A5-M1 Dunstable Northern Bypass

Five-year post-opening project evaluation

The methodology used to generate the data in this document should only be considered in the context of this publication. This methodology, and its subsequent outputs may differ from methodologies used in different analyses at different points in time. This is due to continuous improvements of data mapping, capture, and quality. As these factors evolve over time any comparison with earlier data or data from other sources, should be interpreted with caution.

Foreword

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

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

We work to a five-year funding cycle, a radical new approach to road investment first introduced in 2015 which saw the government committing £15.2 billion in the period from 2015 to 2021. The A5-M1 Dunstable Northern Bypass project was officially opened during this period, in May 2017.

The A5-M1 Dunstable Northern Bypass was designed to provide an alternative route for road users to access the M1 without travelling through Dunstable as the roads around the Dunstable town centre were heavily congested at most times of the day. It aimed to make road users' journeys more reliable and safer by removing strategic traffic out of Dunstable.

This report gives an indication of the project's performance in the fifth year of its operation. The evaluation has demonstrated that customer journeys have become more reliable and journey times have improved. Congestion around Dunstable town centre has notably reduced.

The safety objective for this project was to reduce accidents by removing conflicting movements between strategic and local road traffic. At this five-year evaluation point we have observed a reduction in the rate and number of collisions and improvement to the impact on casualties on the project extent and comparison area.

The evaluation indicated that the project is on track to deliver 'high' value for money. While this is slightly below the anticipated 'very high' value for money, largely due to lower traffic growth than anticipated, it is still providing benefits to road users and delivering a positive economic return on investment.

Elliot Shaw

Chief Customer and Strategy Officer

March 2025

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1. Executive summary

The A5-M1 Dunstable Northern Bypass was designed to provide an alternative route for road users to access the M1 without travelling through Dunstable. It aimed to make road users' journeys more reliable and safer by removing strategic traffic out of Dunstable. The new route aimed to reduce traffic travelling to junctions 9, 11 and 12 of the M1 from the local road network in Dunstable, Houghton Regis and surrounding areas. Construction of the dual carriageway started in 2015 and opened to traffic in May 2017, linking the A5 to the west and the new M1 Junction 11A to the east.

Our evaluation of customer journeys demonstrates improved journey times and reliability. Journey times were much faster than both the before period and the counterfactual journey times, when comparing changes in average journey times between Hockliffe and M1 junction 9. Our results indicate an increase in traffic volumes on the M1 between junctions 9 and 11a, with average growth ranging around 9% to 16%. This suggests road users are choosing to exit the M1 at junction 11a to use the A5.

The safety objective for this project was to reduce accidents by removing conflicting movements between strategic and local road traffic. At this five-year evaluation point we have observed a reduction in the rate and number of collisions and improvement to the impact on casualties on the project extent. The average number of collisions have halved from 32 personal injury collisions (PICs) prior to construction and 16 PICs after construction. There has been a reduction in both serious and slight collision severity, with fatal collisions remaining stable. We believe that the project has met its safety objective.

Our five years after evaluation found that most environmental outcomes were broadly as expected. Strategic traffic was using the new A5 Northern bypass and this was contributing to improvements in air quality within Dunstable. Observed traffic flows along most roads within the project study area were lower than forecast but not low enough to change the predicted noise impacts. The absence of sufficient speed data meant we were unable to quantify changes in greenhouse gas emissions. New landscape earthworks, habitats and drainage features had been provided and these mitigation measures had continued to develop since our one year after evaluation. These measures were helping to integrate the project into the landscape as well as minimising the impacts on biodiversity, the setting of cultural heritage features and the water environment as expected. Whilst these measures were establishing, our five years after site visit did identify issues with the condition of some mitigation. Therefore, there was a risk that if maintenance was not improved, the design year outcomes may not be achieved.

The evaluation indicated that the project is on track to deliver 'high' value for money over the 60-year appraisal period. While this is slightly below the anticipated 'very high' value for money, it is still providing benefits to road users and is likely to have enabled economic prosperity for the wider area. When considering an investment's value for money we also consider all possible benefits, including those we were unable to monetise. For this project, being near functional urban areas such as Luton, Watford and Milton Keynes are relevant considerations for wider area prosperity.

2. Introduction

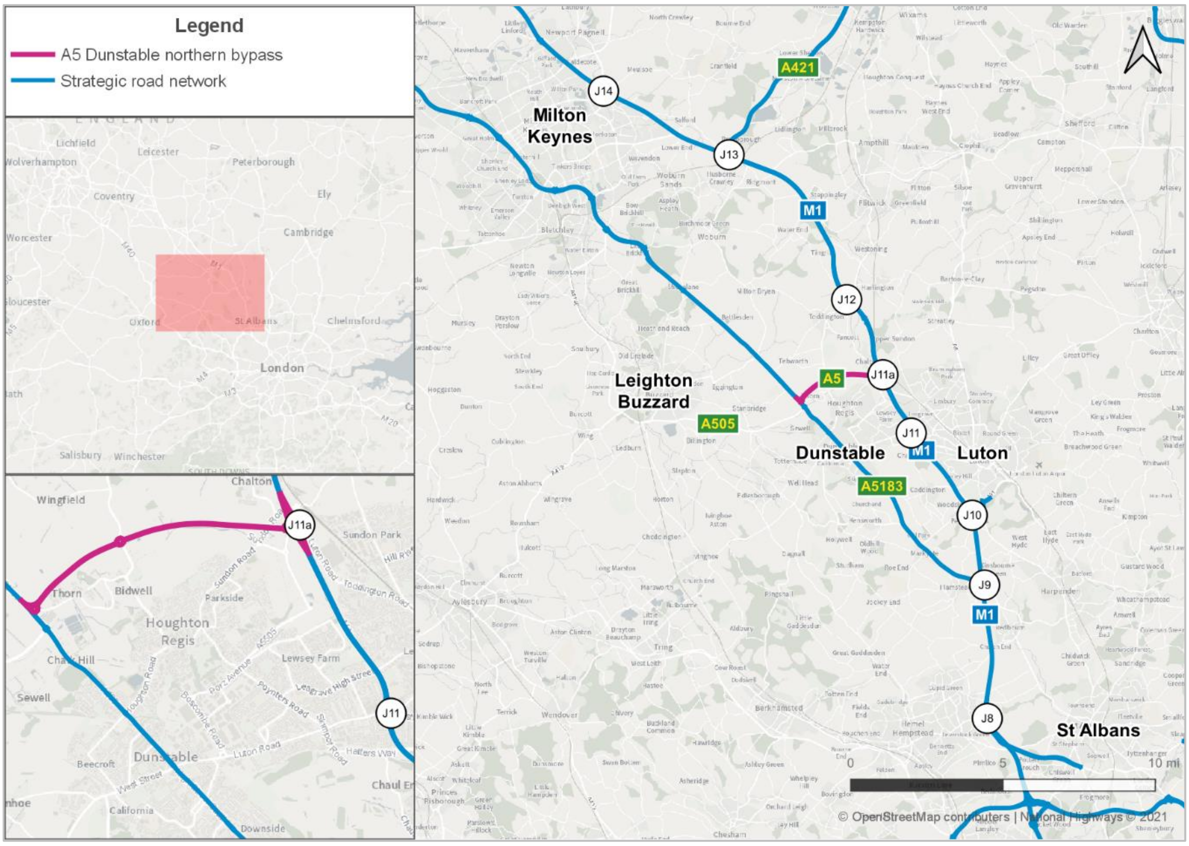
What is the project and what was it designed to achieve?

The A5-M1 Dunstable Northern Bypass was designed to provide an alternative route for road users to access the M1 without travelling through Dunstable. It aimed to make road users' journeys more reliable and safer by removing strategic traffic out of Dunstable. The new route aimed to reduce traffic travelling to junctions 9, 11 and 12 of the M1 from the local road network in Dunstable, Houghton Regis and surrounding areas. Construction of the £148 million dual carriageway started in 2015 and opened to traffic in May 2017, linking the A5 to the west and the new M1 Junction 11A to the east.

Project location

The A5 is a strategic route in England, linking London with the Midlands and the North. The project section is in the county of Bedfordshire to the north of Dunstable and Luton. The location of the project is shown in **Error! Reference source not found.** below.

Figure 1 A5-M1 Dunstable Northern Bypass scheme 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[1] 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.[2]

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

3. Delivering against objectives

How has the project performed against objectives?

Our major projects have specific objectives which are defined early in the business case when project options are being identified. The project had five key objectives, primarily related to improving journey times, maintaining safety for road users, and supporting wider government transport policy.

These objectives are appraised to be realised over 60 years, the evaluation provides early indication if the project is on track to deliver the benefits

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

Table 1 Objectives and Evaluation summary

Objective	Five-year evaluation
Provide an alternative to existing A5 and A505 routes through Dunstable Town Centre.	An average of 36,200 vehicles use Dunstable Northern Bypass on a typical working day. This has been accompanied by a fall in the numbers of vehicles using the existing A5 and A505.
Provide lower journey times and better journey time reliability.	Road users journey times on the Dunstable Northern Bypass show improvement compared to those on the old A5 through Dunstable. Journeys using Dunstable Northern Bypass are more reliable compared to the old A5 through Dunstable.
Contribute to the reduction of strategic traffic movements to/from M1 through Dunstable.	Strategic traffic is using Dunstable Northern Bypass with a reduction in the number of road users on surrounding local road network.
Reduce the number and severity of accidents.	The number of personal injury collisions and severity of collisions has reduced in the project extent. In the wide area, there has been a reduction in the number of collisions. Slight and serious collisions have decreased; however we have observed an increase in fatal collisions.
Enable the connection into J11A of the Woodside Link Road and Luton Northern Bypass which are local authority projects.	Woodside Link Road connects to Dunstable Northern Bypass. Junction 11A is enabled for connection to potential A6 Luton Northern Bypass.

4. Customer journeys

Summary

The A5-M1 Dunstable Bypass project was designed to provide an alternative route for road users to access the M1, as the roads around the Dunstable Town Centre were heavily congested at most times of the day. At five years after, significant improvements were observed, and the congestion had notably reduced in comparison to the pre-construction period.

We found that the new bypass link was carrying large volumes of traffic, with an average of around 36,200 vehicles using it weekly. Improvements in journey times and journey reliability were observed on routes between Hockliffe and junction 9 of the M1. At five years after, the journeys were faster as compared to the before period. Furthermore, road users' journeys had become more reliable. Journeys using the new bypass link were observed to be faster and more reliable across all time periods, compared to travelling through Dunstable itself.

How have traffic levels changed?

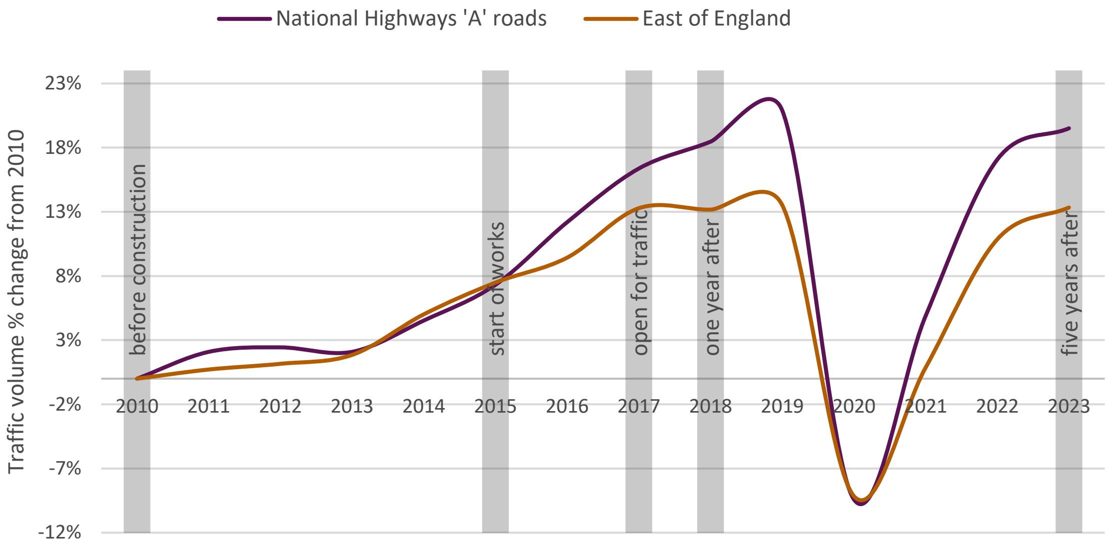
The following sections examine the changes in traffic flow along the project extent and on roads in its vicinity. We have compared these with the observed national, regional and local trends. We have also compared the observed and forecast traffic flows to understand to what extent the forecast flows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

National and regional

To assess the impact of project on traffic growth, 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.[3] The analysis in the following sections should be considered in this context as no adjustments have been made to take account of background traffic growth.

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

Figure 2 Background Trends in Traffic



Source: Department for Transport road traffic statistics

The relevant background trends for the project are illustrated in Figure 2. Between the pre-construction period (2010) and one year after period (2018), National Highways 'A' roads saw the largest increase in traffic volumes of around 18.5%. At the regional (East of England) level, traffic growth of around 13% was observed at one year after period. Between 2019 and 2020, there was a major dip in traffic volumes due to the COVID-19 pandemic. At five years after (2023), the analysis suggests that the traffic volumes are returning to pre-COVID levels. National Highways 'A' roads saw an increase in traffic volumes from 18% to 19%, while at the regional level traffic remained almost same at 13%.

How did traffic volumes change?

The A5-M1 Dunstable Northern Bypass was created to provide a better alternative to the existing route through Dunstable town centre (A5-A505). Due to this, the traffic volumes on the local roads close to the scheme extent were anticipated to fall. However, traffic volumes were expected to increase on the M1 junction 9 to junction 11a, Dunstable Northern Bypass, on A5 to Milton Keynes and A505 towards Leighton Buzzard. Additionally, HGV traffic was also expected to switch to the Strategic Road Network, due to the local authority's implementation of weight restrictions on the local road network.

We have analysed the traffic volumes for sites on the project network and around the project extent. The location of traffic counts can be observed in the Figure 3 below. While interpreting the results, please note that there were data quality[4,5] issues for sites on the project extent and in surrounding local areas. These issues may have influenced the findings and should be considered when drawing conclusions.

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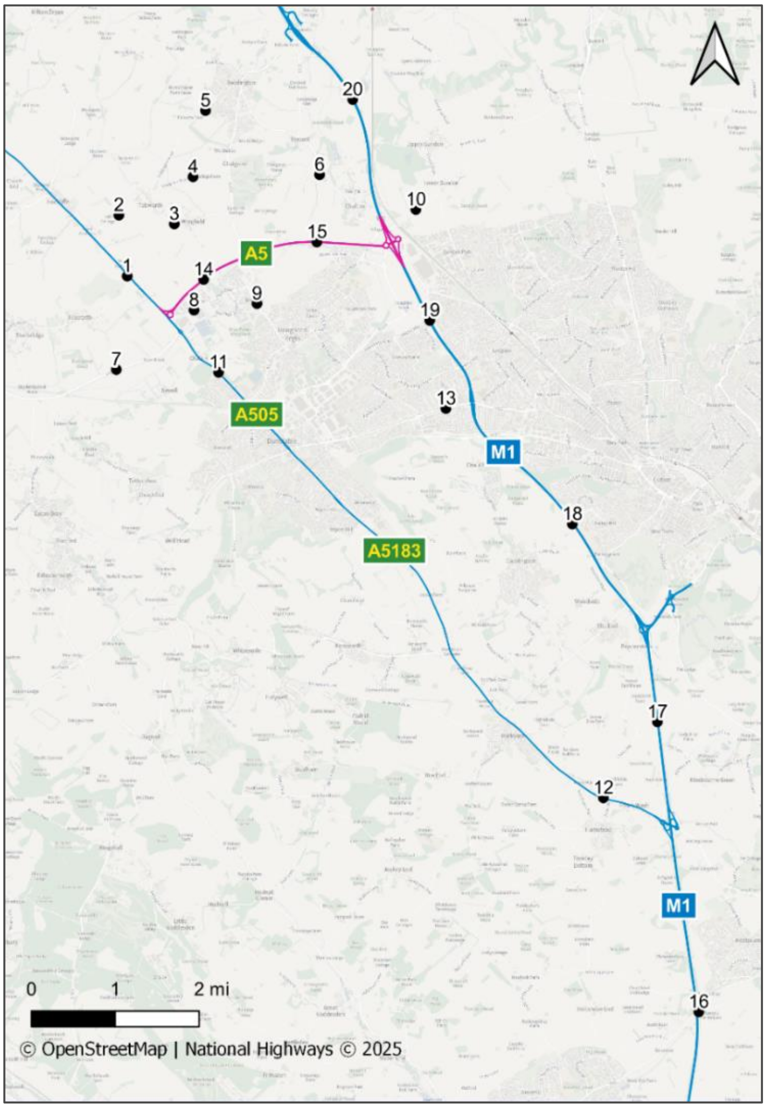
[4] There were significant data quality issues, including instances where data was either incomplete or unreliable. In some cases, the recorded traffic data was significantly lower than expected with differences exceeding 50% at certain sites.

[5] To address this, we have attempted to use complete 7-day data or sourced data from alternative sources such as Webtris. However, in cases where data could not be sought from alternative data sources, the affected sites (Site 4) were excluded from the analysis due to unreliability of the data.

Figure 3 Map of traffic counts



Source: OS Maps, National Highways Commissioned Counts Location (October, November 2023; January 2024)

Table 2 Changes in traffic volumes

ID	Location	Before AWT	5YA AWT	% Change
1	A5 Watling Street	17,800	20,000	12%
2	Hockliffe Road	6,100	2,400	-61%
3	Tebworth Road	400	500	25%
5	Leighton Road	5,000	2,100	-58%
6	Luton Road	9,900	5,800	-41%
7	A505	15,500	23,000	48%
8	Thorn Road	11,900	3,800	-68%
9	B5120 Beford Road	13,800	9,600	-30%
10	Sundon Road	10,600	15,500	46%

ID	Location	Before AWT	5YA AWT	% Change
11	A505 Watling Street	16,600	15,800	-5%
12	A5183	23,500	19,700	-16%
13	A505 Dunstable Road	29,100	22,700	-22%
14	Dunstable Northern Bypass	-	38,000	-
15	Dunstable Northen Bypass	-	34,500	-
16	M1 J8-9	180,100	197,700	10%
17	M1 J9-10	171,300	194,800	14%
18	M1 J10-11	152,700	177,300	16%
19	M1 J11-11a	152,700	166,900	9%
20	M1 J11a-12	139,600	148,400	6%

Source: National Highways commissioned counts (October, November 2023; January 2024) and Webtris (October 2023)

The average weekly traffic (AWT) analysis showed that at five years after an average of over 36,200 vehicles used the bypass. traffic growth was not observed on most local roads at five years after, except for Tebworth road, A505, and Sundon Road where traffic growth ranged between 25% to 48% (

Table 2). Traffic volumes on the A56 north of the Dunstable Bypass increased by around 12% as compared to the before period. Additionally, positive traffic growth was observed across all junctions on the M1, with average growth ranging from 6% to 16% across junction J8 to J12.

Overall, the results of our analysis indicate an increase in traffic volumes on the M1 between junctions 9 and 11a, suggesting that the road users are choosing to exit the M1 at junction 11a to use the A5. This is further supported by increase in traffic levels on the A5 north of the bypass road and on Sundon road which is located at the exit to junction 11a. The analysis also showed a reduction in traffic volumes on the local road network, further supporting the change in traffic patterns.

Was traffic growth as expected?

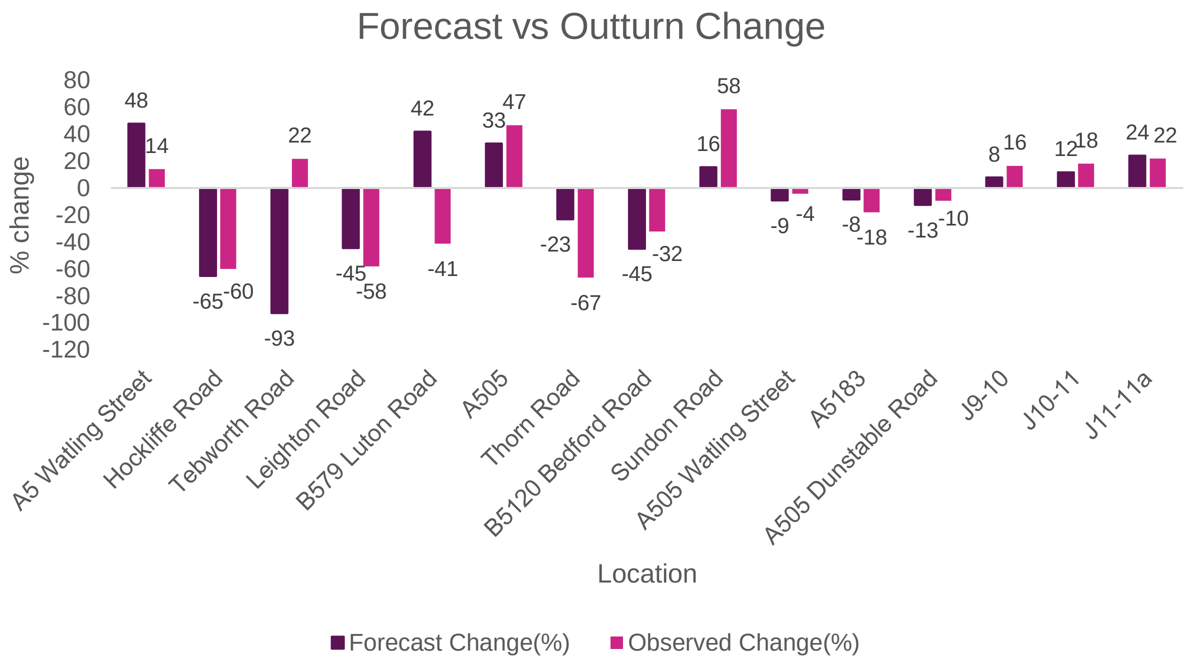
To understand the accuracy of the traffic model and its forecast, we compared the modelled flows with the observed flows at several locations (as shown in Figure 3 Map of traffic countsFigure 3**Error! Reference source not found.**). Sites with no forecast[7] data or unreliable data[4] have been excluded from this analysis. The results of this comparison are shown Figure 4. The analysis showed that the appraisals traffic forecasts were variable with many falling outside the accepted range.[8] The forecasts for the sites on the M1(J9-11a) were generally accurate,

[6] The analysis for site 1-A5 Watling Street is based on approximately 5 days of traffic data, with some missing data for towards the end of the fifth day. These gaps may affect the reliability of the findings and should be considered while interpreting the results.
[7] No forecast data was available for M1 J8-9.
[8] Traffic models are generally considered accurate if the forecast flows are within +/- 15% of the observed flows.

however for most sites on the local roads and on the A5 north of the bypass the forecasts were not within the acceptable range. The difference between forecast and observed change on the A5 north of the bypass is approximately 34%. While this suggests that the appraisal may have overestimated the growth, the lower observed change could also be attributed to the low availability of reliable data on this site.

Overall, the project's appraisal assumed larger changes in traffic than what was observed. The assumptions that underpin the traffic model could have been a factor in the forecasts it produced. The traffic model incorporated assumptions about economic developments and traffic patterns in the area, which could generate more traffic which would use the A5-M1 Dunstable Northern Bypass and the surrounding road network.

Figure 4 Forecast and observed changes in traffic volumes



Source: National Highways Commissioned Counts (October, November 2023; January 2024) and Webtris (October 2023)

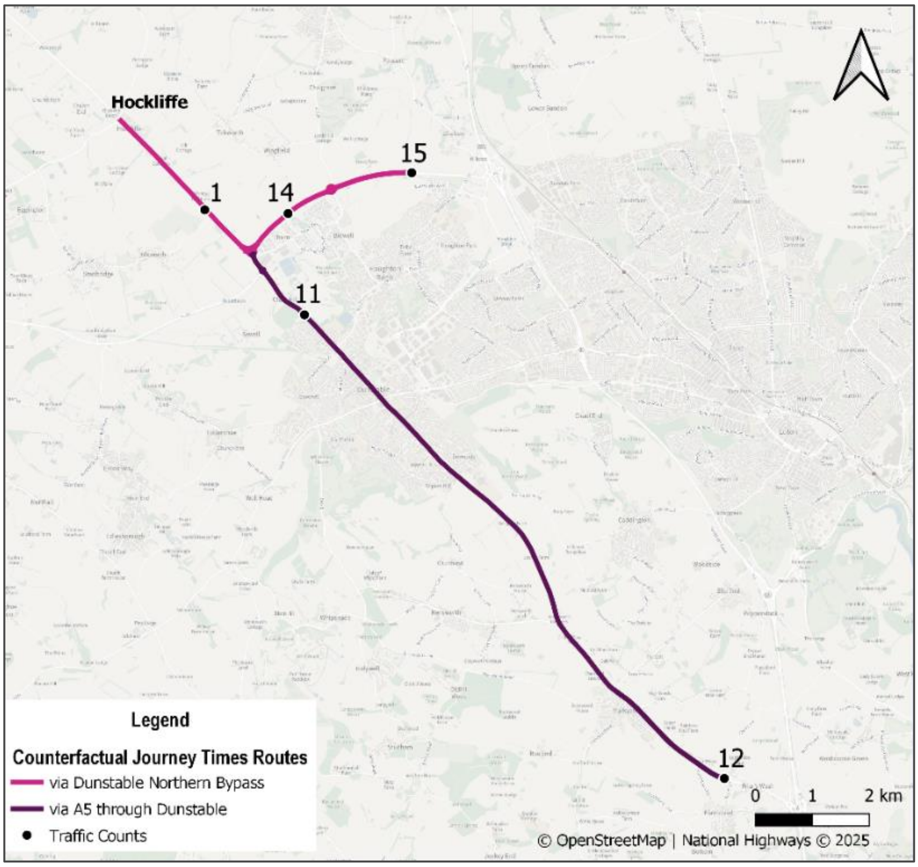
Relieving congestion and making journeys more reliable

One of the key objectives of the project was to improve journey times and reliability when travelling between Hockliffe and junction 9 of the M1. In this section we evaluate the project's impact on journey times and the reliability of journeys. We used satnav traffic information to assess the extent to which the journey times observed on the route varied from the average expected journey times. Comparisons of how this variability changes over time can give an indication of how reliable the average observed journeys are. In turn, we use this information to infer the project's impact on congestion.

Did the project deliver journey time savings?

We compared the changes in average journey times in three key time periods on two routes presented in Figure 5 below. Both routes share the same starting points, beginning at a point in Hockliffe north of the bypass.

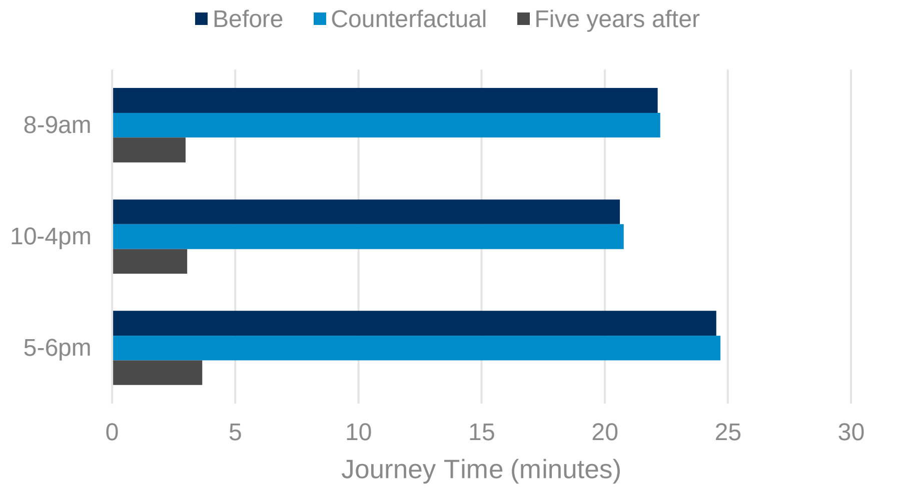
Figure 5 Journey Time Routes



Source: OS Maps; satnav data. Note: Traffic count points shown on the map correspond to those in Figure 3

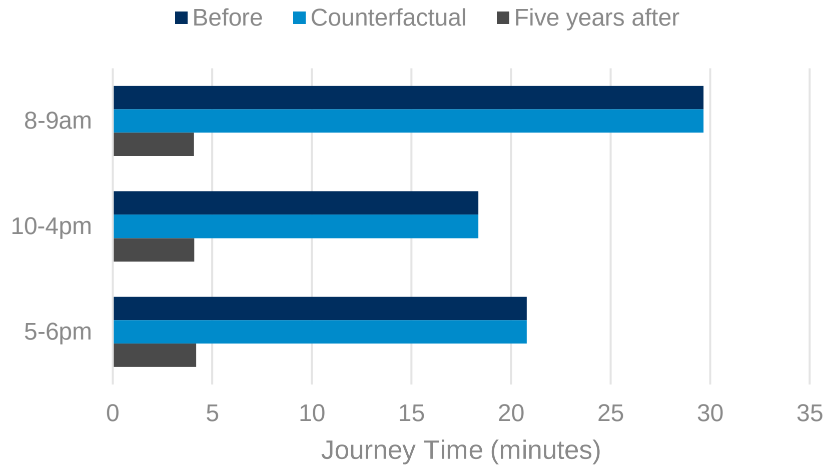
To estimate the change in journey times that would have occurred without the project, we have analysed the counterfactual journey times for selected routes on the project extent. The results of the analysis are shown below in Figure 6 and Figure 7. The counterfactual journey times appear to be either similar to or greater than the before journey times on both northbound and southbound routes. This is as expected as the journey times would have likely increased if the project had not been implemented. At five years after, the observed journey times were much faster than both before and counterfactual journey times.

Figure 6 Counterfactual Journey times (Northbound)



Source: Satnav data (Before: 2014; one year-after: 2018; five years after: 2023).

Figure 7 Counterfactual journey times (Southbound)



Source: Satnav data (Before: 2014; one year-after: 2018; five years after: 2023).

Vehicle Hour Savings

To determine whether the project has had a net benefit in reducing vehicle hours around the scheme section, we have calculated the vehicle hour savings for the same routes used in calculating the counterfactual journey times. Table 3 below shows vehicle hours saved in both directions and as a total.

Table 3 Vehicle hour savings

Direction	Total VHS
Northbound	326,288
Southbound	273,408
Total	599,696

Source: Satnav data (Before: 2014; one year-after: 2018; five years after: 2023), National Highways Commissioned Counts (October, November 2023; January 2024) and Webtris (October 2023).

The total vehicle hours saved at five years after is 599,696 hoursTable 3. The results show a greater number of vehicle hours saved in the northbound direction as compared to southbound. Approximately 54% vehicle hours were saved on the northbound route, while around 45% were saved on the southbound route.

Were journey time savings in line with forecast?

Journey time forecasts were produced for two scenarios in the project's appraisal. The 'Do-Something' (with project) scenario illustrates the changes that were likely to occur if the project was implemented, while the 'Do-Minimum' (without project) scenario illustrated the changes that were likely to occur if the project was not constructed. For each scenario, forecasts were produced for the projects opening year and for a future design year.

The journey time routes[9] in the project's appraisal do not perfectly align with those used in our analysis. However, the forecasted journey time savings indicated that

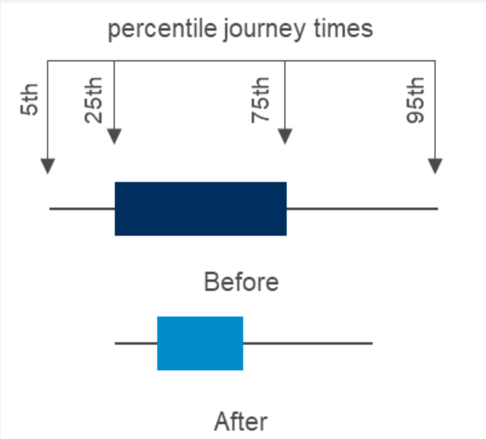
[9] Journey times for routes between Stanbridge (located near A5) and Leagrave (situated near M1 junctions 11 to 11a) were examined in the project's appraisal as these was expected to show the impact of the scheme on vehicles travelling the whole length of the scheme.

the journey times were expected to reduce in both directions across all time periods, with further reductions anticipated by 2029. At five years post implementation, the project was observed to be on track to deliver the forecasted improvements in journey times.

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.

Figure 8 What does a box plot show?

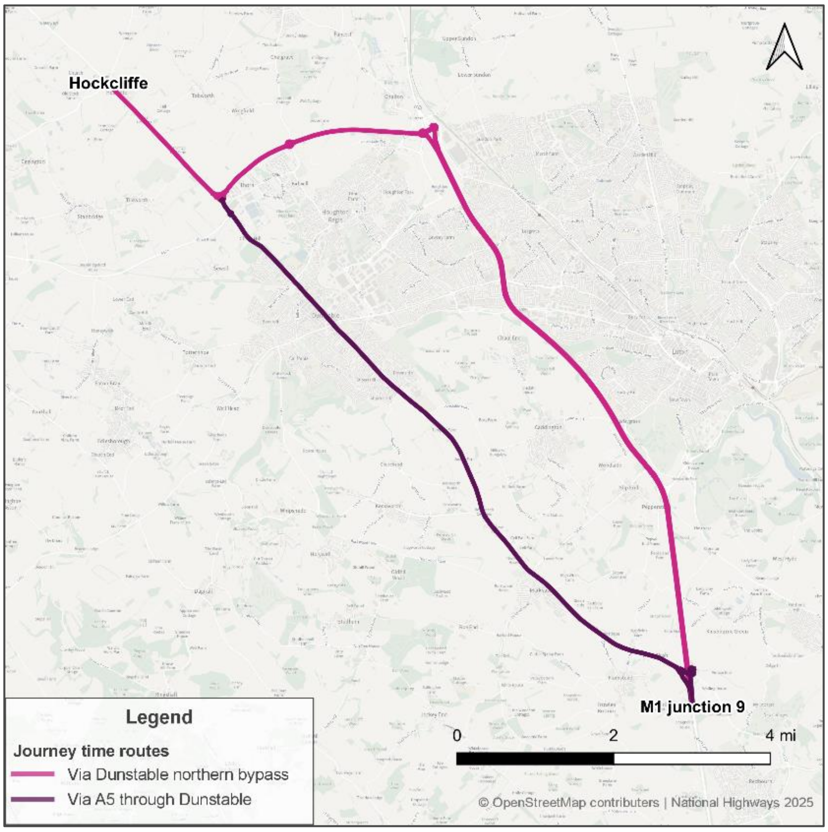


The lowest point is the 5th percentile, this means 5% of journeys take less than this amount of time to complete. The highest point is the 95th percentile, this means 95% of journeys take less time than this to complete.

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

We compared the changes in journey time reliability on two routes presented in Figure 9 below. These routes represent the pre- and post-project alignments of the A5. Both routes share the same starting and ending points, beginning at a point in Hockliffe north of the bypass and ending at junction 9 of the M1.

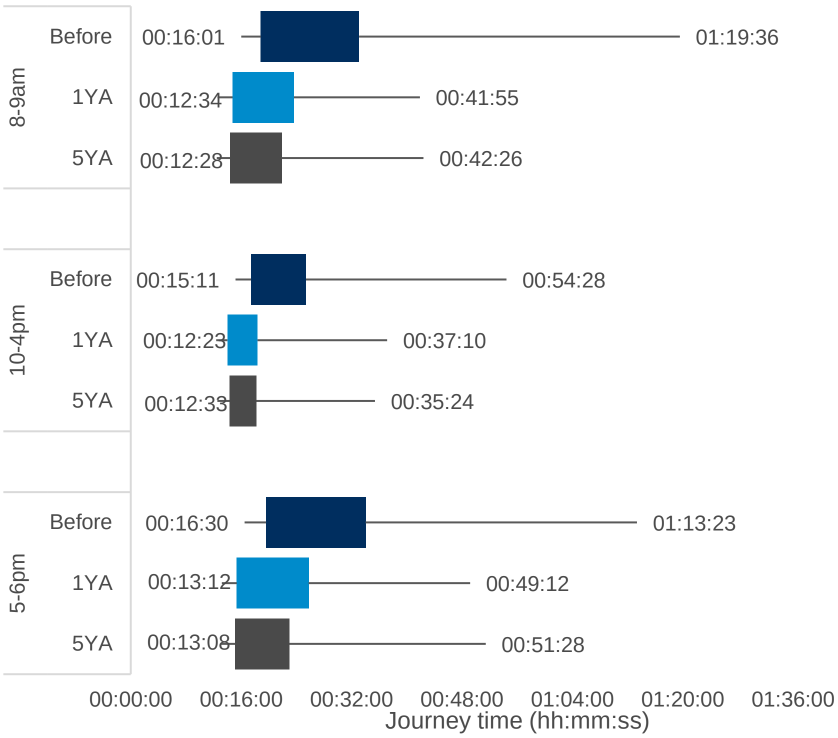
Figure 9: Journey Time Reliability Routes



Source: OS Maps; satnav data. Note: The baseline journey times for 2014 were derived from the old alignment of the A5 though Dunstable. The post-opening journey times for 2023 were derived from the alignment of the new bypass route.

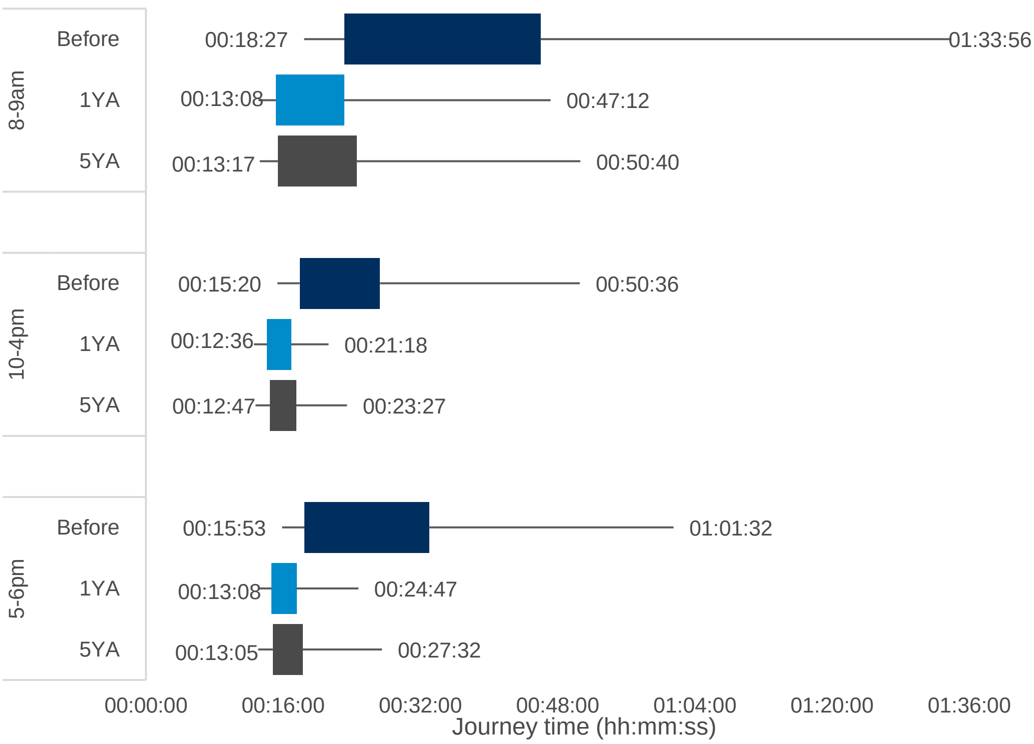
The results of this analysis are shown in Figure 10 and Figure 11. At five years after, the variability of journeys made by road users on the northbound and southbound routes had reduced in comparison to pre-construction period. Improvements in journey time reliability can be observed in all time periods and in both directions. While journeys on the southbound route were slightly more variable at five-year than one year after, they were still better in comparison to the before period. Overall, this indicated that the journey time reliability had improved in comparison to before.

Figure 10 Changes in northbound journey time reliability



Source: Satnav data (Before: 2014; one year-after: 2018; five years after: 2023).

Figure 11 Changes in southbound journey time reliability



Source: Satnav data (Before: 2014; one year-after: 2018; five years after: 2023).

5. Safety evaluation

Summary

The safety objective for this project was to reduce accidents by removing conflicting movements between strategic and local road traffic.

The business case for the project predicted that the development of the bypass would reduce the number of personal injury collisions by an average of 12 per year[10] across the entire safety study area.

The appraisal forecasted an average of five collisions per year on Dunstable Northern Bypass. Overall, the project was forecast to save £86.3m.[11]

Table 4 captures all the key measures for the project extent from before to after construction. Early evaluation shows a reduction across all key safety measures.

Table 4 Summary of project extent key measures

<table>
<tr><th colspan="2">Measure</th><th>Before</th><th>After</th><th>Counterfactual</th><th>Change</th></tr>
<tr><td colspan="2">Personal Injury Collisions (average)</td><td>32</td><td>16</td><td>25</td><td>-16</td></tr>
<tr><td colspan="2">Collision Rates (hmvm)[12]</td><td>47</td><td>25</td><td>42</td><td>-22</td></tr>
<tr><th colspan="2">Measure</th><th>Before</th><th>After</th><th colspan="2">Change</th></tr>
<tr><td rowspan="3">Collision Severity</td><td>Fatal</td><td>1</td><td>1</td><td colspan="2">0</td></tr>
<tr><td>Serious (average)</td><td>6.33</td><td>1.8</td><td colspan="2">-4.53</td></tr>
<tr><td>Slight (average)</td><td>25.07</td><td>17.2</td><td colspan="2">-7.87</td></tr>
<tr><td colspan="2">Fatal Weighted Injury[13]</td><td>1.5</td><td>0.7</td><td colspan="2">-0.8</td></tr>
<tr><td colspan="2">FWI/hmvm[14]</td><td>2.6</td><td>1.5</td><td colspan="2">-1.1</td></tr>
<tr><td colspan="2">Killed or Seriously Injured[15]</td><td>7.8</td><td>2.4</td><td colspan="2">-5.4</td></tr>
<tr><td colspan="2">KSI/hmvm[16]</td><td>12.9</td><td>5.6</td><td colspan="2">-7.3</td></tr>
</table>

Source: STATS19 27 February 2010 – 11 May 2022

[10] Based on an increase of 294 collisions on Dunstable Northern Bypass and a reduction of 714 personal injury collisions over a 60-year appraisal period for the entire safety study area as shown in Figure 12.
[11] The project was initially forecast to make a saving of £54.1m in 2002 base price. This has been updated to 2010 base price.
[12] hmvm = Hundred Million Vehicle Miles
[13] 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.
[14] FWI/hmvm= Fatal Weighted Injury per Hundred Million Vehicle Miles
[15] The number of people killed or seriously injured (KSI) in road traffic collisions. This metric is non-weighted but does not pick up all injuries (slight casualties). KSI rate per hmvm is the rate calculated using the number of people who are killed or seriously injured, and the total miles travelled on a road section or type.
[16] KSI/hmvm = Killed or Serious Injured per Hundred Million Vehicle Miles

The average collision rate in the wider area has reduced by six personal injury collisions (PIC) per hmvm since the project has been open to traffic. The average PIC has reduced by 131 (annual average of 590 to 459 PICs after) in the same period. There has been a reduction across all serious and slight collisions, however, there has been an increase in the number of fatal collisions.

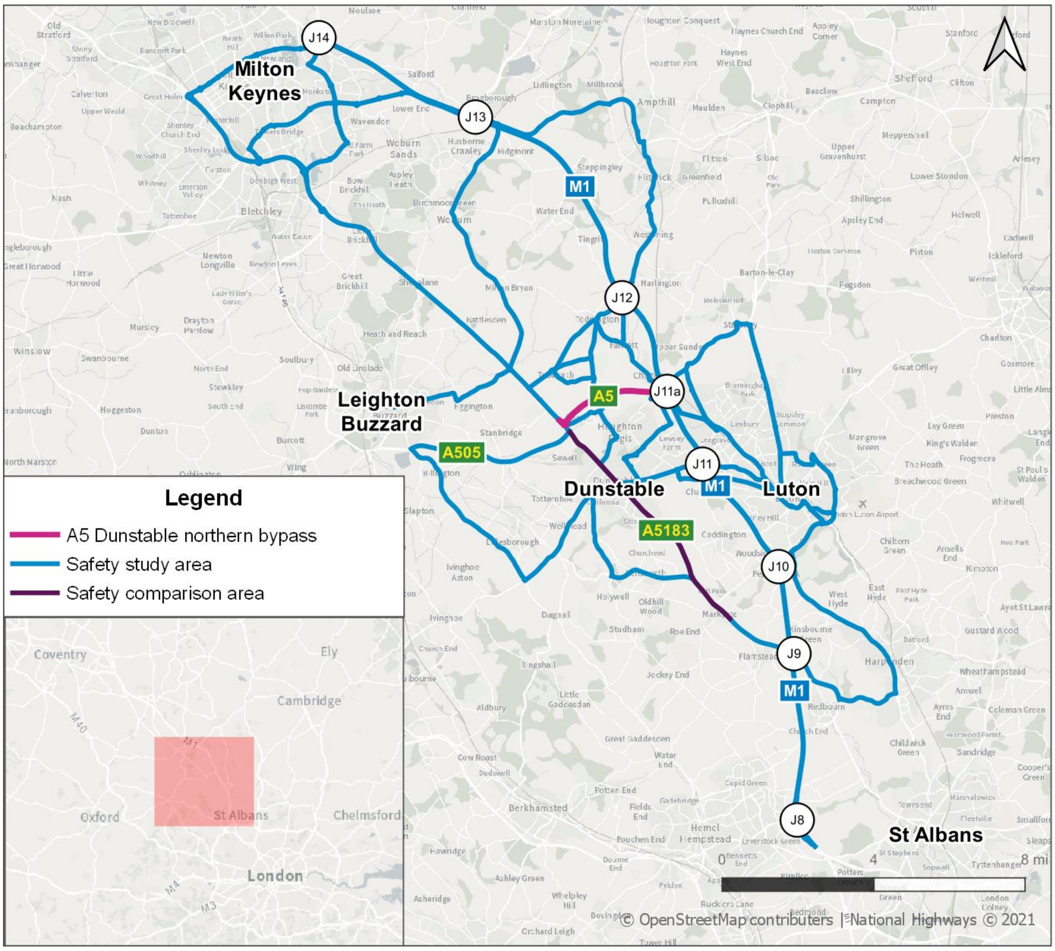
There has been an increase in the observed FWI and KSI measures. If the wider area continues to perform at the current level, it will exceed the predicted reduction. A full summary of the wider area can be found in Appendix A.

At this five-year evaluation point the project is on track to meet its objective to reduce the number and rate of collisions.[17]

Safety study area

The safety study area is shown in Figure 12. This area was assessed in the appraisal supporting the business case for the project to check any potential wider implications of the intervention. This information was then used with other predictions around the potential impact of the scheme such as by how much traffic may grow. We have therefore replicated the appraisal study area to understand the emerging safety trends.

Figure 12 Safety study area



Source: National Highways and OpenStreetMap contributors.

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

Road user safety on the project extent

How had traffic flows impacted collision rates?

The Department for Transport release road safety data[18] that records incidents on public roads that are reported to the police. This evaluation considers only collisions that resulted in personal injury.

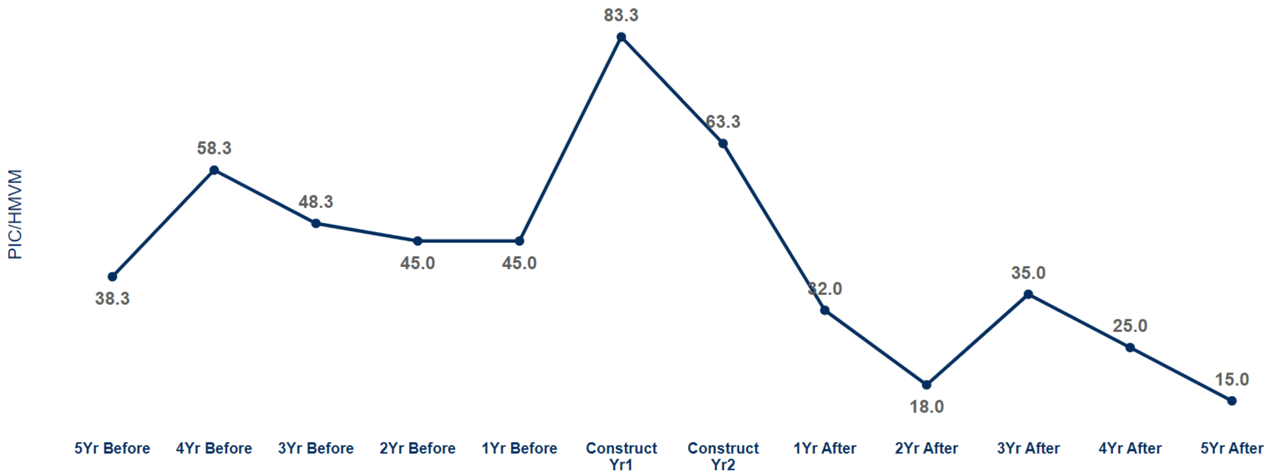
The safety analysis has been undertaken to assess changes over time looking at the trends in the five years before the project was constructed to provide an annual average. We have then assessed the trends from the first 60 months after the bypass was operational and open for road users. This provides an early indication of safety trends, but this will be monitored over a longer timeframe before conclusions can be drawn about the safety impact of the project across the following time periods:

- Pre-construction: 27 February 2010 - 26 February 2015.
- Construction: 27 February 2015 – 11 May 2017.
- Post-opening: 12 May 2017 – 11 May 2022.

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

The average collision rate had decreased to 25 personal injury collisions per hmvm, this equates to travelling four million vehicle miles before a collision occurs. Five years before the project, the average collision rate was 47 personal injury collisions per hmvm, this equates to traveling two million vehicle miles before a collision occurs (Figure 13).

Figure 13 Annual average of collision rate



Source: STATS19 27 February 2010 – 11 May 2022

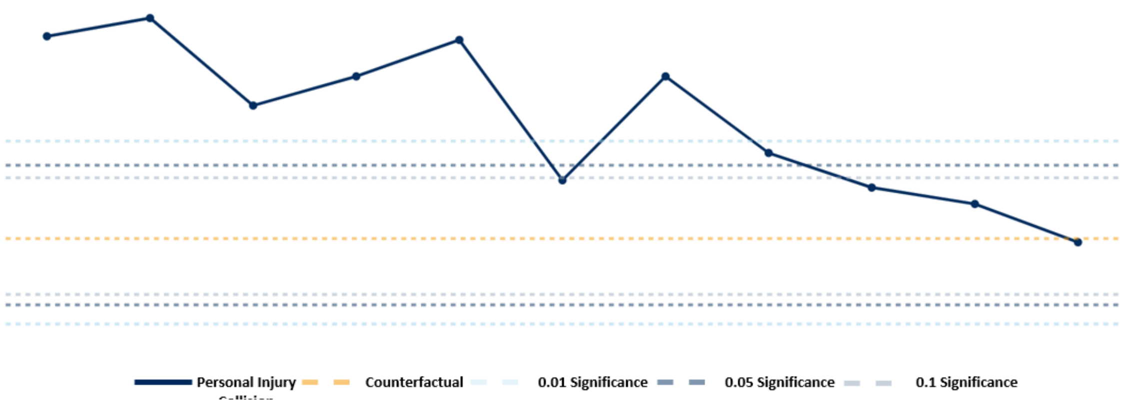
[18] https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data

As part of the safety evaluation, we look to assess what changes in collision rates might have occurred due to factors external to the project over this timeframe. To do this we estimate the trend in personal injury collisions which might have occurred if the road had remained in its previous configuration (this is referred to as a counterfactual - see Figure 14). This is based on changes in regional safety trends for dual carriageways on the strategic road network with a high volume of road users.

Figure 14 What does the counterfactual show?

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

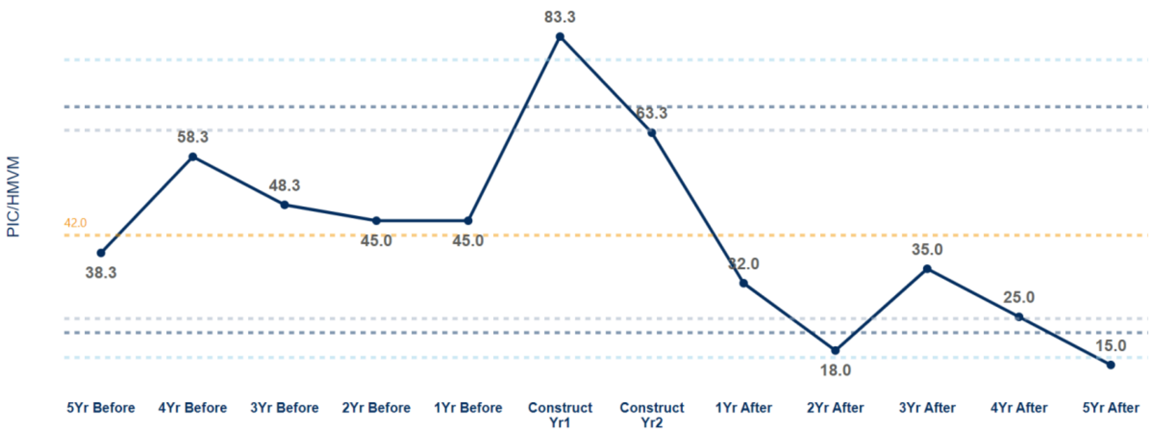
1. Timeseries of personal injury collisions
2. Estimated counterfactual range, which comes from a X^2 hypothesis test on one degree of freedom using a significance level of 0.05. More details can be found in the POPE Methodology Manual.
3. National Highways are developing new statistical methods to compare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



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

The counterfactual test estimated rate would likely reduce to 42 personal injury collisions per hmvm (Figure 15). This counterfactual scenario indicates there would be a reduction in the number of collisions without the project, but the frequency of collisions would reduce mainly as a consequence of increased traffic flows. The after annual average collision rate falls below the counterfactual rate suggesting that the project could be having a positive impact.

Figure 15 Annual average number of collision rate with counterfactual scenario ranges



Source: STATS19 27 February 2010 – 11 May 2022

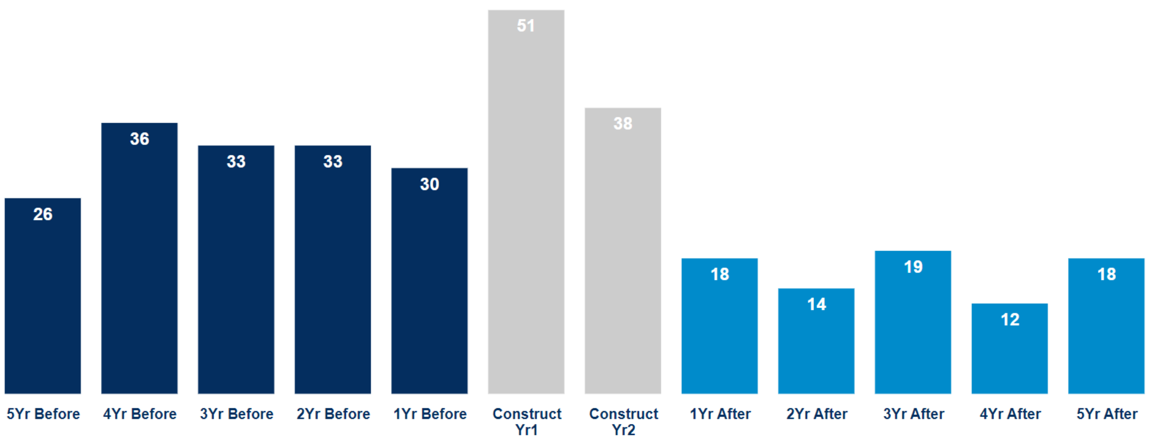
What impact did the project have on road user safety?

The evaluation found the number of personal injury collisions on the project extent had decreased. During the first 60 months the project was operational, there were on average 16 personal injury collisions per year, 16 fewer than the average 32 per year over the five years before the project was constructed (Figure 17).[19]

Figure 16 Average personal injury collisions

32	16	16
Before	After	Fewer

Figure 17 Annual Personal Injury Collisions

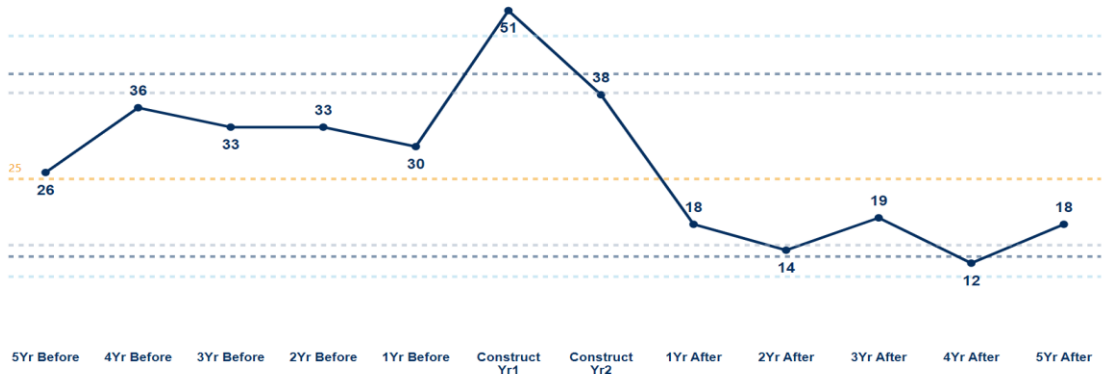


Source: STATS19 27 February 2010 – 11 May 2022

A counterfactual test has also been performed which estimates 25 personal injury collisions would be expected as shown in Figure 18.

[19] This analysis is comparing Dunstable Northern Bypass with the old alignment that ran through Dunstable. On the old alignment we have observed an annual average of 18 personal injury collisions since the bypass opened for traffic.

Figure 18 Annual average number of personal injury collisions with counterfactual scenario ranges



Source: STATS19 27 February 2010 – 11 May 2022

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

What changes in the severity of collisions did we see?

Collisions which result in injury are recorded by severity as either fatal, serious, or slight. The way the police record the severity of road safety collisions changed within the timeframes of the evaluation, following the introduction of a standardised reporting tool – Collision Recording and SHaring (CRASH – see Appendix B). This is an injury-based reporting system, and as such severity is categorised automatically by the most severe injury. This has led to some disparity when comparing trends with the previous reporting method, where severity was categorised by the attending police officer.[20] As a consequence, the Department for Transport have developed a severity adjustment methodology[21] to enable robust comparisons to be made.

The pre-conversion collision severity has been adjusted, using the Department for Transport's severity adjustment factors, to enable comparability with the post-conversion safety trends.[22]

After the project, there has been a severity reduction across serious and slight categories (Table 5). Fatal collision severity has remained stable at one. Figure 19 shows the full breakdown of severity of personal injury collisions by project year.

Table 5 Number of personal injury collisions by severity

	Before	After	Change	Change direction
Fatal	1	1	0	↔
Serious	6.33	1.8	-4.53	↓
Slight	25.07	17.2	-7.87	↓

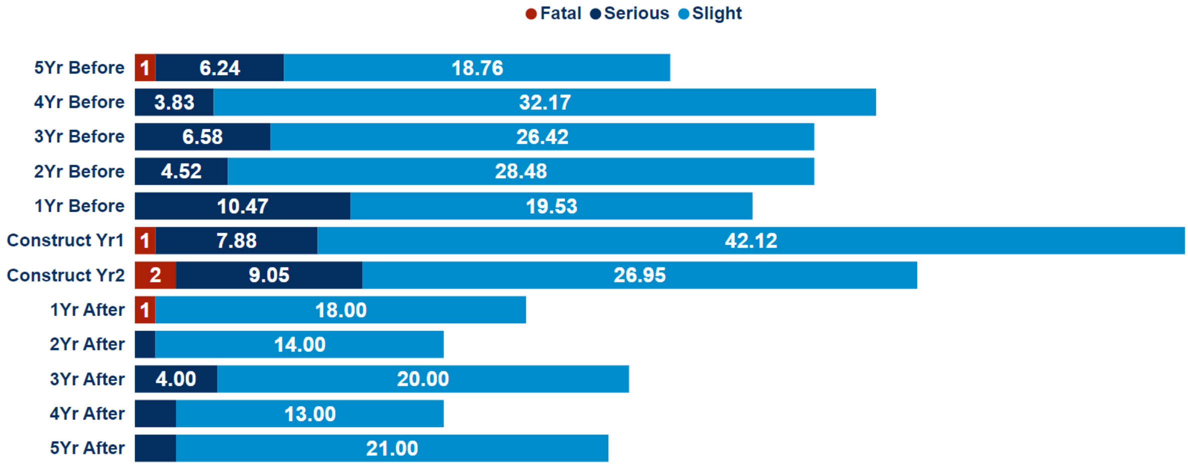
Source: Source: STATS19 27 February 2010 – 11 May 2022

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

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

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

Figure 19 Severity of personal injury collisions within the project extent



Source: STATS19 27 February 2010 – 11 May 2022

How had traffic flows impacted casualty severity?

Like other transport authorities across the UK the key measure we use to assess the safety of roads, is Fatal and Weighted Injuries (FWI). This gives a fatality 10 times the weight of a serious casualty, and a serious casualty 10 times the weight of a slight casualty.[23] In effect, it takes all non-fatal injuries and adds them up using a weighting factor to give a total number of fatality equivalents.[24] This is represented by an annual average and a rate that standardise casualty severities against flow to show the likelihood of a fatality equivalent occurring per distance travelled.

There has been a reduction in the FWI observed annually. The severity of casualties occurring after the project became operational has reduced in the project extent. An annual average of 0.7 FWI were observed. This is a reduction of 0.9 FWI from the 1.5 FWI observed before the project.

The combined measure showed an extra 26 million vehicle miles was travelled before a FWI.[25] The rate of FWI per hmvm[26] has reduced. This suggests that taking into account changes in traffic the project is having a positive safety impact on the severity of casualties within the project extent.

We also assess the impact the project had on casualties using the Killed or Seriously Injured (KSI) measure[27], and consider changes in traffic by calculating an average rate for every hundred million vehicles miles (hmvm) travelled.

A reduction of 5.4 KSI has been observed annually. Reducing from an average of 7.8 KSI before to 2.4 KSI after. The rate of KSI per hmvm has reduced from an average of 12.9 to 5.6 for every hmvm travelled.

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[23] 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.

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

[25] Before the project, 39 million vehicle miles needed to be travelled before a FWI (2.6 FWI per hmvm). After the project this increased to 65 million vehicle miles (1.6 FWI equivalents per hmvm).

[26] hmvm – hundred million vehicle miles

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

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

Has the project achieved its safety objective?

The safety objective for this project was to reduce accidents by removing conflicting movements between strategic and local road traffic. We have observed a reduction in the rate and number of collisions and improvement to the impact on casualties on the project extent and comparison area. We believe that the project has met its safety objective.

6. Environmental evaluation

Summary

The evaluation of environmental impacts of the project uses information on the predicted impacts gathered from the DfT’s Transport Analysis Guidance (TAG) environmental appraisal, and the environmental assessment. It then compares them with findings obtained five years after the project opened for traffic, using evidence from the site visit and desktop research. The project opened for traffic in in May 2017 and the five years after site visit was undertaken in August 2022.

The results of the evaluation were recorded against each of the Transport Analysis Guidance (TAG) environmental sub-objectives and are summarised in the sections below and in Table 6. These findings were based on whether, at five years since opening, conditions were: better than; worse than; or as expected. These do not necessarily mean that the overall impact as set out in the appraisal will change if the conditions are not as expected, but further aftercare may be required. This evaluation was a snapshot in time and reflects progress since the one year after site visit and a judgement on the effectiveness of any mitigation measures towards achieving the desired design year (15 years after opening) outcomes.

Our five years after evaluation found that most outcomes were broadly as expected. Strategic traffic was using the new A5 Northern bypass, and this was contributing to improvements in air quality within Dunstable. Observed traffic flows along most roads within the project study area were lower than forecast but not low enough to change the predicted noise impacts. The absence of sufficient speed data meant we were unable to quantify changes in greenhouse gas. New landscape earthworks, habitats and drainage features had been provided and these mitigation measures had continued to develop since our one year after evaluation. These measures were helping to integrate the project into the landscape as well minimising the impacts on biodiversity, the setting of cultural heritage and the water environment as was expected. However, whilst these measures were establishing, our five years after site visit did identify issues with the condition of some of the mitigation. Therefore, there was a risk that if maintenance was not improved, that the design year outcomes may not be achieved.

Noise

The environmental appraisal predicted that a small number of properties close to the route of the new road would experience noise increases as would some properties on the northern edge of Houghton Regis. Some 18 properties near Chalton and around the M1 were predicted to experience noise reductions. Across the wider study area, properties adjacent to local roads were predicted to experience a mix of increases and reductions in noise due to changes in the number of road users. To help manage noise impacts, the project proposed that the new road would include a low noise surface along its length and noise barriers, including earth noise attenuation bunds. Overall, the project was predicted to cause a negligible increase in the number of people annoyed due to traffic noise.

Our one year after evaluation confirmed that the proposed noise mitigation had been provided. This included a low noise surface and new timber noise fences and earth noise attenuation bunds near Thorn Farm and Grove Farm (Figure 20 and

Figure 20Figure 21). At five years, our site visit confirmed these remained in good condition and therefore should still be delivering their intended benefits.

At one year after we compared the forecast traffic data used to predict the noise impact of the project against the actual traffic observed. This enabled us to consider how well the noise impacts had been predicted. This analysis found that noise impacts from most roads within the study area were either better than expected or broadly as expected. We repeated this analysis at five years after to understand how changes in traffic since then may have changed the outcome. Our analysis found that traffic flows were lower than forecast for most routes including those carrying the largest numbers of road users. This included the Dunstable northern bypass, the M1 junction 11 to 11a and the A505. However, the flows were not low enough to result in a perceptible reduction in predicted noise and so the outcome was as expected.

Figure 20 Noise bund with mitigation planting south-west of Thorn Farm overbridge

Source: 5YA Evaluation Site Visit (August 2022)

Figure 21 Noise barrier west of Grove Farm overbridge

Source: 5YA Evaluation Site Visit (August 2022)

At one year after, our analysis suggested that at three roads impacts were potentially worse than expected due to higher than forecast average traffic flows. At five years we repeated this analysis and found there were only two roads, Thorn Road and Tebworth Road. Flows on these two local roads were higher than forecast but whilst the % changes were above the 25% threshold for an adverse effect to be perceptible, the overall flows still remained lower. As the traffic flows were low, absolute noise levels would be expected to be low too and so it was unlikely that they would lead to significant adverse effects. There has been significant housing development since the opening of the project which may explain why observed flows are higher. Therefore, overall, it was likely that noise impacts were broadly as expected.

Air quality

The environmental assessment predicted that the construction of the new bypass would reduce the number of road users travelling through Dunstable to access the M1. Instead, road users would use the new bypass to access the M1 at junction 11a. This was predicted to worsen air quality adjacent to the M1 north of junction 10 but would not cause any new exceedances of the air quality standards. In Dunstable, where an air quality management area[28] (AQMA) had been declared, it was predicted that the project would improve air quality removing the two air quality exceedances that the assessment had identified. Outside of the AQMA but within 200m of the new bypass, properties were predicted to experience changes in air quality, but air quality would remain below the standards and the project's impacts would not be significant. Overall, the project was predicted to produce an overall improvement in air quality within the study area.

Our one year after evaluation suggested that the project has contributed to improvements to air quality within the Dunstable AQMA as expected. Outside the AQMA, emissions were likely to be higher than forecast along some routes and lower along others. However, these changes were considered unlikely to be significant.

Our five years after evaluation re-examined the forecast and observed number of road users travelling through Dunstable and along and around the new bypass. We also considered air quality monitoring data published by Central Bedfordshire Council in their Air Quality Status Report (2023)[29]. Our analysis indicated that the number of roads users travelling along the A5 Dunstable Northern Bypass and through Dunstable on the A505 and A5183 were all lower than forecast. Monitoring data also indicated widespread compliance with the Nitrogen Dioxide air quality objective across Dunstable including within the AQMA. As a result of the improvements in air quality, Central Bedfordshire Council indicated in their 2023 Status Report that they intended to undertake further modelling to determine if the boundaries of the AQMA could be reduced. If air quality continued to improve over the next three to five years, they also indicated that the AQMA may be revoked entirely.

Our analysis suggested that the project had contributed to improvements to air quality and that overall, the project had not caused any significant effects as had been expected.

Greenhouse gases

The project was predicted to have a beneficial impact on greenhouse gas emissions. This was because the project was expected to allow vehicles to travel more fuel efficiently, lowering the emissions for each kilometre travelled. In the opening year, emissions were predicted to be reduced by 1,358 tonnes and by 81,804 tonnes over the whole 60-year appraisal period.

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[28] Air Quality Management Areas are places where a local authority determines that air quality objectives are not likely to be achieved. https://uk-air.defra.gov.uk/aqma/ .
[29] Central Bedfordshire 2023 Air Quality Annual Status Report

The total greenhouse gas emissions of the project were predicted by calculating the sum of all the individual changes in emissions caused by changes in traffic across the entire traffic model study area. Our evaluation approach recognises that it is not possible to make a direct comparison between the greenhouse gas emissions predicted in the appraisal. This is because observed traffic information is not usually available for every road included in the original modelled study area. Instead, our approach assesses the forecast and observed traffic data available for the project extent and attempts to calculate a reforecast and an observed carbon emission at five years after.

Our analysis of the available data at five years after found that traffic flows along the A5 Dunstable Northern bypass were up to 18% lower than forecast but that the proportion of heavy-duty vehicles were between two and three percent higher. This is similar to our findings at one year after although observed flows were even lower then.

Unfortunately, as was the case at one year after, we do not have sufficient speed data to be able to quantify what these changes in flows and heavy-duty vehicles mean. However, as observed flows were lower than forecast, it was likely that overall greenhouse gas emissions from traffic using the new bypass at five years after opening were lower than forecast.

Landscape

The project was expected to have an adverse impact on the landscape character of the area. Farmland, including hedgerows forming field boundaries, would be lost to accommodate the new road. New infrastructure, including the roundabouts at the A5 and A5120 junctions and new overbridges such as those at Sundon Road and Thorn Farm, would all create new prominent features in the landscape. Locally the road and its infrastructure would impact on the views of nearby residential properties and people using footpaths crossed by the road. The majority of the route would not be lit but new lighting at the junctions and car headlights would all add to the nighttime influence of the road.

To minimise the impacts of the project, measures were included within the design to help integrate the road into the landscape. The alignment of the road was designed to minimise the loss of vegetation and new earthworks were provided to help screen views towards the project. New tree and hedgerow planting was proposed to replace those lost. Overall, it was expected that once all the mitigation planting had established, the impact of the project on the landscape and nearby visual amenity would be slight adverse.

Our one year after evaluation confirmed that landscape impacts had arisen broadly as expected and the new mitigation had been provided. A landscape and ecological maintenance plan had been produced and although there were some maintenance issues, most new landscaping mitigation plots were establishing. The one year after evaluation indicated that ongoing aftercare would be key to ensuring that the long-term design year objectives would be met.

At five years after we undertook a follow up site visit to explore how well the mitigation planting was establishing. This found that most woodland, linear trees and shrubs, native hedgerow, and grassland planting had established and was helping the project integrate into the landscape. However, establishment was variable and in places there was evidence of failed and lost planting and little evidence of recent maintenance. Some plots were in poor condition. The overall outcome is likely to be as expected. However, there is a risk that if maintenance and aftercare programmes are not improved that the mitigation provided will not deliver the expected landscape and visual impact benefits by the design year.

Figure 22 Landscape change and an example of a planting issue

Landscape change: view of the A5-M1 southwest of Thorn farm overbridge

Planting not well established near footbridge 5

Townscape

The environmental appraisal reported that the project was in a rural location and did not pass through a townscape setting. It was predicted that the project would reduce congestion which would bring some improvements to townscape character on Dunstable High Street. Overall, the impact of the project on townscape was considered to be slight beneficial.

Our evaluation confirmed that the A5 Dunstable Northern Bypass did not pass through or impact on the townscapes within Dunstable and Houghton Regis. Analysis suggested that strategic traffic was now using the new bypass to access the M1 rather than via the centre of Dunstable. The effect of this was likely to improve the ambience within the town and so provide benefits to the townscape as expected.

Heritage of historic resources

The project was predicted to have an adverse impact on cultural heritage features in the area. This was because the route of the project was understood to contain a number of undesignated archaeological remains which would be disturbed by the construction works. This included remains from the bronze age, iron age, Romano-British, medieval and modern-day periods. There would be no direct impacts on historic buildings, but the proximity of the new road would impact on the setting of some, including the Thorn Spring Scheduled Monument.

The project included a range of measures designed to minimise the impacts. This included a programme of archaeological investigations and reporting intended to either preserve the sites in-situ or capture and record the knowledge learnt. New earthworks and landscape planting would also be provided to help minimise visual impacts on the settings of historic buildings. Overall, it was anticipated that the impacts would be slight adverse.

Our evaluation included a review of the available documentary evidence and a site visit to consider the performance of the mitigation in place. Our analysis found that archaeological investigations had been undertaken prior to the start of works and the outcome of the trial trenching was published[30]. These works found evidence of archaeological remains from various periods including from the Iron Age, Roman and Medieval periods with the finds deposited at Luton Culture, the local museum service.[31]

Our site visit confirmed that new earth bunds and planting had been provided to help mitigation the visual effects of the project on the setting on nearby archaeological sites. This included landscape bunds and planting along them at the Iron Age and Romano-British Settlement near Grove Farm and Thorn Springs (Park) moated site (Scheduled Monument). In most cases, the planting was establishing and it reflected the historic character of the local area. Once it matures it should help minimise the impacts on historic landscapes including the 18th Century irregular enclosure which had lost its boundary to the project. However, locations were found where planting had not established, had failed or was in poor condition and in these locations there was a risk that the design year outcomes may not be met.

Overall, provided aftercare and maintenance programmes are improved, the outcome should be as expected.

Figure 23 Landscape bund west of Grove Farm overbridge

Source: 5YA Evaluation Site Visit (August 2022)

Biodiversity

The environmental assessment work undertaken for the design of the project predicted that there would be no direct or indirect impacts on statutory or non-statutory nature conservation sites. The construction of the project would however cause the loss of a range of grassland habitats and fragment some foraging routes understood to support a range of species. This included birds, great crested newts and badgers.

A range of measures were proposed to minimise the effects of these impacts. These measures included two new ponds and foraging habitats to minimise impacts on great crested newts and to provide new breeding sites. New and

[30] Archaeological trial trench and test pit evaluation for the A5-M1 link Road Bedfordshire May 2014 – January 2015
[31] The A5-M1 link. Archaeological investigations during construction February – June 2015

replacement planting was proposed to provide new nesting sites for birds including around the Ouzel Brook. New mammal tunnels along with wildlife fencing were also proposed to help connect habitats severed by the road. The loss of grassland, including some containing important assemblages of scarce arable flora, was recognised as an important impact requiring mitigation. New species-rich grasslands were proposed, and seeds would also be collected from those areas containing scarce arable flora impacted by the project. These seeds would then be reused for reinstatement in an area near Grove Farm. Once the mitigation had established, it was anticipated that, overall, the impacts of the project would be slight adverse

Our one year after evaluation confirmed that the predicted impacts had occurred, and the proposed mitigation had been provided. Ecology ponds, mammal tunnels and wildlife fences were all seen. New grassland, hedgerows and scrub planting was provided and appeared to be establishing satisfactorily. However, no monitoring reports were provided, and it was considered too soon to predicted whether the design year outcome would be met.

At five years after we revisited our evaluation and considered the condition of the new habitats and how well they were establishing. No monitoring reports were available and so our findings were limited to the observations made during our site visit. Most habitats were continuing to establish although their condition varied along the project. The new swale had vegetated with species rich grasslands as had been proposed and the new hibernacula, designed to provide habitats for amphibians, was present. Evidence of mammal runs were seen in the vicinity of the mammal tunnels which suggested they were being used. The new ecological ponds were present however there were no monitoring reports available to confirm how successfully they had been and by five years after they were overgrown with vegetation. There is a risk that if the vegetation is not removed, the value of these habitats to support great crested newts will be affected.

Overall, our evaluation found that the impacts were broadly as expected with the proposed mitigation provided and most habitats establishing. However, the condition of some habitats was poor and there was a risk that if aftercare and maintenance programmes were not reviewed, the full benefits of these new habitats may not be realised.

Water environment

The environmental assessment reported that the project would pass through a greenfield site where surface water runoff from existing local roads flows into the existing drainage network with no attenuation or pollution control measures. The project, therefore, had the potential to impact on surface water and groundwater resources in the area including the underlying chalk aquifer. To manage these risks and to minimise the exposure of the underlying chalk, the project design avoided the use of deep cuttings. The design incorporated new drainage features including carrier drains, lined ditches and lined attenuation ponds. These were designed to prevent infiltration into the chalk aquifer and to manage surface water flows to minimise the risk of pollution and flooding. Overall, the impact on the water environment was predicted to be neutral.

Our five years after site visit, confirmed that new drainage features including carrier drains, ditches and attenuations ponds had been provided. Our site visit took place during a period of dry weather and so it was not possible to comment on their performance. However, there was evidence self-seeded trees in some drainage ditches and several of the attenuation ponds were heavily overgrown. It was considered at five years after that the level of vegetation in the attenuation ponds could compromise their drainage function and capacity. Overall, whilst the outcome is likely to be as expected, if maintenance isn't improved, there is a risk that the expected design outcomes may not be achieved.

Figure 24 one of the balancing ponds delivered by the project

At one-year after (Source: Evaluation Site Visit, September 2018)

At five-years after (Source: Evaluation Site Visit, August 2022)

Physical Activity

The environmental assessment reported that the project would disrupt the existing local public rights of way network. These were used for both recreation purposes and to access community facilities, although usage was reported to be low. A number of footpaths including those linking Chalton and Houghton Regis were expected to be affected due to diversion from their existing alignment and rerouted to new crossing points over the A5-M1. Users of footpaths would also be exposed to new traffic impacts including noise and visual intrusion which would deter use. The project would also provide new combined footpath cycleways and new crossing points over the project including a new Pegasus[32] crossing on the A5120 north of A5/A5120 roundabout. Overall, the impacts on physical activity were predicted to be slight adverse.

Our evaluation, including the site visit, confirmed that the predicted impacts were likely to have arisen although we had no information to quantify any change in the level of actual physical activity. Rights of way had been diverted but new footpaths, cycleways and crossing points such as the overbridge at Thorn Farm and the Pegasus crossing were provided. Some damage to the fence leading up to the overbridge at Thorn Farm was observed. However, provided this is repaired, it is expected that the impacts would be as expected.

Overview

The results of the evaluation are summarised against each of the Transport Appraisal Guidance (TAG)[33] environmental sub-objectives and presented in Table 6. In the table we report the evaluation as expected if we believe that the observed

[32] A signal-controlled crossing point designed for use by pedestrians, cyclists and equestrians.
33 TAG provides guidance on appraising transport options against the Government's objective for transport

impacts at five years after are as predicted in the appraisal. We report them as better or worse than expected if we feel the observed impacts are better or worse than expected.

Table 6 Summary of Environmental evaluation against appraisal outcomes

Sub Objective	AST Score	5YA Evaluation Outcome	5YA Evaluation Summary
Noise	Negligible change in population annoyed (year 15) = +50; PVB = +684,206 millions	As expected	Noise mitigations were provided including low noise surfacing and noise barriers. Analysis of traffic flows suggested that overall noise impacts were likely to be as expected.
Air Quality	NPV: Nitrogen dioxide (-£804); Particulate Matter (-£417).	As expected	Numbers of road users along the A5 and through Dunstable town centre were lower than expected and local air quality monitoring data indicated widespread compliance with the air quality objectives.
Greenhouse Gases	Total change in carbon emissions: = -1,358 T (year one). and -81,804 T (whole appraisal period)	Better than expected	Greenhouse gas emissions were likely to be lower than forecast along the A5- M1 bypass. This was likely to be due to lower than forecast overall traffic flows. A direct comparison with the overall predicted emissions was not possible as there was insufficient traffic data.
Landscape	Slight adverse	As expected	The project has become a prominent feature in the landscape. The new roundabouts, overbridges and lighting columns have caused adverse landscape impacts. Mitigation planting was provided. But some plots were in poor condition. There is a risk that if maintenance isn't improved, the expected landscape outcomes may not be achieved by the design year.
Townscape	Slight beneficial	As expected	As the project was a bypass which does not pass through the townscapes of Dunstable and

Sub Objective	AST Score	5YA Evaluation Outcome	5YA Evaluation Summary
			Houghton Regis, the reduced levels of traffic through the urban areas were likely to be a benefit for Dunstable High Street.
Heritage of historic resource	Slight adverse	As expected	Archaeological investigations had been undertaken and the outcomes reported. New landscape bunds and planting had been provided to minimise the visual impacts on settings of historic features. However, poor establishment of mitigation planting could pose a risk to the design year outcomes being met. These should be addressed.
Biodiversity	Slight adverse	As expected	New habitats and species mitigation was provided. However, there was a risk that if maintenance programmes were not improved, the benefits of these new habitats may not be fully realised.
Water Environment	Neutral	As expected	New drainage features had been provided. However, the attenuation ponds were overgrown. If maintenance isn't improved, there is a risk that the expected design outcomes may not be achieved.
Physical Activity	Slight adverse	As expected	Local public rights of way were diverted, but new crossings and footpaths were provided.

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 £148 million, under the forecast cost of £166 million.[34] In the first five years, the road provided additional capacity to support more road users allowing them to travel quicker and more reliably, whilst improving the safety of those journeys. If this trend continues, the project is reforecast to deliver £399 million of benefits over the 60-year period.

Overall, the evaluation indicated that in the first five years this investment is on track to deliver ‘high’ value for money over the 60-year life of the project, under the forecast of ‘very high’ which was anticipated at the time the investment decision was made.

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[35] 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 *A5-M1 Dunstable Northern Bypass* business case are set out in Table 7. 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.

[34] Present value of costs in 2010 prices and values.
[35] Typically scheme life is taken to be 60 years.

Table 7 Monetised benefits of the project (£ million)

	Forecast (£million)	% forecast monetised benefits[36]	Evaluation approach
Journey times	851	89%	Re-forecast for the project area only (not the wider area) using observed and counterfactual[37] traffic flow and journey time data
Vehicle operating costs (VOC)	50	5%	Re-forecast using observed and forecast traffic flow and journey time data
Safety	86	9%	Re-forecast using observed and counterfactual[38] safety data
Carbon	8	1%	Not evaluated (assumed as forecast)
Air quality	0	0%	Not evaluated (assumed as forecast)
Noise	7	1%	Not evaluated (assumed as forecast)
Indirect tax revenues	-46	-5%	Re-forecast using observed and forecast traffic flow and journey time data
Total present value benefits	**957**	**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 8. Based on this information, the scheme 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 £148 million[39], under the anticipated cost of £166 million (see Table 8).

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.

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

[37] 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 (ie a 'counterfactual').

[38] We compared observed trends with an estimation of the trends if the road had remained a conventional motorway (ie a 'counterfactual')

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

Table 8 Cost of the project (£ million)

	Forecast (£M)	% of forecast costs	Evaluation approach
Construction costs	166	98%	Current estimate of project cost
Maintenance costs	3	2%	Not evaluated (assumed as forecast)
Total present value costs	**169**	**100%**	

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

Evaluation of monetised benefits

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

Monetised journey time benefits

As can be seen in Table 7, monetised benefits were primarily driven by forecasted reductions in journey times over the modelled period compared to a 'do-minimum' scenario, what would be expected to happen if the smart motorway were not built. Therefore, in this section of our study, we have compared the 'after' journey times to an estimate of the 'counterfactual' - what journey times are likely to have been without the project. This allows for the deterioration in journey times that we would have expected to have happened due to growth in background traffic levels causing additional congestion.

The overall impact on vehicle hours on the project section in the fifth year was estimated to be positive.[40] This large positive saving for the project extent has led to a monetised benefit of £254million over the 60-year appraisal period. Our methods for monetising journey time benefits and forecasting over the 60 years rely heavily on forecast data and files from the original appraisal. As we were unable locate some of these, a much simpler method was used instead, which excludes any benefits to the wider area. Given that the project has rerouted traffic from more congested local roads, onto the new bypass and the M1, it is more than likely that we would have seen large benefits to journeys outside of the project extent surrounding Dunstable.

Our observations of flows in the wider area showed evidence for decongestion effects on the wider network. As noted in section 4 (

Table 2), the surrounding roads to the new bypass have experienced traffic relief, with a reduction in traffic against a general trend of increasing traffic in the area.

[40] A benefit of 599,696 vehicle hours in the fifth year (Table 3).

We acknowledge that the monetised value presented above does not represent the full impact of the project and does not reflect any impact on the wider road network.

Other reforecast impacts

We reforecast total safety benefits to be £129 million. This figure relates to the benefit on the project extent as well as the wider area over 60 years (see Figure 12). The reforecast is higher than the impacted expected in the appraisal. The appraisal forecast there would be an average of five personal injury collisions per year on the new bypass and a reduction of one collision on the road that that bypass replaced.

There are two further impacts associated with the changes in numbers and speeds of vehicles – indirect tax revenues and vehicle operating costs. Indirect tax revenues are the benefit to the government (and therefore society) of the additional tax income from the additional fuel consumed due to increased speeds and distances travelled. This was forecast to be negative because vehicles were forecast to be travelling at more consistent speeds and therefore using less fuel and paying less tax. We have reforecast that the impact would be smaller than expected, as there were fewer vehicles than expected and were travelling at higher, more inefficient speeds (-£12 million). Vehicle operating costs refer to the fuel and other costs borne by the user (such as the wear and tear on vehicles). This generally increases with increased distance travelled. There was a benefit forecast, which is usually opposite to indirect tax revenues (a negative benefit). 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 small benefit of £13 million.

Impacts assumed as forecast

The evaluation has not been able to reforecast the monetary value of noise, air quality and carbon benefits[41], and instead these were reported as forecast. For noise, air quality and carbon impacts, this assumption is conservative because lower than forecast traffic flows are likely to mean that these impacts are better than forecast.[42]

Journey times and vehicle operating costs during construction and maintenance are not evaluated, however these were not included in the original appraisal so were assumed zero.

Journey time reliability was also not included in the monetised benefits of the appraisal; however, it was considered qualitatively, and traffic analysis has shown significant improvements to road users' journey reliability (section 4).

Overall value for money

The primary driver for the overall reduced level of benefits from this project is the lower level of journey time savings, compared to what was expected. The appraisal forecast significant traffic growth, and with this came faster journeys. The observed data suggested slightly lower traffic growth; however, journey times were still much

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

[42] Refer to section 6 for further detail on noise and greenhouse gas impacts.

quicker and more reliable across the route compared to what they would have been without the new bypass. The method for estimating journey time benefits during the evaluation also did not include the wider area, where it is likely that there would be significant improvements due to traffic rerouting to the strategic road network. This has impacted the projects overall value for money slightly, reducing it by one category.

When considering an investment’s value for money we also consider benefits which we are not able to monetise. For this project, being in close proximity to functional urban areas such as Luton, Watford and Milton Keynes might be relevant considerations. In addition, greenhouse gas emissions as evaluated in the environmental section were expected to be lower than forecast due to slightly lower traffic. These however are unlikely to impact the overall value for money category.

Overall, the evaluation indicated that the project is on track to deliver ‘high’ value for money over the 60-year appraisal period. While this is slightly below the anticipated ‘very high’ value for money, it is still providing benefits to road users and is likely to have enabled economic prosperity for the wider area.

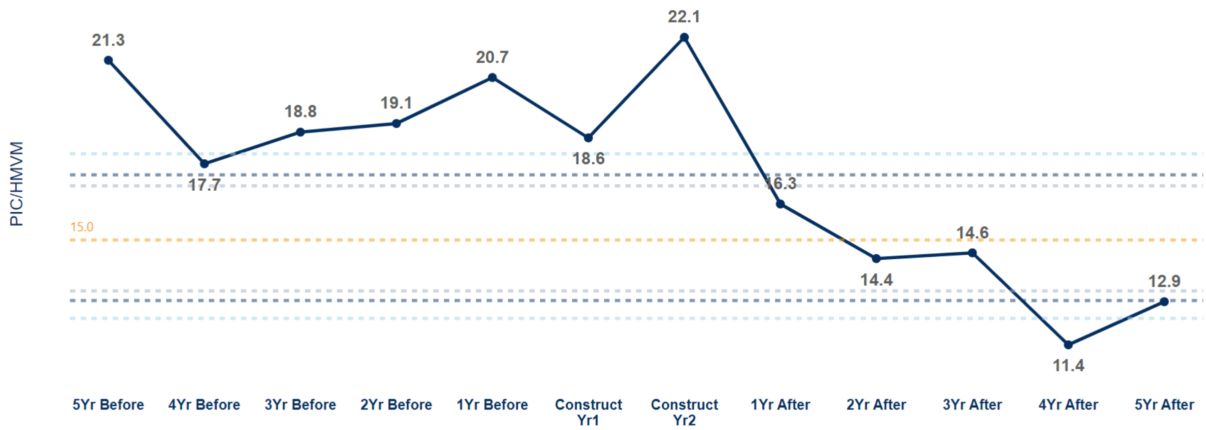
Appendix A

Road user safety on the wider area

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

The evaluation has identified a decrease in the rate of collisions per hundred million vehicle miles (hmvm). Five years before there was an annual average of 20 personal injury collisions per hmvm. Five years after, there was a decrease to 14 personal injury collisions per hmvm (Figure 25). The counterfactual test undertaken found that the collision rate would likely have been between 13-17 personal injury collisions per hmvm. The after annual average collision rate falls just within the counterfactual range of 13-17 collisions per hmvm.

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



Source: STATS19 27 February 2010 – 11 May 2022

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

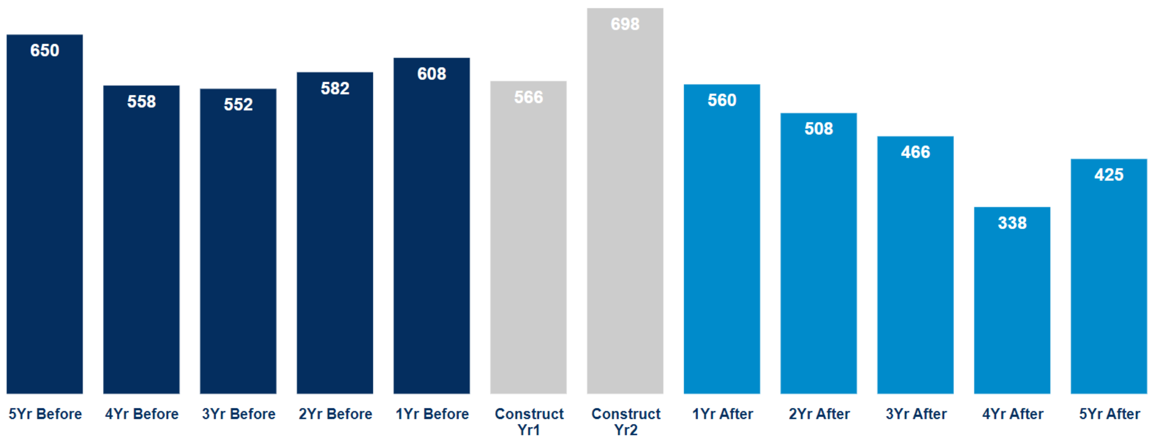
What impact did the project have on safety for the wider area?

Before the project an annual average of 590 collisions were observed. After the project, this had fallen to 459, a decrease of 131 (Figure 27).

Figure 26 Average personal injury collisions

590	459	131
Before	After	Fewer

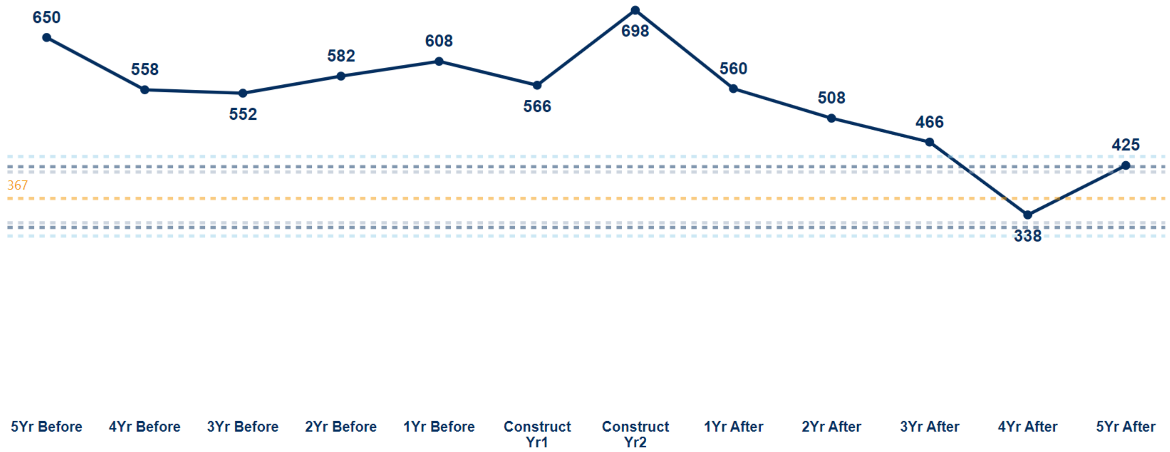
Figure 27 Annual personal injury collisions in wider area



Source: STATS19 27 February 2010 – 11 May 2022

The after annual average falls above the counterfactual range of between 316-423 personal injury collisions per year (Figure 28).[43]

Figure 28 Observed and expected range of personal injury collisions in wider area (annual average)



Source: STATS19 27 February 2010 – 11 May 2022

[43] We have tested the results at 95% confidence interval. The critical value at 95% confidence interval is 367, the observed collision savings for the wider area are higher than this value of 367.

What changes in the severity of collisions did we see?

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

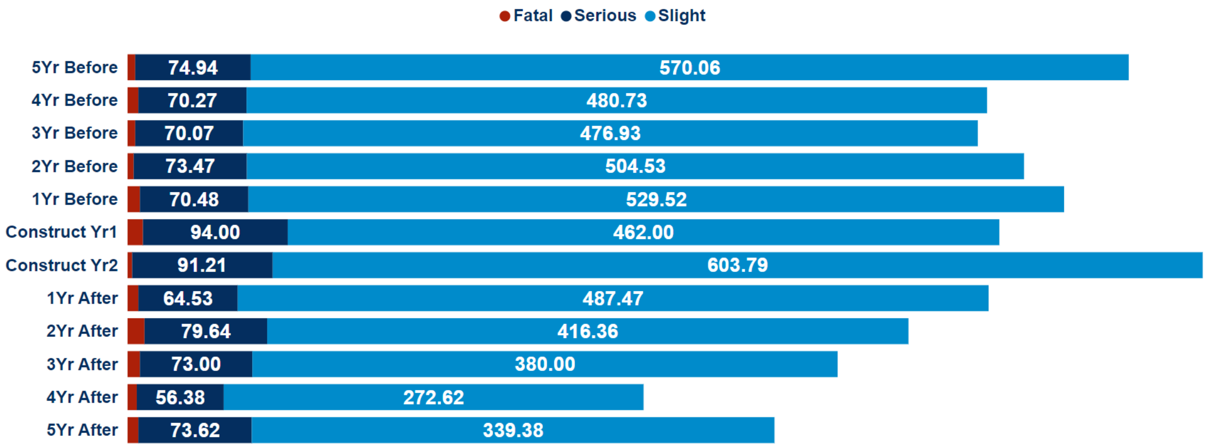
After the project, there has been a reduction severity across serious and slight categories (Table 9). There has been an increase in ten fatal collisions. Figure 29 shows the full breakdown of severity of personal injury collisions by project year.

Table 9 Number of personal injury collisions by severity

	Before	After	Change	Change direction
Fatal	29	39	10	⬆
Serious (average)	71.85	69.44	2.41	⬇
Slight (average)	512.35	379.16	133.19	⬇

Source: Source: STATS19 27 February 2010 – 11 May 2022

Figure 29 **Severity of personal injury collisions within the wider area**



Source: STATS19 27 February 2010 – 11 May 2022

What impact did the project have on casualties?

There has been no change in the FWI observed annually. An annual average of 23 FWI was observed before and after the project became operational were observed.

The combined measure showed an extra 6 million vehicle miles was travelled before an FWI.[44]

An increase of one KSI has been observed annually. Increasing from an average of 88 KSI before to 89 KSI after the project became operational. The rate of KSI per hmvm has reduced from an average of four to three for every hmvm travelled.

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

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

Appendix B

Incident reporting mechanisms

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

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

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

Appendix C

Unadjusted collision severity

The A5-M1 Dunstable Northen Bypass is covered by Bedfordshire police constabulary who transferred from Stats19 to CRASH system for reporting personal injury collisions in April 2016.

Figure 30 shows the unadjusted collision severities on the project extent:

Figure 30 Unadjusted collisions by severity in the project extent

Observation Year	Fatal	Serious	Slight
5Yr Before	1	6	19
4Yr Before	0	3	33
3Yr Before	0	6	27
2Yr Before	0	4	29
1Yr Before	0	10	20
Construct Yr1	1	7	43
Construct Yr2	2	9	27
1Yr After	1	0	17
2Yr After	0	1	13
3Yr After	0	2	17
4Yr After	0	2	10
5Yr After	0	1	17

Source: STATS19 27 February 2010 – 11 May 2022

Part of the wider safety area of the A5-M1 Dunstable Northen Bypass is covered by Bedfordshire and Hertfordshire police constabularies who transferred from Stats19 to CRASH system for reporting personal injury collisions in April 2016.

Figure 31 shows the unadjusted collision severities on the wider safety area:

Figure 31 Unadjusted collisions by severity in the wider area

Observation Year	Fatal	Serious	Slight
5Yr Before	5	62	583
4Yr Before	7	61	490
3Yr Before	5	58	489
2Yr Before	4	59	519
1Yr Before	8	58	542
Construct Yr1	10	82	474
Construct Yr2	3	84	611
1Yr After	7	60	493
2Yr After	11	75	422
3Yr After	8	72	386
4Yr After	6	55	277
5Yr After	7	72	346

Source: STATS19 27 February 2010 – 11 May 2022

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