national highways

A14 Kettering Bypass junctions 7 to 9 widening

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. Safety is our top priority, and we are committed to reducing the number of road users killed or seriously injured on the strategic road network by 50% (from the 2005-2009 baseline) by the end of 2025.

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 drivers first. Post-Opening Project Evaluations (POPEs) are a vital part of that assessment. POPEs are undertaken for all our major projects to understand how traffic changes, due to a project being in place, the environmental and safety impacts and how a project supports the economy.

We work to a five-year funding cycle, a 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 A14 Kettering Bypass project started construction before this period and opened in May 2015. The projects objectives were to relieve congestion and unpredictable journey times around Kettering, where traffic on A14 merged with local routes. We provided extra capacity by widening the existing carriageway, from two to three lanes, in both directions.

We found that the extra capacity provided gave customers more consistent journey times and journey reliability, despite higher traffic levels. Speeds have increased, and some customer journey times have marginally improved.

Road user safety has also improved, with fewer personal injury collisions and a reduction in the rate and number of collisions along the A14.

While delivering both safety and journey time benefits, the project was expected to deliver greater journey time savings, and higher traffic growth was forecast. This has affected the project’s value for money assessment, and our evaluation shows that in the first five years we are not on track to deliver the value for money anticipated over the 60-year life of the project.

Elliot Shaw

Chief Customer and Strategy Officer

August 2024

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1. Executive summary

The project upgraded the A14 between Junctions 7 and 9 around Kettering, Northamptonshire, widening the A14 from two to three lanes. The project was designed to address existing and forecast congestion on the key trade route of the A14 between Haven Ports and the Midlands and help facilitate the substantial increase in housing, which was planned in North Northamptonshire, through increased capacity provision.

Our evaluation found that traffic volumes on the A14 project section had increased when compared to traffic volumes before[1]. It is likely that a substantial amount of growth may have been due to the A14 being a major freight route and reassignment of traffic onto this section of the A14 as a result of the Cambridge to Huntingdon improvement project.

We found that the extra capacity provided by the widening provided road users with consistent journey times and journey reliability, despite the increase in traffic volume, between the before period and five years after. Some congestion was evident on the improved section, with a drop in speeds observed between junctions 7 and 8 westbound (where the A43 runs alongside the A14). However, five years after the project opening, overall, the speeds on this section were still better than before project construction, with average speeds increased in both directions to around 60mph.

Road user safety has improved, with fewer personal injury collisions (PIC) following the project's opening, with a reduction in the rate and number of PICs along the A14.

The five years after evaluation found the impact of the project on greenhouse gases is worse than expected due to the proportion of heavy goods vehicles recorded. The impacts of the project (widening, gantries and new lighting columns) on local noise, landscape, biodiversity, and the water environment (drainage) were broadly as expected by the environmental appraisal and assessment.

While delivering both safety and journey time benefits, the project was expected to deliver greater journey time savings than observed, as well as greater traffic growth. We saw a more modest traffic growth, accompanied by marginal improvement in journey time savings. This has impacted the project's value for money assessment. Overall, based on the evidence from the first five years, this project is not on track to deliver the value for money anticipated over the 60-year life of the project and if the journey time trends observed within the first five years continue, the project is expected to deliver 'poor' value for money.

[1] Traffic volume before (2012) and five years after opening (2021).

2. Introduction

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

The A14 Kettering Bypass Improvement was completed in May 2015. Construction began in November 2013 and involved the upgrade of the A14 between junctions 7 to 9. The purpose of the works was to provide additional capacity by widening the existing carriageway, from two to three lanes, in both directions.

The project was designed to improve the A14 around Kettering, which suffered from congestion and unpredictable journey times where traffic merged with the A14 carriageway from local routes, including the A43, A509 and A601.

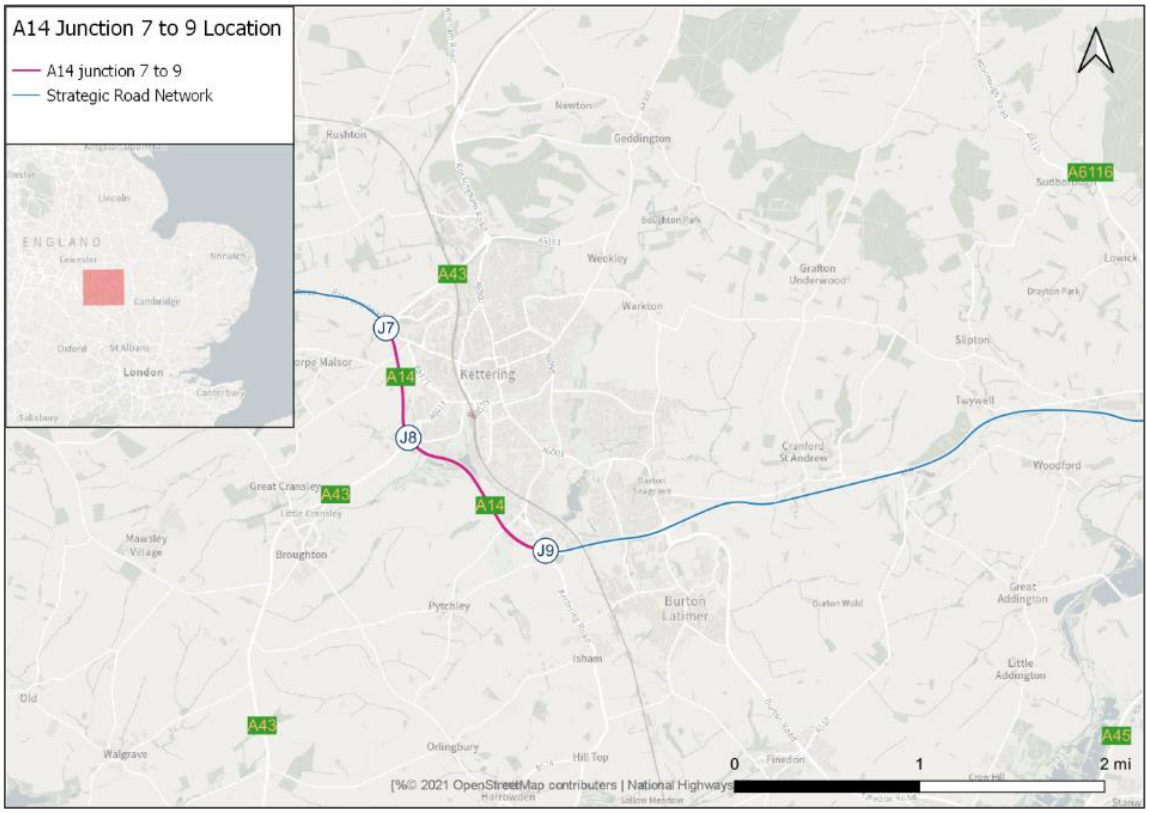
Project location

The project is located to the south-west of Kettering, shown in Figure 1. The A14 is a strategic highway route which connects the M1 and M6 motorways in the Midlands with the A1, the M11 and the east coast ports near Felixstowe.

Due to its links with the port of Felixstowe, the A14 is part of the Trans-European Network, and is the designated UK section of the Ireland – UK – Benelux highway link known as Project 13. Because of the A14's strategic importance, the A14 has a high proportion of HGVs (Heavy Goods Vehicles).

In addition to the A14's strategic importance, the A14 also performs important local and regional functions, providing connections between Cambridge, Ipswich, and Kettering.

Figure 1 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 compares changes in key impact areas[2] 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.[3]

[2] Key impact areas include safety, journey reliability and environmental impacts.
[3] 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. These benefits are appraised over a period of 60 years. The one-year evaluation provided early indication of the performance of the project, the five-years after evaluation provided within this report gives a more detailed insight.

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

Table 1 Objectives and Evaluation summary

Objective	Five-year evaluation
To reduce congestion and provide additional capacity, increase journey time reliability, and ensure the safe and economic operation of the trunk road	Although traffic volume has increased along the project section, the additional capacity has enabled an increase in speeds.
To achieve a safety objective under which the 'after' collision numbers (per annum) on the junctions 7 to 9 section of the A14 are no greater than those 'before' and the severity ratio is not increased	Safety has improved, with fewer personal injury collisions between junctions 7 to 9. There has been no change in the number of collisions resulting in a fatality or serious injury. As we have seen a decrease in slight injuries, this has resulted in an increase in the severity ratio.
To improve journey time reliability by improving and better managing traffic flow conditions	Journey time reliability has remained consistent between the before period and five years after. We found that that the worst journey times before the project have now seen an improvement.
To reduce the effects of queuing on the slip roads on mainline flow	The speeds remain consistent through the junctions, this illustrates that any queues do not affect the A14 mainline flow.
To minimise the detrimental environmental effects of the project and offset by mitigation measures where technically feasible and economic to do so, taking account of costs, availability of funding and statutory obligations.	Mitigation measures have been implemented to reduce the impact of the project on the surrounding area. Housing growth around the area may have had a greater impact on the environment than the project in some cases.

The following objectives were also stated in the Client Project Requirements but were not assessed as part of this evaluation:

- To support sustainable economic activity and local development plans.
- To support and enhance the role of the current A14 Kettering junctions 7 to 9 as a major regional (Trans-European Network) and inter-urban transport artery; and
- To support housing and job growth in the region.

4. Customer journeys

Summary

This evaluation found that traffic volume on the A14 project section had increased when compared to traffic volume before (2012) and five years after (2021). The analysis of regional and local trends showed that there had been an increase locally in Northamptonshire between 2012 and 2019. It is likely that a substantial amount of growth may have been due to the A14 being a major freight route and reassignment of traffic onto this section of the A14 as a result of the Cambridge to Huntingdon improvement project.

We found that the extra capacity provided by the widening provided road users with consistent journey times and journey reliability, despite the increase in traffic volume, between the before period and five years after. Some congestion was evident on the improved section, with a drop in speeds observed between junctions 7 and 8 westbound (where the A43 runs alongside the A14). However, five years after the project opening, overall, the speeds on this section were still better than before project construction, with average speeds increased in both directions to around 60mph.

How have traffic levels changed?

This section examines the changes in traffic volumes along the project extent and on roads in its vicinity since the project opened, and how it was expected to perform over the same timeframe.

National and regional

To assess the impact of the project on traffic levels, it is useful to understand the changes within the context of national and regional traffic. To do this, we use the Department for Transport annual statistics. The data is reported by local authority and road type, recording the total number of million vehicle kilometres travelled[4]. 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.

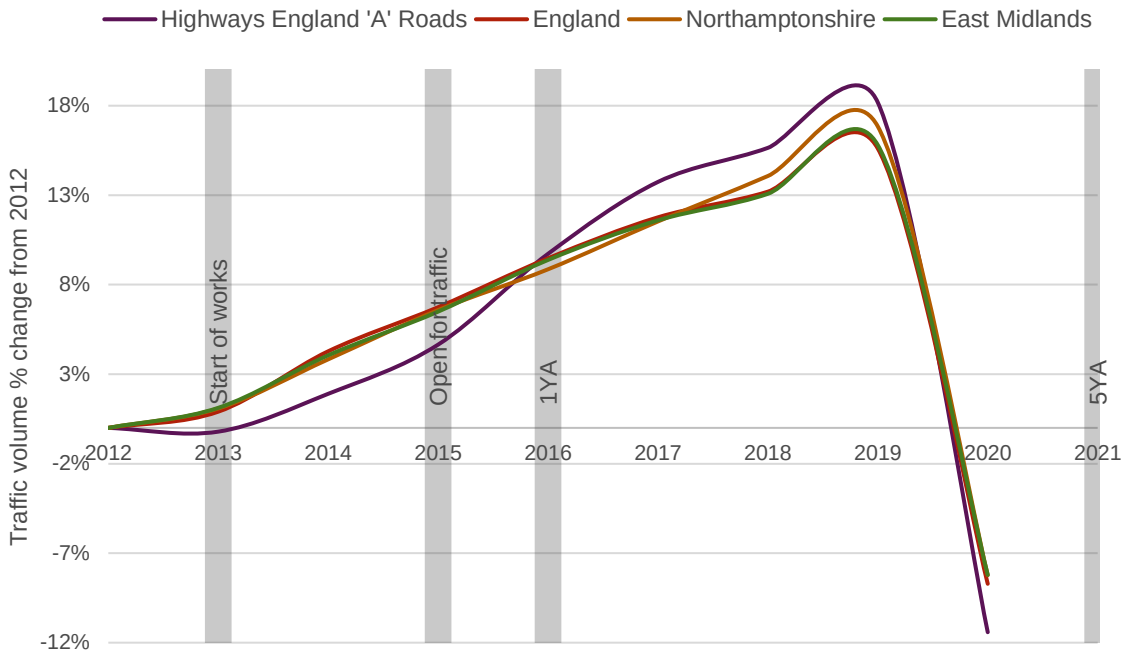
It is important to understand the traffic impacts of the project in the context of the general changes in traffic in the region. We have used data from 2021 to represent five years after because traffic patterns in 2020 were impacted by the coronavirus pandemic and associated lockdowns. Our analysis determined that traffic patterns stabilised enough from September 2021 onwards to enable traffic analysis to resume.

We have presented the change between 2012 which represents the before construction baseline for this evaluation, and 2019, which is the closest year to five years after the project opened which can be accessed and used reliably[5].

[4] Motor vehicle traffic (vehicle kilometres) by region in Great Britain, annual from 1993 to 2019, Table TRA 8904, Department for Transport

[5] 2020 data is dominated by the impact of the coronavirus pandemic and associated lockdowns. 2021 not yet available at the time of writing

Figure 2 National, regional, and local traffic trends



Source: Department for Transport road traffic statistics https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra

Figure 2 shows growth in the order of 17% for Northamptonshire, 16% for the East Midlands, and England and 18% for National Highways 'A' Roads during 2012 to 2019.

The following analysis should be considered in the context that, assuming traffic patterns recover to pre-pandemic levels, growth of 16-18% is likely to be due to background trends, and not due to the project. No factoring of the observed flow data has been undertaken.

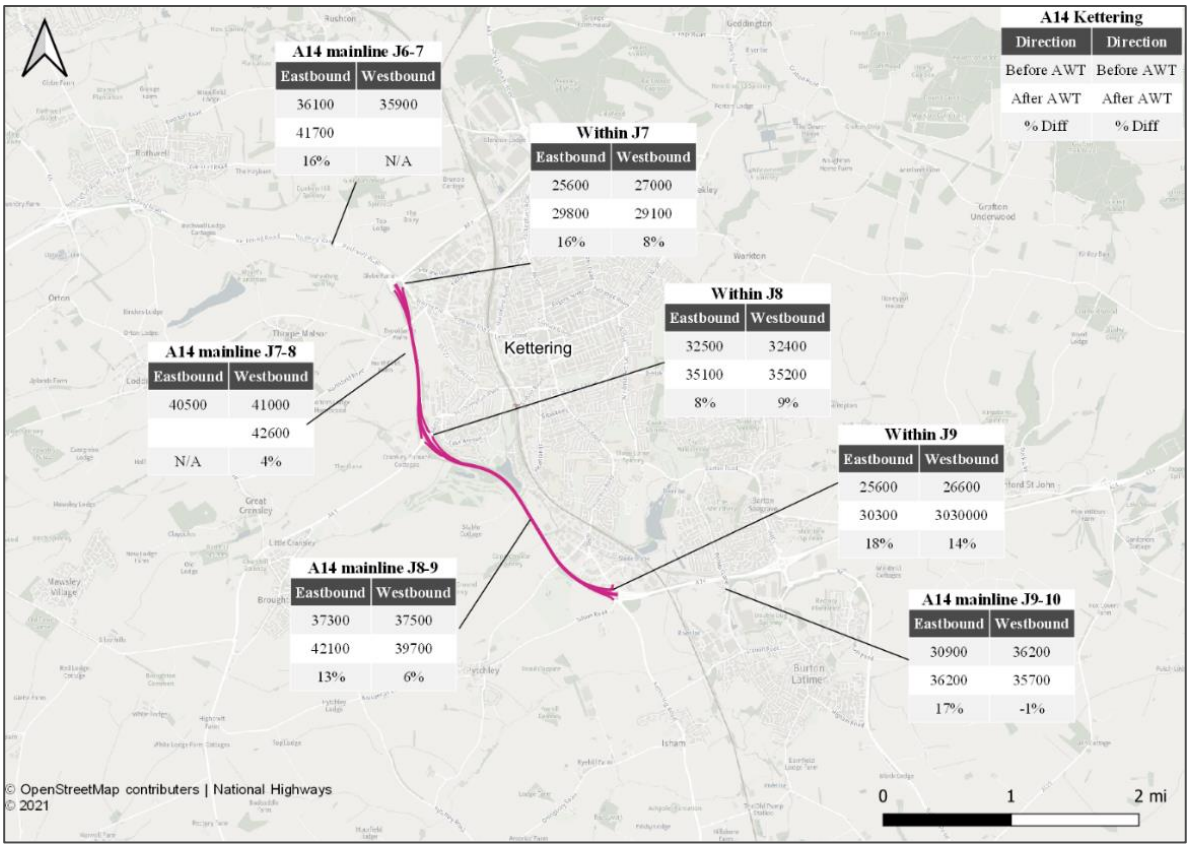
How did traffic volumes change?

The A14 saw traffic volumes increase at all assessed locations in line with the background trends.

Figure 3 presents a comparison of the traffic volumes in the before project period (2012) and the five years after period (2021) along the project section and represents the changes in Average Weekday Traffic (AWT) volumes. Traffic flow information for the A14 was obtained from National Highways Traffic Information System (WebTRIS) database[6].

[6] No data was available on WebTRIS on the eastbound carriageway between junctions 7 and 8 and the westbound carriageway between junctions 6 and 7 in 2021.

Figure 3 Comparison of before and five-year after AWT



Note: All figures are shown to the nearest 100. Source: WebTRIS traffic counts – October 2012 (before) and June 2021 (after)

The level of growth on the A14 is greater on the eastbound carriageway than on the westbound carriageway. This may be due to lower volumes in the eastbound direction before the project commenced. For example, within junction 7 there was a 16% increase in traffic volumes eastbound compared to an 8% increase in traffic volumes westbound but this increase on the eastern carriageway only led to the actual traffic volume numbers evening out.

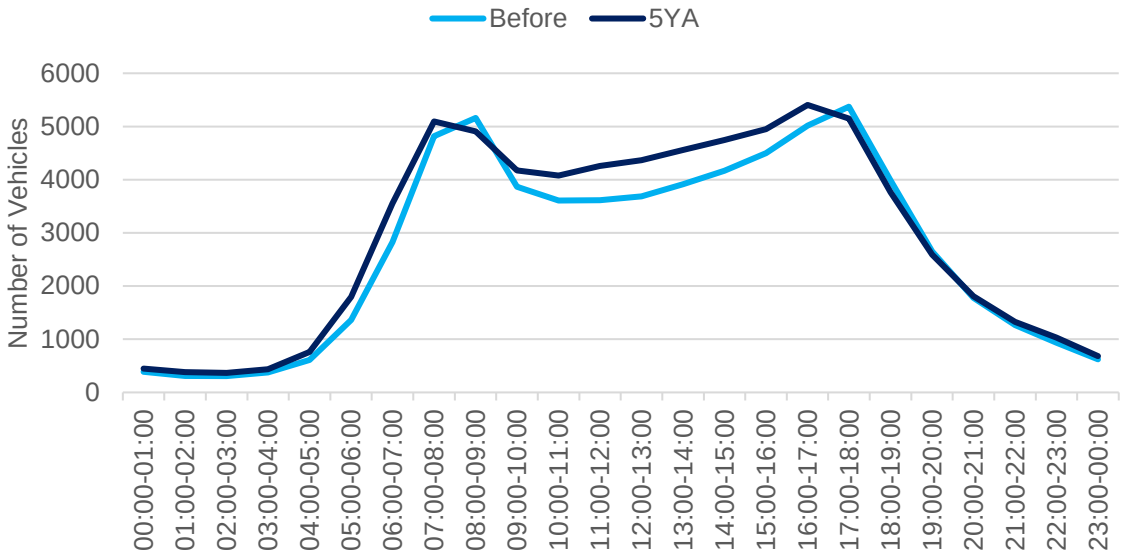
This pattern is also visible between junctions 8 to 9 where eastbound there was a 13% increase in traffic volumes to 42,100 vehicles and westbound there was a 6% increase in traffic volumes to 39,700 vehicles within the same period.

Daily flow profile

We undertook analysis to assess whether there had been a change in the daily profile of traffic volumes to help our understanding of the overall traffic flow changes. We analysed the WebTRIS traffic volumes on the A14 within Junction 8 across a typical weekday to determine whether traffic growth occurred uniformly or at certain times of the day.

Figure 4 shows that during the busiest times on the road network, 07:00-09:00 and 16:00-18:00, traffic volumes have remained similar suggesting that traffic growth has occurred uniformly.

Figure 4 Comparison of average weekday A14 two-way flows before and five years after project opening



Source: WebTRIS traffic counts – October 2012 (before), June 2021 (5YA)

Figure 4 shows that there is an increase in traffic within the inter peak period of between 450 and 700 vehicles per hour, five years after project opening. This is likely due to an increase in industrial activity within the area and the associated freight which is most likely to use the road network in the inter-peak period than commuter vehicles. Further HGV analysis is shown in Appendix A.

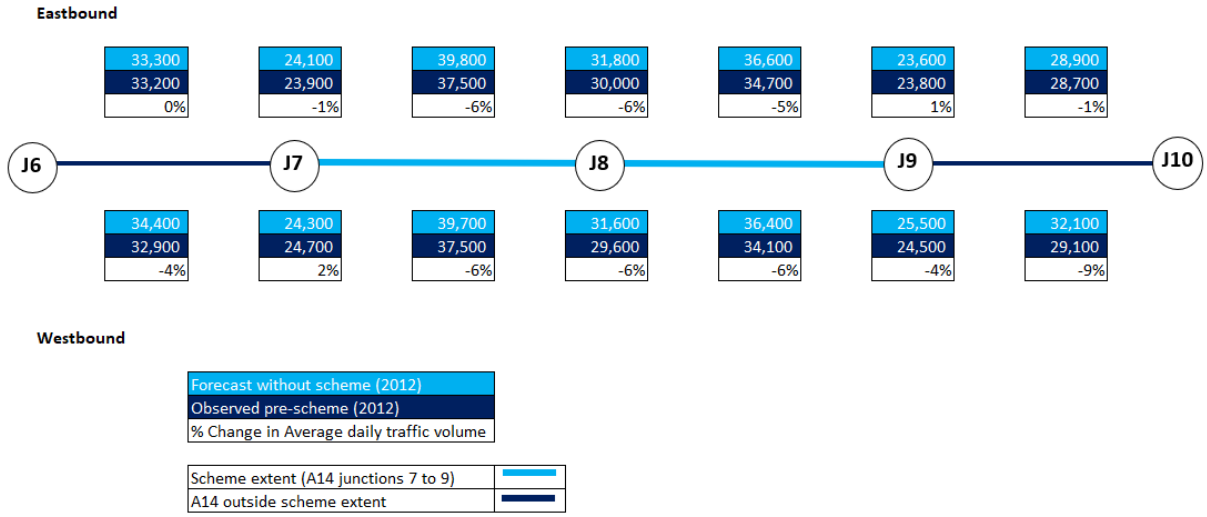
Was traffic growth as expected?

It is important to understand how levels of traffic growth on the project compare to the forecasts, and whether the level of growth predicted has been realised. This section compares the Annual Average Daily Traffic (AADT) volumes from the Traffic Forecasting Report (TFR) which informed the business case (March 2013) with the equivalent observed data.

Appendix A provides more detail on how the project was appraised, key assumptions and detailed analysis.

In summary, forecast traffic volumes pre-project slightly overestimated the observed traffic volumes at the majority of locations. The largest difference though is 9%, and within the project extent 6%, which is just outside the 5% inaccuracy which traffic models are afforded.

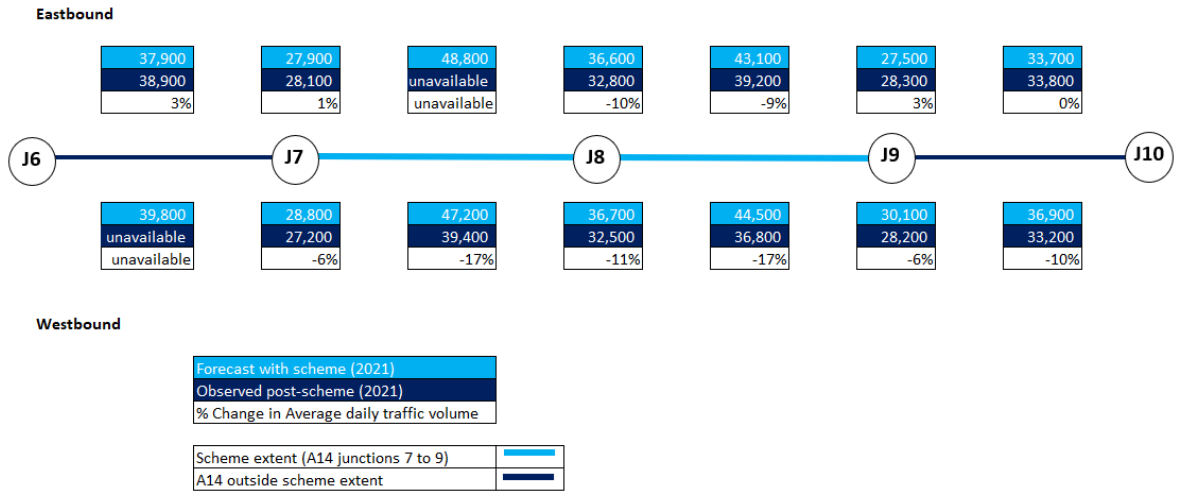
Figure 5 A14 Forecast (2012) and observed (2012) traffic volumes without project



Source: Traffic Forecasting Report (March 2013), WebTRIS (Before, October 2012). Forecast traffic volumes interpolated from 2015 and 2030 forecasted traffic volumes.

Figure 6 presents forecasts of traffic volumes in 2021 compared to observed post-project traffic volumes in 2021. This shows a similar trend to the pre-project data, in that the forecast traffic volumes are higher than the observed traffic volumes by up to 17% between A14 junction 6 to 10.

Figure 6 A14 Forecast (2021) and observed (2021) traffic volumes with project



Source: Traffic Forecasting Report (March 2013), WebTRIS (5YA, June 2021). Forecast traffic volumes interpolated from 2015 and 2030 forecasted traffic volumes.

Appendix A presents additional modelled without project (DM) and with project (DS) AADT volumes on the A14 area mainline and compares them with the observed pre and post project traffic volumes between A14 junction 6 to junction 10 and also includes analysis of traffic volumes within junctions on the A14.

Relieving congestion and making journeys more reliable

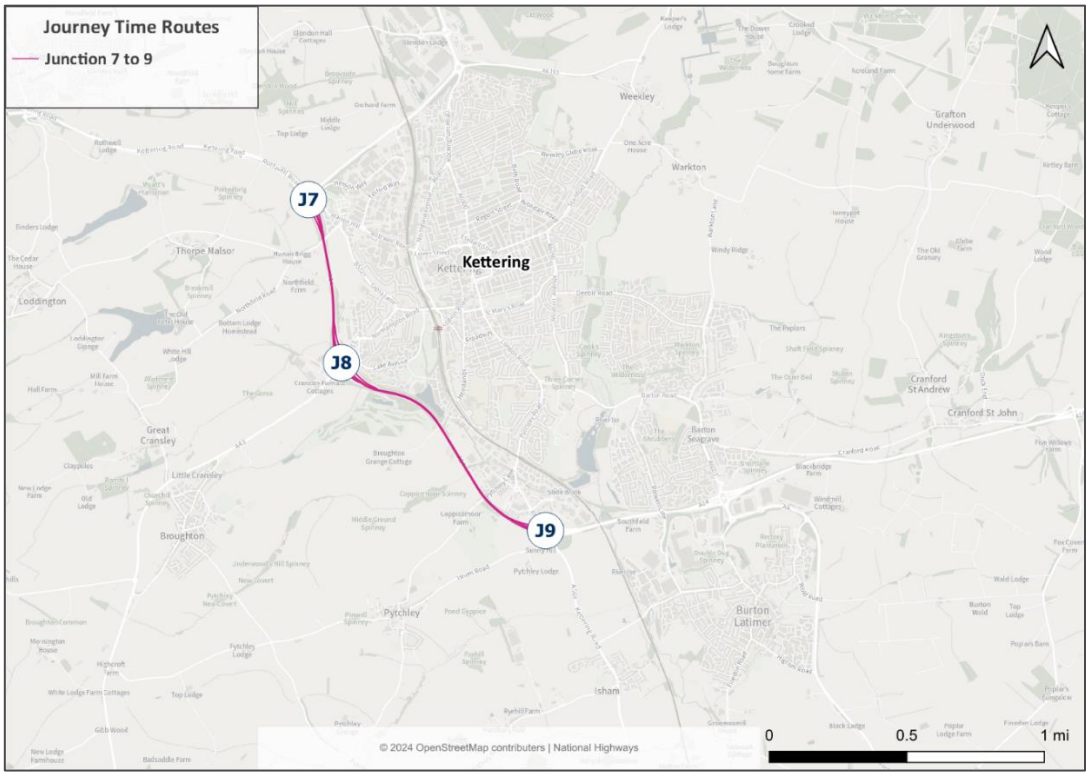
We have analysed journey times as a way of identifying the impact of the project on congestion. The extent to which journey times vary from the expected average journey time indicates how reliable a journey is. This section evaluates how the project impacted journey times and the reliability of journeys.

Did the project deliver journey time savings?

To understand whether the project has resulted in average journey time savings, we have used TomTom GPS data.

To assess the journey time savings a route was selected which captured not only the project section, junctions 7 to 9, but also a wider section (junctions 2 to 12). This route was analysed to match the forecast route provided in the Traffic Forecasting Report, and therefore includes sections of the A14 which are outside of the project section. Figure 7 presents the journey time routes assessed. The journey time route was assessed in both directions.

Figure 7 Journey Time Routes



Source: National Highways and OpenStreetMap contributors

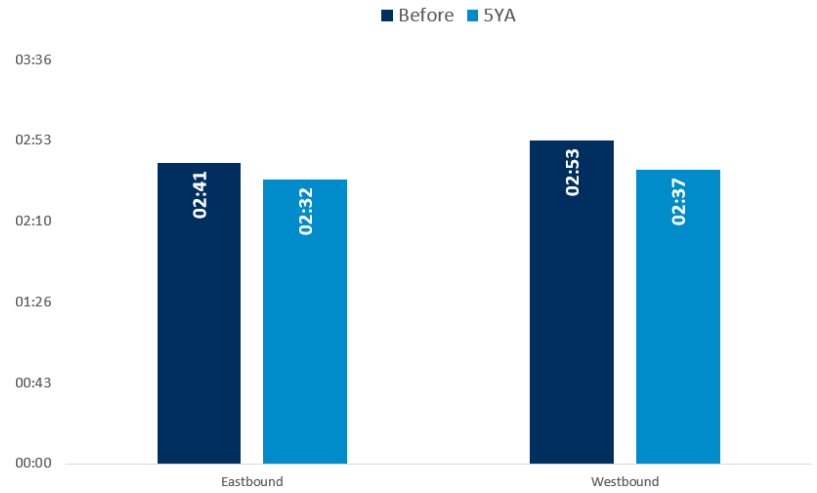
Data from October 2012 was used for the before scenario, and June 2021 for the five-year after. We have used the same time periods that were used in the project appraisal, these were for a weekday:

- Morning peak: 08:00-09:00.
- Evening peak: 17:00-18:00.

An assessment of other hourly time periods was carried out to check relevant or unexpected observed changes, but the above time periods remain the key focus in this section.

Figure 8 shows the average journey times in the morning peak period, before and five years after project opening.

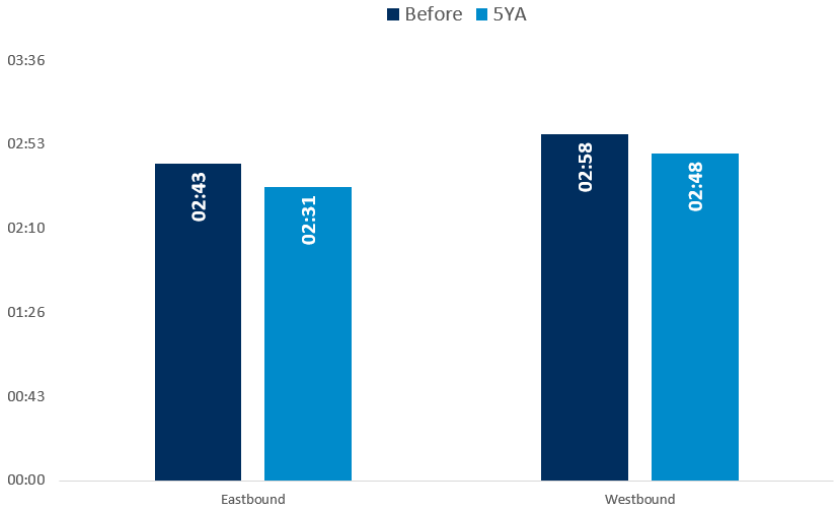
Figure 8 A14 average observed journey times before and five years after project opening in the Morning Peak (mm:ss)



Source: TomTom (October 2012 and June 2021).

Figure 9 shows that the westbound carriageway experienced greater journey time savings than the eastbound carriageway with an average saving of 16 seconds compared to 11 seconds. This is likely due to the westbound carriageway experiencing less traffic growth than the eastbound carriageway and therefore, greater journey time benefits resulting from the extra capacity provided by the project.

Figure 9 A14 average observed journey times before and five years after project opening in the Evening Peak (mm:ss)



Source: TomTom (October 2012 and June 2021).

The evening peak period (Figure 9) shows a similar result to the morning peak period but with the eastbound carriageway seeing greater journey time benefits than the westbound carriageway. The eastbound carriageway has witnessed a 12 second reduction compared to a 10 second reduction on the westbound carriageway.

Further journey time analysis is available in Appendix A which provides further support to the findings presented in Figure 8 and Figure 9.

Were journey time savings in line with forecast?

Forecast journey times were provided in the A14 junctions 7 to 9 Kettering Bypass Improvement Traffic Forecasting Report (March 2013), prepared as part of the project appraisal. To allow a comparison between forecast journey times and the observed journey times, the observed journey time data from TomTom has been analysed for the same project extent used in the Traffic Forecasting Report. This route is from junctions 2 to 12 and can be seen in Figure 7. Forecasts were included for all modelled years and time periods for the without project (DM) and with project (DS) scenarios.

Table 2 and Table 3 present the forecast and observed average journey times for the A14 between junctions 2 and 12 eastbound and westbound.

Table 2 Forecast and Observed Average Journey Times on the A14 Junctions 2-12 Eastbound

	Forecast Journey Time			Observed Journey Time		
Time Period	DM 2021 (mm:ss)	DS 2021 (mm:ss)	Saving (mm:ss)	Before (mm:ss)	5YA (mm:ss)	Saving (mm:ss)
08:00-09:00	22:03	20:47	-01:16	17:27	19:11	01:44
10:00-16:00	20:04	18:57	-01:07	17:02	18:00	00:58
17:00-18:00	25:06	22:52	-02:14	16:56	17:39	00:43

Source: Traffic Forecasting Report (March 2013) and TomTom (October 2012 and June 2021)

Table 3 Forecast and Observed Average Journey Times on the A14 Junctions 2-12 Westbound

	Forecast Journey Time			Observed Journey Time		
Time Period	DM 2021 (mm:ss)	DS 2021 (mm:ss)	Saving (mm:ss)	Before (mm:ss)	5YA (mm:ss)	Saving (mm:ss)
08:00-09:00	23:54	21:43	-02:11	17:01	17:29	00:28
10:00-16:00	20:16	18:58	-01:18	16:55	17:53	00:58
17:00-18:00	22:33	20:27	-02:06	17:15	17:40	00:25

Source: Traffic Forecasting Report (March 2013) and TomTom (October 2012 and June 2021)

Table 2 and Table 3 show journey time savings were over-estimated in all time periods. All observed journey times are better than before project at five years after.

The key driver in the forecast for a reduction in journey times was that the pre-project modelling predicted that delay would grow substantially without the project. Whilst we cannot measure the counterfactual journey times to check whether journey times would have increased to the without project (DM) 2021 values,

evidence from the before and five years after project construction journey times indicate that the delay was not as bad as was anticipated and that the forecast over-estimated journey time savings.

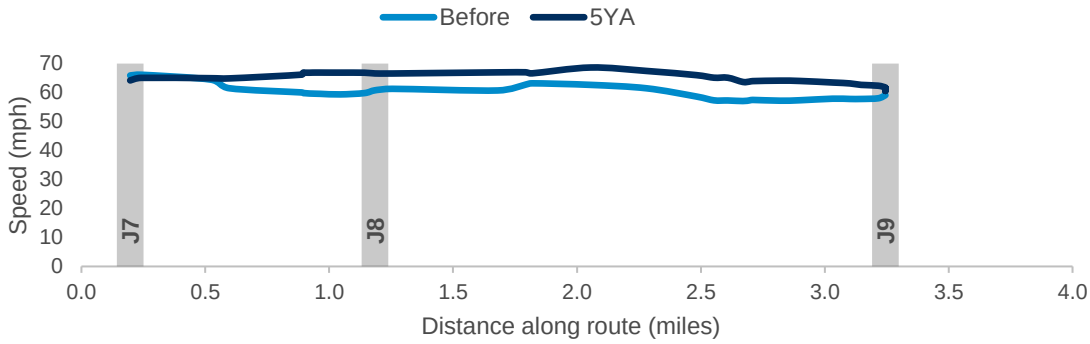
When comparing the journey times at five years after to the forecast with project (DS) 2021 scenario, we can see that the project is performing better than was predicted during pre-project appraisal. In all time periods, the five years after journey times are lower than both the with and without project 2021 scenarios. Although the forecast journey time savings were not realised, the project did perform better than was appraised.

How did the project impact road user's speeds?

This section uses TomTom GPS data to understand the effect of the project on average speed at various points along the project extent. Data from October 2012 was used for the before speeds, and data from June 2021 for five years after.

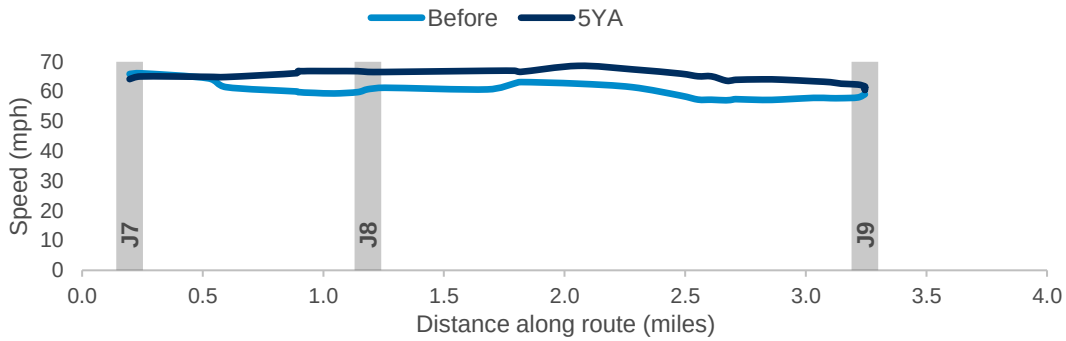
The speeds analysis shows that in the eastbound direction between junctions 7 to 9, the speeds have increased between the before and five years after period. This increase in average speed to around 60mph illustrates that the project is working well. Both figures show speeds slightly reducing between junctions 8 to 9, this may be due to the lane drop which occurs at junction 9. This reduction in speed due to the lane drop may result in slowing traffic as it merges. However, the reduction in speed leading to junction 9 is proportionate to the reduction in speed seen in the before period, this shows that the project has not made it any worse than before. See Figure 10 and Figure 11

Figure 10 Eastbound Speed Over Distance Comparison - Morning Peak



Source: TomTom (October 2012, June 2021).

Figure 11 Eastbound Speed Over Distance Comparison - Evening Peak



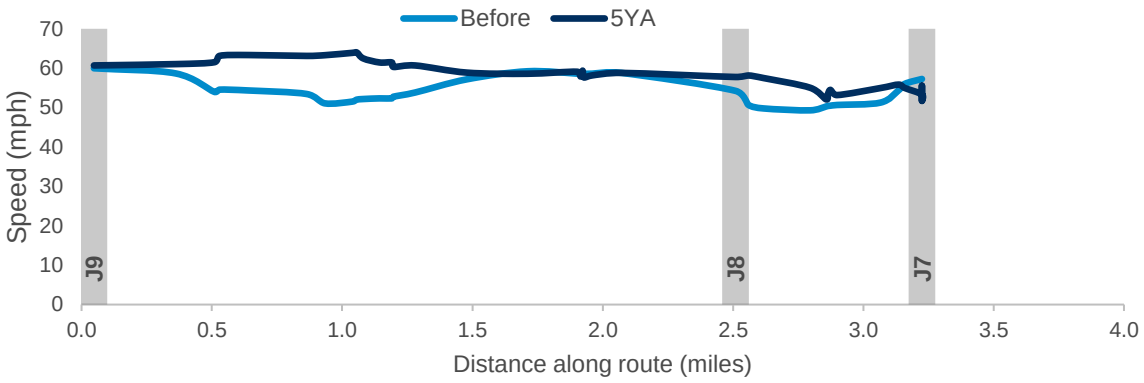
Source: TomTom (October 2012, June 2021)

Figure 12 and Figure 13 illustrate the general pattern for speeds in the westbound direction. Overall, in both time periods the speeds are higher than what was observed in the before period. In the morning peak, speeds are greater than before and more consistent with them remaining high through junction 8 where they had previously reduced.

Although speeds have increased, Table 3 shows that there has been an increase in journey time. One reason for this may be due to vehicles joining the road from the A43 and other associated vehicle movements leading to speed reducing temporarily between Junctions 7 and 8 in the outside lane and therefore journey times increasing.

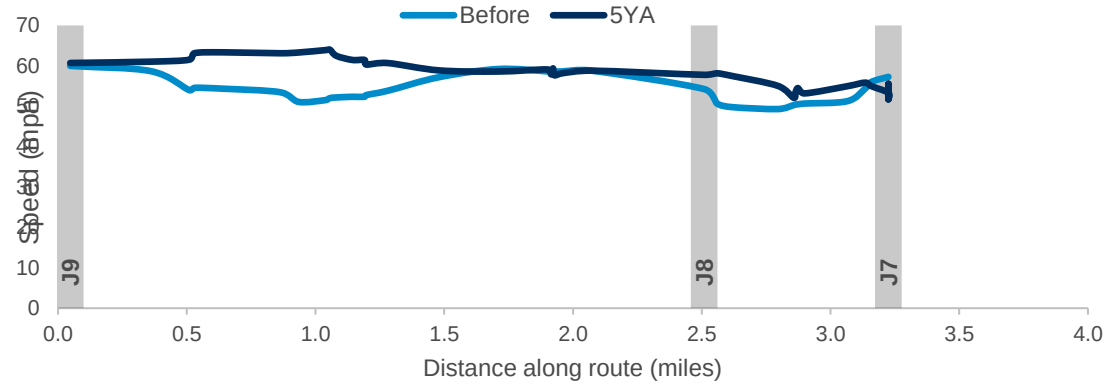
Figure 13 shows that in the evening peak, the average speed drops between junctions 7 and 8, this could explain why we have not seen a significant change in the journey times between before and five years after project in these periods. This reduction in speed may be due to congestion in the evening peak around junction 7 where there is a lane drop and due to the A43 running alongside the A14.

Figure 12 Westbound Speed Over Distance Comparison - Morning Peak



Source: TomTom (October 2012, June 2021).

Figure 13 Westbound Speed Over Distance Comparison – Evening Peak



Source: TomTom (October 2012, June 2021).

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.

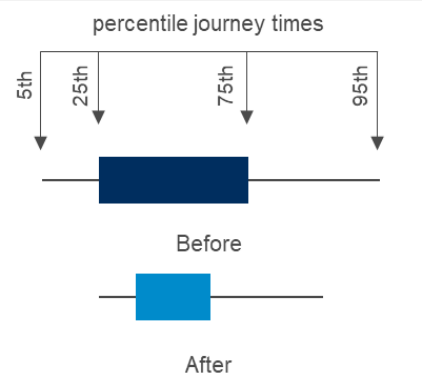
We calculate this using the same GPS data from TomTom that was used in the journey time analysis. We have looked at the percentiles of journey times to establish whether they have become more or less reliable since before the project was implemented. In this section, we present the journey time reliability on the A14 extent used in the journey time impact section.

Figure 15Figure 12 presents the journey time reliability for the A14 eastbound between junctions 7 and 9, before and five years after project opening.

In all time periods, the interquartile range, which is the difference between the 25th and 75th percentile, has increased. The largest change in the interquartile range was an increase of 5 seconds in the inter peak period five years after compared to before, illustrating that variability of journey times has remained the same throughout.

In addition to the interquartile range, the 95th percentile can be used to illustrate the five percent of longest journey times. We have observed a reduction across all time periods in the 95th percentile on the eastbound carriageway.

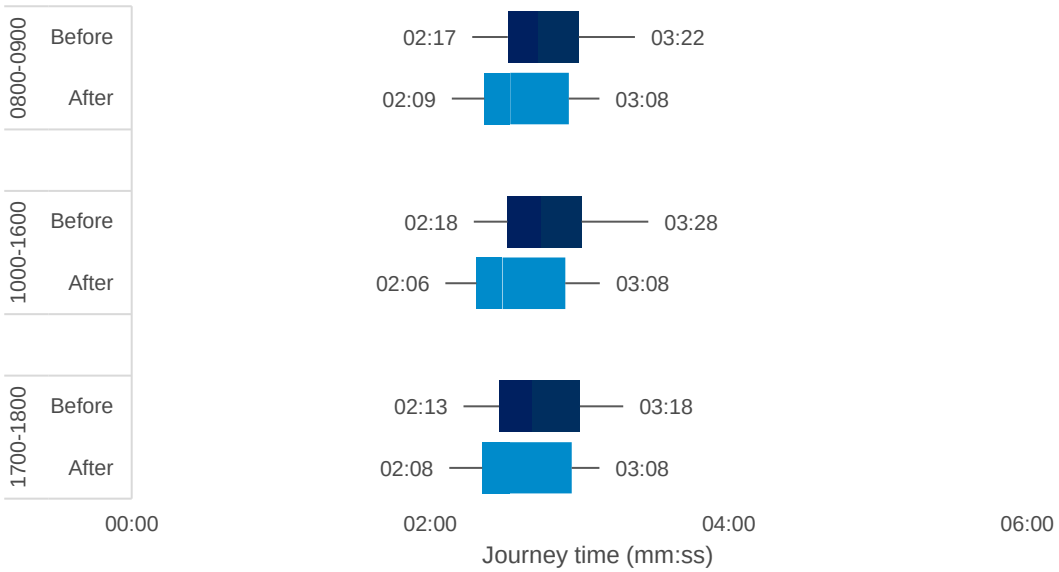
Figure 14 What does a box plot show?



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.

Figure 15 A14 Eastbound junctions 7 to 9 Journey Time Reliability

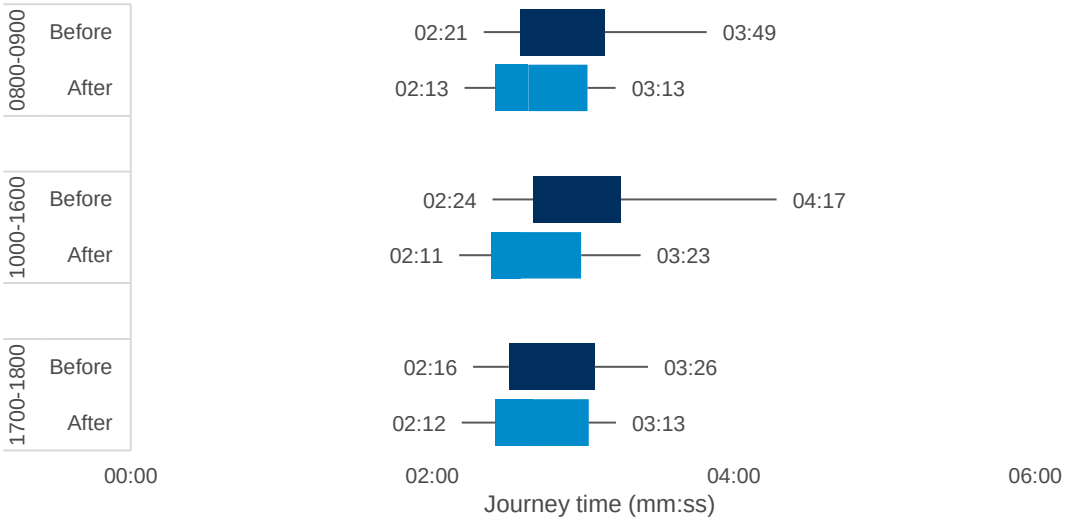


Source: TomTom (October 2012, June 2021).

Figure 16 presents the journey time reliability results for the A14 westbound carriageway between junctions 7 and 9. Similarly to the eastbound carriageway, the interquartile range has increased in all time periods, being the greatest in the evening peak period. The greatest increase in interquartile range was in the evening peak, where the interquartile range was 3 seconds greater in the five-year after period when compared to before.

In both peak periods there has been a decrease in the 95th percentile, illustrating that the worst journeys are improving after the project. Figures 15 and 16 show that journey time reliability has improved, and journeys made during the daytime are marginally more reliable.

Figure 16 A14 Westbound J7-9 Journey Time Reliability



Source: TomTom (October 2012, June 2021)

5. Safety evaluation

Summary

The safety objective for this project is to ensure that the number of accidents and collision rate was no worse than observed before the project.

The number of personal injury collisions[7] and the rate of these collisions per million vehicle kilometres were analysed to track a change over time.

There has been a reduction in the rate and number of personal injury collisions on both the project extent and the surrounding network. This is based on comparing the first five years of the project being operational with the annual average for the five years before project construction.

There had been an annual average reduction of four personal injury collisions, which is in line with the forecast impacts. This is based on an observed annual average of three personal injury collisions after the project was operational compared with seven before the project was constructed.

When accounting for the increased volume of road users over this period, the annual average rate of personal injury collisions per hundred million vehicle miles (hmvm) has also improved over time. The average collision rate had decreased to four personal injury collisions per hmvm, this equates to travelling 29 million vehicle miles before a collision occurs. Before the project, the collision rate was nine per hmvm, this equates to traveling 12 million vehicle km before a collision occurs. If the road had had not been widened to three lanes, we estimate the collision rate would be at five per hmvm.

The severity of collisions had also reduced since the project was operational. There were on average two collisions leading to slight injuries per year after the project was operational. This is a reduction of four collisions as six were observed before the project was operational.

There has been no change in the number of serious and fatal collisions. An average of one serious or fatal collision has been observed before and after the project was operational.

When accounting for the increased number of road users over this period, there had been a reduction from 0.8 to 0.5 fatality equivalents[8] per billion vehicle kms travelled. Reducing the risk of a fatality equivalent by 0.3 for every billion vehicle kms travelled.

On the surrounding network[9] there was an average reduction of 101 personal injury collisions per year (based on an annual average of 338 personal injury collisions observed after the project had opened compared with 439 before the project).

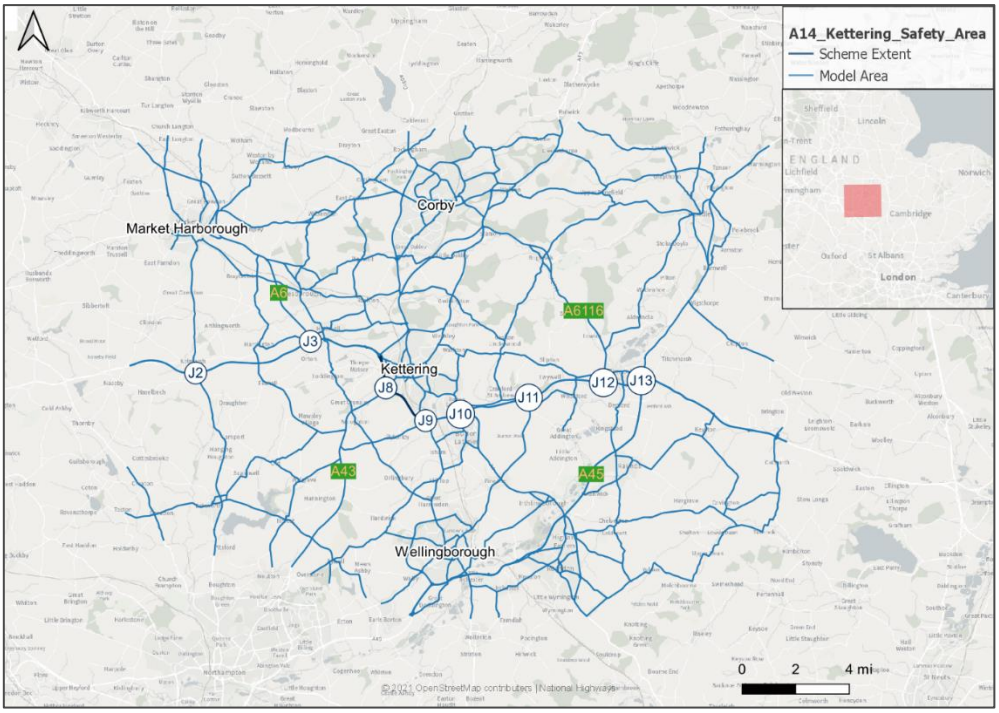
Based on this analysis, we can be confident that the project is on track to meet its safety objective at the end of the 60-year appraisal period.

[7] A collision that involves at least one vehicle and results in an injury to at least one person
[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

Safety study area

The safety study area, shown in Figure 17, was defined as the project extent on the A14 between junctions 7 and 9, and a wider area including adjacent roads on the local road network. This area has been considered to allow us to determine the impacts on safety that the project has had on both the project extent and the wider area.

Figure 17 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 Department for Transport road safety data[10]. This records collisions 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 five years after.

The analysis draws on the following data collection periods:

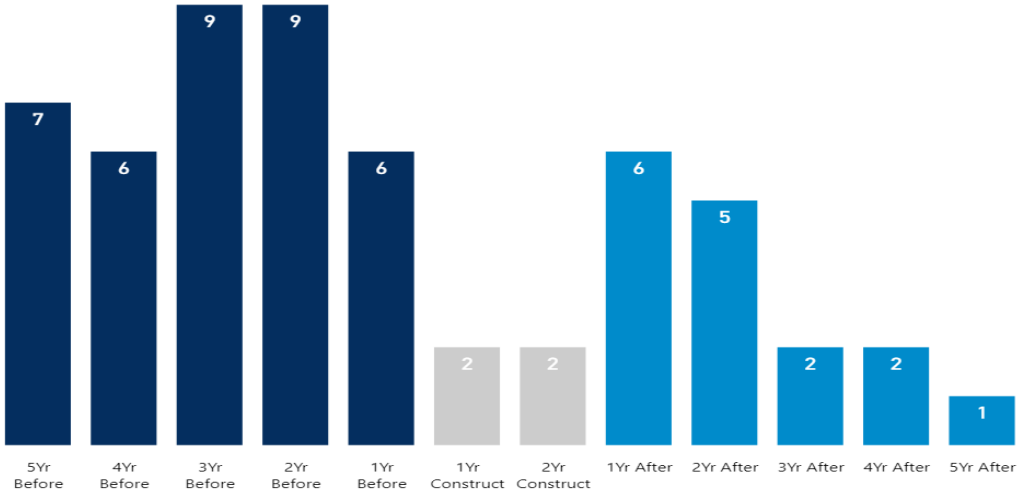
- Pre-construction: 14th May 2008 to 13th May 2013
- Construction: 14th May 2013 to 30th April 2015
- Post-opening: 1st May 2015 to 31st December 2019

The evaluation found the number of personal injury collisions on the project extent, had decreased (impacts on the wider area are discussed later). Over the five years after the project was operational, there were an average of three personal injury

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

collisions per year, four fewer than the average seven per year over the five years before the project was constructed.

Figure 18 Annual Personal Injury Collisions



Source: STATS19: 14th May 2008 to 31st December 2019

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

It is not possible to produce a counterfactual range for the project extent. To do so requires a minimum average of at least 10 personal injury collisions per year. We are able to do so for the wider area and this is reported later in the chapter. This is supported by the safety appraisal which anticipated safety improvements to occur in the wider area.

How had traffic flows impacted collision rates?

It is important to contextualise the collisions against the volume of traffic seen on this stretch. To do this we estimated a collision rate, the number of collisions per annual hundred million vehicle miles (hmvm).

Prior to the project, there was an annual average of nine personal injury collisions per hmvm. After the project became operational there was a decrease to four personal injury collisions per hmvm.

The distance travelled before a personal injury collision occurred increased from 12 to 29 million vehicle miles per personal injury collision.

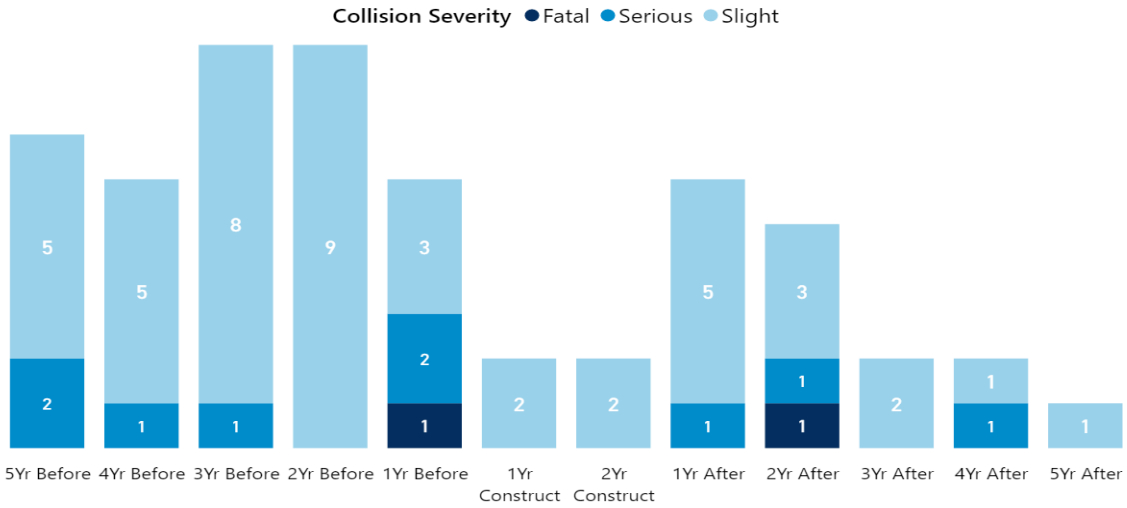
A counterfactual test was undertaken. It found that the collision rate would likely have been five collisions per hmvm. This indicates we predicted a decrease in the number of collisions and a reduction in the rate that they occur despite increased traffic volumes. Statistical testing indicates the difference between the after and counterfactual collision rates falls within the range of what we expected having observed regional trends on similar road types. The reduction in collision rates may have been achieved without the project.

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 was recorded (more information on this can be found in Appendix C).

The evaluation found, after the project there was an average of four fewer collisions resulting in slight injuries per year (the annual average before the project was six, compared to two after). There has been no change in the number of serious and fatal collisions. An average of one serious or fatal collision has been observed before and after the project was operational. Figure 19 shows the severity of personal injury collisions.

Figure 19 Severity of personal injury collisions within the project extent



Source: STATS19: 14th May 2008 to 31st December 2019

How had had traffic flows impacted collision 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[11]. In effect, it takes all non-fatal injuries and adds them up using a weighting factor to give a total number of fatality equivalents. 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 0.1 FWI has been observed. Before the project, an average of 0.4 FWI was observed. After the project this had reduced to 0.3.

The combined measure showed an extra 99 million vehicle miles was travelled before a FWI[12].

This indicates that we are observing a reduction in the severity of injuries occurring after the project was opened to traffic.

[11] 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.

[12] Before the project, 209 million vehicle miles needed to be travelled before a FWI (0.5 FWI per hmvm). After the project, this increased to 308 million vehicle miles (0.3 FWI per hmvm).

Road user safety in the wider area

What changes in safety numbers did we see in the wider area?

Personal injury collisions 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 17. 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 439 collisions were observed. After the project, this had fallen to 338, a reduction of 101.

As part of the safety evaluation, we look to assess what changes in personal injury collisions might have occurred due to factors external to the project over this period. To do this we estimate the trend in personal injury collisions which might have occurred if the road had remained a conventional motorway (this is referred to as a counterfactual - see Appendix B: Safety Counterfactual Methodology). This is based on changes in regional safety trends for A Roads with a high volume of roads users.

Based on this assessment we estimate that if the road had remained as a two-lane dual carriageway, the trend in the number of personal injury collisions would likely have decreased, and collision rates would remain stable as shown in Figure 21 below

Figure 20 What does the Counterfactual show?

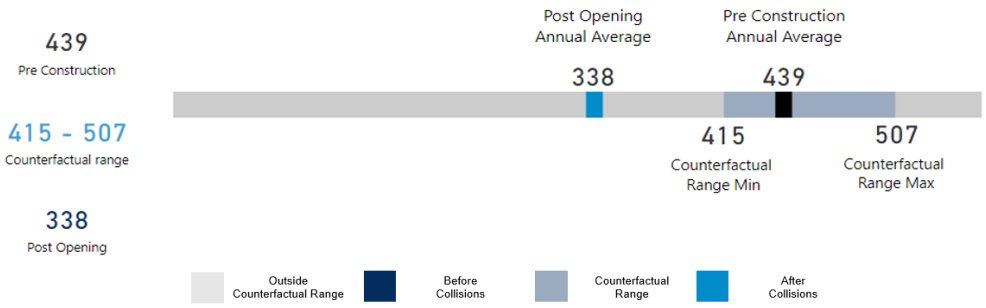
The Counterfactual is an estimation to what we think would have occurred without the scheme taking place. We estimate a range of collisions that follow regional trends.

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

If the number of collisions after the project fall within the range, it is likely that the project has had no significant impact on safety. If the project falls outside the range it is likely the project has had a significant impact on safety.

A range of between 415 and 507 personal injury collisions[13] during the five-year post project period would be expected, as shown in Figure 21.

Figure 21 Observed and expected range of personal injury collisions



Source: STATS19: 14th May 2008 to 31st December 2019

An annual average of 338 personal injury collisions were observed over the five-year post-opening period, this falls below the expected range. Therefore, the observed changes are significant, which means the decline in personal injury collisions could be attributed to the project.

Prior to the project, there was an annual average of 19 personal injury collisions per hmvm. After the project became operational there was a decrease to 14 personal injury collisions per hmvm.

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

A counterfactual test was undertaken. It found that the collision rate would likely have been 12 collisions per hmvm. This indicates we predicted a greater decrease in the rate of collisions as we predicted higher traffic volumes based on observed regional trends for traffic changes on similar roads. Statistical testing indicates the difference between the after and counterfactual collision rates falls within the range of what we expected having observed regional trends on similar road types.

What impact did traffic flows have on collision rates in the wider area?

Prior to the project, there was an annual average of 19 personal injury collisions per hmvm. After the project became operational there was a decrease to 14 personal injury collisions per hmvm.

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

A counterfactual test was undertaken. It found that the collision rate would likely have been 12 collisions per hmvm. Based on observed regional trends for traffic changes on similar roads, we predicted higher traffic volumes and calculated a greater decrease in the rate of collisions than has been observed. Statistical testing indicates the difference between the after and counterfactual collision rates falls within the range of what we expected having observed regional trends on similar road types.

[13] The safety methodology is different from one year to five-year evaluation. We still have confidence in the accuracy of the previous methodology but have made suitable changes that will ensure a methodology fit for purpose for the future.

What changes did we see in the severity of collisions in the wider area?

Collision severity analysis was undertaken for the local and wider area using the same method as for the project extent.

In the wider area, slight collisions had reduced by 89 personal injury collisions per year (from 339 to 250), for killed or seriously injured collisions there had been a reduction of 11 personal injury collisions per year (from 99 to 88).

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

A reduction of six FWI has been observed. Before the project, an average of 28 FWI was observed. After the project this had reduced to 22.

The combined measure showed an extra 33 million vehicle miles was travelled before a FWI[14].

This indicates that we are observing a reduction in the severity of injuries occurring after the project was opened to traffic.

Is the project on track to achieve its safety objective?

The appraisal for the project estimated that there would not be a reduction in personal injury collisions on the project extent. The benefits from the project would be realised within the wider area where there would be an annual reduction of 7 personal injury collisions. We have observed a larger reduction in Personal Injury Collisions than expected.

The project's safety objective is to ensure that the number of accidents and collision rate was no worse than observed before the project.

Analysis shows:

1. A reduction in the number of collisions on the project and wider area
2. A reduction in collision rates on the project and wider area
3. A reduction in the number of KSI PICs on the project and wider area
4. An improvement in the severity of casualties occurring on the project and wider area.

We can be confident that the project is on track to meet its safety objective at the end of the 60-year appraisal period.

[14] Before the project, 82 million vehicle miles needed to be travelled before a FWI (1.2 FWI per hmvm). After the project, this increased to 115 million vehicle miles (0.9 FWI per hmvm).

6. Environmental evaluation

Summary

The evaluation of environmental impacts uses information on the predicted impacts gathered from the environmental appraisal and the environmental assessment report. This information has then been compared with findings observed one year after the project opened for traffic. Observed impacts have been determined during a site visit in October 2020, supported by desktop research. The results of the evaluation are recorded against each of the Transport Analysis Guidance (TAG) environmental sub-objectives. These are presented in the summary table.

Environmental Evaluation focuses on the environmental sub-objectives (noise, air quality, greenhouse gas emissions, landscape, townscape, heritage, biodiversity, and the water environment).

Impacts on heritage have not been evaluated at five years after. Thus, as no new information has arisen since the one year after, heritage has been scoped out of this evaluation too. The project was also not expected to have a direct effect on townscape character. Overall, the impact of the project on the townscape was expected to be neutral. Landscape and townscape effects were not separated out in the Environmental Assessment Report (EAR). Thus, townscape has been treated under landscape.

Environmental evaluation often also considers TAG society impacts such as severance, physical fitness, and journey ambience (quality). However, as there were no outstanding issues from the one year after evaluation, physical fitness, severance, and journey quality have been scoped out of the five years after evaluation. This is in line with POPE guidelines.

The five years after evaluation found that air quality has been improving over time and does not appear to be a problem. The impact of the project on greenhouse gases is worse than expected due to the proportion of heavy goods vehicles recorded. The impacts of the project (widening, gantries and new lighting columns) on local noise, landscape, biodiversity, and the water environment (drainage) were broadly as expected by the environmental appraisal and assessment. Based on the five years after evaluation visit, landscape and ecological mitigations are establishing, but with little evidence of recent management, e.g., on the northeast side of junction 8, and requiring aftercare.

Noise

The Appraisal reported that less (30) properties would experience noise levels of more than 68 dB with the project, compared with 53 properties if the project were not built. Based on the façades with the highest noise level with the project, 69% of properties were expected to experience a negligible or minor increase in traffic noise and approximately 26% of properties were predicted to experience a decrease. However, for most of the receptors, the beneficial impacts were expected to be negligible or minor. Overall, the project was expected to lead to a slight beneficial impact on noise. No significant impacts on nighttime traffic noise levels along the project were expected.

The environmental assessment undertook a scoping exercise to identify the potential for noise impacts from the project. It led to the proposal for the

introduction of low noise surface (LNS) and 2.5m high environmental (acoustic) barriers along the embankment of A14 eastbound. The one year after evaluation reported that impacts of the project on noise were broadly as expected and better than expected for two locations.

The five years after evaluation found that there is low noise surfacing from junctions 3 to 10, the effective installation of the noise barrier on the eastbound carriage after junction 8 (as mitigation for a noise important area) and traffic volumes and percentage heavy-duty vehicles are mostly in line with forecasts. Thus, the noise generated by traffic along the project likely to be as expected. This has been confirmed through a basic noise level assessment.

Figure 22 The new noise barrier on the eastbound side from junction 8 to the BP Service Station at one year after

Source: The one year after Evaluation Report

Figure 23 The noise barrier at five years after

Source: Google Maps, May 2019

Air quality

The appraisal reported that there were 3,248 residential properties within 200m of the project and surrounding affected road links. It further stated that there were no Air Quality Management Areas (AQMAs) in Kettering. The overall impact of the project on air quality was predicted to be neutral.

The one year after evaluation reported that the impact of the project on local air quality was as expected overall, i.e., better than expected for eight locations and worse than expected for two locations. At five years after, post construction heavy goods vehicle numbers show that based on the POPE methodology, the project is predicted to have a worse than expected impact on air quality. However, traffic flow data indicates lower than forecast volumes along the A14 by more than -10%, the effects of the project on local air quality might be better than expected. Traffic

speeds are also within the parameters set by POPE to record and as expected. The latest local Air Quality Status Report (2020) notes that there are no AQMAs along the project. At five years after, local air quality data shows continuous improvement in air quality with no exceedances recorded along the project. So, although post construction heavy goods vehicle numbers are higher/worse than expected, traffic volumes are lower/better than forecast along the A14 by more than -10% and traffic speeds are also within the parameters set. The project is unlikely to have had a significant impact on local air quality.

Greenhouse gases

Government guidance (WEBTAG) notes that carbon dioxide (CO2) is considered the most important greenhouse gas and therefore it is used as the key indicator for the purposes of assessing the impacts of transport options on climate change. The appraisal predicted that, overall, there will be a net disbenefit due to increases in travel distance with the project. The Net Present Value of Carbon Emissions for the proposed project was estimated to be -£7.1million.

The one year after evaluation reported the re-forecast carbon evaluation along the project area (junctions 7 to 9) which showed a net increase of 2,204 tonnes of carbon (+18%). The outturn carbon evaluation indicated that the project has resulted in a net increase of 1,003 tonnes of carbon (+8%), which is lower than forecast. This was because the observed traffic volumes and speeds are lower than forecast. The overall increase in carbon was due to the increase in traffic along the project section and the increased vehicle speeds associated with the additional carriageway capacity.

The five years after evaluation suggests that the impact of the project on greenhouse gases is worse than expected. Kettering is a major distribution area, as such heavy goods vehicles were around 6% greater than forecast. This will have contributed to there being 4,781 tonnes of carbon dioxide per annum greater than expected in the forecasts.

Table 4 Tonnes of greenhouse gases: forecast and observed

	Forecast (CO2 tonnes per annum in fifth year post opening)	Observed (CO2 tonnes per annum in fifth year post opening)	Difference (CO2 tonnes per annum in fifth year post opening)	% Difference
A14 junctions 8 to 9	14,153.07	18,934.47	4,781.41	29%

Source: Traffic Forecasting Report (March 2013), WebTRIS (five years after, June 2021), TomTom (June 2021)

Landscape and Townscape

The environmental appraisal reported that there were arable fields to the south of the A14 and open space and urban edge of Kettering to the north. It noted that there would be a loss of screening vegetation during construction with increased views until mitigation vegetation matured. It further noted that it was not possible to reinstate all vegetation lost due to reduced soft landscape width and constraints of

engineered earthworks treatments. The overall impact of the project on the landscape was expected to be slight adverse.

The project was not expected to have a direct effect on the townscape setting or character. However, the context of the immediate urban edge of Kettering was expected to experience an adverse impact caused by the increased visibility of the A14 and its infrastructure. The implementation of the project was anticipated to benefit the townscape environment of the surrounding areas and offer the potential for increased future development to take advantage of the increased road capacity. Overall, the impact of the project on the townscape character was expected to be neutral.

Based on the one year after site visit observations in August 2016, the one year after evaluation report (August 2017) concluded that the project has had an impact on the surrounding landscape and screening functions previously in place. In areas where the project is on an embankment, the one-year evaluation was concerned that some receptors are likely to still experience a long-term slight adverse effect because of the new gantries and lighting. The evaluation reported that planting will take some time to screen new gantries. Based on this, the impact of the project on the landscape was considered to be worse than expected at one year after.

Based on the outcome of the five-year site visit, the impacts of the project (widening, the introduction of gantries and additional frequency and height of lighting columns) on landscape/ townscape character and visual amenity predicted by the environmental assessment are broadly as expected. Small sections of hedgerows on each side of Pytchley Lane have failed planting and woodland plots in the northeast outskirts of junction 8 have some overgrowth due to lack of maintenance after the end of the 3 years maintenance period. But mitigation planting is doing well at five years after. New housing and industrial/commercial developments seen around junction 8 are likely to contribute to the landscape character changes and visual impacts. But these changes are not part of or due to the project.

Figure 24 Views of the A14 from the footpath off Thorpe Lane

Source: five years after Evaluation visit, October 2020

Figure 25 Assessed and outturn view of the A14 from West Furlong

Source: five years after Evaluation visit, October 2020

During the five years after site visit, observations were attempted along these roads on the northeast side of junction 8. However, only West Furlong was accessible where it meets the new housing estate. The new housing development now blocks views of the A14 from the properties assessed in the environmental assessment. The assessed impacts no longer exist and have been replaced by views of the new houses.

An issue to note is that asset data supplied on EnVIS data contains duplicates, it does not appear to be up to date because old data has not been removed. Without up-to-date data on landscape and ecology assets, aftercare to meet the intended objects of the project may not be effective.

Biodiversity

The appraisal anticipated that, although outside the boundary of the project and not directly affected, Southfield Farm Marsh SSSI and Slade Lake CWS would receive increased protection through improved drainage, run-off attenuation, and treatment to minimise potential indirect effects. The project was expected to have direct impacts on habitats used by grass snake, great crested newt, and common lizard. These impacts would be minimised by adopting appropriate working practices that reduced the exposure of these species to construction activities and afterwards habitats would be reinstated. The project would reduce the value of the mosaic of the verge habitats present and this was expected to lead to some habitat fragmentation and possible slow recolonization by these species. A planting strategy was proposed that would discourage barn owls from foraging along the highway in order to reduce the risk of collisions with traffic. Habitat enhancement opportunities for the common lizards, grass snakes, breeding birds and bats were identified and expected to be implemented where possible. The overall impact of the project on biodiversity was assessed as slight adverse.

The one-year after evaluation report concluded that the impact of the project on biodiversity is as expected, although further information was expected during the five years after evaluation. Based on the one-year after evaluation, the five-year after site visit, and the Handover Environmental Management Plan, the predicted

impacts of the project on biodiversity are broadly as expected. Ecological mitigations for habitats (e.g., replacement planting plots and hedgerows near junction 8) and species (the translocation of common lizards and grass snakes, badger surveys, fencing) appear to have been implemented. But there was little available information on aftercare and monitoring. The aftercare period was three years. While replacement planting was doing well, especially near junction 8, there was overgrowth and the presence of weeds suggesting that no recent aftercare had taken place. Aftercare and monitoring are needed if the intended benefits are to be delivered by the design year.

Water environment

The appraisal reported that the design of the proposed project provides for no loss of floodplain. The addition of penstocks and silt traps was expected to reduce the risk of pollution to the aquatic environment. The overall impact expected for water resources was assessed as slight beneficial.

The environmental assessment suggested operational mitigation, i.e., improved pollution control measures to reduce the potential impacts of the project on water quality. These were expected to comprise the provision of new surface water drainage systems, including surface water channels with limited use of linear drainage channels, gullies and kerb drainage units and the provision of attenuation using large diameter pipes to avoid an associated increase in the flow of runoff.

The one year after evaluation concluded that as no issues were noted during the site visit, drainage improvements were as expected. A visual inspection of surface drainage features was done during the five years after evaluation site visit. The site visit has confirmed that the impacts of the project on water resources are likely to be as expected, and the mitigation provided as planned. Pollution control devices (PCDs) along the embankment of A14 and the penstock and oversized culvert at the entrance to the BP station on the eastbound side of A14 were in place and in good condition. However, no service records or monitoring information is available to confirm the function of drainage control devices.

Overview

The results of the evaluation are summarised against each of the Transport Appraisal Guidance (TAG)[15] environmental sub-objectives and presented in Table 5.

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

Table 5 Environmental Impacts

Sub Objective	Appraisal Summary Table Score	Five-year after Evaluation	Summary
Noise	Net residential properties win/lose PVB +£0.6M Large beneficial	As expected overall	Low Noise Surfacing from junction 3 to junction 10 implemented as expected. Noise barrier on the eastbound carriageway after junction 8 (as a mitigation for a noise important area) effectively implemented. Traffic volumes and percentage heavy duty vehicles are mostly in line with forecasts. Thus, the noise generated by traffic along the project likely to be as expected.
Air Quality	Neutral	Based on the information available AQ does not appear to be a concern and the project is likely to be neutral.	Local AQ monitoring data suggests that that there are no AQMS along the project and there is a continuous improvement in AQ with no exceedances recorded along the project. So, although post construction HDV numbers are higher/worse than expected impact, traffic volumes are lower/better than forecast along the A14 by more than -10% and traffic speeds are also within the parameters set (as expected prediction). The project is unlikely to have had a significant impact on local AQ.
Greenhouse Gases	Adverse (-£7.1)	As expected	Kettering is a major distributions area, as such HDVs were around 6% greater than forecast. This will have contributed to there being 4,781 C02 tonnes per annum greater than expected in the forecasts.
Landscape/ Townscape	Neutral	As expected	The predicted impacts of the project (widening, the introduction of gantries and additional frequency and height of lighting columns) on landscape/townscape character and visual amenity are broadly as expected. Although there has been some localised vegetation loss and new gantries installed, the project has not significantly altered the corridor or the local townscape. New housing and commercial developments have taken place since opening. These developments have had an impact on the townscape character along the A14 and in places their impacts outweigh the changes introduced by our project.

Sub Objective	Appraisal Summary Table Score	Five-year after Evaluation	Summary
Biodiversity	Slight Adverse	As expected	Although there are limited signs of recent aftercare. Ecological mitigations for habitats (e.g., replacement planting plots and hedgerows near junction 8) and species (the translocation of common lizards and grass snakes, badger surveys and fencing) appear to have been implemented. However, there are limited signs of recent aftercare especially for the species rich grasslands. Without aftercare, the enhancements may not continue to provide the intended benefits.
Water resources	Slight Beneficial	As expected	The proposed mitigation measures (PCDs, the penstock and over-sized culvert at the entrance to the BP station on the eastbound side of A14) have been provided and appeared to be in good condition. Provided an appropriate maintenance regime (including service records or monitoring information) is in place, the design year outcomes should be met.

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 £41million, close to the forecast cost[16] of £44 million. In the first five years, the road provided additional capacity to support more road users, whilst keeping journey times consistent and improving the safety of those journeys. If this trend continues, the project is reforecast to deliver £5 million of journey time benefits and £36 million of safety benefits over the 60-year period[17].

While delivering some journey time benefits, the project was expected to deliver greater journey time savings than observed, as well as accommodating more traffic growth. The observed data suggested a more modest traffic growth accompanied by marginal improvement in journey time savings in most time periods. This has impacted the project's value for money assessment.

Overall, the evaluation indicated that in the first five years this investment is not on track to deliver the value for money anticipated over the 60-year life of the project. If the journey time trends observed within the first five years continue, the project is expected to deliver 'poor' value for money.[18]

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[19] are summed together and compared against the investment cost to produce a benefit cost ratio (BCR), The monetised impacts are considered alongside additional impacts which are not able to be monetised, to allocate the project a 'value for money' category.

The monetised benefits forecast by the appraisal which supported the A14 Kettering Bypass business case are set out in Table 6. 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.

[16] Present value of costs in 2010 prices and values.
[17] Based on impacts on the Strategic Road Network.
[18] The value for money categories referenced are defined by the Department for Transport https://www.gov.uk/government/publications/dft-value-for-money-framework
[19] Typically, project life is taken to be 60 years.

Table 6: Monetised benefits of the project (£ million)

	Forecast (£M)	% forecast monetised benefits[20]	Evaluation approach
Journey times	258	105%	Re-forecast for the project area only (not the wider area) using observed and counterfactual[21] traffic flow and journey time data
Vehicle operating costs (VOC)	-29	-12%	Re-forecast using observed and forecast traffic flow and journey time data
Journey time & VOC during construction and maintenance	-11	-4%	Monetised benefits assumed as forecast
Safety	17	7%	Re-forecast using observed and counterfactual[22] safety data
Carbon	-7	-3%	Monetised benefits assumed as forecast
Noise	1	0%	Monetised benefits assumed as forecast
Air quality	-1	0%	Monetised benefits assumed as forecast
Indirect tax revenues	17	7%	Re-forecast using observed and forecast traffic flow and journey time data
Total present value benefits	**245**	**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 7. Based on this information, the project was anticipated to give 'very high' value for money over the 60-year appraisal period.

Evaluation of costs

The project was delivered at a cost of £41 million[23], close to the anticipated cost of £44 million.

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.

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

[21] We calculated the vehicle hours saved by comparing outturn journey times with an estimate of how journey times would have continued to deteriorate had the project not been implemented (i.e., a 'counterfactual').

[22] We compared observed trends with an estimation of the trends if the road had remained a conventional motorway (i.e., a 'counterfactual')

[23] 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.

Table 7: Cost of the project (£ million)

	Forecast (£M)	% of forecast costs	Evaluation approach
Construction costs	41	93%	Current estimate of project cost
Maintenance costs	3	7%	Not evaluated (assumed as forecast)
Total present value costs			

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

The forecast journey time benefits were significantly higher than was observed but the overall impact on vehicle hours on the project section in the fifth year was estimated to be positive[24].

If the trends observed at the fifth year continue over the 60-year period, without any further action to optimise benefits, the monetised impact on journey times, for those using the road, would be £5 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.

Journey reliability benefits

The software usually used to generate monetised benefits could not be used for this project, therefore an alternative method was used to forecast reliability improvements. Monetised benefits for journey reliability were then assessed qualitatively and expected to have been 'moderate.' We have therefore set the monetised benefits to zero and are not included in the forecast value for money assessment. This is likely to be conservative as the project has delivered slight journey reliability improvements to road users over the peak time periods.

Safety benefits

We reforecast total safety benefits to be £36 million. This figure relates to the benefit on the strategic road network over 60-years. The reforecast is higher than

[24] A benefit of 9,320 vehicle hours in the fifth year.

the appraisal forecast. The observed personal injury collision savings are greater than those forecast in the appraisal.

Other reforecast impacts

There are two further impacts associated with the changes in numbers and speeds of vehicles – indirect tax revenues and vehicle operating costs. Indirect tax revenues are the benefit to the government (and therefore society) of the additional tax income from the additional fuel consumed due to increased speeds and distances travelled. This was forecast to be positive because more vehicles were forecast and they were forecast to be travelling at higher speeds, and therefore using more fuel and paying more tax. We have reforecast that the impact would be higher than expected, an increase in tax revenues (£18 million).

Vehicle operating costs refer to the fuel and other costs borne by the user (such as the wear and tear on vehicles). This increases with increased distance travelled. There was a disbenefit forecast. Based off the changes we have seen in our estimate of fuel consumption and indirect tax revenue, we estimate the outturn impact to be a disbenefit of -£30 million compared to the forecast -£29 million disbenefit.

Impacts assumed as forecast

The evaluation has not been able to reforecast the monetary value of noise and carbon benefits[25], and instead these were reported as forecast. This assumption is conservative because lower than forecast traffic volumes are likely to mean that these impacts are better than forecast[26].

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 the lack of journey time savings compared to those forecast. The appraisal forecast a significant traffic growth and improving journey times; the observed data suggested a more modest traffic growth accompanied by improvement in journey time savings in most time periods. There was an expectation the average vehicle speeds would be more greatly impacted westbound between junctions 7 and 8 than has been observed. This has affected the project's value for money.

Journey reliability was also forecast to have had a 'moderate' improvement, but this was not monetised in the benefits. Journey reliability has improved slightly, though this is unlikely to have an impact on the overall re-forecast value for money category.

With few non-monetised benefits to take into consideration, it is likely that this project has offered 'poor' value for money. However, there is indication that the

[25] 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 projects and therefore the impact of assuming as forecast is unlikely to impact on the value for money rating of the project.
[26] Refer to section 6 for further detail on noise and greenhouse gas impacts.

project has supported housing and employment[27] developments to the East of Kettering.[28] This includes the Kettering East Sustainable Urban Extension[29] which is proposed to develop up to 5500 dwellings.

Overall, the evaluation indicated that in the first five years this investment is not on track to deliver the value for money anticipated over the 60-year life of the project.

[27] https://www.kettering.gov.uk/planningApplication/128324

[28] A methodology to understand the projects impact on the wider economy is currently in development. This would enable us to understand any potential benefits resulting from developments and the creation of new jobs as a consequence of developing the project.

[29] Outline planning approval was granted in 2010. More details on the progress for this development can be found at https://www.northnorthants.gov.uk/planning-strategies-and-plans/garden-communities-and-sustainable-urban-extensions/hanwood-park

Appendix A

A.1 Was traffic growth as expected?

It is important to understand how levels of traffic growth on the project compare to the forecasts, and whether the level of growth predicted has been realised. This section compares the Annual Average Daily Traffic (AADT) volumes from the Traffic Forecasting Report (TFR) which informed the business case (March 2013) with the equivalent observed data.

To do this, we firstly need to understand how the project was appraised and the key assumptions that were used. This then helps us to understand any potential differences between traffic levels forecast and observed impacts.

The project was appraised using a SATURN model with the following forecast years[30]:

- 2015 – Forecast year of project opening.
- 2017 – Interim year required for economic assessment of transport user costs during maintenance.
- 2021 – Interim year required for economic assessment of transport user costs during maintenance; and
- 2030 – Project design year (15 years after opening).

The model had two forecast scenarios: Do-Minimum (DM) and Do-Something (DS). The DM is a 'without project' scenario and models the effects of the current road layout without any committed development scenarios. The DS is a 'with project' scenario which models the effects of introducing an improvement or project, in this case adding additional capacity to the A14 Kettering Bypass between junctions 7 to 9 through the widening of the route from two to three lanes.

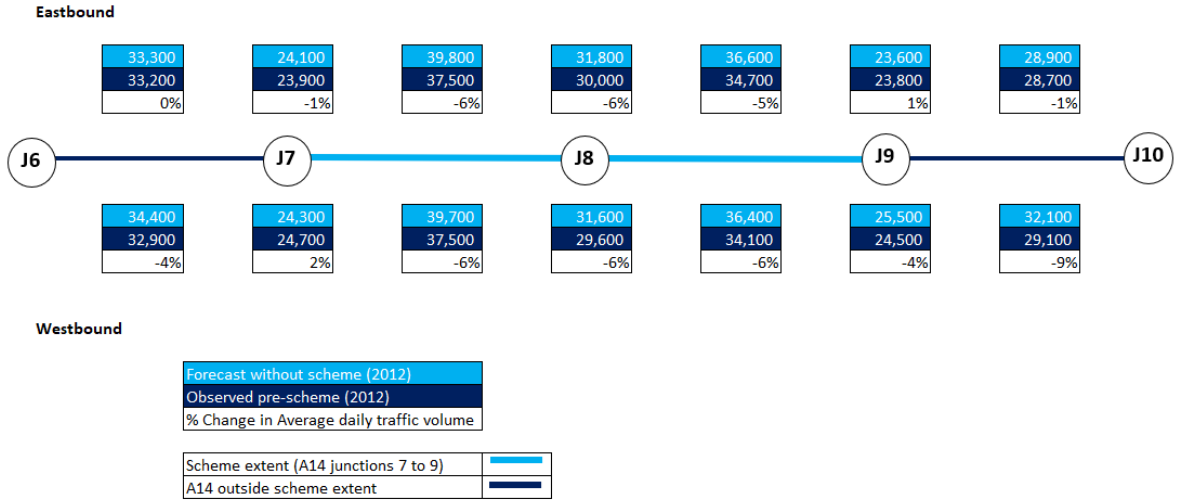
The Do-Minimum and Do-Something have been used in this evaluation for comparison with observed traffic volumes. To produce the forecast models, local growth factors were derived from Trip End Modal Presentation Program (TEMPro) version 6.2 and applied to the base year data when estimating traffic growth for forecast years.

Although forecasts were produced for 2017, 2021 and 2024 the Traffic Forecast Report (TFR) only presented forecast traffic volumes for 2015 and 2030 therefore, we have used straight line interpolation to adjust the forecasted traffic volumes to 2012 and 2021. This method enabled us to compare the pre-project observed traffic data from 2012 and the five years after observed traffic data from 2021 to the corresponding forecast year.

Forecasts of traffic volumes in 2012 without project were compared to observed pre-project traffic volumes in 2012 (Figure 5). Forecast traffic volumes pre-project slightly overestimated the observed traffic volumes at the majority of locations on the schematic diagram. The largest difference though is 9%, and within the project extent 6%, which is just outside the 5% inaccuracy which traffic models are afforded.

[30] The base model used in the TFR was the August 2012 model developed for the Kettering area using version 11.1.09 of the SATURN suite of modelling programs. This model was developed with an original base year of 2005 but has since been updated to reflect a 2012 base year.

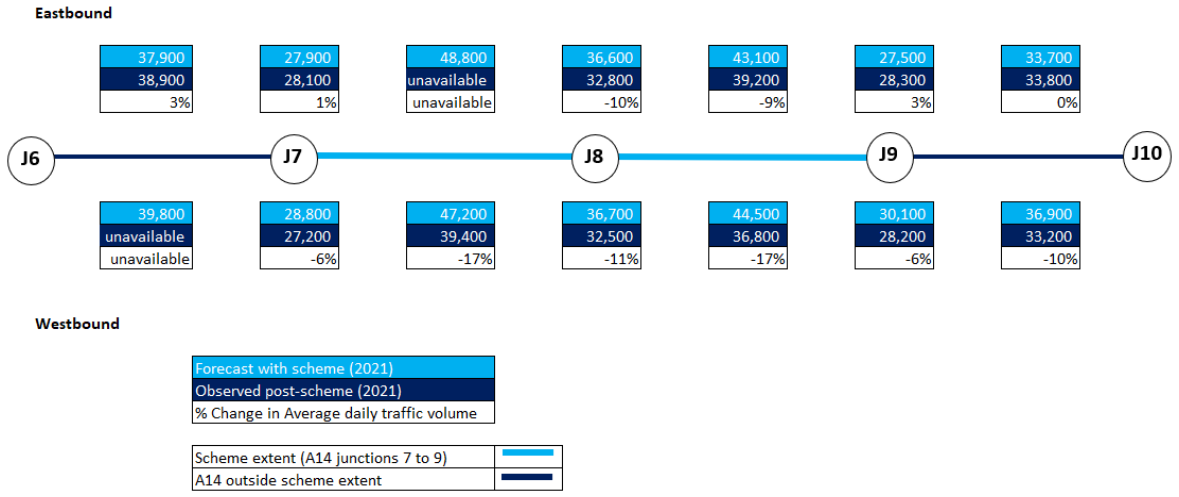
Figure 26: A14 Forecast (2012) and observed (2012) traffic volumes without project



Source: Traffic Forecasting Report (March 2013), WebTRIS (Before, October 2012). Forecast traffic volumes interpolated from 2015 and 2030 forecasted traffic volumes.

Figure 27 presents forecasts of traffic volumes in 2021 with project compared to observed post-project traffic volumes in 2021. This shows a similar trend to the pre-project data, in that the forecast traffic volumes are higher than the observed traffic volumes by up to 17% between A14 junctions 6 to 10.

Figure 27: A14 Forecast (2021) and observed (2021) traffic volumes with project



Source: Traffic Forecasting Report (March 2013), WebTRIS (5YA, June 2021). Forecast traffic volumes interpolated from 2015 and 2030 forecasted traffic volumes.

Appendix A.2 presents additional modelled DM and DS AADT volumes on the A14 area mainline and compares them with the observed pre and post project traffic volumes between A14 junction 6 to junction 10 and also includes analysis of traffic volumes within junctions on the A14.

The analysis in Appendix A.2 shows:

- On the project section between junctions 7 to 9, the model forecasted an AADT increase of between 18-23% between DM (2012) and DS (2021). The observed

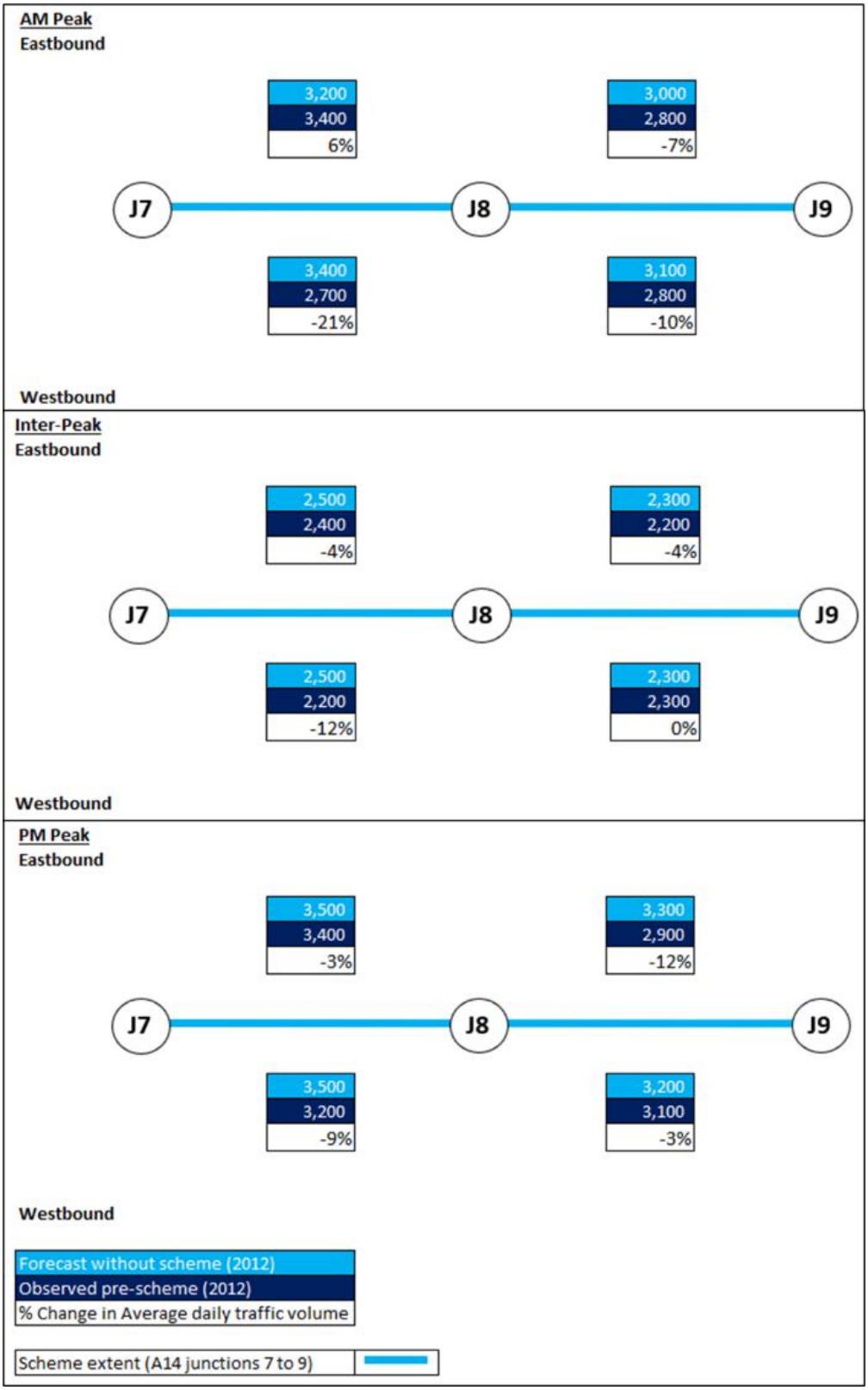
AADT demonstrates that traffic growth along the project section has been lower than forecast with the increase between observed DM (2012) and observed DS (2021) ranging between 5-19%.

- Traffic volumes have had the greatest percentage increase within junction 9 on the eastbound carriageway, with an observed increase of 19%.
- In the majority of cases, where the DM observed volumes were lower or higher than forecast a similar trend is observed for the difference between forecast and observed DS volumes. The overestimation of traffic volumes in the DS 2021 scenario may have been due to the TFR not forecasting the impacts of the Covid-19 pandemic on road traffic as observed traffic volumes country-wide reduced significantly during the pandemic.

As demonstrated, the observed traffic growth along the project section has been lower than forecast. To further evaluate this difference, the forecast and observed volumes (DM and DS) have been compared for the following time periods (see Figure 7, Figure 8 and Appendix A):

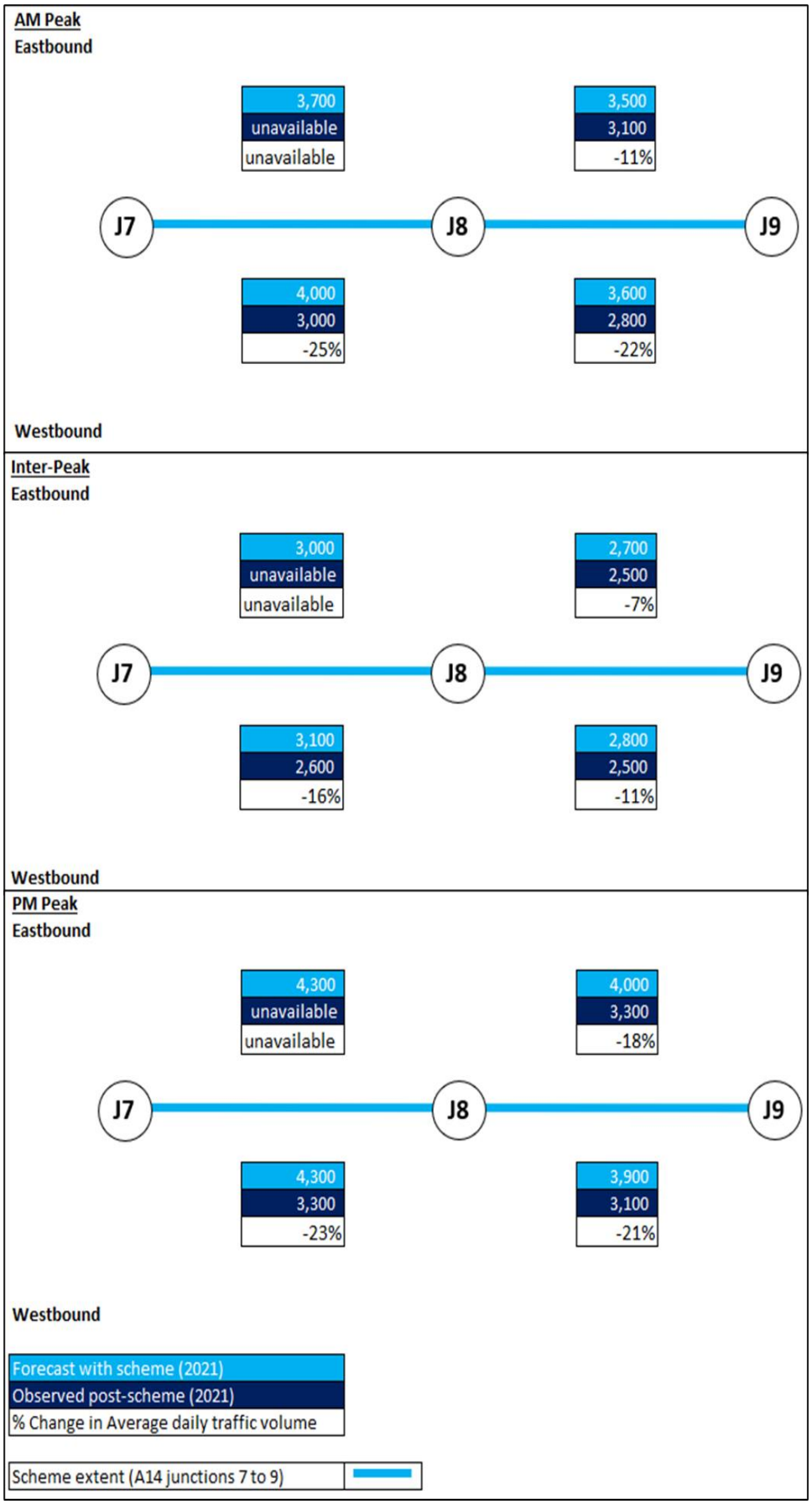
- Morning Peak Hour (0800-0900).
- Average Inter Peak Hour (1000-1600); and
- Evening Peak Hour (1700-1800).

Figure 28: Forecast (2012) and Observed (2012) Peak Hour Flows on A14 Project Section (junctions 7 to 9)



Source: Traffic Forecasting Report (March 2013), WebTRIS (Before, October 2012)

Figure 29: Forecast (2021) and Observed (2021) Peak Hour Flows



Source: Traffic Forecasting Report (March 2013), WebTRIS (5YA, June 2021)

Figure 28 and Figure 29 show an overestimation of the number of vehicles travelling along the A14 project section in both the DM and DS peak hour improvement scenarios.

As previously stated, the A14 acts as a strategic route for HGVs travelling between the east coast ports near Felixstowe and the Midlands. Therefore, it is important to consider the forecast impact of the project on HGV levels against the observed impact.

Appendix 0 presents the number of HGVs, percentage of HGVs as a proportion of total traffic, and the percentage difference in HGVs between forecast and observed traffic flow for the before project and five year after period.

Whilst there was an overestimation in the forecast data between the DM and DS for the total number of vehicles travelling on the A14 compared to observed traffic volumes. Analysis of the number of HGVs travelling on the project section and wider A14 corridor (see Appendix 0) shows that the traffic forecast underestimated the percentage of HGVs compared to observed volumes.

A.2 Forecast and observed traffic flow

Table 8: Forecast and Observed Peak Hour Flows (AADT) on A14 Project Section (junctions 7 to 9)

Source: Traffic Forecasting Report (March 2013), WebTRIS (Before, October 2012), (5YA, June 2021)

	Without Project 2012			With Project 2021			Increase with Project		
	DM Forecast	Observed Before	% Diff	DS Forecast	Observed After	% Diff	Forecast	Observed	Difference
A14 Mainline J7-8 (Eastbound)									
AM Peak	3,200	3,400	6%	3,700	-	-	14%	-	-
Inter Peak	2,500	2,400	-4%	3,000	-	-	17%	-	-
PM Peak	3,500	3,400	-3%	4,300	-	-	19%	-	-
A14 Mainline J7-8 (Westbound)									
AM Peak	3,400	2,700	-26%	4,000	3,000	-33%	15%	10%	-5%
Inter Peak	2,500	2,200	-14%	3,100	2,600	-19%	19%	15%	-4%
PM Peak	3,500	3,200	-9%	4,300	3,300	-30%	19%	3%	-16%
A14 Mainline J8-9 (Eastbound)									
AM Peak	3,000	2,800	-4%	3,500	3,100	-13%	14%	10%	-4%
Inter Peak	2,300	2,200	-5%	2,700	2,500	-8%	15%	12%	-3%
PM Peak	3,200	2,900	-10%	4,000	3,300	-21%	18%	12%	-6%
A14 Mainline J8-9 (Westbound)									
AM Peak	3,100	2,800	-11%	3,600	2,800	-29%	14%	0%	-14%
Inter Peak	2,300	2,300	0%	2,800	2,500	-12%	18%	8%	-10%
PM Peak	3,200	3,100	-3%	3,900	3,100	-26%	18%	0%	-18%

Table 9: Forecast and Observed (AADT) on the A14

Dir	Without Project 2012			With Project 2021			Increase with Project		
	DM Forecast	Observed Before	% Diff	DS Forecast	Observed After	% Diff	Forecast	Observed	% Diff
A14 Mainline J6-7									
EB	33,300	33,200	0%	37,900	38,900	3%	12%	15%	3%
WB	34,400	32,900	-5%	39,800	-	-	14%	-	-
A14 Mainline J7-8									
EB	39,800	37,500	-6%	48,800	-	-	18%	-	-
WB	39,700	37,500	-6%	47,200	39,400	-20%	16%	5%	-11%
A14 Mainline J8-9									
EB	36,600	34,700	-5%	43,100	39,200	-10%	15%	11%	-4%
WB	36,400	34,100	-7%	44,500	36,800	-21%	18%	7%	-11%
A14 Mainline J9-10									
EB	28,900	28,700	-1%	33,700	33,800	0%	14%	15%	1%
WB	32,100	29,100	-10%	36,900	33,200	-11%	13%	12%	-1%
Within J7									
EB	24,100	23,900	-1%	27,900	28,100	1%	14%	15%	1%
WB	24,300	24,700	2%	28,800	27,200	-6%	16%	9%	-6%
Within J8									
EB	31,800	30,000	-6%	36,600	32,800	-12%	13%	9%	-5%
WB	31,600	29,600	-7%	36,700	32,500	-13%	14%	9%	-5%
Within J9									
EB	23,600	23,800	1%	27,500	28,300	3%	14%	16%	2%
WB	25,500	24,500	-4%	30,100	28,200	-7%	15%	13%	-2%

Source: Traffic Forecasting Report (March 2013), WebTRIS (Before, October 2012), (5YA, June 2021)

A.3 HGV AADT forecast vs observed traffic volumes

Table 10: Forecast (2012) and Observed (2012) HGVs on A14 junctions 6-9

Location	Dir	DM Forecast			2012 Observed		
		All Vehicles	HGV	%HGV	All Vehicles	HGV	%HGV
A14 Mainline J6-7	EB	33,300	5,400	16%	33,200	6,000	18%
	WB	34,400	5,600	16%	32,900	6,300	19%
A14 Mainline J7-8	EB	39,800	5,600	14%	37,500	7,300	19%
	WB	39,700	6,000	15%	37,500	7,100	19%
A14 Mainline J8-9	EB	36,600	4,800	13%	34,700	9,400	27%
	WB	36,400	5,200	14%	34,100	5,500	16%
A14 Mainline J9-10	EB	28,900	3,800	13%	28,700	5,000	17%
	WB	32,100	4,200	13%	29,100	5,300	18%
Within J7	EB	24,100	4,400	18%	23,900	4,700	20%
	WB	24,300	4,400	18%	24,700	-	-
Within J8	EB	31,800	4,800	15%	30,000	7,800	26%
	WB	31,600	4,700	15%	29,600	6,300	21%
Within J9	EB	23,600	3,500	15%	23,800	4,600	19%
	WB	25,500	3,800	15%	24,500	4,900	20%

Source: Traffic Forecasting Report (March 2013), WebTRIS (Before, October 2012)

Table 11: Forecast (2021) and Observed (2021) HGVs on A14 junctions 6-9

Location	Dir	DS Forecast			2021 Observed		
		All Vehicles	HGV	%HGV	All Vehicles	HGV	%HGV
A14 Mainline J6-7	EB	37,900	5,900	16%	38,900	8,600	22%
	WB	39,800	5,800	15%	-	-	-
A14 Mainline J7-8	EB	47,200	6,000	13%	-	-	-
	WB	48,900	6,400	13 %	39,400	10,400	26%
A14 Mainline J8-9	EB	43,100	5,200	12%	39,200	7,400	19%
	WB	44,500	5,400	12%	36,800	6,900	19%
A14 Mainline J9-10	EB	33,700	4,200	12%	33,800	7,100	21%
	WB	36,900	4,600	12%	33,200	6,900	21%
Within J7	EB	27,900	4,900	18%	28,100	6,300	22%
	WB	28,900	4,800	17%	27,200	6,200	23%
Within J8	EB	36,600	5,100	14%	32,800	7,300	22%
	WB	36,700	5,000	14%	32,500	7,000	22%
Within J9	EB	27,500	4,000	15%	28,300	6,300	22%
	WB	30,100	4,400	15%	28,200	6,500	23%

Source: Traffic Forecasting Report (March 2013), WebTRIS (5YA, June 2021)

Appendix B

B.1 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 C

C.1 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 do not. 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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