junction; and the B2115 at Warninglid. High traffic levels made the road unsafe to cross and discouraged local journeys on foot.

5.148 Potential impacts on NMUs were predicted to include positive safety benefits due to improved crossing facilities, severance due to increased traffic flows, shortening of PRoWs due to a new road footprint and changes in amenity.

5.149 Proposed mitigation is summarised in Table 5-15 below and would include a new pedestrian subway, as well as a new dedicated cycleway/footpath to be built along the entire length of the Scheme, which would also provide pedestrians and cyclists with a safer alternative access to East Park and Handcross Market Garden. Extensive planting and landscaping would be undertaken at all sites where there would be adverse visual impacts e.g. as a result of the loss of the existing central reserve planting.

5.150 The impact of the overall scheme on NMUs was assessed as Moderate Beneficial.

Consultation

5.151 Ansty and Staplefield PC consider the cycle path to be a great success and that the provision of cycle paths should be encouraged as part of all new road schemes.

5.152 West Sussex County Council (WSCC) stated that this scheme has helped “correct errors and problems for non-motorised users (NMUs) created by past works. A popular footpath was previously severed by realignment of the A23 and no provision was made for walkers to safely connect from one side of the A23 to the other – consequently the paths became less used and, sadly, a few users tried still to cross the A23 at-grade, endangering themselves and

motorists. The creation of an underpass to link footpaths 14S and 15S is an excellent solution of great benefit to walkers in this area".

5.153 "The scheme has also created a new bridleway on the western side of the A23 connecting Cuckfield Lane and Staplefield Road. With a dearth of other off-road routes for cyclists and equestrians in the local area, this is an incredibly valuable enhancement for local NMUs. The design has been compromised to a degree from the highest of standards as a bridleway, in terms of width, surface material and position relative to the road, but it is safely usable and certainly an improvement on people using the local road network as previous. The full potential has, however, not been realised as whilst an excellent north – south route is available, the opportunity to create a route going east from that spine has not been delivered. The underpass is suitable for bridleway use and Highways England has dedicated bridleway status to a point on the edge of its land east of the A23; there is though no bridleway connection established through to Staplefield Lane." It is considered that "this could have been created when negotiating various land swaps and purchases, but it proved too late in the process to secure such a route through these means and when influence was available; it is now left to user groups and to the highway authority to try to negotiate with landowners, which is proving difficult. The compromises in the provision, and not realising the full potential of the opportunity arising from the A23 works, result from this only being designed following successful representation by user groups (British Horse Society, Sustrans) at the public inquiry".

5.154 WSCC adds that the contractor was excellent in communicating with WSCC PRoW when on site and it was appreciated that they sought input from WSCC PRoW during the construction period.

Evaluation

5.155 As expected a new subway for pedestrians has been provided which connects PRoWs on either side of the A23 and a new dedicated cycleway/footpath has been built along the entire length of the Scheme. POPE is not aware of any NMU surveys which would inform usage of the PRoW network. During the site visit in May one cyclist was observed on the east bound combined cycle/footway in the vicinity of Handcross travelling north[17]. It is understood that the cycleway was expected to form part of the long distance cycleway planned between London and Brighton – however OS maps indicate that instead, this cycle route crosses the A23 at the Warninglid overbridge and makes use of local lanes to the east of the A23 including the B2114 into Handcross.

5.156 The northern extent of the NMU route on the eastern side, adjacent to the A23 mainline is lit for a short distance and then no further lighting is provided south of this location or on the shared-use path to the west. It is understood that in response to concerns raised in the 2014 Road Safety Audit report which thought that lack of lighting could prove hazardous for NMU users particularly cyclists, additional white lining at changes of direction and reflective markers at gateways and on hazards e.g. sign posts have been incorporated into the scheme. The scheme was not visited at night so the reflective properties of white lines and reflectors were not viewed, but the site visit confirmed them to be in place at various locations.

5.157 Another concern raised related to the shared-use bridleway related to the 2 metre high fence which screens the bridleway from the A23 and its traffic and which ends at a location where the path is quite close to the mainline. It was suggested that should be extended for 20m to 30m northwards to ensure that horses are screened from traffic where they are not at a safe distance from the mainline. The fence is in place where the path is closest to the carriageway but based on the site visit and As Built landscape plans the fence stops before balancing pond 2 and although the path is at the bottom of a low embankment slope and should in time be screened by vegetation, traffic is very visible and the NMU route might have benefitted by the environmental barrier extending as far as the balancing pond where the path diverts away from the road.

[17] The cyclist was observed during a one hour period spent assessing this section of the scheme.

5.158 POPE has not been provided with any later information with regard to these issues having been closed out and it is suggested that the status of NMU routes could be reconsidered at FYA when further information may be available.

5.159 As expected the three long distance trails have not be affected by the scheme. There have been no NMU surveys specifically undertaken for this POPE report and POPE is not aware of any NMU audits or Vulnerable User Studies which would confirm usage. Table 5-15 below summarises mitigation and evaluation at OYA for the PRoW network. OYA photographs illustrating various aspects of the NMU provision are included in Appendix F of this report.

Table 5-15 Summary of Proposed Mitigation for NMUs and OYA Evaluation

PROWs	ES Proposed Mitigation	OYA Evaluation
Bridleways 7aS and 7bS – known as Park Road, private road through Slaugham Park Estate between Slaugham Village and Handcross Village. Lightly used by pedestrian and equestrians and is well maintained as a vehicular access to Slaugham Park.	Temporary night closure during construction – long term would not be affected by the Scheme	As expected
Footpath 3S – connects the B2110 west of the A23 to Park Road.	Unlikely to affected by the Scheme	As expected
Footpath 4S – formerly crossed the A23 connecting Park Road with Brighton Road. Reduced to a short length of overgrown path linking A23 layby to Brighton Road.	The scheme proposed removal of the lay-by and parking that provided access to this footpath. It was considered dangerous to cross the A23 at road level and it was proposed that this short footpath be closed.	It appear that this link is incorporated into the short length of NMU route accessed off the A23 signed for cyclists and pedestrians.
Footpath 9S signposted from the A23 and starts at a stile on the southbound highway boundary approximately 200m north of Slaugham Junction. Becomes 7CR after East Park stream	Temporarily realigned during construction, long term it was considered that the Scheme would have a positive impact on this footpath by linking it to the proposed new footway and cycleway running along the A23 The loss of the existing central reserve planting would adversely impact on visual amenity for Footpaths 9S- mitigation measures would include new planting areas of native trees and shrubs, hedge planting, infill planting and sowing of open areas with species rich grass.	Footpath 9s links into the new NMU route alongside the A23 as expected. Visual amenity has been affected and the A23 traffic is very prominent - new planting is too immature at this OYA stage to provide any landscape integration or screening of views and impacts should be reconsidered at FYA. On the day of the POPE site visit no NMUs were observed using the PRoW.
Footpath 13CR connects the D164 east of the A23 to Slough Green Lane.	Unlikely to be affected by the Scheme	As expected
Footpaths 14S and 15S – considered to form a continuous east-west route across the A23, which, although very difficult and dangerous to cross due to high traffic levels, anecdotal evidence and accident statistics suggested that attempts were made to cross the A23 between the two footpaths	A new subway with movement activated lighting was proposed to link the footpaths either side of the A23 and provide a safe crossing point. The PRoW route would be slightly realigned reducing journey length and time. 15 slightly realigned to avoid the	The subway has been provided although no lighting appears to have been installed; it provides a safe crossing of the A23 as expected. There was evidence of use by horse riders of the shared-use path. Mounting blocks have been provided at the subway – it is understood that horse riders

PROWs	ES Proposed Mitigation	OYA Evaluation
using the central reserve as a refuge and requiring approximately 30 minutes of walking along the highway in an unpleasant and dangerous environment (i.e. very close to a 70mph dual carriageway).	proposed balancing pond The loss of the existing central reserve planting would adversely impact on visual amenity for Footpath 14S - mitigation measures would include new planting areas of native trees and shrubs, hedge planting, infill planting and sowing of open areas with species rich grass.	must dismount due to limited headroom to remain seated (2.7m). 15S to the east of the A23 links into the wider footpath network and is signed although as noted by WSCC bridleway access does not extend beyond the highway boundary. 14S descends from fields at the higher plateau level through a new gate and steps down an embankment to join the new shared-use path to link either under the subway or north towards Slaugham junction. The A23 remains a prominent feature in views and new planting is too immature to provide any screening or landscape integration at OYA. It is likely that over time the new features will tone down and blend in with planting filtering views to the wider landscape as it matures. New traditional wooden signs are in place although in one location a sign more appropriate to an urban setting doubles up on signage.
Footpath 10CR – continued route of 15S but appeared little used	Unlikely to be affected by the Scheme.	As expected
Footpath 34S (turning into footpath 1CR through Cow and Harrys Wood) –	Unlikely to be affected by the Scheme.	As expected

5.160 Consultation received has been generally positive about the NMU provision, although WSCC also considers that opportunities have been lost to link into the wider bridleway network and as stated in its consultation response 'would encourage a 'lesson learned' for the future to be to make an early positive commitment to enhance off-road access opportunities and to consult with user groups and highway authorities on their expectations for non-motorised access opportunities from the outset, and to embrace these aspirations much earlier in the design and authority / agreement processes'.

5.161 It was expected that the Scheme would have a slight beneficial impact on amenity, as safety and journey ambience would be improved due to construction of the subway connecting two PRoWs and provision of dedicated cycle and pedestrian paths, however, views for users of some PRoWs would be adversely affected due to widening of the road corridor. Based on the information available at OYA the overall effect of the scheme is considered to be as expected. It is suggested that NMUs should be reconsidered at FYA.

Table 5-16 – Evaluation Summary: Physical Activity

Sub-Objective	AST	OYA
Physical Activity	Slight beneficial	As expected

Journey Quality

Forecast

Appraisal Summary Table

5.162 The journey quality sub-objective considers traveller care (facilities and information), traveller views, and traveller stress (frustration, fear of potential accidents, and route uncertainty).

5.163 The AST stated that the changes to the proposed changes to the scheme were taken into consideration and the score of 'moderate beneficial' did not change from the previous scheme. There would be benefits for travellers through reduced frustration, fear of accidents and improved route certainty. Traveller care would be improved by better information and facilities would be maintained. There would be an adverse impact on travellers' views due to removal of central reservation trees, however, the significant beneficial impacts on Traveller Stress would result in an overall large beneficial impact on journey ambience.

Environmental Statement

5.164 The ES considered the effects of the Scheme on vehicle travellers, including travellers' views, changes in amenity (traveller care), and driver stress summarised as:

- Traveller Care: Existing facilities on this section of the A23 were limited to a short length of existing cycleway on the west side of the A23 between Warninglid Junction and Stanbridge View, and two lay-bys. There were no service areas. Information on the existing route was limited to standard signage and three Variable Message Signs.

- Traveller Views: The Handcross to Warninglid section of the A23 lies within the High Weald AONB. Between Handcross and Slaugham Junction views from the road were restricted by mature woodland typical of the High Weald ridge. The mature trees within the central reserve, combined with the winding nature of road reinforced this wooded character with a strong sense of place, in particular a contrast between the wooded ridges of the High Weald with the Ouse Valley to the south. Views from the road for this section of the route were classified as restricted – with mature trees restricting the view.

- The Ouse Valley, to the south of Slaugham Junction, was characterised by pastures enclosed by hedgerows and tree belts which generally contained views from the road; however the valley character, in contrast to the wooded canopy in the north, provided the traveller with a sense of openness. Existing views to and from the A23 were quite open on the east side, although restricted by undulating landform, hedges and trees. On the west side, south of Anne's Wood Stream, a zone of woodland restricted distant views. North of the stream there were intermittent views from the A23 to Slaugham Place and surroundings. Narrow belts of trees along the verges of both sides of the road screened the traffic, particularly in summer. Views from the road for this section of the route were classified as intermittent – with barriers to views at intervals.

- Traveller Stress: The existing A23 was two lanes in both directions with steep uphill gradients which effectively reduced capacity (especially between Chainages 0 and 1600 northbound) where slow moving HGVs forced traffic onto a single lane. Drivers could become frustrated and take risks in overtaking, particularly if unable to pass slow moving HGVs. Congestion during peak periods leading to a lack of opportunities to overtake slower vehicles, exacerbated driver frustration. At peak times, the existing level of driver stress in both directions on the A23 was estimated as high taking into account traffic flows and speeds. Established trees in the central reserve limited visibility in places and could lead to driver uncertainty in some cases. Vertical and horizontal alignments were substandard and together with the existing substandard accesses onto the A23 increasing the potential for accidents would be likely to increase driver stress further.

5.165 The ES expected that the Scheme would improve safety and traffic flow by straightening bends, smoothing gradients, providing an additional lane in each direction, improving junction

layouts and closing direct accesses onto the A23. The DVSA[18] site would be marginally relocated with a longer on and off slip road to provide safer access from the highway into the site. The Scheme would include replacement and upgrade of signage and carriageway lighting. A new pedestrian and cycle route would be provided along the entire length. This would generally be 2m wide with 0.5m minimum offset along the edge of the northbound and southbound carriageways. Landscape planting and visual screens would reduce the visual impact of the road on the landscape.

Summary

5.166 The ES stated that taking into account the reduction in driver stress, slight beneficial impact on traveller care and the slight adverse impact on views from the road, the overall impact score, on balance, for vehicle travellers was assessed to be moderate beneficial.

Consultation

5.167 No responses to consultation requests were received for this sub-objective.

Evaluation

5.168 Table 5-17 and Table 5-18 below summarise the evaluation of the Scheme's impact on Traveller Factors and Journey Quality.

Table 5-17– Evaluation Summary: Traveller Factors

Traveller Factor	ES	OYA
Care	Traveller information provided would be improved with better signage at the junctions and along the route. The impact on facilities would be slight adverse due to the existing lay-bys not being replaced as a result of the proposed Scheme. There would be an overall slight beneficial impact on traveller care.	Signage and road lighting has been upgraded in line with road improvements. As expected, laybys have been removed. Journey quality is improved for cyclists and pedestrians due to provision and design of the dedicated facilities, such as cycle lanes and crossings. Beneficial impact on traveller care.
Views	Existing views from the road were enclosed between Handcross and Slaugham Junction and opened up between Slaugham Junction and Warninglid. The proposed Scheme would lead to deterioration in views from the road and a general opening up of the highway corridor. Impacts would reduce as planting matured. Overall there would be a slight adverse impact on views from the road in the long term.	At OYA the scale of the road has increased due to the loss of trees adjacent to the road which has opened up the route corridor and loss of mature trees from the former central reserve, and replaced with a visually prominent concrete barrier. Subject to the successful establishment of new landscape planting and softening of materials used within the scheme it is likely that the effects of the Scheme would be less obvious than they are at OYA. Adverse impact on traveller views.

[18] Driver and Vehicle Standards Agency site - the DVSA was formerly known as the Vehicle and Operator Services Agency (DVSA) prior to April 2014.

Traveller Factor	ES	OYA
Stress	Existing levels of driver stress on the A23 were considered to be high due to several factors such as the high level of accidents and the volume of traffic and congestion. The Scheme would lead to reductions in driver stress with a reduction of congestion and a likely reduction of traffic accidents. There would be a large beneficial impact on driver stress	Driver stress is likely to have reduced due to the additional lanes reducing congestion and more reliable journey times leading to less driver frustration. Clearer forward visibility and junction layouts, together with closure of direct accesses onto the A23 has improved safety and is likely to have reduced the fear of accidents, and together with upgraded signage will also have helped reduce route uncertainty. Based on information with the traffic sections of this report, the scheme appears to have had a clear beneficial effect on the frequency of collisions along the A23 between Handcross and Warninglid. It is also noted that post opening to date there have been no collisions in the vicinity of the VOSA site in comparison to a cluster of collisions at the northbound diverge and merge pre-scheme. Improved pedestrian crossing facilities and the introduction of a dedicated cycle lane will have reduced the fear of accidents related to NMUs. However, during the OYA site visit several cars were noted apparently mistaking the service road for access onto the A23 having to turn around at the 'dead end'. Anecdotally it is understood that there have been a couple of incidents at night of driver confusion mistaking the service road for the A23 on slip and attempting to join the carriageway at the dead end. **Overall Beneficial impact on driver stress, although there seems to be some driver confusion at the new Warninglid junction**.

Summary

5.169 Based on the information available to POPE, it is considered that the effects of the Scheme on Journey Quality are likely to be as expected in terms of Traveller Care, Traveller Views, and Traveller Stress. However, anecdotal evidence from the OYA site visit indicates that there might be some confusion for drivers at the new Warninglid junction as to which exit is for the A23 rather than the service road. As well as drivers having to turn around at the 'dead end' it has apparently led to a couple of vehicles at night attempting to enter the A23 northbound from the end of the service road. No surveys have been undertaken for traffic levels on the service road.

Table 5-18 – Evaluation Summary: Journey Quality

Sub-Objective	AST	OYA
Journey Quality	Moderate Beneficial	As expected

Key Points – Environment

Noise and Local Air Quality

- Traffic forecast data indicates that the observed post-opening ADT traffic flows are lower than expected by approximately 14% on the A23 between Handcross and Warninglid.
    - The impact on the noise climate is considered likely to be as expected; and
    - The percentage differences between forecast and observed traffic flows are considered significant, and impacts on local air quality are likely to be better than expected.

Greenhouse Gases

- The scheme has resulted in an increase in carbon post opening, although to a lower level than forecast.

Landscape

- Mitigation measures are in place but there is varied plant growth throughout the scheme with most areas exhibiting slow growth and this could compromise the longer term objectives for landscape screening and integration;
- Apart from weed free circles, routine maintenance activities including replacement planting do not appear to be in place;
- It is considered too soon to fully evaluate the overall effectiveness of the landscape mitigation and ongoing establishment and visual impacts should be reconsidered at FYA;
- Based on the situation observed at OYA it is considered that the ES score of moderate adverse better reflects the impacts of the scheme on the high quality AONB landscape and the adverse visual impact for a small number of receptors, than the revised AST score of slight adverse.

Townscape

- As expected it is unlikely that any townscape feature has been affected by the Scheme.

Heritage & Historic Resources

- Visual impacts on built heritage are considered to be as expected. POPE has no pre and post opening noise information to be able to confirm whether noise levels at Nymans and Slaugham Place have changed as a result of the scheme – the ES suggested that cultural heritage sites might benefit from reduced noise levels as a result of the use of a low noise surface. The WW II pill box has been adapted as a bat roost and hibernaculum; and
- No archaeological information to confirm works on site or any archaeology reports have been made available to POPE and as such it is not possible to fully evaluate this sub-objective at OYA.

Biodiversity

- Ecological mitigation measures for species and habitats appear to have been implemented broadly as expected;
- No post construction survey or monitoring information has been made available to POPE which would have enabled the effectiveness of these measures to be confirmed; and
- West Sussex County Council suggested that a critical review should be undertaken to assess the success of the biodiversity mitigation (and compensation) measures, including a “snagging list” of issues requiring remedial works.

Water Environment

- POPE is not aware of any information to suggest that drainage measures are functioning other than as expected.

Physical Activity

- Consultation received has been generally positive about the NMU provision, although WSCC considers that opportunities have been lost to link into the wider bridleway network and would encourage a ‘lesson learned’ for the future to be to make an early positive commitment to enhance off-road access opportunities and to consult with user groups and highway authorities on their expectations for non-motorised access opportunities from the outset;
- As expected, it is considered that there has been a beneficial impact on safety and journey ambience has improved due to the subway providing safe NMU crossing of the A23 and provision of dedicated cycle and pedestrian paths, however, views for users of some PRoWs has been adversely affected due to widening of the road corridor.

Journey Quality

- The effects of the Project on Journey Quality are likely to be as expected in terms of Traveller Care, Traveller Views, and Traveller Stress. However, it appears there could be some driver confusion at the Warninglid roundabout as to which exit is for the A23.

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

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 use it, because they have the option of another mode should their car become unavailable.

6.4 The AST for this scheme states that there would be 'no opening or closure of any transport services and therefore no impact on people's option values'. Therefore, the AST forecast was that option values was **not applicable**.

Evaluation

6.5 The main services using the scheme extent between Handcross and Warninglid are:

- The 273 Metrobus Service, serving locations including Crawley, Handcross, Warninglid, Bolney, through to Brighton. This runs up to eight times a day on weekdays, and seven times a day on Saturdays.
- The Handcross District Community Bus, serving locations including Crawley, Handcross, Slaugham, Staplefield and Warninglid. This includes two services a day on local bus routes in the area.

6.6 Bus routes also connected to the Handcross junctions include the 271 Metrobus. Bus routes connected to the Warninglid junction include the Warden Park School service and the 89 Arriva bus route.

6.7 The improvement in journey time reliability along the scheme extent may have improved bus reliability, although there is no indication that the scheme has resulted in any additional services or route frequencies.

6.8 As there is no evidence to suggest that the A23 Handcross to Warninglid scheme has led to any changes in option values, this sub-objective has been assessed as **neutral**.

Access to the Transport System

Forecast

6.9 For this objective, the AST forecast impact states 'no change in the resident population with access either to a car or to a daytime hourly public transport service therefore no change in access to the transport system. Therefore, the AST forecast a score of not applicable for this objective.

Evaluation

6.10 The reduction in traffic and congestion along the A23 Handcross to Warninglid is likely to have improved bus reliability for the services travelling across it.

6.11 The improved journey times for traffic will also allow improved access to the transport interchanges at Handcross and Warninglid. However, the closure of the junction, as well as other access points along the route has reduced the access points to these locations.

Severance

Forecast

6.12 Severance, as defined by WebTag, represents the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes in traffic flows.

6.13 For this objective the AST forecast that the 'The creation of a subway linking footpath 14S and 15S would reduce severance due to the A23 for Slaugham and Stanbridge communities'.

6.14 Given the forecast impact, the AST forecast a score of **Slight Beneficial** for this objective.

Evaluation

6.15 No post opening NMU surveys were available for this scheme, therefore the evaluation of this objective will focus on the qualitative impacts.

6.16 The improvements to the dedicated NMU route along the A23 has provided a high quality route, part of which is shown through Figure 6.1. The addition of the underpass, as shown by Figure 6.2, allows users to cross the A23 in the middle of the scheme, reducing severance for users, including those in the communities of Slaugham and Staplefield. There has been some increase in traffic flows since scheme opening, however, it is not anticipated that this was at an extent to have impacted severance and some sections have been separated from the mainline through fencing (as shown in Figure 6.1).

Figure 6.1 Non-Motorised User Route

Figure 6.2 Pedestrian Underpass

6.17 A post opening site visit provided evidence of some use of the route by dog walkers, while feedback from the Ansty and Staplefield Parish Council was that 'the cycle path is a great success'.

6.18 Given the detail above, the assessment score of **Slight Beneficial** has been upheld for the scheme overall.

Integration

6.19 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

6.20 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. The AST forecast for this scheme was 'no interchange between different modes of transport proposed'. As such, the AST forecast a neutral impact for transport interchange.

Evaluation

6.21 No freight or passenger transport interchanges were included in within the scope of the scheme therefore the AST assessment is retained at the OYA stage.

Land Use/Other Government Policy

6.22 This section looks at the scheme in relation to national, regional and local level land use and development policies.

Forecast

6.23 For the land use policy objective, the AST stated that *'the proposed Scheme would support key policies on transport safety, accessibility and capacity, walking and cycling and economic growth in the Ten Year Transport Plan, PPG13 and the West Sussex, Mid Sussex and Local Transport Plans. The proposed Scheme would strongly support RPG9 in relation to economic development of the south coast regeneration area. The proposed Scheme would hinder key policies on nature conservation, archaeology, landscape (particularly related to the AONB) and noise policies in PPGs 9, 15, 16, 24 and Mid Sussex/West Sussex Plans'*.

6.24 For the other government policy objective, the AST stated *'Policies related to recreation, economic growth and competitiveness and social inclusion would be helped by the proposed Scheme. Policies related to conservation of the environment, biodiversity, archaeology, landscape and agriculture would be hindered by the proposed Scheme. More key policies would be benefited than hindered by the proposed Scheme'.*

6.25 Overall, the AST judged the scheme to have a **beneficial** impact in respect of national, regional and local planning policies.

Evaluation

6.26 An evaluation of the scheme in relation to policy has been undertaken and summarised in Table 6-1 on the following page. Beneficial impacts are seen for non-environmental policies, although the comments in the AST stand true for impacts on conservation, archaeology and landscape. Given the findings presented, it is considered that the overall impact of the scheme on land use policy integration is **beneficial**, as forecast in the AST.

Table 6-1 – Scheme **Alignment with National, Regional and Local Policy**

	Policy/Document	Relevant Policy Objective/Reference	Relevant Scheme Impacts	Alignment
Local and Sub-Regional Policies	**West Sussex Local Transport Plan 2001-2016**	The main objectives of the West Sussex LTP were to: • Improve access to jobs and services • Improve safety • Reduce pollution • Reduce congestion The A23 was identified as a vital link and noted that the route was showing 'signs of strain in terms of traffic capacity and road safety'. A particular area of concern was the A23 between Warninglid and Handcross, and identified this section as an area for improvement. It was also noted that any improvements would need to minimise effect on High Weald AONB and historic parks/conservation areas.	• The scheme has helped to improve the A23 trunk road, providing improved connectivity between Brighton and London/Gatwick. • The scheme has included several measures to try and protect habitats, air and water quality, although does affect landscape and heritage features • The scheme has improved safety on the A23 trunk road.	✓
Reg Policy	**Regional Transport Strategy (RTS) for the South East (2004) and South East Plan (2006 draft)**	The Regional Transport Strategy (RTS) for the South East adopted in 2004 formed part of the new RSS (The South East Plan). The strategy's vision was to have a high quality transport system to act as a catalyst for continued economic growth and provide for an improved quality of life for all in a sustainable and socially inclusive manner. The RTS sought to reduce the wider environmental, health and community impacts associated with the transport system by bringing forward measures to positively manage the transport system in ways that reduce dependence on the private car. At the same time the strategy sought to improve the strategic road and rail network to improve spatial connectivity and realise economic opportunities to reduce disparities within the region.	• The scheme has achieved a considerable reduction in the number of collisions on the A23 route. • The scheme has considerably improved journey times for trunk road traffic and relieved pressure on other roads, removing congestion hotspots. • The provision of high quality NMU routes reduce dependence on the private car for shorter journeys.	✓
	Gatwick Sub-Regional Study (2005)	The Gatwick Sub-Region is centred on Crawley/Gatwick and Horley extending north to the edge of Redhill, east to East Grinstead, south to Burgess Hill/Haywards Heath and west to Horsham. The strategy went on to form part of the submitted draft South East Plan that was prepared jointly by the area's local authorities and it sets out key policies and a framework for action for the area. The key objective for the Gatwick area Sub-Region: 'To capitalise on the sub-region's location in relation to Gatwick Airport, London and Brighton, positively related to the Gatwick Diamond concept and focusing on diversifying the economy to reduce reliance on the airport'. The vision of the sub-region is that it should continue to provide an excellent quality of life for its communities including maximising the value added by its economy, providing a high quality transportation system that meets the demands that would be placed upon it and providing adequate new housing and other development designed and built to a high standard, in a way that enhances access to services and facilities. The strategy makes provision for a substantial amount of new housing, employment and related development. The planned development includes the provision of infrastructure as a prerequisite to growth. The sub-region has a high quality environment including the High Weald AONB to the south and east of Crawley, and pleasant lowland countryside. The strategy requires construction, layout, scale appearance, materials, and landscaping of new development the A23 area to respect character of the sub-region.	• The scheme has improved journey times, therefore improving connections to Gatwick from the South. • The improvements increase capacity, therefore allowing for resilience against the new developments planed at Gatwick.	✓
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: • To protect and enhance the built and natural environment. • To improve safety for all travellers • To contribute to an efficient economy, and to support sustainable economic growth in appropriate locations. • To promote accessibility to everyday facilities for all, especially those without a car. • To promote the integration of all forms of transport and land use planning, leading to a better, more efficient transport system	• The scheme has delivered journey time benefits, improving the efficiency of the trunk road network, with potential for wider economic benefits. • The scheme has considerably improved journey times for trunk road traffic and relieved pressure on other roads. • The scheme has improved road safety for all travellers along the scheme section.	✓
	Transport 2010: The Ten Year Plan (2000)	The strategy for transport aims to tackle congestion and pollution by improving all types of transport -rail and road, public and private - in ways that increase choice. It is a strategy for investment in the future to create prosperity and a better environment.	• The scheme has delivered major journey time benefits, improving the efficiency of the trunk road network, with potential for wider economic benefits. • The impact on the environment has been minimised through mitigation, but the scheme impacts on the AONB.	✓ Partial
	The Future of Transport: A Network for 2030 (2004)	The Strategy builds on the progress that had already been made since the implementation of the 10 year plan for transport. This plan extended out to 2014-2015 but strategy also looks even further ahead, at the challenges faced over the next 20-30years. The Strategy is built around three themes, Sustained investment, Improvements in transport management and Planning ahead	• The scheme has delivered journey time benefits and improved capacity of the route for future traffic growth.	✓

7. Conclusions

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

Scheme Specific Objectives

7.2 Table 7–1 presents an evaluation of the scheme's objectives using the evidence presented in this study.

Table 7–1 Success against Scheme Objectives

Objective	Has the scheme objective been achieved?	
Provide increased capacity by removing the existing bottleneck on the strategic M23/ A23 route between London and Brighton with associated peak hour delays.	The scheme has removed the bottleneck at this location by providing additional capacity. Peak hour delays, particularly the AM peak have reduced significantly at the scheme location.	✓
Provide improved journey times and increased safety.	Journey times have improved in all time periods and in both directions along the widened section. Safety has significantly improved for the A23, and the wider area (including the scheme extent).	✓
Improve safety for residents and operators by removing all direct private and commercial accesses to A23.	The provision of the local access road has removed the need for private and commercial direct access to the A23, thereby reducing the risk of collisions. Safety has been seen to improve along the new widened section of the A23.	✓
Reduce congestion and improve journey time reliability along the A23 and improve existing junctions at Handcross and Warninglid.	The widening to three lanes of this section of the A23 has removed a bottleneck and provides reduced and more reliable journey times.	✓
Reduce congestion and improve journey time reliability to and from Gatwick Airport, to and from the key infrastructure element of the Gatwick Diamond economic growth area, and the major new housing allocations in Mid-Sussex, Crawley and Horsham.	Additional capacity has been provided through the upgrade of the A23, improving journey time reliability along the stretch. Therefore access to the M23, and therefore Gatwick has therefore improved access from the south. The increased capacity ensures there is a level of futureproofing	✓
Provide improved routes for pedestrians, equestrians and cyclists, and improved junctions at Handcross and Warninglid, thereby improving safety.	Improved routes have been provided for pedestrians, equestrians and cyclists, including a new underpass to ease passage across the A23 in the middle of the scheme. Improved junctions have also assisted cyclists crossing slip roads. No pedestrian collisions were noted pre scheme, with one cycle collision post opening on the A23 where the rider lost control.	✓
Minimise environmental impact and seek opportunities for enhancement taking account of value for money.	The scheme was constructed within the existing highway boundary as far as possible, and was fully landscaped to integrate into the existing landscape. Lighting was limited to those area where already existing. Habitat enhancement	✓

	was included in the scheme.	
Minimise land acquisition, particularly of National Trust land. **Minimise effect on Ancient Woodland.**	Retaining walls have been utilised to reduce land take. Landscape As Built plans show locations for translocated woodland material and soil. Plans also indicate indicative locations for coppiced stools. Hazel and hornbeam coppiced tree stools were viewed at OYA in areas B and C. POPE cannot comment on the number of stools originally translocated; of those viewed most were showing signs of coming into leaf, growth was very variable (previous browsing may be a cause) and a few had not survived the translocation.	✓

8. Appendices

Appendix A. AST and EST

Table 8-1 – Appraisal Summary Table (AST)

A23 Handcross to Warninglid				
OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT	ASSESSMENT
Environment	**Noise**	In updating this AST the proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, have been taken into account. These are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. Receptors located adjacent to the A23 and associated slip roads in general are predicted to experience a slight increase in noise levels as a result of the proposed Scheme. Overall, however, there would be a slight increase in population annoyed by noise, as a result of changes in traffic flow on the local road network and alignment changes to the A23. No residential receptor would experience a noise change >3dB in design year (when comparing the Do- Minimum 2013 and Do-Something 2028). Key assumptions: in the opening year, the do-minimum road surface has been assumed to be hot rolled asphalt and the do-something road surface a low noise surface. In the design year, both do something and d…..[remaining text missing]	Without scheme: estimated 222 people likely to be annoyed by traffic noise in the longer term With scheme: estimated 228 people likely to be annoyed by traffic noise in the longer term Without scheme 2028: 288 people exposed to noise levels in excess of 66dB LAeq. With scheme 2028: 286 people exposed to noise levels in excess of 66dB LAeq. With and without scheme: 0 people exposed to noise levels > 80dB LAeq.	Net annoyance change: 7 NPV (60 year period): -£0.18m
	Local Air Quality	In updating this AST the proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, have been taken into consideration. These are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. The marginal changes in the air quality reported in the AST are a result of the minor changes in the traffic flows due to the removal of Slaugham junction and the resulting reassignment of the traffic. All assessed properties would experience deterioration in air quality due to widening of road. Pollutant concentrations would remain well below Air Quality Objective levels.	NO2: 41 properties with an improvement. 33 properties with no change. 283 properties with a deterioration. PM10: 41 properties with an improvement. 31 properties with no change. 285 properties with a deterioration	Concentrations weighted for exposure: NO2: +26.00 PM10: +42.62
	Greenhouse Gases	The proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, have been taken into account. These are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. Over the 60 year appraisal period the predicted amount of carbon emissions would be more with the proposed Scheme compared to the without proposed Scheme scenario.	Change in Carbon Emissions over 60 year appraisal period (tonnes): 54,409 Change in Carbon Emissions in Opening year (tonnes): 743	Net Present Value of Carbon Emissions of Proposal: -£2.24m
	Landscape	The proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, have been taken into account in reaching a revised score of 'slight adverse' (compared with 'moderate adverse' previously). These are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. There is extensive tree cover immediately adjacent to the majority of the proposed Scheme. The proposed Scheme would result in the loss of the tree-covered central reserve and encroach onto inalienable National Trust land. The proposed Scheme would result in local adverse impacts on the High Weald and Ouse Valley Landscape Character areas in the AONB. The proposed access to East Park Properties and Stanbridge Place, culvert works and pond access would cause localised impacts to landscape outside the road corridor.		Slight Adverse
	Townscape	The proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, have been taken into consideration. These are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. The proposed carriageways and enlarged junctions, would not affect townscape character.		Neutral
	Heritage of Historic Resources	Direct construction impact on 3 known cultural heritage sites of local importance and 1 site of national importance. The three sites include two sites of geophysical survey features on either side of the road at Slaugham junction. The remaining site is an area of possible prehistoric remains in the River Ouse floodplain. Direct physical impact on a small area of Nymans Gardens, of national importance. The area has already been compromised by the construction of an access track and a structure, and is not representative of the area of Registered Garden. Based on this the impact is considered to be slight. The proposed changes to the Scheme will not increase neither diminish the effect of the Scheme.		Slight Adverse
	Biodiversity	The proposed Scheme would result in permanent loss of some woodland and scrub, including a small area of Ancient Woodland. The loss of the wooded central reserve could result in an adverse impact on rare bats (Barbastelle's, Bechstein's and Natterer's) due to potential severance of habitats. The proposed Scheme would result in the permanent loss of a small area of Orange Gill Woods SNCI. There would be an adverse impact on protected and threatened species due to loss and severance of habitat. The proposed Scheme includes extensive compensation measures, including a multi-species tunnel, substantial replanting, habitat creation and improved management of retained ancient woodland. The proposed changes to the Scheme are likely to reduce the area of habitat affected as a result of the reduced footprint. However this habitat is generally of poorer quality and the scheme as a whole will still result in the loss of the most sensitive habitats.		Moderate Adverse
	Water	The proposed Scheme crosses two named watercourses, the River Ouse and Anne's Wood Stream. There are currently very limited formal pollution control measures used along the section of highway. The proposed Scheme would provide a more controlled drainage system with a better defined collection and discharge system. This would facilitate provision of appropriate pollution control facilities at specific locations including treatment areas, ponds and, prior to treatment areas, oil interceptors. Spillage risk calculations indicate no significant impacts with the proposed Scheme in place but facilities for containment of spillages would be provided. The proposed changes to the Scheme will not alter the mitigation proposed in terms of drainage and river geomorphology.		Slight Beneficial
	Physical Fitness	The proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. Current non-motorised journeys would be shortened by the proposed Scheme due to provision of a crossing point and better cycling/walking routes along the A23. However, as the current number of journeys is considered negligible, the impact of the proposed Scheme in terms of physical fitness is considered to be slight beneficial, as the subway and new dedicated cycle/pedestrian routes would encourage use of non-motorised modes from an almost zero base level.	N/A	Slight Beneficial
	Journey Ambience	The proposed changes to the Scheme, following the removal of Slaugham junction and the Comprehensive Spending Review, have been taken into consideration. These are a reduction in carriageway width by 3.5 metres along the entire length of the Scheme, changes to the horizontal alignment and alterations to proposed position and height of earthworks in order to reduce the surplus quantity of cut material on the Scheme as a whole. The score of 'moderate beneficial' does not change from the previous scheme. Benefits for travellers through reduced frustration, fear of accidents and improved route certainty. Traveller care would be improved by better information and facilities are maintained. There would be an adverse impact on travellers' views due to removal of central reservation trees, however the significant beneficial impacts on Traveller Stress		Moderate Beneficial

A23 Handcross to Warninglid				
		results in an overall large beneficial impact on journey ambience.		
Safety	**Accidents**	Benefits from reduced accidents from proposed Scheme & re-assignment of traffic from local roads.	None identified	PVB £1.52m
	Security	Not assessed; any security impact would be marginal & not quantifiable.	None identified	Score
Economy	**Public Accounts**	Govt PVC, No Local Govt PVC. Benefit of £12.11m from an increase in indirect taxation revenue collected.	Local Govt Funding: Broad Transport Budget, PVC = £0m Central Govt Funding: Broad Transport Budget, PVC = £26.59m Central Govt Funding: Wider Public Finances, PVC = -£12.04m	PVC £26.59m PVB £12.04m
	Transport Economic Efficiency: Business Users & Transport Providers	Significant journey time savings for business car & HGV trips.	None identified	PVB £91.23m
	Transport Economic Efficiency: Consumers	Significant journey time savings for consumer car trips.	None identified	PVB £112.79m
	Reliability	Widening is expected to improve journey time reliability by increasing capacity, facilitating overtaking of slow vehicles and by-passing of incidents more easily.	Not assessed quantitatively	N/A
	Wider Economic Impacts	No impact on any regeneration areas therefore an assessment of wider economic impacts is not required by TAG.	N/A	N/A
Accessibility	**Option Values**	No opening or closure of any transport services and therefore no impact on people's option values.	N/A	N/A
	Severance	The creation of a subway linking footpath 14S and 15S would reduce severance due to the A23 for Slaugham and Stanbridge communities.	N/A	Slight Beneficial
	Access to the Transport System	No change in the resident population with access either to a car or to a daytime hourly public transport service therefore no change in access to the transport system	N/A	N/A
Integration	**Transport Interchange**	This sub-objective is not applicable as there is no interchange between different modes of transport proposed		0
	Land-use Policy	The proposed Scheme would support key policies on transport safety, accessibility and capacity, walking and cycling and economic growth in the Ten Year Transport Plan, PPG13 and the West Sussex, Mid Sussex and Local Transport Plans. The proposed Scheme would strongly support RPG9 in relation to economic development of the south coast regeneration area. The proposed Scheme would hinder key policies on nature conservation, archaeology, landscape (particularly related to the AONB) and noise policies in PPGs 9, 15, 16, 24 and Mid Sussex/West Sussex Plans.		Beneficial
	Other Government Policies	Policies related to recreation, economic growth and competitiveness and social inclusion would be helped by the proposed Scheme. Policies related to conservation of the environment, biodiversity, archaeology, landscape and agriculture would be hindered by the proposed Scheme. More key policies would be benefited than hindered by the proposed Scheme.		Beneficial

Table 8-2 Evaluation Summary Table (EST)

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT	ASSESSMENT
Environment	**Noise**	Based on the traffic survey results, noise levels in the vicinity of the scheme are as expected.		As expected (Slight Adverse)
	Local Air Quality	Based on the traffic survey results, air quality in the vicinity of the scheme is likely to be better than expected.		Better than expected (Slight Beneficial)
	Greenhouse Gases	Carbon output from vehicles using the A23 scheme section has increased post scheme opening, possibly to a higher level than expected in the opening year.		As expected (Slight Adverse)
	Landscape	Planting within the scheme has been implemented as set out in the ES/Environmental Masterplan. Screen planting is in place but appears to be slow growing which may compromise longer term screening. Some maintenance does not seem to be in place (replacement planting). It is considered too soon to evaluate the overall effectiveness of the landscape mitigation and should be reconsidered at FYA.		As expected (Moderate Adverse) (ES score)
	Townscape	As expected, the scheme has had limited or no impact on townscape.		As expected (Neutral)
	Heritage of Historic Resources	Reporting on archaeological investigation is ongoing. Impacts appear largely as described in the AST/ES.		Unable to evaluate at OYA
	Biodiversity	Ecological mitigation appears to have been implemented as expected. No post construction monitoring has been made available to POPE to confirm the effectiveness of this mitigation.		As expected (Moderate Adverse)
	Water	No issues with drainage were noted during the site visit. No information has been made available to POPE to indicate that measures are not functioning as expected.		As expected (Slight Beneficial)
	Physical Fitness	The impacts described in the ES and AST are generally considered to be as expected.		As expected (Slight Beneficial)
	Journey Ambience	Journey ambience has been improved as expected in the ES, with reduced driver stress associated with improved conditions and reduced congestion and conflict with NMU.		As expected (Moderate Beneficial)
Safety	**Accidents**	The collision rate on the A23, and the A23 and the wider area, had reduced significantly, suggesting that the scheme has had a direct beneficial impact on collisions on the improved links.	Modelled area savings in no. collisions per annum: 9.6 during post-opening period (includes national background reduction in collisions)	PVB = £32.45m (higher than expected)
	Security	The impact on security is considered limited, as expected. It is noted that the underpass is not lit, although as the NMU routes in the area are not universally lit due to concerns over impact on AONB.		As expected (Neutral)
Economy	**Public Accounts**		Forecast PVC: £28.3m Reforecast PVC based on OYA impact: £33.8m	As expected
	Transport Economic Efficiency: Business Users & Transport Providers	Travel times using the A23 between Handcross and Warninglid have reduced considerably at the OYA stage when compared to those seen pre scheme. Times in all periods have reduced with the largest savings seen in the peak periods. Overall journey times have not reduced quite to the level forecast, particularly in the AM peak where the delays in the pre scheme period were overestimated.	Journey time benefits £63.436m (27% of forecast) VOC -£13.3m Indirect Tax £8.85m	Lower than expected, but beneficial
	Transport Economic Efficiency: Consumers			
	Reliability	Post-opening travel times along the new A23 route are consistent throughout the day whereas previously, travel times were considerably higher during peak periods. Suggests improvements in journey reliability.	Route stress 75% (adjusted) post opening	Beneficial (not scored in AST)
	Wider Economic Impacts	Improvements in journey times combined with increased road capacity are likely to have helped promote a more efficient transport system, improving north-south access, particularly between Brighton and Gatwick/London.		As expected (Neutral/No impact)
Accessibility	**Option Values**	No impact on option values		As expected (Neutral/No impact)
	Severance	All scheme measures were implemented as expected. The new underpass has improved links for NMUs. Provision of a high quality cycleway along much of the route should encourage increased cycle and walking in the area.		As expected (Slight Beneficial)
	Access to the Transport System	No impact on access to the transport system.		As expected (Neutral)
Integration	**Transport Interchange**	No impact on transport interchange		As expected (Neutral)
	Land-use Policy	The scheme aligns with national, regional and local policies, improving journey times and increasing the regions connectivity as well as reducing the number of road collisions. The scheme does not align with a number of environmental policies, although mitigation measures have been implemented to minimise this.		As expected (Neutral)
	Other Government Policies			

Appendix B. Forecast vs Observed Peak Flows

Table 8-3 - Traffic Flow forecast vs observed flow: AM Peak*

			Without Scheme			With Scheme		
Map Ref	Site Description	Direction	Do-Minimum Forecast	Pre-scheme Observed	Difference (% Difference)	Do-Something Forecast	Post-scheme Observed	Difference (% Difference)
1	A23, North of Warninglid	NB	3,730	3,010	-720 (-19%)	4,440	3,660	-780 (-18%)
		SB	2,260	2,290	30 (1%)	2,380	2,280	-100 (-4%)
		Two-Way	5,990	5,380	-610 (-10%)	6,820	5,940	-880 (-13%)
2	A23, North of Handcross	NB	4,090	3,320	-770 (-19%)	4,770	3,470	-1,300 (-27%)
		SB	2,160	2,130	-30 (-1%)	2,250	2,160	-90 (-4%)
		Two-Way	6,260	5,450	-810 (-13%)	7,020	5,630	-1,390 (-20)
3	B2110 Handcross	EB	740	440	-300 (-41%)	625	455	-170 (-27%)
		WB	250	200	-50 (-20%)	275	255	-20 (-7%)
		Two-Way	990	635	-355 (-36%)	900	710	-190 (-21%)
6	B2115 Warninglid	EB	320	125	-195 (-61%)	330	140	-190 (-58%)
		WB	230	185	-45 (-20%)	275	175	-100 (-36%)
		Two-Way	550	310	-240 (-44%)	605	310	-295 (-49%)
7	Slaugham Lane	NB	25	20	-5 (-20%)	45	15	-30 (-67%)
		SB	20	15	-5 (-25%)	20	15	-5 (-25%)
		Two-Way	45	35	-10 (-22%)	65	35	-30 (-46%)
9	B2115 Plummers Plain	EB	185	95	-90 (-49%)	180	115	-65 (-36%)
		WB	160	155	-5 (-3%)	170	155	-15 (-9%)
		Two-Way	345	255	-90 (-26%)	350	265	-85 (-24%)
10	Ashfold Crossways	EB	55	15	-40 (-73%)	60	10	-50 (-83%)
		WB	50	20	-30 (-60%)	55	15	-40 (-73%)
		Two-Way	105	35	-70 (-67%)	110	20	-90 (-82%)
11	Coos Lane	NB	15	20	5 (33%)	65	15	-50 (-77%)
		SB	5	15	10 (200%)	10	15	5 (50%)
		Two-Way	20	35	15 (75%)	75	25	-50 (-67%)
12	Staplefield Lane	NB	15	5	-10 (-67%)	10	15	5 (50%)
		SB	15	15	0 (0%)	20	15	-5 (-25%)
		Two-Way	30	20	-10 (-33%)	25	30	5 (20%)
13	B2114 Handcross	NB	275	250	-25 (-9%)	275	155	-120 (-44%)
		SB	55	210	155 (282%)	50	135	85 (170%)
		Two-Way	325	470	145 (45%)	330	290	-40 (-12%)
14	B2110 Handcross	NB	515	405	-110 (-21%)	550	410	-140 (-25%)
		SB	445	400	-45 (-10%)	490	430	-60 (-12%)
		Two-Way	960	805	-155 (-16%)	1,040	840	-200 (-19%)

* Figures higher than 750 have been rounded to the nearest 10, while figures lower than 750 have been rounded to the nearest 5. Therefore, overall changes may not always add up.

Table 8-4 - Traffic Flow forecast vs observed flow: PM Peak**

			Without Scheme			With Scheme		
Map Ref	Site Description	Direction	Forecast	Observed	Difference (% Difference)	Forecast	Observed	Difference (% Difference)
1	A23, North of Warninglid	NB	2,490	2,330	-160 (-6%)	2,370	2,350	-20 (-1%)
		SB	3,360	3,280	-80 (-2%)	3,720	3,250	-470 (-13%)
		Two-Way	5,850	5,570	-280 (-5%)	6,090	5,600	-490 (-8%)
2	A23, North of Handcross	NB	2,260	2,340	80 (4%)	2,470	2,410	-60 (-2%)
		SB	3,380	3,110	-270 -8%)	3,650	3,340	-310 (-8%)
		Two-Way	5,650	5,450	-200 (-4%)	6,110	5,750	-360 (-6%
3	B2110 Handcross	EB	245	240	-5 (-2%)	245	265	20 (8%)
		WB	200	345	145 (73%)	240	350	11 (46%)
		Two-Way	445	585	140 (31%)	485	610	125 26%
6	B2115 Warninglid	EB	170	165	-5 (-3%)	185	175	-10 -5%
		WB	260	120	-140 (-54%)	300	120	-180 -60%
		Two-Way	430	285	-145 (-34%)	485	295	-190 (-39%)
7	Slaugham Lane	NB	5	10	5 (100%)	25	10	-15 (-60%)
		SB	35	15	-20 (-57%)	50	15	-35 (-70%)
		Two-Way	45	25	-20 (-44%)	75	25	-50 (-67%)
9	B2115 Plummers Plain	EB	90	150	60 (67%)	95	155	60 (63%)
		WB	170	95	-75 (-44%)	190	100	-90 (-47%)
		Two-Way	260	245	-15 (-6%)	285	255	-30 (-11%)
10	Ashfold Crossways	EB	65	15	-50 (-77%)	90	10	-80 (-89%)
		WB	70	15	-55 (-79%)	40	5	-35 (-88%)
		Two-Way	140	35	-105 (-75%)	130	20	-110 (-85%)
11	Coos Lane	NB	5	15	10 (200%)	10	10	0 (0%)
		SB	0	15	15 (N/A)	10	15	5 (50%)
		Two-Way	10	30	20 (200%)	20	25	5 (25%)
12	Staplefield Lane	NB	15	10	-5 (-33%)	15	10	-5 (-33%)
		SB	0	10	10 (N/A)	5	10	5 (100%)
		Two-Way	10	25	15 (150%)	20	20	0 (0%)
13	B2114 Handcross	NB	110	170	60 (55%)	95	125	30 (32%)
		SB	235	170	-65	235	155	-80 (-34%)
		Two-Way	340	340	0	335	280	-55 (-16%)
14	B2110 Handcross	NB	370	290	-80	385	270	-115 (-30%)
		SB	380	510	130	445	270	-175 (-39%)
		Two-Way	750	800	50	830	535	-295 (-36%)

** Figures higher than 750 have been rounded to the nearest 10, while figures lower than 750 have been rounded to the nearest 5. Therefore, overall changes may not always add up.

Appendix C. Tables and Figures in this Report

Tables

Figures

Appendix D. 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 Beauty**
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.
BS EN 1794-2	**British Standard – Road Traffic Noise Reducing Devices**
Bvkm	**Billion Vehicle Kilometres**
CEMP	**Construction environmental management plan**
CO_2	**Carbon dioxide**
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 accidents), and expresses the results in terms of a monetary valuation. The COBA model uses the fixed trip matrix unless it is being used in Accident-only mode.
CRF	**Congestion Reference Flow**
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.
DMRB	**Design Manual for Roads and Bridges**
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**
EH	**English Heritage**
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 Years After**
GCN	**Great crested newt**

Terms	Definition
ha	**Hectare**
HEMP	**Handover environmental management plan**
HGV	**Heavy Goods Vehicle**
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.
$L_{a10\ 18h}$	Noise level exceeded 10% of the time, over an 18 hour measurement period.
Laeq	Equivalent continuous noise level
LCA	**Landscape character area**
LEAP	**Landscape and Ecology Aftercare Plan**
LNS	**Low Noise Surfacing**
MAC	**Managing Area Contractor** Organisation normally contracted in 5-year terms for undertaking the management of the road network within a HA area.
Mph	**Miles per hour**
MVKM	**Million Vehicle Kilometres**
NE	**Natural England**
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.
NTM	**National Transport Model (NTM) Local Growth Factors**
OYA	**One Year After**
PIC	**Personal Injury Collisions**
PM_{10}	Particulate matter less than 10 micrometres in size
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
RSI	**Road Surface Influence**
SAM	**Scheduled Ancient Monument**
SoC	**Public Inquiry Statement of Case**
SSSI	**Site of Special Scientific Interest**
STATS19	A database of injury collision statistics recorded by police officers attending collisions.
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.
TRADS	**Traffic Flow Data System**. Database holding information on traffic flows at sites on the strategic network.
UK	**United Kingdom**
webTAG	DfT's website for guidance on the conduct of transport studies at http://www.webtag.org.uk/
WSCC	**West Sussex County Council**

Appendix E. Information requested for Environmental Evaluation

Table A.1 – Information requested to evaluate the environmental sub-objectives

Environment Specific Requirements	OYA Response
Environment Statement (ES) or Stage 3 Project Assessment Report (SAR) or Environmental Assessment Report (EAR) including Environmental Masterplan (EMP) drawings.	Environmental Statement Volumes 1A Main Text, 1B Figures and Technical Reports, October 2008; Non-Technical Summary to the ES
AST.	Appraisal Summary Table (dated 20/04/12 Version 5)
Any amendments / updates, additional surveys or reports since the ES / SAR / EAR.	ES Chapter 9 Noise and Vibration, & Technical Report: Noise and Vibration Addendum March 2009 and Further Addendum Modifications to Draft Orders December 2009
Any changes to the Project since the ES / SAR / EAR e.g. to lighting and signs, retention of material on site in earthworks in the form of landscape bunds or other, or to proposed mitigation measures.	Amendments to junction design
As built drawings for landscape/ biodiversity/ environmental mitigation measures/ drainage/ fencing/ earthworks etc.	Environmental Masterplan Sheets 1 – 6 (Version P2 dated 7/7/11) 'As Built' plans provided within HEMP
Construction Environment Management Plan (CEMP), Landscape and Ecology Aftercare Plan (LEAP), Landscape Management Plan (LMP) or Handover Environmental Management Plan (HEMP).	Preliminary Handover Environmental Management Plan (HEMP) 17th April 2015 (described as 'first release of report')
Health and Safety File – Environment sections (to include all environment As-Built reports).	Health and Safety File July 2015 received
Relevant Contact Names for consultation.	Provided
Archaeological Reports (popular and academic).	Not received
The Road Surface Influence (RSI) value of any low noise surface installed.	Not received
The insulation performance properties of any noise barriers installed (The BS EN 1794-2 result provided by the noise barrier manufacturer).	Not applicable
List of properties eligible for noise insulation.	N/A
Employers Requirements Works Information - Environment sections.	Received
Reports for any pre/ post opening survey and monitoring work e.g. for noise, biodiversity, water quality).	Provided as follows: • Environmental Site Inspection Reports • Pre and Post Scheme Noise Monitoring report March 2015 • Designers Response to Stage 3 Road Safety Audits on the A23 Mainline February 2015 • Ecological Monitoring Programme 2013 Invasive Alien Species Survey Report October 2013 • Badger Survey Report May 2010 (pre-scheme) • Bat Survey Report 2009 (pre-construction) and Bat Monitoring Reports for 2013 and 2014 (during construction) • Dormouse Survey Reports for 2009, 2011, (pre-construction) and 2012 and 2013 (during construction) • Great Crested Newt Survey Report 2011 (pre-construction) • Riparian Mammals and Kingfishers Survey Report 2010

Environment Specific Requirements	OYA Response
Animal mortality data.	Provided by the Managing Agent Contractor (MAC).
Pre or Post opening Non-motorised User (NMU) Audits or Vulnerable User Surveys.	Not provided
Information may be available regarding environmental enhancements to streetscape/townscape for bypassed settlements	Not applicable
Project Newsletters/ publicity material/ Award information for the Project.	Project Newsletters available from Highways England project webpage

Appendix F. Physical Fitness – OYA photographs illustrating various aspects of the NMU network

Figure F1 (left) shared NMU route north from Pond 1 illustrating white lines at change of direction and reflective markers on the post and highway sign.

Figure F2 (right) Shared NMU route alongside private means of access and Footpath 9S

Figure F3 (left) Shared NMU route view south illustrating additional hazard warning

Figure F4 (right) Signed access to shared NMU route at Staplefield Road to west of A23

Figure F5 (left) environmental barrier to screen vehicles on A23 from bridleway /NMU route could have been more effective if extended further north

Figure F6 (right) NMU route west of A23 rising up from underpass and looking north

Figure F7 (left) new steps from NMU route to existing Footpath 14S through gate at top of embankment

Figure F8 (right) environmental barrier at highway boundary with A23 beyond. Signs are ‘doubled up’ with prominent blue sign and traditional timber finger post sign discreetly located next to fence.

Figure F9 (left) approach to underpass from west with gabion basket retaining wall and mounting blocks for horse riders. Sign advises of limited headroom.

Figure F10 (right) approach to underpass from east. Weed growth evident within grassed areas.

Figure F11 (left) gap in highway boundary fence which may have had a gate at one time? The gap is in close proximity to the underpass and NMU route.

Figure F12 (right) Illustrates the NMU route adjacent to the service road (Nursery Lane) view north.

Appendix G. Photomontages

ES Figure 12.11.1 Photomontage View PM 1 – looking south from A23 eastern verge near East Park

ES existing view with mature trees in central reserve

OYA comparison view May 2016 illustrating loss of mature central reserve trees, additional lighting and gabian retaing wall. Overall view has been opened up and the A23 route corridor is visible in the distance.

ES photomontage 15 years after completion of construction, showing merging of the southbound on slip from Handcross

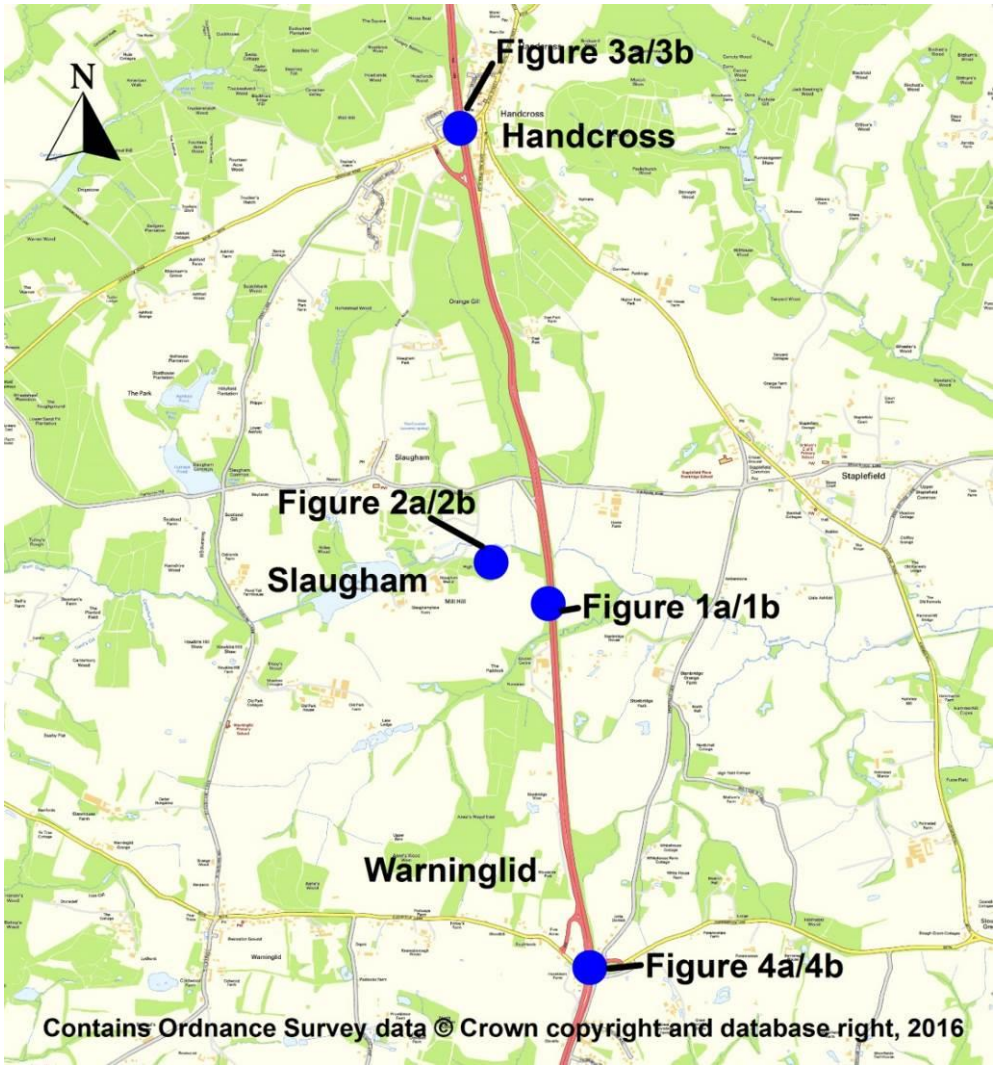
ES Figure 12.11.2 Photomontage View PM 2 from public footpath S14

Existing View from public footpath S14 on Mill Hill looking north towards Slaugham Junction

View including the proposed Scheme at completion of construction

View 15 years after completion of construction

OYA view May 2016



Location map of key viewpoint images

Figure 1a - View from footpath S14 where it meets the A23

Figure 1b – Footpath S14 links into new NMU route with A23 beyond environmental barrier

Figure 2a - View from footpath S14

Figure 2b – Similar view at OYA

Figure 3a - Southward view of road corridor from Handcross Bridge

Figure 3b - Southward view of road corridor from Handcross Bridge

Figure 4a - View north from Bridge at Warninglid Junction

Figure 4b – View north from B2115 Cuckfield Lane overbridge at Warninglid junction at OYA