national highways

A21 Pembury to Tonbridge dualling project

Five-year post-opening project evaluation

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Foreword

National Highways is the government-owned company that operates, maintains, and improves England's motorways and major A roads. Our roads help our customers get to their destination safely – and in the time they expect to. Road safety is, and will always be, our number one priority. We are committed to reducing the number of people killed or seriously injured on our roads.

As Chief Customer and Strategy Officer, I want to know that developments on our network are meeting their objectives and are putting the needs of our customers first. Post Opening Project Evaluations (POPEs) are a vital part of that assessment. POPEs are undertaken for all our major projects to understand how the project has influenced the safety and quality of road users' journeys, the local environment and the economy.

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. The A21 Pembury to Tonbridge dualling project was officially opened during this period, in September 2017.

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 improvements included a dual carriageway. Carriageway realignment was undertaken to enhance visibility along the route

This report gives an indication of the project's performance in the fifth year of its operation. The project aimed to improve safety for all users, improve journey time reliability, and reduce congestion.

The project has achieved its objectives, with improved safety following a reduction in personal injury collisions, collision rates and number of serious and fatal collisions. Congestion has improved, with speeds doubling and the time taken to travel along the A21 Tonbridge to Pembury route halved. Journey reliability has also improved, enabling road users to be more confident about how long their journey will take. There has been an increase in traffic on the A21, with a corresponding decrease in traffic using local roads.

With appropriate ongoing mitigation, the project has achieved its objective to keep adverse environmental impacts to a minimum. Some maintenance issues have been noted including some overgrown planting, presence of reedmace, and excess vegetation growth within the drainage network.

While the project is below the anticipated value for money, based on evidence from the first five years of operation, it is still expected to deliver a positive economic return on investment.

Elliot Shaw

Chief Customer and Strategy Officer

March 2025

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1. Executive summary

The A21 Tonbridge to Pembury dualling project opened to traffic in September 2017. The project aimed to improve journey time reliability, reduce congestion and improve safety for all users. Without the improvements, these issues were expected to be exacerbated by predicted growth in traffic volumes.

The improvements widened two and a half miles of single carriageway to create a 2-lane all-purpose dual carriageway, bridging the 'missing link' between Tonbridge and Pembury bypasses. In addition, two grade separated junctions were constructed, Longfield Road junction replaced a roundabout at the southern end of the project extent and Fairthorne junction in the middle of the project extent has replaced former direct turnings onto the A21. Carriageway realignment was undertaken to enhance visibility along the route.

A new Public Right of Way (PRoW) was also provided for pedestrians, cyclists and equestrians adjacent to the mainline, including a pedestrian overbridge at Blackhurst Lane.

Traffic analysis has shown an increase in journey speeds along the A21 Tonbridge to Pembury route, with speeds typically doubling. The route has seen a corresponding reduction in journey times, with a 2.5-minute reduction in the southbound direction (halving journey times) and a 1.5 minute reduction in the northbound direction. Journey times are now more reliable, which means road users can be more confident about how long their journey will take. Traffic volumes along the project extent have increased by 19.1% compared to traffic flows prior to construction, although observed traffic flow is lower than forecast (potentially owing to the impact of COVID-19 upon traffic levels). Analysis shows that traffic has generally shifted away from local roads as well as on the A26 between Tonbridge and Tunbridge Wells.

In the first five years since the upgrades, the annual number of personal injury collisions decreased from an average of 27 before construction to four after opening. The annual average rate of personal injury collisions per hundred million vehicle miles has also improved. The average collision rate decreased to 11.9 personal injury collisions per annual hundred million vehicle miles. This equates to travelling 11 million vehicle miles before a personal injury collision occurs. Prior to the project, there was an annual average of 80.6 personal injury collisions per annual hundred million vehicle miles. This equates to traveling one million vehicle miles before a personal injury collision occurs. This falls below the range of what would have been expected if the route upgrades had not occurred, and therefore considered statistically significant and is considered as a result of the project.

An evaluation of environmental impacts shows that all TAG[1] environmental sub-objectives (Noise, Air Quality, Greenhouse Gases, Landscape, Heritage of Historic Resources, Biodiversity and Water Environment) and society[2] sub-objectives (Severance, Physical Activity and Journey Quality) were 'as expected' compared to

[1] The Department for Transport's transport analysis guidance (TAG) provides information on the role of transport modelling and appraisal. https://assets.publishing.service.gov.uk/media/66434490ae748c43d3793a87/tag-unit-a3-environmental-impact-appraisal.pdf

[2] https://assets.publishing.service.gov.uk/media/63a32a8d8fa8f539198d9bf3/TAG_Unit_A4.1_-_Social-impact-appraisal_Nov_2022_Accessible_v1.0.pdf.pdf

pre-project appraisal, with the exception of Greenhouse Gases which is ‘better than expected’.

Whilst some issues have been raised (including road cracking, issues with heathland remediation, drainage network silting, and flooding incidents) we consider that, with appropriate ongoing mitigation, the project has achieved its objective to keep adverse impacts to a minimum.

Once a project has been operating for five years, the evaluation monitors the construction costs and trajectory of benefits as an estimate of the 60-year project life value for money. The projects’ value for money has been evaluated as ‘medium’, taking into consideration both monetised and non-monetised benefits (including safety). If only the monetised benefits were accounted for, this would change to ‘low’ value for money. The ‘medium’ category assigned from this evaluation is just below the ‘high’ value for money expected at as part of the business case. However, this may be due to methodological limitations associated with the five-year assessment, the impact of COVID-19 upon traffic levels, as well as cost overruns associated with clearing hazardous material found at several locations during ground works.

2. Introduction

What is the project and what was it designed to achieve?

The A21 between Tonbridge and Pembury was a single carriageway section of the A21 positioned between two sections of dual carriageway. The project widened two and a half miles of single carriageway to create a 2-lane all-purpose dual carriageway. A significant length of the route was also realigned to enhance visibility. In addition, two grade separated junctions were constructed, Longfield Road junction replaced a roundabout at the southern end of the project extent and Fairthorne junction in the middle of the project extent has replaced former direct turnings onto the A21. A new route was also provided for pedestrians, cyclists and equestrians adjacent to the mainline, including a pedestrian overbridge at Blackhurst Lane.

The work was conducted to create a continuous dual carriageway link between the M25 and Kipping's Cross to improve journey time reliability. The project also intended to remove junction bottlenecks, enhance active travel facilities and improve safety for all users.

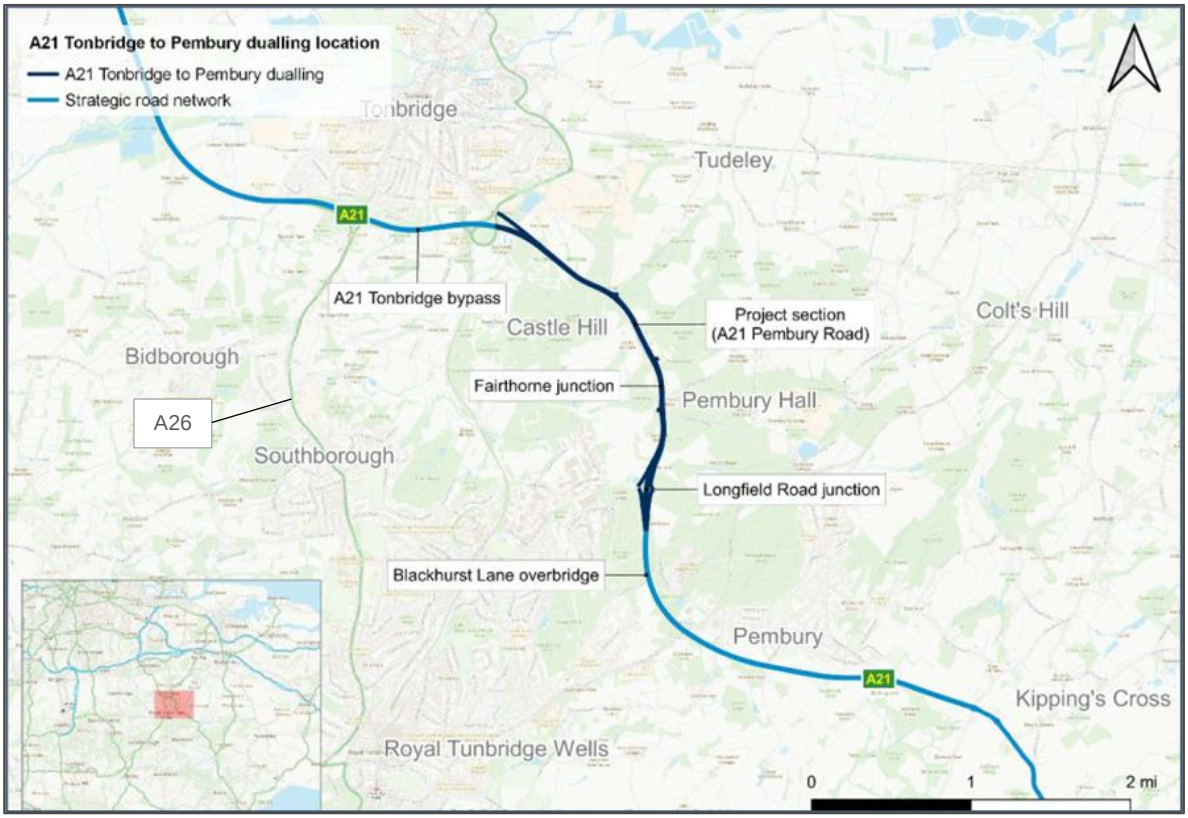
The A21 Tonbridge to Pembury dualling project began construction in April 2015 and was completed and opened to traffic in September 2017.

Project location

The A21 forms the main route between London (via the M25) and the Bexhill, Hastings and Rye section of the southeast coast. The project extent is located approximately 3km from Tonbridge town centre, and 5km north east of Royal Tunbridge Wells. The village of Pembury is located at the southern extent of the project extent.

Figure 1 shows the location of the project. The A21 provides connection into Tonbridge at its northern extent via the A2014 and A26, and to Pembury and Royal Tunbridge Wells at its southern extent via the A228 and A264, respectively.

Figure 1 A21 dualling project location



Source: National Highways and OpenStreetMap contributors (©OpenStreetMap 2024)

How has the project been evaluated?

Post-opening project evaluations are carried out for major projects to validate the accuracy of expected project impacts which were agreed as part of the business case for investment. They seek to determine whether the expected project benefits are likely to be realised and are important for providing transparency and accountability for public expenditure, by assessing whether projects are on track to deliver value for money. They also provide opportunities to learn and improve future project appraisals and business cases.

A post-opening project evaluation compares changes in key impact areas[3] by observing trends on a route before a project is constructed (baseline) and tracking these after it has opened to traffic. The outturn impacts are evaluated against the expected impacts (presented in the forecasts made during the appraisal) to review the project's performance. For more details of the evaluation methods used in this study please refer to the post-opening project evaluation (POPE) methodology manual on our website.[4]

[3] Key impact areas include safety, journey reliability and environmental impacts.
[4] https://nationalhighways.co.uk/media/exypgk11/pope-methodology-note-jan-2022.pdf

3. Delivering against objectives

How has the project performed against objectives?

All our major projects have specific objectives which are defined early in the business case when project options are being identified. The project's objectives primarily related to reducing congestion and improving journey times and reliability, whilst also improving road safety and enhancing sustainable access.

These objectives are appraised to be realised over 60 years; a five-year evaluation provides an early indication of whether the project is on track to deliver the benefits.

Table 1 summarises the project's performance against each of the objectives, using evidence gathered for this study.

Table 1 Objectives and Evaluation summary

Objective	Five-year evaluation
Provide the 'missing link' between the existing Tonbridge and Pembury bypasses, significantly improving journey time reliability.	There is now a continuous dual carriageway link connecting Tonbridge and Pembury bypasses. Average speeds have typically doubled, with journey times reducing by more than half in the southbound direction (2.5 minutes) and 1.5 minutes in the northbound direction. The dualling, as well as upgraded junctions, mean that journeys are considered more reliable than prior to construction.
Remove bottlenecks at Castle Hill and Longfield Road and segregate local access traffic and through traffic.	Two grade separated junctions were constructed, with journey times decreasing through these sections when compared with pre-project. Traffic volumes on the project extent have increased, whilst traffic using alternative, local, routes have typically decreased. This suggests that some local access traffic has been separated from through traffic.
Improve facilities for cyclists, horse riders, and walkers, particularly ease of access across the A21 to the Pembury Walks area.	This objective is not assessed within the POPE methodology; however, it is expected that conditions for cyclists, pedestrians and horse riders have improved as a result of the project owing to the creation of a new public right of way / bridleway and the removal of traffic from some local routes.
Minimise the environmental impact of traffic within the AONB, RSPB Nature Reserve and the Scheduled Ancient Monument.	All TAG environmental sub-objectives (Noise, Air Quality, Greenhouse Gases, Landscape, Heritage of Historic Resources, Biodiversity, Water Environment) and TAG social impacts (Severance, Physical Activity and Journey Quality) were 'as expected' compared to pre-project appraisal, with the exception of Greenhouse Gases which is 'better than expected'.
Improve safety for all users.	The project has seen a reduction in the rate and number of personal injury collisions on both the project extent and the surrounding network. There has been an annual reduction of 23 personal injury collisions on the project extent. Within the wider area the average collision rate has reduced by 70 personal injury collisions per hundred million vehicle miles (hmvm) since the project opened to traffic. At this five-year evaluation point the project is on track to meet its objective to reduce the number and rate of collisions.

4. Customer journeys

Summary

For our evaluation of traffic impacts, our baseline is 2014 (before construction). For our five years after study, we have used data from 2022. This largely avoids the period impacted by COVID-19 lockdown restrictions (generally accepted to be between March 2020 and December 2021).

The analysis indicates that the project has supported an increase in road users, with an increase in 24-hour Average Weekday Traffic (AWT) flow of 19.1% compared to pre-project flows. Comparing to the counterfactual (which estimates expected traffic flows had the project not gone ahead) shows a 12.6% increase in traffic when averaged across all available count sites. Traffic growth along the A21 project extent is greater than wider regional and national traffic growth trends between 2014 and 2022.

Examining traffic flows within the surrounding area shows a reduction in traffic flow on routes leading to the A26 (which provides an alternative parallel route to the A21) and on the section of the A26 itself between Tonbridge and Tunbridge Wells. Routes to the A21 have generally seen an increase in traffic flow. This indicates that the project has supported an increase in road users on the A21, with some users shifting away from the A26 through Southborough and Royal Tunbridge Wells.

The project had an objective to improve journey time reliability and remove junction bottlenecks. Five years after opening, the dualling project has led to a near doubling of speed (36mph to 66mph northbound and 27mph to 65mph southbound), and a corresponding improvement in journey time (3:42 minutes to 2:11 minutes northbound and 5:01 minutes to 2:23 minutes southbound). Route stress analysis indicates that road users can now be more confident about how long their journey will take when travelling along the route.

How have traffic levels changed?

The following sections examine the changes in traffic flow along the project extent and on roads in its vicinity. We have compared these with the observed national, regional and local trends. We have also compared the observed and forecast traffic flows to understand to what extent the forecast flows were realised.

National and regional

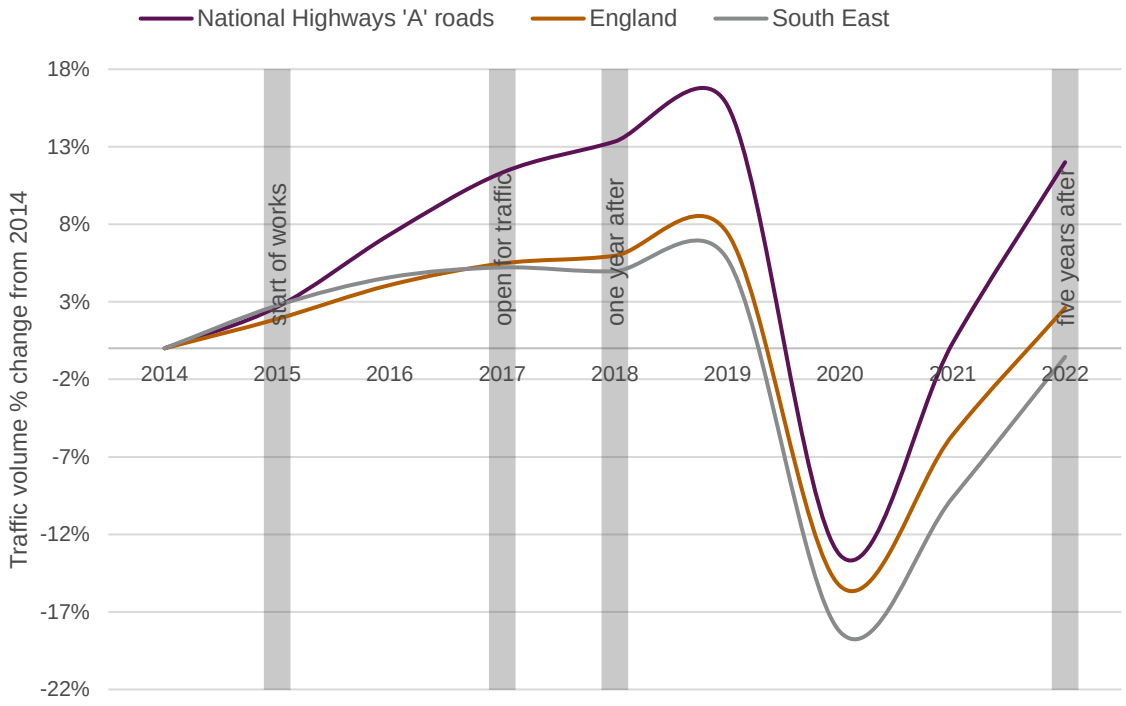
To assess the impact of the project on traffic levels, it is useful to understand the changes within the context of national and regional traffic. To do this, we use the Department for Transport annual statistics. The data is reported by region (South East) and road type, recording the total number of million vehicle kilometres travelled[5]. This data is used as a baseline, and we attribute any growth observed on roads in the project area which is above national and regional trends to the project.

[5] Motor vehicle traffic (vehicle kilometres) by region in Great Britain, annual from 1993 to 2022, Table TRA 8901, Department for Transport

Figure 2 shows traffic growth in England and the South East between 2014 (before construction) and 2022 (five years after project opening). The graph shows the impact that the COVID-19 pandemic had upon traffic levels in the UK during 2020.

Between 2014 and 2022 traffic decreased by 0.6% in the South East region (with traffic levels likely still recovering from the impact of COVID-19), with an increase of 12.0% on all National Highways 'A' roads. Averaging these two numbers gives the background growth of the project (5.7% between 2014 and 2022).

Figure 2 Changes in National and Regional Background Levels of Traffic between 2014 and 2022 (A21 dualling project)



Source: Department for Transport

How did traffic volumes change?

Traffic volumes were analysed through the project area by comparing the average weekday traffic (AWT) data. Appendix A shows the observed AWT flows at locations along the project extent and the wider area compared to the counterfactual for the morning peak, daytime and evening peak. The counterfactual presents an estimate of what traffic flows might have been in 2022 if the project had not gone ahead.

The evaluation found observed (24 hour) traffic flow on the A21 project extent to be 19.1% higher than traffic flows prior to construction when averaged across all available count site data. When comparing to the counterfactual (2022), flows were 12.6% higher. This indicates that the growth in traffic flow may be attributed to the A21 dualling project.

On local roads, data analysis typically shows an increase in traffic on routes to / from the A21 project extent, coupled with a decrease in traffic flow on the section of the A26 which connects Tonbridge to Tunbridge Wells (an alternative parallel route to the A21). Fewer vehicles on local routes indicates that trips may have moved onto the A21.

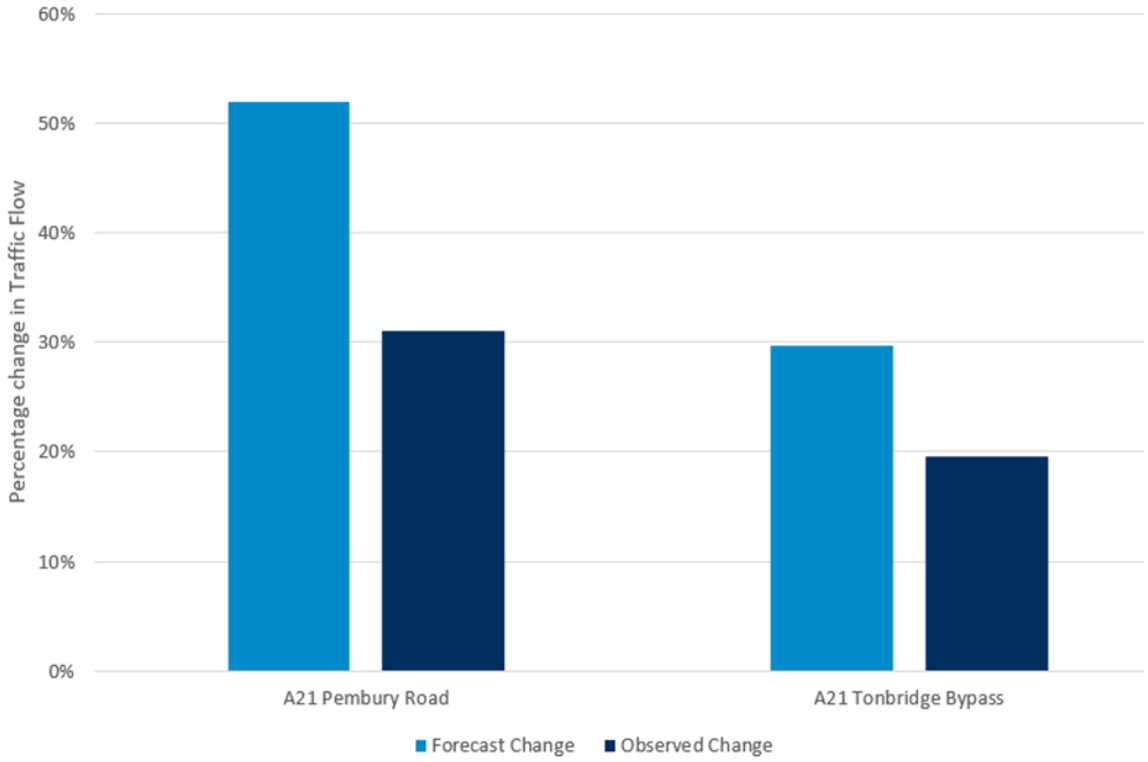
Was traffic growth as expected?

Prior to construction, traffic growth forecasts were developed to support the business case for the project. Forecasts were made based upon a transport model that calculated likely changes to traffic levels 'with' and 'without' the project. The forecasts 'with' the project also included the likely traffic impact of the M25 junctions 5 to 7 smart motorway[6].

Figure 3 to Figure 5 compare the forecast traffic flows (light blue) to the observed traffic flows (darker blue) for the morning, daytime and evening peak on the A21 Pembury Road (on the project extent) and on the A21 Tonbridge Bypass (to the north of the A21 / A26 junction, just north of the project extent).

The observed flows were lower than forecast flows in all time periods, suggesting that actual growth in traffic volume was not as much as expected. We think this may be due to the impact of the COVID-19 pandemic upon traffic levels in the South East region, with traffic levels in 2022 6% lower than pre-pandemic (2019) levels (see Figure 2).

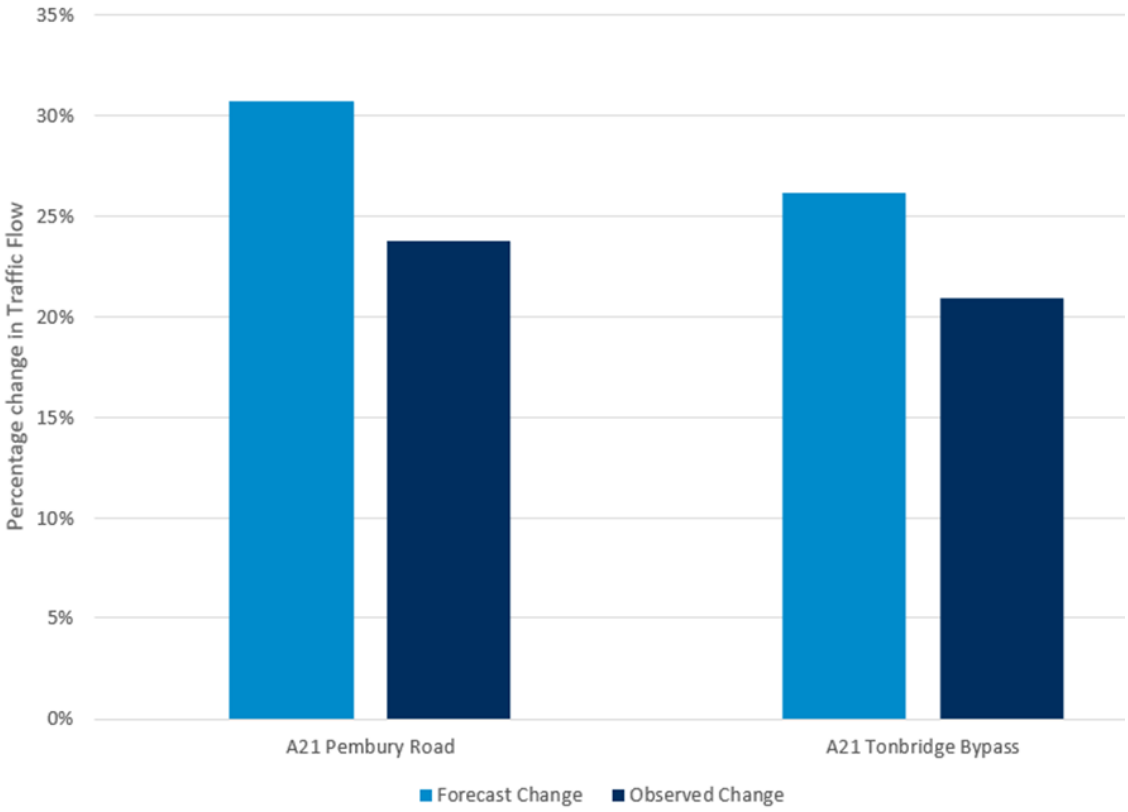
Figure 3 Forecast and Observed two-way Traffic Volume – Morning Peak



Source: WebTRIS and Traffic Forecasting Report (Highways Agency, 2013)

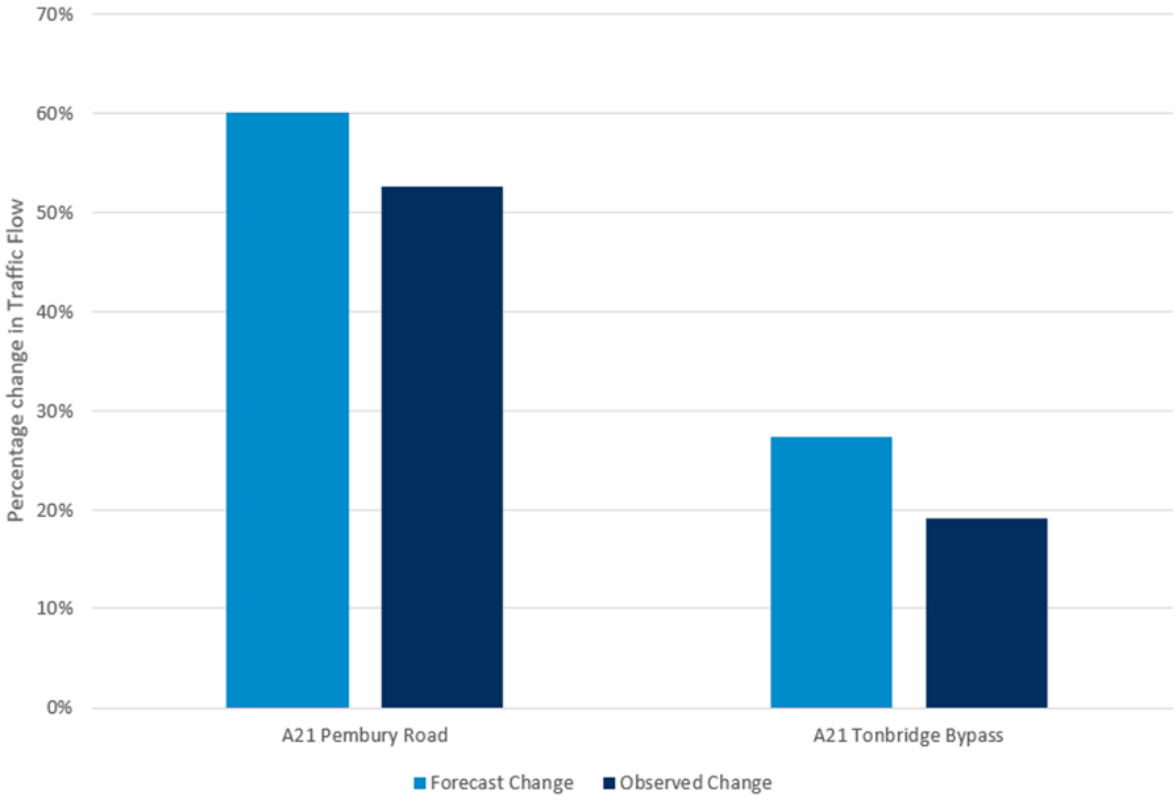
[6] Opened to traffic in 2014

Figure 4 Forecast and Observed two-way Traffic Volume – Daytime



Source: WebTRIS and Traffic Forecasting Report (Highways Agency, 2013)

Figure 5 Forecast and Observed two-way Traffic Volume – Evening Peak



Source: WebTRIS and Traffic Forecasting Report (Highways Agency, 2013)

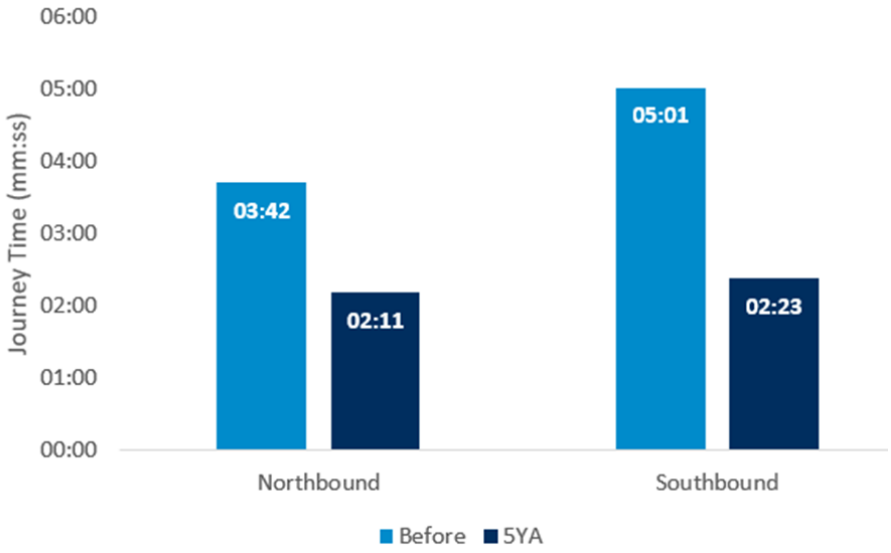
Relieving congestion and making journeys more reliable

Analysis of journey times and speeds can indicate the impact of the route upgrade on congestion. The extent to which journey times vary from the expected average journey time indicates how reliable a journey is.

Did the project deliver journey time savings?

The project intended to remove bottlenecks at Castle Hill and Longfield Road junctions to improve journey times along the route. Figure 6 compares the journey time along the A21 (between the A21 / A26 junction to the south of Tonbridge and the A21 / A264 / A228 junction to the west of Pembury). The graph shows an improvement in daily average journey time in both directions, with the greatest reduction occurring in the southbound direction (2.5-minute reduction).

Figure 6 Average daily journey time (Before vs Five years after)



Source: Teletrac Navman and INRIX data. Before: 2014, 5YA: 2022

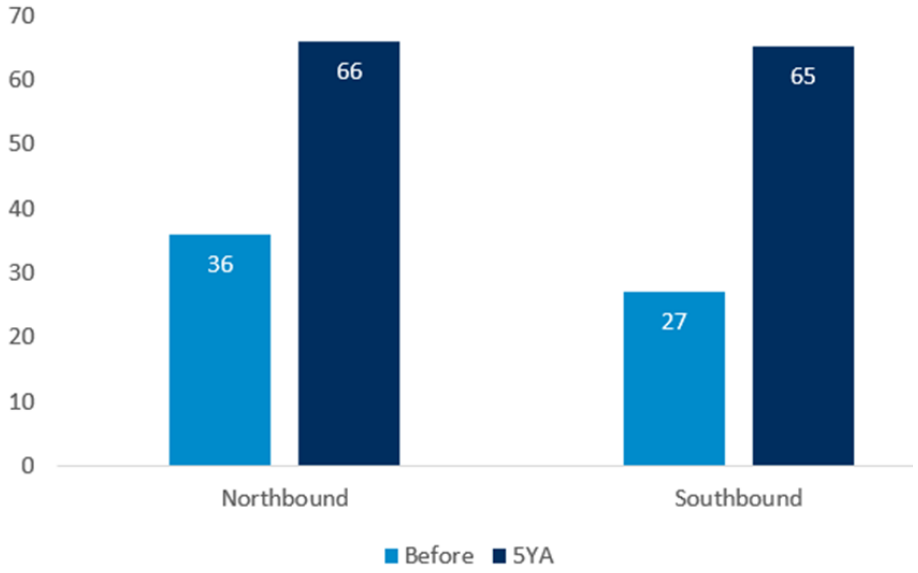
How did the project impact road user's speeds?

In combination with journey time analysis, speed can help to determine the impact the project has had on congestion.

Figure 7 shows changes to the average daily speed along the A21. The graph shows an increase in average speed for both directions of travel, with the northbound seeing a 30mph increase (from 36mph to 66mph) and the southbound experiencing a 38mph increase (from 27mph to 65mph).

The increases in speed correlate to the improvements in journey time discussed above.

Figure 7 Average Daily Speed (mph) (Before vs Five years after)



Source: Teletrac Navman and INRIX data. Before: 2014, 5YA: 2022

Were journey time savings in line with forecast?

Forecast journey times calculated prior to project construction were not in a format that allows comparison with five years after journey time data. It is therefore not possible to say whether journey time savings are in line with forecasts.

Did the project make journeys more reliable?

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.

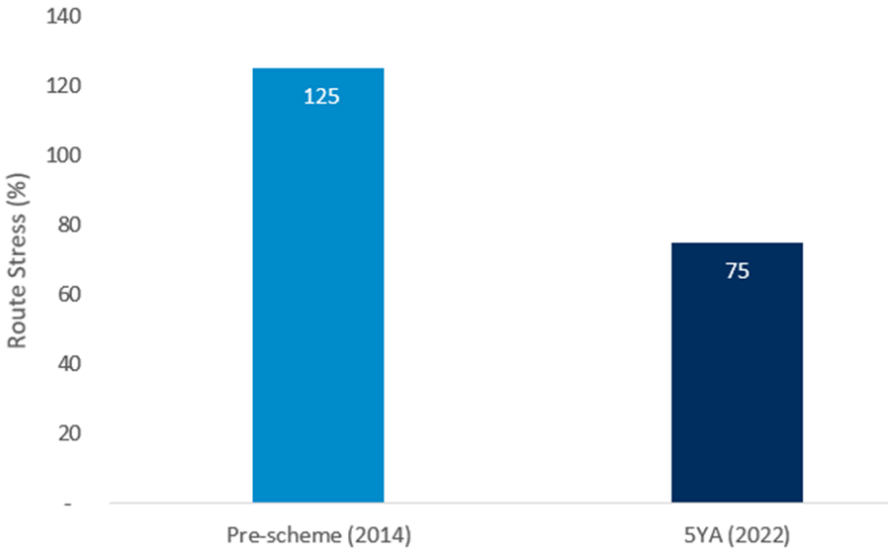
Route Stress acts as a proxy for journey time reliability. It is the ratio of the Annual Average Daily Traffic (AADT) flow to the Congestion Reference Flow (CRF), which shows the theoretical capacity of the road.

The analysis shows a reduction in route stress from 128% prior to project construction to 14% five years after construction.

DfT guidance states that only values between 75% and 125% should be considered, with values less than this adjusted up to 75% and values greater than this adjusted down to 125%. Figure 8 has therefore been adjusted and shows that there has been an improvement to journey reliability for users travelling along the A21 in 2022 compared to the pre-project (2014).

This indicates that road users can now be more confident about how long their journey will take when travelling along the route.

Figure 8 Route Stress Metric – A21 south of the A21 / A26 / A2014 junction – northern extent of the project)



Source: WebTRIS, DMRB volume 5 section 1 part 3 TA46/97 Annex D

5. Safety evaluation

Summary

The safety objective for the dualling of the A21 was to improve road safety for all, in particular by reducing the number and severity of collisions.

The business case forecast a saving of 141 collisions over the 60-year appraisal period. The safety benefits were primarily expected on the A21 and routes that run parallel to the A21 as traffic rerouted to the dual carriageway. The predicted casualty reduction was 15 fatal, 74 serious and 179 slight over the 60-year appraisal period.

Table 2 captures all the key measures for the project extent from before to after construction. Early evaluation shows a reduction across all key safety measures.

Table 2 Summary of project extent key measures

Measure		Before	After	Counterfactual	Change
Personal Injury Collisions		27	4	21	-23
Collision Rates		81	12	67	-69
Measure		**Before**	**After**	**Change**	
Collision Severity	Fatal	6	3	-3	
	Serious (average)	5	1	-4	
	Slight (average)	21	3	-18	
Fatal Weighted Injury[7]		2.4	0.8	-1.7	
FWI/hmvm[8]		7.8	2.1	-5.7	
Killed or Seriously Injured[9]		10	2	-8	
KSI/hmvm[10]		32.2	4.6	-27.6	

Source: STATS19 2 April 2010 – 1 September 2022

The average collision rate in the wider area[11] has reduced by 70 personal injury collisions (PIC) per hmvm since the project has been open to traffic. The average

[7] The FWI weights Collisions based on their severity. A fatal collision is 1, a serious collision is 0.1 and a slight collision is 0.01. The combined measure is added up. A full number is the equivalent to a fatality.
[8] FWI/hmvm= Fatal Weighted Injury per Hundred Million Vehicle Miles
[9] The number of people killed or seriously injured (KSI) in road traffic collisions. This metric is non-weighted but does not pick up all injuries (slight casualties). KSI rate per hmvm is the rate calculated using the number of people who are killed or seriously injured, and the total miles travelled on a road section or type.
[10] KSI/hmvm = Killed or Serious Injured per Hundred Million Vehicle Miles
[11] The road network is determined as part of the appraisal process to understand changes to road safety on the project extent and roads which the project may have an impact.

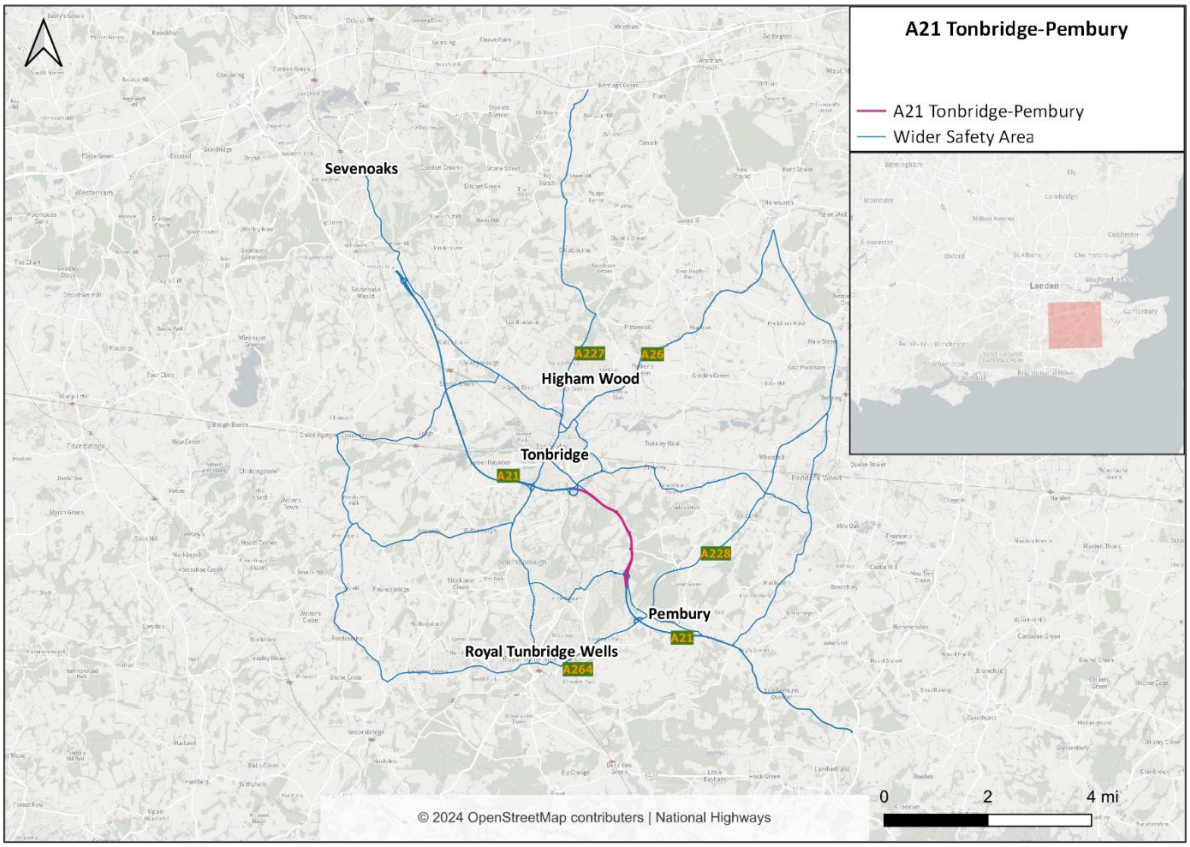
PIC has reduced by 186 (annual average of 326 to 140 PICs after) in the same period. There has been an increase in the number of fatal collisions and a reduction in serious and slight collisions, FWI and KSI measures. If the wider area continues to perform at the current level, it will exceed the predicted reduction. A full summary of the wider area can be found in Appendix B.

At this five-year evaluation point the project is on track to meet its objective to reduce the number and rate of collisions[12].

Safety study area

The safety study area is shown in Figure 9. This area was assessed in the appraisal supporting the business case for the project to check any potential wider implications of the intervention[13]. This information was then used with other predictions around the potential impact of the project such as by how much traffic may grow. The evaluation has used the strategic roads within the same area as the appraisal to understand the emerging safety trends.

Figure 9 Safety study area



Source: National Highways and OpenStreetMap contributors (2024)

[12] Projects are appraised over a 60-year period. The conclusion is based on the findings at five years after the project opened for traffic.

[13] The wider area evaluation has compared before and after analysis for the strategic road network, where the main impact is likely to occur. The appraisal also included some local roads, but we do not have the data to include this in our evaluation.

Road user safety on the project extent

How has traffic flow impacted collision rates?

The Department for Transport release road safety data[14] that records incidents on public roads that are reported to the police. This evaluation considers only collisions that resulted in personal injury.

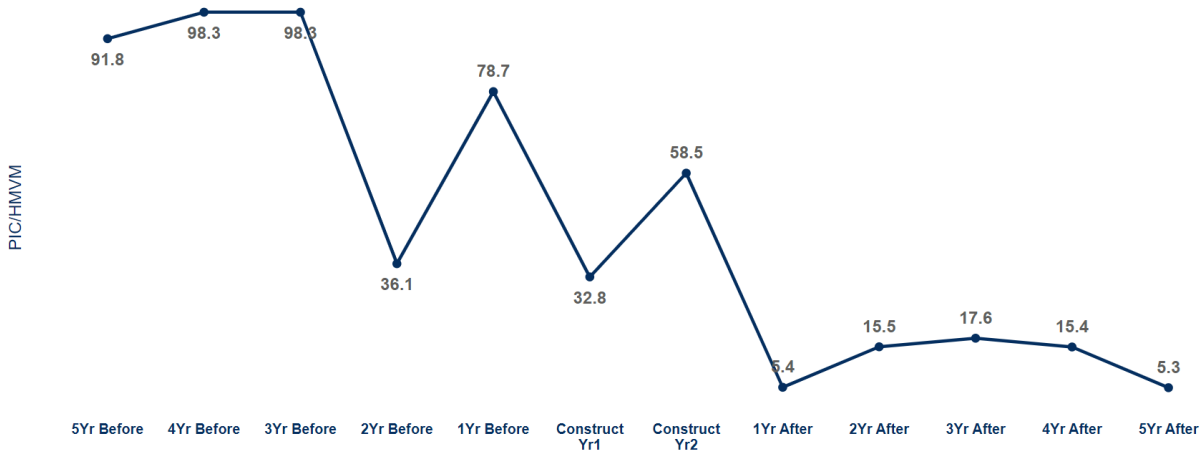
The safety analysis has been undertaken to assess changes over time looking at the trends in the five years before the project was constructed to provide an annual average. We have then assessed the trends from the first 60 months after the dualling of the A21 was operational and open for road users. This provides an early indication of safety trends, and safety impact of the project across the following time periods:

- Pre-construction: 2 April 2010 – 1 April 2015
- Construction: 2 April 2015 – 1 September 2017
- Post-opening: 2 September 2017 – 1 September 2022.

To understand potential safety benefits, we consider changes in the volume of traffic and the number of collisions observed. A rate is calculated using the number of personal injury collisions and the total miles travelled on a road section or type. The rate is presented as the number of collisions per hundred million vehicle miles (hmvm).

The average collision rate had decreased to 11.9 personal injury collisions per hmvm, this equates to travelling 11 million vehicle miles before a collision occurs. Five years before the project, the average collision rate was 80.6 personal injury collisions per hmvm, this equates to traveling one million vehicle miles before a collision occurs (Figure 10).

Figure 10 Annual average of collision rate



Source: STATS19 2 April 2010 – 1 September 2022

As part of the safety evaluation, we look to assess what changes in collision rates might have occurred due to factors external to the project over this timeframe. To do this we estimate the trend in personal injury collisions which might have occurred if the road had remained in its previous configuration (this is referred to as

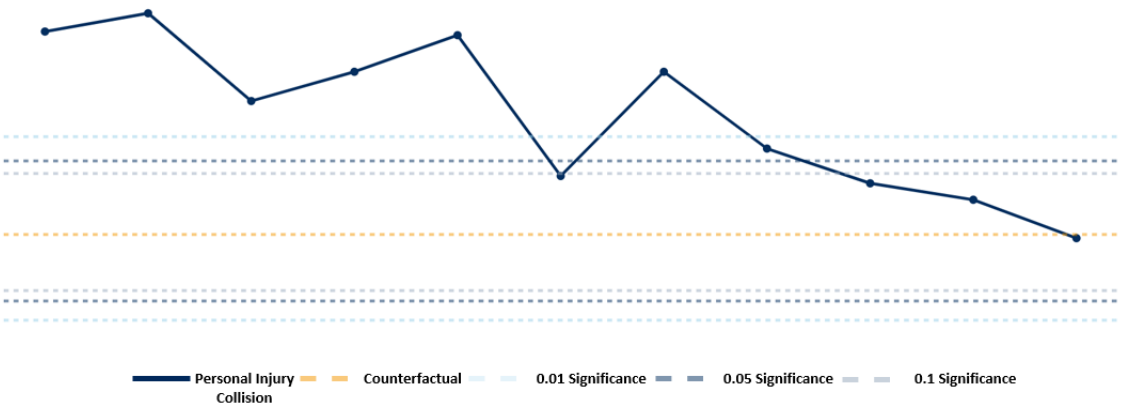
[14] https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data

a counterfactual[15]). This is based on changes in regional safety trends for dual carriageways on the strategic road network with a high volume of road users.

Figure 11 What does the counterfactual show?

The counterfactual is an estimation of what we think would occur without the project taking place. We estimate a range of collisions that follow regional trends. The chart shows:

1. Timeseries of personal injury collisions
2. Estimated counterfactual range, which comes from a X^2 hypothesis test on one degree of freedom using a significance level of 0.05. More details can be found in the POPE Methodology Manual.
3. National Highways are developing new statistical methods to compare collision and casualty rates. We anticipate adopting these once the methods are finalised.

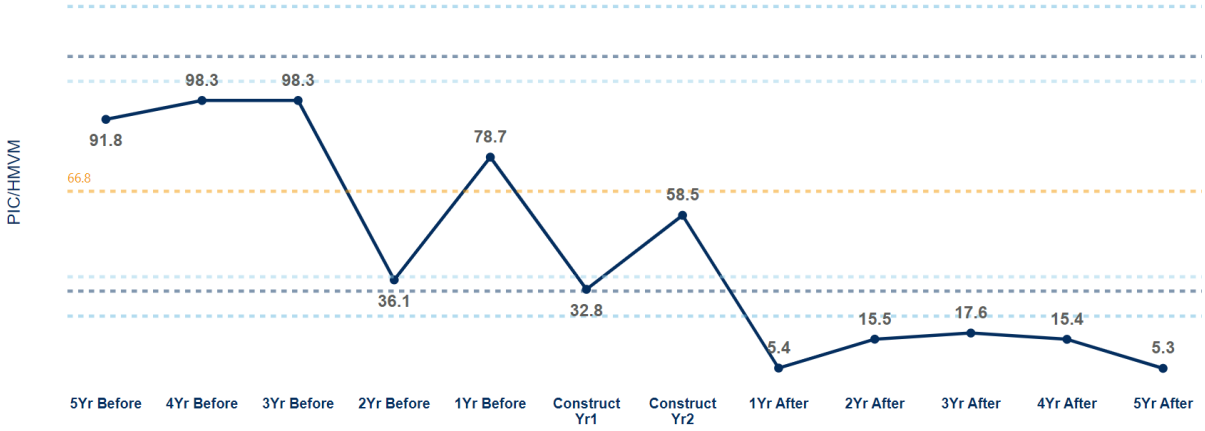


Based on this assessment we estimate that if the dualling of the A21 had not occurred, the trend in the number of personal injury collisions and collision rates would likely have reduced, but not to the extent to what has been observed.

The counterfactual test estimated the rate would likely reduce to 66.8 personal injury collisions per hmvm (Figure 12). This counterfactual scenario indicates there would be a reduction in the number of collisions without the project, but the frequency of collisions would reduce mainly as a consequence of increased traffic flows. The after annual average collision rate falls below the counterfactual rate suggesting that the project could be having a positive impact.

[15] Refer to the POPE methodology manual: https://nationalhighways.co.uk/media/exypgk11/pope-methodology-note-2024-v2.pdf

Figure 12 Annual average number of collision rate with counterfactual scenario ranges



Source: STATS19 2 April 2010 – 1 September 2022

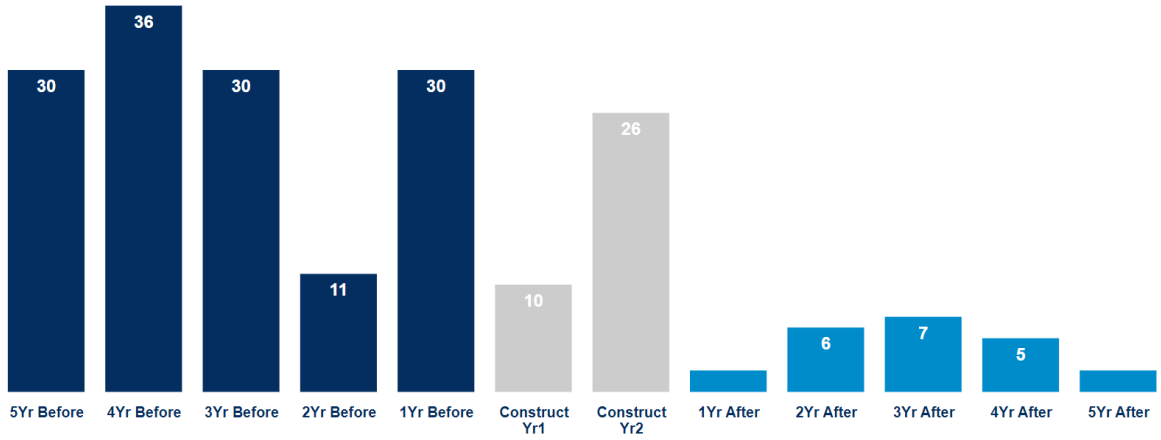
What impact did the project have on road user safety?

The evaluation found the number of personal injury collisions on the project extent had decreased. During the first 60 months the project was operational, there were on average four personal injury collisions per year, 23 fewer than the average 27 per year over the five years before the project was constructed (Figure 13).

Average personal injury per year collisions

27	4	23
Before	After	Fewer

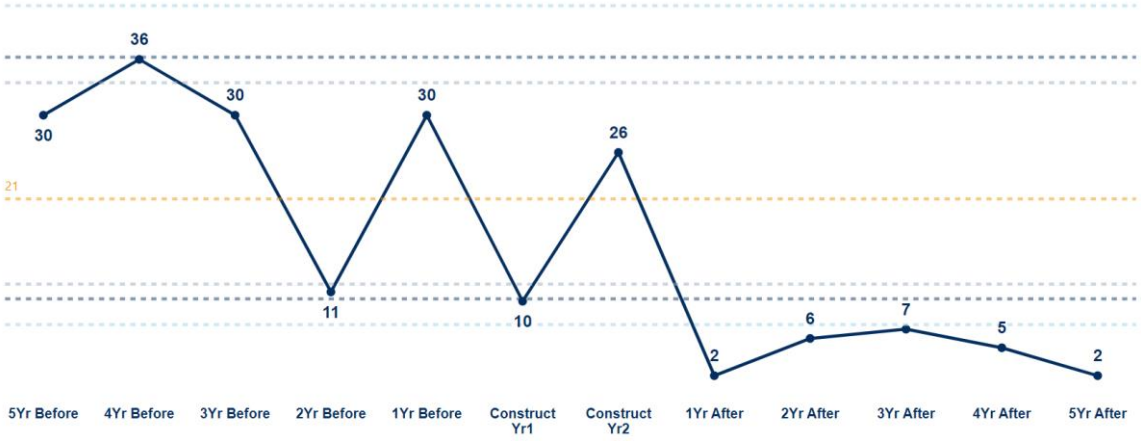
Figure 13 Annual Personal Injury Collisions



Source: STATS19 2 April 2010 – 1 September 2022

A counterfactual test has also been performed which estimates a range of between 10 and 36 personal injury collisions would be expected as shown in Figure 14.

Figure 14 Annual average number of personal injury collisions with counterfactual ranges



Source: STATS19 2 April 2010 – 1 September 2022

Similar to collision rates, collision numbers are also lower than what we would have expected without the project. This is a positive indication that the project has had a positive impact on safety.

What changes in the severity of collisions did we see?

Collisions which result in injury are recorded by severity as either fatal, serious, or slight. The way the police record the severity of road safety collisions changed within the timeframes of the evaluation, following the introduction of a standardised reporting tool – Collision Recording and SHaring (CRASH). This is an injury-based reporting system, and as such severity is categorised automatically by the most severe injury. This has led to some disparity when comparing trends with the previous reporting method, where severity was categorised by the attending police officer.[16] As a consequence, the Department for Transport have developed a severity adjustment methodology[17] to enable robust comparisons to be made.

The pre-conversion collision severity has been adjusted, using the Department for Transport's severity adjustment factors, to enable comparability with the post-conversion safety trends.[18]

After the project, there has been a severity reduction across all three categories (Table 3). Figure 15 shows the full breakdown of severity of personal injury collisions by project year.

Table 3 Number of personal injury collisions by severity

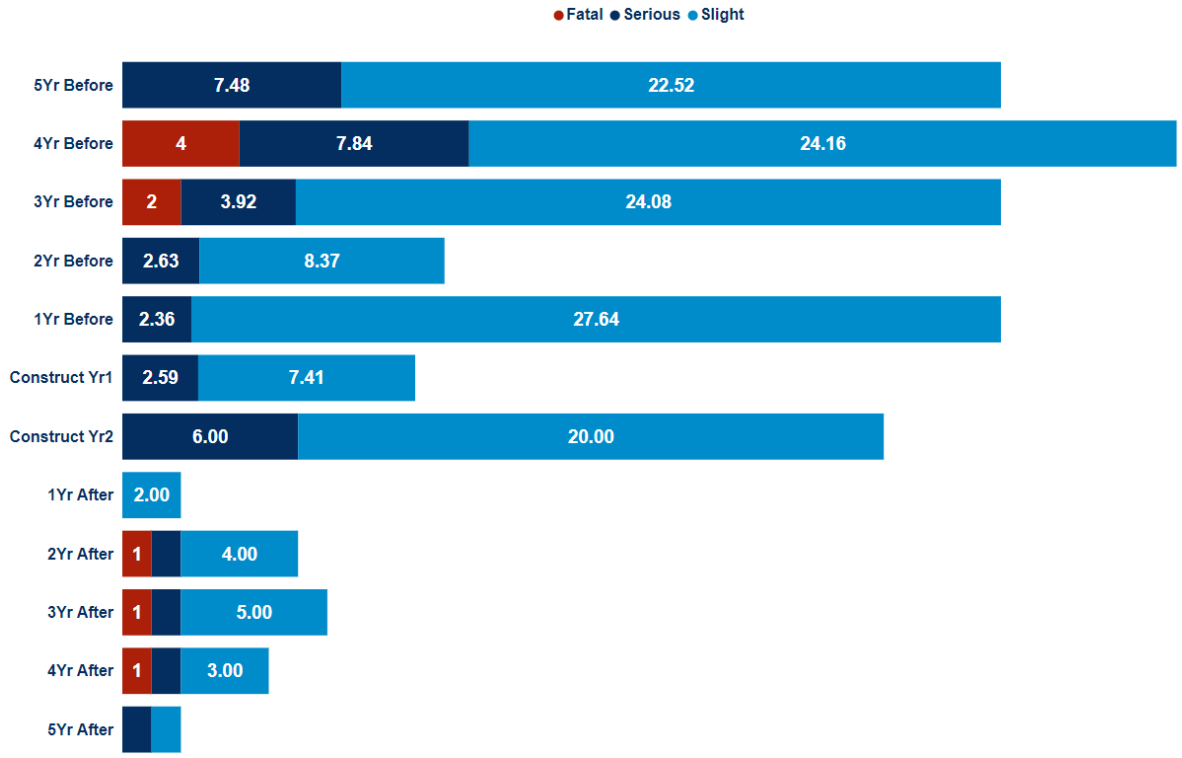
	Before	After	Change	Change direction
Fatal	6	3	3	↓
Serious (average)	4.85	0.8	4.05	↓
Slight (average)	21.35	3	18.35	↓

[16] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820588/severity-reporting-methodology-final-report.odt

[17] https://www.gov.uk/government/publications/guide-to-severity-adjustments-for-reported-road-casualty-statistics/guide-to-severity-adjustments-for-reported-road-casualties-great-britain#guidance-on-severity-adjustment-use

[18] Collision Severities within this report use the 2022 adjustment factor.

Figure 15 Severity of personal injury collisions within the project extent



Source: STATS19 2 April 2010 – 1 September 2022

What impact did the project have on casualty severity?

Like other transport authorities across the UK the key measure we use to assess the safety of roads, is Fatal and Weighted Injuries (FWI). This gives a fatality 10 times the weight of a serious casualty, and a serious casualty 10 times the weight of a slight casualty[19]. In effect, it takes all non-fatal injuries and adds them up using a weighting factor to give a total number of fatality equivalents[20]. This is represented by an annual average and a rate that standardise casualty severities against flow to show the likelihood of a fatality equivalent occurring per distance travelled.

There has been a reduction of 1.7 FWI observed annually. The severity of casualties occurring after the project became operational has reduced in the project extent. An annual average of 2.4 FWI were observed before compared to 0.8 after.

The combined measure showed an extra 26 million vehicle miles was travelled before a FWI[21]. The rate of FWI per hmvm[22] has reduced. This suggests that taking into account changes in traffic the project is having a positive safety impact on the severity of casualties within the project extent.

[19] The FWI weights Collisions based on their severity. A fatal collision is 1, a serious collision is 0.1 and a slight collision is 0.01. So 10 serious collisions, or 100 slight collisions are taken as being statistically equivalent to one fatality.
[20] Casualty severities within this report use the 2022 adjustment factor.
[21] Before the project, 39 million vehicle miles needed to be travelled before a FWI (2.6 FWI per hmvm). After the project this increased to 65 million vehicle miles (1.5 FWI per hmvm).
[22] hmvm – hundred million vehicle miles

We also assess the impact the project had on casualties using the Killed or Seriously Injured (KSI) measure [23], and consider changes in traffic by calculating an average rate for every hundred million vehicles miles (hmvm) travelled.

A reduction of eight KSI has been observed annually. Reducing from an average of 10 KSI before to two KSI after. The rate of KSI per hmvm has decreased from an average of 32.2 to 4.6 for every hmvm travelled.

The observations for KSI suggests that the project is having a positive safety impact on the severity of casualties within the project extent.

Is the project on track to achieve its safety objective?

The safety objective was to achieve improving road safety for all. We have observed a reduction in the rate and number of collisions and improvement to the impact on casualties. Observations from the wider safety area support these reductions. We believe that the project has met its safety objective.

The business case forecast was a reduction in PICs as a result of this project, with a saving of 141 collisions over the 60-year appraisal period. Findings at the five years after stage suggest the project is likely to outperform the appraisal scenario.

[23] The number of people killed or seriously injured in road traffic collisions. This metric is non-weighted but does not pick up all injuries (slight casualties). KSI rate per hmvm is the rate calculated using the number of people who are killed or seriously injured, and the total miles travelled on a road section or type.

6. Environmental evaluation

The evaluation of environmental impacts compares observable impacts of the project with those forecast within the business case and the Environmental Statement (ES). Observed impacts are gathered from site visits (conducted at one and five years after) and desktop analysis conducted at five years after project opening.

The results of the evaluation are recorded against each of the Transport Analysis Guidance (TAG)[24] environmental sub-objectives in the sections to follow and summarised in Table 4. The appraisal also considered the three society[25] sub-objectives of physical activity, journey quality and severance.

Site visits were undertaken in July 2019 and August 2022. Townscape impacts were considered neutral in the appraisal because the project was considered to be on-line within a rural area and therefore were scoped out of the post-project evaluation process. Since there were no new severance, physical fitness or journey quality issues generated by the project within the five years after evaluation period, these were scoped out of the 5YA evaluation in line with POPE guidance.

The environmental sub-objectives, noise, air quality, heritage of historic resources, biodiversity and the water environment were assessed as 'as expected'. Greenhouse gases are likely to be lower than expected. Provided routine maintenance is carried out, landscape impacts are broadly as expected.

Noise

The environmental appraisal (AST)[26] undertaken for the Project predicted that on opening the Project would result in 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 were predicted to occur at 15 properties close to the Project. The change in noise at all other properties within the project area was predicted to be negligible. The overall impact of the project on noise was predicted to slight negative.

The Revised Environmental Statement (RES) undertaken for the Project 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 Project incorporated several traffic noise-reducing features such as earth mounds/false cuttings and purpose-built noise barriers that appeared to have been delivered as expected, as confirmed in the one year after (1YA) and five years after (5YA) evaluation site visits. A quieter/lower noise road surface (LNS) to reduce noise was also laid, as confirmed by the pavement management system.

[24] The Department for Transport's transport analysis guidance (TAG) provides information on the role of transport modelling and appraisal. https://assets.publishing.service.gov.uk/media/66434490ae748c43d3793a87/tag-unit-a3-environmental-impact-appraisal.pdf

[25] https://assets.publishing.service.gov.uk/media/63a32a8d8fa8f539198d9bf3/TAG_Unit_A4.1_-_Social-impact-appraisal_Nov_2022_Accessible_v1.0.pdf.pdf

[26] The environmental appraisal is summarised in the Appraisal Summary Table (AST) (Feb 2014).

At 1YA, data was available for only one link (part of the project), i.e., Pembury Road which was the main project extent. No traffic data is available beyond the Longfield Road Junction (i.e., for Hasting Road at the southern end of the project). Therefore, traffic comments referred to Pembury Road only.

Two-way AADT flows provided suggested that outturn flows are slightly lower than forecast for all links of the project and within the threshold, i.e., -1% lower along the Pembury Road which was the main project extent. The suggested that the impact of the traffic on noise was likely to be as expected.

This POPE five years after evaluation has considered 30 road links across the road network, for which traffic flow data have been provided. However, all three traffic screening criteria could not be tested for any road link due to the lack of valid HDV and speed data. In addition, five of the 30 links could not be included in the evaluation due to lack of AADT traffic flows in the out-turn traffic data. Nevertheless, the evaluation has considered whether the Project outcome per road link is worse than, better than or as expected based on the AADT traffic flow for each of the remaining 25 road links, together with the HDV data for six of the 25 road links where data have been available.

Of the 25 road traffic links:

- 6 key road links along the A21 (A21 Tonbridge Bypass northbound (NB) and southbound (SB) (north of the Project), A21 Pembury Road NB and SB (with the Project extent) and A21 south of Longfield Road/Hastings Road NB and SB (south of the Project) had no change in flow between the forecast and out-turn AADT traffic flow data exceeding ‘25% more or 20% less’, nor a change in %HDV changes of ‘at least 10%’, as per the POPE criteria. The change in noise levels for these road links, based upon the traffic data available, would therefore be between 1.0 dB and +1.0 dB, resulting in an “as expected” outcome.
- A further 15 road links had no change in flow between the forecast and out-turn AADT traffic flow data exceeding ‘25% more or 20% less’, as per the POPE criteria. The change in noise levels for these road links, based upon the traffic data available, would therefore be between 1.0 dB and +1.0 dB, resulting in an “as expected” outcome.
- Four road links had a 20% decrease in flow between the forecast and out-turn AADT traffic flow data. The change in noise levels for these road links, based upon the traffic data available, would therefore be less than -1.0 dB, resulting in a “better than expected” outcome.
- The four road links which had a 20% decrease in traffic flow between the forecast and out turn traffic data are the A264 Pembury Road eastbound, B2176 Bidborough Ridge eastbound and A228 Maidstone Road northbound and southbound. There are residential properties adjacent to each of these four road traffic links, which may experience an overall “better than expected” slight decrease in road traffic noise levels.

Based on the available road links evaluated, the overall outcome of the five years after evaluation for Noise is “as expected”.

Air quality

The environmental appraisal originally reported that there would be an overall improvement in air quality at local properties due to the Project. However, the Project was also expected to result in an increase of nitrogen oxides (NO_x) emissions across the region. Overall, a benefit of £0.14 million was predicted.

The Revised Environmental Statement (RES) predicted improvements due to the Project, particularly along the A21 Castle Hill, where the road alignment changed to move emissions further away from properties, and along the A26 through Tunbridge Wells, where a reduction in predicted traffic flows was predicted. These improvements were in areas where the relevant air quality threshold was not expected to be exceeded. Overall, these improvements were determined to have a minor beneficial effect, which was considered significant.

As at one year after, this five years after evaluation was based on a comparison of observed traffic data to the forecast traffic data that was used for the original appraisal and Revised Environmental Statement. On the roads where data was available, traffic flows were found to be lower than expected. This included the Project road links (the A21 Pembury Road) and other roads in the wider area, including the A26. The overall effect of these changes is that emissions are likely lower than was originally expected. Additionally, air quality monitoring data[27][28] has been considered, and is compliant with air quality standards.

While not all data was available (limited availability of traffic observation data, particularly the numbers of heavy goods vehicles and the average speeds), sufficient data was available to carry out a robust assessment of the impacts.

Overall, evaluation of significance of the Project was likely to be as expected.

Greenhouse Gases

As was the case for the one-year after report, a calculation of Greenhouse gas emissions from observed traffic data to compare with forecast emissions was not possible due to absence of this data needed for these calculations (including speeds, and percentage of heavy duty vehicles). The total change in emissions caused by the Project cannot be evaluated with confidence from the data. Therefore, daily traffic flows were compared, and it was found that on the Project road links (including the A21 Pembury Road) there was less traffic than was forecast, which implies that CO_2 emissions were likely to also be lower than was forecast.

Landscape

The environmental appraisal reported that the project would have an adverse effect on the High Weald Area of Natural Beauty (AONB). This was due to loss of woodlands and hedgerows resulting in landscape severance along the local ridgeline, although the existing A21 already traversed the AONB imposing a degree of severance. The loss of sections of woodland was expected to open up of views of the widened road corridor, elevated junctions, traffic and lighting to the surrounding countryside. The enlarged Longfield Road junction was also expected to become more dominant in the landscape. The project was not expected to be lit

[27] TMBC air quality report – Tonbridge and Malling Borough Council
[28] Air quality (tunbridgewells.gov.uk)

except around slip roads at Longfield Road. The significance of the impact of the project was predicted to be moderate adverse.

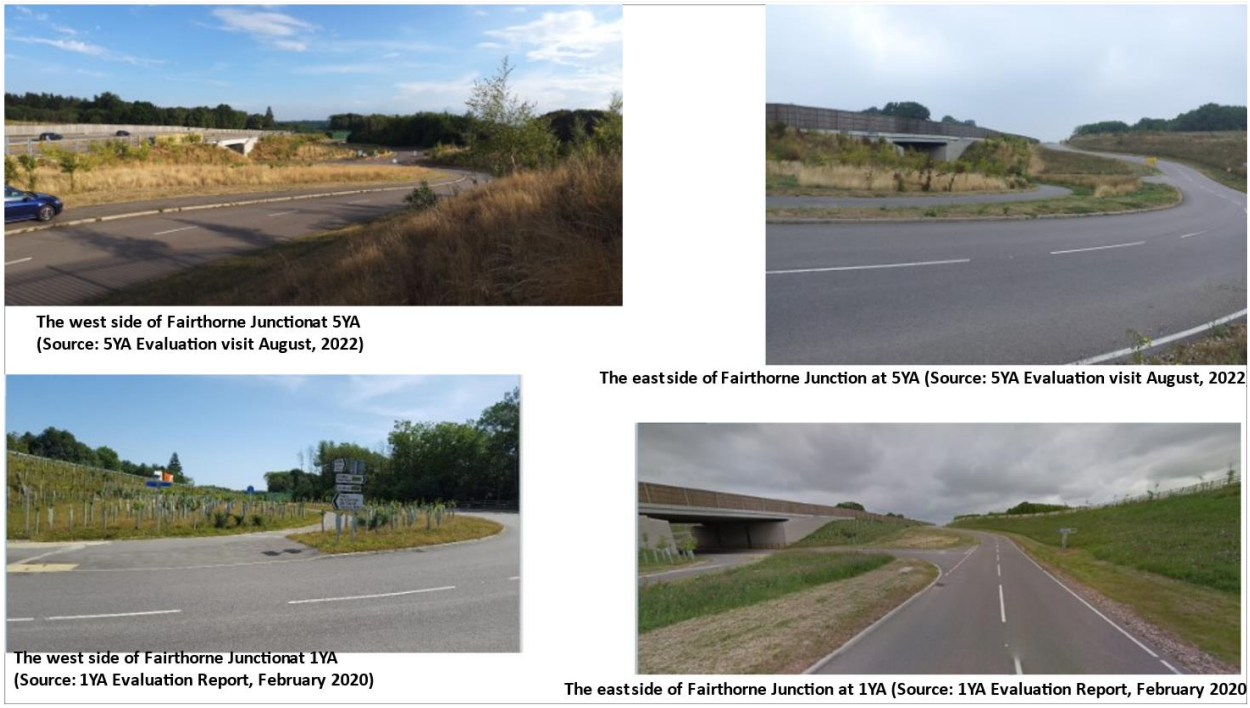
To mitigate the impacts, new woodland and hedge planting, and landscape bunds were proposed to reflect the existing pattern and help to obscure the road and reduce its impacts.

Our evaluation confirmed that the proposed landscape design was implemented as expected. Carriageway widening opened up the AONB, making the A21 a more prominent feature in the landscape. But this was mitigated by planting of embankment trees, species-rich grassland and hedges (especially those helping to blend some visual noise barriers) and planting at grade-separated junctions (Fairthorne and Longfield Road) and soil nailing at Castle Hill. At 1YA, planting was starting to establish. Further maturity of the planting was observed during the five years after evaluation site visit. Figure 16 provides an example of landscape changes at Fairthorne Junction.

Other mitigations (e.g. the Castle bund and trees on top and the retaining wall in Tudeley Woods) were in place and likely to perform as expected. However, one issue was noted at one year after (visual barrier broken by traffic north of Castle Hill) and another at five years after (cracks appearing on the road at Castle Hill). These were being resolved by the Area Team at the time of writing.

Overall, our evaluation indicated that whilst some issues have arisen, the impacts are broadly as expected. Provided an appropriate maintenance programme is implemented, the mitigation planting should continue to establish and overtime ensure the project meets its design year outcomes.

Figure 16 Establishment of the planting at Fairthorne Junction



Source: Five-year evaluation environmental site visit August 2022

Heritage of historic resources

The environmental appraisal and assessment reported that the Project would lead to the loss of woodland opening up the landscape and leading to views from properties along the road. Particular impacts of the project were expected to include the demolition and relocation of a Grade II listed building, demolition of an additional Grade II listed building and four historic buildings, impacts on the setting of historic buildings and the loss or partial loss of undesignated archaeological remains. With the adoption of a mitigation strategy, comprising archaeological, historic landscape, historic building evaluation, recording and excavation, it was concluded that the project would result in overall *moderate adverse* impact on historic resources.

Based on the one year after evaluation, desktop information and as confirmed at five years after, the impacts of the project on the Castle Hill Ancient Monument remained as expected. Excavation and post-excavation investigations, mitigations (recording and reporting) for archaeological remains were undertaken as expected. Demolition and relocation of the Burgess Hill buildings was undertaken as expected. Impacts and mitigations for other historic buildings remained as expected as screening by visual/noise barriers was likely to be functioning and mitigation planting was growing further from one year after as expected. Visual and noise fencing at Carpenters Cottage was in the process of being upgraded (see Figure 17). Thus, the overall impact of the project on historic resources was as expected.

Figure 17 Visual barrier near Carpenters Cottage (taken from the footway / cycleway towards A21)

At 1YA (Source: 1YA Evaluation Report, February 2020)

At 5YA barrier was being upgraded with concrete poles (Source: 5YA Evaluation visit August, 2022)

Source: Five-year evaluation environmental site visit August 2022

Biodiversity

The environmental appraisal reported that the project would result in the loss of 9ha of ancient woodland of which 3.1ha were designated as a Local Wildlife Site (LWS) and a potential Site of Special Scientific Interest (SSSI) for fungi. The appraisal predicted further impacts on habitats of negligible to medium value, including benefits for creating a heathland. Mitigations including woodland translocation/creation and 26.6ha of woodland enhancement were expected, with the widening project also enabling the construction of mitigation measures to enhance connectivity, such as badger tunnels. Compensation measures in the form of habitat translocation and/or habitat creation were expected to be implemented. The expected impact on protected species, including birds, bats and badgers was predicted to be neutral. This was on the assumption that the

mitigation and enhancement provided would address any adverse impacts. The impact on dormice was expected to be slight beneficial due to the overall increase in suitable habitat for this species. The overall significance of the impact of the project on biodiversity was expected to be *moderate adverse.*

The initial one year after evaluation and this five years after evaluation confirmed that the construction of the project resulted in the loss of ancient woodland and other terrestrial habitats along the project. The new woodlands and hedgerows were continuing to grow well further from one year after and were likely to function as habitats and corridors as expected from the environmental assessment. However, species-rich grasslands and two woodland plots planted on bunds (WC2A and WC6A) were struggling due to temporary dryness caused by the 2022 summer heatwave.

This five years after evaluations notes that woodlands generally require long term aftercare in order to meet the intended benefits This includes replacing failed trees and monitoring. Due to persistent issues with heathland remediation at the time of the five years after evaluation linked to issues establishing correct soil pH levels (see Figure 18), there were plans to turn the heathland area into a grassland. The experimental translocation of fungi did not succeed as expected. While mitigations for species, habitat and crossing points (works under licences, e.g., the bat hopover and underpass at Fairthorne Junction) were delivered and seen during site visits, it was not possible to fully comment on their effectiveness due to the absence of monitoring information at five years after

The Woodland Management Plan developed at the time of the environmental assessment needs to be implemented and continuously monitored to maintain the ecological benefits of the project. Conversations were ongoing between Natural England and the National Highways regarding long-term woodland management. Most mitigations were working at five years after. But due to the failure of heathland mitigation, it was difficult to confirm that the impact of the project was as expected.

Figure 18 Heathland and bund at Fairthorne Junction looking towards A21 (pH issues still unresolved)

Source: Five-year evaluation environmental site visit August 2022

Water environment

The appraisal predicted that the project 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 project design, it was expected that there would be a *slight benefit* to water quality and conveyance of flow.

Based on the one year after and five years after evaluation visits, the drainage appeared to be a significant improvement over the previous system reported in the environmental assessment, with the improvement of the Somerhill Stream Culvert and introduction of the balancing ponds and pollution control devices to control discharge to watercourses. In the absence of service records and/or monitoring information for drainage facilities which are needed to confirm findings, the ponds (and other water resources) were provided and appeared to be functioning as expected. However, silting was identified near Somerhill Stream although it was not considered that it had a material effect on the who drainage system. Concerns were raised regarding flooding incidents involving excess road surface water at times and filter drains not functioning well at some locations (e.g., north of Castle Hill). These were being addressed by the Area team at the time of the five years after evaluation. Regular maintenance of the balancing ponds will be important to keep them functioning as designed.

Figure 19 Balancing Pond one at the northern end of the project

Balancing pond one at 1YA (Source: 1YA Evaluation Report, February 2020)

Balancing pond one at 5YA (Source: 5YA Evaluation visit August, 2022)

Overview

The results of the evaluation are summarised against each of the Transport Appraisal Guidance (TAG)[29] environmental sub-objectives and presented in Table 4. In the table we report the evaluation as expected if we believe that the observed impacts at five years 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 soon to say if we feel that there is insufficient evidence to draw firm conclusions.

[29] TAG provides guidance on appraising transport options against the Government's objective for transport

Table 4 - Summary of Environmental findings

Sub Objective	AST Score	Evaluation Outcome	5YA Evaluation Summary
Noise	Change in population annoyed by design year = -2 NPV = £0.096million	As expected	Several noise-reducing features comprising earth mounds/false cuttings and purpose-built noise barriers and a low noise surface that appear to be delivered as expected. 6 key road links along the A21 itself (including those within the Project extent) are with the +1.0dB to -1.0 dB range ('as expected'). 21 road traffic links are within the +1.0dB to -1.0 dB range ('as expected'). 4 links had a change in noise level of less than -1.0 dB ('better than expected').
Air Quality	NO2 = -176 PM10 = -103 NPV = £0.14million	Likely as expected	Local air quality monitoring reported no significant air quality concerns along the project. Daily traffic flows were observed to be lower than was originally forecast on both Project road links (the A21 Pembury Road), and in the wider area, likely resulting in lower pollutant concentrations than were forecast. Improvements in air quality in off-scheme areas of existing poor air quality were forecast and these improvements have been evidenced by local monitoring showing concentrations below the NO_2 annual mean objective value. The Project remains significant effect classed as minor beneficial.
Greenhouse Gases	NPV (non-traded emissions) = -13.09million	Likely better than expected	On the basis of the limited dataset available it is possible that the Project has led to lower Greenhouse gas emissions than was predicted due to lower-than-expected traffic flows. But there was no reliable traffic data to confirm.

Sub Objective	AST Score	Evaluation Outcome	5YA Evaluation Summary
Landscape	Moderate adverse	As expected	Carriageway widening opened up the High Weald AONB, making the A21 a more prominent feature in the landscape but this has been mitigated by replacement planting. The proposed mitigation appeared to be in place and was establishing in most locations Provided maintenance continues, the mitigations should perform their intended functions by design year.
Heritage of historic resource	Moderate adverse	As expected	The archaeological investigations were undertaken (including recording and reporting) as expected. The impacts on other historical resources (e.g. Castle Hill Ancient monument, the relocated Burgess Hill buildings, Carpenters Cottage, etc.) were as expected.
Biodiversity	Moderate adverse	Mostly as expected	The project led to the loss of ancient woodland and other terrestrial habitats. However, new woodlands and hedgerows were observed to be maturing well. Some plots were observed to be struggling owing to the temporary Summer 2022 heatwave. Provided maintenance continues, the mitigations should perform their intended functions by design year.
Water Environment	Slight benefit	As expected	The drainage appeared to be a significant improvement over the previous system reported in the environmental assessment, with the improvement of the Somerhill Stream Culvert, creation of the balancing ponds and pollution control devices to control discharge to watercourses. With regular maintenance, the drainage system should continue to control flooding and water quality by the design year.

7. Value for money

Summary

As part of the business case, an economic appraisal was conducted to determine the project's value for money. This assessment was based on an estimation of costs and benefits over a 60-year period.

A value for money (VfM) assessment conducted at five years after opening indicates that the project represents a positive economic case with a category of 'medium', considering both monetised and non-monetised benefits. If non-monetised benefits were discounted, then the project would likely offer 'low' value for money instead. The category assigned at the evaluation lies below the forecast 'high' value for money (and below the high / low growth forecast range), however this may be due to methodological limitations associated with the five years after assessment, the impact of COVID-19 upon traffic levels, as well as cost overruns associated with clearing hazardous material found at several locations during ground works.

The project has provided additional capacity to support more road users (with 24-hour Average Weekday Traffic (AWT) flow increasing by 19.1%), increased speeds, reduced journey times and improved journey time reliability.

Forecast value for money

An economic appraisal is undertaken prior to construction to determine a project's value for money and inform the business case. The appraisal is based on an estimation of costs and benefits. The impacts of a project, such as journey time savings, changes to user costs, safety impacts and some environmental impacts can be monetised. This is undertaken using standard values which are consistent across government. The positive and negative impacts over the life of the project[30] are summed together and compared against the investment cost to produce a benefit cost ratio (BCR). The monetised impacts are considered alongside additional impacts which are not able to be monetised, to allocate the project a 'value for money' category.

Since 2011, we have routinely forecasted benefits over a range of possible traffic growth scenarios.[31]

The monetised benefits forecast by the appraisal which supported the A21 dualling business case are set out in Table 5. We have also included an indication of what proportion of the monetised benefits each impact accounted for and a summary of how we have treated the monetisation of each impact in this evaluation.

[30] Typically project life is taken to be 60 years.

[31] For this project we undertook a core scenario, which is intended to provide a consistent basis for decision-making given current evidence, and a 'common comparator' to assess all projects and options against. There are significant uncertainties associated with forecasting travel demand. Therefore, we also undertook scenario testing to check whether the intervention is likely to still provide value for money under low demand assumptions and the likely effects of high demand on the project impacts. Not all the benefits considered would have contained high and low growth forecasts, so a proportionate method was designed to estimate these based on existing evidence.

Table 5 - Monetised benefits of the project (£ million)

	Forecast (£M)	% forecast monetised benefits[32]	Evaluation approach
Journey times	287	99%	Re-forecast using observed and counterfactual traffic flow and journey time data for the project area only and not those in the wider area. Only the 12-hour period can be re-forecast (Morning, Daytime and Evening). This may miss some of the journey time benefits associated with the overnight period.
Vehicle operating costs (VOC)	-1	0%	Re-forecast using observed and forecast traffic flow and journey time data.
Journey time & VOC during construction and maintenance	-15	-5%	Not evaluated (assumed as forecast)
Safety	29	10%	Monetised benefits assumed as forecast.
Carbon	-13	-5%	Not evaluated (assumed as forecast)
Noise	0	0%	Not evaluated (assumed as forecast)
Air quality	0	0%	Not evaluated (assumed as forecast)
Indirect tax revenues	3	-1%	Re-forecast using observed and forecast traffic flow and journey time data.
Total present value benefits	**291**	**100%**	

Note: 2010 prices discounted to 2010. Due to rounding the numbers and percentages may not always add up exactly to the presented totals.

The costs anticipated in the appraisal are set out in Table 6. Based on this information, the project was anticipated to deliver 'High' value for money under the core traffic growth (most likely) scenario over the 60-year appraisal period. In addition to the core forecast, high and low alternative growth scenarios were also tested. These alternative growth scenarios were used to determine the impact associated with higher-than-expected future traffic growth, and lower-than-expected traffic growth. The sensitivity tests resulted in an expected value for money range of 'high' to 'very high' value for money.

Evaluation of costs

The project was delivered at a cost of £102.5 million[33], this was above the anticipated cost of £82.8 million (see Table 6). The cost overrun is due to extra cost associated with clearing hazardous material found at several locations during ground works.

[32] Disbenefits are presented as negative numbers and percentages. The total of the positive and negative contributions total to 100%

[33] This is the PVC (present value cost) of the project. This means it is presented in 2010 prices, discounted to 2010 to be comparable with the other monetary values presented.

Usually, maintenance costs are reported separately in appraisal, however these were included as part of the capital construction costs.

Table 6 - Cost of the project (£ million)

	Forecast (£M)	% of forecast costs	Evaluation approach
Construction costs	82.8	100%	Current estimate of project cost
Maintenance costs	-	-	Not forecast (included in capital cost of construction)
Total present value costs	**82.8**	**100%**	

Note: 2010 prices discounted to 2010. Due to rounding the numbers and percentages may not always add up exactly to the presented totals.

Evaluation of monetised benefits

Once a project has been operating for five years, the evaluation monitors the construction costs and the trajectory of benefits to re-forecast these for the 60-year project life. It is not proportionate to replicate modelling undertaken at the appraisal of a project or to monitor benefits over the entire lifecycle, so we take an assessment based on the trends observed over the first five years of operation and estimate the trend over the project life, based on these observations. This provides a useful indication and helps to identify opportunities for optimising benefits. In instances where it was not feasible to robustly compare forecast and observed impacts, the findings have been presented with relevant caveats.

Monetised journey time benefits

As can be seen in Table 5, monetised benefits were primarily driven by forecasted reductions in journey times over the modelled period compared to a 'do-minimum' scenario, what would be expected to happen if the project hadn't been constructed.

If the trends observed at the fifth year continue over the 60-year period, without any further action to optimise benefits, the monetised impact on journey times, for those using the road, would be 123.3million. This is lower than the £286.9 million forecast prior to project construction. The re-forecast figure, however, only reflects journey time trends observed on the project extent, not the surrounding road network which would have been considered in the appraisal. Moreover, it was only possible to re-forecast journey time benefits representing the 12-hour period (including morning, daytime and evening peaks). Any journey time benefits associated with the overnight period (between 7pm – 7am) were not included owing to a lack of data. Re-forecast monetised journey time benefits therefore likely under-value the true journey time benefits.

Moreover, observed traffic flows are lower than forecast traffic flows (likely owing to the COVID-19 pandemic). Journey time benefits are therefore multiplied over fewer road users than expected and therefore the monetised reforecast impacts are lower.

Monetised journey reliability benefits

Journey time reliability was not forecast at the pre-construction stage, and therefore it has not been monetised five years after. The route stress metric, which is a non-monetised indicator, shows evidence of improved journey time reliability as a result of the project improvements. This indicates that journey time reliability has improved, and users can now be more confident about how long their journey will take.

Other reforecast impacts

There are two further impacts associated with the changes in numbers and speeds of vehicles – indirect tax revenues and vehicle operating costs.

Indirect tax revenues are the benefit to the government (and therefore society) of the additional tax income from the additional fuel consumed due to increased speeds and distances travelled. This was forecast to be positive because more vehicles were forecast and they were forecast to be travelling at higher speeds, and therefore using more fuel and paying more tax. We have reforecast that the impact would be smaller (£2.3million) than the expected £3.2 million (Table 5)[34]. The indirect tax revenues are smaller because our evaluation has shown that the daily traffic flows on the route are lower than what was forecast. This is likely owing to the impact of COVID-19 upon traffic levels regionally.

Vehicle operating costs refer to the fuel and other costs borne by the user (such as the wear and tear on vehicles). These vehicle operating costs increase with increased distance travelled. There was a forecast vehicle operating cost disbenefit of £0.8 million (Table 5) and, based on the changes we have seen in observed traffic flows and journey times, we estimate the outturn impact to be a disbenefit of £0.6 million[35]. The disbenefit is reduced slightly because our evaluation has shown that the daily traffic flows on the route are lower than was forecast (as noted above, this may be attributed, in part, to the COVID-19 pandemic).

Impacts assumed as forecast

It was not possible to re-forecast a monetised value of safety due to the way the safety appraisal information was presented within the business case (the safety appraisal did not split by project extent and wider area). The value originally forecast (£29.1 million) has therefore been assumed.

There is currently no methodology available to re-forecast the carbon impact, noise or air quality impacts, and therefore these have been assumed as forecast[36].

Journey time and vehicle operating costs during construction and maintenance are not evaluated and therefore assumed as forecast. As the majority of maintenance costs will be accrued in the future, we did not have any information with which to update the estimate of maintenance costs and therefore the forecast from the appraisal remains our best estimate.

[34] This is the contribution to the PVB of the project. This means it is presented in 2010 prices, discounted to 2010 to be comparable with the other monetary values presented.
[35] This is the contribution to the PVB of the project. This means it is presented in 2010 prices, discounted to 2010 to be comparable with the other monetary values presented.
[36] These generally have a small contribution to the monetised benefits of projects and therefore the impact of assuming as forecast is unlikely to impact on the value for money rating of the project.

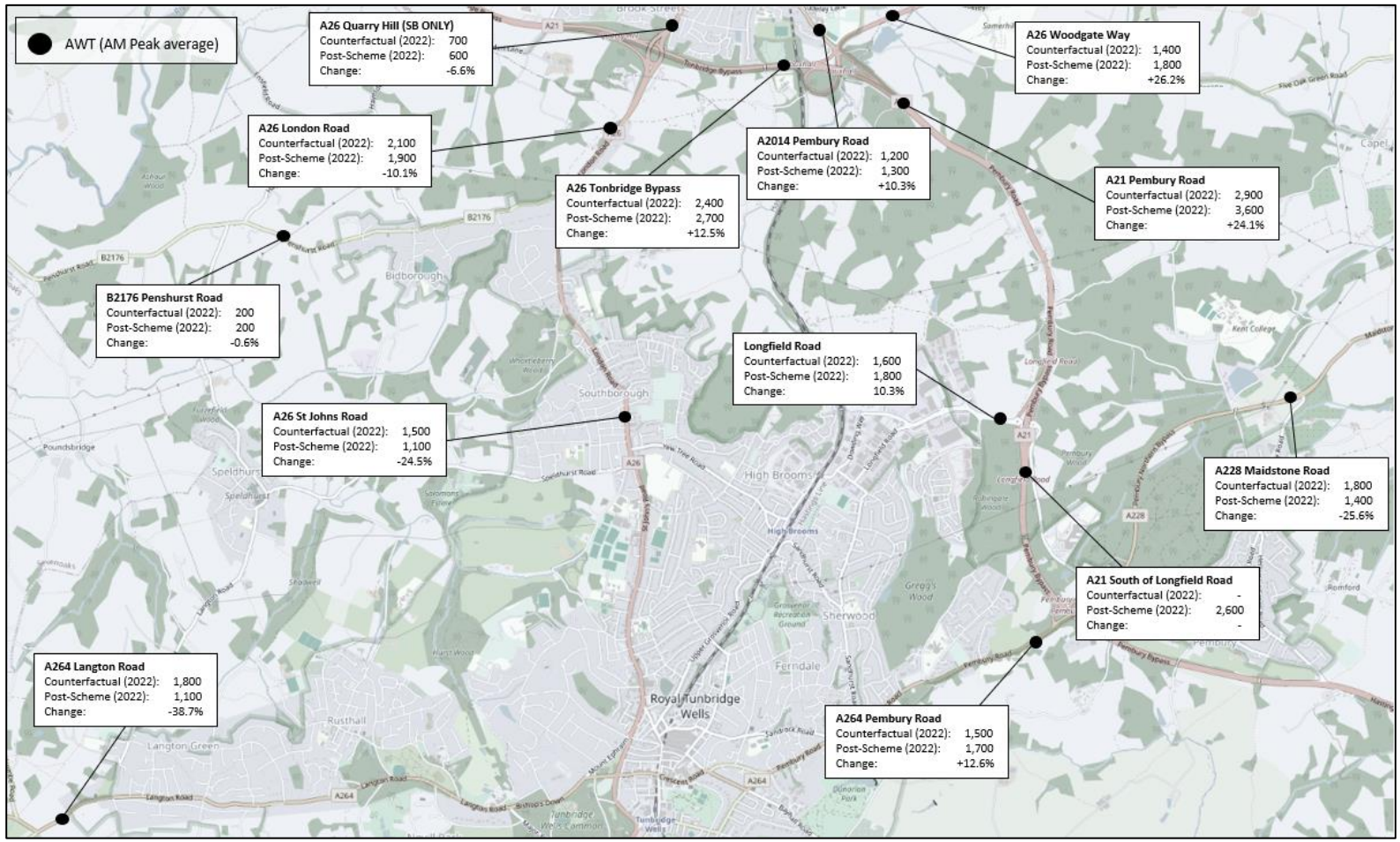
Overall value for money

When considering an investment's value for money, we also consider benefits that we are not able to monetise. For this project, wider economic benefits might be relevant but were not assessed as part of the forecasting or evaluation. Safety benefits have been assumed as forecast, however it is likely that reforecast benefits would be higher than the forecast due to greater collision savings. These non-monetarised benefits may therefore push the project into the 'medium' value for money category, although this cannot be said with confidence.

Analysis indicates that the project, based on the first five years, represents a positive economic case with a value for money assessment of 'low', once non-monetarised impacts are considered, such as safety. If only the monetised benefits were considered, this would change to 'low' value for money. The 'medium' category assigned from this evaluation is just below the 'high' value for money expected at as part of the business case. However, this may be due to methodological limitations associated with the five-year assessment, the impact of COVID-19 upon traffic levels, as well as cost overruns associated with clearing hazardous material found at several locations during ground works.

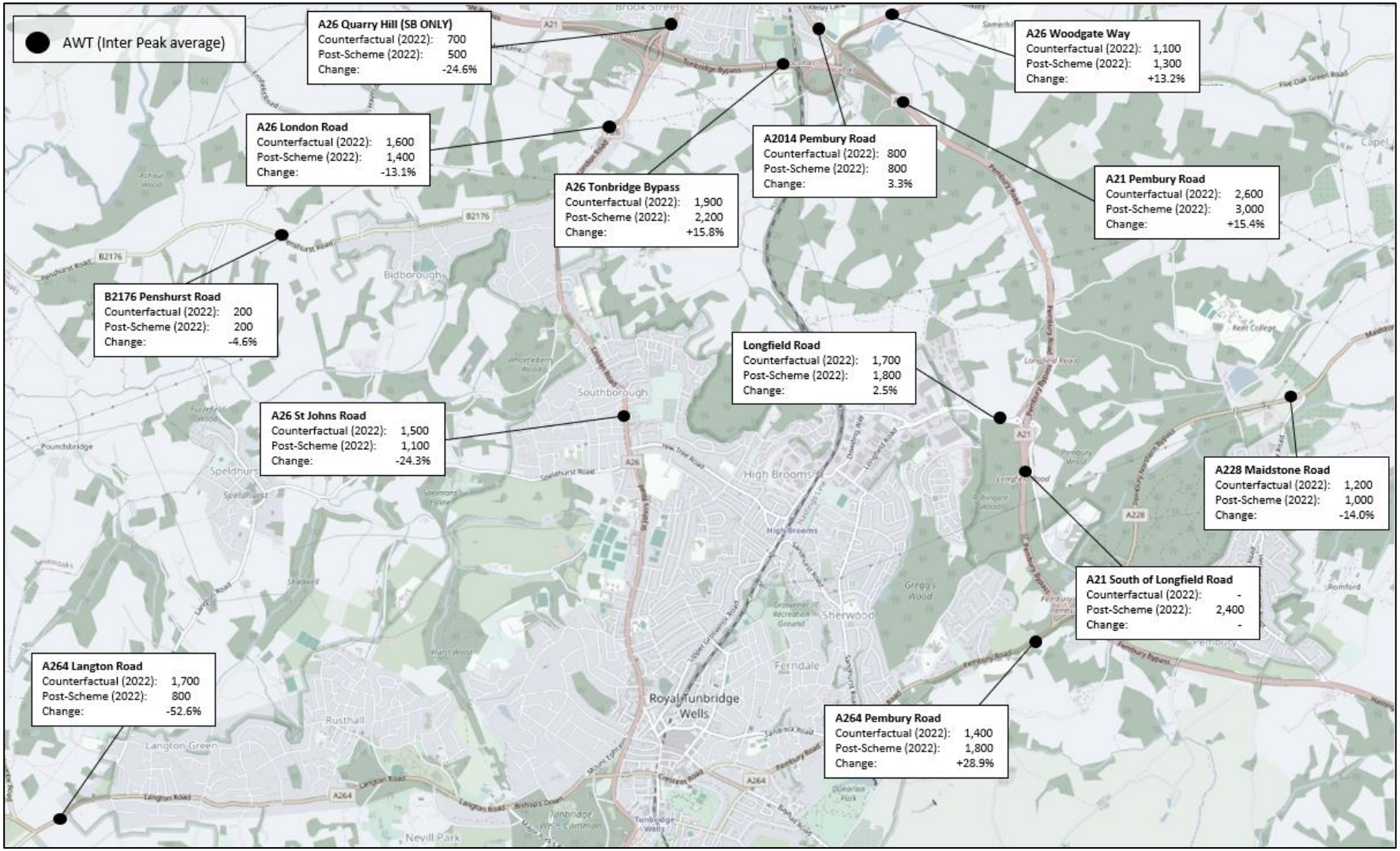
Appendix A

A.1 Changes in two-way traffic volumes (AWT) (Counterfactual vs Observed) – Morning Peak



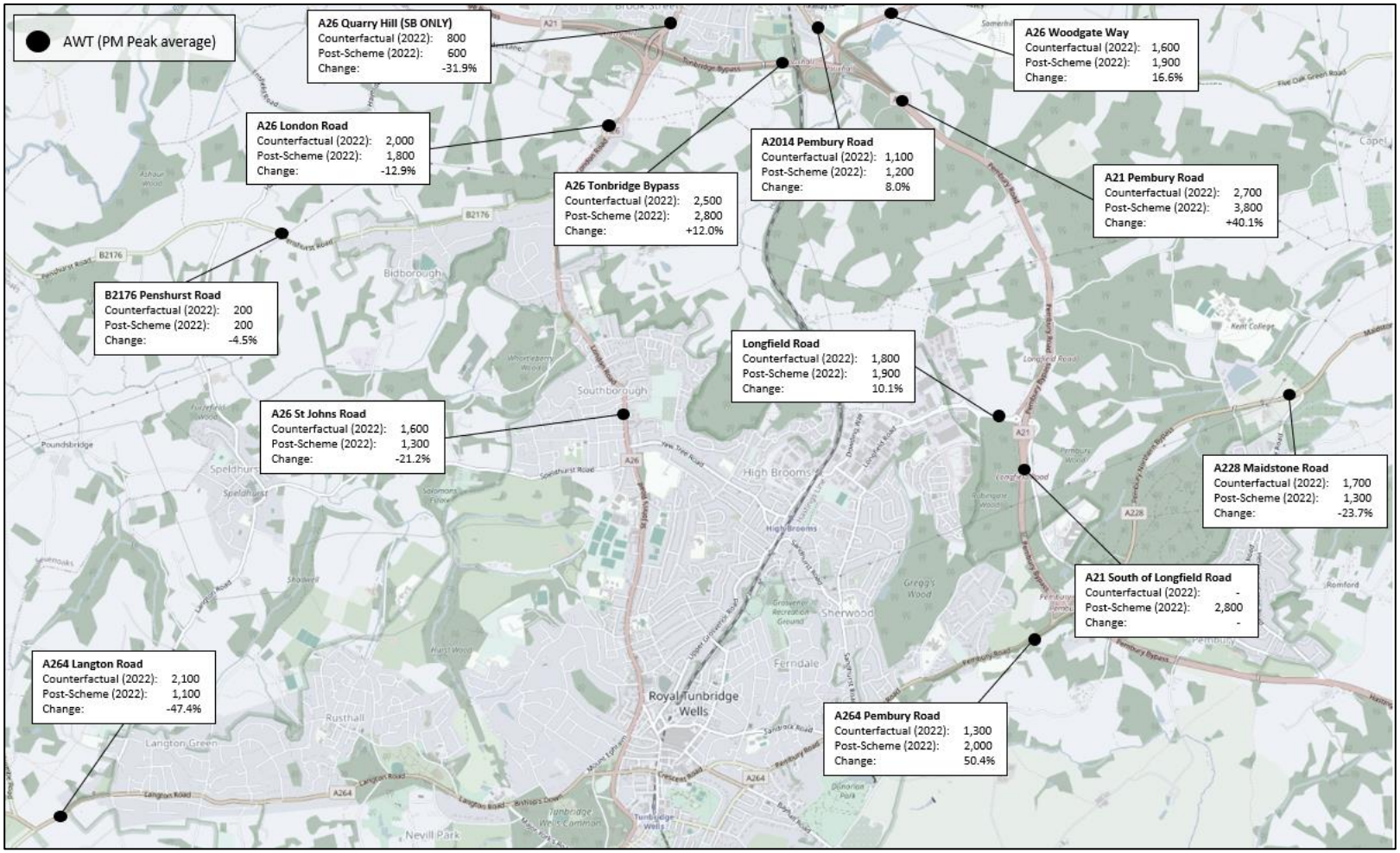
Source: WebTRIS and OpenStreetMap contributors (2024)

A.2 Changes in two-way traffic volumes (AWT) (Counterfactual vs Observed) – Daytime Peak



Source: WebTRIS and OpenStreetMap contributors (2024)

A.3 Changes in two-way traffic volumes (AWT) (Counterfactual vs Observed) – Evening Peak



Source: WebTRIS and OpenStreetMap contributors (2024)

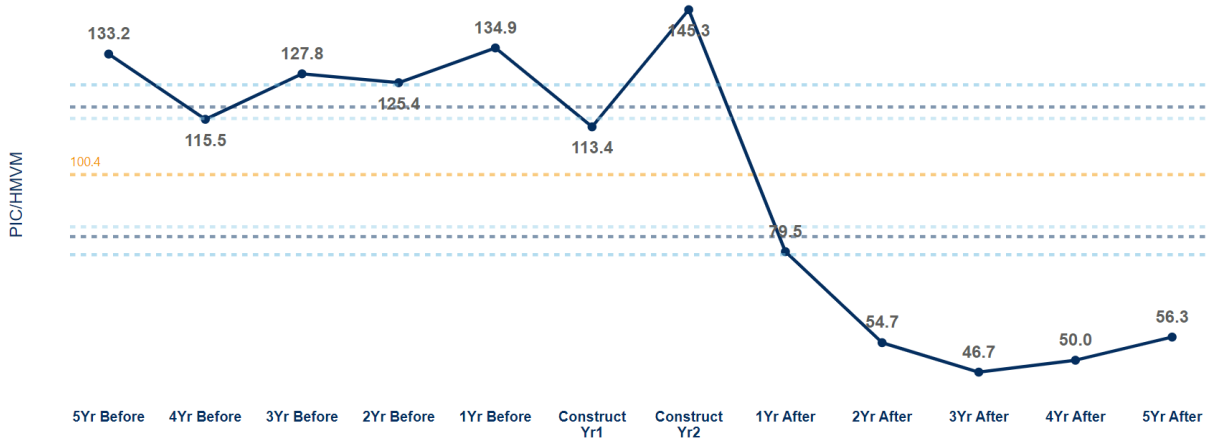
Appendix B

A.1 Road user safety on the wider area

How had traffic flows impacted collision rates in the wider area?

The evaluation has identified a decrease in the rate of collisions per hundred million vehicle miles (hmvm). Five years before there was an annual average of 127.4 personal injury collisions per hmvm. Five years after, there was a decrease to 57.4 personal injury collisions per hmvm (Figure A1). The counterfactual test undertaken found that the collision rate would likely have been between 84-119 personal injury collisions per hmvm. The after annual average collision rate falls outside the counterfactual range.

Figure A1 Annual average number of collision rate with counterfactual scenario ranges



Source: STATS19 2 April 2010 – 1 September 2022

This indicates we have observed a larger reduction in the rate that personal injury collisions occur than predicted.

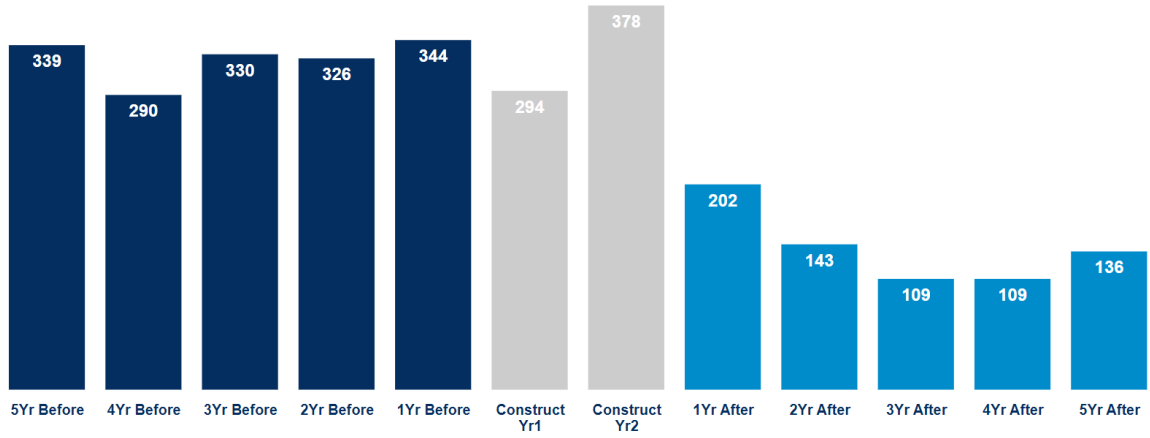
What impact did the project have on safety for the wider area?

Before the project an annual average of 326 collisions were observed. After the project, this had fallen to 140, a decrease of 186 (Figure A2).

Average personal injury collisions

326	140	186
Before	After	Fewer

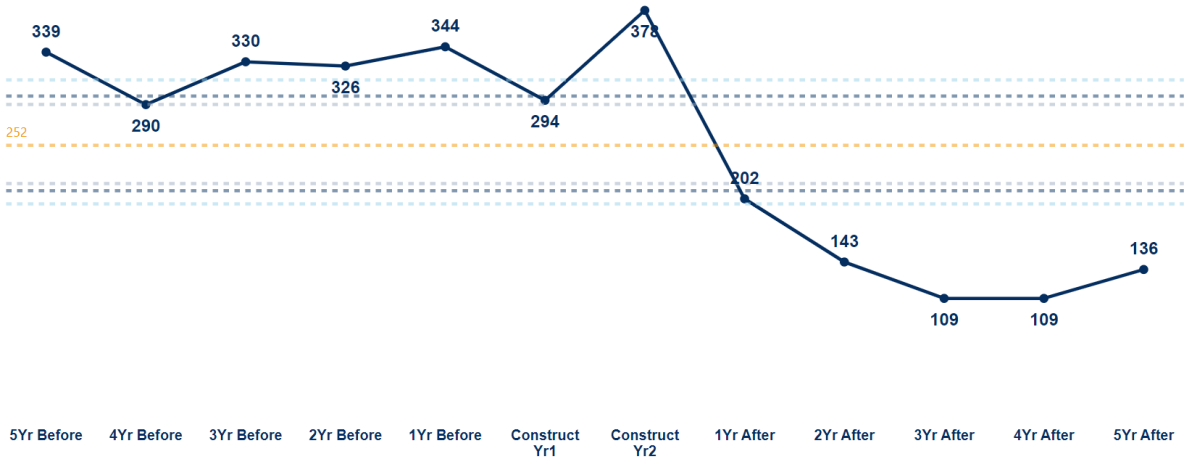
Figure A2 Annual personal injury collisions in wider area



Source: STATS19 2 April 2010 – 1 September 2022

The after annual average falls within the counterfactual range of between 210-298 personal injury collisions per year (Figure A3).[37]

Figure A3 Observed and expected range of personal injury collisions in wider area (annual average)



Source: STATS19 27 June 2013 – 30 March 2022

What changes in the severity of collisions did we see?

See Annex B for information on when police forces transitioned to a new method in how severity of incidents is recorded.

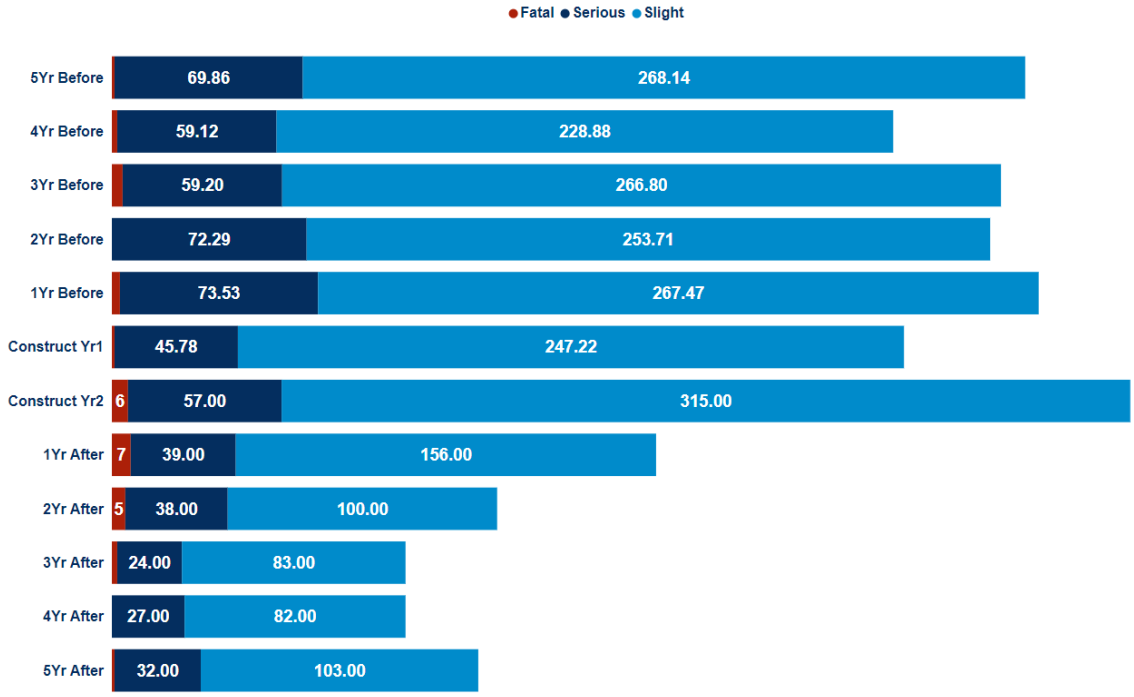
After the project there has been a reduction in serious and slight severity categories (Table A1) and an increase in fatal collisions. Figure A4 shows the full breakdown of severity of personal injury collisions by project year.

[37] We have tested the results at 95% confidence interval. The critical value at 95% confidence interval is 252, the observed collision savings for the wider area are lower than this value of 252. We believe that the collisions savings observed for the wider safety area ensure that the project has met its safety objective.

A1 Number of personal injury collisions by severity

	Before	After	Change	Change direction
Fatal	10	15	5	↑
Serious (average)	66.8	32	34.8	↓
Slight (average)	257	104.8	152.2	↓

Figure A4 Severity of personal injury collisions within the wider area



Source: STATS19 2 April 2010 – 1 September 2022

What impact did the project have on casualties?

There has been a reduction in the FWI observed annually. An annual average of 8.4 FWI was observed after the project became operational. This is a reduction compared to the average 13.3 FWI observed before.

The combined measure showed an extra six million vehicle miles was travelled before an FWI[38].

A reduction of 37 KSI has been observed annually. Reducing from an average of 78 KSI before to 41 KSI after the project became operational. The rate of KSI per hmvm has reduced from an average of 30.8 to 17 for every hmvm travelled.

The observations for KSI suggests that the project is having a positive safety impact on the severity of casualties within the wider area.

[38] Before the project, 109 million vehicle miles needed to be travelled before a FWI (0.9 FWI per hmvm). After the project this increased to 115 million vehicle miles (0.9 FWI per hmvm).

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