national highways

A21 Tonbridge to Pembury dualling

One-year post-opening project evaluation

Foreword

National Highways – previously known as Highways England when the A21 Tonbridge to Pembury scheme was delivered – is the government-owned company that operates, maintains and improves England's motorway and long-distance trunk road network. We work to a five-year funding cycle, a radical new approach to road investment first introduced in 2015, which saw the government committing £15.2 billion in the period from 2015 to 2021. We delivered under our remit to make our roads safer and more reliable for the millions who depend on them daily.

Our post-opening project evaluations provide an opportunity to determine how effective we are in delivering improvements against our portfolio of major schemes in the road investment programme.

The A21 forms the main route between London and the Bexhill, Hastings and Rye section of the southeast coast. The section between Tonbridge and Pembury was a single carriageway with a poor alignment which restricted visibility and contributed to a high accident rate. The section was regularly congested, leading to traffic opting to use other, less suitable roads. The section was considered a bottleneck or a 'missing link' between two sections which were dual carriageway.

We carried out the A21 Tonbridge to Pembury dualling project as part of our first road investment strategy. The project aimed to remove the bottleneck, improve journey time reliability, safety and facilities for cyclists, horse riders and walkers, and to do so while minimising the impact on the environment.

This report provides an initial indication of how the scheme performed in the period of operation after it opened to traffic in September 2017 and whether it was meeting the objectives that could be measured at that point in time. The report forms part of a long-term evaluation study that will review performance over several years.

The findings suggest that, after the first year, the project was on track to meet its objectives. It has delivered the capacity improvements between the existing Tonbridge and Pembury bypasses, improved facilities for non-motorised users, and safety analysis shows positive early signs.

Despite higher peak time flows, the scheme section was not congested in the post-scheme period, due to the additional capacity. Average journey times improved and journey times were more reliable.

Most environmental impacts of the scheme were broadly as expected. The heathland near the Fairthorne junction has yet to be established and remediation work is ongoing.

We are also continuing to investigate the drainage of road surface water in this vicinity, as there are suggestions that it is performing below expectations.

Safety trends can vary each year and we will monitor this trend over a longer timeframe before drawing conclusions about the safety impact of the scheme. This scheme aimed to reduce the number of personal injury collisions along the A21 Tonbridge to Pembury section and on subsidiary routes. In the first year of the scheme being operational, there were positive signs that this objective was on track to be achieved, with a reduction in the rate and number of personal injury

collisions compared with the annual average for the five years before the scheme was built. Sadly, we are aware of fatal collisions which occurred beyond the scope of this report. These will be included in our next review of this scheme.

At National Highways, safety is our top priority. We are committed to reducing the number of road users killed or seriously injured on the strategic road network by 50% (from the 2005-2009 baseline) by the end of 2025, with a vision of zero harm by 2040.

Elliot Shaw

Executive Director, Strategy and Planning

November 2021

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1. Executive summary

1.1 Project description

The A21 between Tonbridge and Pembury was a single carriageway section of the A21 positioned between two sections of dual carriageway. It had a poor alignment which restricted visibility and contributed to a high accident rate. The section was regularly congested, causing some road users to opt to use local roads, as an alternative route.

The scheme aimed to remove the bottlenecks at the junctions, improve journey time reliability, improve facilities for non-motorised users, improve safety and reduce the environmental impact of traffic.

The upgraded route opened in September 2017. The project widened two and a half miles of single carriageway to a dual carriageway and significant lengths were realigned.

Two grade-separated junctions were constructed. Longfield Road junction replaced a roundabout at the southern end of the scheme and Fairthorne junction in the middle of the scheme has replaced former direct turnings onto the A21. In addition, a new route was provided for pedestrians, cyclists and equestrians,[1] adjacent to the new mainline, and a pedestrian overbridge at Blackhurst Lane was provided to provide a safer crossing for the footpath.[2]

Some vegetation was removed to accommodate the dual carriageway and, as compensation for this, six woodland translocation sites[3] and a new area of heathland were created.

1.2 Evaluation findings

This report indicates how the dual carriageway was performing within its first year of operation. This initial assessment forms part of a longer-term evaluation which reviews performance over time as the benefits mature. The one-year after study is not intended to provide conclusive evidence about project benefits but gives an early indication about whether it is heading in the right direction. This helps us identify areas where we can focus effort to optimise the benefits of the project.

The findings suggest that after the first year, the project was on track to meet its objectives. It has delivered the capacity improvements between the existing Tonbridge and Pembury bypasses, improved facilities for non-motorised users and safety analysis shows positive early signs.

1.2.1. Customer journeys

The findings indicate that within the first year, the additional capacity provided on the route has supported a 20% increase in the number of road users whilst reducing the level of congestion experienced. The largest increase in road users

[1] collectively identified as non-motorised users (NMUs).
[2] The footpath previously had an unprotected crossing – there was a gap in the safety fence to facilitate crossing, but there was no infrastructure provided to help pedestrians cross safely.
[3] Where soil and stumps were moved to a new location in an attempt to re-establish the woodland.

was during the peak travel periods, suggesting the scheme had removed previous constraints.

Customer journeys have become quicker (by an average of two minutes) and there are indications that the route is becoming more reliable.

Prior to the construction of the dual carriageway, this section of the A21 was heavily congested and some road users would travel via the parallel A26 through Tunbridge Wells. It was projected within the business case that the improved A21 would attract traffic from adjacent roads, in particular the A26, resulting in reduced congestion along these roads. The evaluation has found some evidence of a reduction of road users on the A26, but the pattern of changes was not conclusive.

The forecast pattern of traffic changes was broadly correct. The appraisal forecast substantial journey time savings of between three and seven and a half minutes in peak periods in 2032, but forecasts for the opening year were not recorded in the documentation and therefore could not be compared to our observations.

1.2.2. Safety

Personal injury collisions on the strategic road network are rare and can have many contributing factors. Due to their unpredictable nature, we monitor trends over many years before we can be confident that a real change has occurred as result of the scheme. Within the first year, it is not possible to be conclusive about the safety impacts of the scheme, but it is an important indicator to check if we are on track.

The safety objective for this scheme was to reduce collisions along the A21 Tonbridge to Pembury section and reduce accidents from subsidiary routes. In the first year of the scheme being operational, there was a reduction in the rate and number of personal injury collisions compared with the annual average for the five years before the scheme was built.

During the first 12 months of the scheme being open, there was 1 personal injury collision compared with an average of 15 per year before the scheme was constructed. If the road had not been upgraded, we estimate that the number of personal injury collisions would have changed to between 7and 29. The number of personal injury collisions was also lower than forecast within the business case.

In the context of other findings in this report, these are positive early signs. Collisions are reducing at a time where congestion is being released and traffic is moving quicker. However, the analysis will need to be revisited in later years to verify the findings,[4] especially as traffic levels are set to increase in future. Results at the follow up evaluation will be essential to check if this trend continues.

1.2.3. Environment

The evaluation found that the impacts of the scheme are broadly as expected on landscape, heritage, water environment, physical activity and severance. The impacts are as expected for noise and air quality as traffic flows are slightly lower than forecast.

[4] A fatal collision occurred just beyond the scope of this report. This will be analysed at the Five-Year After Stage.

Landscape mitigations are establishing, but due to the length of time needed for newly created woodlands/habitats to establish, and ongoing works on the heathland ecological mitigations, it was too early for evaluation to confirm the impact of the scheme on the High Weald area of natural beauty.

2. Introduction

2.1 What is the scheme and what was it designed to achieve?

The A21 between Tonbridge and Pembury was a single carriageway with a poor alignment, restricting visibility and contributing to a high accident rate. There were also many direct accesses onto the carriageway. The section was regularly congested, causing some road users to opt to use local roads as an alternative route.

Between the M25 and Tonbridge, the A21 is a dual carriageway with grade-separated junctions, limited accesses and no central reserve gaps. South of the Longfield Road roundabout at Pembury, the A21 continues as a dual carriageway to Kipping's Cross. This section was considered a 'missing link' between the two sections which were dual carriageway.

The scheme opened in September 2017 and widened two and a half miles of the existing single carriageway to a 2-lane all-purpose dual carriageway and significant lengths were realigned. Two grade-separated junctions were constructed (at the Fairthorne junction in the middle of the scheme and Longfield Road at the southern end of the scheme).

In addition, a new route was provided for pedestrians, cyclists and equestrians,[5] adjacent to the new mainline, and a pedestrian overbridge at Blackhurst Lane was provided to provide a safer crossing for the footpath.[6]

Some vegetation was removed as part of the scheme and, as compensation for this, six woodland translocation sites and a new area of heathland were created. Various drainage works were also undertaken.

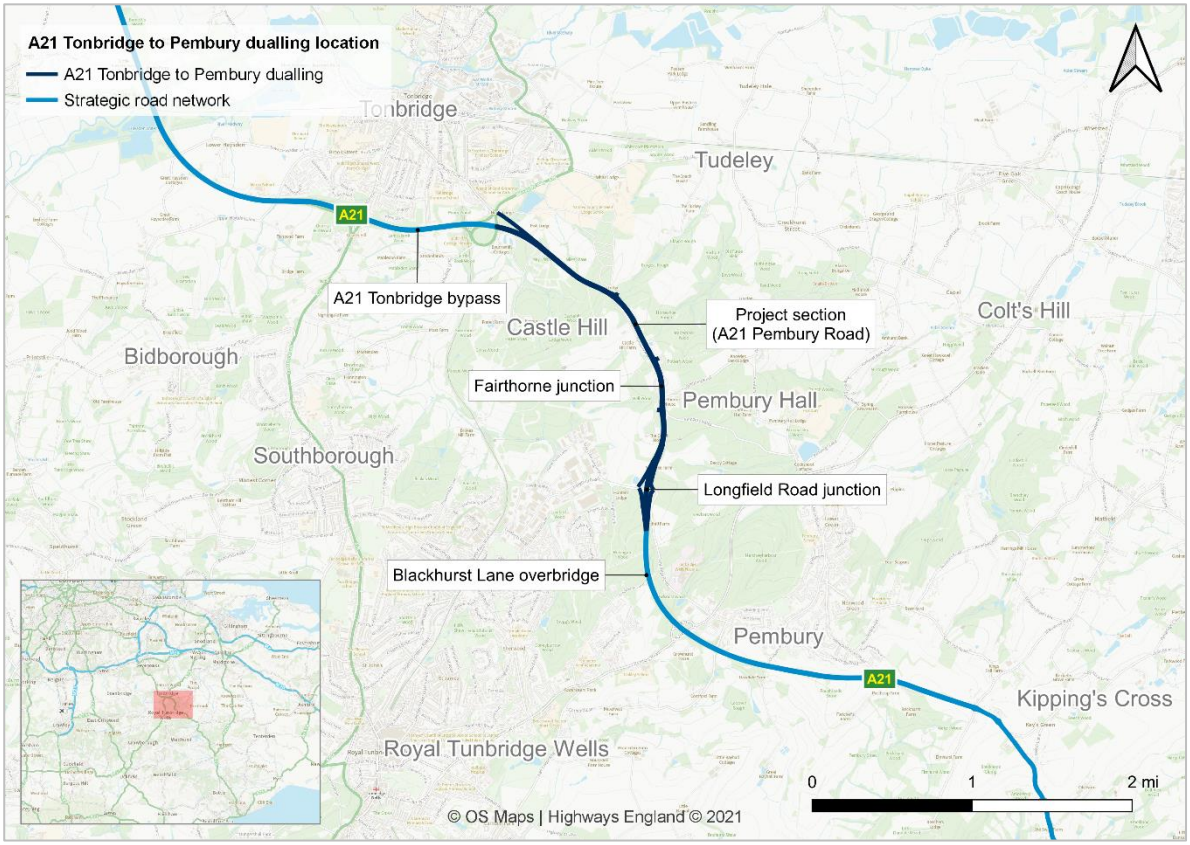
2.2 Scheme Location

The A21 forms the main route from London to the Bexhill, Hastings and Rye section of the southeast coast. Figure 1 shows the scheme's location.

[5] Collectively identified as non-motorised users (NMUs).

[6] The footpath previously had an unprotected crossing – there was a gap in the safety fence to facilitate crossing, but there was no infrastructure provided to help pedestrians cross safely.

Figure 1: Project location



Source: National Highways and OpenStreetMap contributors

2.3 How has the scheme been evaluated?

Post-opening project evaluations are carried out for major schemes to understand the impact the scheme has had on the journey experience for road users. We compare the impact in key areas, including journey reliability, safety and on the environment. This report considers the performance of the A21 Tonbridge to Pembury dualling scheme after its first year of operation.

During the business case for the scheme, the impacts were assessed over a period of 60 years after scheme opening.[7] The evaluation provides an early mechanism to ensure the scheme is on track to deliver the anticipated benefits over this assessment period.

We assess impacts by observing trends on the route before the scheme was constructed (baseline) and evaluating these after the scheme improvements have been completed and the route is fully operational to traffic. We also assess the impacts of the scheme against the expected impacts presented in the forecasts made during the project planning process.

For more details of the evaluation methods used in this study, please refer to the post-opening project evaluation (POPE) methodology manual. This can be found on our website.[8]

[7] https://www.gov.uk/guidance/transport-analysis-guidance-tag
[8] http://www.nationalhighways.co.uk/publications

3. Delivering against objectives

3.1 How has the scheme performed against objectives?

All National Highways major schemes have specific objectives which are defined early in the business case when scheme options are being identified. These benefits are appraised to be realised over 60 years, so the first-year evaluation provides early indication of progress. The objectives for the A21 Tonbridge to Pembury dualling included the following:

Table 1 Objectives and Evaluation Summary

Objective	One-year evaluation
Provide the 'missing link' between the existing Tonbridge and Pembury bypasses, significantly improving journey time reliability.	The route is now fully dual carriageway. Average journey times have been reduced and route stress calculations indicate that the route is no longer congested, therefore journey times should be more reliable.
Remove bottlenecks at Castle Hill and Longfield Road roundabout and segregate local access traffic and through traffic.	Two grade-separated junctions were constructed at these locations segregating local and strategic traffic. The route no longer experiences regular congestion.
Improve facilities for cyclists, horse riders and walkers, particularly ease of access across the A21 to the Pembury Walks area.	Shared-use path alongside A21 and improved crossings have been provided.
Minimise the environmental impact of traffic within the area of outstanding natural beauty (AONB), RSPB[9] Nature Reserve and the Scheduled Ancient Monument.	Loss of mature woodland made the A21 a more prominent feature in the AONB, but the impact is no worse than expected. Castle Hill is unaffected, as expected.
Improve safety for all users	The first 12 months of analysis shows positive signs. However, the analysis will need to be revisited in later years to verify the findings.[10]

[9] Royal Society for the Protection of Birds

[10] A fatal collision occurred just beyond the scope of this report. This will be analysed at the Five-Year After Stage.

4. Customer journeys

4.1 Summary

The findings indicate that within the first year, the additional capacity provided on the route has supported a 20% increase in the number of road users whilst reducing the level of congestion experienced. The largest increase in road users was during the peak travel periods, suggesting the scheme had removed previous constraints.

Customer journeys have become quicker (by an average of two minutes) and there are indications that the route is becoming more reliable.

Prior to the construction of the dual carriageway, this section of the A21 was heavily congested and some road users would travel via the parallel A26 through Tunbridge Wells. It was projected within the business case that the improved A21 would attract traffic from adjacent roads, in particular the A26, resulting in reduced congestion along these roads. The evaluation has found some evidence of a reduction of road users on the A26, but the pattern of changes was not conclusive.

The forecast pattern of traffic changes was broadly correct. The appraisal forecast substantial journey time savings of between three and seven and a half minutes in peak periods in 2032, but forecasts for the opening year were not recorded in the documentation and therefore could not be compared to our observations.

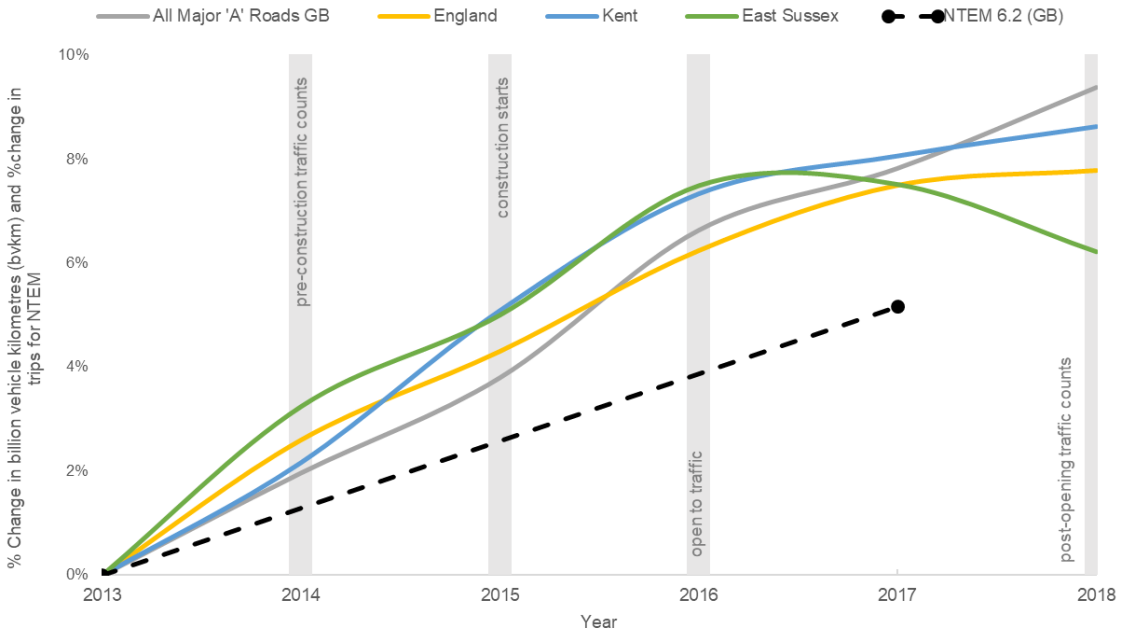
4.2 How have traffic levels changed?

The following sections will examine if the traffic levels changed over the evaluation period and to what extent the forecast traffic levels were realised.

4.2.1. National and regional context

To assess the impact of the scheme on traffic levels, it is useful to understand the changes within the context of national and regional traffic (Figure 2).

Figure 2 National and regional percentage traffic volume changes



Source: Department for Transport road traffic statistics 2018;[11] NTEM v6.2

The key time period is the increase between 2014 (pre-scheme baseline period) and 2018 (when we undertook the post-scheme counts which inform this study). Over this period, traffic volumes increased by between three to six per cent. The National Trip End Model (NTEM[12] 6.2) line shows the growth anticipated by the traffic modelling that informed the appraisal.

The analysis that follows should be considered in this context as no adjustments have been made to take account of background traffic growth.

4.2.2. How did traffic volumes change?

Changes in the number of road users on the route and across the local area between pre-construction and post-opening years have been analysed.

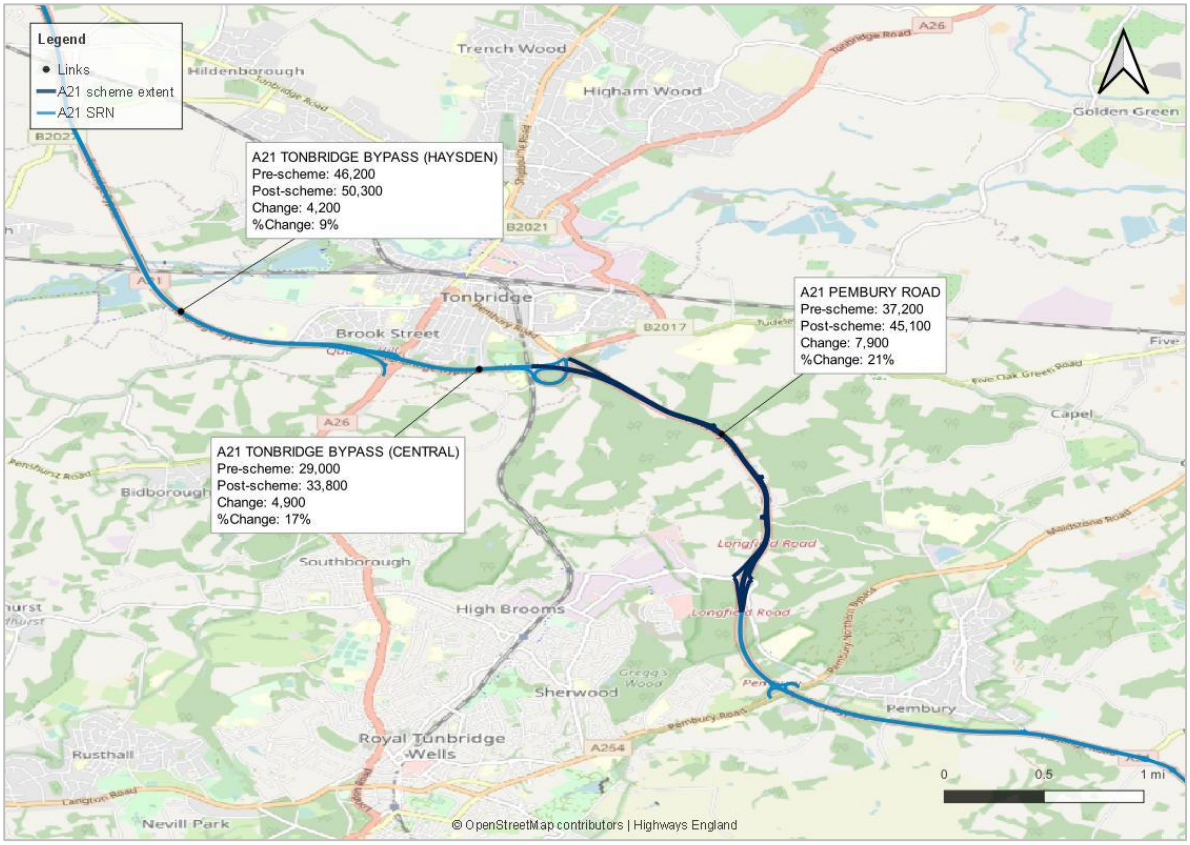
It was only possible to analyse changes in traffic volumes on one section on the route, A21 Pembury Road. This section comprises the majority of the improved section and is therefore considered to be sufficiently representative. Given this, two sections of the A21 to the northwest of the scheme were also assessed for context.[13] Two-way all-day traffic volumes on the A21, presented in Figure 3 below, show the additional capacity provided on the route has supported an increase of around 20% in the number of road users.

[11] https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra

[12] NTEM – National Trip End Model.

[13] We were unable to obtain figures for the two sections immediately to the south of the scheme. No traffic information was available from the relevant traffic counters on the SRN. They were deemed to be inactive.

Figure 3 Changes in average daily traffic (ADT)

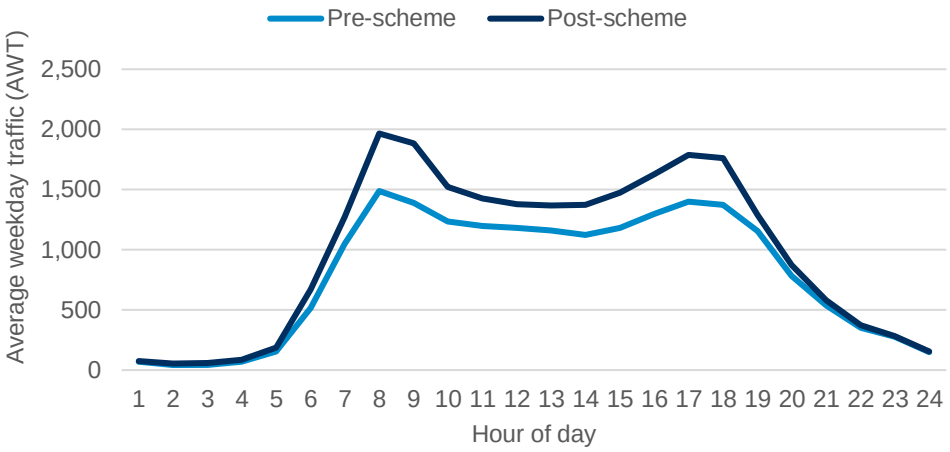


Source: National Highways traffic count data (September 2014, September 2018)

Our analysis (shown in Figure 4 and Figure 5) indicated that peak time traffic on this part of the route had increased substantially, by around 30% on the northbound carriageway and by around 50% on the southbound carriageway. The large increases in southbound traffic suggested that peak time traffic was particularly constrained before the scheme. The morning peak on the northbound carriageway had shifted an hour later to 9am, suggesting the additional capacity enabled more people to travel at their preferred time.

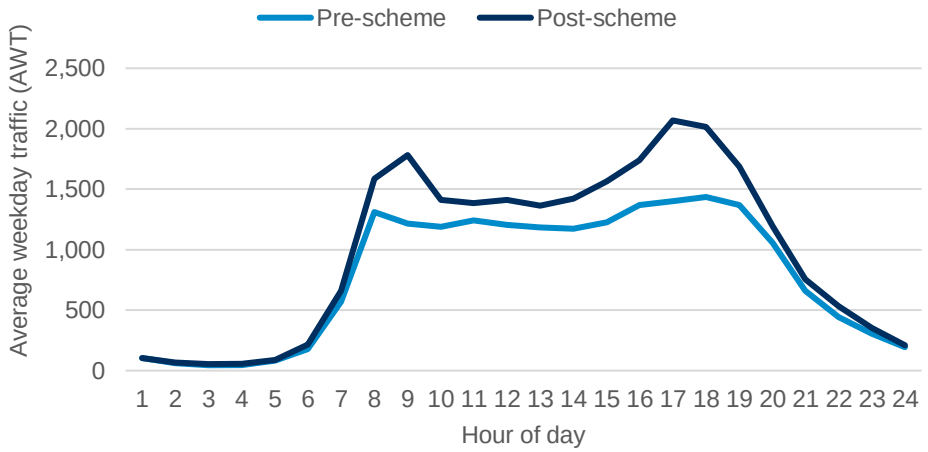
In the morning, volumes of traffic heading north were observed to be higher than those heading south. In the evening peak, the reverse pattern was observed. This tidal pattern was not evident before the additional capacity was provided.

Figure 4 Northbound flow profile over the day



Note: Data for A21 Pembury Road section. Source: webTRIS (2014 and 2018).

Figure 5 Southbound flow profile over the day



Note: Data for A21 Pembury Road section. Source: webTRIS (2014 and 2018).

Figure 6 shows the changes on the local road network over the period assessed.[14] We could not draw firm conclusions on the project's impact on wider traffic patterns due to the complex nature of the changes observed, the variable quality of traffic volume information available and the four-year timeframe under comparison.

The A26 provides a parallel north-south route to the A21. Prior to improvement, congestion on the A21 was thought to be causing traffic to route via A26. Our evaluation found substantial falls in traffic volumes on A26 between Southborough and Tunbridge Wells. This might indicate some road users opting to use the A21 dual carriageway instead of the A26, however this pattern was not observed in the changes north of Bidborough and so we cannot be confident in this assertion.

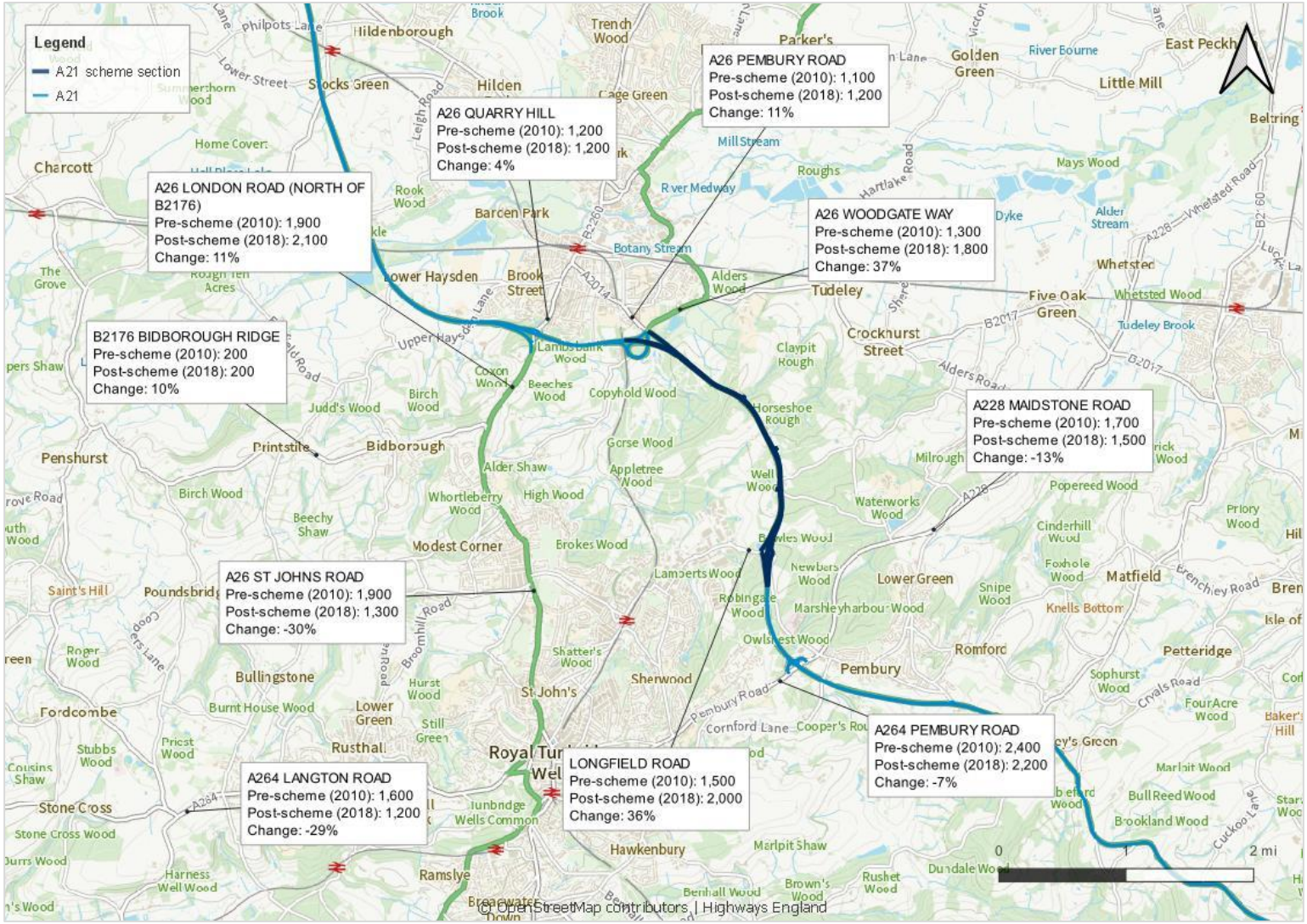
On the roads closest to the scheme section, traffic volumes increased in most time periods. The most substantial increases were seen on Longfield Road and Woodgate Way. These increases were above background trends. A contributory

[14] Similar diagrams for the interpeak and evening peak are available in annex 1.

factor to this growth could have been a housing development near Longfield Road, which we understand was completed around the same time as the scheme.

South of the scheme, traffic volumes on an east-west local route (A228-A264) broadly fell. The falls were larger to the west of Tunbridge Wells. Comparing with the forecasts, we noted that a small reduction was expected at this location, but we could not confidently ascribe this larger fall to the scheme.

Figure 6 Changes in traffic on local roads (morning peak)



Source: Two-way average weekday flows from various traffic count suppliers.

4.2.3. Was traffic growth as expected within the business case?

On both sections of the A21, it was expected that traffic volumes would increase in all time periods. The observed volumes indicated that the forecasts were broadly correct. Substantial increases were expected on the route during the busiest periods of the day, and this is in line with the observed trend.

Forecasts for traffic volumes were produced for 2017 and presented for three time periods:

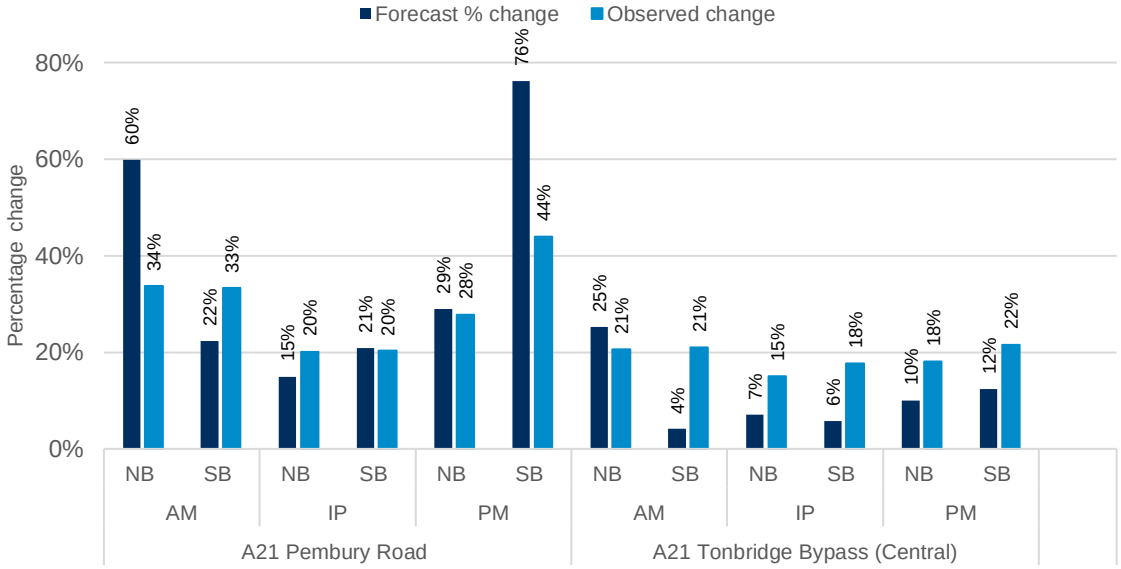
- Morning peak: between 07:00 and 09:00
- Interpeak: between 09:00 and 16:00, and 18:00 and 19:00
- Afternoon peak: between 16:00 and 18:00

On the scheme section, an increase of 60% was expected on the northbound carriageway in the morning peak and an increase of 76% was expected on the southbound carriageway in the afternoon peak. This suggested that a substantial tidal movement of traffic across the day would develop.

A similar sized tidal movement was not expected to develop on the Tonbridge Bypass section, where proportionately smaller increases were expected. From this we inferred that a substantial proportion of northbound traffic in the morning was expected to leave the scheme section at the Vauxhall Lane junction,[15] and in the evening a substantial proportion of southbound traffic would join the scheme section via the same junction. This pattern was mirrored in flows expected on Woodgate Road which feeds into the junction.

Our observations suggested these movements were broadly correct but that tidality did not develop to the expected levels. Figure 7 summarises the comparisons.

Figure 7 Forecast vs observed change



Source: Forecasts from traffic forecast report. Observed data from webTRIS.

[15] Junction of A21 with A2014, A26 and Pembury Road.

We also looked at the accuracy of the do-minimum[16] (DM) and do-something[17] (DS) forecasts which underpin the data presented in Figure 7. We found the forecasts for both sections to be reasonably accurate, but that the relevant do-something forecasts overestimated the growth in flows in respect to the tidal movement expected to develop on the scheme section. With respect to the Tonbridge Bypass section, we found a pattern of slightly under-forecasting traffic growth in the do-something scenario.

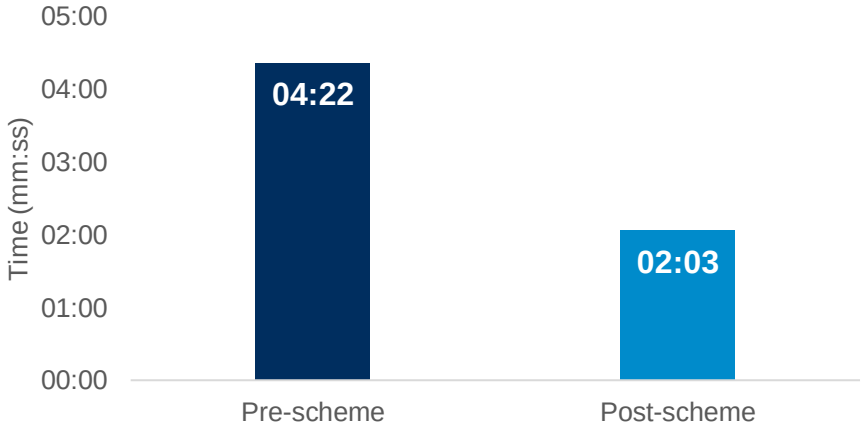
4.3 Relieving congestion and making journeys more reliable

The project was predicted to improve journey times on the A21 between Sevenoaks and Kipping's Cross and to make them more predictable, and so make customers' journeys more reliable. The appraisal forecast that the widening to dual carriageway and the removal of the at-grade junctions would generate substantial journey time savings across the busiest periods. By 2032, these benefits would be between three and seven and a half minutes, compared to if the route had not been improved. The appraisal information available did not provide a forecast for the first year, which means direct comparisons are not possible within this evaluation.

Due to substantial realignment of the carriageway, it was not possible to conduct the standard analysis of journey times and reliability using satnav data. An alternative data source was provided by Department for Transport.[18]

This data has a limited sample size, so we have only undertaken analysis for the whole day, not by time period. It indicated that journey times on the scheme section had reduced on average by around two minutes in each direction between 2014 and 2018, and that customers' journeys were now faster.

Figure 8 Change in average journey time



Note: Two-way average journey time. Source: Teletrac Navman data, DfT (2014 and 2018).

Congestion was a major issue before the conversion to a dual carriageway. The business case cited significantly higher numbers of road users than the capacity of a single carriageway and the road had a sub-standard horizontal and vertical alignment with restricted visibility. As a result, it was frequently heavily congested.

[16] DM – Do Minimum, that is, the forecast of how the road network would perform if the scheme wasn't constructed.
[17] DS – Do Something, that is, the forecast of how the road network would perform if the scheme is constructed.
[18] Teletrac Navman data.

Congestion can make journey times unreliable. If the time taken to travel the same journey each day varies, journey times are unreliable and the road user is less confident in planning how long their journey will take them. If journey times do not vary, the road user can be more confident in the time their journey will take and allow a smaller window of time to make that journey.

The improvement in journey times since the construction of the scheme implies that the route is no longer congested. To verify this, we calculated the 'route stress' metric[19] for the periods before and after the scheme's construction to infer its impact on journey time reliability. Table 2 shows the results.

We found that, despite higher peak time flows, the scheme section was not congested in the post-scheme period, due to the additional capacity. The route stress metric demonstrated that journey time reliability was likely to have improved.

Table 2 Route stress metric[20]

Evaluation period	Route Stress
Before	1.14
After	0.75

[19] 'Route Stress' is a standard metric for journey time reliability, which considers the ratio of the amount of traffic using a road to the theoretical capacity as measured by 'congestion reference flow'. A decrease in 'route stress' is an indication of improved journey time reliability.

[20] Route stress metric has a range of 0.75 (uncongested and reliable journey times) to 1.25 (congested and unreliable journey times).

5. Safety evaluation

5.1 Summary

The safety objective for this scheme was to improve safety for all users. In the first year of the scheme being operational, there was a reduction in the rate and number of personal injury collisions compared with the annual average for the five years before the scheme was built.

During the first 12 months of the scheme being open, there was one personal injury collision compared with an average of 15 per year before the scheme was constructed. If the road had remained a single carriageway, we estimate that the number of personal injury collisions in this first year would have ranged from 7 to 29. Therefore, the early indication is that the dual carriageway is improving safety whilst supporting more road users.

Whilst the business case expected the improvement to deliver safety benefits, the level of change observed within the first year was higher than expected in the business case.

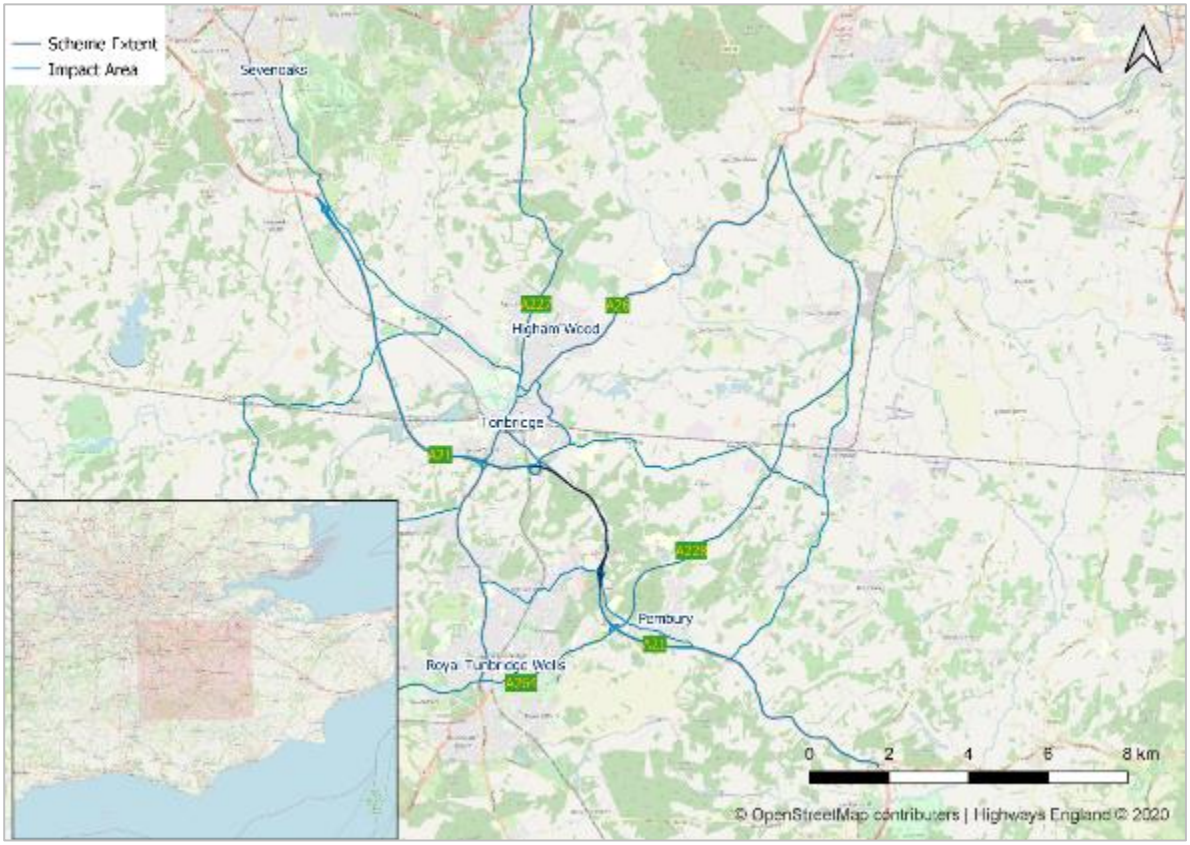
In the context of other findings in this report, these are positive early signs. Collisions are reducing at a time where congestion is being released and traffic is moving quicker. However, the analysis will need to be revisited in later years to verify the findings,[21] especially as traffic levels are set to increase in future. Results at the follow up evaluation will be essential to check if this trend continues.

5.2 Safety study area

The safety study area is shown in Figure 9. This is a wider area encapsulating both strategic and local roads surrounding the scheme. This area is assessed in the appraisal supporting the business case for the project. It checks any potential wider implications for the intervention. This information is then used with other forecasts around the potential impact of the scheme such as by how much traffic may grow. We have therefore replicated the appraisal study area to understand the emerging safety trends.

[21] A fatal collision occurred just beyond the scope of this report. This will be analysed at the Five-Year After Stage.

Figure 9 Safety study area



Source: National Highways and OpenStreetMap contributors.

5.3 What are the emerging safety trends?

The safety data for this evaluation was obtained from Department for Transport Road Safety Data.[22] This dataset records incidents on public roads that are reported to the police. This evaluation considers only collisions that resulted in personal injury.

The safety analysis has been undertaken to assess changes over time looking at the trends in the five years before the scheme was constructed to provide an annual average. We have then assessed the trends from the first 12 months after the scheme was operational and open for road users. This provides an early indication of safety trends, but this will be monitored over a longer timeframe before conclusions can be drawn about the safety impact of the scheme.

The analysis draws on the following data collection periods:

Pre-construction: 1 April 2010 – 31 March 2015;

Construction: 1 April 2015 – 20 September 2017;

Post-opening: 21 September 2017 – 20 September 2018.

The early indications are that the number of personal injury collisions for the first year of the scheme are lower than the period before construction began. The number of personal injury collisions reduced from an annual average of 15 to one

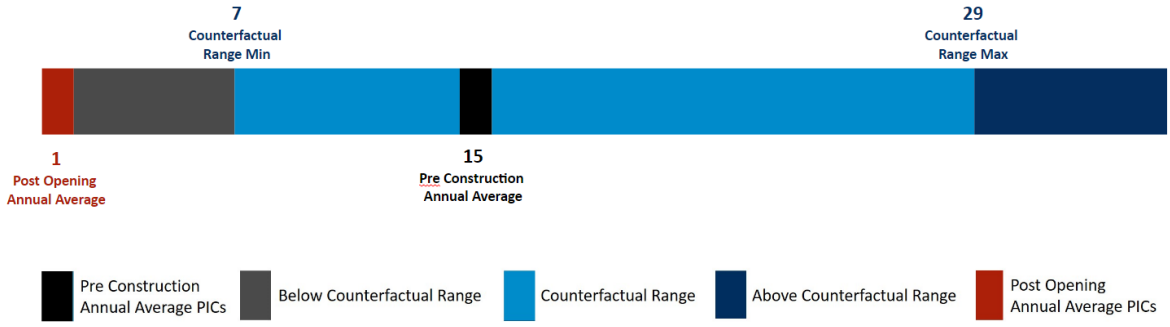
[22] https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data

personal injury collision during the first 12 months of the scheme being open for road users.

As part of the safety evaluation, we look to assess what changes in personal injury collisions might have occurred due to factors external to the scheme over this timeframe. To do this, we estimate the trend in personal injury collisions which might have occurred if the road had remained a single carriageway (this is referred to as a counterfactual). This is based on changes in regional safety trends with a high volume of roads users. This helps us to estimate how the pre-construction safety levels would have changed over the evaluation period if the road had remained a single carriageway.

Based on this assessment, we estimate that if the road had not been converted to a dual carriageway the trend in the number of personal injury collisions would have changed over time (to between seven and 29) but not by as much as we have observed for the scheme.

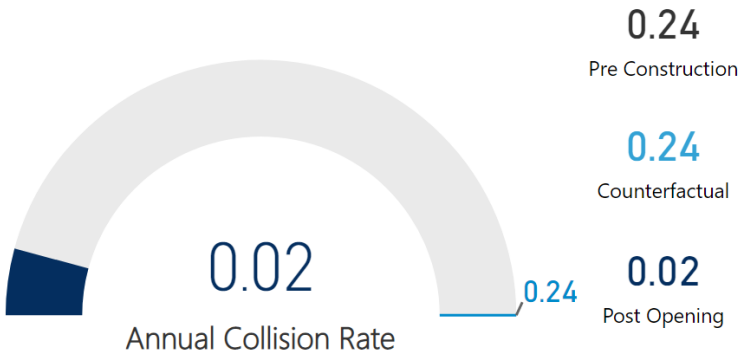
Figure 10 Observed number of personal injury collisions



Source: STATS19 1 April 2010 – 20 September 2018.

Before the route was converted to a dual carriageway, there was a personal injury collision for every 4.3 million kilometres travelled (based on the annual average rates across the five-year pre-construction period). When considering the increased number of road users on this road over the first year, there was one personal injury collision for 49.7 million kilometres travelled by road users. If the route had remained a single carriageway, it is predicted that the rate of collisions would have remained consistent with the trend seen in the five-year period before the project was undertaken (Figure 11).

Figure 11 Collision rates - personal injury collisions per million vehicle kms on the scheme



Source: STATS19 1 April 2010 – 20 September 2018.

The business case for the scheme predicted that a reduction in collisions along the A21 Tonbridge to Pembury section because of reduced interactions. The scheme would also draw traffic away from less suitable routes, further reducing accidents. The forecast predicted the scheme would reduce the number of personal injury collisions by an average of two per year.[23] The results indicate that the scheme is on its way to achieving the objective to improve safety for all users. A further evaluation will be conducted after the scheme has been open for a longer timeframe. This will allow a more representative time period to determine if the safety objective has been achieved.[24]

Safety trends can vary each year, and we will monitor this trend over a longer timeframe before drawing conclusions about the safety impact of the scheme.

5.4 Why is analysis of collision severity not feasible?

The way the police record the severity of road safety collisions changed within the timeframes of the evaluation. There has been a shift to a standardised reporting tool known as CRASH – Collision Recording and Sharing. CRASH is an injury-based reporting system and, as such, severity is categorised automatically by the most severe injury. This has led to some disparity with the previous reporting methods, where severity was categorised by the attending police officer.[25]

In this instance, one reporting mechanism was largely used prior to the improvement and another afterwards. As this will have an impact on severity categorisation for serious and slight collisions that is not attributable to the smart motorway, it would produce unreliable results at this stage. For more detail see Annex 3.

Fatal collisions are not affected by the transfer to CRASH, and we are able to report these. For A21 Tonbridge-Pembury, three fatal collisions were observed in

[23] Based on a reduction of 141 personal injury collisions over a 60-year appraisal period.
[24] This further evaluation will consider whether it is possible to segregate the data by type of user.
[25] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820588/severity-reporting-methodology-final-report.odt

the five-year period before the scheme and none in the first 12 months of operation.[26] For the wider area three fatal collisions were observed in the five-year period before the scheme and three fatal collisions occurred in the first 12 months of operation as represented in Table 4 below.

Table 4 Fatal Collisions A21 Tonbridge-Pembury and wider area

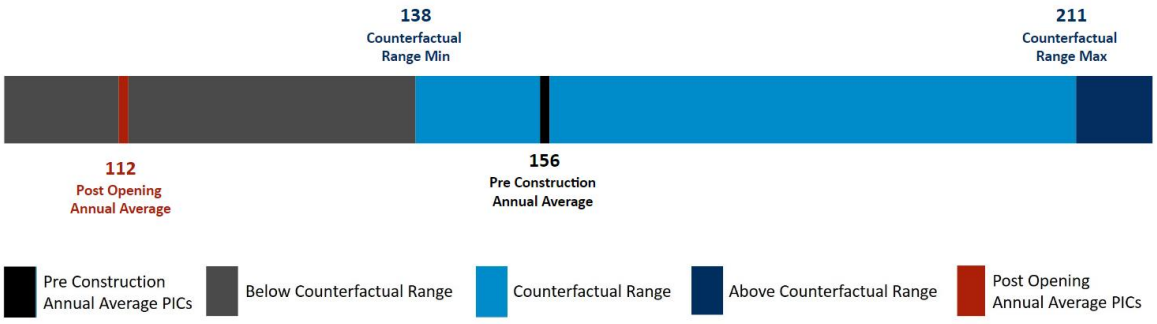
Observation Year	A21 Tonbridge-Pembury	Wider Area
Before 5	0	0
Before 4	2	1
Before 3	1	2
Before 2	0	0
Before 1	0	0
After 1	0	3

5.5 How did safety trends impact other parts of the road network?

Changes in personal injury collisions in the wider impact area were analysed. The area was defined in the scheme's appraisal (see Figure 9).

There was a reduction in the average number of personal injury collisions per year in the wider safety area, from 156 per year in the five years before the scheme to 112 in the first year after. There are on average 44 fewer personal injury collisions in the first 12 months in the wider safety area. It is estimated that if the route had remained a single carriageway the safety trends across the wider area would have changed to between 138 and 211 personal injury collisions per year. This indicates that the construction of the scheme could be having a positive impact on the safety of the surrounding road network as anticipated within the scheme's business case. However, more evidence is required before it is possible to conclude whether the anticipated safety benefits across the wider safety area are likely to be realised.

Figure 12 Observed number of personal injury collisions (wider study area)



Source: STATS19 1 April 2010 – 20 September 2018.

[26] A fatal collision occurred just beyond the scope of this report. This will be analysed at the Five-Year After Stage.

6. Environmental evaluation

6.1 Summary

The evaluation of environmental impacts uses information on the predicted impacts gathered from the environmental appraisal and the environmental assessment report. This information has then been compared with findings observed one year after the scheme opened for traffic. Observed impacts have been determined during a site visit in July 2019, supported by desktop research. The results of the evaluation are recorded against each of the transport appraisal guidance (TAG)[27] environmental sub-objectives. These are presented in Table 3.

The environmental evaluation focuses on the environmental sub-objectives (noise, air quality, greenhouse gas emissions, landscape, biodiversity, the water environment). In addition, TAG social impacts such as physical fitness, journey ambience (quality) and severance are evaluated.

The evaluation found that the impacts of the scheme are broadly as expected on landscape, heritage, water environment, physical activity and severance. The impacts are as expected for noise and air quality. Landscape mitigations are establishing, but due to the length of time needed for newly created woodlands/habitats to establish, and ongoing works on the heathland ecological mitigations, it was too early for evaluation to confirm the impact of the scheme on the High Weald area of outstanding natural beauty (AONB).

6.2 Noise

The appraisal reported that when the upgraded road opened there would be minor to major reductions in noise at 25 properties and minor increases in noise at two properties. By the design year (2032) minor to major reductions in noise would occur at 15 further properties close to the scheme. The change in noise at all other properties within the scheme area was predicted to be negligible. Despite this, the overall significance of the impact of noise was predicted to be slight negative.

The environmental assessment reported that noise level changes were expected to occur within and around the built-up area of Tonbridge, and minor improvements were expected to the south-east of the A26/A2014 Vauxhall Lane junction. The scheme incorporated several noise-reducing features.[28] These were delivered in line with expectations.

Traffic data was only available for the Pembury Road section of the A21, but we consider it to be a reasonable representation of the scheme as a whole.[29] The volume of road users along Pembury Road section of the A21 are slightly lower than forecast. This suggests that the noise impact from post-construction traffic levels was likely to be as expected within the business case.

[27] Transport Appraisal Guidance (TAG) provides guidance on appraising transport options against the government's objective for transport.
[28] Noise reducing features included: earth mounds, false cuttings, purpose-built noise barriers and a low noise surface.
[29] See section 4.2.2.

Figure 13 Examples of noise reducing measures along the A21: environmental barriers landscape bund

The Tudeley Woods landscape bund with new planting in front of Castle Hill Farmhouse

Environmental (noise) barriers and segregation from the southbound carriage of the A21 at Yew Tree Farmhouse

Source: One-year after evaluation visit, July 2018.

6.3 Air quality

The appraisal forecast an overall increase in emissions of nitrogen dioxide (NO_2) and particulate matter across the affected road network due to increase in vehicle kilometres travelled. The appraisal also predicted an improvement in NO_2 at properties in the Tunbridge Wells A26 air quality management area (AQMA). More properties were expected to experience an improvement in particulate matter (PM_{10}) than a deterioration. No exceedances of the statutory annual mean objectives for nitrogen dioxide or particulate matter were expected.

Since the widening of the road, the Tunbridge Wells Annual Air Quality Status Report (2018)[30] stated that air quality concerns along A26, where an AQMA has been declared, are not influenced by roads controlled by National Highways.

Traffic data was only available for the Pembury Road section of the A21, but we consider it to be a reasonable representation of the scheme as a whole.[31] At this section of the route, the number of road users were slightly lower than forecast, but there was a higher proportion of heavy duty vehicles (HDVs). Although the number of HDVs was higher than forecast, it is unlikely that pollutant concentrations at receptors along A21 are significantly impacted. The modelled air quality impacts of the scheme,[32] were predicted to be well below the UK air quality standard of 40

[30] https://tunbridgewells.gov.uk/__data/assets/pdf_file/0004/358609/Tunbridge-Wells-Borough-Council-2018-ASR-Final.pdf
[31] Refer to section 4.2.2.
[32] That is pollutant concentrations at properties closest to this section of the A21 with the scheme in operation as reported in the environmental statement.

µgm-3. This indicates that there is a low risk that the difference in HDVs will cause a significant change. The outcome was considered to be as expected.

6.4 Greenhouse gases

It has not been possible to evaluate greenhouse gas emissions for the one year after evaluation.

The appraisal predicted an overall increase in carbon emissions with the project due to an increase of vehicle kilometres travelled. The appraisal predicted that the carbon emissions would increase in the opening year, by 0.003 million tonnes of carbon dioxide equivalent.[33]

To fully evaluate the impact of the scheme on greenhouse gases, analysis would be required across the full geographical impact area developed for the appraisal, using forecast and observed traffic data for all the road links used in the full appraisal study area. It is not feasible to conduct this level of analysis within the POPE process.

This data is not available. Instead, we would usually focus on changes within the scheme extent, where forecast and observed data would normally be available, to allow for comparison. Speed data is an important component of total emissions. However, for the A21 Tonbridge to Pembury, no opening year forecast speed data is available. Consequently, quantification is not possible. Thus, it is not possible to evaluate greenhouse gas emissions for the one year after evaluation.

The overall traffic flows along Pembury Road (part of the scheme extent) at one year after are lower than forecast. This suggests that there was a smaller increase in traffic than predicted and so a lower rate in increase in carbon emissions along the scheme extent is likely.

6.5 Landscape and townscape

The environmental appraisal reported that the scheme would have an adverse effect on the High Weald area of outstanding natural beauty (AONB). This was due to the loss of woodlands and hedgerows resulting in further landscape severance along the local ridgeline. The enlarged Longfield Road junction was expected to become more dominant in the landscape. The significance of the impact of the scheme was predicted to be moderate adverse.

The townscape appraisal predicted the impacts to be neutral because the scheme was an online improvement in a rural location with no townscape features affected.

The widening of the A21, along with the new junctions, led to the loss of a significant amount of mature woodland. However, one significant ancient tree, expected to be removed was able to be retained.

[33] This is a consistent measure of assessing the contribution of greenhouse gases to global warming.

Panel fencing along the scheme slightly increased urbanisation. This has made the A21 a more prominent feature in the landscape. New replacement planting and earth bunds have been provided to reduce the impacts. The site visit at one year after confirmed that the landscape mitigation was establishing broadly as expected apart from the soil nailing at Castle Hill (which was slow to establish). This, along with the management of the new woodlands, should be confirmed at the five-year evaluation when mitigation planting will have had more time to become established.

Figure 14: Landscape changes

a) Before the scheme: looking north along A21 from carpenters Cottage in 2010.

Source: Proof of Evidence Report, Landscape, 2013.

b) After construction: looking north from 1.5km north of the Cottage at Castle Hill[34] in 2018 (note the shared-use foot/cycleway running along the northbound embankment).

Source: Environmental site visit, July 2019.

6.6 Heritage of historic resources

The appraisal reported that with the adoption of a mitigation strategy, the scheme would result in an overall moderate adverse impact due to the loss of woodland opening up the landscape and leading to views from properties along the road. The impacts included the demolition and relocation of a Grade II listed building and the demolition of an additional Grade II listed building and four other non-listed historic buildings, for example, Burgess Hill Farmhouse and barn. There would also be impacts on the setting of historic buildings and the loss or partial loss of undesignated archaeological remains.

At one year after opening, the impact of the scheme on historic landscapes were as expected within the appraisal. The impact on the Castle Hill Ancient monuments was neutral as expected. Excavation and post-excavation publication reports available at the local Tonbridge Wells Museum in Kent suggest that investigations and mitigations for archaeological remains were undertaken as expected. The post-construction visual and physical impacts on historic buildings are mostly as expected. Rebuilding of the demolished May Day Farm barn was undertaken at the Weald and Downland Museum,[35] as expected. Observed impacts and mitigations such as new tree planting on various individual receptors were largely as expected. At some locations the mitigation has yet to establish and should be reconsidered as part of the five-year after evaluation.

[34] Link to the exact view after construction: https://www.google.com/maps/@51.16658,0.3056559,3a,75y,335.52h,94.71t/data=!3m6!1e1!3m4!1sBH8F3jkEqX61akQR8MbOyA!2e0!7i13312!8i6656

[35] https://www.wealddown.co.uk/buildings/may-day-farm-from-tonbridge-kent/

6.7 Biodiversity

The ecological appraisal reported that the scheme would result in a moderate adverse impact on biodiversity, due to the loss of nine hectares of ancient woodland, of which just over three hectares were designated as a local wildlife site (LWS) and a potential site of special scientific interest (SSSI) for fungi. The widening of the route would also cause adverse impacts to other habitats (which were of negligible to medium value) within the existing highway boundary and to the land immediately adjacent. The proposed mitigation included translocated woodland and hedgerows, the enhancement of over 26 hectares of woodland in Pembury Walks and new species-rich grasslands. A new area of heathland would also be provided. The overall significance of the impact on biodiversity was expected to be moderate adverse. A new area of heathland would also be provided. The overall significance of the impact on biodiversity was expected to be moderate adverse.

Our evaluation confirmed that the project resulted in the loss of a significant amount of ancient woodland and terrestrial habitat as predicted in the environmental assessment. The mitigation, including translocated woodland and hedgerows and new species-rich grasslands, were provided, although ongoing maintenance (including the removal of weeds) is required to ensure the planting becomes established.

Mitigation measures for protected species such as dormice and bats were provided, but no monitoring reports were provided to allow their outcome to be evaluated. Experimental plots for translocated fungi were not establishing well and the heathland creation was still ongoing at the time of the evaluation. A 25-year woodland and heathland management plan was in place and its implementation will be important if the design outcomes are to be met. The impact of the scheme on biodiversity is too early to conclude. The mitigation should be reconsidered as part of the five-year after study.

6.8 Water environment

The appraisal predicted that the scheme would have a negligible impact on all water environment features due to the adoption of effective pollution control measures. Overall, with the inclusion of catch pits, balancing ponds and interceptors in the scheme design, it was expected that there would be a slight benefit to water quality and conveyance of flow.

The scheme provided balancing ponds, and new drainage and pollution control devices along a route that previously had none. As expected, this will be an improvement. No service records or monitoring information were provided, but the balancing ponds and drainage system appear to be installed as expected. The outfall at Somerhill Stream which is meant to channel water from the A21 was beginning to silt up, which may affect the functioning of the drainage system. Regular maintenance will be important if the design outcome is to be achieved.

Although we considered the impacts on the water environment were as expected, following the site visit, we have been made aware of an investigation which is being conducted into the drainage of surface water from the road. The outcome of this will be considered during the five-year after evaluation.

6.9 Physical activity

The environmental appraisal predicted that the provision of a new pedestrian footbridge and off-road non-motorised user (NMU) route for the entire length of the scheme would increase opportunities for pedestrians and cyclists and, to a lesser extent, for equestrians. The new facilities would encourage more physical activity resulting in slight beneficial impacts overall.

Based on our site visit, the new combined foot/cycleway along the entire length of the scheme has been provided as expected. No surveys have been undertaken, but cyclists were seen using the new facilities. The new crossings at Fairthorne junction and Longfield Road have improved the amenity for NMUs. The combination of these enhancements is likely to encourage physical activity, as expected.

6.10 Severance

The appraisal reported that the new NMU routes would improve local accessibility and that were likely to reduce severance for pedestrians and cyclists. Overall, a slight beneficial impact was predicted.

The one-year after site visit confirmed that new combined (shared-use) footpaths/cycleways have been provided along the route which has been integrated into the local network. New safer crossing points have been provided at Fairthorne and Longfield Road junctions and a new combined footbridge/cycleway has been provided at Blackhurst Lane. These new facilities would have reduced severance and improved amenity for NMUs. The design of the Blackhurst footbridge was functional, but it was in contrast to the woodland setting. However, overall, the impacts of the scheme are beneficial and as expected.

6.11 Journey quality

The appraisal predicted that the scheme would have a moderate beneficial impact because driver's frustration, stress and fear of potential accidents are likely to reduce due to the provision of a high-quality dual carriageway road. The appraisal predicted no change in travellers' views from the existing situation. However, it also suggested that there would be improvements in views from the road as a result of landscape planting proposals which would enhance traveller views.

Based on the one-year after site visit, the loss of vegetation along the route had opened up views and the new panel fencing along sections of the project had caused an urbanising effect (see landscape Figure 14: b). As tree planting establishes, the sense of enclosure that existed before the scheme should begin to return but it will take time. The urbanising effect of the new fencing is likely to remain and at one-year after was making views for drivers worse than expected.

The loss of roadside of the petrol station near the Fairthorne junction had worsened traveller care. However, the new open road layouts and clear signage had helped to improve route certainty. Along with improved traffic conditions, this should reduce driver stress, frustration and fear of accidents as expected.

6.12 Overview

The results of the evaluation are summarised against each of the Transport Appraisal Guidance (TAG)[36] environmental sub-objectives and presented in Table 3. In the table we report the evaluation 'as expected' if we believe that the observed impacts at one-year after are as predicted in the appraisal. We report them as' better or worse than expected' if we feel the observed impacts are better or worse than expected. Finally, we report impacts as 'too early to say' if we feel that at one-year after there is insufficient evidence to draw firm conclusions.

Table 3: Summary of environmental impacts

Sub-objective	Appraisal score	One-year evaluation	Summary
Noise	Slight adverse	As expected	Traffic noise-reducing features such as earth mounds/false cuttings and purpose-built noise barriers and a low noise surface delivered as expected. Outturn traffic flows slightly lower than forecast.
Air quality	Moderate beneficial	As expected	There are no air quality management areas (AQMAs) along the scheme extent. Local air quality concerns are based in the AQMA along A26 were not deemed to be influenced by the scheme. Outturn traffic flows are lower than forecast, but with a higher proportion of heavy duty vehicles. However, it is likely that pollutant concentrations at receptors along A21 are in line with forecasts.
Greenhouse gases	Increase in emissions due to increase in traffic	Cannot be confirmed	It has not been possible to quantify the change in greenhouse gases caused by the scheme because of insufficient data. At one year after opening, there was a smaller increase in traffic levels on one part of the route than predicted.
Landscape	Moderate adverse	As expected	The appraised and assessed impacts of widening on the landscape character and visual amenity, and the mitigation provided were all broadly as expected. The widening and the new junctions have led to the loss of a mature woodland, making the A21 a more prominent feature in the AONB/landscape. Wooden fencing increased the sense of urbanisation, but

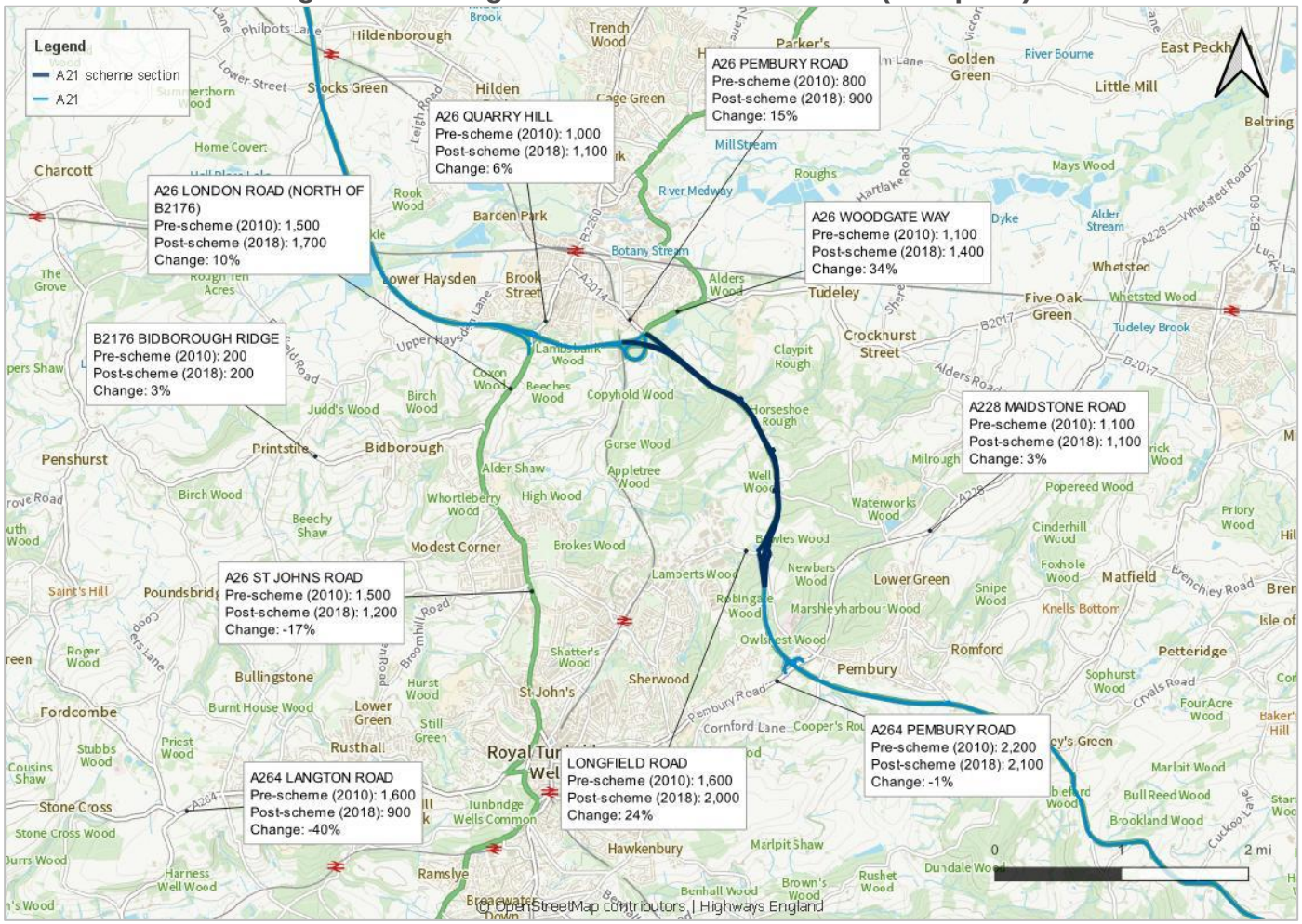
[36] TAG provides guidance on appraising transport options against the government's objective for transport.

			replacement planting and earth bunds were provided to reduce the impacts.
Heritage of historic resource	Moderate adverse	As expected	Mitigations for ancient monuments and archaeological remains have been undertaken. Excavation and post-excavation publication reports available at the local museum. The post-construction visual and physical impacts on the setting of historic buildings were mostly as expected.
Biodiversity	Moderate adverse	Too early to say	The scheme led to the loss of ancient woodland and terrestrial habitat as predicted in the environmental assessment. Mitigation was provided although there is a need for ongoing maintenance. The one-year after site visit noted the experimental plots for translocated fungi were not establishing well and the heathland creation was still ongoing. The mitigation should be reassessed at five years after.
Water environment	Slight beneficial	As expected	The scheme improved drainage by providing balancing ponds, and new drainage and pollution control devices, although no service records or monitoring information were provided. Regular maintenance will be important if the design outcome is the be achieved.
Physical activity	Slight beneficial	As expected	New shared-use foot/cycle path along the entire length of the scheme. The new crossings at Fairthorne junction and Longfield Road have improved the amenity for NMUs. Combined, these enhancements are likely to encourage more physical activity.
Severance	Slight beneficial	As expected	New shared-use foot/cycle paths were integrated into the local network. New safer crossing points have been provided at Fairthorne and Longfield Road junctions and Blackhurst Lane.
Journey quality	Large beneficial	Worse than expected for driver views and customer care. As expected	The new open road layouts, clear signage and improved traffic conditions are likely to reduce driver stress. The loss of vegetation along the route opened up views, and the panel fencing caused an urbanising effect. The loss of roadside facilities worsened traveller care.

		for driver stress	

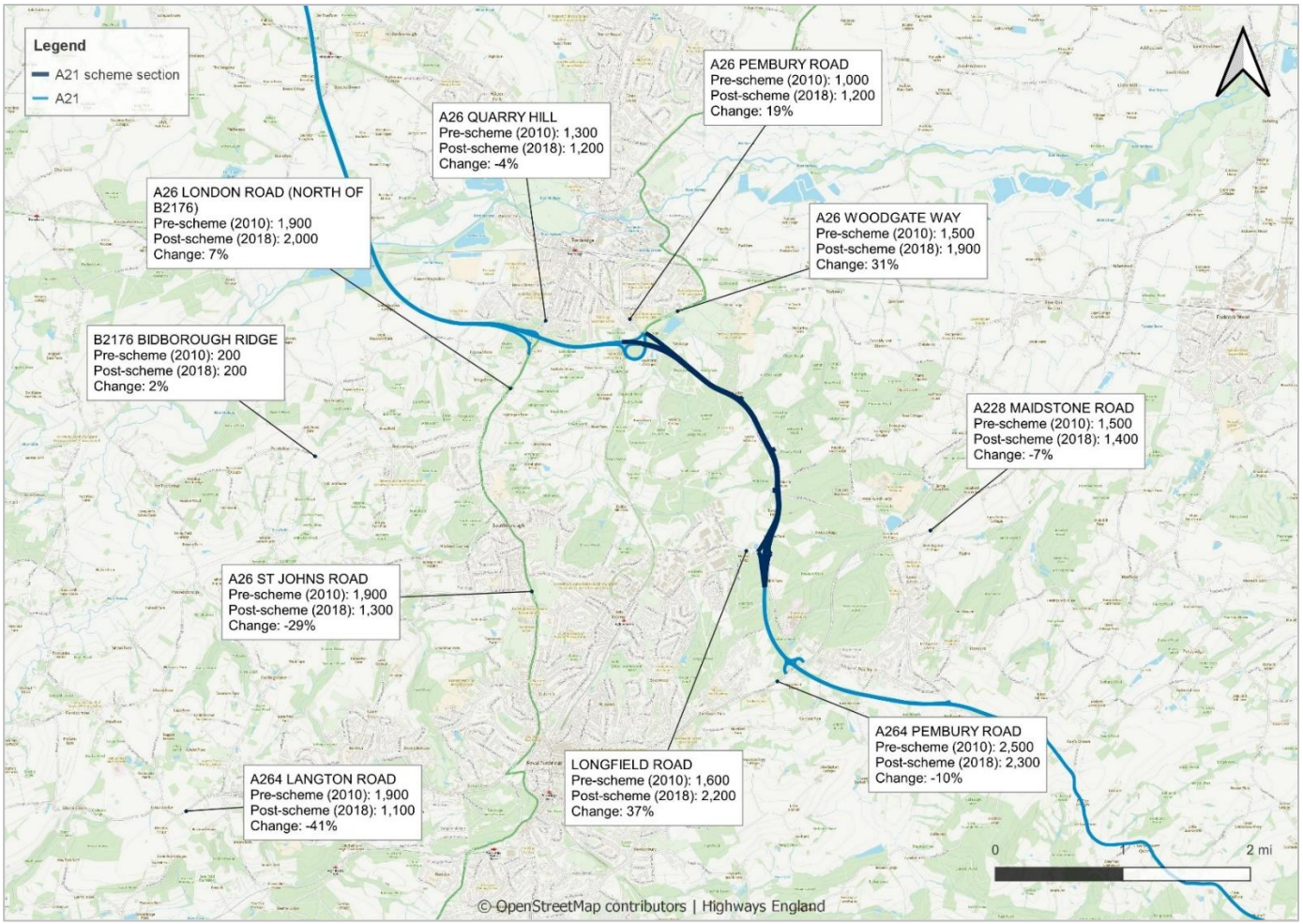
Annex 1: Traffic on local road network

Figure 15 Changes in traffic on local roads (interpeak)



Source: Two-way average weekday flows from various traffic count suppliers.

Figure 16 Changes in traffic on local roads (evening peak)



Source: Two-way average weekday flows from various traffic count suppliers.

Annex 2: Counterfactual methodology

Personal injury collisions (hereafter referred to as collisions) on the strategic road network are rare and can be caused by many factors. Due to their unpredictable nature, we monitor trends over many years before we can be confident that a real change has occurred as result of the scheme.

To establish whether any change in collision numbers is due to the scheme or part of wider regional trends, we have established a test we call the 'counterfactual'. The counterfactual answers the question: What would have likely occurred without the scheme being implemented? To answer this question, we estimate the range of collisions that could have occurred without the scheme in place. Previous Post-Opening Project Evaluations answered this question by looking at national trends in collisions. Adjustments have been made to the methodology for estimating the counterfactual. These have been made to address the following areas:

Amended Data Collection Method:

- Revised method for identifying collisions that occurred on the network.
- Only validated STATS19 information is used for reporting purposes.

Adjusting for Traffic Flows:

- Baseline traffic flows are an important factor when determining the counterfactual. We now assume that without the changes made to the network, the trends would follow regional background traffic growth patterns.
- We can now calculate the collision rate for the busiest stretches of conventional motorways.

Assessing Regional Trends:

- The new method uses regional rather than national trends for collision rates and background traffic growth, which provides greater granularity and makes the hypotheses more realistic.

We have found that the adjustments have resulted in a slight change from the previous methodology. We still have confidence in the accuracy of the previous methodology but believe we have made suitable changes that will ensure a methodology fit for purpose for the future.

Annex 3: Incident reporting mechanisms

Police forces choose how they collect STATS19 data. Some police forces do this electronically, for example, using mobile devices, while others complete paper forms which are later digitised. In addition, some collisions are reported by members of the public after the event. Since 2016, new data collection systems (called CRaSH and COPA) have been introduced by some police forces.

Before these new systems, reporting police officers categorised the severity of non-killed casualties as either serious or slight according to their own judgment of the injuries sustained. This was based on information available within a short time of the collision, and often did not reflect the results of medical examination. This sometimes led to casualties being incorrectly classified as slight injuries when they were serious, or vice versa.

In January 2016 Kent police constabulary transferred from STATS19 to CRaSH (Collision Recording and Sharing) system for reporting personal injury collisions. In CRaSH reporting, police officers record the types of injuries suffered by the casualty rather than the severity. In previous systems the determination of severity was at the discretion of the reporting police officer. CRaSH automatically converted the injury type to a severity classification. This led to implications for reporting on collision severity as there had been an increase in the number of serious collisions recorded.

These changes make it difficult to monitor trends in the number of killed or seriously injured (KSI) casualties over time or between different police forces. To help with this, the Office for National Statistics (ONS) has undertaken research to identify methods of estimating and adjusting for the increased recording of serious injuries in the new systems. Based on this work, DfT have published an adjusted time series of KSIs at the national level and statistical adjustments at the record level. These adjustments are based on estimates of how casualty severity may have been recorded had injury-based severity reporting systems always been used.

The adjustments will be reviewed by the ONS and DfT as more data becomes available, and it is possible that further refinements will be made to the adjustment methodology in the future. Currently it is not possible to reliably adjust collision severity information at the granular level required for this scheme.

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