national highways

A45/A46 Tollbar End improvement

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 A45/A46 Tollbar End Improvement project was officially opened during this period, in March 2017.

Before the project, this part of the road network had been operating above its design capacity for many years, causing queues and delays especially during peak hours. The project was designed to relieve traffic congestion and improve access to local businesses and Coventry Airport. It was also our objective to improve safety and to improve pedestrian access around Tollbar End roundabout.

The improvements included a dual carriageway underpass link enabling customers on this route to avoid using Tollbar End roundabout circulatory and widened the existing A45 Stonebridge Highway from a two-lane dual-carriageway to a three-lane dual-carriageway between the improved Tollbar End junction and Stivichall Interchange.

This report gives an indication of the project's performance in the fifth year of its operation. The project has achieved its objectives, with improved safety following a reduction in personal injury collisions, and collision rates. Congestion has reduced, with journey times and reliability improved at five years after for customers using the new underpass link at Tollbar End. However, average journeys times have increased on several approaches to Tollbar End roundabout.

The project has delivered improved facilities for pedestrians and with appropriate ongoing mitigation, the project has kept adverse environmental impacts to a minimum. Some maintenance issues have been noted, including the presence of weeds in planting plots and Typha latifolia in balancing ponds.

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 A45-A46 Tollbar End improvement is situated to the south of Coventry. The project encompassed the A45 Stonebridge Highway, extending to the A46 south of Stivichall Interchange and the A46 east of Tollbar End junction. The improvement was officially opened in March 2017.

The project created a two-lane dual-carriageway underpass link between A45 Stonebridge Highway and A46 Coventry Eastern Bypass at Tollbar End junction. The new underpass link enables customers on this route to avoid using Tollbar End roundabout circulatory. The project also widened the existing A45 Stonebridge Highway from a two-lane dual-carriageway to a three-lane dual-carriageway between the improved Tollbar End junction and Stivichall Interchange. The approach arms to Tollbar End junction and two of the approaches to Stivichall Interchange were improved as part of the project to allow traffic to manoeuvre safely into the required lane on approach to the junctions and to aid traffic flow.

Before the project, this part of the road network had been operating above its design capacity for many years, causing queues and delays especially during peak hours. The project was designed to relieve traffic congestion and improve access to local businesses and Coventry Airport. It was also our objective to improve safety and to improve pedestrian access around Tollbar End roundabout.

This report presents the findings of the evaluation of the project after the first five years of its operation (2022) and builds on the emerging finding reported at one-year after.[1]

Our evaluation of customer journeys showed a mixture of findings. Journey times and reliability improved at five years after for customers using the new underpass link at Tollbar End but deteriorated for some movements through Tollbar End junction. The total vehicle hour savings for all movements through the junction decreased considerably at five years after compared to one-year after. This reduction is likely to be due to a decrease in traffic levels post covid-19 pandemic. A comparison of observed and forecasted journey times also highlighted mixed changes for different routes and directions.

In the five years since the project opened for traffic, there had been a reduction in the rate and number of collisions on the project extent. Average collision rate had decreased by ten personal injury collisions (PICs) per hundred million vehicle miles (hmvm). Reducing from 24 PICs per hmvm before the project to 14 PICs per hmvm after the project. The average number of collisions had nearly halved from 11 PICs prior to construction and six PICs after construction. Serious and slight collision severity had improved but there had been an increase of one fatal collision[2]. Observations from the wider safety area suggested a positive impact on all key safety measures. We believe that the project is on track to meet its safety objective.

The environmental impacts of the project were broadly as expected although limited traffic data meant the scope of our noise, air quality and greenhouse gas evaluations were affected. The presence of weeds in planting plots and Typha latifolia in balancing ponds was identified and these will need to be managed

[1] https://nationalhighways.co.uk/media/klrpiseb/a45-a46-tollbar-one-year-post-opening-evaluation.pdf

[2] Fatal incident involved a pedestrian using unofficial route on outside of Tollbar End roundabout

effectively to ensure the success of the mitigation. New developments adjacent to the A45 Stonebridge highway at Whitley south including the logistic hub and junction at Scimitar Way had impacted on our soft estate. However, their impact on our landscape and biodiversity outcomes could not be quantified.

When taking non-monetised additional benefits into account it is likely that the project could deliver ‘medium’ value for money over the 60-year appraisal period. However, this still falls below the anticipated ‘very high’ value for money. As traffic growth is expected to return to what was forecast when this project was appraised, it is possible that the project could deliver more benefits in the future. If the trends observed within the first five years continue, the project is expected to deliver lower than expected value for money.

2. Introduction

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

The A45 Tollbar End junction had been operating above its design capacity for many years, causing queues and delays especially during peak hours.

The project was designed to provide relief from traffic congestion and improve access to local businesses and Coventry Airport. The project design set out to achieve these objectives by improving the capacity around the Tollbar End junction and A45 Stonebridge Highway.

It was also an objective to improve safety and to improve pedestrian access around Tollbar End roundabout.

The project comprised of the following elements:

- two-lane dual-carriageway underpass link between A45 Stonebridge Highway and A46 Coventry Eastern Bypass at Tollbar End
- A45 Stonebridge Highway widened to a three-lane dual carriageway, between Tollbar End junction and Stivichall junction.
- improvements to approach arms and circulatory carriageway at Tollbar End roundabout
- Siskin Drive and Rowley Road junction upgraded from a roundabout to a traffic signal-controlled junction.
- traffic signals introduced on all approaches to the improved Tollbar End roundabout[3]
- new sign gantries and re-painted lane markings at A46 northbound approach to Stivichall Interchange and A45 westbound approach to Stivichall Interchange
- junction of Stonehouse Lane and Stonebridge Highway closed.
- improved pedestrian access around Tollbar End roundabout
- new shared footpath cycleway along the southern side of the A45 Stonebridge Highway linking together Tollbar End and Stivichall junctions.

The project was designed to reduce the volume of traffic using Tollbar End roundabout (by providing the underpass link). Widening the A45 Stonebridge Highway was to enable traffic to safely manoeuvre into the required lane on the approach to Tollbar End junction and Stivichall Interchange, as well as increasing capacity.

Signalising the junction of Siskin Drive and Rowley Road was designed to improve access to local businesses and Coventry Airport. Signalising all approaches to Tollbar End roundabout was to maximise the efficiency of traffic movement through the area.

[3] Prior to the improvement only some approaches to Tollbar End roundabout were signalised: A45 Stonebridge Highway, A46 Coventry Eastern Bypass and A45 London Road.

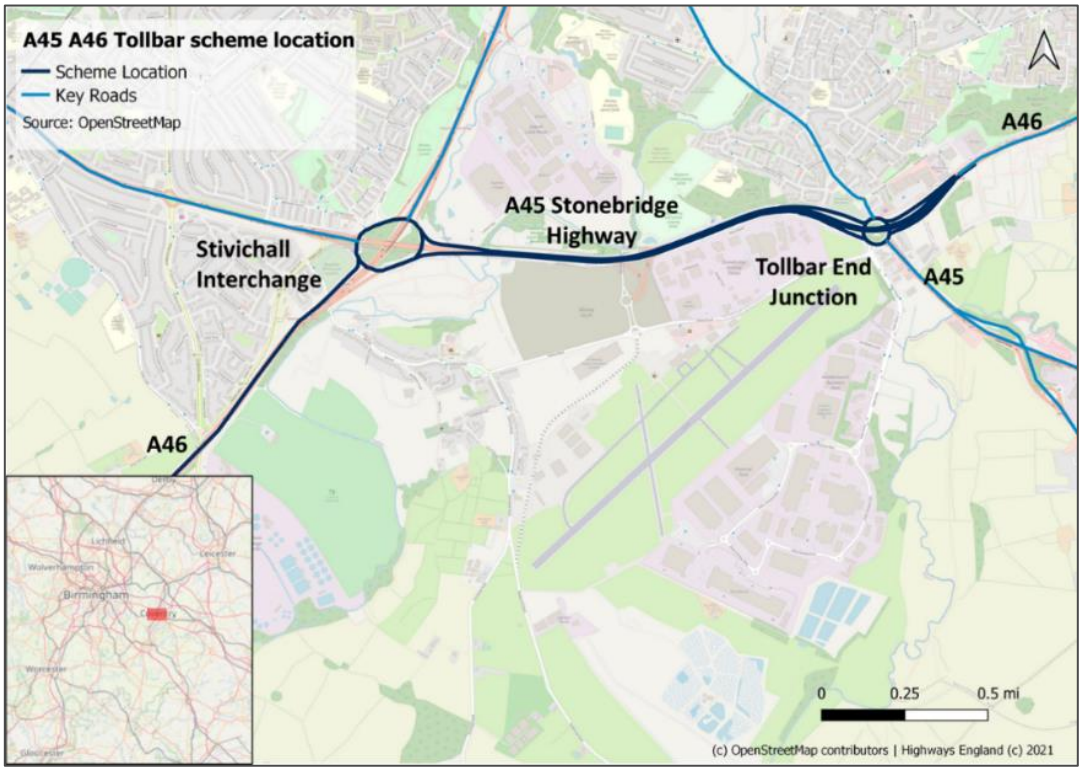
The creation of new shared-use paths was to improve access for pedestrians and cyclists around Tollbar End roundabout and between Tollbar End and Stivichall Interchange.

The improvement was officially opened in March 2017. Since the opening of our Tollbar End project there have been further road improvements in the vicinity on both the A45 and A46. This includes a new junction on the A45 just to the west of Tollbar at Whitley south. This opened in July 2021 during our five years after analysis and supports the new logistics park and Jaguar Land Rover factory. To the northeast of Tollbar along the A46, Binley junction[4] has also been improved and it opened in November 2022.

Project location

The A45-A46 Tollbar End improvement is situated to the south of Coventry. The project encompassed the A45 Stonebridge Highway, extending to the A46 south of Stivichall Interchange and the A46 east of Tollbar End junction.

Figure 1 A45 / A46 Tollbar End project location



Source: National Highways and OpenStreetMap contributors

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.

[4] https://nationalhighways.co.uk/our-roads/west-midlands/a46-coventry-junctions-upgrade/

A post-opening project evaluation compares changes in key impact areas[5] 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.[6]

[5] Key impact areas include safety, journey reliability and environmental impacts.
[6] https://nationalhighways.co.uk/media/pq2jb142/pope-methodology-note-2024-v2.pdf

3. Delivering against objectives

How has the project performed against objectives?

Our major projects have specific objectives which are defined early in the business case when project options are being identified. The project had five key objectives, primarily related to relieving congestion, maintaining safety for road users, and improving access to local business and Coventry airport.

These objectives are appraised to be realised over 60 years, the evaluation provides early indication if 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. There had been no changes to the pedestrian access around Tollbar End roundabout since the one-year after evaluation and so the outcome presented here is a summary of the outcome reported then.

Table 1 Objectives and Evaluation summary

Objective	Five-year evaluation
Provide relief from traffic congestion	The project had reduced the overall volume of traffic going around the junction and improved journey times for those using the new underpass. The new road markings and signage improved traffic flow on the approach to the Stivichall Interchange. However, despite the removal of traffic from the junction, average journey times for some customers travelling around the junction increased in some assessed time periods.
Maintain and, where possible, improve current safety standards	On the project extent, there had been a reduction in collision rate and the number of collisions. Serious and slight collision severity had improved. There had been an increase of one fatal collision. Observations from the wider safety area suggested a positive impact on all key safety measures. We believe that the project is on track to meet its safety objective.
Improve pedestrian access around Tollbar End roundabout	New shared footpath/cycleway built along the southern side of the A45 Stonebridge Highway linking together Tollbar End and Stivichall Interchange. Pedestrian access was also improved at Tollbar End roundabout with new signal-controlled crossing points.
Improve access to local businesses and Coventry Airport	Access to local businesses at Coventry Airport and Middlemarch Industrial Estate had been improved by the changes to the junction at Siskin Drive and Rowley Road. However, average journey times appear to have increased on several approaches to Tollbar End roundabout.
Ensure there is no significant worsening of the Appraisal Summary Table sub-criteria and to improve them over the existing conditions where possible	The project had a positive impact on safety and delivered improved facilities for pedestrians. The environmental impacts were broadly in line with those predicted and provided an appropriate maintenance regime is followed; the design year outcomes should be met.

4. Customer journeys

Summary

At five years after, traffic levels had dropped on the roads in the vicinity of the project. This decrease in traffic levels is in line with the background growth in traffic and is lower than forecast traffic levels.

For customers using the new underpass link at Tollbar End, journey times and reliability improved. Average journey times improved by 60 seconds or greater at five years after in all time periods in comparison to the before period.

For customers travelling through Tollbar End junction, journey times and reliability deteriorated in some movements. It is likely that the increased journey times are a result of traffic flow increases for certain movements (B4110 London Road and A45 London Road) at Tollbar End, despite observed flows around the project being below forecast flows.

We also analysed the vehicle hour savings to determine if there was an overall net benefit on congestion in the study area. This is driven by the vehicle hour savings from the new underpass link at Tollbar End. In comparison to the one year after, the vehicle hours saved at five years reduced significantly by 83600 hours for all movements at the Tollbar End junction. The reduction in vehicle hours is likely due to decrease in traffic levels post covid-19 pandemic. However, there was an increase in the total vehicle hours saved on the Tollbar End only movements at five years after.

The comparison between observed journey times and forecast was possible only for two routes: between A45 Stonebridge Highway and A46 Coventry Eastern Bypass, and between A46 Kenilworth Bypass and A46 Coventry Eastern Bypass. Between A45 Stonebridge Highway and A46 Coventry Eastern bypass, the eastbound route saw positive changes with observed journey times at five years after lower than forecasted journey times in all time periods. On the westbound route, observed journey times were higher than forecast in the interpeak period, but lower than forecast in the morning and evening peak periods.

Between A46 Kenilworth Bypass and A46 Coventry Eastern Bypass, the eastbound route showed positive changes with observed journey times at five years after lower than forecast in the morning and evening peak periods. However, on the westbound route, the observed journey times were higher than forecast during the interpeak and evening peak periods, but lower than forecast in the morning peak periods, indicating a positive change only during the morning peak.

In summary, the evaluation of customer journeys showed a mixture of findings. Journey times and reliability improved at five years after for customers using the new underpass link at Tollbar End but deteriorated for some movements through Tollbar End junction. The total vehicle hour savings for all movements through the junction decreased considerably at five years after compared to one-year after, and the comparison of observed and forecasted journey times highlighted mixed changes for different routes and directions.

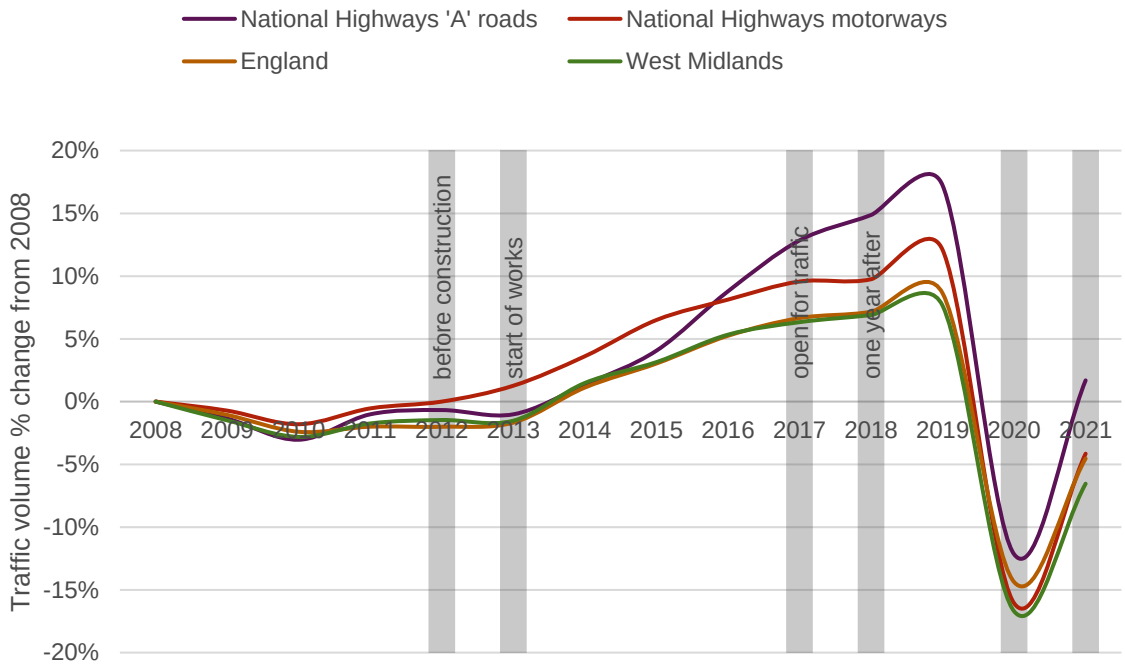
How have traffic levels changed?

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

National and regional

To assess the impact of project on traffic growth, it is useful to understand the changes within the context of national and regional traffic. We use this information as a relative baseline from which to measure a project's impact on traffic growth. We attribute to the project any growth observed on roads in the study area which is above the baseline trends.

Figure 2 Background Traffic Trends



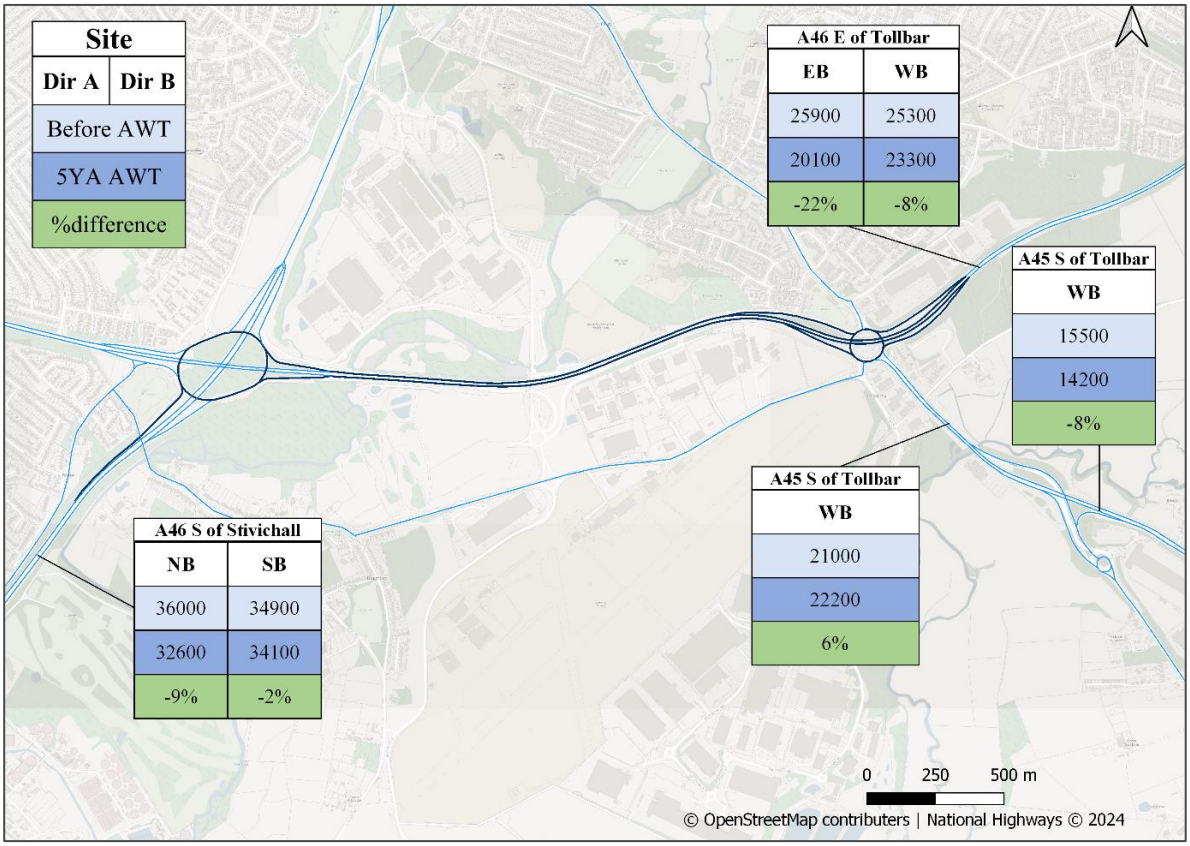
Source: Department for Transport road traffic statistics

The relevant background trends for the project are illustrated in Figure 2. Between the pre-construction period (2012) and one-year after period (2018), National Highways 'A' roads saw the largest increase in traffic volumes of around 15%. At the national (England) and regional (West Midlands) level, traffic growth of around 7% was observed whereas on the National Highways motorways traffic volumes grew by around 10%. Between 2019 and 2020, there was a major dip in traffic volumes due to the COVID-19 pandemic. In 2021(five years after period), National Highways motorways saw a slight increase in traffic volumes of around 2%, while all other road types saw negative growth in traffic volumes.

How did traffic volumes change?

We analysed the traffic growth adjacent to the project extent and its vicinity for before (2012) and five years after (2021). Our analysis of traffic growth was limited by the lack of five years after data around the Stivichall Interchange. We have attempted to use data from site locations adjacent to project section to support our evaluation.

Figure 3 Comparison of average weekly traffic



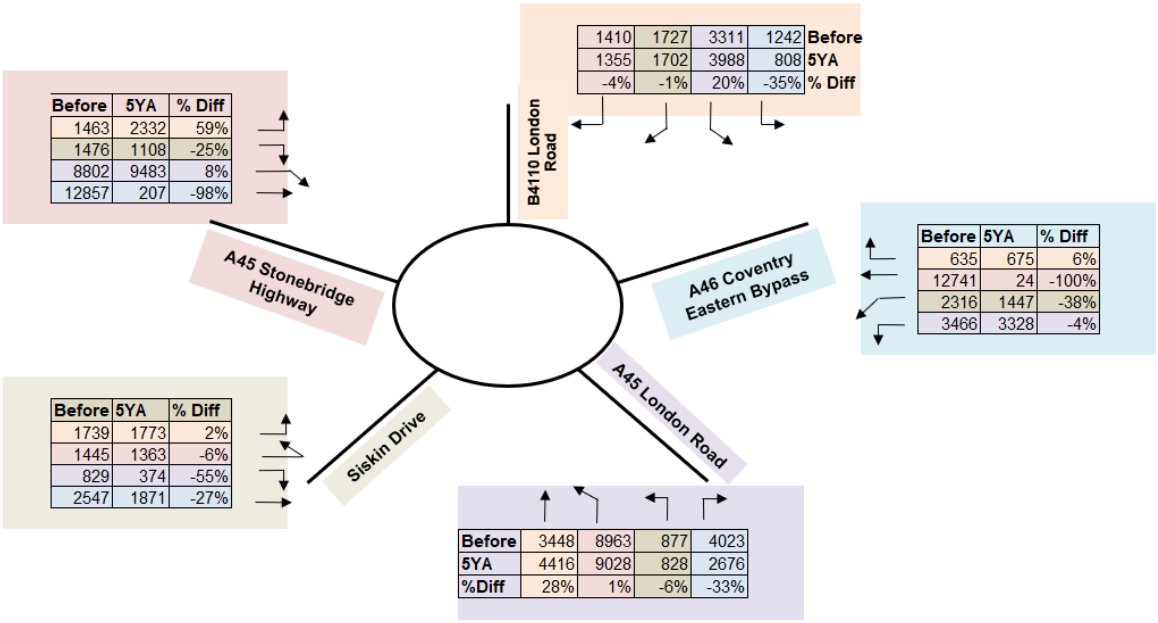
Source: WebTRIS traffic counts – November 2012 (before) and November 2021 (5YA). All figures are to the nearest 100.

At five years after, traffic volumes have decreased to around -2% to -22%. This level of growth is similar to or lower than the trends we saw across England, National Highways motorways and West Midlands. This could be attributed to the decrease in economic activity in this area due to the COVID-19 pandemic. However, A45 to the South of Tollbar End Junction was an outlier to this pattern and saw an increase of 6% in traffic compared to the before period.

Tollbar End Junction

We have analysed the traffic movements on the Tollbar End junction to understand the changes in traffic volumes and to demonstrate the impact of the new underpass link. A comparison between before and five years after turning movements for the Tollbar End junction is shown in Figure 4.

Figure 4 Comparison of Turning Movements on the Tollbar End Junction



Source: Turning Count Traffic Survey – October 2013 (before) and November 2021 (5YA). All figures are to the nearest 100.

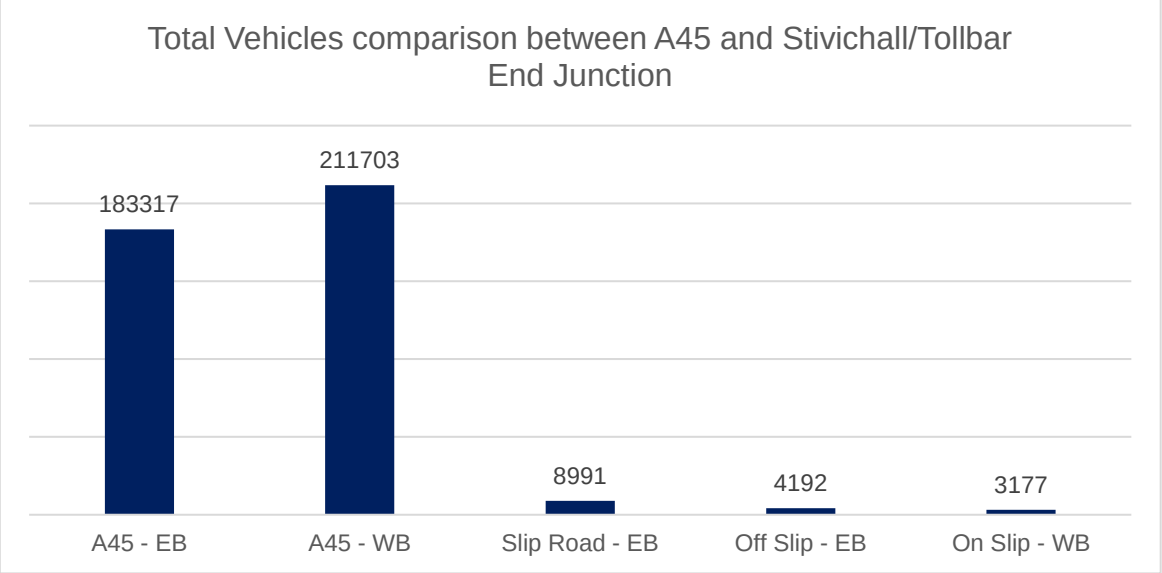
Before the project, Tollbar End junction had two major movements in both directions: A45 Stonebridge Highway to A46 Coventry Eastern Bypass and A45 Stonebridge Highway to A45 London Road. At five years after traffic travelling between A45 Stonebridge Highway and A46 Coventry Eastern bypass has significantly reduced. A significant drop in traffic flows between -98% and -100% was observed in both directions.

Traffic travelling from A45 Stonebridge Highway and B4110 London Road had increased significantly at five years after. The turning count observations show an increase of 59% in traffic volumes on this route. An increase of 28% was also observed in traffic volumes travelling from the A45 London Road to B4110 London Road. Siskin Drive showed a decrease in traffic volumes across most movements around the Tollbar End junction except for B4110 London Road which showed a slight increase of 2%.

New Junction Analysis

Analysis was carried out on the new junction (see section 2) constructed on the A45 between one-year after and five years after evaluation period to find the impact of it on the schemes traffic flow.

Figure 5 Total vehicle comparison between A45 Stonebridge Road and Stivichall/Tollbar End Junction



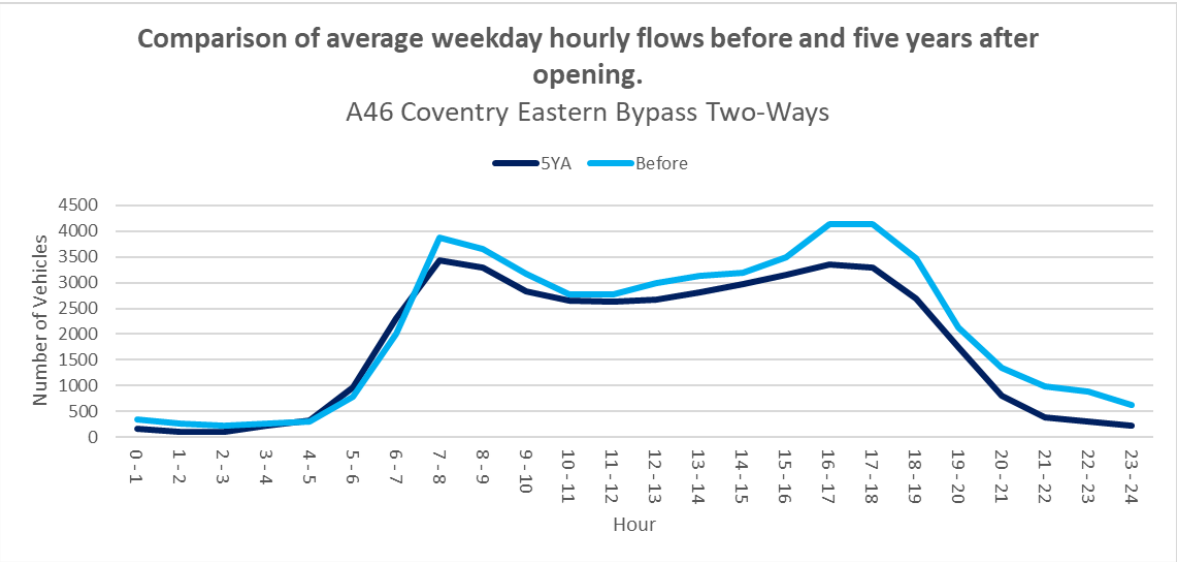
Source: Turning Count Traffic Survey -November 2021.

Comparison between the traffic volume using the slip roads and the main carriageway traffic is seen in Figure 5. A total of 99% of west bound traffic is on the main carriageway, compared to 93% of the east bound traffic. This means there is no strong case that the new junction is affecting flow values that may skew our flow analysis.

How are traffic flows distributed across the day?

We also analysed the hourly traffic flows across a typical weekday to determine whether the traffic growth has occurred uniformly or at certain times of the day. The hourly traffic flow analysis along the A46 Coventry Eastern Bypass (two way) is show below in Figure 6.

Figure 6 Comparison of average weekday hourly flows before and five years after opening.



Source: WebTRIS traffic counts – November 2012 (before) and November 2021 (5YA).

We found that there was a similar trend in traffic in the before and five years after period. The busiest times on the road network at this location were 7am to 9am

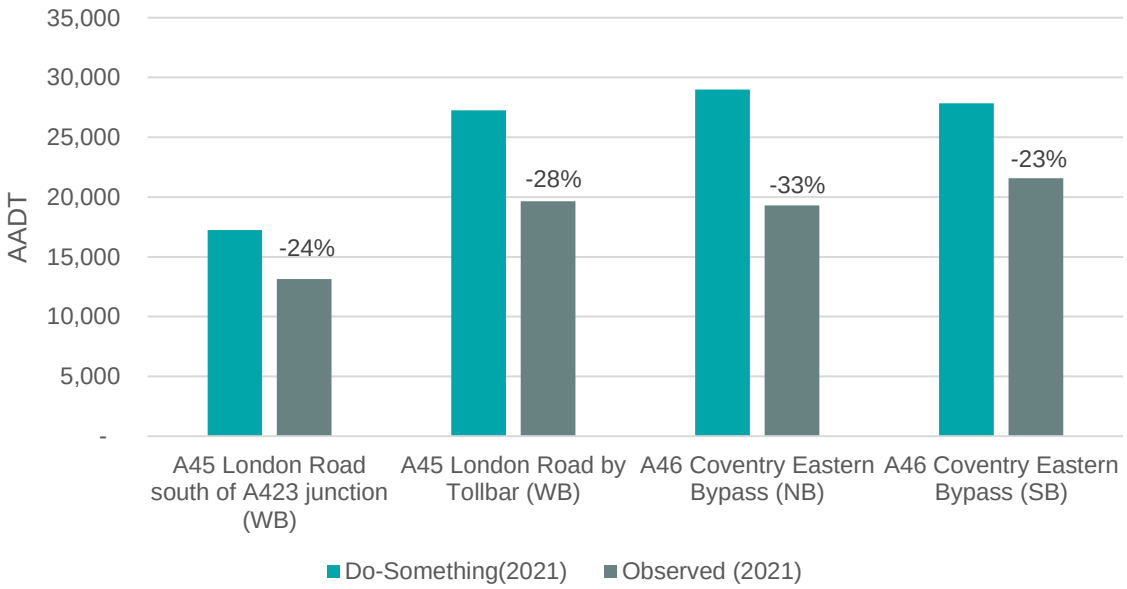
before the project and at five years after. Following this, the traffic flows slowly increased after 1pm and decreased after 5pm in the evening. However, despite having a similar trend in traffic flows, the number of vehicles observed on this link were low at five years after in comparison to the before period. In total at five years after, around 43000 vehicles were observed on this route on an average weekday, whereas the before period saw an average of around 51000 vehicles.

Was traffic growth as expected within the business case?

We compared the modelled flows against the observed data for sites[7] along the project extent. Where possible we compared the observed data with the forecast to evaluate how the road network would perform if the scheme was constructed (Do-Something DS) and if the scheme was not constructed (Do-Minimum DM).

Figure 7 shows the accuracy of the flows in the 'with project' scenario (Do-Something). It can be observed that the forecast flows accuracy was higher than the observed flows in the Do-something scenario. The difference between the observed flows and modelled flows was between -23% and -33%.

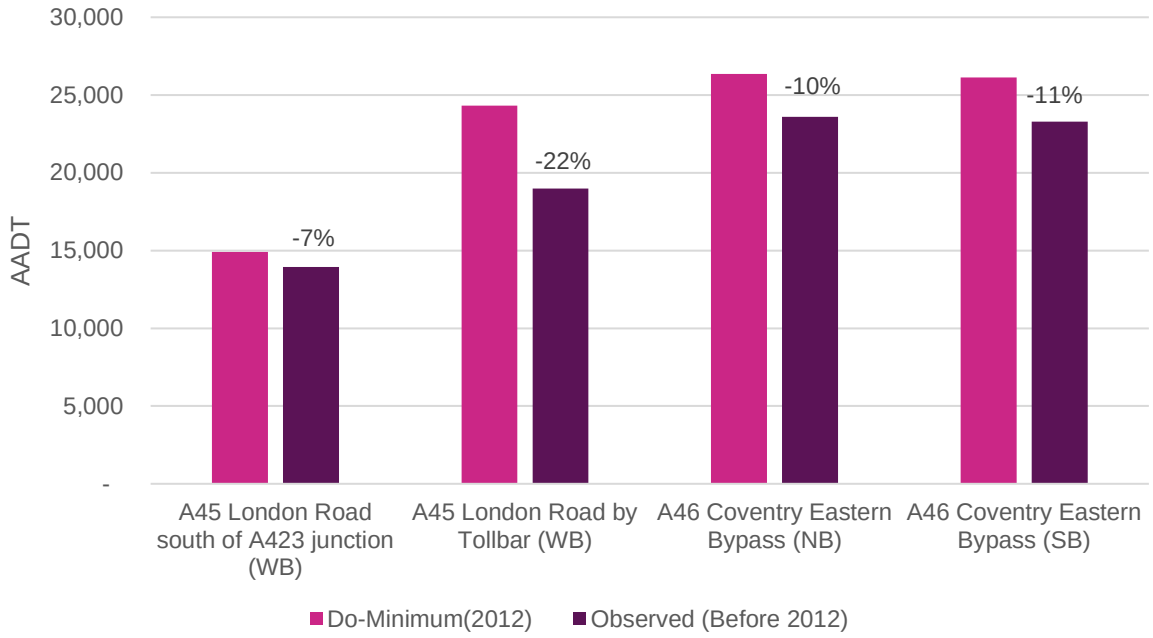
Figure 7 Do-Something model flows vs five years after observed flows



Source: Traffic Forecasting Report and WebTRIS traffic counts

[7] In the one-year after analysis eight sites on the project extent were analysed. In 2021, we could only obtain data for four sites around the project location.

Figure 8 Do-Minimum Model Flows vs Before project observed flows



Source: Traffic Forecasting Report and WebTRIS traffic counts

Figure 8 shows the accuracy of the forecasted do-minimum flows. It can be observed from the figure that the DM flows were higher than the observed before flows. The observed flows were around -7% to -22% lower than the forecast flows.

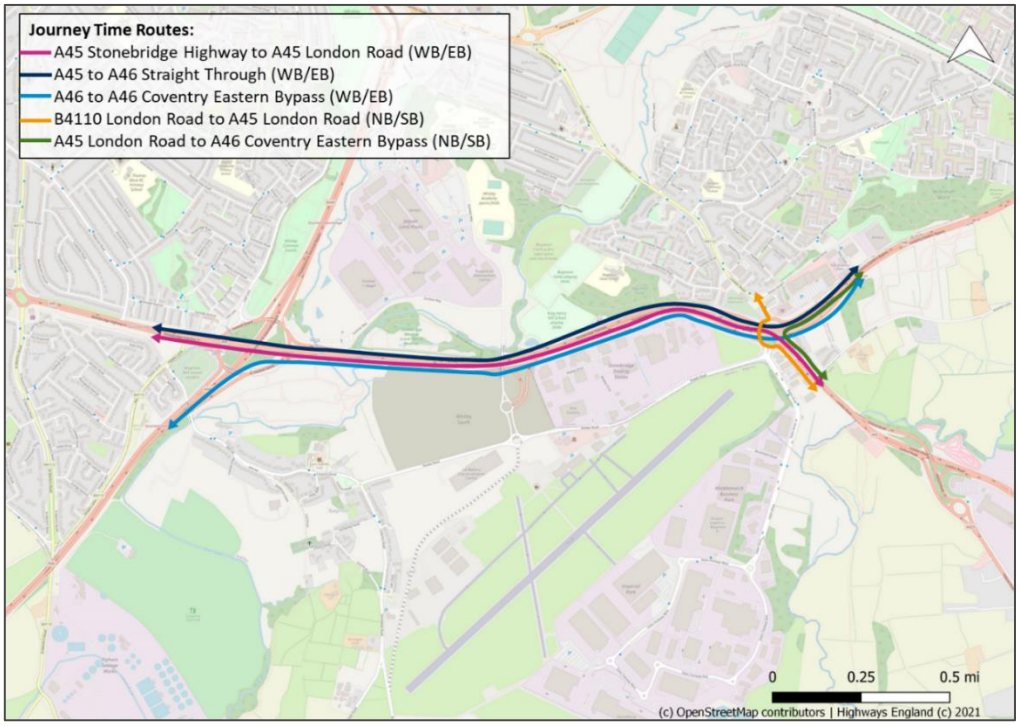
Relieving congestion and making journeys more reliable

One of the objectives of this project was to provide relief from traffic congestion. We analysed journey times as a way of identifying the impact of the project on congestion. We also considered the extent to which journey times vary from expected average journey times which indicates how reliable a journey is.

Did the project deliver journey time savings?

To understand whether the scheme has resulted in average journey time savings, we used satnav data. Routes have been selected to capture both local movements around Tollbar End junction and routes which travel along the wider scheme extent including the A45 Stonebridge Highway and Stivichall Interchange. Figure 9 presents the journey time routes assessed. All routes were assessed in both directions.

Figure 9 Journey Time Routes



Source: National Highways and OpenStreetMap contributors

The five years after journey time results were compared to the journey times observed in the pre-construction[8] and one-year[9] after post-opening period. We looked at the following time periods[10]:

- Morning Peak: 7am to 8am, 8am to 9am
- Interpeak: 10am to 4pm
- Evening Peak: 4pm to 5pm, 5pm to 6pm

We assessed other hourly time periods to ensure any relevant or unexpected changes were explored, but the above time periods remain the key focus of analysis in this section.

A45 Stonebridge Highway (A45 W) - A46 Coventry Eastern Bypass (A46 E)

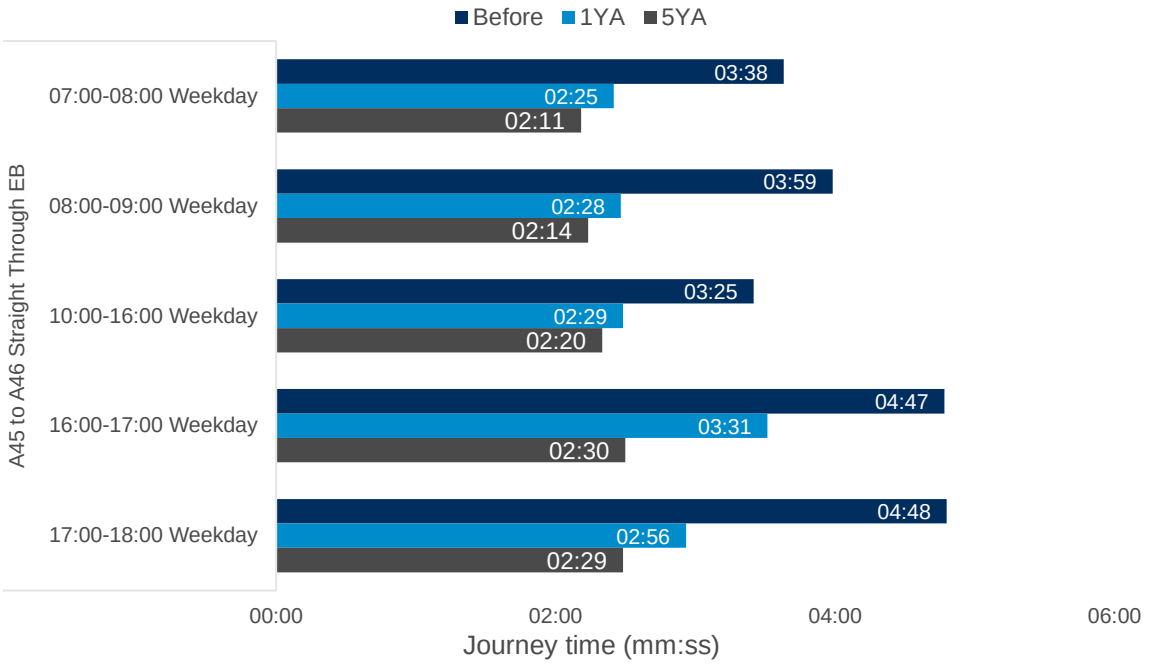
As a part of the project improvements, a new two-lane dual carriageway underpass link was provided between the A45 Stonebridge Highway and the A46 Coventry Eastern Bypass at Tollbar End Junction, and the A45 Stonebridge Highway was widened from two-lanes to three-lanes in both directions. As a result of these improvements, customers using the new underpass were expected to experience the greatest benefits as they were no longer required to travel through Tollbar junction.

Average journey time savings of 60 seconds or greater at five years after compared to before were observed in all time periods between A45 Stonebridge Highway westbound and A46 Coventry Eastern Bypass eastbound (Figure 10). The greatest journey time savings of over 2 minutes were observed on this route in the evening peak. On the westbound route between A46 Coventry Eastern Bypass

[8] Data from October 2012 to September 2013 was used in the pre-construction (before) scenario.
[9] Data from April 2018 to March 2019 was used in the one year after scenario.
[10] We used the same time periods as used in the project appraisal, plus some additional time periods.

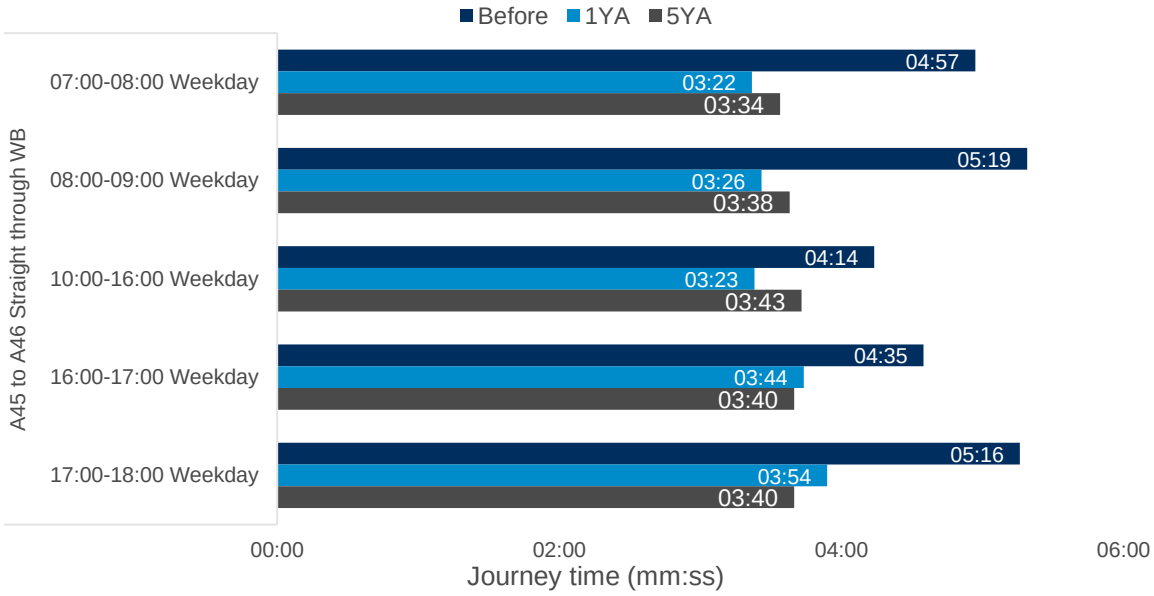
eastbound and A45 Stonebridge Highway westbound (Figure 11), average journey times had increased as compared to the one year after period in the morning and interpeak period. However, the average journey times in all time periods had improved in comparison to the before period.

Figure 10 Comparison of observed average journey times A45 Stonebridge Highway (A45 W) - A46 Coventry Eastern Bypass (A46 E)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 11 Comparison of observed average journey times- A46 Coventry Eastern Bypass (A46 E) - A45 Stonebridge Highway (A45 W)

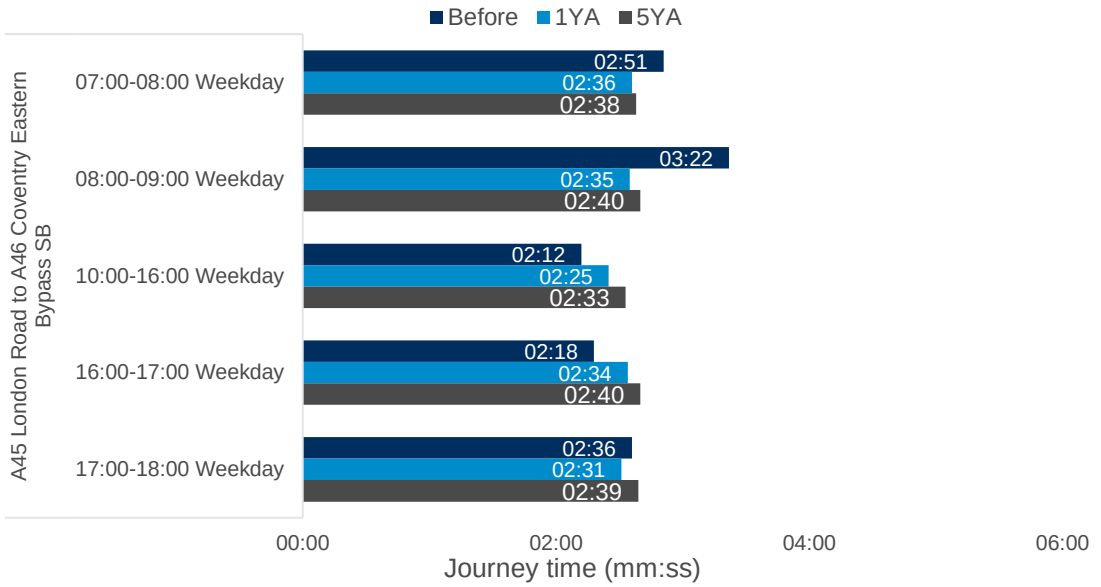


Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

A45 London Road (A45 S) – A46 Coventry Eastern Bypass (A46 E)

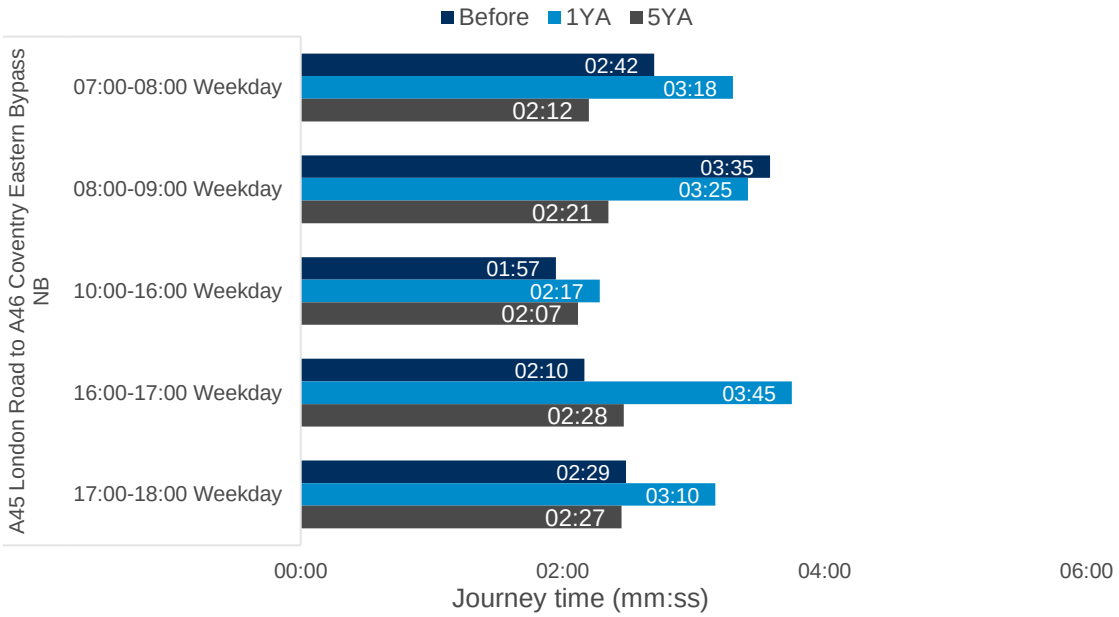
The results of our evaluation show that journey times between A46 Coventry Eastern Bypass (Eastbound) and A45 London Road (Southbound) had slightly increased in most of the time periods when comparing the before and one-year after periods (Figure 12). At five years after, journey time improvements were observed only in the morning peak hours on this route. In comparison to the before period, journey times had improved at five years during the morning peaks but were still marginally worse in comparison to the one-year after period.

Figure 12 Comparison of observed average journey times A46 Coventry Eastern Bypass (A46 E) – A45 London Road (A45 S)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 13 Comparison of observed average journey times A45 London Road (A45 S) - A46 Coventry Eastern Bypass (A46 E)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Between A45 London Road (Southbound) and A46 Coventry Eastern Bypass (Eastbound), the journey times had improved all the time periods at five years after in comparison to the one year after period (Figure 13). In comparison to before, five years after journey times increased marginally in most of the time periods except the two morning peaks.

The increases in journey times were likely due to increased traffic volumes on some movements on the Tollbar End roundabout. As a part of the project's improvements, traffic signals[11] were introduced on all approach arms of Tollbar End roundabout. The newly introduced traffic signals at Tollbar End may have contributed to the increases in journey times on some routes, though its impacts were relatively minor.

Average journey time graphs for all other routes are in Appendix A. Based on the analysis of the assessed routes, we can conclude that the customers using the new underpass link at Tollbar End experienced journey time improvements in both directions and across all time periods. The routes which used the Tollbar End circulatory showed journey time improvements in most time periods. At five years after the increase in journey times was mostly on the route between B4110 London Road and A45 London Road. This is due to increased traffic volumes on these routes.

As part of the project improvements, signals were added to all approach arms of the Tollbar End Roundabout. Before the project, only some approach arms to the Tollbar End roundabout were signalised. It is likely that the signal staging and timings may have also been amended compared to the before project traffic signal timings. Overall, this introduction of traffic signals might have also contributed to the increases in journey times on some routes, though its impact would have been minor.

Were journey time savings in line with forecast?

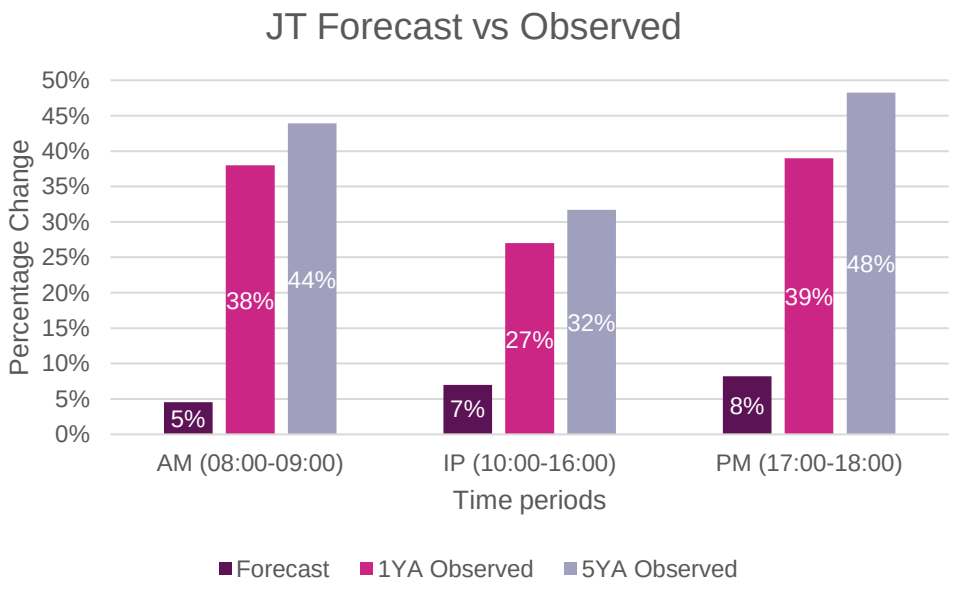
Forecast journey times were provided for some routes in the Traffic Forecasting Report (TFR). The routes included in the Traffic Forecasting Report were – A45 Stonebridge Highway to A46 Coventry Eastern Bypass and A46 Kenilworth Bypass to A46 Coventry Bypass. We assessed the forecast percentage change[12] in journey times against observed percentage change[13][14].

[11] Before the project, only some arm approaches of the Tollbar End Roundabout had traffic signals. Due to the project, traffic signals were introduced on all arm approaches of Tollbar End. It is likely that the signal staging and timings may have amended as compared to the before project signal timings.
[12] The forecast percentage change refers to the percentage reduction in journey times from DM (do minimum) and DS (Do Something) forecasts.
[13] The observed percentage change refers to the percentage reduction in journey times from before to one year after and five years after.
[14] In the one-year after evaluation, forecast percentage change in journey times against observed percentage change were presented rather than absolute journey times, as the Traffic Forecasting Report (TFR) did not mention precise start and end points of the routes. At five years after the same method has been followed to maintain consistency with the one-year after evaluation.

A45 Stonebridge Highway (A45 W) – A46 Coventry Eastern Bypass (A46 E)

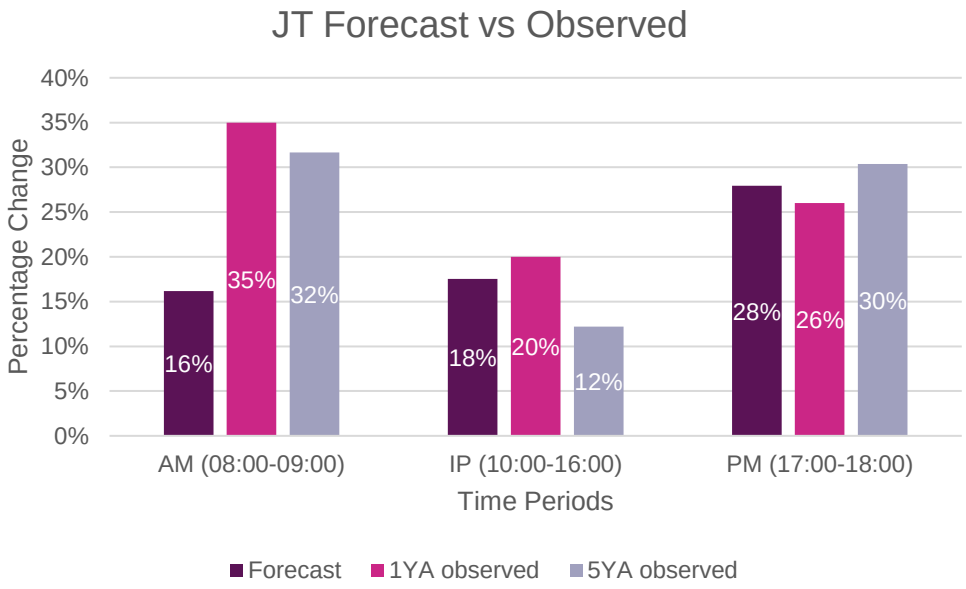
The forecast and observed percentage change in journey times between A45 Stonebridge Highway and A46 Coventry Bypass are presented in Figure 14 and Figure 15. On the eastbound route (A45W to A46E), the observed percentage change in journey time at five years after is greater in all time periods in comparison to the forecast and one-year after observed change. At five years after, on the westbound route (A46 E to A45W), higher percentage changes were observed in the morning and evening peak period than the forecast. However, in the interpeak period, the observed five years after change in journey time was lower than forecast.

Figure 14 Forecast and observed journey time percentage change (A45 W to A46 E)



Source: Traffic Forecasting Report and Satnav data

Figure 15 Forecast and observed journey time percentage change (A46 E to A45 W)

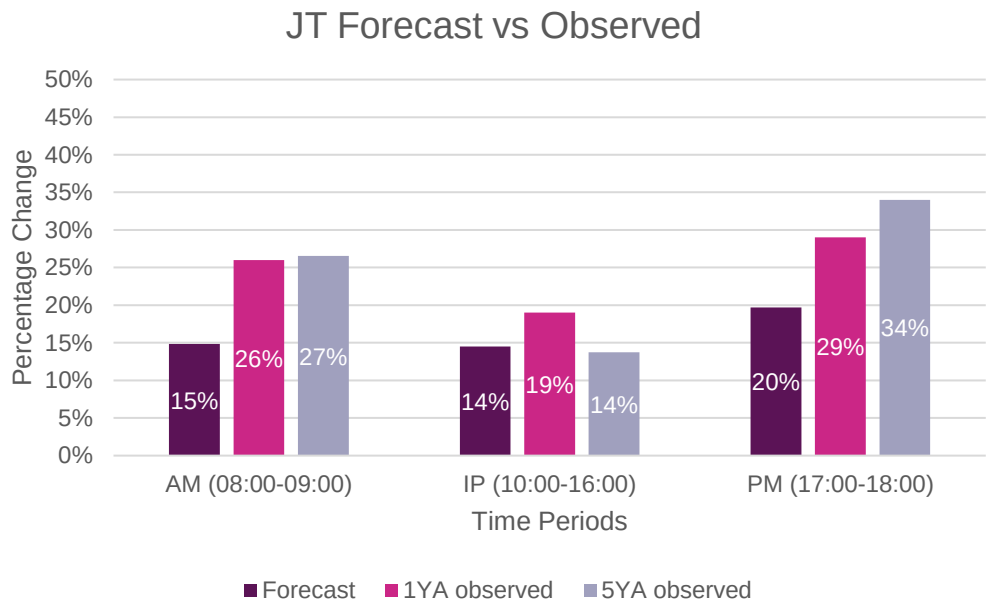


Source: Traffic Forecasting Report and Satnav data

A46 Kenilworth Bypass (A46 W) – A46 Coventry Eastern Bypass (A46 E)

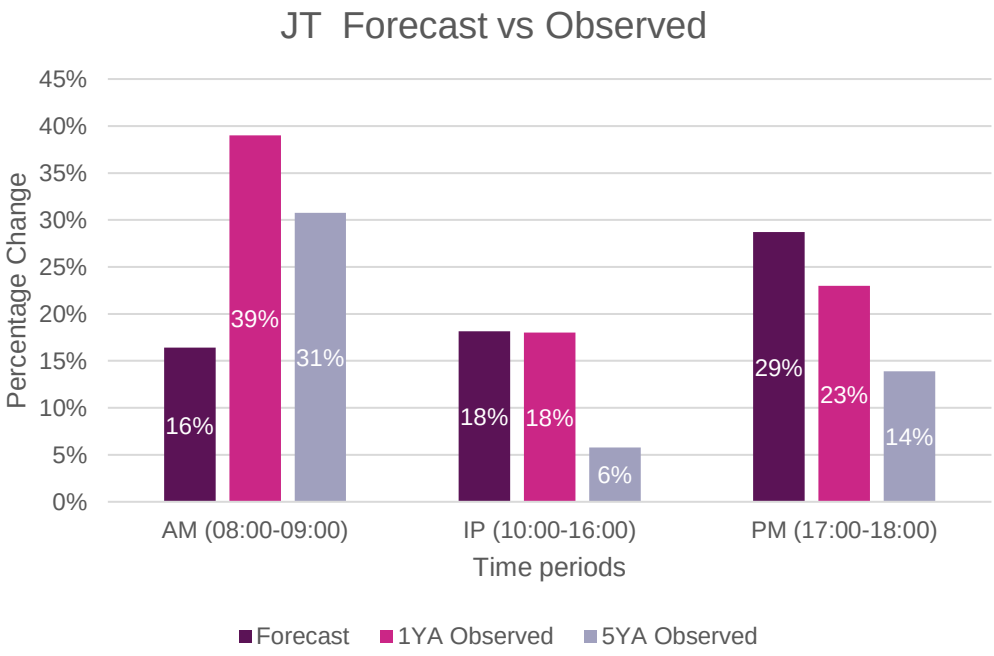
The forecast and observed percentage change in journey times between A46 Kenilworth Bypass and A46 Coventry Eastern Bypass are shown in Figure 16 and Figure 17. On the eastbound route (A46 W to A46 E), greater percentage change was observed at five years after than the forecast in the morning and evening peak periods. However, in the interpeak period, the observed percentage change in journey time was similar to the forecast. On the westbound route (A46 E to A46 W), the observed journey time percentage change in the morning period was higher than forecast. However, in the interpeak and evening peak periods, the observed percentage change was lower than the forecast.

Figure 16 Forecast and observed journey time percentage change (A46 W to A46 E)



Source: Traffic Forecasting Report and Satnav data

Figure 17 Forecast and observed journey time percentage change (A46 E to A46 W)



Source: Traffic Forecasting Report and Satnav data

Overall impact on journeys

To determine whether the project has had a net benefit in reducing vehicle hours around the scheme section, we calculated vehicle hour savings for journey time routes through Tollbar End junction.

Table 2 Vehicle Hours Saving

Time Periods	All Movements (1YA results)	All Movements (5YA Results)	Tollbar End Only (1YA Results)	Tollbar End Only (5YA Results)
07:00-08:00	9000	19000	-7100	15000
08:00-09:00	21800	39500	2700	32600
Interpeak	191100	54400	-51700	56100
16:00-17:00	4700	15300	-6700	9200
17:00-18:00	18300	33100	-1900	19800
Overall Result (Total)	**244900**	**161300**	**-64600**	**132700**

Source: WebTRIS traffic counts and Satnav data

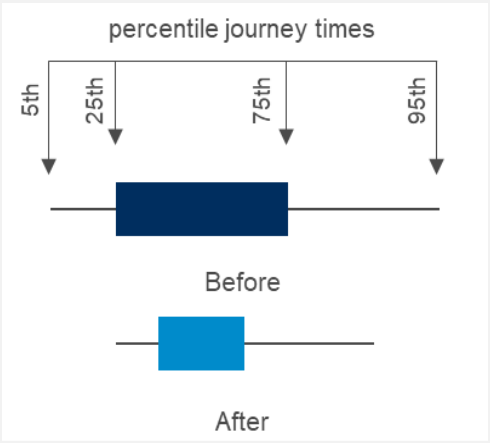
The vehicle hours analysis[15] is shown in Table 2**Table 2**. When considering all movements at the Tollbar End Junction the vehicle hours saved at five years after, have reduced in comparison to one year after by 83600 hours. The total vehicle hours saved for all movements at five years after is 161,300 hours. This may have been due to reduction in traffic post covid-19 pandemic. However, there has been an increase in the total vehicle hours saved on the Tollbar End Only Movements. The total vehicle hours saved for these movements at five years after was 132700. Overall, the scheme has a net benefit at reducing the vehicle hours. The improvements on the Stivichall Interchange could not be captured.

Did the project make journeys more reliable?

One of the projects objectives was to improve the reliability of customers journeys by making them more predictable. If the time taken to travel the same journey each day varies, we are less confident in planning how long our journey will take. If journey times are more consistent, we can be more confident and allow a smaller window of time to make that journey. More reliable journeys are valued by customers.

[15] Positive number indicates an increase in the vehicle hours saved, whereas a negative number indicates that the journey times had increased which resulted in reduction in vehicle hours saved.

Figure 18 What does a box plot show?

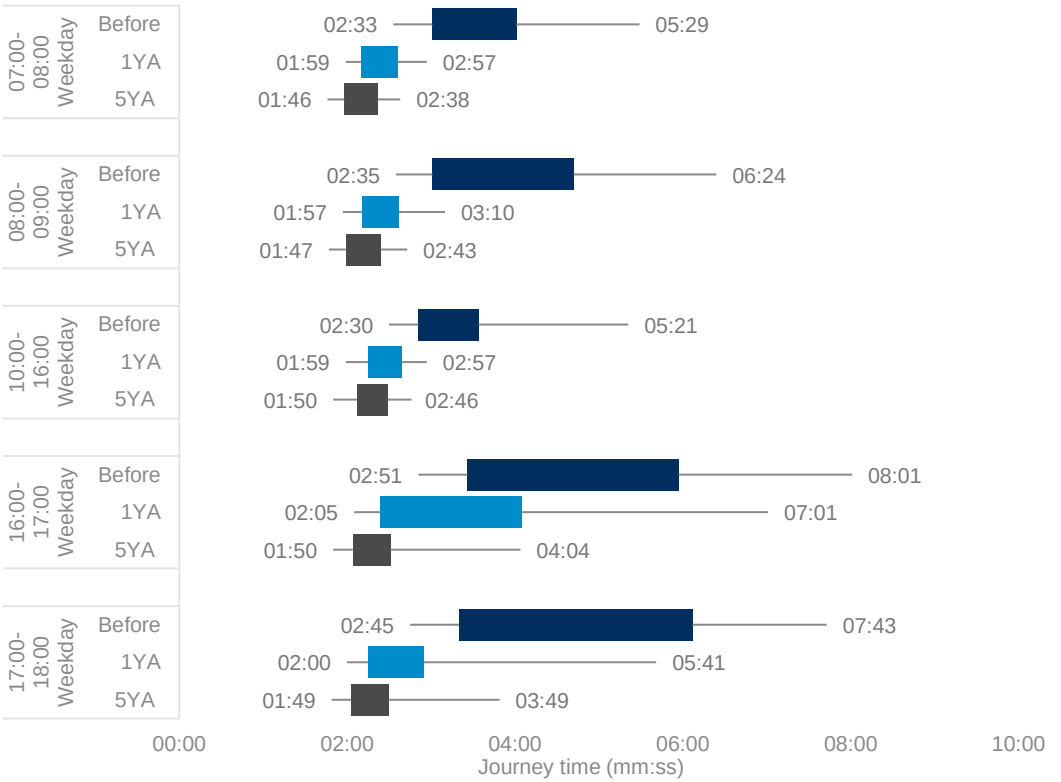


The lowest point is the 5th percentile, this means 5% of journeys take less than this amount of time to complete. The highest point is the 95th percentile, this means 95% of journeys take less time than this to complete.

The length of the box shows how the journey times vary between the 25th and 75th percentile (the journey time 25% and 75% of journeys are faster than). The narrower the box the less variable, and hence more reliable, the journey.

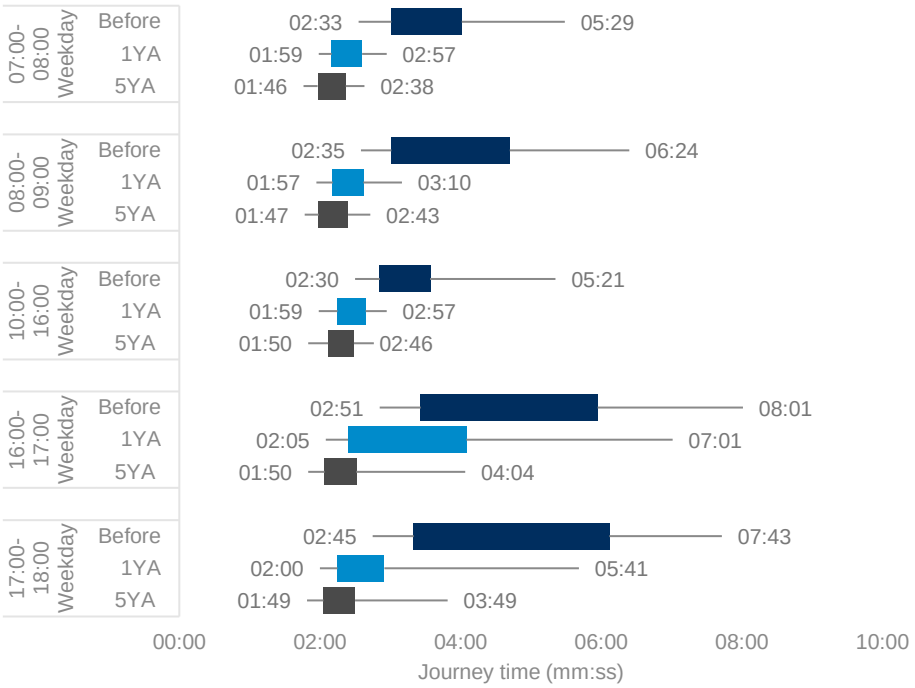
A45 Stonebridge Highway (A45 W) – A46 Coventry Eastern Bypass (A46 E)
Between A45 Stonebridge Highway (A45W) and A46 Coventry Eastern Bypass (A46 E) journey time reliability had improved in all time periods and in both directions at five years after. Overall, journeys were more reliable as compared to the before period. In comparison to the one-year after period, journeys were particularly more reliable in the evening peak period between 4pm and 5pm at five years after. The results are shown in Figure 19 and Figure 20.

Figure 19 Journey time reliability A45 W to A46 E (Eastbound)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 20 Journey time reliability A46 E to A45 W (Westbound)

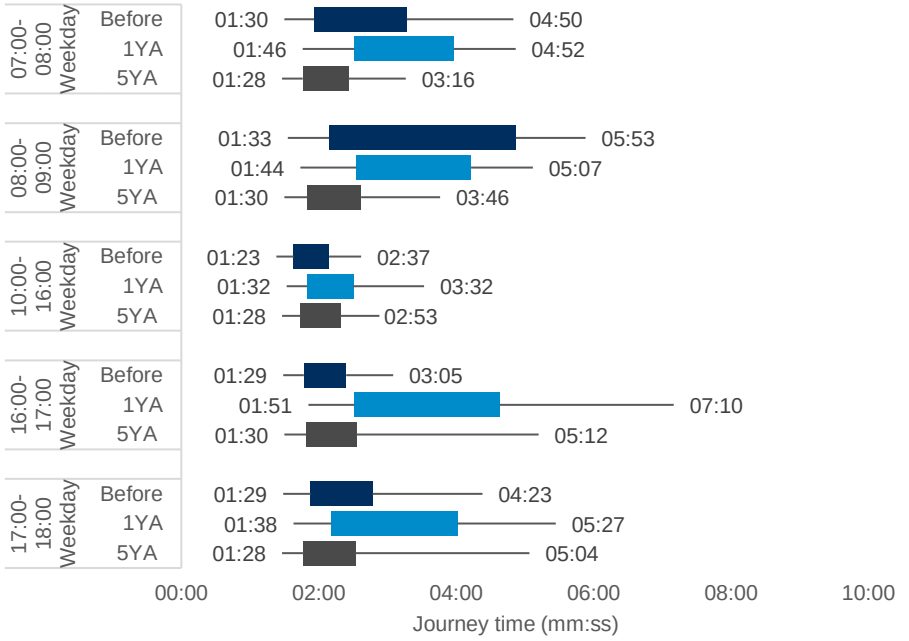


Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

A45 London Road (A45 S) to A46 Coventry Eastern Bypass (A46 E)

In the northbound direction, journey time reliability had mostly worsened at the one-year after period, compared to the before period (Figure 21). However, at five years after journey time reliability had improved in comparison to the one-year after period. Journey time reliability was only slightly worse in the interpeak period and the first evening peak at five years after in comparison to before but was still better than the one-year after period.

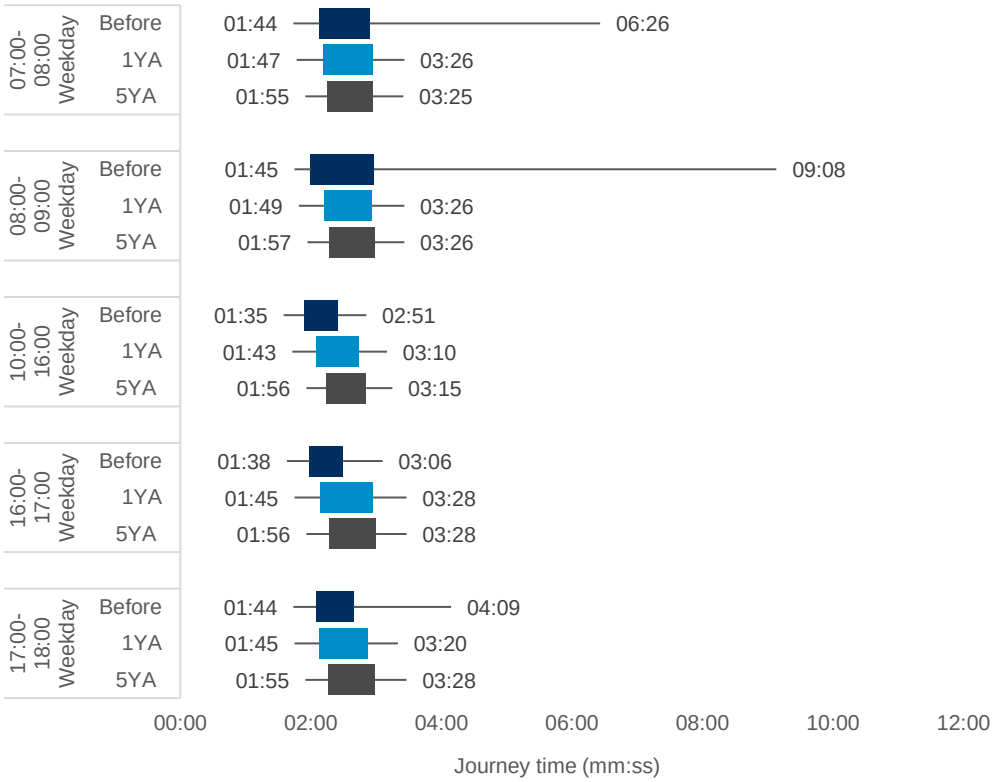
Figure 21 Journey time reliability A45 S to A46 E (Northbound)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

In the southbound direction (Figure 22), journey time reliability remained similar in the morning peak periods at five years after in comparison to the one-year after period. Journey time reliability at five years after had worsened in comparison to the before period in the interpeak and evening peak periods. The changes in the reliability along this route are likely due to the increased traffic volumes on some movements and new traffic signal timings around the junction. Journey time reliability graphs for other routes are in Appendix B.

Figure 22 Journey time reliability A46 E to A45 S (Southbound)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

5. Safety evaluation

Summary

The safety objective for this project was to maintain and, where possible, improve current safety standards. Most of the expected benefits were related to improvements in journey time and reliability.

The business case forecast a saving of 12 collisions over the 60-year appraisal period across the project extent and wider area. The monetary value of the overall change in collisions would be a benefit of £0.1m.

Table 3 captures all the key measures for the project extent from before to after construction. Five-year evaluation shows a reduction across all key safety measures except fatal collisions and fatal and weighted injuries (FWI).

Table 3 Summary of project extent key measures

Measure		Before	After	Counterfactual[16]	Change[17]
Personal Injury Collisions		11	6	N/A	-4
Collision Rates		24	14	15	-10
Measure		**Before**	**After**	**Change[18]**	
Collision Severity	Fatal	0	1	1	
	Serious	8	2	-6	
	Slight	46	29	-17	
Fatal Weighted Injury[19]		0.3	0.3	0	
FWI/hmvm[20]		1.2	1.5	0.3	
Killed or Seriously Injured[21]		1.5	0.6	-0.9	
KSI/hmvm[22]		6.8	2.7	-4.1	

Source: STATS19 1 October 2008 – 14 December 2021

[16] Due to the limited sample size, we have been unable to calculate a counterfactual for the project extent.
[17] Rounding has been applied to values. Therefore, independent calculations may not result in the values presented in the table.
[18] Due to the limited sample size totals of collisions by severity have been presented.
[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. The combined measure is added up. A full number is the equivalent to a fatality.
[20] FWI/hmvm= Fatal Weighted Injury per Hundred Million Vehicle Miles.
[21] 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.
[22] KSI/hmvm = Killed or Serious Injured per Hundred Million Vehicle Miles.

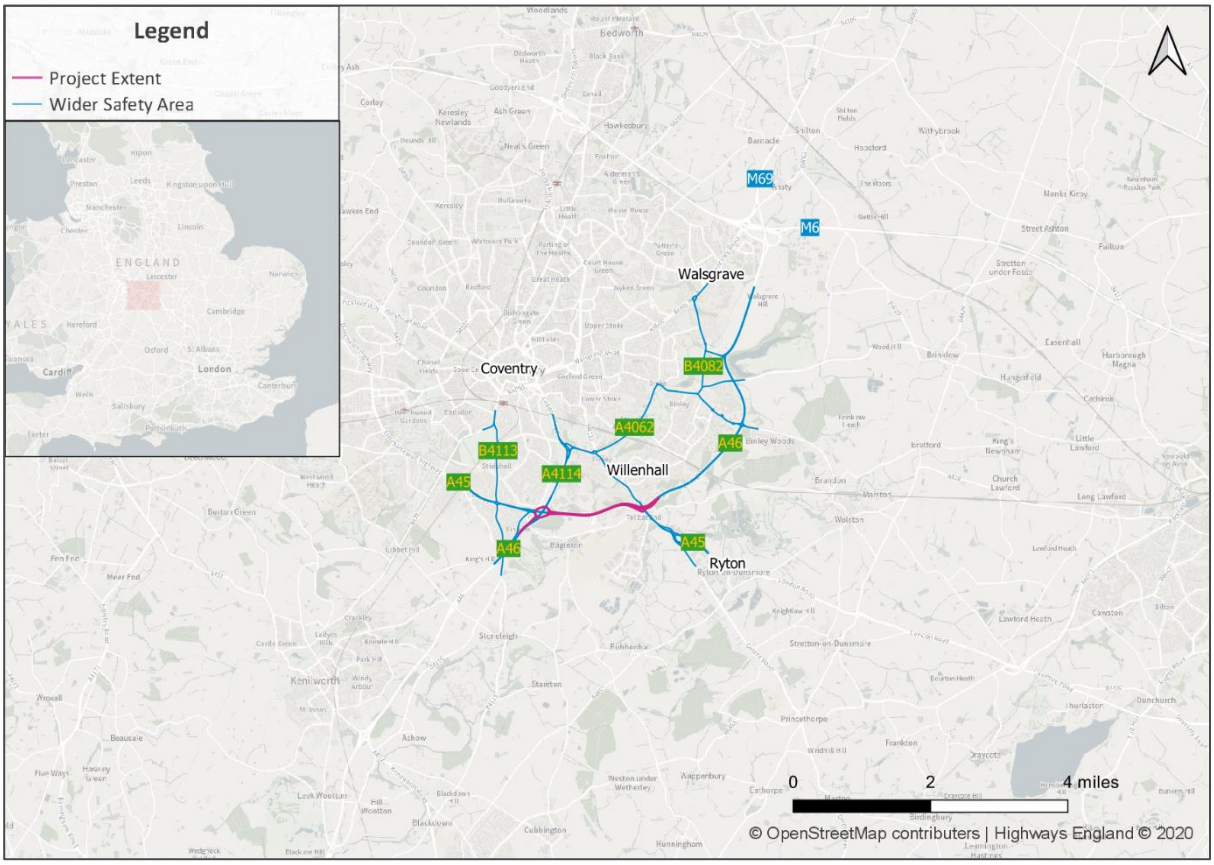
The average collision rate in the wider area has reduced by nine personal injury collisions (PIC) per hmvm since the project has been open to traffic. The average PIC has reduced by 18 (annual average of 67 to 49 PICs after) in the same period. There has been a positive reduction across serious and slight collision severities and KSI measures. Fatal collisions have remained stable at four collisions and FWI has remained stable. If the wider area continues to perform at the current level, it will meet the predicted reduction. A full summary of the wider area can be found in Appendix C.

At this five-year evaluation point the project is on track to meet its objective to maintain and, where possible, improve safety standards.[23]

Safety study area

The safety study area is shown in Figure 23. This area is assessed in the appraisal supporting the business case for the project. We have therefore replicated the appraisal study area to understand the emerging safety trends.

Figure 23 Safety study area



Source: National Highways and OpenStreetMap contributors

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

Road user safety on the project extent

How has traffic flow impacted collision rates?

The Department for Transport release road safety data[24] that records incidents on public roads that are reported to the police. This evaluation considers only collisions that resulted in personal injury.

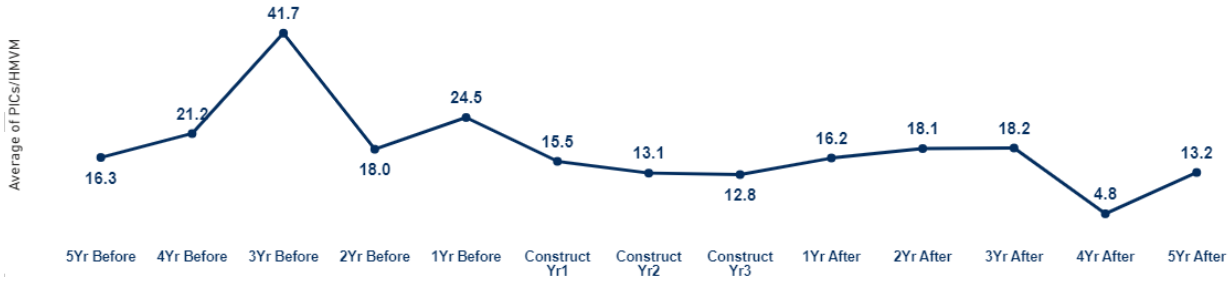
The safety analysis has been undertaken to assess changes over time looking at the trends in the five years before the project was constructed to provide an annual average. We have then assessed the trends from the first five years after the Tollbar improvement project was operational and open for road users.

- Pre-construction: 1 October 2008 - 30 September 2013
- Construction: 1 October 2013 - 14 December 2016
- Post-opening: 15 December 2016 - 14 December 2021.

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 14.1 personal injury collisions per hmvm, this equates to travelling nine million vehicle miles before a collision occurs. Five years before the project, the average collision rate was 24.3 personal injury collisions per hmvm, this equates to traveling six million vehicle miles before a collision occurs (Figure 24).

Figure 24 Annual average of collision rate



Source: STATS19 1 October 2008 – 14 December 2021

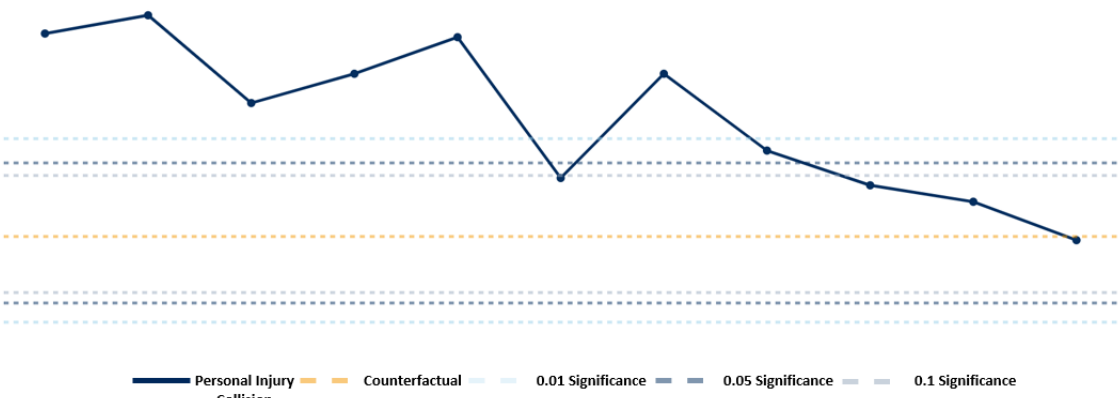
As part of the safety evaluation, we look to assess what changes in collision rates might have occurred due to factors external to the project over this timeframe. To do this we estimate the trend in personal injury collisions which might have occurred if the road had remained in its previous configuration (this is referred to as a counterfactual). This is based on changes in regional safety trends for dual carriageways on the strategic road network with a high volume of road users.

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

Figure 25 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:

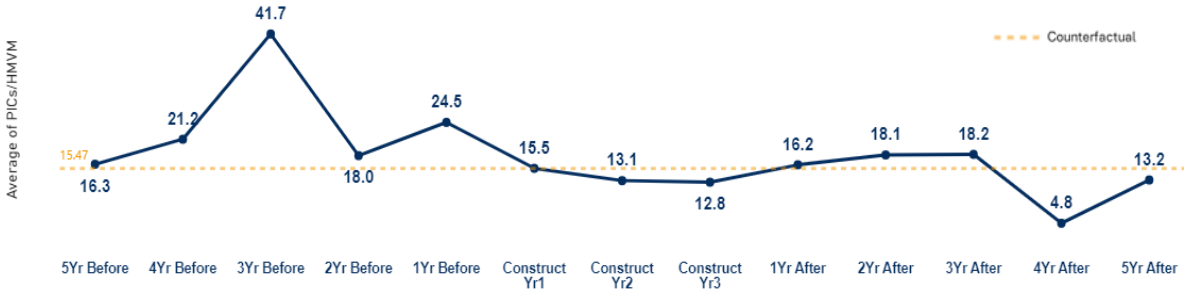
1. Timeseries of personal injury collisions
2. Estimated counterfactual range, which comes from a X^2 hypothesis test on one degree of freedom using a significance level of 0.05. More details can be found in the POPE Methodology Manual (and Appendix D).
3. National Highways are developing new statistical 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 Tollbar improvement project had not occurred, the trend in the number of personal injury collisions and collision rates would likely have reduced but not to the extent where we can be confident that the project is a cause for this reduction.

The counterfactual test estimated rate would likely reduce to 15.47 personal injury collisions per hmvm (Figure 26). 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 one below the counterfactual rate suggesting that the project could be having a positive impact.

Figure 26 Annual average number of collision rate with counterfactual scenario ranges[25]



Source: STATS19 1 October 2008 – 14 December 2021

[25] Due to the small sample size, we have been unable to perform the normal counterfactual test and estimate the likely range of collisions. We have also been unable to perform statistical significance testing on these results.

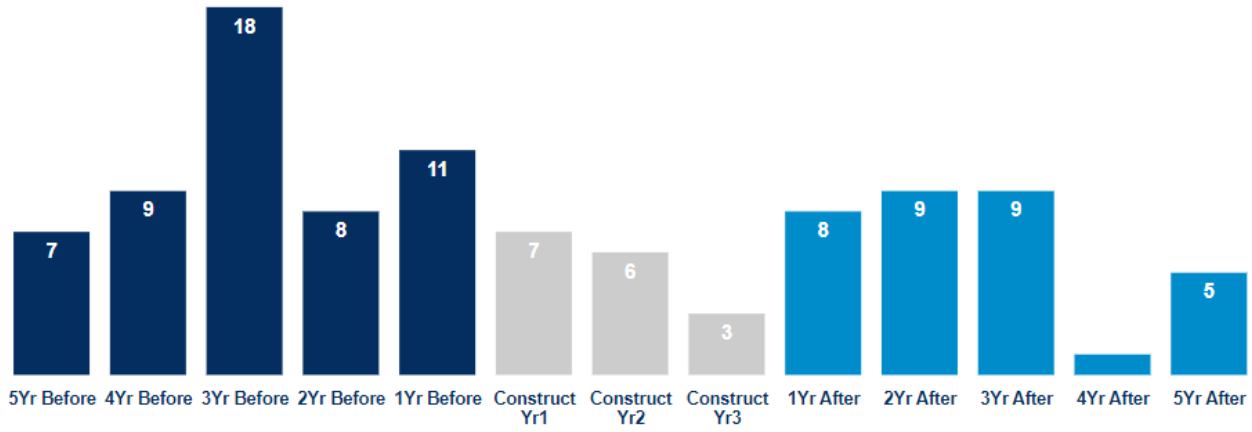
What impact did the project have on road user safety?

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 six personal injury collisions per year, four fewer than the average 11 per year over the five years before the project was constructed (Figure 27).[26]

Average personal injury collisions

11	6	4
Before	After	Fewer

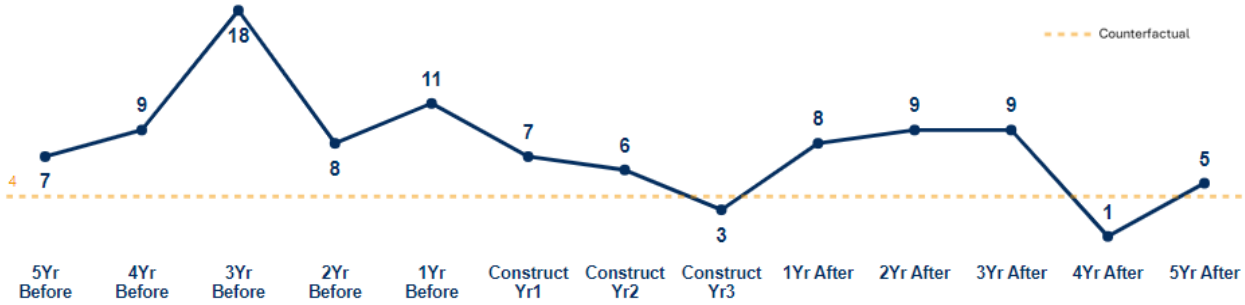
Figure 27 Annual personal injury collisions



Source: STATS19 1 October 2008 – 14 December 2021

A counterfactual test has also been performed which estimates four[27] personal injury collisions would be expected as shown in Figure 28.

Figure 28 Annual average number of personal injury collisions with counterfactual scenario ranges



Source: STATS19 1 October 2008 – 14 December 2021

Unlike collision rates, collision numbers are higher than what we would have expected without the project but have still reduced compared to before construction. This indicates that the project has had a positive impact on safety, as the number of PICs have nearly halved.

[26] Personal injury collisions are presented as averages and have rounding applied to values. Therefore, independent calculations may not result in the values presented.
[27] Due to the small sample size, we have been unable to perform the normal counterfactual test and estimate the likely range of collisions. We have also been unable to perform statistical significance testing on these results.

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, see Appendix E). 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.[28] As a consequence, the Department for Transport have developed a severity adjustment methodology[29] 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 (unadjusted collision severity see Appendix F).[30]

After the project, fatal severity has increased by one[31]. Due to the small sample size, total values instead of averages have been used for serious and slight severity categories. There has been a reduction in both serious and slight casualties (Table 4). Figure 29 shows the full breakdown of severity of personal injury collisions by project year.

Table 4 Number of personal injury collisions by severity[32]

	Before	After	Change	Change direction
Fatal	0	1	1	↑
Serious	8	2	6	↓
Slight	46	29	17	↓

Source: STATS19 1 October 2008 – 14 December 2021

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

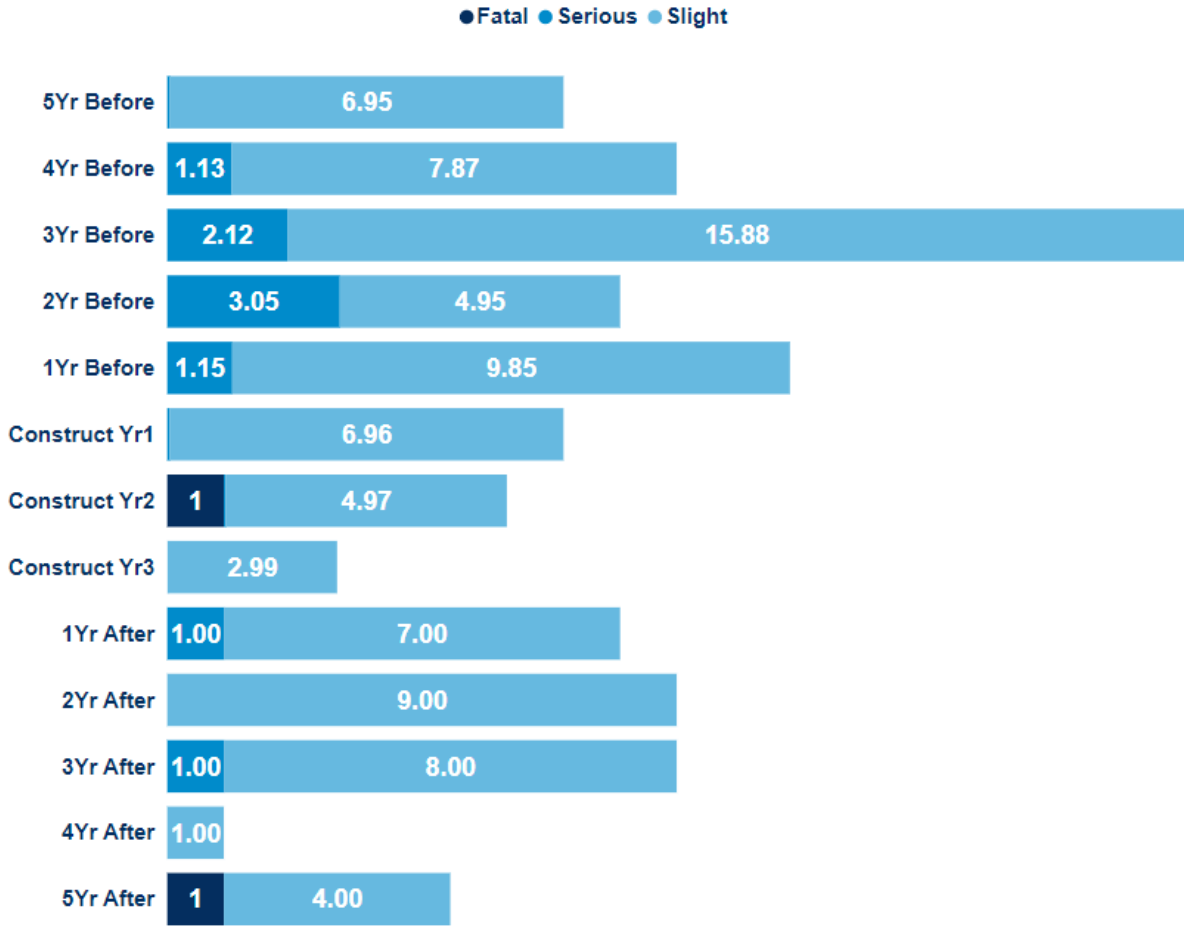
29 https://www.gov.uk/government/publications/guide-to-severity-adjustments-for-reported-road-casualty-statistics/guide-to-severity-adjustments-for-reported-road-casualties-great-britain#guidance-on-severity-adjustment-use

30 Collision Severities within this report use the 2022 adjustment factor.

31 Fatal incident involving pedestrian using unofficial route on outside of Tollbar End roundabout

32 Due to the limited sample size totals of collisions by severity have been presented.

Figure 29 Severity of personal injury collisions within the project extent



Source: STATS19 1 October 2008 – 14 December 2021

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[33]. In effect, it takes all non-fatal injuries and adds them up using a weighting factor to give a total number of fatality equivalents[34]. 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 no change in the FWI observed annually. The severity of casualties occurring after the project became operational has remained stable in the project extent. An annual average of 0.3 was observed before the project and 0.3 FWI after project. This is likely due to the small sample size of collisions collected.

[33] 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.
[34] Casualty severities within this report use the 2022 adjustment factor.

The combined measure showed a reduction of eight million vehicle miles was travelled before a FWI[35]. The rate of FWI per hmvm[36] has reduced. This suggests that taking into account changes in traffic, the project is having a neutral safety impact on the severity of casualties within the project extent.

We also assess the impact the project had on casualties using the Killed or Seriously Injured (KSI) measure [37], and consider changes in traffic by calculating an average rate for every hundred million vehicles miles (hmvm) travelled.

Killed or Seriously Injured measure have remained stable, observing an annual average of 1.5 KSI before to 0.6 KSI after. The rate of KSI per hmvm has decreased from an average of seven to three for every hmvm travelled.

The observations for KSI suggests that the project is having a neutral 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 maintain and, where possible, improve current safety standards. Despite the small sample size for the project extent, we have observed a reduction in the rate and number of collisions and improvement to the impact on serious and slight collision severity. However there has been an increase in the number of fatal casualties. Observations from the wider safety area suggest a positive impact on all key safety measures. We believe that the project has met its safety objective.

The business case forecast was a reduction in personal injury collisions (PICs) as a result of this project, with a saving of 12 collisions over the 60-year appraisal period. Findings at the five years after stage suggest the project is likely to meet the appraisal scenario.

[35] Before the project, 80 million vehicle miles needed to be travelled before a FWI (1.4 FWI per hmvm). After the project this reduced to 72 million vehicle miles (1.3 FWI equivalents per hmvm).
[36] hmvm – hundred million vehicle miles.
[37] 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

Summary

The evaluation of environmental impacts of the project uses information on the predicted impacts gathered from the DfT's Transport Analysis Guidance (TAG) environmental appraisal[38], and the Environmental Statement (ES). It then compares them with findings obtained five years after the project opened for traffic, using evidence from the site visit and desktop research. The project opened for traffic in December 2016 and the five years after site visit was undertaken in September 2021.

The results of the evaluation were recorded against each of the TAG environmental sub-objectives[39] and are summarised in the following sections. These findings were based on whether, five years since opening, conditions are: better than; worse than; or as expected. These do not necessarily mean that the overall impact as set out in the appraisal will change if the conditions are not as expected, but further aftercare may be required. This evaluation was a snapshot in time and reflects progress since the one-year after site visit as observed at five years after, and a judgement on the effectiveness of any mitigation measures towards achieving the desired design year (15 years after opening) outcomes.

Traffic data is required for the evaluation of the impact of the project on noise, air quality and greenhouse gas emissions. This is because these impacts are connected to changes in traffic caused by the project. At five years after, our evaluation was affected by the limited traffic data that was available. Data was obtained for the A46 Coventry Eastern Bypass, the A46 Mainline (near St Martins Road) and A45 London Road. As at one-year after, there was still no traffic data for the main road link, i.e. A45 Stonebridge Highway which was widened by the project and also no forecast data for lorries and other heavy-duty vehicles (HDV).

The evaluation highlighted that the impact of the project on noise and air quality was likely to be as expected. Due to the absence of forecast HDV data, impacts on Greenhouse gas emissions could not be quantified. The change to a grade-separated junction at Tollbar End and widening of Stonebridge Highways opened up the landscape and slightly increased urbanisation. However, the design of the project incorporated landscape and ecology mitigations that were implemented as expected. These were likely to perform their environmental functions in the long-term provided appropriate maintenance continues. Impacts of the project on historic resources were likely to be to be as expected. Drainage and water quality mitigation had also been implemented which should deliver the expected benefits provided an appropriate maintenance regime is followed.

[38] https://www.gov.uk/government/publications/tag-unit-a3-environmental-impact-appraisal

[39] Noise, air quality, greenhouse gas emissions, landscape, townscape, heritage of historic resources biodiversity, the water environment

Noise

The environmental appraisal predicted an overall slight beneficial impact on noise. This was because the project was predicted to lead to major decreases in noise level for properties near to the Tollbar End roundabout due to the new underpass. There would be an increase in noise level at the Stivichall roundabout, but this would be imperceptible. There were no other properties or locations sensitive to noise changes around the project area that were predicted to experience a change of greater than 1dB(A) and no significant impact upon night-time noise levels were expected.

Our one-year after evaluation reported that noise reducing features such as noise barriers at A45 London Road and Selsey Close and low noise surfacing along A45/A46 Toll Bar End Junction were installed as expected. The noise barrier on London Road was originally proposed to be a single continuous section of barrier However, after agreement with local residents a gap was included to provide pedestrian access through it. The gap may limit the effectiveness of noise screening for properties at the location. There was limited traffic data[40] available and so further, more detailed analysis, was not possible.

Our five years after evaluation confirmed that the noise mitigations remained unchanged. It remains likely that the gap in the noise barrier at London Road will still be affecting the benefits experienced. Some traffic data was available to support our five years after evaluation but not for the full extent of the project. Data for a key road in the project area, i.e., Stonebridge Highway was unavailable and this affected the scope of our evaluation. However, a comparison of forecast and outturn data for other parts of the project area suggested that traffic flows were lower by amounts varying from 23% to 29 %. These flows lower than forecast suggest that the project was likely to lead to an improvement in local noise as was expected.

Air quality

The environmental appraisal predicted that in both the with and without project scenarios, there would be exceedances of the EU Limit Value for Nitrogen dioxide[41]. However, it predicted a reduction in the total number of properties likely to exceed the threshold, leading to an overall benefit. An overall net improvement in Nitrogen dioxide and Particulate Matter concentrations was expected with the project in terms of local air quality, while regional emissions for both Nitrogen dioxide and Particulate Matter were expected to be negatively affected.

Air quality monitoring results for 2019 along A45/A46 Tollbar End Junction were available at one-year after for two locations adjacent to the Tollbar junction. The results showed that nitrogen dioxide levels were well below the annual national threshold, which suggested that there were no significant air quality concerns in the vicinity of the project. However, reliable traffic data was not available to enable us to evaluate this further.

The five years after evaluation obtained local air monitoring information for 2022[42] which suggested that all local air quality monitoring locations around the project

[40] Post-opening traffic flow data which would have enabled a comparison between the EAR traffic forecasts and recent observed traffic data was not available.
[41] UK air quality standards: https://uk-air.defra.gov.uk/air-pollution/uk-eu-limits.
[42] https://www.coventry.gov.uk/pollution-1/air-quality/3

were complaint with the annual air quality threshold. We also obtained traffic data for some sections of the project although not for one of the key roads in the project area, i.e., Stonebridge Highway. For other links around Tollbar, a comparison of forecast and outturn data suggested that observed traffic flows were lower by more than 10,000 AADT[43]. This suggested that implying that the project was likely to lead to an improvement in air quality as expected.

Greenhouse gases

Carbon Dioxide (CO_2) is considered the most important greenhouse gas. Therefore, it was used by the environmental appraisal as a key indicator for the purposes of assessing the impacts of transport options on climate change. The environmental appraisal predicted that the project would reduce greenhouse gas (GHG) emissions and result in a net benefit.

To evaluate the greenhouse gas emissions, forecast and observed traffic data is required for the appraised study area. At the one-year after stage, there was no observed post-opening traffic flow data available within the project extent along Stonebridge Highways (i.e., between Stivichall Interchange and Tollbar junction). As such, it was not possible to follow the evaluation methodology and conduct a reliable evaluation of the project's impact on greenhouse gas emissions. At five years after there was some data but not for the key link along Stonebridge highway nor did we have forecasts for HDVs. This meant we were unable to quantify greenhouse gas emissions along the project.

Our evaluation noted that for those sections of the project where we had data traffic flows were lower. This suggests that greenhouse gas emissions could be lower. However, HDVs are a key contributor to greenhouse gas emissions, and so we do not know what affect changes in HDVs may have had on the overall outcome. Thus, an evaluation of the impact of the project on greenhouse gas emissions could not be done.

Landscape

The environmental appraisal reported that the loss of vegetation within the highways estate because of construction would result in localised changes to adjacent landscape character. However, within the medium to long term as replacement planting established, the effects would reduce to neutral. The environmental assessment anticipated adverse visual impacts on residential properties located near the existing highway, including London Road (north and south of the Tollbar End roundabout), Selsey Close and Montgomery Close.

Our evaluation confirmed that highway vegetation had been removed as part of the widening along the Stonebridge Highway. It had slightly opened up the landscape and increased the views of the Stonebridge Highway towards Tollbar. At one-year after, the landscape and visual impacts were considered to be broadly as expected although the Tollbar End Junction was visually more cluttered than predicted. The proposed landscape mitigations were considered to have been implemented as expected. Replacement planting was broadly as expected, but had yet to mature and tree plots were doing well while some hedgerows had gaps. A further examination of the tree plots and hedgerows was recommended at the five years after stage to ascertain whether visual impacts on nearby properties and the

[43] AADT – annual average daily traffic

cumulative effect of third-party development would still be as expected by the design year.

Our five years after evaluation confirmed that landscape mitigations such as tree planting plots, hedgerows and grasslands had continued to establish. However, gaps identified in hedgerows at one-years were still present and weeds (brambles, gorse and broom) were growing in most planting plots. Based on the observed progress in plant growth, the landscape mitigations were likely to provide their intended benefits by the design year as expected. However, this would be dependent on adequate aftercare e.g., to eliminate gaps in hedgerows and to remove weeds. Since our one-year after evaluation, industrial development adjacent to the A45 and a new bridge constructed at Scimitar Way (in the middle of the project) had been built. These developments had caused additional unexpected changes to the local landscape adjacent to the highway. These changes were not part of the Tollbar End project but may still impact on the project's landscape outcomes.

Figure 30 Landscape changes along Stonebridge highway after the project

New junction on A45 at Whitley Scimitar Way

Footpath end due to new junction located about 300m behind the gantry, and sign directs users to diverge into the Stonebridge Industrial Estate and Rowley Industrial Estate

Source: five years after evaluation site visit, 14 September 2021

Townscape

The environmental appraisal reported that the adjacent townscape is ordinary in value and typical of an urban fringe environment. Despite the increase in scale of the project, the design of the new structures and the new landscaping would help minimise any impacts. The resulting significance of the impact of the project was expected to be neutral.

Our one-year after evaluation reported that due to a new grade separated junction at Tollbar (concrete structure in the urban fringe of Coventry) and widening of the Stonebridge Highway, the sense of urbanisation had slightly increased. There was also additional vertical elements in the townscape due to the lighting columns. New mitigation planting was implemented as expected but at the time had yet to establish. At five years after, our evaluation visit confirmed that the new mitigation planting was still maturing but was beginning to integrate the project into the

townscape. However, weeds (gorse and broom) were observed among the planting which could affect their successful establishment. Provided aftercare maintenance continues, and weeds are managed, the intended outcome should still be achieved as expected by the design year.

Figure 31 The grade separated Tollbar End junction at five years after

Source: five years after Evaluation visit, 14 September 2021

Heritage of historic resources

The environmental appraisal anticipated that historic landscapes would be unaffected, but that there would be slight adverse impacts to the settings of nearby listed buildings. A low value locally listed boundary post was expected to be relocated. The appraisal also anticipated a low potential for unrecorded remains to be present. The significance of the impact of the project on historic resources was predicted to be slight adverse.

The one-year after evaluation reported that, historic landscapes were unaffected, as expected. The environmental assessment had proposed that the potential for impacts on previously unknown buried archaeology would be managed by way of an integrated archive. This would comprise a watching brief during construction to post excavation archiving and reporting if anything was encountered. However, at one-year after there was no information available to confirm if archaeology had been encountered and so it was recommended that it should be reconsidered at five years after.

As at one-year after, the five years after evaluation visit found that visual impacts on scheduled monuments (e.g. the Lunt Roman Fort and the Kings Hill medieval village) and historic buildings (e.g., boundary posts) were as expected. Low noise surfacing along Stonebridge Highway was also likely to be limiting noise impacts affecting their setting. The project's handover environmental management plan noted that, a watching brief was agreed with Coventry City Planning Archaeologist. However, no update on the outcome of the watching brief was received. Thus, whilst most outcomes were as expected, those for buried archaeology could not be confirmed.

Biodiversity

The appraisal reported that there would be slight adverse impacts on statutory nature conservation sites in and around the Tollbar End due to widening of the Stonebridge Highway and changes at Tollbar. This included Stonebridge Meadows, a Local Nature Reserve, and an ancient dry pond near Tollbar junction). It was predicted that a neutral effect on amphibians and a slight beneficial effect on hedgerows, watercourses, and semi-improved grassland would arise. All other habitat and species impacts were expected to be neutral or insignificant. The

significance of the impact of the project on biodiversity, overall, was expected to be slight adverse in the short-term reducing to neutral by the design year after ecological mitigation has established.

The evidence gathered as part of the one-year after site visit confirmed that the impacts of the project on ecology were partly as predicted. Ecological mitigations were implemented as expected. Trees were establishing and likely to provide new habitats. However, species rich grasslands had not yet established, hedgerows had gaps needing attention and evidence of aftercare was limited. Thus, it was considered that it was too soon to properly consider the biodiversity impacts of the project. It was recommended that biodiversity be re-considered at five years after when further data confirming ongoing habitat management and maintenance commitments would be available to inform the evaluation.

Our five years after evaluation confirmed that mitigation (i.e., planting of trees, hedgerows and species-rich grassland) were provided as expected and were establishing. However, weeds including brambles and gorse were growing among many of the tree and grassland plots. Sections of dead hedgerows noted at one-year after still required aftercare. However, the mitigation planting was still likely to provide the new and replacement habitats and wildlife corridors as expected provided aftercare and maintenance continued, and weeds managed. New industrial development adjacent to the A45 at Scimitar Way including the new junction at the planned logistic hub had affected the mitigation provided by our scheme but the magnitude of this impact could not be confirmed.

Water environment

The environmental appraisal and assessment reported that the existing Tollbar junction did not have adequate drainage facilities to manage routine road runoff. Therefore, the project design included the provision of new storm water attenuation and treatment facilities which would help better manage current and proposed drainage needs. It was predicted that the project would confer a benefit for future water quality and flood protection. The significance of the impact of the project on the water environment was expected to be slight beneficial.

The five years after evaluation visit confirmed that while design changes eliminated one of the proposed balancing ponds, the remaining two were implemented and likely to be providing the intended benefits. The pumping station and bioretention pond were also implemented. However, the anticipated service records for these assets were unavailable. At one-year after, it had been observed that Typha Latifolia[44] had established in the balancing ponds and there was a risk it could affect the performance of the ponds. This remained the case at five years after. The typha will need to be managed to ensure the drainage mitigations continue to perform as intended. Since the opening of the project further industrial development had occurred adjacent to A45 including a new bridge structure which appeared to have reduced the size of one balancing pond. However, overall it was still likely that the drainage outcomes would be as expected.

[44] https://www.rhs.org.uk/plants/18566/typha-latifolia/details

Overview

The results of the evaluation are summarised against each of the Transport Appraisal Guidance (TAG)[45] environmental sub-objectives and presented in Table 5.

We report the evaluation as expected if we believe that the observed impacts at five years after were as predicted in the appraisal. We report them as better or worse than expected if we feel the observed impacts were better or worse than expected. Finally, we report impacts as too soon to say if we feel that at five years after there was still insufficient evidence to draw firm conclusions.

Table 5 Summary of environmental findings

Sub objective	AST score	Five-year evaluation outcome	Five-year evaluation summary
Noise	Net benefit (NPV+£5.3million)	As expected	The five years after evaluation confirmed that noise mitigations were undertaken as expected although the pedestrian access in the noise barrier may limit its benefits. The limited traffic data available suggested that the project was likely to lead to an improvement in local noise conditions
Air Quality	Slight benefit (NPV = £0.25million)	As expected	Local air quality monitoring data for 2022 suggested no exceedances of the AQ threshold along the project had occurred. The limited traffic data available suggested that the project was likely to lead to an improvement in local air quality as expected.
Greenhouse Gases	Overall reduction in GHGs (NPV = £5.9million)	Cannot be confirmed	Analysis of available traffic data suggested greenhouse gas emissions could be lower. However, the absence of forecast data for heavy-duty vehicles meant we could not quantify the effect they may have had.
Landscape	Neutral	As expected	The widening of Stonebridge Highway had led to the loss of vegetation and increased awareness of the road and new junction. Mitigation was establishing and was likely to provide their intended benefits provided maintenance continues. Local (third-party) industrial development and a new bridge at Scimitar Way had added further changes to the local landscape.
Townscape	Neutral	As expected	The new junction, timber barriers and lighting had increased the sense of urbanisation. New planting was in place

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

Sub objective	AST score	Five-year evaluation outcome	Five-year evaluation summary
			and was helping to integration project into the townscape.
Heritage of historic resource	Slight Adverse	As expected	The impacts of the project on scheduled monuments and historic buildings were likely to be as expected. Archaeological benefits could not be confirmed due to the absence of evidence of the watching brief having been implemented.
Biodiversity	Neutral	As expected	Ecological mitigations were provided and were establishing. Provided maintenance continues and weeds managed the design year outcome should be met. The impact of new development at Scimitar Way on ecology could not be confirmed.
Water environment	Slight beneficial	As expected	Mitigation was implemented broadly as expected and provided maintenance continues and weeds managed the outcomes should be delivered.

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.

The project was delivered at a cost of £90.4 million[46], over the forecast cost. In the first five years, the road provided additional capacity to support more road users at Tollbar End by upgrading it to a grade-separated junction, whilst improving the safety of those journeys. Journeys were quicker than before, with reliability improving particularly for the A45 to A46 route which now bypasses Tollbar End roundabout. If these trends continue, the project is reforecast to deliver £132.8 million of benefits over the 60-year period[47].

Value for money was forecasted over a range of possible traffic growth scenarios[48]. All the scenarios expected that this project would deliver 'very high' value for money. The appraisal forecast significant traffic growth and improving journey times; the observed data suggested a decrease in traffic compared to before, but journeys were still faster, more reliable and safer. This has impacted the project's value for money which we have re-forecast to be 'medium'. As traffic growth is expected to return to what was forecast when this project was appraised, it is likely that this project could deliver more benefits in the future, though it is not currently on track to deliver the value for money anticipated over the 60-year life of the project.

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[49] are summed together and compared against the investment cost to produce a benefit-to-cost ratio (BCR). The monetised impacts are considered alongside additional impacts that 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.[50] The monetised benefits forecast by the appraisal which supported the A45/A46 Tollbar End improvement project business case are set out

[46] Present value of costs in 2010 prices and values.
[47] Based on impacts on the Strategic Road Network.
[48] See section 7 – *Forecast value for money.*
[49] Typically scheme life is taken to be 60 years.
[50] 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.

in Table 6. These benefits relate to the core traffic growth scenario. We use these to re-forecast and provide an estimate for outturn value for money based on data from the first five years after opening. For the appraisal of this project, there was no low growth forecast scenario, only the core and high traffic growth. During this evaluation, we considered the high growth scenario, however as we have observed lower traffic growth than expected it is unlikely this scenario occurred. We have also included in Table 6 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.

Table 6 Monetised benefits for the core traffic growth scenario (£ million))

	Forecast (£m)	% of forecast monetised benefits	Evaluation approach
Journey times	697	95%	Re-forecast using observed and counterfactual traffic flow and journey time data for the project area only and not those in the wider area
Vehicle operating costs	49	7%	Re-forecast using observed and forecast traffic flow and journey time data
Journey time & VOC during construction and maintenance	-9	-1%	Not evaluated (assumed as forecast)
Journey time reliability	0	0%	Re-forecast using observed traffic flow data
Safety	0	0%	Re-forecast using observed and counterfactual safety data
Carbon	6	1%	Monetised benefits assumed as forecast
Air quality	6	1%	Monetised benefits assumed as forecast
Noise	0	0%	Monetised benefits assumed as forecast
Indirect tax revenues	-13	-2%	Re-forecast using observed and forecast traffic flow and journey time data
User charges	0	0%	Monetised benefits assumed as forecast
Operating costs (private toll revenue)	0	0%	Monetised benefits assumed as forecast
Total present value benefits	**735**	**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 costs

The project was delivered at a cost of £90.4 million[51], higher than the anticipated cost of £79.2 million (see Table 7).

The appraisal expected that the project would result in an increase in maintenance costs over the life of the project. As most of this maintenance is still in the future, the evaluation uses the maintenance costs forecast within the business case.

Table 7 Cost of the project (£ million)

	Forecast (£M)	% of forecast costs	Evaluation approach
Construction costs	79.2	97%	Current estimate of project cost
Maintenance costs	2.3	3%	Not evaluated (assumed as forecast)
Total present value costs	**81.5**	**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 6, 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 improvement did was not built. We would usually compare the 'after' observed journey times to an estimate of the 'counterfactual' – what journey times are likely to have been without the project. Due to limitations in our current methodology[52], we were unable to estimate this for the A45/A46 Tollbar End improvement, so we have therefore compared directly to the 'before' journey times.

The forecasts generally overstated traffic increase[53]. The business case would have been based on growth assumptions before the impacts of COVID-19, which stalled the rate of traffic growth in 2020 and 2021. The overall impact on vehicle

[51] 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.
[52] Our current methodology does not currently allow counterfactual journey time calculations for junction improvements. Comparing the 'after' to 'before' journey times is a more conservative comparison as journey times are likely to have increased over time if the project had not been built.
[53] Refer to section 4 for further details.

hours on the project section in the fifth year was estimated to be positive, but lower than expected[54].

The appraisal assumed the project would deliver journey time savings for both those using the improved junction and those using the surrounding road network, where congestion would be eased by the additional capacity. The evaluation has not monitored the journey time impact on the surrounding roads and can only directly quantify a proportion of the journey times. Our findings relating to the project area are very different from those forecast for that area, therefore did not feel we had sufficient confidence in the forecasts to use them as the basis of an estimate of the outturn impact in the wider area.

If the trends observed at the fifth year continue over the 60-year period, the monetised impact on journey times, for those using the junction, would be £67.8 million. This figure only reflects journey time trends observed on the project area, not the surrounding road network which would have been considered in the appraisal. We acknowledge that the monetised value presented above does not represent the full impact of the project and does not reflect any impact on the wider road network.

Other reforecast impacts

We reforecast total safety benefits to be £0.1 million, as forecast. This figure relates to the benefit on both the strategic road network and the wider area, over 60-years. The personal injury collisions saving against the counterfactual was the same as forecast, so it follows that the monetised value is the same as forecast.

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 negative (-£12.8 million), indicating that the tax intake was expected to be less. We have reforecast that the impact would be greater than expected, a larger decrease in increase in tax revenues (-£22.2 million). The impact is larger because our evaluation has shown that there wasn't as much traffic growth as forecast, therefore less fuel consumed. Vehicle operating costs refer to the fuel and other costs borne by the user (such as the wear and tear on vehicles). This generally increases with increases distance travelled. There was a benefit forecast of £48.7 million. Based off the changes we have seen in our estimate of fuel consumption and indirect tax revenue, we estimate the outturn impact to be larger than forecast, a benefit of £84.3 million.

Impacts assumed as forecast

The evaluation has not been able to reforecast the monetary value of noise, air quality and carbon benefits[55], and instead these were reported as forecast. For noise, air quality and carbon impacts, this assumption is conservative because

[54] A benefit of 635,225 vehicle hours saved were forecast in the fifth year compared to an observed benefit of 161,300.

[55] We do not have a method for reforecasting the monetised impact of noise or carbon impacts. These generally have a small contribution to the monetised benefits of schemes and therefore the impact of assuming as forecast is unlikely to impact on the value for money rating of the project.

lower than forecast traffic flows are likely to mean that these impacts are better than forecast[56].

Journey time reliability was not a main objective of this project and was not included in appraisal, therefore the monetised benefit was zero. However, this is a conservative approach as the project did improve journey reliability for all routes.

Journey times and vehicle operating costs during construction and maintenance are not evaluated and therefore assumed as forecast. As the vast majority of this maintenance is still in the future, we did not have any information with which to update the estimate for this and therefore the forecast from the appraisal remains our best estimate.

Overall value for money

The main reason for the overall reduced level of benefits from this project is reduced level of journey time savings compared to what was expected. The appraisal forecast an increase in traffic and faster journey times; the observed data suggested a decrease in traffic but accompanied by those quicker and more reliable journeys. This has affected the project's value for money.

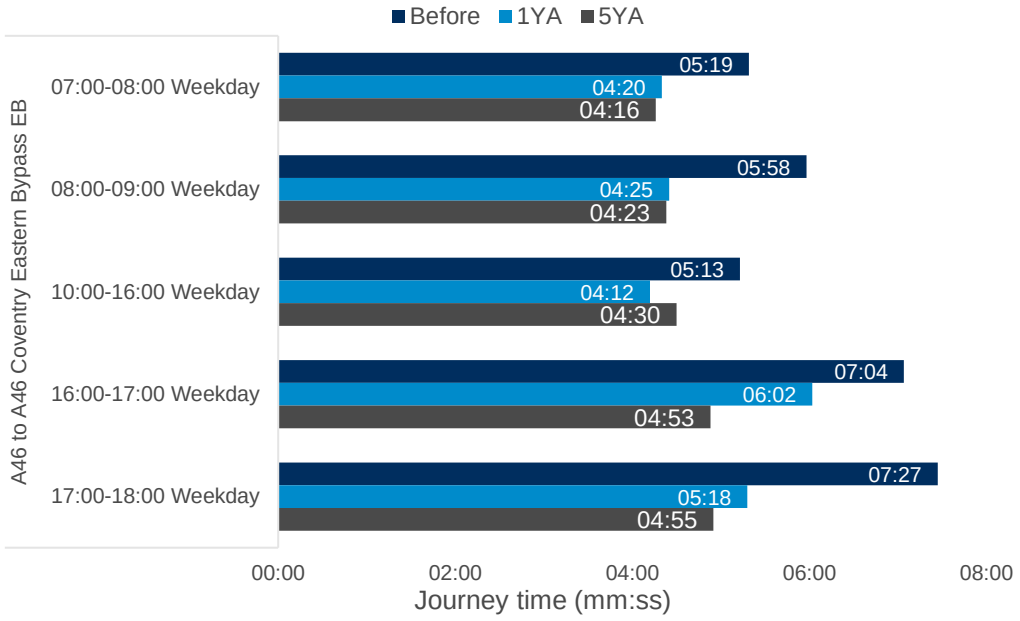
When considering an investment's value for money we also consider benefits which we are not able to monetise. For this project, being close to functional urban areas (Coventry, Birmingham and Rugby) might be a relevant consideration. It is possible that it could have had wider economic impacts which have not been considered. The environmental evaluation was not able to conclude the impact on greenhouse gases, though as the levels of traffic observed after opening were lower than forecast, the impacts could be better than expected. Along with this, journey time benefits presented in this section referred to the project extent only. As it is more than probable that the project had delivered benefits to the wider area, there could be additional journey time benefits not captured quantitively. In addition, no monetised estimate of journey time reliability has been included.

Without taking into consideration any non-monetised benefits, the project is set to deliver 'low' value for money. When taking these additional benefits into account it is likely that the project could deliver 'medium' value for money over the 60-year appraisal period. However, this still falls below the anticipated 'very high' value for money. As traffic growth is expected to return to what was forecast when this project was appraised, it is possible that the project could deliver more benefits in the future. If the trends observed within the first five years continue, the project is expected to deliver lower than expected value for money.

[56] Refer to section 6 for further detail on noise, air quality and greenhouse gas impacts.

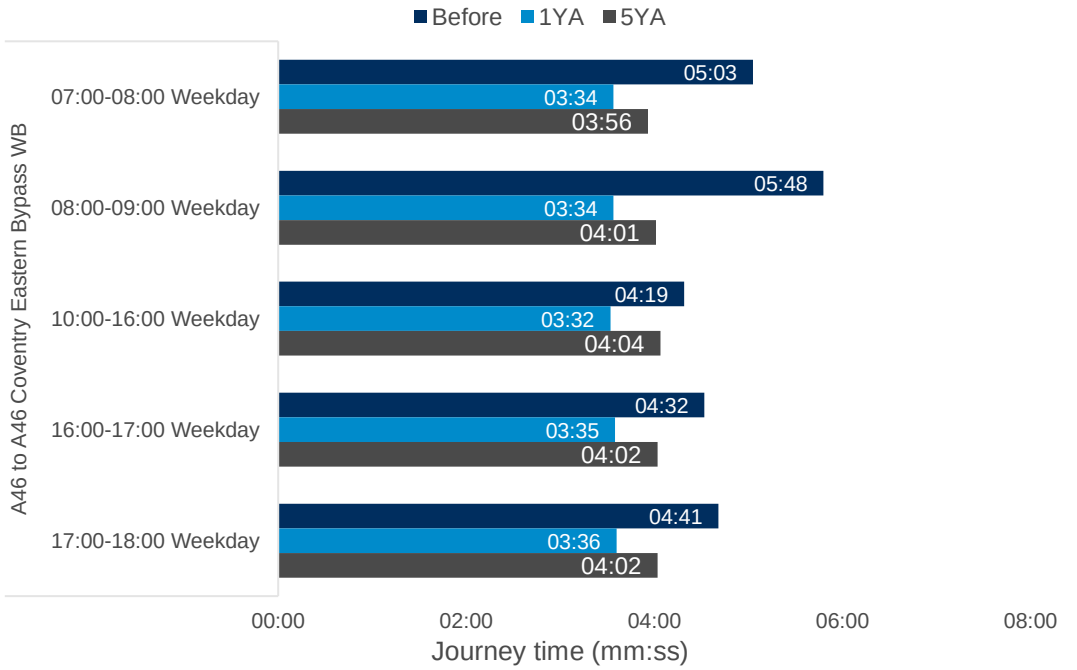
Appendix A: Average journey time analysis (additional routes)

Figure 32 Comparison of observed average journey times A46 Kenilworth Bypass (A46 W)- A46 Coventry Eastern Bypass (A46 E)



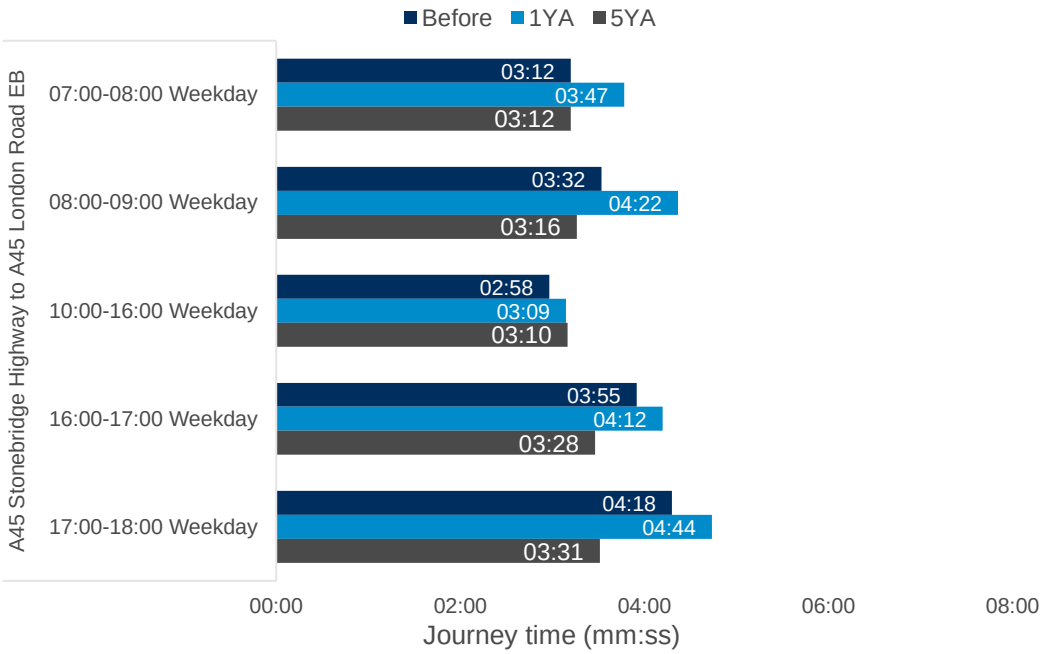
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 33 Comparison of observed average journey times A46 Coventry Eastern Bypass (A46 E) - A46 Kenilworth Bypass (A46 W)



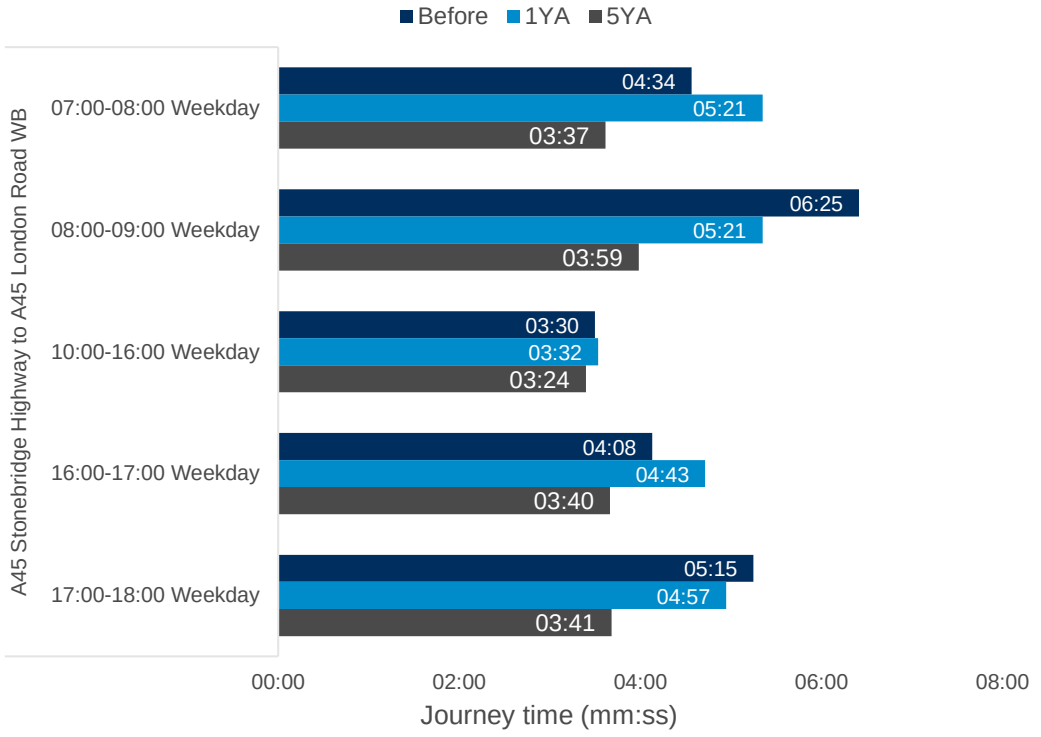
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 34 Comparison of observed average journey times A45 Stonebridge Highway (A45 W) - A45 London Road (A45 S)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 35 Comparison of observed average journey times A45 London Road (A45 S) - A45 Stonebridge Highway (A45 W)



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 36 Comparison of observed average journey times A45 London Road (A45 S) - B4110 London Road (B4110 N)

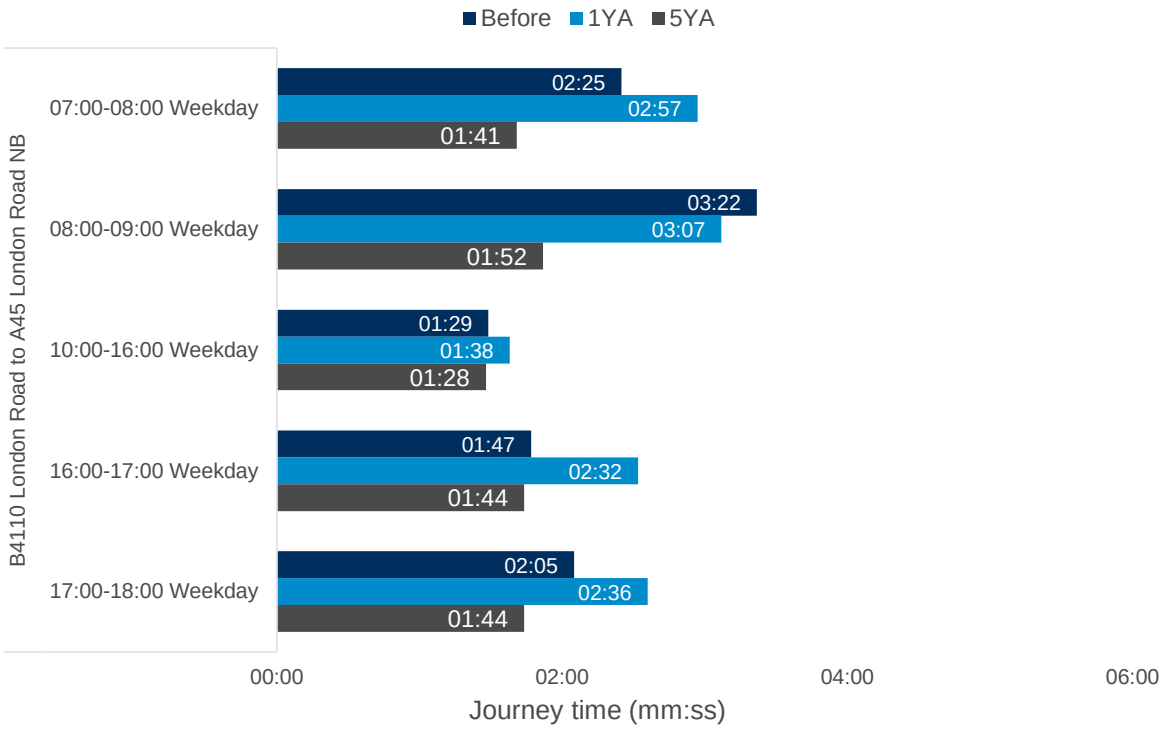
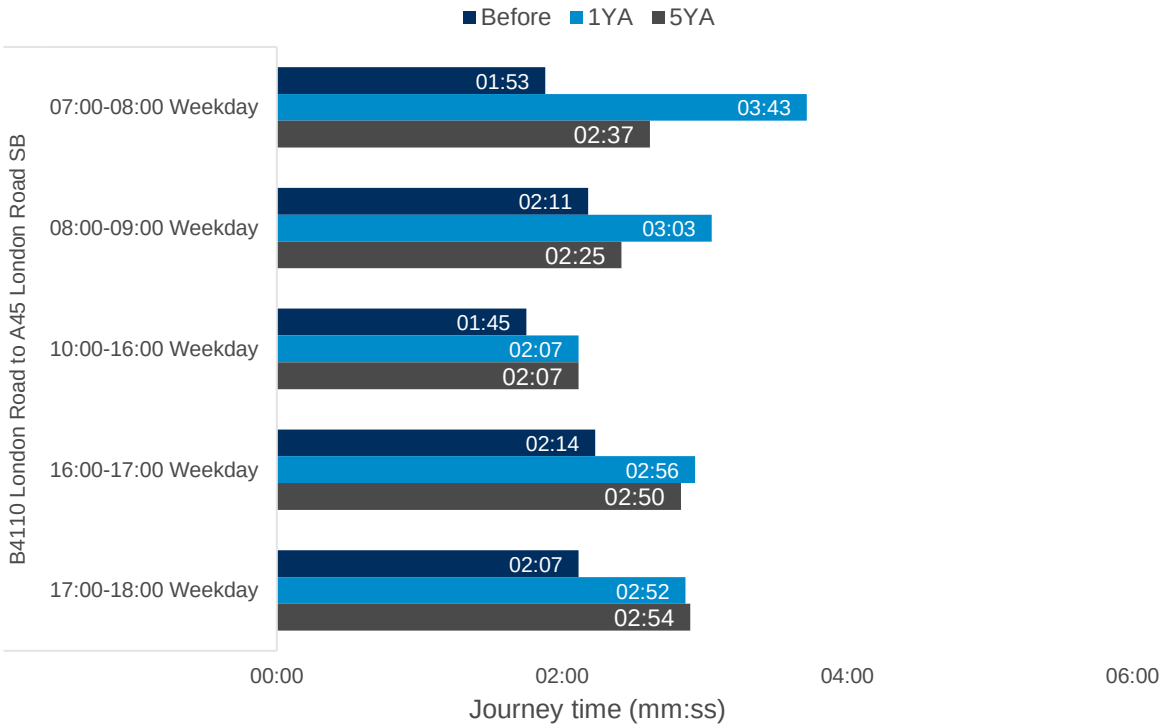
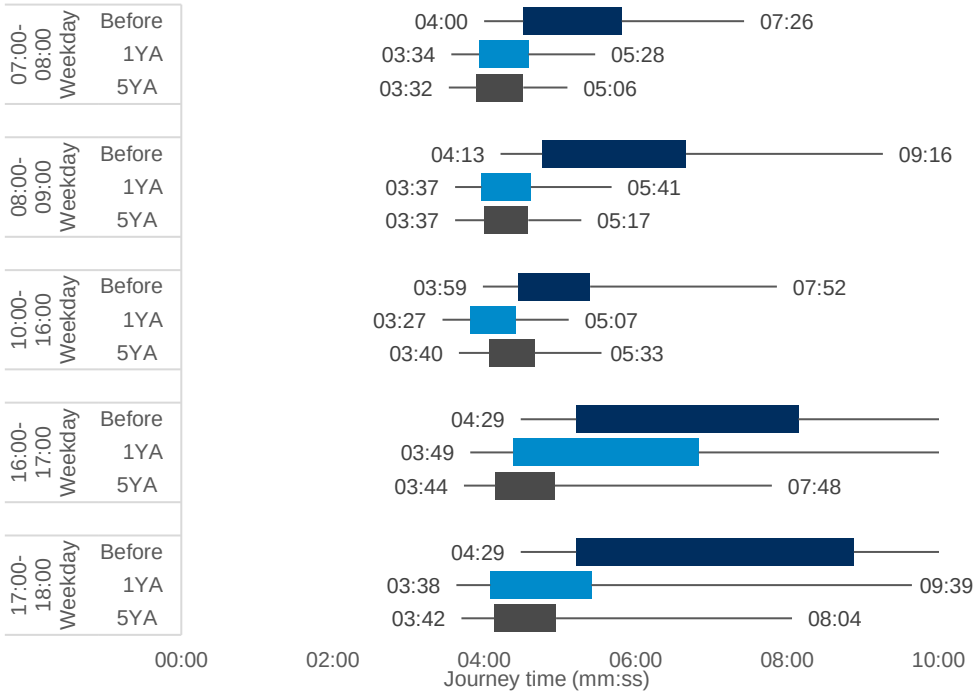


Figure 37 Comparison of observed average journey times B4110 London Road (B4110 N) - A45 London Road (A45 S)



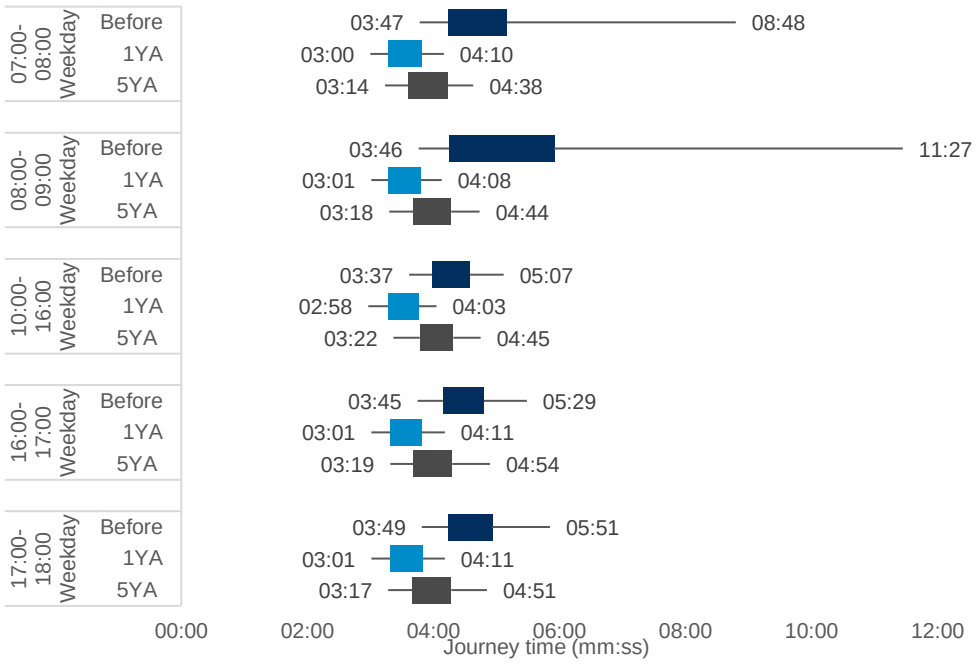
Appendix B: Journey time reliability analysis (additional routes)

Figure 38 A46 Kenilworth Bypass (A46 W) - A46 Coventry Eastern Bypass (A46 E) journey time reliability



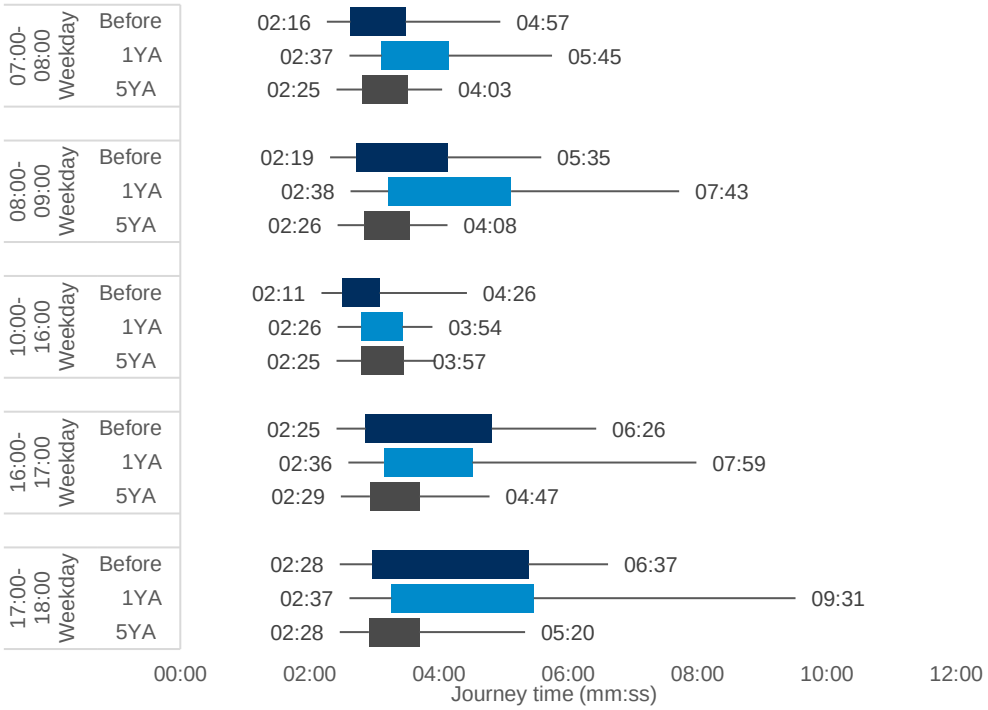
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 39 A46 Coventry Eastern Bypass (A46 E) - A46 Kenilworth Bypass (A46 W) journey time reliability



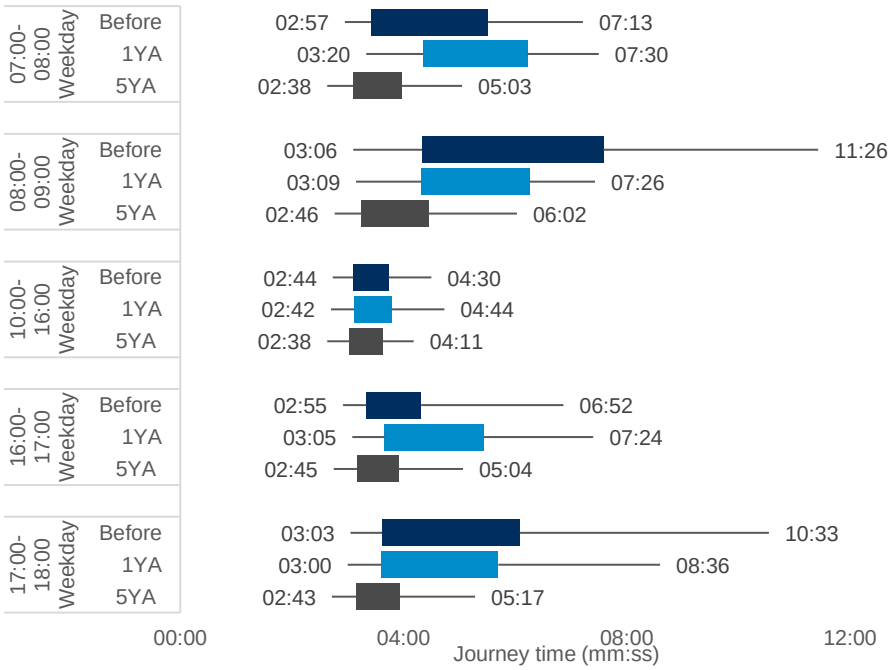
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 40 A45 Stonebridge Highway (A45 W) - A45 London Road (A45 S) journey time reliability



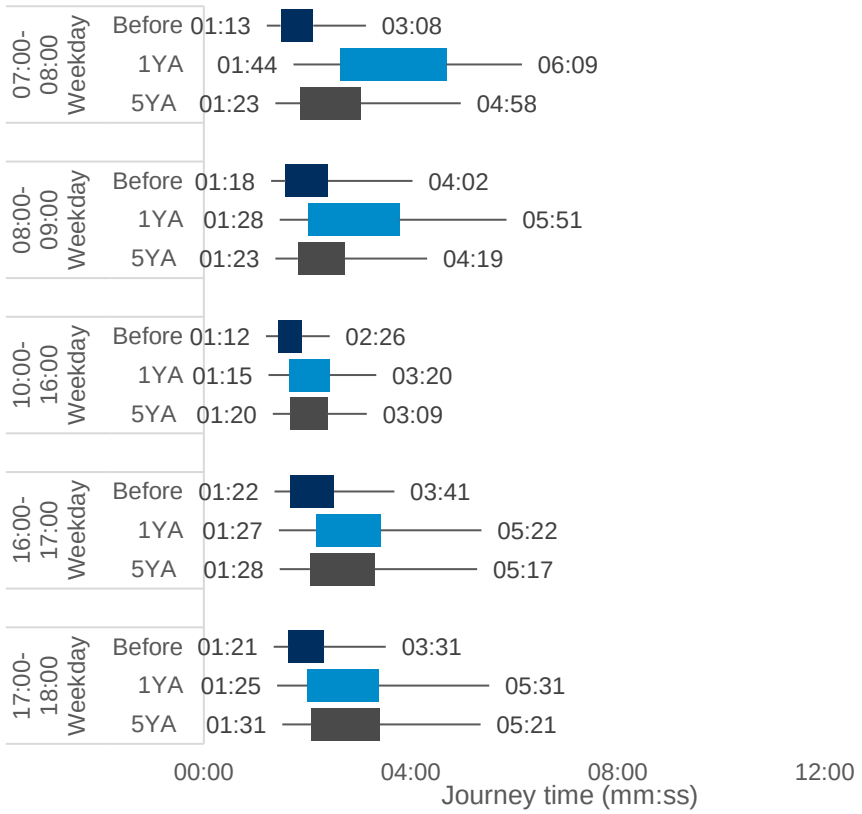
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 41 A45 London Road (A45 S)- A45 Stonebridge Highway (A45 W) journey time reliability



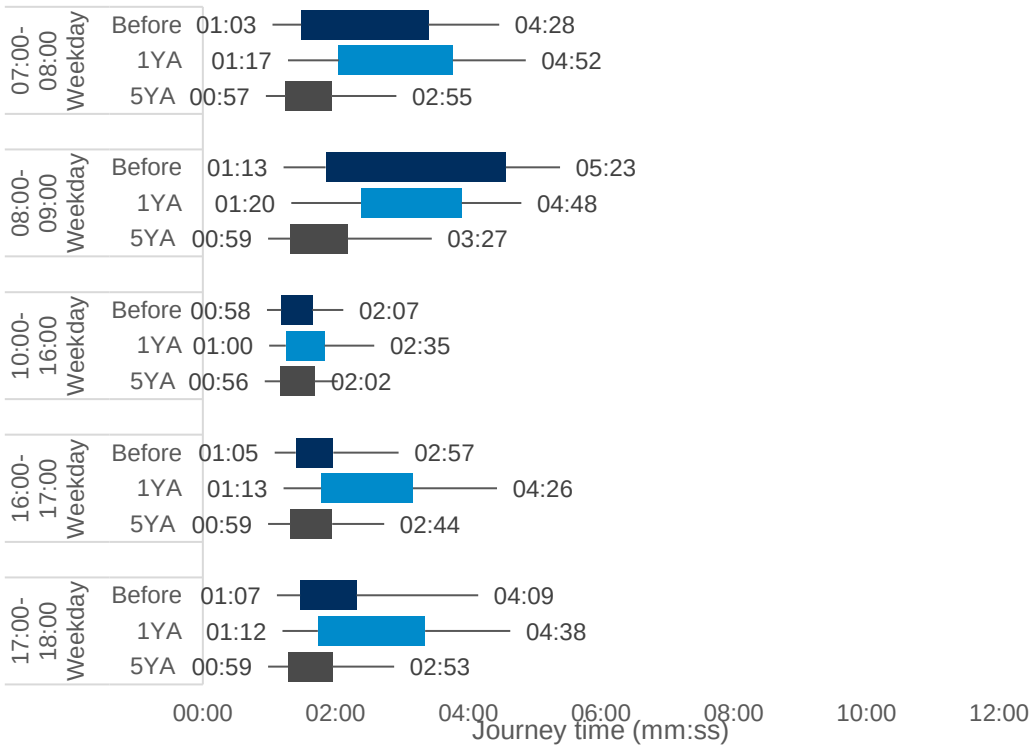
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 42 B4110 London Road (B4110 N) - A45 London Road (A45 S) journey time reliability



Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Figure 43 A45 London Road (A45 S)- B4110 London Road (B4110 N) journey time reliability



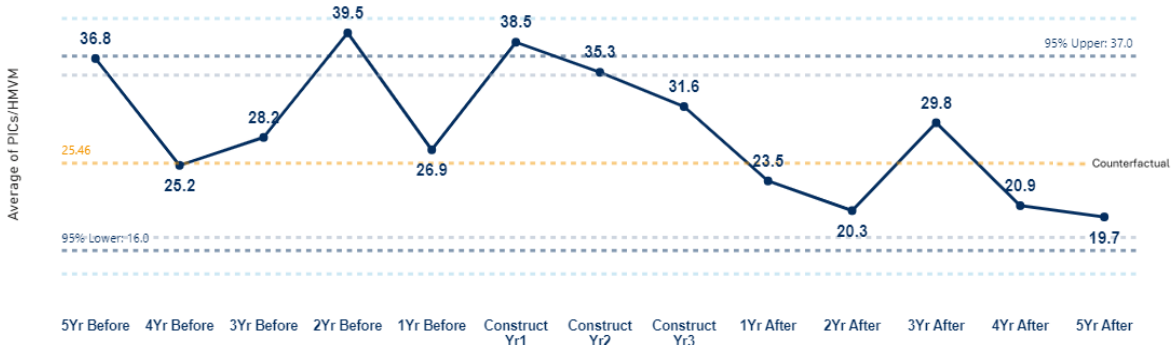
Source: Satnav Data (Before: October 2012 to September 2013, 1YA: April 2018- March 2019, 5YA: November 2021 to October 2022)

Appendix C: 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 31.3 personal injury collisions per hmvm. Five years after, there was a decrease to 22.9 personal injury collisions per hmvm (Figure 44). The counterfactual test undertaken found that the collision rate would likely have been between 16-37 personal injury collisions per hmvm. The after annual average collision rate falls within the counterfactual range of 16-37 collisions per hmvm.

Figure 44 Annual average number of collision rate with counterfactual scenario ranges



Source: STATS19 1 October 2008 – 14 December 2021

Collision rates have reduced but not to the extent where we can be confident that the project is a cause for this reduction.

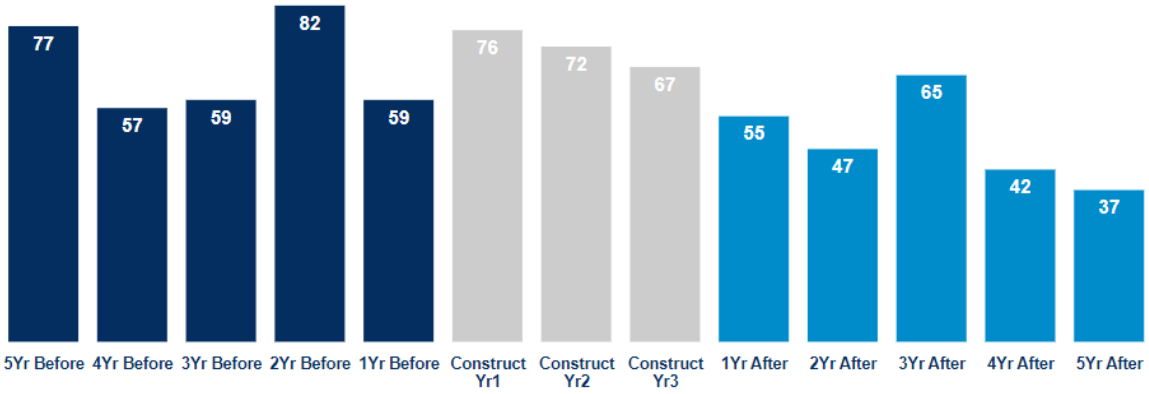
What impact did the project have on safety for the wider area?

Before the project an annual average of 67 collisions were observed. After the project, this had fallen to 49, a reduction of 18 (Figure 45).

Average personal injury collisions

67	49	18
Before	After	Fewer

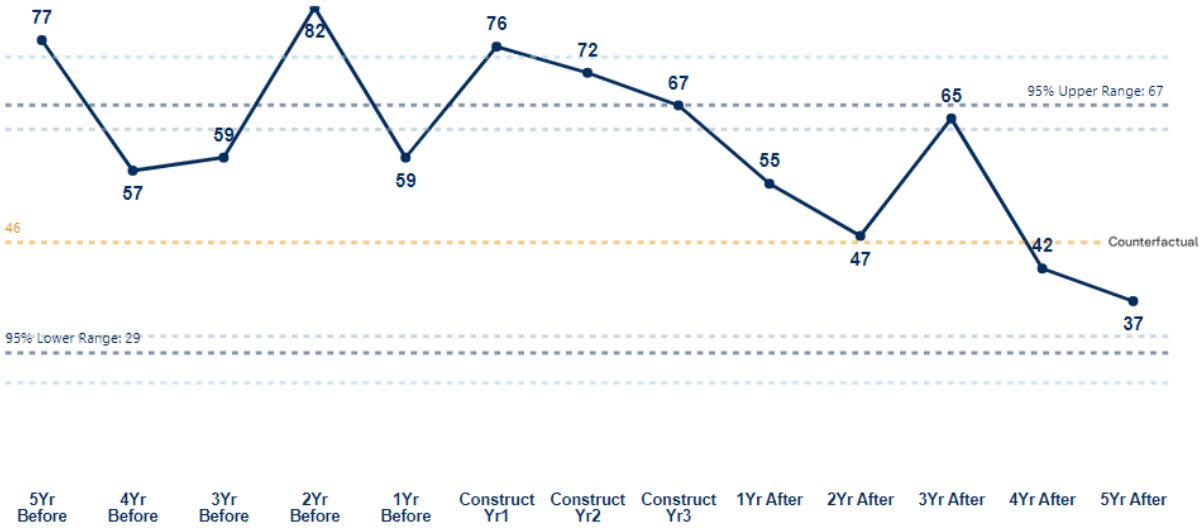
Figure 45 Annual personal injury collisions in wider area



Source: STATS19 1 October 2008 – 14 December 2021

The after annual average falls within the counterfactual range of between 29-67 personal injury collisions per year (Figure 46).[57]

Figure 46 Observed and expected range of personal injury collisions in wider area (annual average)



Source: STATS19 1 October 2008 – 14 December 2021

[57] We have tested the results at 95% confidence interval. The critical value at 95% confidence interval is 46, the observed collision savings for the wider area are higher than this value of 46. We believe that the collisions savings observed for the wider safety area ensure that the project is on track to meet its safety objective.

What changes in the severity of collisions did we see?

See Appendix E 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 across average serious and slight severity categories (Table 8). Total fatal collisions have remained stable with no changed. Figure 47 shows the full breakdown of severity of personal injury collisions by project year.

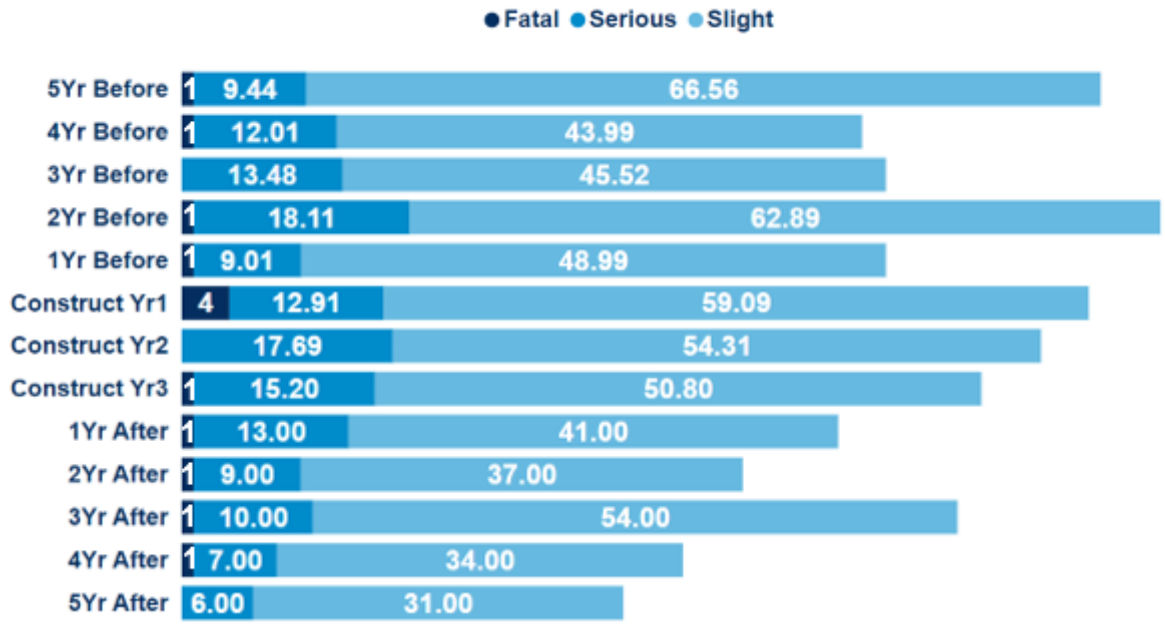
Table 8 Number of personal injury collisions by severity

	Before	After	Change	Change direction
Fatal	4	4	0	⇔
Serious (average)	6.21	4.50	1.71	↓
Slight (average)	29.79	19.70	7.09	↓

Source: STATS19 1 October 2008 – 14 December 2021

If the project continues to perform at the currently level, it will achieve the predicted reduction.

Figure 47 Severity of personal injury collisions within the wider area



Source: STATS19 1 October 2008 – 14 December 2021

What impact did the project have on casualties?

There has been no change in the FWI observed annually. An annual average of 2.2 FWI was observed after the project became operational were observed. This has remained stable compared to the average 2.8 FWI observed before.

The combined measure showed an extra 24 million vehicle miles was travelled before an FWI.[58]

A reduction of three KSI has been observed annually. Reducing from an average of 12.9 KSI before to 9.6 KSI after the project became operational. The rate of KSI per hmvm has reduced from an average of seven to five 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.

[58] Before the project, 60 million vehicle miles needed to be travelled before a FWI (1.2 FWI per hmvm). After the project this increased to 84 million vehicle miles (1.7 FWI per hmvm).

Appendix D: Counterfactual safety methodology

Personal injury 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 project.

To establish whether any change in collision numbers is due to the project or part of wider regional trends we estimate what would have likely occurred to the safety trends if the project was not constructed. Prior to 2020, post opening project evaluations answered this question by applying the national average trends in personal injury collisions to the baseline observed before the project was constructed.

During 2020 the methodology has been reviewed and updated to generate a more accurate estimation. The revised method enables us to align the counterfactual with regional rather than national trends in traffic volumes and personal injury collisions.

It also allows for a more granular differentiation of road type. Previously the counterfactual for smart motorways was based on the national trends averaged across all types of motorways, the new method provides information for average conventional motorways and those with higher-than-average traffic levels (which are more comparative to the motorways which were converted to smart motorways). It also allows for differentiation between different types of smart motorways.

We now also report a counterfactual range, rather than an individual figure. This is the likely number of collisions that would occur, at the same post evaluation point, if the smart motorway was not built. The range is based on a 95% confidence interval.

Appendix E: Incident reporting mechanisms

Since 2012, many police forces have changed the way they collect STATS19 data (for more information see here). These changes mean casualty severity is now categorised automatically based on the most severe injury, rather than the judgement of an attending police officer.

Police forces using the new systems, called injury-based severity reporting systems, (also known as CRaSH and COPA) report more seriously injured casualties than those which don't. These changes make it particularly difficult to monitor trends in the number of killed and seriously injured casualties over time, or between different police forces. In response to these challenges, DfT and the Office for National Statistics (ONS) have developed an approach to adjust the data collected from those police forces not currently using injury-based reporting systems.

These adjustments are estimates for how casualty severity may have been recorded had the new injury-based reporting system been used. These adjusted estimates apply retrospectively from 2004 and adjust historical data to show casualty severity 'as if' this was recorded under the new injury-based system. Until all police forces have started using the new systems, these historical adjustments will continue to be updated every year. Using these adjusted totals allows for more consistent and comparable reporting when tracking casualty severity over time, across a region, or nationally. While there is no impact on total casualties or collisions, and no impact on total fatalities, these adjustments do impact serious and slight casualties and collisions.

Appendix F: Unadjusted collision severity

The project extent is covered by West Midlands and Warwickshire police constabulary, both transferred from Stats19 to CRaSH in November 2015.

Table 9 shows the unadjusted collision severities on the project extent:

Table 9 Unadjusted collisions by severity for project extent

Observation Year	Fatal	Serious	Slight
5Yr Before	0	0	7
4Yr Before	0	1	8
3Yr Before	0	2	16
2Yr Before	0	3	5
1Yr Before	0	1	10
Construct Yr1	0	0	7
Construct Yr2	1	0	5
Construct Yr3	0	0	3
1Yr After	0	1	7
2Yr After	0	0	9
3Yr After	0	1	8
4Yr After	0	0	1
5Yr After	1	0	4

Source: STATS19 1 October 2008 – 14 December 2021

The wider safety area of the A45/A46 Tollbar project is covered by West Midlands and Warwickshire police constabulary, both police constabulary transferred from Stats19 to CRaSH in November 2015.

Table 10 shows the unadjusted collision severities on the wider safety area:

Table 10 Unadjusted collisions by severity for the wider area

Observation Year	Fatal	Serious	Slight
5Yr Before	1	8	68
4Yr Before	1	11	45
3Yr Before	0	13	46
2Yr Before	1	16	65
1Yr Before	1	8	50
Construct Yr1	4	12	60
Construct Yr2	0	17	55
Construct Yr3	1	13	50
1Yr After	1	13	41
2Yr After	1	9	37
3Yr After	1	10	54
4Yr After	1	7	34
5Yr After	0	6	31

Source: STATS19 1 October 2008 – 14 December 2021

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