national highways

M1 junction 19 improvement project

Three-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 M1 junction 19 (Catthorpe Interchange) project was officially opened during this period, in December 2016.

This report gives an initial indication of the project's performance in the third year of its operation. The project aimed to reduce congestion, reduce journey times, improve journey reliability, and maintain safety. The improvements incorporated a direct dual carriageway link between M6 and A14, free flow links between both A14 and M6 and the M1, with new east-west link joining Catthorpe and Swinford.

The three years after evaluation indicates the project is on track to meet its safety objective with a reduction in personal injury collisions, collision rates and number of serious and fatal collisions.

There has been a general increase in traffic in most time periods, with a corresponding decrease in traffic using local roads. An analysis of journey times shows a reduction in average journey times on all routes, directly impacted by the junction improvements. Average speeds have doubled on the A14 to M6 and M1 to A14. An improvement in journey times on all routes across all time periods means that road users can now be more confident about how long their journey will take.

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

Value for money assessment, based on evidence from three years of operation, indicates that the project is on track 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 M1 junction 19 (Catthorpe interchange) upgrade project opened to traffic in December 2016. The project aimed to reduce congestion, reduce journey times, improve journey reliability, and maintain safety. Without the improvements, these issues were expected to be exacerbated by predicted growth in traffic volumes. The improvements incorporated a direct dual carriageway link between the M6 and A14, together with free flow links between both the A14 and M6 and the M1, as well as a new east-west link joining Catthorpe (south-west of J19) and Swinford (north-east of J19). The project included six new bridges and a new public right of way / bridleway. The project also included the removal of the existing twin dumbbell roundabout, the redirection of footpaths and the removal of the M6 to M1 northbound link.

Three years after the project opened, there has been a general increase in traffic in most time periods, with a corresponding decrease in traffic using local roads. Observed data broadly aligns with forecasts, although there are modest differences across all routes and time periods. An analysis of journey times shows a reduction in average journey times on all routes directly impacted by the junction improvements. Average speeds have doubled on the A14 to M6 and M1 to A14. An improvement in journey times on all routes across all time periods means that road users can now be more confident about how long their journey will take.

In the first three years since the junction was upgraded, the annual number of personal injury collisions (PICs) decreased from an average of six before construction to one after opening. The annual average rate of PICs per hundred million vehicle miles (hmvm) has also improved. The average collision rate decreased to three PICs per annual hmvm. Prior to the project, there was an annual average of 18 PICs per annual hmvm. This falls below the range of what would have been expected if the junction upgrades had not occurred and therefore considered statistically significant and is considered as a result of the project.

An evaluation of environmental impacts shows that all TAG[1] environmental sub-objectives (Noise, Air Quality, Greenhouse Gases, Landscape, Heritage of Historic Resources, Biodiversity and Water Environment) and society[2] sub-objectives (Severance, Physical Activity and Journey Quality) were ‘as expected’ compared to pre-project appraisal (exceptions were Air Quality and Greenhouse Gases, which were both evaluated as ‘likely as expected’ owing to limited data).

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

Overall, based on the evidence from the first three years, the M1 junction 19 project is on track to deliver a positive economic return on investment with the project likely achieving ‘medium’ value for money once non-monetarised impacts are considered.

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

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

2. Introduction

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

The M1 junction 19 (Catthorpe interchange) upgrade project saw the removal of two roundabouts linking the A14 with the M6, which were replaced with a free-flow dual carriageway. Improvements also included the creation of a free-flow link between the M1 and A14, as well as the construction of six new bridges and a new public right of way / bridleway.

Prior to construction, the junctions experienced congestion and unreliable journey times. This impacted the strategic importance of this junction, which provides east-west connectivity via the M6 and A14.

The project aimed to reduce congestion, reduce journey times, improve journey reliability and maintain safety performance. Without the improvements, these issues were expected to be exacerbated by predicted growth in traffic volumes.

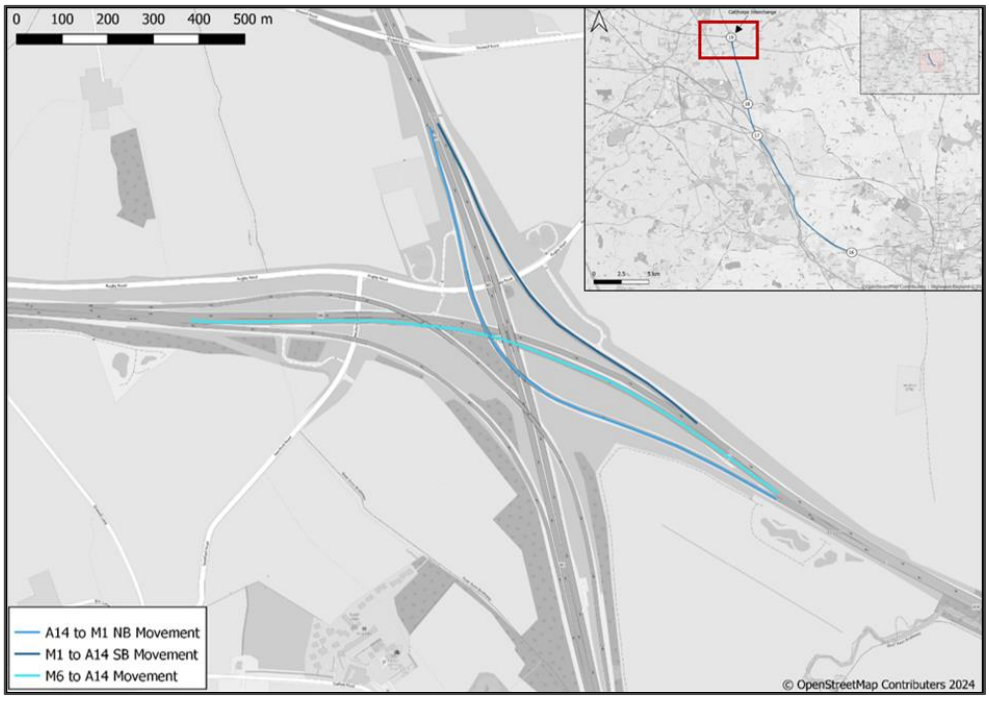
The M1 junction 19 project began construction in January 2014 and was completed and opened to traffic in December 2016.

Project location

The M1 is a key strategic route connecting the south-east to the north between London and Leeds. M1 junction 19 is located in Leicestershire, approximately 25km south of Leicester and 26km north-west of Northampton. The junction is located 1km south-west of the town of Swinford and 1km north-east of Catthorpe.

Figure 1 shows the location of the project. Junction 19 is the intersection with the A14 (connecting the M1 to the port of Felixstowe in Suffolk) and M6 (connecting the M1 to Birmingham, the north-west of England and Scotland).

Figure 1 M1 junction 19 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.

A post-opening project evaluation (POPE) compares changes in key impact areas[3] by observing trends on a route before a project is constructed (baseline) and tracking these after it has opened to traffic (outturn). 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 POPE methodology manual on our website.[4]

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

3. Delivering against objectives

How has the project performed against objectives?

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

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

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

Table 1 Objectives and Evaluation summary

Objective	Three-year evaluation
Reduce congestion and delays on the A14 (westbound), M6 (eastbound) and M1 (southbound) on the approach to the junction (particularly at peak times) and improve journey reliability.	Journey times have been halved (or better) on the routes directly impacted by the junction upgrades. Speeds have also increased along the A14 to M1 and A14 to M6, with the delays associated with queuing at the dumbbell roundabouts removed. Large improvements to journey time reliability mean road users were more confident about how long their journey takes when travelling through the junction.
Improve road safety (particularly on slip roads back from the M6 and M1).	The project has seen a reduction in the rate and number of personal injury collisions (PICs) on both the project extent and the surrounding network. There has been an annual reduction of five PICs, which is in line with the appraised business case for the project. No fatal collisions have been recorded on the project extent since the project became operational.
Separate local traffic (e.g. travelling to Catthorpe and Swinford) from long distance traffic.	Analysis of traffic flow on the project extent and the wider area shows evidence of long-distance traffic being removed from the local road network. Local vehicles no longer need to travel through the junction owing to the creation of a new link connecting Catthorpe (to the south-west) with Swinford (to the north-east).
Improve conditions for cyclists, pedestrians and horse riders crossing the junction.	This objective is not assessed within the POPE methodology; however, it is expected that conditions for cyclists, pedestrians (including mobility impaired) and horse riders have improved as a result of the project owing to the creation of a new public right of way / bridleway and the removal of traffic from local routes.
Keep adverse environmental impacts to a minimum.	All TAG environmental sub-objectives were 'as expected' compared to pre-project appraisal (except for Air Quality and Greenhouse Gases which were evaluated as 'likely as expected' owing to limited data). Mitigation measures were delivered as proposed.
Support local regeneration and development plans	This objective is not assessed within the POPE methodology. However, it is expected that the project helped to unlock opportunities for growth by improving traffic flow and making journeys more reliable for road users.

4. Customer journeys

Summary

For our evaluation of traffic impacts, our baseline is 2013 (before construction). For our three years after study, we have used data from 2019 to avoid the period impacted by COVID-19 lockdown restrictions.

The analysis indicates that the project has supported an increase in road users travelling through M1 junction 19. During the three years since the project opened, the route has seen an increase in traffic flow on all routes in all directions (except for the A14 to M1 southbound movement in the AM peak) compared to pre-project flows.

Examining traffic flows on the local road network surrounding the project demonstrates a reduction in traffic on most local routes across all time periods as a result of the project.

The project had an objective to improve journey time reliability and journey times. Three years after opening, the junction upgrades have led to an increase in speed along the A14 to M1 and A14 to M6, resulting in journey times being halved (or better) in all time periods and directions on the routes directly impacted by the junction improvements.

The longest journeys (95th percentile) are quicker in all time periods. Large improvements to journey time reliability mean road users can now be more confident about how long their journey will take when travelling through the junction.

How have traffic levels changed?

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

National and regional

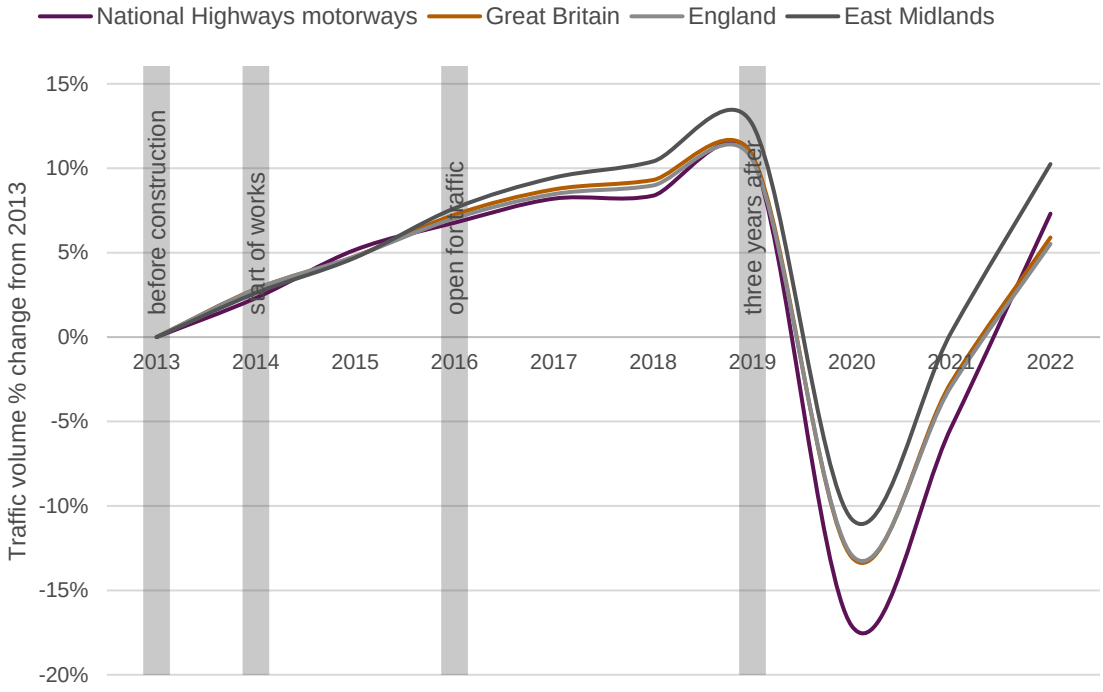
To assess the impact of the project on traffic levels, it is useful to understand the changes within the context of national and regional traffic. To do this, we use the Department for Transport (DfT) annual statistics. The data is reported by region (East Midlands) and road type, recording the total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

Figure 2 shows traffic growth in England and the East Midlands between 2013 (before construction) and 2019 (three years after project opening). Traffic increased by 12.6% in the East Midlands, with all National Highways motorways experiencing an average 10.7% growth. Averaging these two numbers gives the background growth of the project (11.6% between 2013 and 2019).

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

The graph shows traffic growth to 2022, to demonstrate the impact COVID-19 had upon traffic levels in the UK. The three years after analysis is based on a pre-pandemic position.

Figure 2 Changes in national and regional background levels of traffic between 2013 and 2022 (M1 junction 19 improvement project)



Source: Department for Transport

How did traffic volumes change?

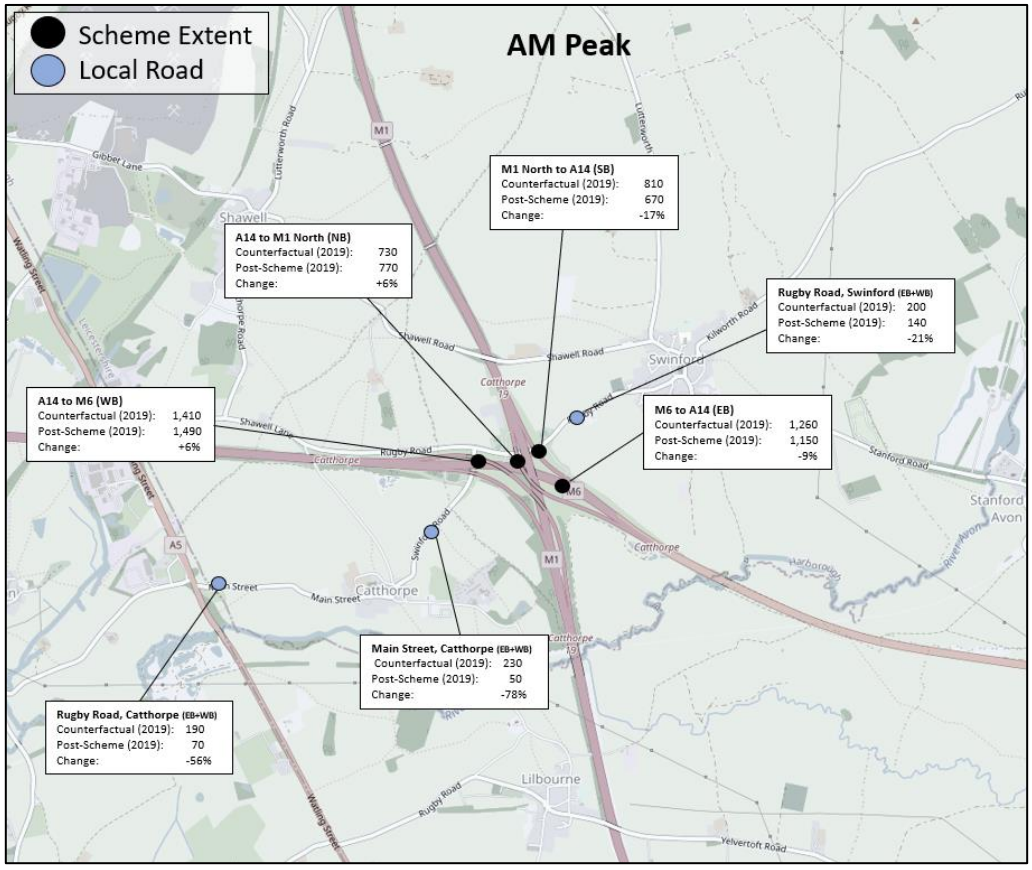
Traffic volumes were analysed through the project area by comparing the average weekday traffic (AWT) data. Figure 3 to Figure 5 shows the observed AWT flows at locations along the project extent and the wider area compared to the counterfactual for the morning peak, daytime, and evening peak. The counterfactual presents an estimate of what traffic flows might have been in 2019 if the project had not gone ahead.

The evaluation found observed traffic growth using M1 junction 19 to be 8% higher in the morning peak, 18% higher in the daytime and 24% higher in the evening peak when compared to traffic flow data collected before project construction.

When comparing to the counterfactual, flows were 3% lower in the morning peak, but 6% and 11% higher in the daytime and evening, respectively. Averaged across all time periods this gives a 4.6% increase in traffic. This indicates that the growth in traffic flow may be attributed to the junction upgrades.

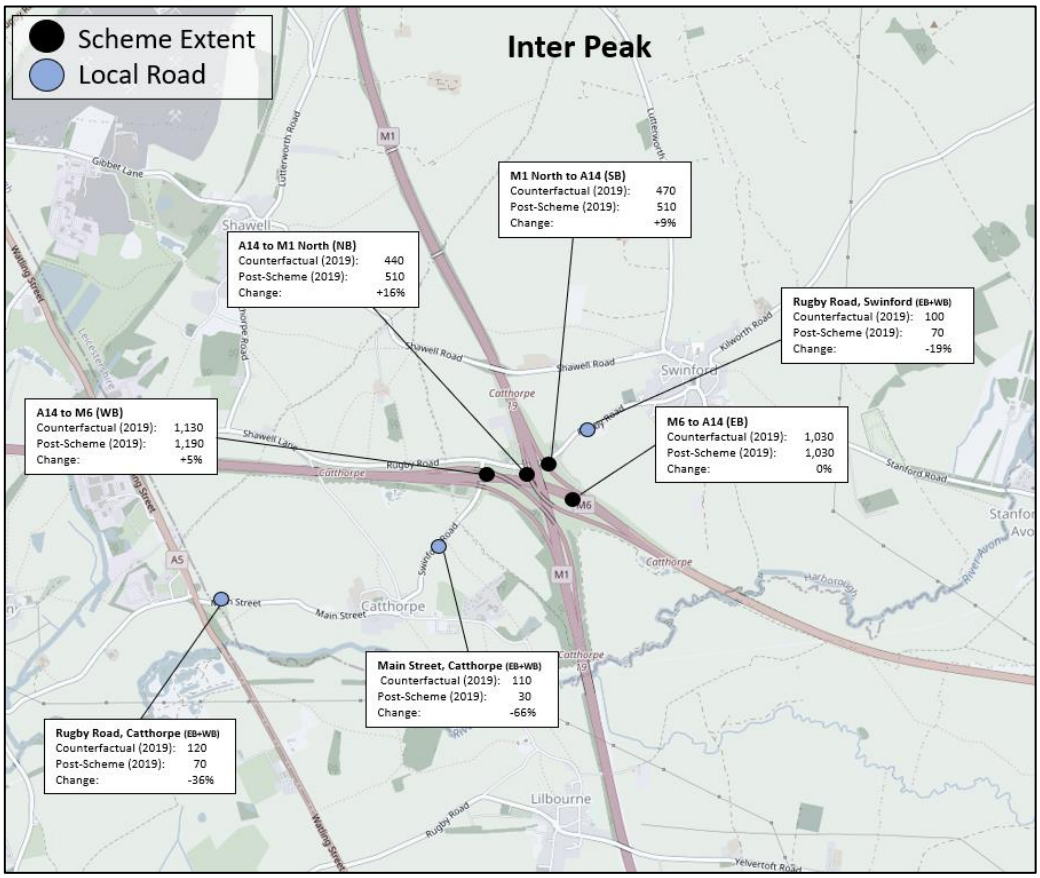
On local roads, typically traffic flows have decreased between the counterfactual and 2019, except for the evening peak on Rugby Road at Swinford. Fewer vehicles on local routes indicates that trips may have moved onto the M1 junction 19 improvements.

Figure 3 Changes in traffic volumes (AWT) – Morning Peak



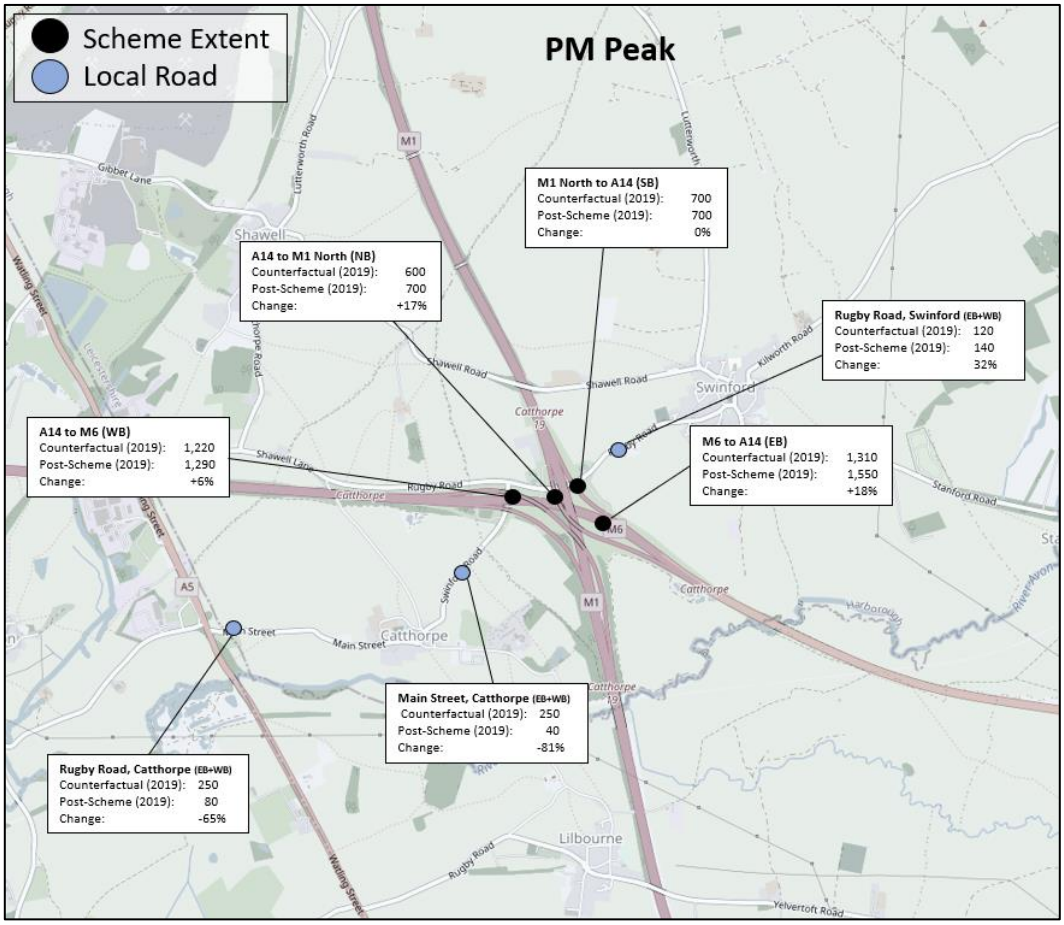
Source: National Highways and OpenStreetMap contributors

Figure 4 Changes in traffic volumes (AWT) – Daytime



Source: National Highways and OpenStreetMap contributors

Figure 5 Changes in traffic volumes (AWT) – Evening Peak



Source: National Highways and OpenStreetMap contributors

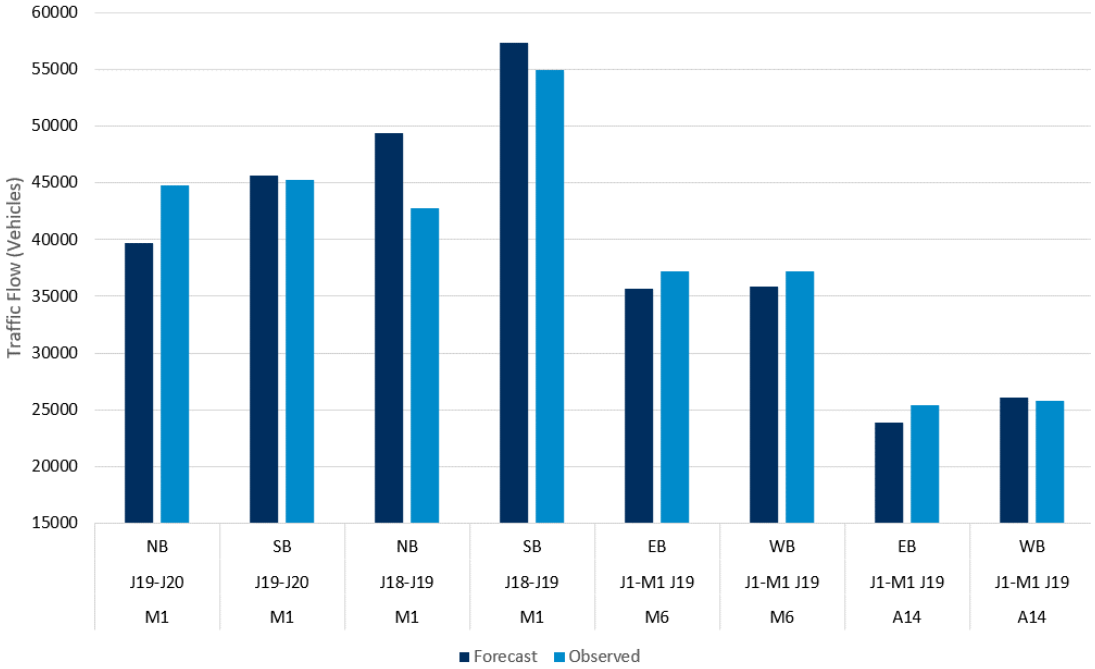
Was traffic growth as expected?

Prior to construction, traffic growth forecasts were developed to support the business case for the project. Forecasts were made based upon a transport model that calculated likely changes to traffic levels 'with' and 'without' the project.

Figure 6 compares the forecast traffic flows (dark blue) to the observed traffic flows (light blue), based on Average Annual Daily Traffic (AADT). The forecast flows are broadly in line with the observed flows on all routes, indicating that the 2019 forecasts were generally accurate.

Observed flows are slightly higher than forecast between the M1 junction 20 to junction 19, on the M6 between junction 1 and the M1 junction 19 in both directions, and on the A14 between junction 1 and the M1 junction 19. On all other routes, observed flows were slightly lower than forecast.

Figure 6 Forecast and observed traffic volume (24hr AADT)

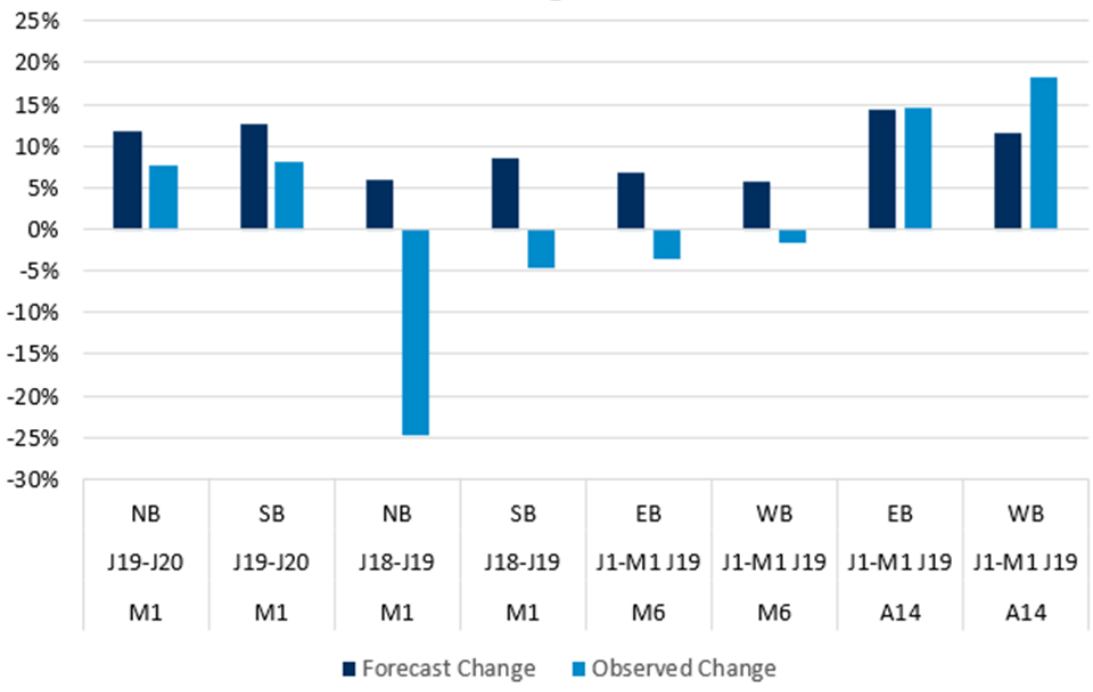


Source: The 2019 forecast is interpolated between the 2017 Opening Year and 2025 interim year traffic forecasts. Observed data is from National Highways data, 2019.

Figure 7 shows forecast growth along the project extent of between 6-14% over the six-year period (2013 – 2019). Observed growth across this period is also shown.

Increases in traffic volume were observed along the M1 between junction 20 and junction 19 in both directions of 8%. Between M1 junction 18 and junction 19, there was a 25% decrease in traffic volume in the northbound direction, and 5% in the southbound direction. The M6 between junction 1 and the M1 junction 19 has decreased by 4% in the eastbound direction and 2% westbound. The A14 has increased traffic volume in both directions; 15% eastbound and 18% westbound.

Figure 7 Forecast and observed change in 24hr AADT traffic volume (2013 vs 2019)



Source: National Highways (Economic Appraisal Report)

Relieving congestion and making journeys more reliable

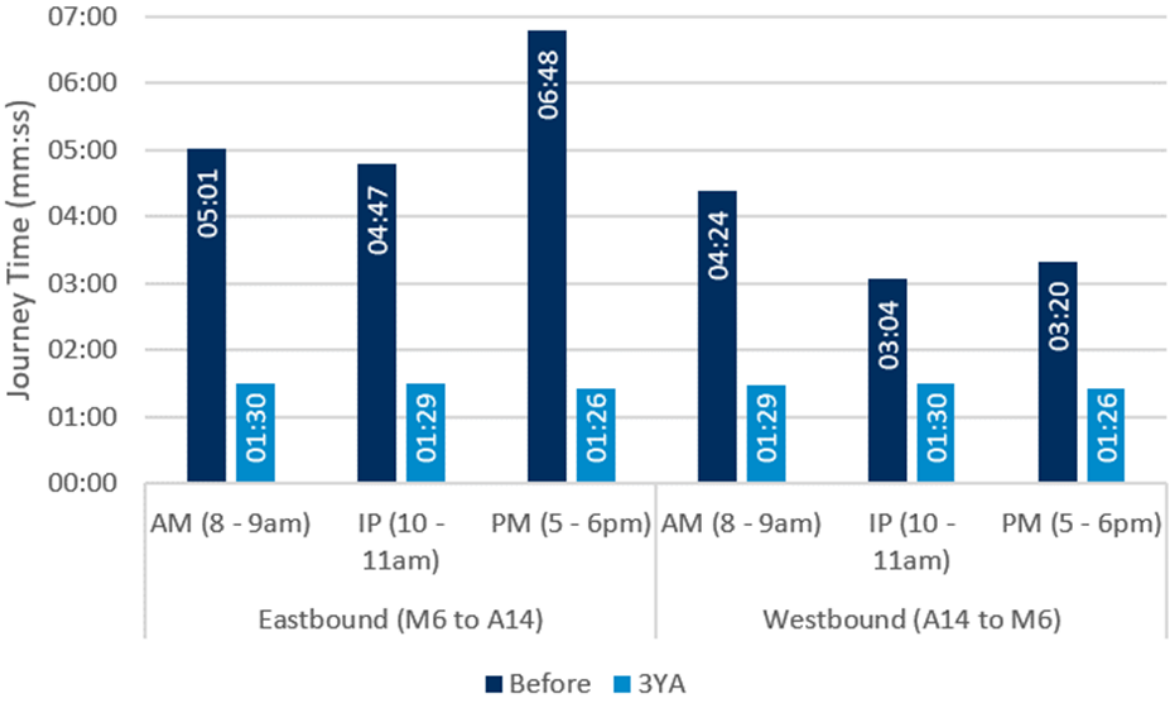
Analysis of journey times and speeds can indicate the impact of the junction improvement on congestion. The extent to which journey times vary from the average journey time indicates how reliable a journey is.

Did the project deliver journey time savings?

Improvements in journey times are an objective of this project and at three years after opening, results show that journey times have improved in all directions during all periods of the day.

Figure 8 compares the journey time on the M6 to A14 between 2013 (before construction) and 2019 (three years after opening). The graph shows an improvement to journey times in all time periods, with the greatest change occurring in the evening peak (with time reducing from an average journey time of nearly 7 minutes to 1.5 minutes).

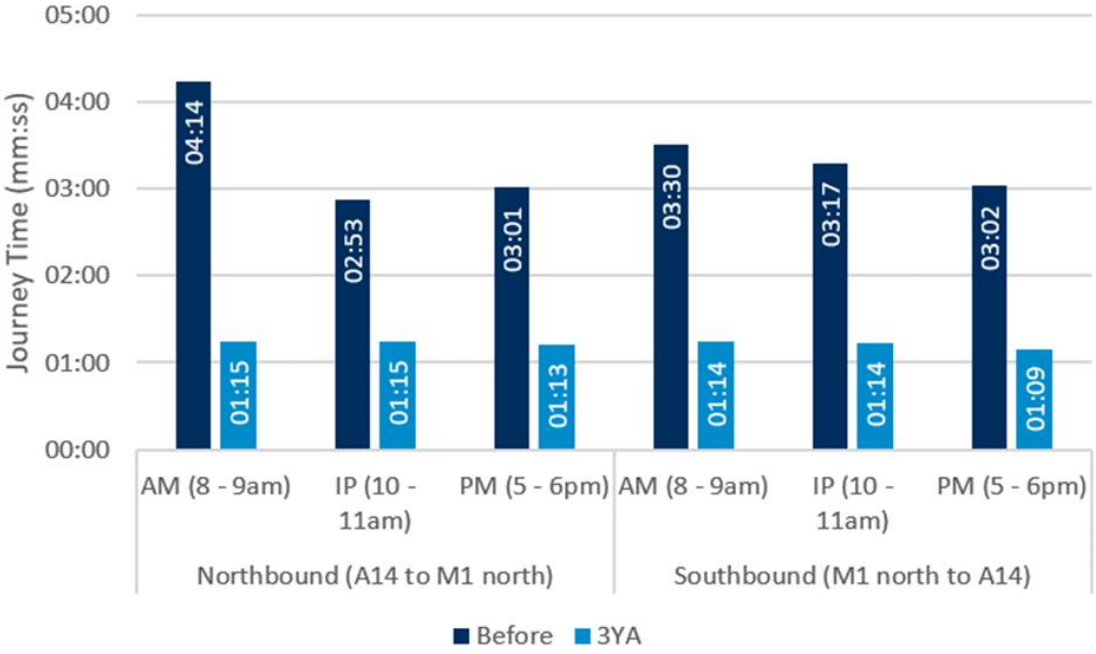
Figure 8 Change in average weekday journey times (A14 to M6)



Source: Observed journey times from Teletrac Navman Data. Before: 2013, three years after: 2019

Figure 9 compares the journey time on the M1 to the A14 (showing both northbound and southbound directions) between 2013 (before construction) and 2019 (three years after opening). The data shows improvements to journey times across all peak periods, with the greatest improvement occurring in the morning peak in the northbound direction (with journey times reducing from 4.25 minutes before the project to 1.25 minutes three years after the project).

Figure 9 Change in average weekday journey times (M1 to A14)



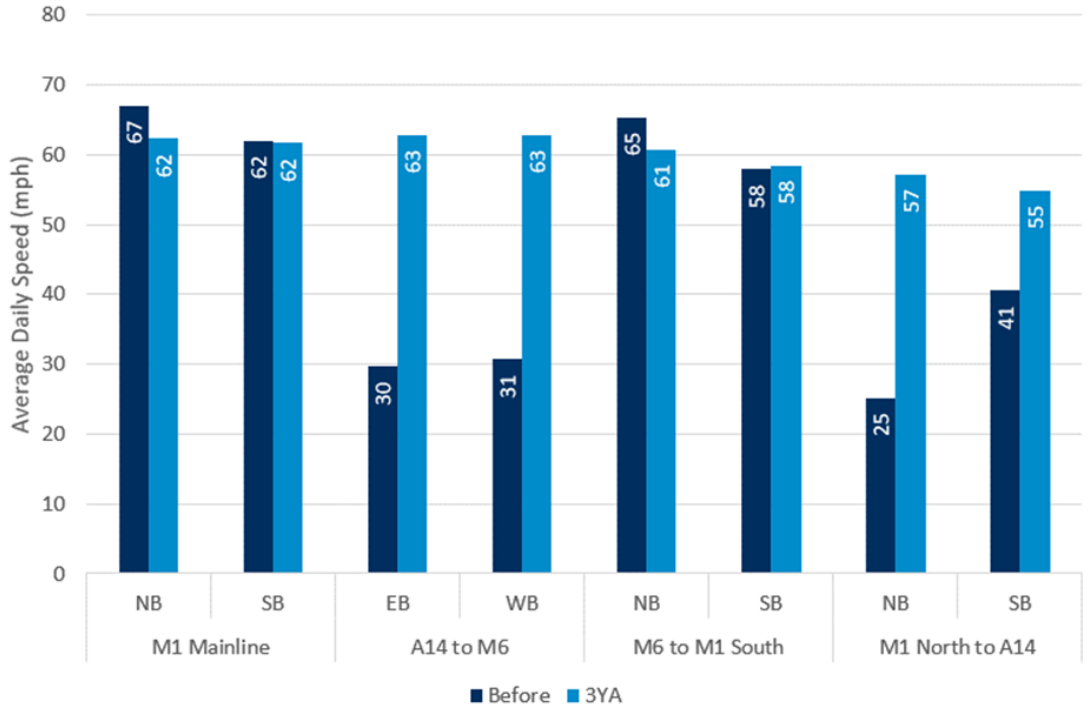
Source: Observed journey times from Teletrac Navman Data. Before: 2013, three years after: 2019

How did the project impact road user's speeds?

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

Figure 10 shows that the project results in improvements to average journey speeds on the A14 to M6 and M1 to A14. This finding correlates to the journey time improvements noted above. There have been minimal changes to speed on the M1 (through the junction) and M6 to M1 movement indicating that the project has had negligible impacts upon roads not directly part of the junction upgrades.

Figure 10 Average daily speed (mph)



Source: Observed journey times from Teletrac Navman Data. Before: 2013, three years after: 2019

Were journey time savings in line with forecast?

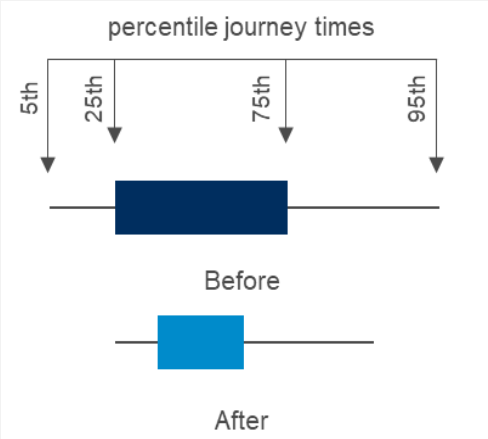
Forecast journey times calculated prior to project construction were not in a format that allows comparison with three years after journey time data. It is, therefore, not possible to say whether journey time savings are in line with forecasts.

Did the project make journeys more reliable?

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

The distribution of journey times for the A14 to M6 route and M1 to A14 for both directions of travel were analysed, and the statistics of variation presented as box-and-whiskers diagrams for both direction journeys. An explanation of what metrics are shown in the box-and-whiskers diagrams is detailed in Figure 11.

Figure 11 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. This shows the difference between the longest and the shortest journey times observed.

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.

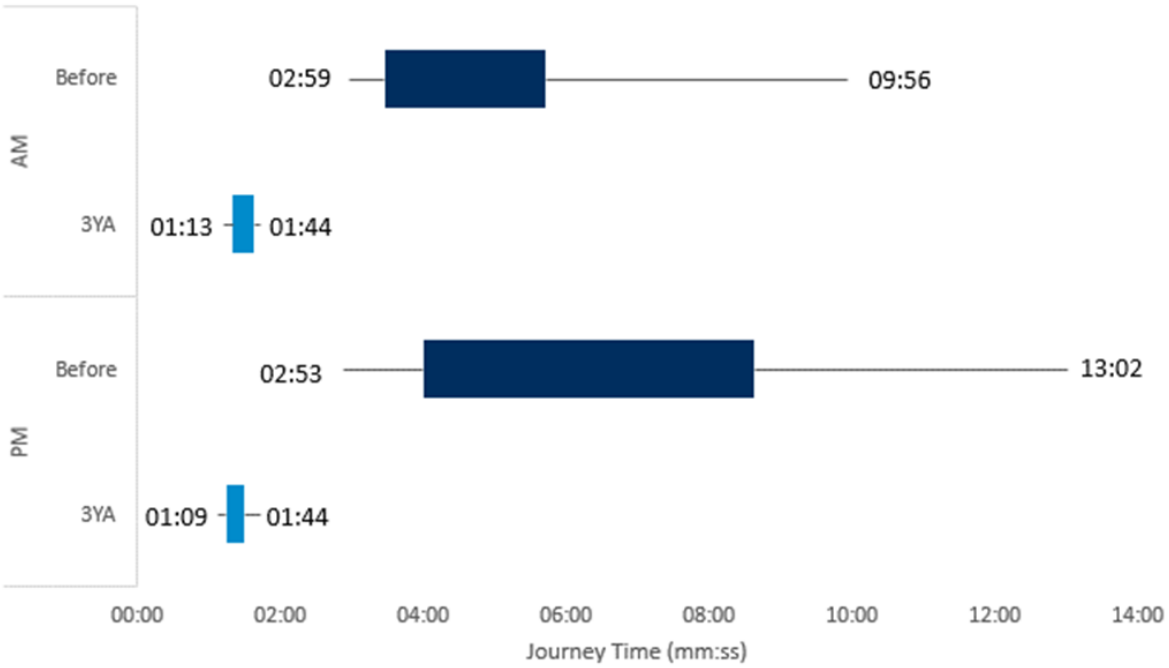
The journey time reliability is depicted by the 25th to 75th percentile boxes in Figure 12 and Figure 13, if the boxes get shorter, this indicates journeys become more reliable.

Journey time reliability for customers travelling between the A14 and M6 has improved in all time periods and direction of travel.

The 95th percentile gives an indication for the longest journey times. Before project construction, the longest journey times for road users travelling on the A14 to M6 was over thirteen minutes in the evening peak for those travelling in the eastbound direction and just under nine minutes in the morning peak for those travelling in the westbound direction. These longest journey times have now reduced to less than two minutes in both directions. This shows that the longest journey times have seen a significant reduction as a result of the project.

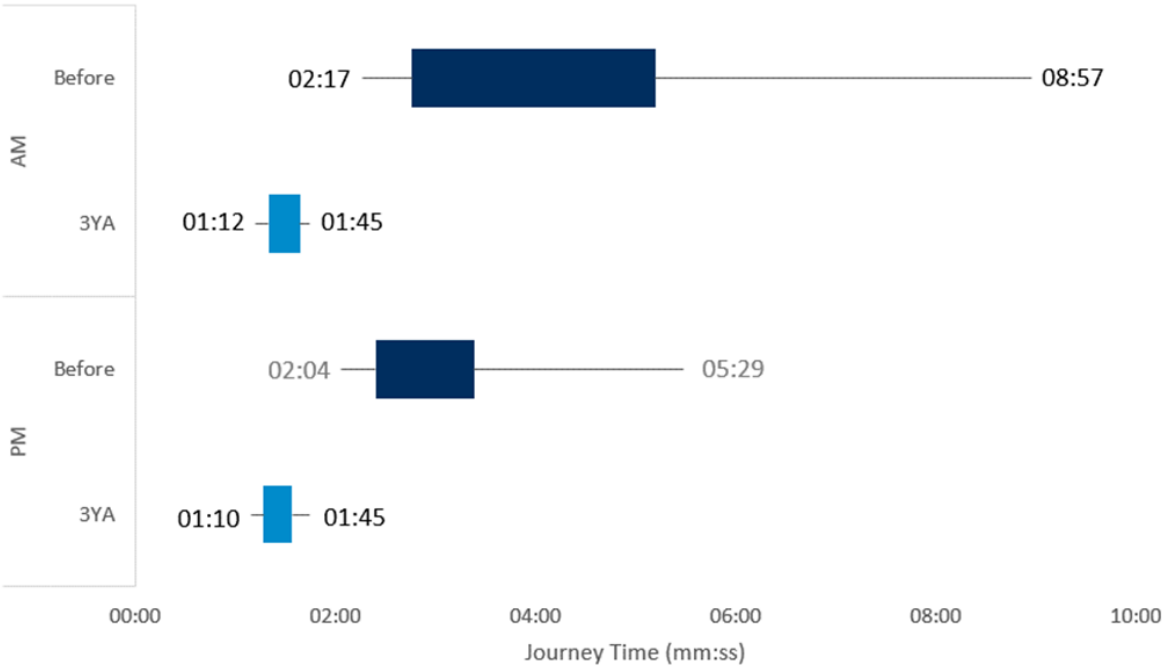
This indicates that road users can now be more confident about how long their journey will take when travelling between the A14 and M6.

Figure 12 Journey time reliability – M6 to A14 (Eastbound)



Source: Teletrac Navman Data. Before: 2013, three years after: 2019

Figure 13 Journey time reliability – A14 to M6 (Westbound)



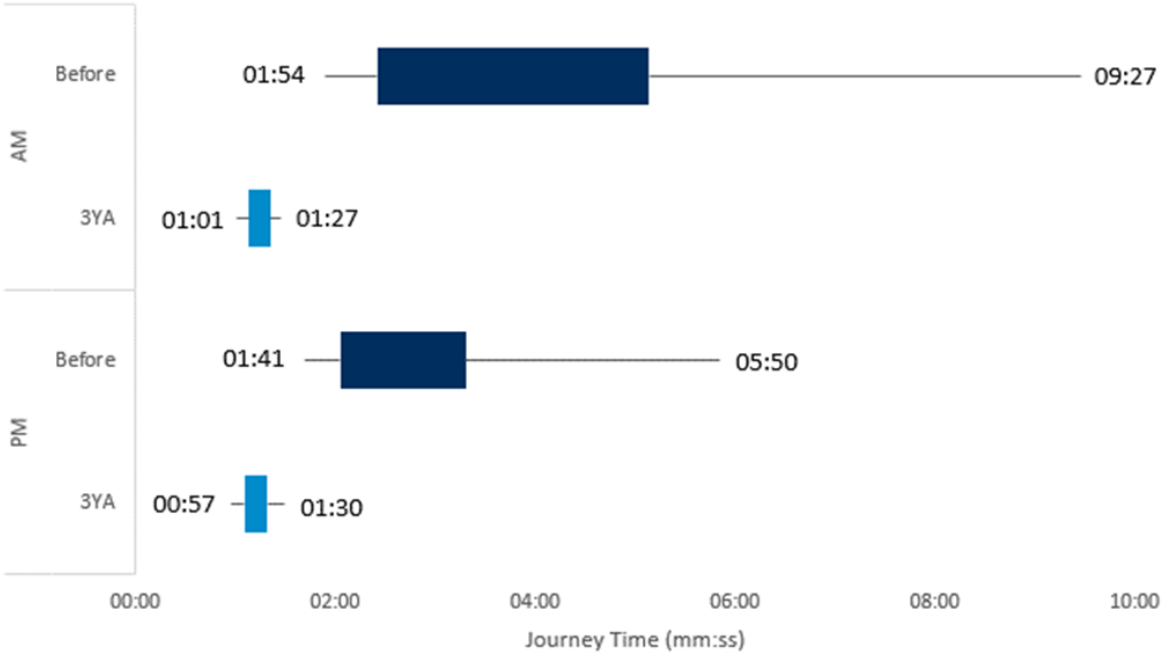
Source: Teletrac Navman Data. Before: 2013, three years after: 2019

Figure 14 and Figure 15 show that journey time reliability has also improved for customers travelling between the M1 and A14 in all time periods and direction of travel.

Before construction, the longest journey time was nine and a half minutes in the morning peak for those travelling in the northbound direction, and just under six minutes in the morning peak for those travelling southbound. This has reduced to less than one and a half minutes in both directions.

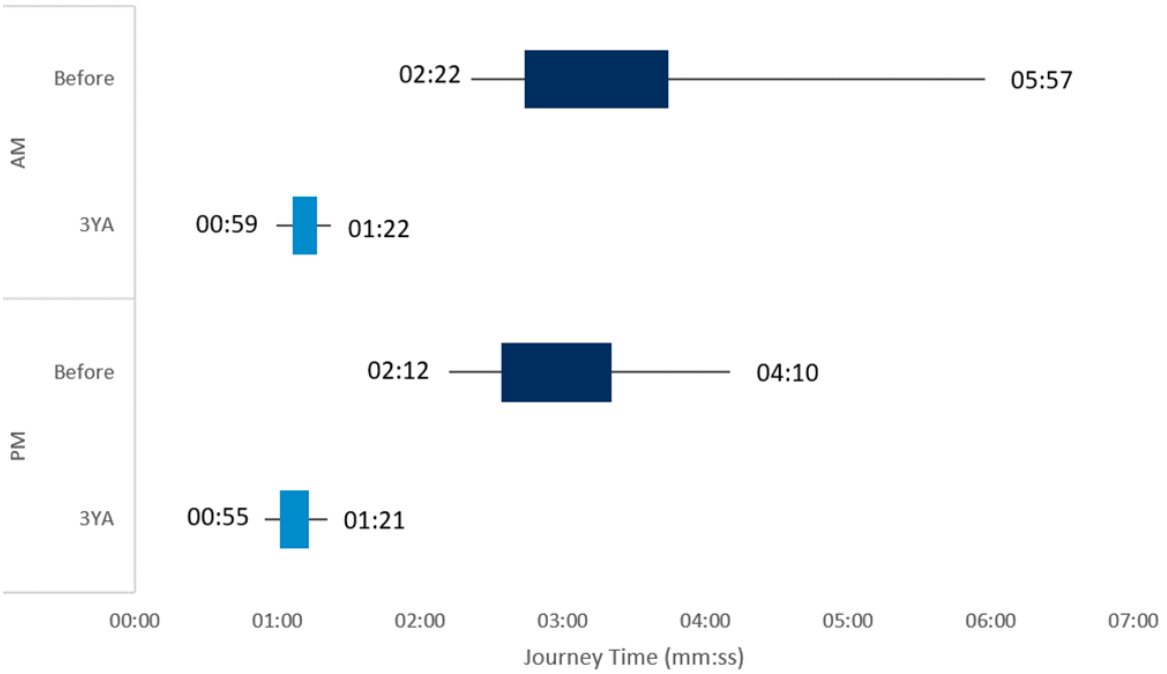
This indicates that road users can now be more confident about how long their journey will take when travelling between the M1 and A14. This has been achieved through the removal of the roundabouts connecting the A14, M6 and M1 North and replacing them with free-flow links.

Figure 14 Journey time reliability – M1 North to A14 (Northbound)



Source: Teletrac Navman Data. Before: 2013, three years after: 2019

Figure 15 Journey time reliability – M1 North to A14 (Southbound)



Source: Teletrac Navman Data. Before: 2013, three years after: 2019

5. Safety evaluation

Summary

The safety objective for this project was to improve safety performance; in particular, by reducing the number and severity of collisions.

The number of personal injury collisions (PIC)[6] and the rate of these collisions per hundred million vehicle miles (hmvm)[7] were analysed to track change over time.

There has been a reduction in the rate and number of PICs on both the project extent and the surrounding network. This is based on comparing the first three years of the project being operational with the annual average for the years before the project improvements.

There has been an annual average reduction of five PICs, which is in line with the appraised business case for the project. This is based on an annual average of one PIC after the project was operational compared with six before the project. If the new junction had not been constructed, we estimate that the number of PICs would have been between 1 and 14.

When accounting for the increased volume of road users over this period, the annual average rate of PICs per hmvm has also improved. The average collision rate decreased to three PICs per hmvm, this equates to travelling 38 million vehicle miles before a PIC occurs. Before the project, the collision rate was 18 per hmvm, this equates to traveling six million vehicle miles before a PIC occurs. If the junction had not been upgraded, we estimate the collision rate would have remained at 16 collisions per hmvm. The reduction in collision rates suggest that safety has improved.

The number of fatal collisions has changed with a total of two before and none after the project became operational.

The number of Fatal and Weighted Injuries (FWI)[8] has decreased annually. Before the project there was an annual average of 1 FWI per year. After the project became operational, this has reduced to zero FWI per year. When accounting for the increased number of road users over this period, there has been a reduction from 1.5 to 0.1 FWI per hmvm travelled.

On the surrounding network[9], there was an average decrease of 79 PICs per year (based on an annual average of 183 PICs observed after the project had opened, compared with 262 before the project). If the new junction had not been constructed, we estimate that the number of PICs would be between 227 to 305.

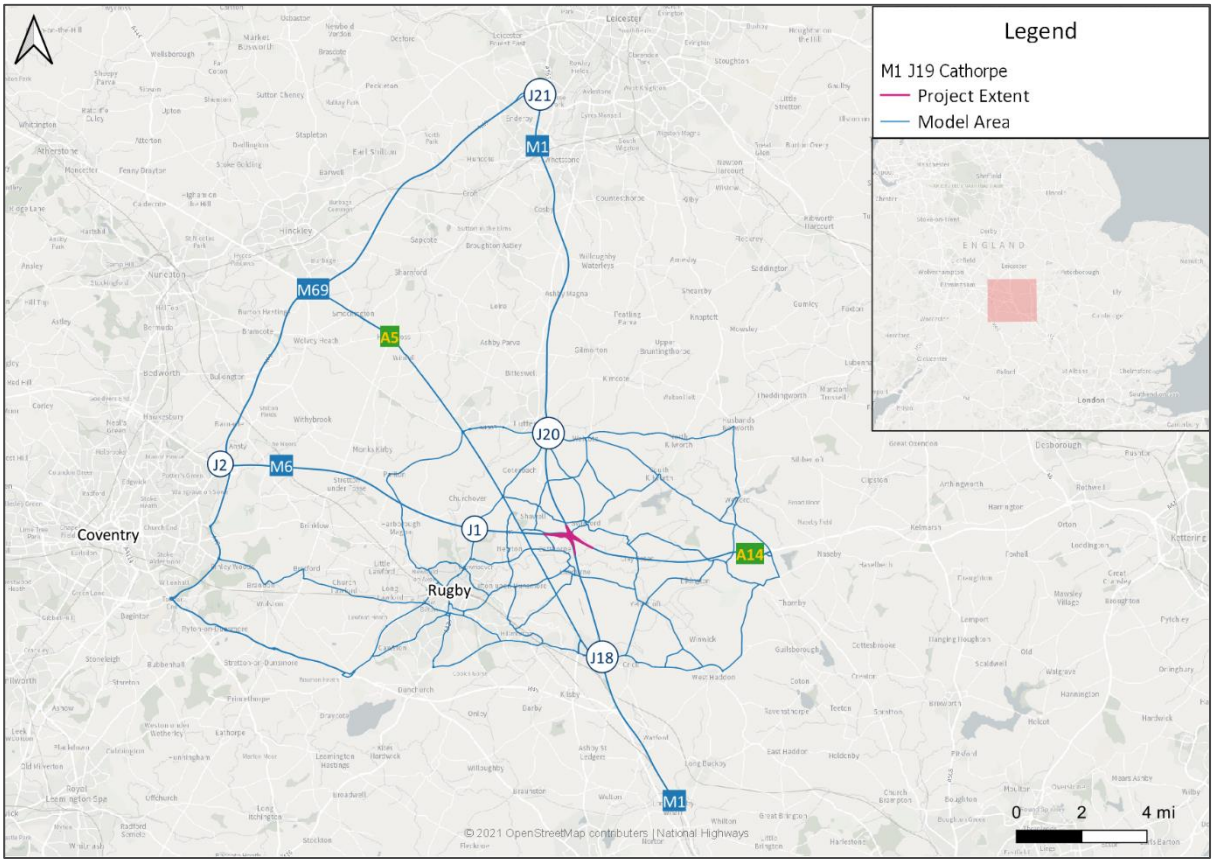
Based on this analysis, the evaluation found there has been a reduction in the number and severity of PICs. At this three years after evaluation point, the project has met its objective to reduce the number and severity of accidents.[10]

[6] A collision that involves at least one vehicle and results in an injury to at least one person
[7] hmvm – hundred million vehicle miles
[8] 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.
[9] The road network is determined as part of the appraisal process to understand changes to road safety on the project extent and roads which the project may have an impact.
[10] Projects are appraised over a 60-year period. This conclusion is based on the findings at three-years after the project opened for traffic.

Safety study area

The safety study area is shown in Figure 16. This area was assessed in the appraisal supporting the business case for the project to check any potential wider implications of the intervention.[11] This information was then used with other predictions around the potential impact of the project such as by how much traffic may grow. The evaluation has used the strategic roads within the same area as the appraisal to understand the emerging safety trends.

Figure 16 Safety study area



Source: National Highways and OpenStreetMap contributors

Road user safety on the project extent

What impact did the project have on road user safety?

Safety data was obtained from the DfT road safety data[12]. This records incidents on public roads that are reported to the police. This evaluation considers only collisions that resulted in personal injury via this dataset.

The safety analysis was undertaken to assess changes over time looking at the trends in the five years before the project was operational to provide an annual average. We have then assessed the trends three years after.

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

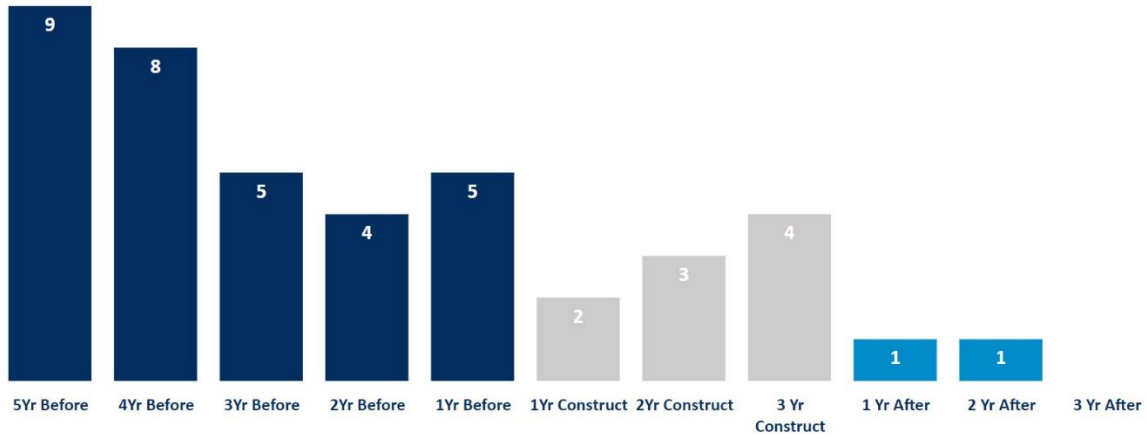
[12] https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data

The analysis draws on the following data collection periods:

- Pre-construction: 28 November 2008 to 27 November 2013
- Construction: 28 November 2013 to 21 December 2016
- Post-opening: 22 December 2016 to 2 December 2019

The evaluation found the number of PICs on the project extent, had decreased[13]. Over the three years after the project was operational, there were an average of one PIC per year[14], five fewer than the average six per year over the five years before the project was constructed[15]. No collisions were recorded in the third year after opening.

Figure 17 Annual PICs



Source: STATS19: 28 November 2008 to 21 December 2019

How had traffic flows impacted collision rates?

It is important to contextualise any incidents in the volume of traffic seen on this stretch via a collision rate, the number of PICs per annual hmvm.

Our evaluation has identified a decrease in the rate of PICs per annual hundred million miles.

Prior to the project, there was an annual average of 18 PICs per annual hmvm. After the project improvements were made, there was a decrease to three PICs per annual hmvm.

The average distance travelled before a PIC occurred increased from six to 34 million vehicle miles per PIC.

A counterfactual test was undertaken (refer to the POPE methodology manual)[16]. It found that the collision rate would likely have been 16 collisions per annual hmvm in the counterfactual scenario. The reduction in collision rates suggest that safety has also improved.[17]

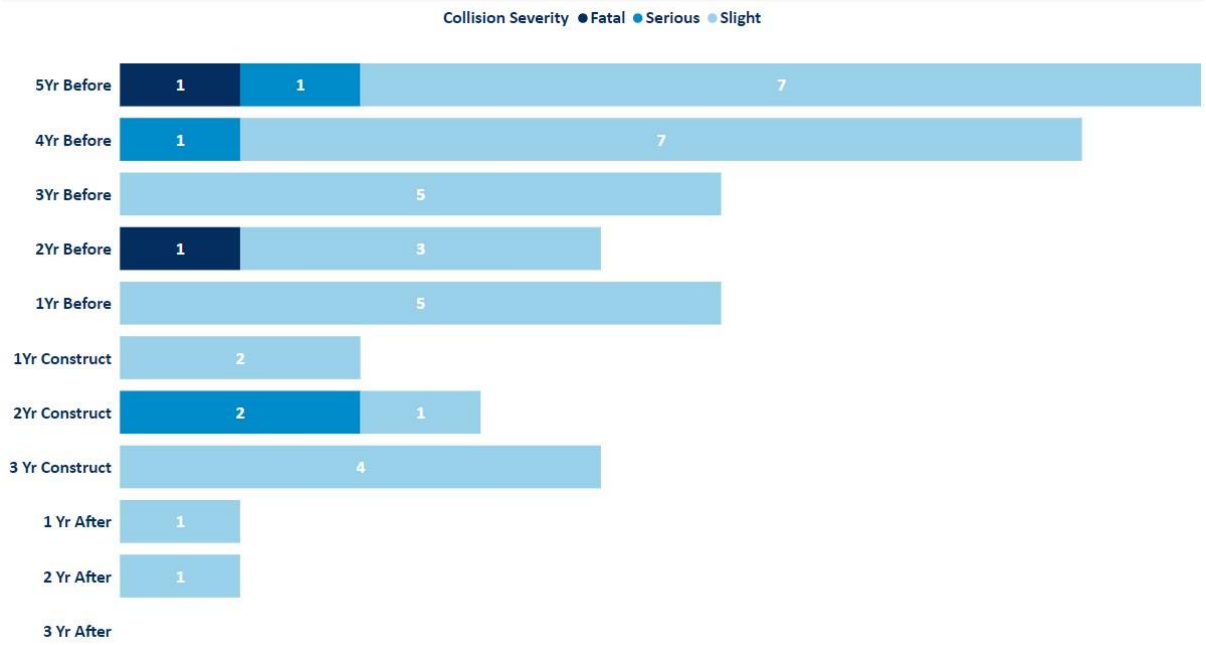
[13] Impacts on the wider area are discussed later in this section.
[14] No PICs were observed during the third year post opening.
[15] Due to the small sample size, we are unable to conduct counterfactual analysis for the project extent.
[16] https://nationalhighways.co.uk/media/exypgk11/pope-methodology-note-2024-v2.pdf
[17] We have tested the results at 95% confidence interval and believe the project has met its safety objective.

What changes in the severity of collisions did we see?

Collisions which result in injury are recorded by severity as either fatal, severe or slight. During 2016, there was a transition in how severity of incidents were recorded (more information on this can be found in Appendix A).

After the project there were an average of four fewer collisions resulting in slight injuries per year (the annual average before the project was five, compared to one after). Before the project, there was a total of two fatal collisions and two serious collisions. We have observed no fatal or serious collisions after the project became operational. Figure 18 shows the severity of PICs. No collisions were recorded in the third year after opening.

Figure 18 PICs by severity



Source: STATS19: 28 November 2008 to 21 December 2019

How has traffic flow impacted 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 ten times the weight of a serious casualty, and a serious casualty ten times the weight of a slight casualty.[18] In effect, it takes all non-fatal injuries and adds them up using a weighting factor to give a total number of fatality equivalents.[19] 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.

A reduction of one FWI has been observed annually. The severity of casualties occurring after the project became operational has reduced in the project extent. Before the project, an annual average one FWI were observed. After the project, this had reduced to zero.

[18] 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.
[19] Casualty severities within this report use the 2020 adjustment factor.

The combined measure showed an extra 1,629 million vehicle miles was travelled before an FWI[20]. The rate of FWI per hmvm has reduced. This suggests that considering changes in traffic the project is having a positive safety impact on the severity of casualties within the project extent.

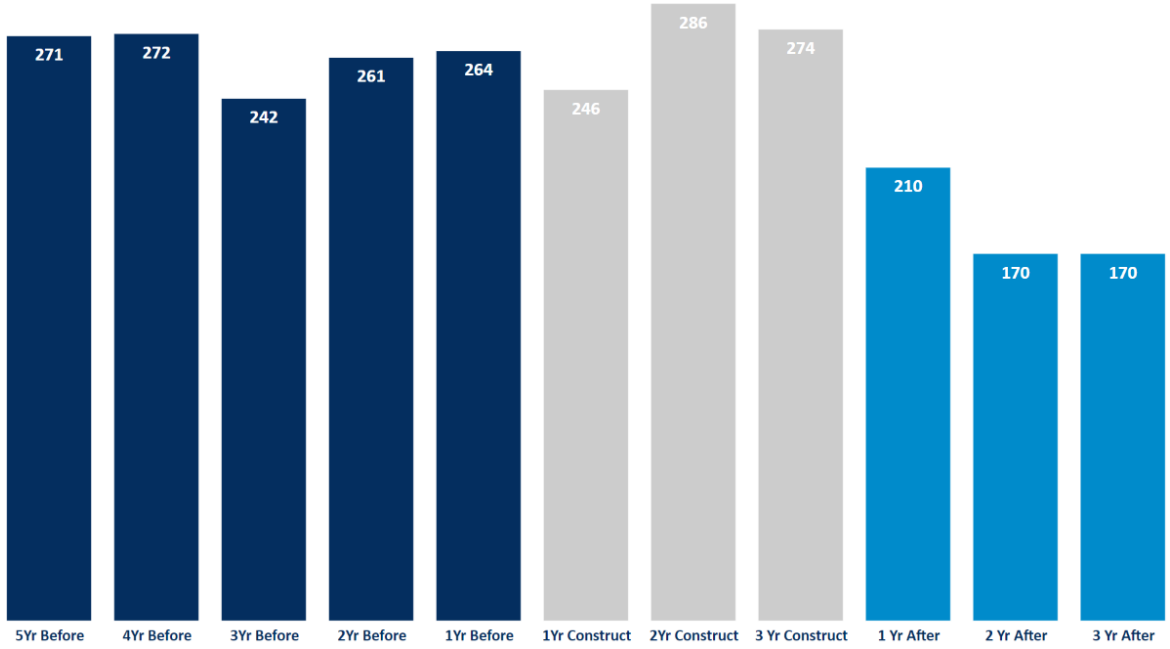
Road user safety on the wider area

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

PICs were observed for a wider impact area, which is derived from the safety appraisal for the project. The appraised wider area was split into two areas as shown in Figure 16. The local area, comprising of roads adjacent to the project extent and a wider area, to check any potential wider impacts from the intervention.

Before the project, an annual average of 262 collisions were observed. After the project, this has reduced to 183, a decrease of 79.

Figure 19 Annual PICs in wider area



Source: STATS19: 28 November 2008 to 21 December 2019

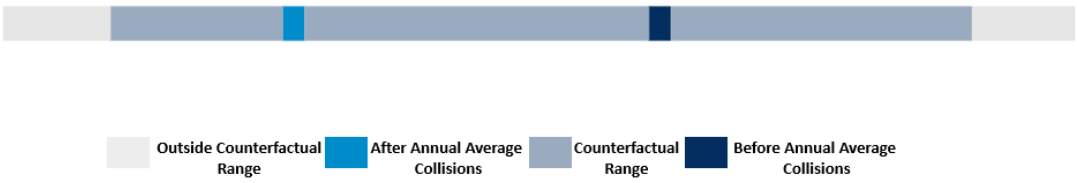
As part of the safety evaluation, we look to assess what changes in PICs might have occurred due to factors external to the project over this timeframe. To do this we estimate the trend in PICs, which might have occurred if the original junction configuration had not changed (this is referred to as a counterfactual – refer to Figure 20 and the POPE methodology manual[21]). This is based on changes in regional safety trends for conventional motorways with a high volume of roads users.

[20] Before the project, 68 million vehicle miles needed to be travelled before a fatality equivalent (1.5 FWI per hmvm). After the project, this increased to 1,697 million vehicle miles (0.1 FWI per hmvm).
[21] https://nationalhighways.co.uk/media/exypgk11/pope-methodology-note-2024-v2.pdf

Figure 20 What does the counterfactual show?

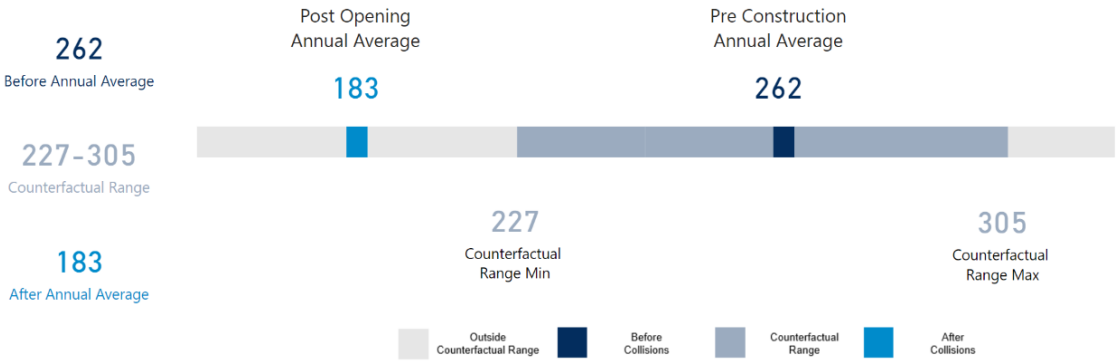
The counterfactual is an estimation of what we think would occur without the project taking place. We estimate a range of collisions that follow regional trends. The chart shows:

1. Annual average number of collisions from before the project
2. Annual average number of collisions after the project
3. 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.
4. National Highways are developing new statistical methods to compare collision and casualty rates. We anticipate adopting these once the methods are finalised.



The counterfactual analysis indicated that it is likely that an annual average of between 227 and 305[22] PICs would have occurred (Figure 21). The observed annual average of 183 PICs falls just outside the range. Therefore, this may be evidence to suggest that safety has improved.

Figure 21 Observed and expected range of PICs in wider area (annual average)



Source: STATS19: 28 November 2008 to 21 December 2019

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

The evaluation has identified a decrease in the rate of collisions per hmvm.

Prior to the project, there was an annual average of 22 PICs per hmvm. After the improvements were made, there was a decrease to 14 PICs per hmvm. A decrease of eight PICs per hmvm.

The distance travelled before a PIC occurred increased from five to seven million vehicle miles per PIC.

A counterfactual test was undertaken. It found that the collision rate would likely have been 21 collisions per hmvm in the counterfactual scenario. This indicates we have observed a larger reduction in the rate that PICs occur than predicted. Statistical testing indicates this reduction is significant suggesting that the project could be having a positive impact on the wider area.

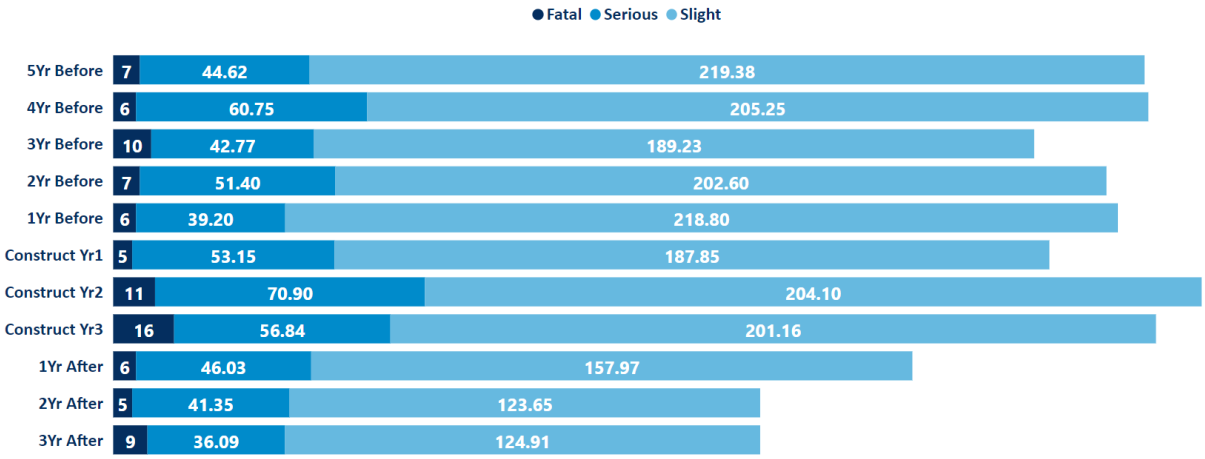
What impact did the project have on the severity of collisions in wider area?

Collisions which result in injury are recorded by severity as either fatal, serious, or slight. The way the police record the severity of road safety collisions changed within the timeframes of the evaluation, following the introduction of a standardised reporting tool – Collision Recording and SHaring (CRASH). This is an injury-based reporting system, and as such severity is categorised automatically by the most severe injury. This has led to some disparity when comparing trends with the previous reporting method, where severity was categorised by the attending police officer.[23] As a consequence, DfT has developed a severity adjustment methodology[24] to enable robust comparisons to be made.

For this evaluation, one reporting mechanism was largely used prior to the junction upgrades and another afterwards. The pre-conversion collision severity has been adjusted, using DfT severity adjustment factors, to enable comparability with the post-conversion safety trends.[25].

After the project, we have observed a reduction in collisions resulting in fatalities (the total before the project was 36, compared to 20 after). There was an average of seven fewer collisions resulting in serious injuries per year (the annual average before the project was 48, compared to 41 after). There was an average of 72 fewer collisions resulting in slight injuries per year (the annual average before the project was 207.05, compared to 135.50 after). Figure 22 shows the severity of PICs.

Figure 22 PICs by severity in wider area



Source: STATS19: 28 November 2008 to 21 December 2019

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

24 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

25 Collision severities within this report use the 2020 adjustment factor.

How had traffic flows impacted casualty severity in the wider area?

A decrease of three FWI has been observed. Before the project, the average 17 FWI were observed. After the project, this had decreased to 14.

The combined measure showed an increase of 18 million vehicle miles was travelled before a FWI. Before the project, 71 million vehicle miles needed to be travelled before a FWI (1.4 FWI per hmvm). After the project, this increased to 89 million vehicle miles (1.1 FWI per hmvm).

Has the project achieved its safety objectives?

The key safety objective was to reduce the number and severity of collisions. The evaluation found PICs and rates have both decreased. We have also observed a reduction in the number of serious and fatal collisions.

Statistical testing of collisions and collision rates for project extent are significant. We can be confident that the project is on track to meet its safety objective.

Appraised expectation for the project forecast a reduction of 577 PICs over the appraisal period (60 years) for project extent and wider area. This equated to an annual decrease of 10 PICs over the appraisal period.

Analysis shows that the project is outperforming the appraised safety benefits for this project.

6. Environmental evaluation

Evaluation approach

The evaluation of environmental impacts compares observable impacts of the project with those forecast within the business case and the Environmental Statement (ES). Observed impacts are gathered from site visits (conducted at one- and five-years after) and desktop analysis conducted at three years after project opening. Typically, all observed impacts would be assessed in the same evaluation year, however parts of the evaluation (safety, traffic) will have been affected by changes in travel behaviours caused by the COVID-19 pandemic. The environmental topics reliant on traffic and safety data therefore use data at three years after which avoids the effects of COVID.

The results of the evaluation are recorded against each of the Transport Appraisal Guidance (TAG)[26] environmental sub-objectives in the sections to follow and summarised in Table 2. This also includes the three society[27] sub-objectives of physical activity, journey quality and severance.

Site visits were undertaken in July 2018 and August 2021. Townscape impacts were not assessed since it was concluded within forecast appraisal that no townscape would be affected and therefore could be scoped out of the evaluation process. Physical fitness, journey quality and severance were scoped out at five-years after as there were no outstanding issues from one-year after and this analysis has, therefore, been reproduced within this report.

Noise

Forecast Impacts

The Appraisal Summary Table (AST) stated that:

> *"although the proposals would give rise to increases and decreases in noise and nuisance levels, most of the impact is due to changes in flow on the local roads. The majority of the changes in noise and nuisance level would be decreases. This pattern of change would be the same for both daytime and night-time noise levels. There would be 20 dwellings with noise levels of 68 dB or more but none of these would qualify for insulation."*

The AST stated that there would be four less people annoyed with the project in place, 15-years after opening.

The ES noise chapter (Paragraph 6.9.4) concluded that:

> *"the introduction of the proposals for the M1 junction 19 improvement would give rise to both increases and decreases in noise levels and nuisance at individual properties. Most of the impact is due to changes in traffic flow on the local roads and the majority of the changes in noise level would be decreases. The overall significance of the noise and vibration impact has been assessed as being Moderate Beneficial".*

[26] DfT's Transport Analysis Guidance (TAG) provides information on the role of transport modelling and appraisal. https://assets.publishing.service.gov.uk/media/66434490ae748c43d3793a87/tag-unit-a3-environmental-impact-appraisal.pdf

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

Evaluated Impacts

The mitigation measures proposed within the ES to reduce the noise impacts included low noise surfacing along all new motorway and trunk road sections of the M1 junction 19 improvement, which aligns with current National Highways policy. It has been confirmed by National Highways that low noise surfacing[28] was laid along the main carriageways and slip roads. No other noise mitigation was proposed or installed as part of the project.

This three years after evaluation considered 16 road traffic links across the road network for which traffic flow data have been available for the appraisal. However, all three screening criteria could not be tested due to a lack of valid HDV (Heavy-Duty Vehicle) and average speed data. In addition, two links could not be included in the evaluation due to a lack of AADT flow data in the outturn traffic data. Nevertheless, the evaluation considers whether the project outcome per road link is worse than, better than or as expected based on the AADT traffic flow for each of the remaining 14 road links

Of the 14 links, all had changes in road traffic noise levels within the +1.0 dB to -1.0 dB range, resulting in an 'as expected' outcome.

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

Air quality

Forecast Impacts

The environmental appraisal originally identified that a net deterioration in air quality was anticipated due to the project at local receptors. The project was also expected to result in a small increase of nitrogen oxides (NO_x) emissions across the region in the opening year (2017). However, as time goes on, this trend was expected to reverse giving a decrease in regional emissions of NO_x, leading to an overall decrease in NO_x emissions.

The ES and Supplementary Note (SN), which reported on the assessment of air quality prior to the project being built predicted some small to medium improvements and some small worsening of air quality at local properties near the road network because of the project. These were due to changes in predicted traffic flows on roads near the project. However, predicted representative concentrations of both nitrogen dioxide (NO_2) and particulate matter (PM_{10}) were assessed to be below the relevant annual mean objective values[29] (40 µg/m³ for both pollutants) at all but one modelled receptor. With reference to the guidance in place at the time, these changes were determined to be not significant. As the ES or SN did not find any significant air quality effects, no mitigation was proposed.

Evaluated Impacts

This evaluation was based on a comparison of available observed traffic data to the forecast traffic data that was used for the environmental assessment. There was no forecast data available for the percentage of HDVs or average road

[28] Tarmac Ultipave 10mm and 14mm and Aggregate Superhitex 14mm
[29] https://uk-air.defra.gov.uk/air-pollution/uk-limits

speeds, therefore comparisons could only be made between observed and forecasted daily traffic flow data.

A lack of available data has impacted the accuracy of determining local air quality changes due to the project.

It was found that on some local roads, daily traffic flows were higher than had been forecasted and therefore emissions may be higher than forecast, while on other local roads, daily traffic flows were lower than had been forecasted and therefore emissions may be lower than forecast. Overall, the differences between the forecast and observed traffic data would not change the overall evaluation of significance of the project and it remains “not significant” for air quality, on the basis of local monitoring[30] in the wider area, which is below the relevant objective values.

Greenhouse Gases

Forecast Impacts

The environmental appraisal originally predicted that the project would result in an increase in carbon dioxide (CO_2) emissions of 0.520 $MtCO_2e$ tonnes over the 60-year appraisal period. The total value of the change in CO_2 emissions was calculated as a £26.6 million detriment.

Evaluated Impacts

The POPE methodology manual sets out an approach for evaluating the carbon emissions along our projects. It recognises that it is not possible to make a direct comparison between predicted and observed carbon emissions. This is because the appraisal is based on the entire modelled area over 60 years, whereas at evaluation, traffic information for the whole study area is not usually available. Instead, we evaluate the impacts by comparing a forecast and observed emissions just for the project extent. To calculate the emissions, the emission factor toolkit published by UK Government is used. For this project, it was not possible to quantify the emissions along the project extent because we did not have sufficient information on the HDVs and speeds to enable this to be done. Overall, the differences between the forecast and observed traffic data were between -15% to +9% and therefore would not likely result in significant differences to the change in CO_2 that was forecast.

The total change in emissions caused by the project cannot be evaluated with confidence from the limited data, however the difference between forecast and observed traffic flow indicates that Greenhouse Gases are ‘likely as expected’.

Landscape

Forecast Impacts

The environmental appraisal and assessment reported that the project sat within a rural area surrounded by agricultural land and a small number of isolated properties. There were no protected landscapes nearby. The existing motorway network was a dominant feature within the local landscape and the settlements of

[30] Harborough District Council Air Quality Annual Status Report (2023), Rugby Borough Council Air Quality Annual Status Report (2023)

Catthorpe and Swinford already had distant views towards the motorway and the Catthorpe Interchange. However, the existing interchange was surrounded by mature vegetation which helped to limit views and integrate it into the landscape.

The pre-project environmental assessment predicted that the construction of the project including the new elevated free flow links and new local road would require the removal of substantial areas of mature trees and vegetation. This was predicted to open up views of the interchange and the vehicles using it; however, these visual impacts would be limited to a small number of nearby properties. Retained vegetation, the intervening landform and the distance would ensure views from the settlements of Catthorpe and Swinford were less affected.

To minimise the impacts, significant areas of new tree, shrub and hedgerow planting were proposed to screen views of the project. New earthworks were also incorporated into the design to help the new structures integrate into the landform.

Overall, once the new planting had matured it was predicted that the significance of the effects of the project would be “slight adverse”.

Evaluated Impacts

Our evaluation confirmed that most of the landscape impacts occurred as predicted by the ES. Mature vegetation had been lost on the north-east side of the junction and alongside the north side of the M6. The character of Shawell Lane to the north of the M6 had been changed with the creation of the new Rugby Road leading to Swinford.

Except for a small number of isolated properties and users of nearby footpaths, views of the new junction remained limited to properties on the north-east edge of Catthorpe and the south-west of Swinford. These properties experienced views of the junction before the project was constructed. Mitigation in the form of new and replacement planting and earth embankments had been provided and are broadly as proposed. Landscape inspection reports confirmed that routine maintenance works including weeding and replacement of failed planting had occurred although the COVID-19 pandemic had affected some of the monitoring work.

Site visits found that mitigation planting was generally establishing well (see Figure 23 and Figure 24 for examples). While some plots were becoming overgrown, there were sections of hedgerows along the local roads where growth had been particularly good.

Overall, our evaluation indicated that whilst there were some problems particularly with two plots either side of the M6-A14 link, the impacts were broadly as expected. Provided an appropriate maintenance programme is implemented the mitigation planting should continue to establish and over time, ensure the project meets its design year outcomes.

Figure 23 Example of landscape changes at Catthorpe Road

July 2018 August 2021

Figure 24 Example of landscape changes along M6 Southbound embankment

July 2018 August 2021

Heritage of historic resources

Forecast Impacts

The environmental appraisal and assessment reported that there were a range of local and national cultural heritage features within the study area of the project. This included listed buildings within the conservation areas of Catthorpe, Shawell and Swinford and the scheduled ancient monument at Lilbourne. The assessment predicted that there would be no direct impacts on listed building or scheduled monuments although there could be direct impacts on any buried archaeological remains within the footprint of the project.

The project was predicted to cause both beneficial and adverse indirect impacts on the setting of cultural heritage features. This included visual impacts caused by removal of significant areas of mature vegetation and noise impacts caused by changes in traffic, particularly on the local road network.

The project proposed measures to minimise the adverse effects including archaeological investigations before the start of works and new planting to minimise visual impacts. Overall, the project was predicted to cause “slight adverse” impacts.

Evaluated Impacts

The evaluation confirmed that prior to the start of works a programme of archaeological investigations were undertaken. The findings of this work were reported in the Archaeological Strip, Map and Sample excavation and watching

brief report 2017[31]. This reported that the remains encountered were largely confined to the area of the site compound where evidence was found for two phases of Roman activity. The first phase indicated the presence of quarrying activity and the second showed the progression of the site to a probable agricultural complex. A moderate assemblage of Roman pottery was also found, which suggested a Middle Roman date from the mid-2nd century AD onwards. The report considered that these excavation results were of local significance and a summary report was published in the Transactions of the Leicestershire Archaeology Society[32].

The two site visits confirmed that there were no direct impacts to listed buildings or the scheduled monument. There were indirect adverse visual impacts to the settings of the unlisted Old Barn Farm, Tomley Hall Farm and Westfield Lodge, however mitigation planting was in place which should over time minimise the impacts as expected.

No noise monitoring was conducted, so it was not possible to quantify any noise benefits to the setting of the conservation areas in Catthorpe, Shawell and Swinford. However, as traffic can no longer directly access the motorways or the A14 at Catthorpe, it is likely that there were some.

The evaluation confirmed that the archaeological investigations were undertaken, and knowledge of the findings published. Indirect impacts to the setting to some historic building had occurred but the proposed mitigation was provided. Overall, the impacts on heritage and historic resource are as expected.

Biodiversity

Forecast Impacts

The environmental appraisal and assessment recognised that the existing species diversity was low surrounding the project extent, and it was expected that the habitat creation and local ecology improvements associated with the project would lead to an overall “slight beneficial” impact upon biodiversity. All species assessed were expected to see a positive impact associated with the project, except for badgers (“slight adverse”*)* owing to a loss of outlying setts.

Evaluated Impacts

The evaluation comprised two site visits, designed to observe the impacts that had arisen, and the condition of the mitigation provided. The five-years after site visit further considered how well the mitigation had developed since one-year after. The site visit confirmed that the proposed habitats and species mitigation had been delivered (including new hedgerows, vole mitigation area and mammal crossing and exclusion fencing).

The following species-specific observations were made:

- Birds – 123 bird boxes had been provided with 46 (37%) showing evidence of nesting. This is considered a ‘good’ uptake given that many of the boxes had only recently been installed.

[31] https://legacy-reports.cotswoldarchaeology.co.uk/report/m1-junction-19-improvement-catthorpe-interchange/
[32] https://www.le.ac.uk/lahs/downloads/2018/2018%20(92)%20P239-246%20Garland.pdf

- Bats – Mitigation measures had been delivered (including a temporary screen along the north side of the M6).
- Great crested newts – population status has remained unchanged and has been maintained at favourable conservation status.
- Otters – mitigation measures (including a new otter ledge, holt and improved river margins) had been delivered. Evidence of otters using the river Avon, including a breeding female.
- Habitats – Mitigation measures had been delivered (including balancing ponds), however reedmace (invasive wetland plant) has been noted at site visits conducted at both one-year after and five-years after. If left uncontrolled, it can affect flows in and out of balancing ponds and reduce storage capacity.

Overall, provided an appropriate maintenance regime is in place, the impacts of the project were as expected, and the design year outcome should be met.

Figure 25 Example of species rich hedgerow on Swinford Road

Water environment

Forecast Impacts

The environmental assessment predicted that the construction and operation of the new junction had the potential to impact the water environment. This included impacts to water quality and flood risk. These impacts were caused by increased road drainage from increased impermeable surfaces and changes in the risk of accidental spillages. Works near the A14 would also impact on flood risk as this area near the river Avon had a greater risk of flooding.

A new drainage network was included in the project design to mitigate theses impacts. This included new balancing ponds to manage the storage and flow of surface water road run off, pollution control devices to manage accidental spills and flood compensation areas to reduce the risk of flooding. Overall, the assessment predicted that with the mitigation measures in place the project would lead to an overall “slight beneficial” improvement.

Evaluated Impacts

The evaluation found that the new balancing ponds and drainage ditches proposed were provided broadly as expected. Pollution control devices were in place and new flood compensation areas near the river Avon were provided. Although the predicted impacts were likely to have arisen, they were being managed by the new drainage network as expected.

The design incorporated new pond planting to help filter and treat pollutants within the road run off, as well as to provide additional biodiversity benefits. However, some of the ponds and ditches were becoming overgrown and in some inappropriate species, such as reedmace found (see Figure 26). Whilst signage indicated the location of pollution control devices, vegetation hindered access to some. The drainage network appeared to be functioning as expected. Observations during the site visits indicated that the maintenance regime needs to be reviewed to ensure the new planting does not hinder the performance of the drainage network.

Overall, provided an appropriate maintenance regime is in place, the impacts of the project were as expected, and the design year outcome should be met.

Figure 26 Example of heavily vegetated drainage network (including by the drainage inlet)

July 2018 August 2021

Physical Activity

Forecast Impacts

The environmental assessment and appraisal reported that there were several footpaths and bridleways linking the villages of Catthorpe, Swinford and Shawell. However, many of the routes had been diverted following the construction of the M1 and this had resulted in a disjointed network, especially in the immediate vicinity of M1 junction 19. The assessment predicted that three of the routes would be impacted by the project causing journeys to be lengthened by between 0.1km and 1.4km. However, pre-project surveys identified that the numbers of users were very small and so the overall impact once mitigation was provided was predicted to be “neutral”.

Evaluated Impacts

Our evaluation was based on a site visit and qualitative observations of the mitigation provided by the project and its usage. Increasing physical activity was not an objective of the project and so as numbers of pedestrians, cyclists and

equestrians was low before the project, post opening surveys were not considered proportionate.

The site visit confirmed that the bridleway improvements along the river Avon including equestrian bridge had been provided as had the footway improvements along the local road between Catthorpe and Swinford. The project had removed strategic traffic from the local roads and as a result had reduced conflicts between road users so should have improved the amenity for walkers, cyclists and equestrians. Very few pedestrians, cyclists or equestrians were encountered using the new facilities during the site visits, which suggested that usage remained low. It is unlikely that the project has had any significant impact on physical activity.

Overall, based on the finding of the site visit, we consider that the impact is as expected.

Severance

Forecast Impacts

The environmental appraisal reported that there was no severance on most routes in the local area as local roads and footpaths provided access between the villages of Catthorpe, Swinford and Shawell and the local services they support. The appraisal did however highlight that those travelling between Catthorpe and Swinford did experience severance as road users moving between the M6, M1 and A14 at the dumbbell roundabout did cause congestion and delays. The severance was most significant for pedestrians (including mobility impaired), cyclists and equestrians who struggled to cross the dumbbell roundabout.

The appraisal predicted that the construction of the project would improve the footway between Catthorpe and Swinford and remove the dumbbell roundabout. This would remove the conflict that existed. Whilst this would deliver severance benefits, the appraisal reported that due to the low number of pedestrians, cyclists and equestrians using the route, the overall impact would be “neutral”.

Evaluated Impacts

The evaluation confirmed that the project had provided the footway improvements between Catthorpe and Swinford. The creation of the free flow links between the M6/M1 and A14 and the removal of the dumbbell roundabout had reduced conflicts between road users and pedestrians, cyclists and equestrians. This had reduced severance. Whilst there had been beneficial impacts on severance, qualitative observations during the site visits indicated that the numbers of users benefiting was small. Overall, the impacts are likely to be as expected.

Journey quality

Forecast Impacts

The environmental appraisal and assessment of journey quality considered the impacts of the project on traveller care, traveller views and traveller stress.

The assessment highlighted that there were no service stations within the immediate vicinity of the junction. However, the layby on the east bound A14 would be removed reducing facilities for road users. New signage would be provided

which would provide road users with better information, but overall traveller care would be worse.

For traveller views, the assessment predicted that replacement of the congested dumbbell roundabout with new elevated freeflow links would provide road users with more open long distant views. These were predicted to provide a more pleasant experience for road users.

The assessment of impacts on traveller stress considered the impact of the project on driver frustration, fear of accidents and route uncertainty. It predicted that replacing the dumbbell roundabout with freeflow links would reduce congestion allowing road users to drive at more desirable speeds. This was predicted to reduce driver frustration, but despite new signage, the inability to travel between the M6 and M1 northbound and M1 southbound and M6 westbound would offset some of the benefit. The removal of the stop-start nature of the dumbbell roundabout and potential concerns over lane discipline was predicted to reduce the fear of accidents. The new signage and road layout including the freeflow links were also predicted to reduce route uncertainty.

Overall, it was predicted that traveller stress would reduce but balancing the other factors of driver views and traveller care, the outcome would be “neutral”.

Evaluated Impacts

The evaluation included a site visit to observe the project’s impact on journey quality. The evidence gathered suggested that the removal of the dumbbell junction and provision of new free flow links had reduced driver stress and provided improved views for travellers. The loss of the layby had affected driver care although alternative laybys were available further east. The removal of the option to travel from the M6 to M1 northbound had caused some frustration however improved signage at M6 junction 1 had helped mitigate some of this. Overall, it was expected that journey quality would be as expected.

Overview

The results of the evaluation are summarised against each of the TAG[33] environmental sub-objectives and presented in Table 2. In the table, we report the evaluation as expected if we believe that the observed impacts are as predicted in the appraisal. We report them as better or worse than expected if we feel the observed impacts are better or worse than expected. Finally, we report impacts as too soon to say if we feel that there is insufficient evidence to draw firm conclusions.

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

Table 2 Summary of Environmental findings

Sub Objective	AST Score	Evaluation Outcome	Evaluation Summary
Noise	Estimated population annoyed by noise in 2032 Do-minimum (DM) = 190 Estimated population annoyed by noise in 2032 (With project) = 186 £0.223 million (net benefit)	As expected	The mitigation measures proposed within the ES to reduce the noise impacts included low noise surfacing along all new motorway and trunk road sections of the M1 junction 19 improvement, which aligns with current National Highways policy. No other noise mitigation was proposed or installed as part of the project. Of the 14 links, all had changes in road traffic noise levels within the +1.0 dB to -1.0 dB range, resulting in an 'as expected' outcome
Air Quality	+£8,272 Net Present Value (NPV)	Likely as expected	There is no consistent trend in the observed traffic data compared to those that were forecasted, with some being higher and some being lower. However, where monitoring is available, monitored concentrations are well below the NO_2 objective value. The highest NO_2 annual mean concentrations from the project-specific survey were monitored at one site (38.7µg/m3). Therefore, the evaluation of significance is unchanged and the project remains not significant.
Greenhouse Gases	Disbenefit of £26.6 million Net Present Value (NPV)	Likely as expected	Some road links have higher AADT than was forecast and therefore emissions may be higher than forecast, while other road links have lower AADT than was forecasted and therefore emissions may be lower than forecast. Overall, the difference is not considered likely to be significant.
Landscape	Slight adverse	As expected	Mature vegetation was lost, and views of new gantries and structures were possible. The impacts were broadly as expected. The proposed mitigation appeared to be in place and was establishing in most locations. Provided maintenance continues, the design year outcome should be achieved.

Sub Objective	AST Score	Evaluation Outcome	Evaluation Summary
Heritage of historic resources	Slight adverse	As expected	The archaeological investigations were undertaken, and knowledge of the findings published. Indirect impacts to the setting to some historic building has occurred, but the proposed mitigation was provided.
Biodiversity	Slight beneficial	As expected	Proposed mitigation measures have been delivered as expected. Provided an appropriate maintenance regime is in place, the impacts of the project are as expected, and the design year outcome should be met.
Water Environment	Slight beneficial	As expected	Balancing ponds and pollution prevention devices were installed broadly as expected. There were some maintenance issues including the need to remove reedmace from several ponds and remove vegetation restricting access to pollution control devices but provided maintenance is undertaken, the expected design outcomes are likely to be achieved.
Physical activity	Neutral	As expected	Footpath and bridleway improvements were provided broadly as expected. No surveys were undertaken but the site visit suggested usage of the new facilities remained low.
Severance	Neutral	As expected	New pavements for pedestrians and the removal of conflicts between strategic and local traffic has reduced severance impacts between Catthorpe and Swinford. Qualitative observations however indicated that the number of users of this route remains low.
Journey quality	Neutral	As expected	The removal of the dumbbell junction and provision of new free flow links has reduced driver stress and provided improved views for travellers. The loss of the layby on the A14 and the option to join the M1 northbound from the M6 has affected driver care and caused frustration. However improved signage has mitigated much of this.

7. Value for money

Summary

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

This evaluation conducted three years after opening indicates that the project is on track to deliver a positive economic return on investment with the project likely achieving 'medium' value for money once non-monetarised impacts are considered. The re-forecast value for money category lies below the forecast as part of the economic appraisal undertaken prior to construction ('high') however, this could be due to limitations associated with the methodology[34].

The project was delivered at a cost of £173.8 million, under the forecast cost of £182.2 million[35]. In the first three years, the road provided additional capacity to support more road users (an increase of 8% in the morning peak, 18% in the daytime peak and 24% in the evening peak compared to pre-project flows), while also improving the safety of these journeys.

Forecast value for money

An economic appraisal is undertaken prior to construction to determine a project's VfM 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[36] are summed together and compared against the investment cost to produce a benefit-cost ratio (BCR). The monetised impacts are considered alongside additional impacts which are not able to be monetised, to allocate the project a VfM category.

The monetised benefits forecast by the appraisal which supported the M1 J19 business case are set out in Table 3. We have also included an indication of what proportion of the monetised benefits each impact accounted for and a summary of how we have treated the monetisation of each impact in this evaluation.

Since 2011, we have routinely forecasted benefits over a range of possible traffic growth scenarios[37].

[34] The re-forecast figure was calculated using a discounting method, which only reflects journey time trends observed on the project area, not the surrounding road network which would have been considered in the appraisal. Moreover, limited traffic data means that it was only possible to calculate the 12-hour (7am – 7pm) journey time benefit. Any benefit associated with journey time savings in the nighttime period (7pm – 7am) is not included within the re-forecast value.

[35] Present value of costs in 2010 prices and values.

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

[37] 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 scheme impacts. Not all the benefits considered would have contained high and low growth forecasts, so a proportionate method was designed to estimate these based on existing evidence.

Table 3 Monetised benefits of the project (£ million)

	Forecast (£m)	% Forecast monetised benefits[38]	Evaluation approach
Journey times	587	90%	Re-forecast for the project area only (not the wider area) using observed and traffic flow and journey time data. Only the 12-hour period can be re-forecast (Morning, Daytime and Evening). This may under-value some of the journey time benefits associated with the overnight period.
Vehicle operating costs (VOC)	65	10%	Monetised benefits assumed as forecast
Journey time & VOC during construction and maintenance	1	0%	Not evaluated (assumed as forecast)
Journey time reliability	0	0%	Monetised benefits assumed as forecast.
Safety	31	5%	Monetarised benefits assumed as forecast.
Carbon	-27	-4%	Not evaluated (assumed as forecast)
Noise	0	0%	Not evaluated (assumed as forecast)
Air quality	0	0%	Not evaluated (assumed as forecast)
Indirect tax revenues	-9	-1%	Monetised benefits assumed as forecast
Total present value benefits (PVB)	**649**	**100%**	

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

The costs anticipated in the appraisal are set out in Table 4. Based on this information, the project was anticipated to deliver 'high' value for money under the core (most likely) traffic growth scenario over the 60-year appraisal period. During this evaluation, we considered the high and low growth scenarios in response to the lower than forecast traffic levels we have observed. These scenarios resulted in an expected value for money range of 'high' to 'very high' value for money.

Evaluation of costs

The project was delivered at a cost of £173.8 million[39], under the anticipated cost of £182.4 million (see Table 4). Usually, maintenance costs are reported separately in appraisal, however these were included as part of the capital construction costs.

Table 4 Cost of the project (£ million)

	Forecast (£m)	% of forecast costs	Evaluation approach

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

[39] 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.

Construction costs	182	100%	Current estimate of project cost
Maintenance costs	-	-	Not forecast (included in capital cost of construction)
Total present value of Costs (PVC)	**182**	**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 three 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 three 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 3, monetised benefits were primarily driven by forecasted reductions in journey times over the modelled period compared to a 'without project' scenario (what would be expected to happen if the project hadn't been constructed).

If the trends observed at the third year continue over the 60-year period, without any further action to optimise benefits, the monetised impact on journey times, for those using the road, would be £187 million. This is lower than the £587 million forecast prior to project construction. The re-forecast figure, however, only reflects journey time trends observed on the project extent, not the surrounding road network, which would have been considered in the appraisal. Moreover, it was only possible to re-forecast journey time benefits representing the 12-hour period (including morning, daytime and evening peaks). Any journey time benefits associated with the overnight period (between 7pm – 7am) were not included owing to a lack of data. Re-forecast monetised journey time benefits therefore likely under-value the true journey time benefits since the reconfiguration of the junction layout (and resulting decreased journey length) would likely bring journey time benefit even outside of peak periods.

Monetised journey reliability benefits

Journey time reliability was a main objective of this project. Our evaluation showed an improvement in reliability on both the M1 to A14 and M6 to A14 routes in all time periods in both directions. For example, on the M6 to A14 (eastbound) the slowest 5% of journeys took 13 minutes in the evening peak (owing to the two roundabout junctions). This has now reduced to less than two minutes (Figure 12). Variability in the middle 50% of journeys on all routes have also improved.

Monetised benefits of journey time reliability were not forecast at the pre-construction stage, and therefore it has not been included at three years after.

Notwithstanding, non-monetised indicators (including the box and whisker diagrams shown in Figure 12 to Figure 15) show evidence of improved journey time reliability as a result of the project improvements.

Impacts assumed as forecast

Data limitations has meant that it's not possible to re-forecast indirect tax revenues (ITR) or vehicle operating costs (VOC) and instead these have been reported as forecast. 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 because more vehicles were forecast and they were forecast to be travelling at higher (more fuel efficient) speeds, and therefore using less fuel and paying less tax.

VOCs refer to the fuel and other costs borne by the user (such as the wear and tear on vehicles). This generally increases with increased distance travelled. Since it was not possible to reforecast ITR, VOCs have also not been reforecast, with the value assumed as forecast (this value is a benefit due to the reduced distance travelled as a result of the improvements).

Safety benefits have also been assumed as forecast (£30.6 million). A reforecast of safety benefits was conducted resulting in a benefit larger than the forecast value. In this case, a more conservative forecast value has been used in the evaluation so as not to over-value the project benefits. Notwithstanding this, section 5 shows that the project is outperforming the appraised safety benefits for this project, and therefore, the safety benefits in reality are likely to be higher than the forecast value. This has been taken into consideration via the inclusion of 'non-monetised' benefits within the overall value for money of the project.

There is currently no methodology available to re-forecast the carbon impact, noise or air quality impacts, and therefore these have been assumed as forecast[40]. This assumption is considered representative, since observed traffic flows are similar to forecast traffic flows at three years after (2019).

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

Overall value for money

When considering an investment's value for money, we also consider benefits that we are not able to monetise. For this project, wider economic benefits might be relevant but were not assessed as part of the forecasting or evaluation. Moreover, safety benefits have been assumed as forecast. However, owing to collision savings above forecast levels, it's likely that reforecast benefits would be higher than the forecast value. These non-monetised benefits are therefore likely to push the project into the 'medium' value for money category. Whilst this is lower than the 'high' value for money forecast at appraisal, this could be due to methodological limitations associated with the three-year assessment (i.e. only considering the

[40] These generally have a small contribution to the monetised benefits of projects and therefore the impact of assuming as forecast is unlikely to impact on the value for money rating of the project.

project area, rather than the surrounding road network, which was considered in the appraisal, as well as only representing 12-hours of journey time benefit). The reforecast value therefore only considers part of the journey time benefit.

Overall, based on the evidence from the first three years, the M1 junction 19 project is on track to deliver a positive economic return on investment with the project likely achieving ‘medium’ value for money once non-monetarised impacts are considered.

Appendix A

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.

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