national highways

A1 Dishforth to Leeming

Seven-year post-opening project evaluation

A1 Leeming to Barton

One-year post-opening project evaluation

Foreword

National Highways – previously known as Highways England, is the Government-owned company, which operates, maintains and improves England's motorway and trunk road network. We work to a five-year funding cycle, a radical new approach to road investment first introduced in 2015, which saw the Government committing £15.2bn in the period from 2015 to 2020. Before 2015, Highways Agency, an executive agency of the Department for Transport, was responsible for England's motorways and truck road network. Our post-opening project evaluations provide an opportunity for us to determine how effective we are in delivering improvements against our portfolio of major schemes, including those in the road investment programme.

The A1 is a strategic route linking London with the north-east of England and Scotland. The section between Dishforth and Barton lies within North Yorkshire and supports journeys between Yorkshire and the North East as well as linking into the A66 trans-Pennine route. This section of the A1 was a two-lane dual carriageway, and road users encountered congestion and delays caused by high volumes of HGVs and slow moving local and agricultural traffic. The route contained several junctions requiring upgrading to address concerns over road user safety and network operation.

We aimed to address these issues and improve this section of the A1 by adding an extra lane in both directions, new and improved junctions and creating a new local access road parallel to the route for local traffic. The aim had originally been to construct one single project, however, it was subsequently decided to deliver the improvements as two separate projects. The first project was the A1 Dishforth to Leeming, which opened for traffic in 2012, and the second project was the A1 Leeming to Barton, which opened in 2017.

This evaluation report assesses benefits of the two both projects and builds on the one-year after post-opening project evaluation for the A1 Dishforth to Leeming project. It covers the performance of these projects over the first seven years for the A1 Dishforth to Leeming and the A1 Leeming to Barton over the first 12 months of being open to road users.

We had difficulties obtaining sufficient data to quantify journey benefits and so our analysis of customer journeys was limited. However, the analysis we did do shows that both projects reduced congestion and improved the reliability of journey times.

The roads of our strategic network are among the safest in the country and personal injury collisions are rare. Due to their unpredictable nature, we monitor trends over several years before we can be confident that a real change has occurred as result of our projects.

Our analysis showed that the A1 Dishforth to Leeming project had improved safety for road users in the seven years since it opened. We have seen a reduction in the number of personal injury collisions and, when accounting for the increase in road users, a reduction in the rate of collisions too. The severity of collisions had reduced with the number of fatalities reducing from seven in the five years before the start of construction to one in the seven years after opening.

The A1 Leeming to Barton aimed to reduce the number of personal injury collisions along the project. In the first year of the project being operational, there were positive signs that this objective was on track to be achieved. We saw a reduction

in the rate and number of personal injury collisions, compared with the annual average for the five years before the project was built. However, data covering a longer period is required before we can be confident the objective has been met. This will be reassessed when we undertake the five years after evaluation.

Managing the environmental impacts of our projects is an important element of our work. For the A1 Dishforth to Leeming the environmental impacts were broadly as expected. Issues were identified with the condition of some habitats near Scott Lane and in response a management plan has been put in place to maintain the habitat in a manner needed to support the Great Crested Newt population. The planned mammal tunnel at Hergil was not built, however, since this scheme was built, the decision-making processes have been changed and tightened, and we are confident that on future schemes all such environmental interventions will either be delivered or will have robust, transparent, documented evidence why the change had been made.

For the A1 Leeming to Barton project, the environmental mitigation provided as part of the project is establishing and we will be monitoring its establishment over the next few years to determine if the design objectives are met.

It was not possible to measure journey time benefits, nor monetise the safety benefits of the A1 Dishforth to Leeming project. However, our analysis showed the project did bring benefits including extra capacity, reduced congestion and improved road user safety. An evaluation of the value for money of the A1 Leeming to Barton project was not within the scope of its one year after evaluation as it was considered too soon to assess all the benefits that will be realised. A reforecast of outturn BCR for the A1 Leeming to Barton project will be made at five years after.

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1. Executive summary

1.1. Background

This report presents the post-opening impacts of two road widening projects: the A1 Dishforth to Leeming and the A1 Leeming to Barton. The two projects were originally conceived as one, but, following a decision made by the Secretary of State for Transport in March 2008, it was decided to construct them in two consecutive phases. The first phase was the A1 Dishforth to Leeming, which began construction in February 2009 and was completed in March 2012. The second phase, A1 Leeming to Barton was suspended following the government's 2010 spending review and removed from the road programme. A new study and business case was produced and the A1 Leeming to Barton project re-entered the road programme and was given approval to proceed in December 2012. Construction began in March 2014 and was completed in March 2018. This evaluation study measures the emerging benefits after both projects had completed construction and were fully open to road users.

This evaluation assesses benefits from both projects and builds on the one-year after post-opening project evaluation for the A1 Dishforth to Leeming. It covers the performance of this project over the first seven years and the A1 Leeming to Barton over the first 12 months of being open to road users. Due to the construction of the A1 Leeming to Barton during 2017, it was not possible to robustly assess the benefits of the A1 Dishforth to Leeming project after the first five years of operation[1] and the earliest opportunity to provide reliable evidence was after both projects had completed construction and were open to road users.

The evaluation measures the impacts of these projects on road user journeys, safety and environment. The report also assesses the value for money aspects of the A1 Dishforth to Leeming project, based on the observed performance of the route. The value for money of the Leeming to Barton project will be considered after it has been operating for at least five years.

The projects are situated in North Yorkshire. The purpose of the projects was to alleviate congestion, improve customer journeys and improve safety along the route. To achieve these outcomes, the original two-lane carriageways were upgraded to a three-lane motorway along the entire route. This added extra capacity. New junctions and a new local access route (LAR) were constructed parallel to the A1 to help separate local and strategic traffic.

When undertaking the evaluations, the quality of the monitoring data available limited the extent to which we were able to draw robust conclusions. This was particularly evident for the analysis of journey time and reliability impacts. Where it was possible to assess change in key performance metrics, we have done so, and where the available data did not enable us to draw conclusions, we have caveated the findings.

[1] Post-opening project evaluations are generally undertaken after a project has been fully open to road users for at least 12 months and after five years. It would not have been possible to confidently attribute the observed changes in road user journeys to the A1 Dishforth to Leeming whilst the A1 Leeming to Barton project was under construction.

1.2. Evaluation findings

1.2.1. Customer journeys

A1 Dishforth to Leeming

At seven years after opening, evidence indicated the project had had a positive impact on the reliability of road users' journeys on the upgraded A1, while at the same time experiencing increased volumes of traffic.[2] There were no signs of congestion on the project extent.[3] Traffic volumes had increased in line with background growth trends for national motorways (11% over the 10-year period).

Our analysis also showed road users were utilising the local access road (A6055) for local journeys rather than the A1 near Dishforth.[4] Elsewhere, the construction of junction 50 at Baldersby had improved connectivity for road users on the A61 near Ripon (Figure 4).

Insight into the accuracy of the expected traffic-related impacts of the project was limited. The appraisal's forecasts for the 'optimistic' scenario could only be obtained[5] and comparison of these with observed volumes were of limited value. The economic downturn which occurred in 2008 after the project's appraisal compounded the issue. Traffic levels across the country were substantially impacted both during and after the project's construction.

A1 Leeming to Barton

The project appeared to have had a positive impact on the reliability[6] of road users' journeys at one year after opening, and that it had achieved its objective to reduce congestion on the A1. Traffic on upgraded A1 was not congested.[7]

Traffic on the Catterick South to Leeming section had increased in line with background growth (between 9% and 12%),[8] and above that expected in the appraisal. The appraisal's expectations of background growth were lower than those observed too, suggesting its forecasts of traffic growth might have been too low (Figure 3).

The project appeared to have contributed to a redistribution of traffic on the local road network. Numbers of road users on four of the five local roads surrounding the A1 assessed had fallen by around 50% during the first year after opening. These were in line with the appraisal forecasts.

[2] This was assessed by calculation of the change in route stress. We were unable to complete the full journey time and reliability analysis, as the carriageway realignments prevented provision of the satellite navigation data which underpins it.
[3] This was based on assessment of the route stress metric.
[4] It was provided to improve safety and ease congestion on the A1 by reducing interactions between local and strategic traffic.
[5] Forecasts are produced to predict the future benefits and costs of different projects. The accuracy of a forecast decreases for later years in the forecasting period. To get a measure of the uncertainty around a forecast, a range of forecasts for different scenarios are produced. The 'core' scenario is intended to be the best basis for decision-making given current evidence. The 'high' (or optimistic) and 'low' (or pessimistic) scenarios are intended to provide alternatives for consideration during the decision process. Respectively, they incorporate the impacts of high or low economic growth on future traffic forecasts. See DfT's WebTAG Unit M4 'Forecast and Uncertainty' for more information.
[6] We were unable to complete our analyses of journey times and journey time reliability due to the carriageway realignments which prevented provision of the satellite navigation data which underpins the analysis.
[7] As above, based on assessment of the route stress metric.
[8] The small number of active traffic counters on the project extent over the evaluation period restricted the scope of traffic analysis.

1.2.2. Safety

A1 Dishforth to Leeming

Over the seven-year evaluation period, the number of personal injury collisions had reduced from an annual average of 36 (in the five years before the conversion to a three lane motorway) to 11 after the project opened. This was an average saving of 25 collisions (31%) per year.

The annual average rate of personal injury collisions per million vehicle km had also improved over time. Before the project was constructed, there was an average of one personal injury collision per 10 million vehicle km travelled. In the seven years after the project opened to traffic, this changed to an average of one personal injury collision per 37.1 million vehicle km travelled. This result showed that there were fewer collisions and road users can travel further without being involved in a personal injury collision.

The findings indicated that there had been a statistically significant[9] reduction in the number and rate of personal injury collisions compared to the predicted[10] trends if the route had remained a dual carriageway.

The severity of collisions had also reduced since the project opened. During the five years before the project was constructed there were, in total, seven fatal collisions, compared with a single fatal collision observed in the seven-year period after the project had opened to traffic. On average, there were 20 fewer collisions leading to slight injuries per year and four fewer collisions leading to serious injuries per year. When accounting for the increased number of road users over this period, there has been a reduction from 12.2 to 1.8 fatality equivalents[11] per billion vehicle km travelled; reducing the risk of a fatality equivalent by 10.4 for every billion vehicle km travelled.

A1 Leeming to Barton

During the first 12 months of the A1 between Leeming and Barton being opened, the number of personal injury collisions reduced from an annual average of 15 (based on the five years) before the project was constructed to seven after the project opened, a reduction of eight personal injury collisions. If the road had remained a dual carriageway, we estimate that the number of personal injury collisions would have ranged between six to 27.

The annual average rate of personal injury collisions per million vehicle km had also improved over time. Before the project was constructed, there was an average of one personal injury collision per 25 million vehicle kms travelled. In the year after the project opened to traffic, this halved to one personal injury collision per 50 million vehicle km travelled. This result showed that there were fewer collisions and road users can travel further without being involved in a personal injury collision.

On the surrounding network,[12] the traffic forecasts, within the business case, predicted a reduction in the number of road users after the project was constructed. Over the first 12 months, there were 13 personal injury collisions

[9] Based on chi squatted test using a 95% confidence interval.
[10] This assessment is based on changes in numbers of road users for dual carriageways and accounts for changes in regional safety trends. For more information, please refer to Annex 1.
[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. The combined measure is added up. A full number is the equivalent to a fatality.
[12] The road network is determined as part of the appraisal process to understand changes to road safety on the scheme extent and roads on which the scheme may have an impact.

observed which is a reduction of 36 personal injury collisions when compared with the annual average of 49 personal injury collisions during the five year period before construction of the project. If the road had remained a dual carriageway, it is estimated the number of personal injury collisions would have been between 30 and 69, so as the observed collisions after the project opened is below this range, it indicates it could be having a positive effect. A further review will be required at five years post-opening to confirm this reduction is sustained and can be attributed to the project.

1.2.3. Environment

A1 Dishforth to Leeming

The seven-years after evaluation highlighted that most of the impacts on the environmental appraisal sub-objectives were better than expected or as expected.

However, not all of the biodiversity mitigation was implemented as expected in the business case. The outcome for biodiversity, which was predicted to be slight adverse, was worse than expected.

- Noise and air quality were likely to be better than expected due to lower than predicted numbers of road users.
- Landscape and townscape impacts were broadly as expected although slow growth in some places and the presence of weeds in many plots may mean the design outcome is delayed beyond year 15. At one year after the bund at Oak Tree underpass looked out of context in the landscape and this remained the case at seven years after. However, the tree planting there was beginning to soften its outline which should, in time, improve its appearance.
- Biodiversity impacts occurred broadly as expected, however the evidence suggested that not all the mitigation proposed was delivered or maintained. The mammal tunnel near Hergill balancing pond, which was proposed in the environmental masterplan, was not built and the grassland habitat for great crested newts at Scot Lane had not been maintained. Overall the outcome was worse than expected.

A1 Leeming to Barton

The one-year after evaluation highlighted that most of the impacts on the environmental appraisal sub-objectives were either as expected or considered to be too early to conclude. For physical activity, the impact was considered to be better than expected.

- The Environmental Statement predicted that noise and air quality impacts would not be significant. Our comparison of traffic data suggests this was the case.
- Landscape, townscape and biodiversity impacts were broadly as expected but limited evidence of maintenance was observed within the first 12 months. Effective maintenance is essential for good establishment. This meant that it was too early to confirm with confidence that the design year outcomes would be met.
- The construction of the A6136 Catterick Road overbridge faced significant cultural heritage and engineering challenges during construction and

resulted in many different engineering design materials and finishes being used. The constraints were acknowledged but there are likely to be design lessons to be learnt from this structure which could help improve future projects.

- For Physical Activity, adverse impacts were predicted in the appraisal. There was some uncertainty in the appraisal information supporting this outcome, but the construction of a new bridleway and new cycling provision suggested that the overall outcome was better than expected.

1.2.4. Value for money

As part of project appraisal, an economic assessment is used to determine the project's value for money. The assessment is based on an estimation of costs and benefits. This includes benefits related to travel times, vehicle operating costs and user charges. Accident benefits including savings related to numbers and severity level of accidents and costs to users due to delays during construction and future maintenance periods.

A1 Dishforth to Leeming

At seven years after, it was not possible to measure journey time benefits[13] nor monetise the safety benefits[14]. This meant that we were unable to reforecast an outturn benefit cost ratio (BCR). Whilst we were unable to monetise project benefits, our analysis did show that the project did deliver benefits. These included adding capacity, reducing congestion and improving road user safety.

A1 Leeming to Barton

An evaluation of the value for money is not within the scope for one-year after evaluations as it is considered too soon to assess all the benefits that will be realised. A reforecast of outturn BCR for the A1 Leeming to Barton project will be made at five years after.

[13] This was due to the carriageway realignments which were implemented. These realignments prevented the provision of the satellite navigation data which underpins the analysis.
[14] We do not have the required accident forecast data for the Dishforth to Leeming project extent to allow the necessary analysis to be done.

2. Introduction

This report presents the evaluation of the post-opening impacts of two road widening projects, the A1 Dishforth to Leeming and the A1 Leeming to Barton. It measures the emerging benefits after both projects had completed construction and were fully open to road users. For A1 Dishforth to Leeming, it also builds on the one-year after post-opening project evaluation which was published in July 2015 and can be located on the UK government's website.[15]

This report covers the performance of the A1 Dishforth to Leeming project over the first seven years and the A1 Leeming to Barton over the first 12 months of being open to road users. Due to the construction of the A1 Leeming to Barton during 2017, it was not possible to robustly assess the benefits of the A1 Dishforth to Leeming project after the first five years of operation,[16] and the earliest opportunity to provide reliable evidence was after both projects had completed construction and were open to road users.

This report provides the outcome of the one-year after evaluation of the A1 Leeming to Barton project and an update to the evaluation of the A1 Dishforth to Leeming at seven years after.

2.1. Project description

The A1 Dishforth to Leeming is a 13-mile section from Junction 49 to 51 and the A1 Leeming to Barton is a 12-mile section from Junction 51 to 56. Both sections are within North Yorkshire. The two projects were originally conceived as one project but, following a decision made by the Secretary of State for Transport in March 2008, they were delivered as two phases.

The first phase was the A1 Dishforth to Leeming, which began construction in February 2009 and was completed in March 2012. The second phase, which was the A1 Leeming to Barton was paused following a government spending review and then removed from the roads programme. In 2012 the project re-entered the roads programme and, following a new appraisal and business case, was given approval to proceed in December 2012. Construction began in March 2014 and was completed in March 2018.

2.2. Project locations

The A1 is a strategic route in England linking London with the Midlands and the North East, and the two A1 projects are situated within North Yorkshire. Several key strategic routes join the A1 near the two projects. This includes the A168 at Junction 49 that links to the A19 and Middlesbrough and Sunderland and the A66 at Junction 53 (Scotch Corner) which provides links across the Pennines to the North West. The geographical location of the projects in relation to the region and surrounding highway network is shown in Figure 1 below.

[15] https://www.gov.uk/government/publications/pope-of-major-schemes-a1-dishforth-to-leeming-improvement

[16] Post-opening project evaluations are generally undertaken after a project has been fully open to road users for at least 12 months and again after five years. It would not have been possible to confidently attribute the observed changes in road user journeys to the A1 Dishforth to Leeming whilst the A1 Leeming to Barton project was under construction.

Figure 1 Project locations

Source: National Highways and OpenStreetMap contributors.

2.3. What were the projects designed to achieve?

The A1 between Dishforth and Barton was a two-lane dual carriageway and was reported to be regularly congested. The congestion was due to high volumes of HGVs and slow moving local and agricultural traffic. The route also contained several junctions requiring upgrading which led to safety concerns. To reduce these congestion and safety concerns, it was decided to upgrade this section of the A1 to motorway standard.

A1 Dishforth to Leeming project comprised the:

- upgrade of a dual two-lane carriageway to dual three-lane between Dishforth and Leeming junctions;
- provision of new and improved junctions at Dishforth (Junction 49), A61 Baldersby (Junction 50) and Leeming (Junction 51); and
- provision of a single carriageway local access road (LAR) – the A6055 – between Baldersby (Junction 50) and Leeming (Junction 51), to meet the demand for local and non-motorway traffic.

A1 Leeming to Barton project comprised the:

- upgrade of the dual two-lane carriageway to a dual three-lane motorway between Leeming and Barton junctions;
- new grade separated junction at Junction 52 Catterick and capacity enhancements at Junction 53 Scotch Corner; and
- a new local access road (LAR) that extends the A6055 from Junction 51 at Leeming to Junction 56 at Barton to meet demand for local and non-motorway traffic.

2.4. How have the projects been evaluated?

The evaluation assessed the outturn impacts of the A1 Leeming to Barton at one-year post opening. It also presents the outturn impacts of the A1 Dishforth to Leeming which, due to the impact of the construction of the A1 Leeming to Barton, is at seven years after opening.

Post-opening project evaluations are carried out for major projects to validate the accuracy of estimated project impacts which were agreed as part of the business case for investment. They also seek to measure whether the expected project benefits are likely to be realised. This provides lessons learned to improve future project appraisals and business cases.

The evaluation is also important for transparency and accountability of public expenditure by assessing whether projects are on track to deliver the anticipated value for money.

A post-opening project evaluation compares changes in key impact areas (including safety, journey reliability and environment) by observing trends on the route before the project was constructed (baseline) and tracking these after the opening of the project to traffic. The outturn impacts of the project are evaluated against the expected impacts of the project (presented in the forecasts made during the project planning process) to review the project's performance.

For more details of the evaluation methods used in this study, please refer to the POPE methodology manual. This can be located on our website.[17]

[17] https://highwaysengland.co.uk/publications/

3. Delivering against objectives

3.1. How have the projects performed against their objectives?

All National Highways' major projects have specific objectives which are defined early in the business case when project options are being identified. These benefits are appraised to be realised over 60 years. The one-year evaluation provides early indication of progress, followed by the five-years after evaluation although for A1 Dishforth to Leeming this is seven-years after, which gives a more detailed insight. The objectives for the A1 Dishforth to Leeming and A1 Leeming to Barton projects included the following:

Table 1 A1 Dishforth to Leeming – objectives and evaluation summary

Objective	Seven-year evaluation
Reduce the high level of accidents	Safety has been improved along the widened route, with a statistically significant reduction in the average number and rate of personal injury collisions compared with if the route had remained a dual carriageway.
Reduce congestion	We widened the A1 and built a new local access road (A6055) which has added capacity for both strategic and local road users. Evidence showed that congestion on the route had improved despite the growth in traffic volumes.
Enhance journey time reliability	The one-year after evaluation confirmed that journey time reliability had improved. Data limitations prevented journey time savings being recalculated at seven years after,[18] but as the project was shown to remain uncongested, journey times are likely to remain reliable.

Table 2 A1 Leeming to Barton – objectives and evaluation summary

Objective	One-year evaluation
Reduce the current level of accidents	A reduction in the number and rate of personal injury collisions was observed. However, data covering a longer period is required before we can be confident the objective has been met. This will be reassessed when we undertake the five-years after evaluation.
Reduce congestion	We widened the A1 and built a new local access road (A6055) which has added capacity for both

[18] This was due to the carriageway realignments which were implemented. These realignments prevented the provision of the satellite navigation data which underpins the analysis.

	strategic and local road users. Evidence showed that congestion on the route had improved despite the growth in traffic volumes.
Enhance journey times	The data limitations restricted the ability to monitor changes in journey times since the widening of the road.[18]
Minimise the impact of the scheme on the environment	Mitigation measures were provided as part of the project to minimise impacts on the environment. Ongoing maintenance will be required to ensure they remain effective.

4. Customer journeys

4.1. Summary

This section evaluates the respective traffic-related impacts of the Dishforth to Leeming project at seven years after opening and of the Leeming to Barton project at one year after opening. The two projects were designed to provide extra capacity to reduce congestion resulting from interactions between local and strategic traffic, and to improve road users' journey times. The evaluations were impacted by two factors. Firstly, the limited number of active traffic counters to measure change over time. This was more pronounced for Leeming to Barton. Secondly, the carriageway realignments implemented impacted journey time data provision. Analysis of journey times and journey time reliability could not be completed for either project.

A1 Dishforth to Leeming

Evidence indicated the project had positively impacted the reliability of road users' journeys on the upgraded A1. At one year after opening, congestion on the project extent was found to have reduced, while at seven years after, there were no signs of congestion.[19] Traffic volumes on the upgraded route had increased broadly in line with background growth levels trends for national motorways (11% over the 10-year period).

Evidence indicated the local access road (A6055) was being utilised by road users at seven years after for local journeys rather than the A1. It was provided to improve safety and ease congestion on the A1 by helping to reduce interactions between local and strategic traffic on the route. Near Dishforth, local road users were using the A6055 rather than the A1. Elsewhere, the construction of junction 50 at Baldersby had improved connectivity for road users on the A61 near Ripon (Figure 4).

Insight into the accuracy of the expected traffic-related impacts of the project was limited. The appraisal's forecasts for the 'optimistic' scenario could only be obtained[20] and comparison of these with observed volumes were of limited value.

The economic downturn in 2008, which occurred after the appraisal compounded the issue with traffic across the country, both during and after construction of the project, substantially impacted.

A1 Leeming to Barton

Evidence at one year after opening indicated that the project had had a positive impact on the reliability of road users' journeys, and had achieved its objective to reduce congestion on the A1. Traffic on the upgraded A1 was not congested.[21]

The small number of active traffic counters on the project extent over the evaluation period restricted the scope of traffic analysis. Traffic volumes on the

[19] Based on assessment of the route stress metric.
[20] Forecasts are produced to predict the future benefits and costs of different projects. The accuracy of a forecast decreases for later years in the forecasting period. To get a measure of the uncertainty around a forecast, a range of forecasts for different scenarios are produced. The 'core' scenario is intended to be the best basis for decision-making given current evidence. The 'high' (or optimistic) and 'low' (or pessimistic) scenarios are intended to provide alternatives for consideration during the decision process. Respectively, they incorporate the impacts of high or low economic growth on future traffic forecasts. See DfT's WebTAG Unit M4 'Forecast and Uncertainty' for more information.
[21] As above, based on assessment of the route stress metric.

Catterick South to Leeming section increased in line with background growth of between 9% and 12%. Such growth was not expected in the appraisal. The background growth trends observed were higher than those used in the appraisal, suggesting the appraisal's forecasts of traffic growth might have been too low (Figure 3).

The project appeared to have contributed to a redistribution of traffic on the local road network. Numbers of road users on four of the five local roads surrounding the A1 assessed had fallen by around 50% during the first year after opening. These were in line with the appraisal forecasts.

4.2. How have the numbers of road users changed?

Before the projects were implemented, the A1 between Dishforth and Barton was regularly congested due to the high numbers of HGVs and slow-moving local and agricultural traffic using the route. The two projects were designed to provide extra capacity to reduce congestion and improve road users' journey times. Measures involved widening the carriageway to three lanes and the construction of a local access route (A6055) running parallel to the A1 to reduce the interactions between local and strategic traffic. The following sections examine the projects' respective traffic-related impacts on road users' journeys, and the extent to which the expected traffic-related benefits of each were realised.

4.2.1. National and regional changes

To first get a sense of the background changes in traffic, we reviewed relevant traffic statistics covering the evaluation periods.[22] Where possible, we plotted the trajectory of national increases in trips over time used in the project's appraisal.[23] The background trends for the Dishforth to Leeming project are shown in Figure 2 while those for the Leeming to Barton project are shown in Figure 3.

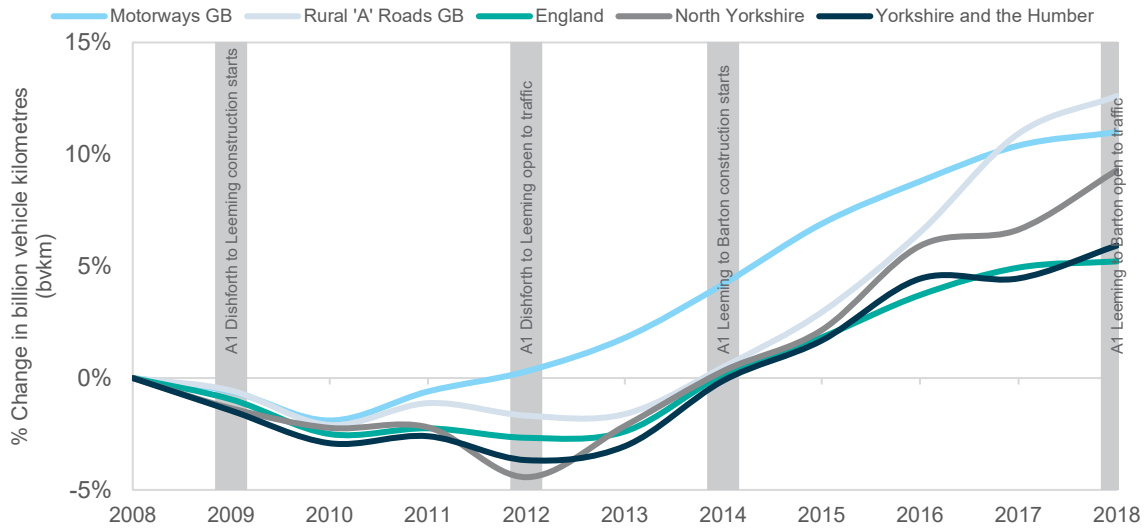
The findings discussed in subsequent sections were not adjusted to take account of background traffic trends, as occurred in earlier project evaluations. The method was viewed as out-of-date following the economic downturn in 2008 which affected road traffic for a prolonged period. Instead we advise a qualitative approach to the interpretation of changes which incorporates background trends. Any above-background increases observed in traffic volumes on a project's extent would provide qualitative evidence of a project's impact.

A1 Dishforth to Leeming

Between 2008 and 2018, the amount of distance travelled by road users increased. The nationwide dip in road traffic due to the economic downturn of 2008 was evident in the trends. Over time, road travel began to recover. By 2018, the distance travelled by road users on roads of all types at the regional level grew by between 6% and 9%. However, on national motorways the amount of distance travelled by road users had grown by 11%. Given the upgrade of the A1 to motorway standard we would have expected traffic growth on the route over the 10 year period to be around this figure.

[22] The Department for Transport annually produces traffic statistics by local authority and road type, detailing total numbers of observed million vehicle kilometres (mvkm) travelled. We used the DfT's data table TRA8904.
[23] These were the forecasts of the National Trip End Model (NTEM) v5.3. The National Trip End Model (NTEM) model forecasts the growth in trip origin-destinations (or productions-attractions) up to 2051 for use in transport modelling. The forecasts take into account national projections of: population, employment, housing, car ownership, trip rates. (Source: DFT, https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem)

Figure 2 Changes in background traffic (2008-18) – Dishforth to Leeming project

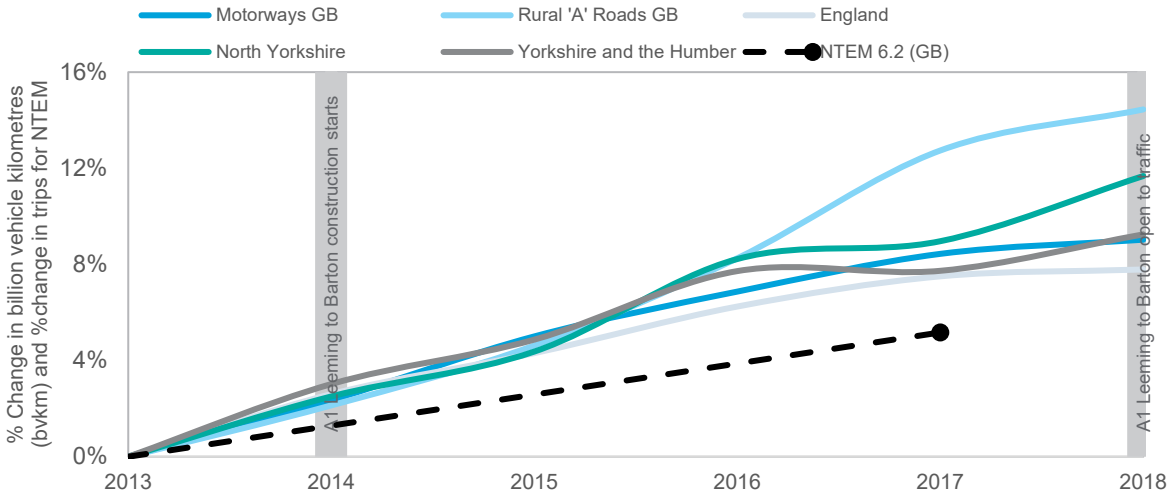


Source: Department for Transport road traffic statistics.

A1 Leeming to Barton

The A1 Leeming to Barton project opened several years after the economic downturn. Between 2013 and 2018, the amount of distance travelled on roads of all types in the region grew by between 9% and 12%. However, on national motorways, the amount of distance travelled by road users grew by around 9%. We would expect traffic growth over the five year period on the route to have been around this figure. The appraisal expected a growth rate around 5% for trips at the national level (as produced by NTEM 6.2).[24]

Figure 3 Changes in background traffic and NTEM (2013-18) – Leeming to Barton project



Source: Department for Transport road traffic statistics ; NTEM 6.2

4.2.2. How did road user volumes change?

Changes in the volumes of traffic from a pre-construction baseline and over the post-opening period were assessed. We looked at sections of the A1 between

[24] The National Trip End Model (NTEM) model forecasts the growth in trip origin-destinations (or productions-attractions) up to 2051 for use in transport modelling. The forecasts take into account national projections of: population, employment, housing, car ownership, trip rates. (Source: DFT, https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem)

Dishforth and Barton and on local roads which were expected to be impacted by the projects. Active traffic counters on the projects' extents were limited, more so for Leeming to Barton.

On the Dishforth to Leeming project extent, detailed data on traffic volumes could be obtained for two junctions and for one mainline section. This was deemed sufficient for the evaluation.[25] On the Leeming to Barton project extent, detailed data was only available for one mainline section in both the baseline and post-opening time periods. This was not sufficient for a robust assessment of the project's impact on traffic volumes and comparison with forecasts.

A1 Dishforth to Leeming

The Traffic Forecasting Report (2005) for the Dishforth to Barton Scheme noted that re-assignment of traffic from the A19 and other strategic routes (including the M6) was expected to be minimal. Between 2008 and 2019, traffic volumes on the A19 and A168, the main alternate route to Middlesbrough, Sunderland and Newcastle, increased by a larger proportion than traffic on the A1, by between 13% and 19% respectively. The A1 however, still carried more traffic in absolute terms. On average it carried over 10,000 more vehicles per day than the aforementioned A roads (see Figure 4).

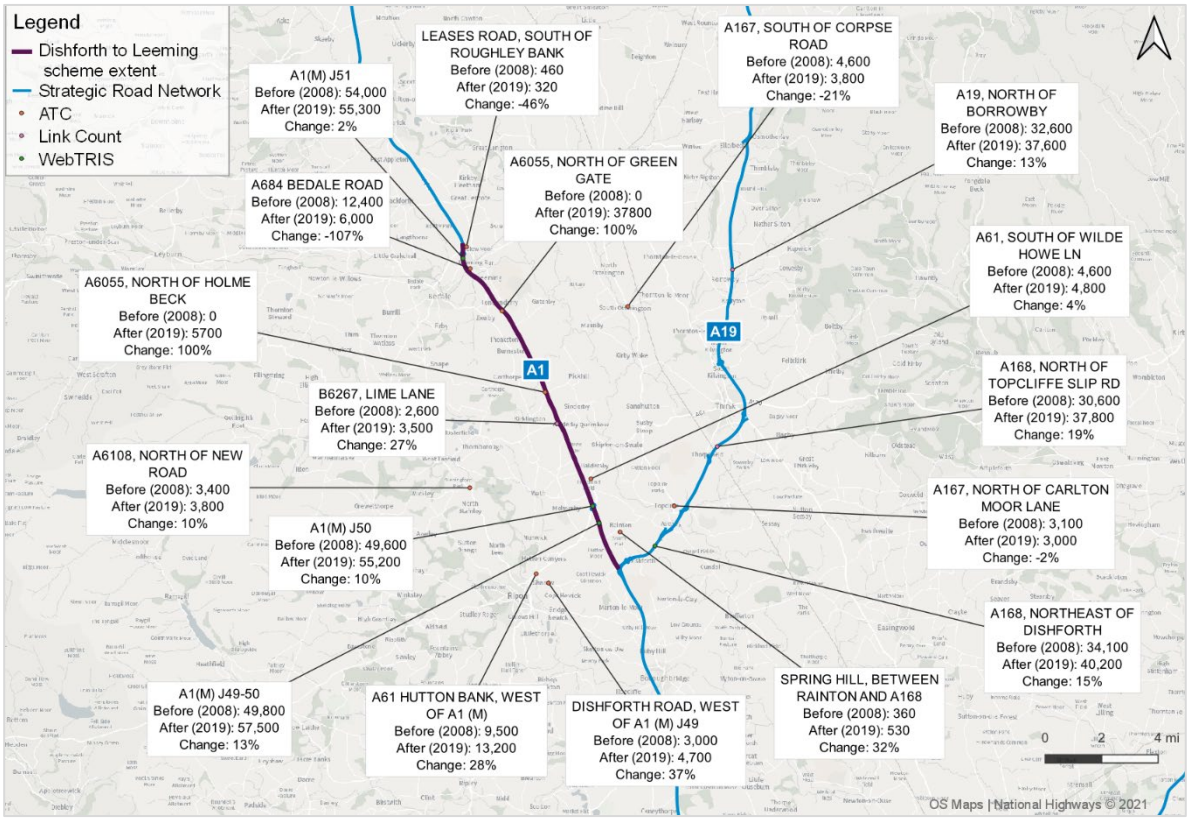
The local access road, the A6055, was designed to draw local traffic off the A1 and ease congestion. We considered the balance of traffic across the A1 and the A6055 and the evidence suggested this had occurred. Traffic volumes on the A1 at seven-years after had increased more to the south around Dishforth than in the north near Leeming. Traffic grew by 13% between junctions 49 and 50 but by only 2% through junction 51. It seemed that a proportion of traffic which previously used junction 51 had switched to the local access road, as the combination of the respective volumes observed was roughly similar to that seen between junctions 49 and 50.

Elsewhere we found evidence to suggest the introduction of junction 50 at Baldersby had made the A1 a more attractive option for road users on the A61 headed north or south. Traffic levels on the A61 which intersects with the A1 increased. However, growth was higher to the west of the A1, by 28%, than to the east, by only 4%.

Traffic levels on the A167 south of Corpse Road fell by 21%, while levels on the A684 Bedale Road fell by 107%. These declines could indicate that at seven-years after, road users were opting to avoid Leeming Bar and instead use the A684 to either join the A1 at junction 51 or to travel onto local destinations west of the A1.

[25] Sufficient in terms of geographical and historical scope to be deemed representative of the changes across the entire project extent.

Figure 4 Changes in two-way average weekly flows in Dishforth to Leeming study area



Source: Strategic road network counts: National Highways WebTRIS; automatic and link counts on local roads: Intelligent Data Collection Ltd.

A1 Leeming to Barton

Table 3 shows the changes in the number of road users on the Catterick South to Leeming section. The level of growth observed was consistent with regional background trends and above the national growth rate in trips expected by the appraisal. This suggested that the appraisal's forecasts may have been based on growth assumptions that weren't high enough.

Historically, the A1 played an important role in the movement of freight up and down the country. Before the project it carried a higher proportion of HGV traffic than the national average for HGVs on our roads. We found evidence to suggest this remained the case after the completion of the project. The proportions observed before and after were similar at around 23%.

Table 3 Observed changes in average weekly traffic on project link by direction

Section	Direction	2013	HGV %	2019	HGV %	Difference	Difference %	HGV Difference %
Catterick South to Leeming	Northbound	26,400	23%	28,700	24%	2,300	9%	1%
	Southbound	25,300	23%	28,500	24%	3,100	12%	2%

Note: Before May 2013; After May 2019.
Source National Highways WebTRIS.

As well as the widening of the A1, other major enhancements provided by the Leeming to Barton project were:

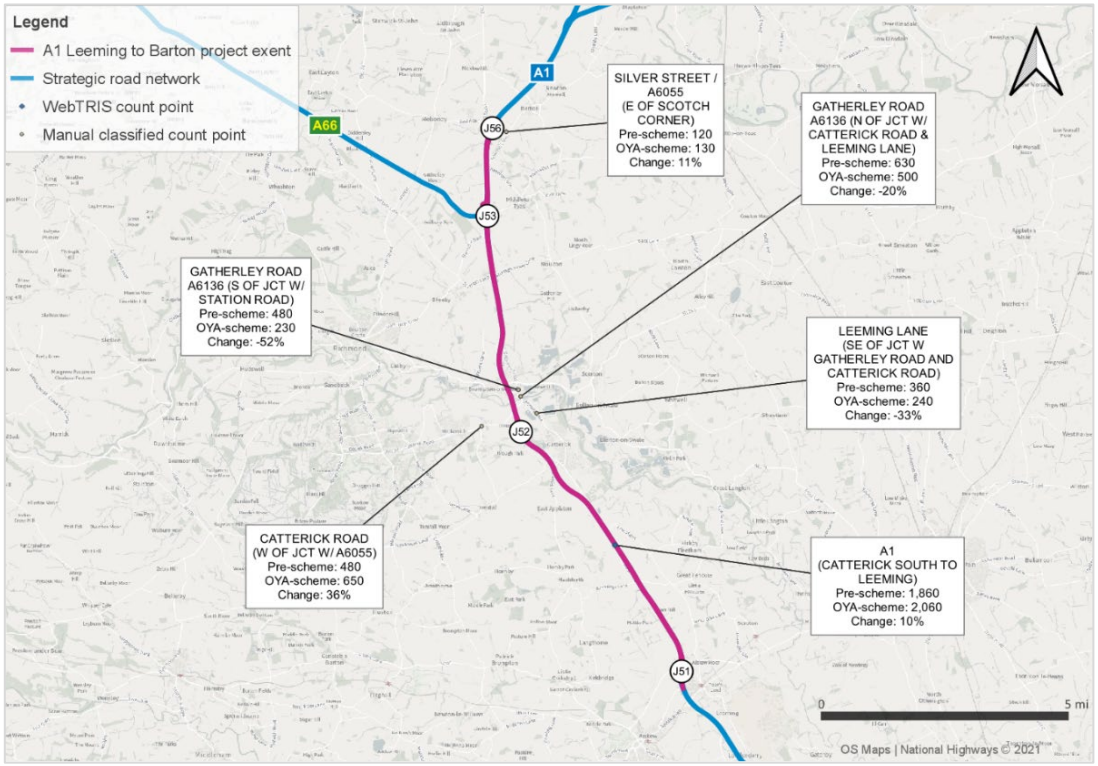
- a new road layout to enable the removal of the old A1 exit sliproad to Gatherley Road and to accommodate the new local access road (A6055);
- replacement of Fort bridge to accommodate the additional lanes of the A1(M), and;
- construction of the new grade-separated junction 52 providing access to the A1(M) from the local road network and local access road.

To get some understanding of the project's impacts on traffic in the wider area, we assessed what changes had occurred at one year after opening on the A1 section and on five local roads. Figure 5 and Figure 6 show the results for morning and evening peaks.

The project was predicted to lead to a reduction in the volume of traffic on local roads in the area. There was evidence to suggest the project's improvements around Brompton-le-Swale and Catterick Bridge had reduced traffic volumes on Gatherley Road and Leeming Road in Catterick Bridge by 20% and 50% respectively.

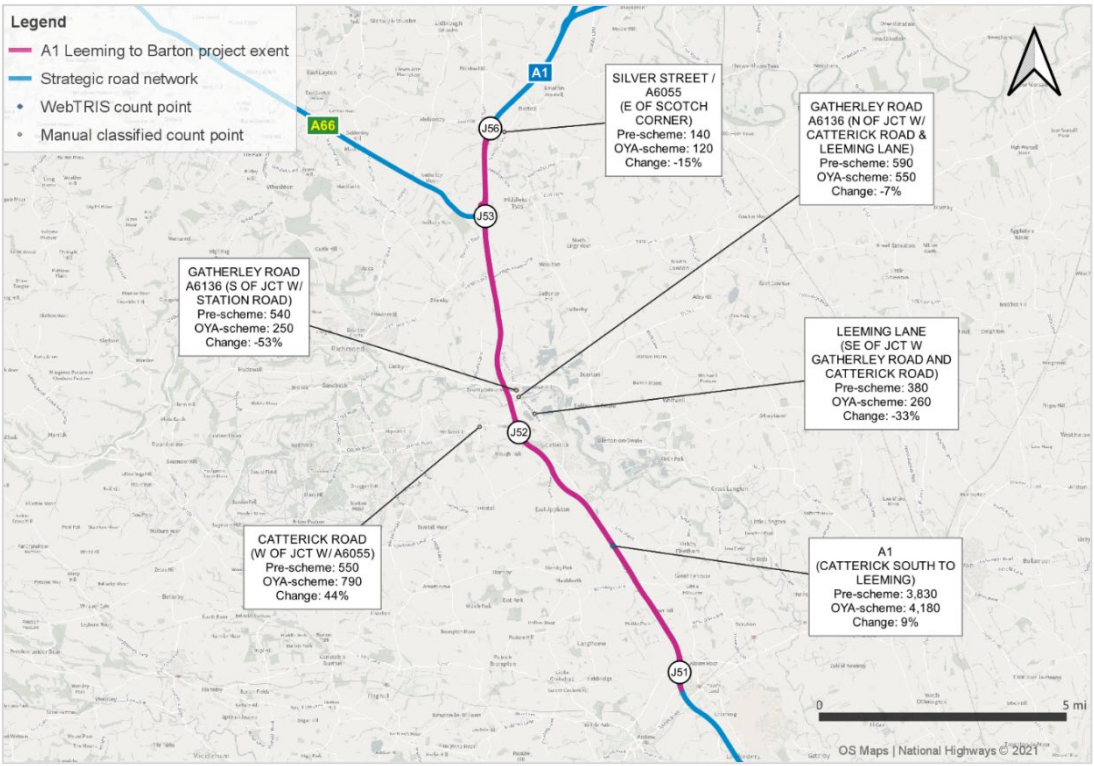
In contrast, traffic levels on Catterick Road west of junction 52 increased by 42% in the morning peak and by 44% in the evening peak. On Silver Street east of junction 53, traffic increased by 9% in the morning peak, more in line with regional background trends, but fell by 3% in the evening peak. While the proportional changes observed on these local roads were large in some instances, it should be noted that the absolute volumes of traffic were low.

Figure 5 Changes in morning peak volumes in the Leeming to Barton study area



Note: Volumes are two-way average weekly traffic. The time periods used mirrored those of the appraisal's traffic model. Morning peak: 08:00-09:00; Interpeak: 07:00-08:00, 09:00-17:00, 18:00-19:00 (average hour); Evening peak: 17:00-18:00. Source: Strategic road network: National Highways WebTRIS; automatic and link counts on local roads: commissioned by Atkins in May 2013 and July 2019 Figures rounded to nearest to nearest 10.

Figure 6 Changes in evening peak volumes in the Leeming to Barton study area



Note: Volumes are two-way average weekly traffic. The time periods used mirrored those of the appraisal's traffic model. Morning peak: 08:00-09:00; Interpeak: 07:00-08:00, 09:00-17:00, 18:00-19:00 (average hour); Evening peak: 17:00-18:00. Source: strategic road network: National Highways WebTRIS; automatic and link counts on local roads: commissioned by Atkins in May 2013 and July 2019. Figures rounded to nearest to nearest 10.

4.2.3. Was traffic growth as expected in the projects' business cases?

This section compares the observed traffic impacts of the projects to the changes forecast in their respective appraisals. First we'll outline the impact of the decision to split the original project along with other issues.

Impact of splitting the original project and other issues

The decision to split the original A1 Dishforth to Barton project impacted the appraisal of the two subsequent projects in different ways. Traffic modelling for the original project was undertaken in 2005. The model was not updated following the decision to proceed only with the southern section of proposed improvement, between Dishforth and Leeming. This meant its appraisal used traffic flow forecasts that assumed the entire extent of the A1 between Dishforth and Barton would be upgraded to motorway standard on opening, along with the other improvements.

For this evaluation, as for the one-year after evaluation,[26] only the forecasts from project's Environmental Statement (2006)[27] could be retrieved. These were produced for the 'optimistic' scenario.[28]

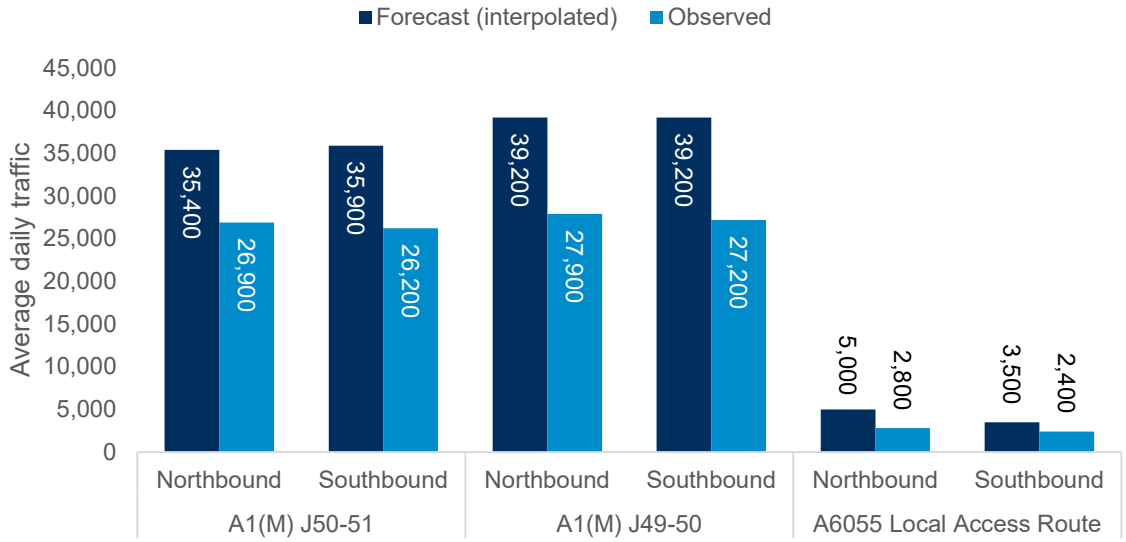
[26] A1 Dishforth to Leeming: One Year After Study, Highways England (July 2015)
[27] The only applicable traffic volumes forecasts that could be retrieved were from the Environmental Statement (ES) for the years 2010 and 2025. The Traffic Forecasting Report only contained trip matrix totals.
[28] DFT's transport appraisal guidance stipulates that a range of traffic forecasts for different growth scenarios should be developed (central/core, high, low growth) to consider the impact of uncertainty around input assumptions on demand forecasts, for example, new housing development or assumptions about supply side (source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/249189/webtag-tag-unit-m4-forecasting-and-uncertainty.pdf).

In contrast, when the decision was made to proceed with the Leeming to Barton project, the model for the original A1 Dishforth to Barton improvement was updated for its appraisal. It's purpose was to illustrate the traffic impacts of the improvement of the A1 between Leeming and Barton along with other improvements. It assumed the former project was complete and that the entire stretch between Dishforth and Barton would be upgraded to motorway standard. The project's appraisal forecasts could be obtained,[29] but comparisons were restricted to where observed traffic information was available, the Catterick South to Leeming section.

A1 Dishforth to Leeming

In an attempt to gain some insight we undertook interpolation of the forecasts.[30] However, as might be expected, the interpolated 'optimistic' forecast volumes were around 25% to 30% higher than those observed on the respective sections of the A1, and around 30% to 45% higher than those observed on the local access road A6055. Figure 7 shows the results.

Figure 7 Comparison of optimistic forecasts and observed volumes for selected project sections and A6055 local access road



Note: Forecast volumes interpolated to 2019 for best comparability with the observed. They were derived from the Do Something forecasts of the optimistic scenario. The observed volumes were made in 2019.
Source: National Highways WebTRIS; A1 A1 Dishforth to Barton improvement scheme Environmental Statement (March 2006). All figures are rounded to nearest 100.

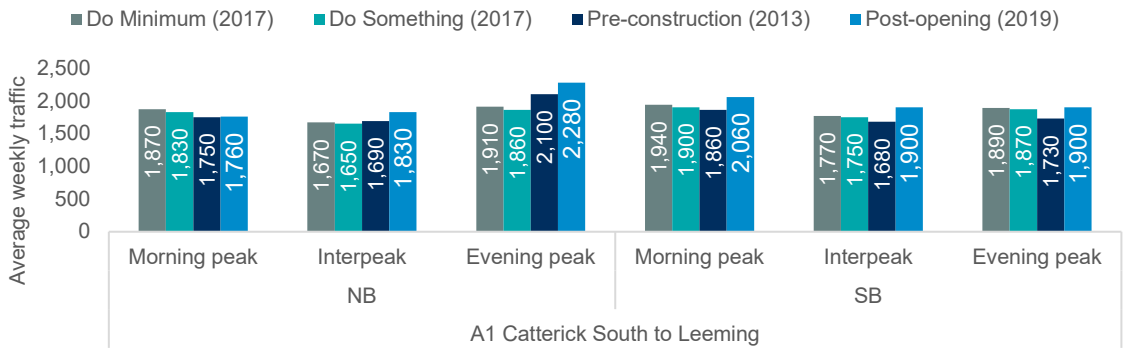
A1 Leeming to Barton

The appraisal expected traffic volumes would not change on most of the seven sections of the A1 within the project extent in the opening year. The Catterick South to Leeming section was one of only two sections where volumes were expected to fall slightly, by around 2%.[31] Between 2013 and 2019, volumes were observed to increase by between 10% and 13%. Figure 8 compares the respective volumes expected and observed on the section, while Figure 9 summarises the forecast and expected change.

[29] Forecasts were provided for the A1 Leeming to Barton project's opening year of 2017. This deemed close enough to the year of 2019, when post-scheme observations were made, that interpolation was not necessary.
[30] Interpolation is a statistical method to determine values between a pair of data points. In this instance, we used the linear interpolation formula in Microsoft Excel. In this instance, we used the Do Something forecasts for the years 2010 and 2025 to arrive at figures for 2019.
[31] Traffic volumes were also expected to fall slightly on the section between Barton and Scotch Corner to the north.

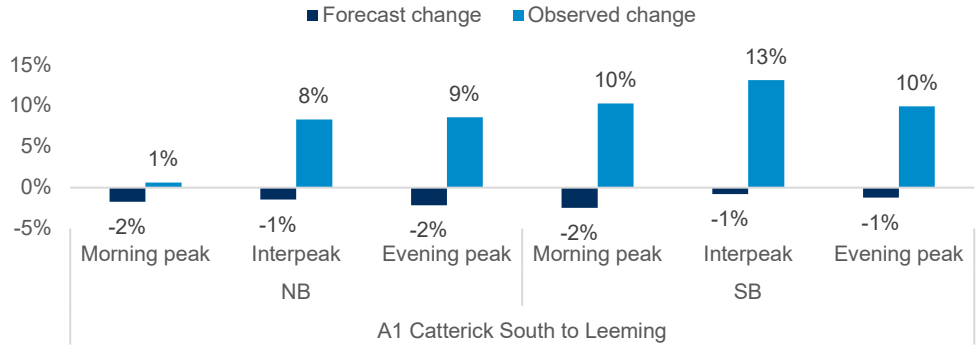
Due to the level of background growth that occurred between 2013 and 2018, it could be inferred that the project's improvements produced little extra growth on this section. Given the limited amount of information available, these results may not be representative of the changes across the whole project extent.

Figure 8 Forecast and observed average weekly traffic volumes



Source: Forecast data: A1 Dishforth to Barton Improvement Leeming to Barton Section Traffic Forecasting Report, Aecom (September 2013); Observed data: National Highways WebTRIS. Note: Figures rounded to nearest 10.

Figure 9 Forecast and observed change

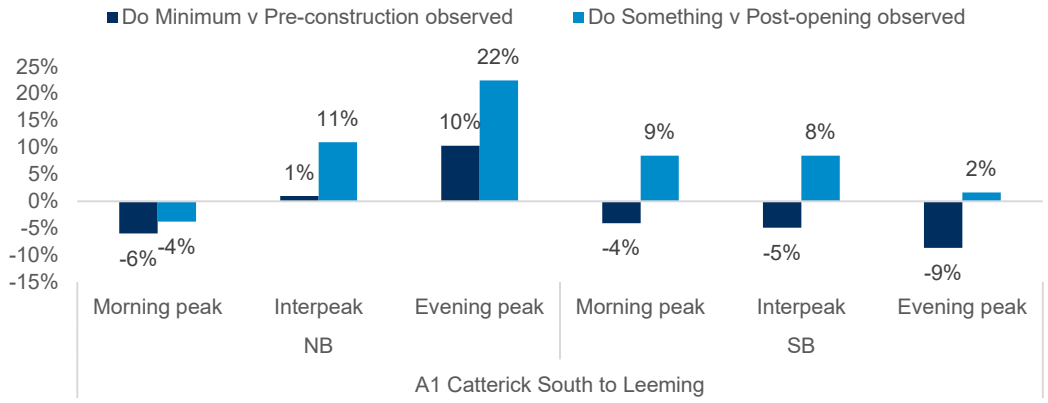


Source: A1 Dishforth to Barton Improvement Leeming to Barton Section Traffic Forecasting Report, Aecom (September 2013); National Highways WebTRIS.

The traffic model appeared reasonably accurate for the Catterick South to Leeming section. Comparisons of the differences between relevant forecasts and their observed equivalents[32] indicated the forecasts for the section were broadly within accepted ranges.[33] The exception was the forecast for the evening peak on the northbound carriageway. The results are shown in Figure 10.

[32] Do Minimum forecast volumes were compared to the pre-construction observed volumes and Do Something forecast volumes were compared to the post-opening volumes.
[33] Traffic models are usually deemed acceptably accurate if the forecast flows are within +/-15% of the observed flows used to validate the model.

Figure 10 Comparison of forecast and observed flows



Source: A1 Dishforth to Barton Improvement Leeming to Barton Section Traffic Forecasting Report, Aecom (September 2013); National Highways WebTRIS.

The appraisal generally expected that some users of local roads would reassign to the strategic road network following the project's improvements. Observations at most locations assessed indicated these expectations were generally correct (see Table 8 in Annex 1).

In terms of accuracy, the forecasts for the local roads were within the accepted ranges. While the changes and the variances were quite substantial, the actual volumes of traffic these represented were relatively small.

4.3. Relieving congestion and making journeys more reliable

Both projects had an objective to reduce congestion along the route. Also, the Dishforth to Leeming project had an objective to enhance journey time reliability, while the Leeming to Barton project had an objective to enhance journey times.

Both projects involved carriageway realignment which prevented the provision of satnav data. As such, assessment of the projects' respective journey time and reliability impacts could not be undertaken. We therefore calculated the route stress metric for each project to gain some understanding of their respective impacts on congestion, and infer their respective impacts on reliability.

4.3.1. Did the project reduce congestion?

The route stress metric is an alternative measure of congestion which involves calculation of congestion reference flow.[34] We calculated the congestion reference flows for the locations where information was available for both projects. Neither showed signs of congestion despite the higher post-project traffic volumes. These were positive results for reliability for both projects.

[34] Congestion reference flow is an estimate of the total annual average daily traffic (AADT) flow at which the carriageway is likely to be 'congested' in the peak periods.

5. Safety evaluation

The objectives for the A1 Dishforth to Leeming scheme were to reduce the "high level" of collisions. We expected that this would lead to a reduction in the loss of life and injuries resulting from transport collisions. Similarly, the objectives for the A1 Leeming to Barton were to reduce the "current level" of accidents.

5.1. Summary

A1 Dishforth to Leeming

Over the seven-year evaluation period, there was a reduction in the annual average number and rate of personal injury collisions[35] on the A1 between Dishforth and Leeming. Our analysis showed that these findings were statistically significant,[36] implying that the observed trend was not likely to be by chance.

There was an average reduction of 25 personal injury collisions each year. This was based on an annual average of 11 personal injury collisions after the project had opened compared with 36 before the project was constructed.

The annual average rate of personal injury collisions per million vehicle km had also improved over time, even against a trend of increasing volume of road users over this period. Before the project was constructed there was an annual average of one personal injury collision per 10 million vehicle km travelled. In the seven years after the project opened to traffic, this changed to an annual average of one personal injury collision per 37.1 million vehicle km travelled. This showed that over seven years after the project opened, there had been on average an additional 27.1 million vehicle km travelled on the route for every one personal injury collision. This result shows that there were less collisions as road users can travel further without an incident.

The severity of collisions had also reduced since the project opened. During the five years before the project was constructed there were in total seven fatal collisions, compared with a single fatal collision observed in the seven-year period after the project had opened to traffic. On average, there were 20 fewer collisions leading to slight injuries per year and four fewer collisions leading to serious injuries per year. When accounting for the increased number of road users over this period, there had been a reduction from 12.2 to 1.8 fatality equivalents[37] per billion vehicle km travelled, reducing the risk of a fatality equivalent by 10.4 for every billion vehicles km travelled.

A1 Leeming to Barton

During the first 12 months of the A1 between Leeming and Barton being opened, there were seven personal injury collisions compared with an average of 15 per year before the project was constructed. The annual average rate of personal injury collisions per million vehicle km had also improved over time. Before the project was constructed, there was an average of one personal injury collision per 25 million vehicle km travelled. In the year after the project opened to traffic, this

[35] A collision that involves at least one vehicle and results in an injury to at least one person.
[36] Based on chi squatted test using a 95% confidence interval.
[37] 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.

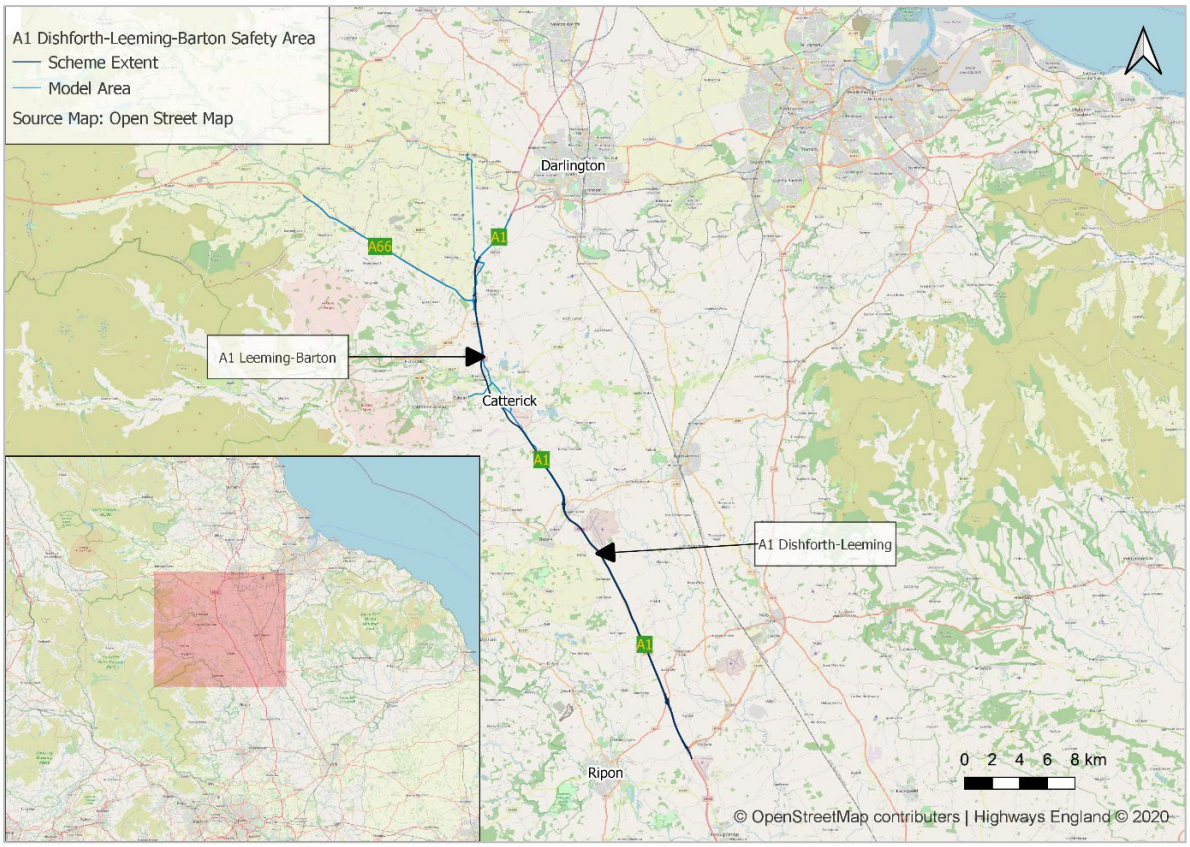
halved to one personal injury collision per 50 million vehicle km travelled. This result showed that there were fewer collisions and road users can travel further without being involved in a personal injury collision.

On the surrounding network,[38] there was a reduction of 36 personal injury collisions over the evaluation period. This is based on 13 personal injury collisions observed in the first 12 months after the project had opened compared with an annual average of 49 in the five years before the project was constructed. This reduction was statistically significant compared to the estimated annual average of between 30 and 69 personal injury collisions if the project had remained a dual carriageway. This indicates that the surrounding road network might have experienced an increase in personal injury collisions if the A1 between Leeming and Barton had remained a dual carriageway.

5.2. Safety study area

The safety study area, shown in Figure 11 was defined as the project extent on the A1 between Dishforth-Leeming-Barton. There was a wider area including adjacent roads on the local road network for the A1 Leeming-Barton project. This area was considered to allow us to determine the impacts the project has had on road user safety both on the project extent and the wider area.

Figure 11 Safety study area



Source: National Highways and OpenStreetMap contributors.

[38] The road network is determined as part of the appraisal process to understand changes to road safety on the scheme extent and roads which the scheme may have an impact.

5.3. What impact did the project have on road user safety?

A1 Dishforth to Leeming

There was a reduction in the number of personal injury collisions within the project extent. (Impacts on the wider area are discussed later in section 5.5).

Over the seven years after the project opened, there were on average 11 personal injury collisions per year, 25 fewer than the average 36 per year over the five years before the project was constructed. This has been based on collision data[39] from Department for Transport, and covers the following time periods:

- Pre-construction – 1 March 2004 to 28 February 2009 (Five years)
- Construction – 1 March 2009 to 31 March 2012 (Three years)
- Post-opening – 1 April 2012 to 31 March 2019 (Seven years)

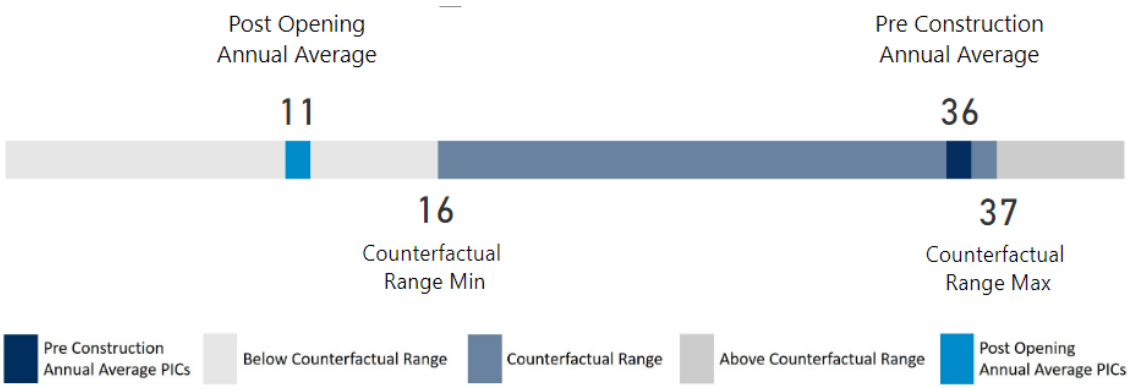
Overall, the numbers of personal injury collisions on UK roads have fallen over the past decade despite traffic volumes increasing. To establish whether the change in collision numbers was due to the project or influenced by wider regional trends, a counterfactual test was undertaken. The counterfactual test poses the question: what would have likely occurred without the project being implemented? To answer this question, we estimated the range of personal injury collisions that could have occurred without the project in place, accounting for numbers of road users, type of road and regional trends. A comparison can then be made between the counterfactual 'without scheme' scenario and the observed post-opening data which is the 'with scheme' scenario. A Chi Square test is used to develop a range. The Chi Square test uses the counterfactual and the observed number of personal injury collisions to establish whether the changes are significant or are likely to have occurred by chance.

In the counterfactual scenario, it is expected that there will be increased traffic flow and collision rates would remain stable. Also, the expected personal injury collisions[40] during the seven-year post scheme period ranged between 16 and 37 per year. As discussed above, an annual average of 11 personal injury collisions were observed over the seven-year post-opening period. This falls below the expected range in the counterfactual scenario (as illustrated in Figure 12). Therefore, the observed changes were statistically significant, implying that the decline in personal injury collisions could be attributed to the project.

[39] The collision data is based on records of PICs (that is, collisions that may involve injuries to one or more persons) recorded in the STATS19 data collected by the police when attending collisions. Collisions that do not result in injury are not included in this dataset and are therefore not considered in this evaluation.

[40] 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.

Figure 12 Observed and expected range of personal injury collisions



Data Source: STATS19: 1st March 2004 to 31st March 2019.

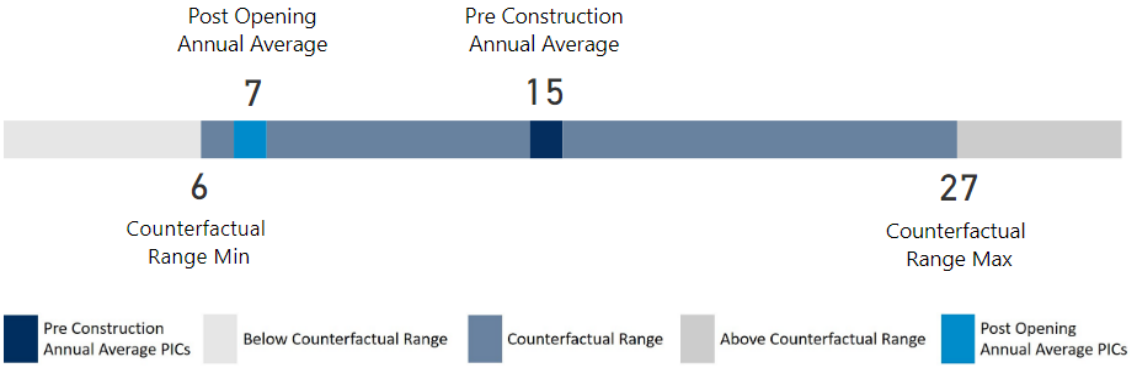
A1 Leeming to Barton

During the first 12 months after the project opened, there were an average of seven personal injury collisions per year, eight fewer than the average 15 per year over the five years before the scheme was constructed. This was based on collision data that covers the following time periods:

- Pre-scheme – 1 March 2009 to 28 February 2014 (Five years)
- Construction – 1 March 2014 to 28 March 2018 (Four years)
- Post-scheme – 1 March 2018 to 28 February 2019 (One year)

A counterfactual test was also undertaken. In this scenario, numbers of road users would have increased and collision rates would decrease. A range of between six and 27 personal injury collisions during the first-year post scheme period was expected. An annual average of seven personal injury collisions were observed over the 12 months after the scheme opened. This falls within the expected range as illustrated in Figure 13, so it can be concluded the reduction was not statistically significant and may not be solely due to the project. However, as the observed post-opening figure was at the lower end of the range, it suggested a positive effect in the first year after opening

Figure 13 Observed and expected range of personal injury collisions



Source: STATS19: 1st March 2009 to 28th February 2019.

5.4. How had the number of road users impacted on collision rates?

A1 Dishforth to Leeming

It is important to contextualise any incidents with the volume of traffic seen on the road. To do this a collision rate was calculated: the number of collisions per annual hundred million vehicle miles (hmvm).

The evaluation identified a decrease in the rate of collisions per hundred million vehicle miles.

Prior to the project, there was an annual average of 17.7 personal injury collisions per hundred million vehicle miles. After the scheme improvements were made there was a decrease to 4.8 personal injury collisions per hundred million vehicle miles. The rate of personal injury collisions had decreased by 13 personal injury collisions per hundred million vehicle miles.

The distance travelled before a personal injury collision occurred increased from 5.7 to 21.2 million vehicle miles, indicating that that there were fewer collisions, as vehicles can travel further without an incident.

A counterfactual test was undertaken. It found that the collision rate would likely have been 11.6 personal injury collisions per hundred million vehicle miles in the counterfactual scenario. This indicates that there would be a decrease in the rate that collisions occur. Taking into account the change in numbers of road users, the scheme appeared to be improving the safety performance of the road.

A1 Leeming to Barton

Prior to the project, there was an annual average of 6.6 personal injury collisions per hundred million vehicle miles. After the scheme improvements were made, there was a decrease to 2.5 personal injury collisions per hundred million vehicle miles. The rate of personal injury collisions had decreased by 4.1 personal injury collisions per hundred million vehicle miles.

The distance travelled before a personal injury collision occurred increased from 15.2 to 39.4 million vehicle miles, indicating that that there were fewer collisions, as vehicles can travel further without an incident.

A counterfactual test was undertaken. It found that the collision rate would likely have been 5.6 personal injury collisions per hundred million vehicle miles in the counterfactual scenario. These early indications suggest the project has had a positive effect, however, further years of data are required to confirm the project has met the safety objectives.

5.5. How have safety trends changed on other parts of the strategic and local road network?

Changes in personal injury collisions in the wider impact area were analysed for the A1 Leeming to Barton project. The wider area was defined in the scheme's appraisal – where the evidence for the value of a scheme is assessed ahead of a decision to deliver an intervention. More detail on the study area can be found in section 5.2 Safety study area. The expected safety benefits on the wider area as a consequence of the A1 Dishforth to Leeming project cannot be considered at this

stage but will be considered in the future as part of the five years after A1 Leeming to Barton report.

A1 Leeming to Barton

During the first 12 months after the project opened, there were 13 personal injury collisions in the wider study area. This was 36 fewer than the average 49 per year over the five years before the scheme was constructed. It is estimated that if the route had remained a dual carriageway (without the project improvement) the estimated safety trends across the wider area would have been between 30 and 69 personal injury collisions per year. This indicates that the enhancement of the project could be having a positive impact on the safety of the surrounding road network as anticipated within the project's business case. However, more evidence is required before it is possible to conclude whether the anticipated safety benefits across the wider safety area are likely to be realised.

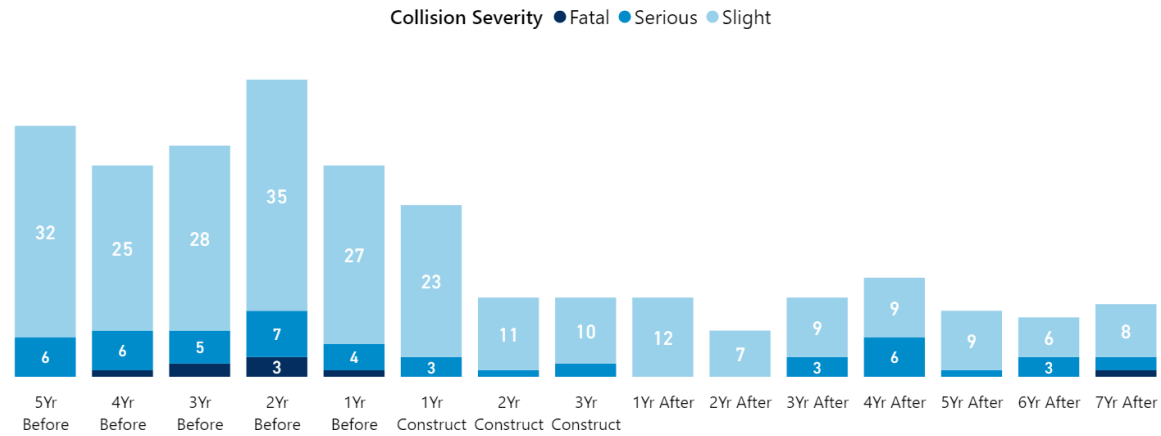
5.6. What impact did the project have on the severity of collisions?

A1 Dishforth to Leeming

Personal Injury Collisions which result in injury are recorded by severity as either fatal, severe or slight. It should be noted that collision severity has been presented using unadjusted information[41].

The evaluation found that, after the project, there were an average of 20 fewer personal injury collisions resulting in slight injuries per year (the annual average before the project was 29, compared to nine after) and four fewer collisions resulting in serious injury per year as shown in Figure 14 (the annual average before the project was six, compared to two after). There was a total of one fatal incident recorded in the seven years after the project opened (with a total of seven in the five years before the project), which shows the severity of personal injury collisions.

Figure 14 Severity of personal injury collisions within the project extent



Source: STATS19: 1st March 2004 to 31st March 2019.

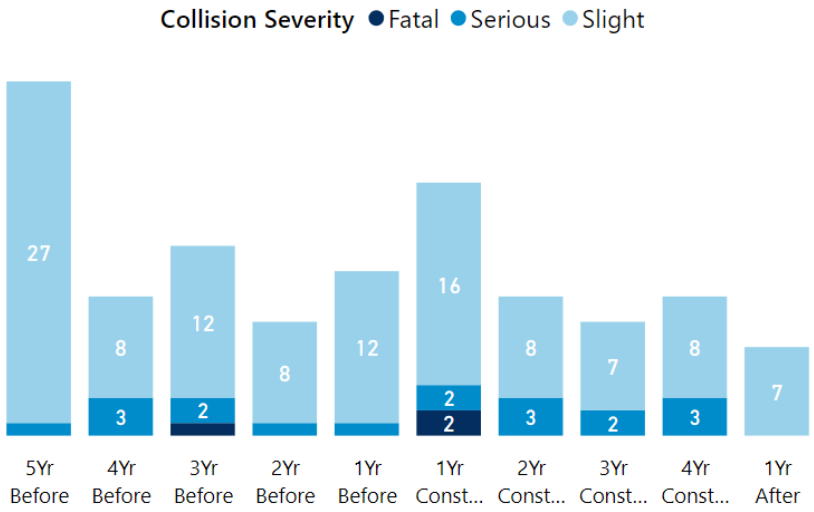
[41] Unadjusted data refers to collisions severity that was determined by the recording police officer and has not been altered. See Annex 2.

A1 Leeming to Barton

It should be noted that collision severity has been presented using unadjusted information.

The evaluation found that, after the project, there were an average of six fewer collisions resulting in slight injuries per year (the annual average before the project was 13, compared to seven after). There have been no serious or fatal collisions observed post opening (in the five years before the project, there was a total of eight serious collisions and one fatal collision). Figure 15 shows the severity of personal injury collisions.

Figure 15 Severity of personal injury collisions within the project extent.



Source: STATS19: 1st March 2009 to 28th February 2019.

5.7. How had the number of road users impacted collision severity?

A1 Dishforth to Leeming

To understand the impact of the increased traffic flow on collision severity, a fatalities and weighted injuries index (FWI Index) can be used. The FWI Index[42] is a combined measure of incidents adjusted for severity based on the number of fatal, serious and slight incidents as weighted proportions.

The combined metric (FWI/BnVKm) is used to standardise the collision categories against flow to show the likelihood of a fatality equivalent occurring per billion kilometres travelled.

Before the project, there was a fatality equivalent every 82 million vehicle km travelled (average of 1.0 billion vehicle km/12.2). Following the project improvements, there was a fatality equivalent every 563 million vehicle km travelled (average of 1.0 billion vehicle km/1.8). This was an observed reduction of 10.4 fatality equivalents for every billion vehicle kilometres travelled or an extra 481 million vehicle km travelled before a fatality equivalent occurs.

[42] 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.

A1 Leeming to Barton

To evaluate the changes in severity of incidents on the project, we require three years of data. For this reason, we exclude this metric until the five-year after evaluation.

5.8. Have the projects safety objectives been met?

A1 Dishforth to Leeming

The projects safety objective was to reduce the frequency of collisions. We expected that this would lead to a reduction in the loss of life and injuries resulting from transport collisions.

The analysis showed that personal injury collisions and rates had decreased. There has also been a decrease in the severity of collisions and casualties suffered after the project became operational. Testing of the results indicated that we could be confident that the changes observed can be attributed to the project.

A1 Leeming to Barton

The early indications were that the safety objective was on track to be achieved. Collisions were reducing at a time where congestion was being released and traffic was moving quicker in some time periods. The analysis will need to be revisited in later years before we can be sure that the change is significant. It will require a longer timeframe to determine if these initial positive findings are a real trend or natural fluctuation.

6. Environmental evaluation

6.1. Summary

The evaluation of environmental impacts used information on the predicted impacts gathered from the Transport Analysis Guidance (TAG) environmental appraisal summary table (AST) and the environmental assessment report (EAR). For the A1 Dishforth to Leeming project, the findings of the one-year after opening evaluation[43] were also used.

This information was then compared with findings obtained after the projects had opened for traffic. For the A1 Dishforth to Leeming, this was at seven years after opening and for the A1 Leeming to Barton, one year after opening. Observed impacts were determined during a site visit in June 2019, supported by desktop research. The results of the evaluation were recorded against each of the TAG environmental sub-objectives and presented in Table 8 for A1 Dishforth to Leeming and Table 9 for A1 Leeming to Barton. For A1 Leeming to Barton, the society sub-objectives of physical activity, journey quality and severance were included.

A1 Dishforth to Leeming

The seven-years after evaluation highlighted that most of the impacts on the environmental appraisal sub-objectives were better than expected or as expected. However, not all of the biodiversity mitigation was implemented as expected in the business case. The outcome for biodiversity, which was predicted to be slight adverse, was worse than expected.

- Noise and air quality were likely to be better than expected due to lower than predicted numbers of road users.
- Landscape and townscape impacts were broadly as expected, although slow tree growth in some places and the presence of weeds in many planting plots may mean the design outcome would be delayed beyond year 15. At one year after, the bund at Oak Tree underpass looked out of context in the landscape and this remained the case at seven years after. However the tree planting there was beginning to soften its outline which should, in time, improve its appearance.
- Biodiversity impacts occurred broadly as expected, however the evidence suggested that not all the mitigation proposed was delivered or maintained. The mammal tunnel near Hergill balancing pond which was proposed in the environmental masterplan was not built and the grassland habitat for great crested newts at Scot Lane had not been maintained as expected. Overall, the outcome was worse than expected.
- No environmental asset data was submitted onto the National Highways environmental asset system (EnvIS). The absence of good asset data may affect on-going asset management.

A1 Leeming to Barton

The one-year after evaluation highlighted that most of the impacts on the environmental appraisal sub-objectives were either as expected or considered to

[43] https://www.gov.uk/government/publications/pope-of-major-schemes-a1-dishforth-to-leeming-improvement

be too early to say. For physical activity, the impact was considered to be better than expected.

- Landscape, townscape and biodiversity impacts were broadly as expected but limited evidence of maintenance was observed. Effective maintenance is essential for good establishment. This means it was too early to confirm with confidence that the design year outcomes would be met.
- The construction of the A6136 Catterick Road overbridge faced significant cultural heritage and engineering challenges during construction and resulted in many different materials and finishes being used. The constraints were acknowledged but there are likely to be design lessons to be learnt from this structure which could help improve future projects.
- For Physical Activity, adverse impacts were predicted in the AST. There was some uncertainty in the appraisal information supporting this outcome, but the construction of a new bridleway and new cycling provision suggested that the overall outcome was better than expected.

6.2. Noise

A1 Dishforth to Leeming

The 2006 environmental appraisal reported that there would be an overall improvement in noise levels. This assumed the project would include low noise surfacing throughout. It was expected that one location would be exposed to a substantial increase in noise levels however there were no details within the AST to indicate where that one location would be.

Our evaluation confirmed that a low noise surface was laid along the project and the three proposed noise barriers were installed. No noise monitoring was undertaken as part of our evaluation, but the barriers observed during the site visit appeared to be in good condition. Traffic data was analysed which indicated that flows were between 24% and 27% lower than forecast. This is more than the 20% threshold used to indicate an improvement. The proposed mitigation had been installed and as the flows were lower than forecasted, the impacts were considered to be better than expected.

A1 Leeming to Barton

The 2014 environmental appraisal reported that unmitigated, adverse and beneficial impacts would occur due to the road alignment passing closer to some residential properties and further away from others. In addition, beneficial impacts were predicted on some roads in the study area due to reductions in numbers of road users. The Environmental Statement reported that low noise surfacing would be laid along the project and new noise barriers provided to mitigate the impacts. Overall, the appraisal predicted 78 fewer people would be seriously annoyed by the project by the design year.

Our evaluation confirmed that the new noise barriers had been provided. No noise monitoring was undertaken but the barriers appeared to be in good condition and certification was provided to confirm their performance. It was understood that a low noise surface had been laid but asset data had not been updated at the time so could not be confirmed. This should be checked during the five-year after evaluation. Traffic data was analysed for those sections of the project where

forecast and observed data was available. The observed flows were higher than forecast but still lower than the 25% increase threshold which would have indicated a worsening in noise impacts. The proposed mitigation appeared to have been installed and, as the observed flows were broadly as expected, the impacts were considered to be as expected

6.3. Air quality

A1 Dishforth to Leeming

The 2006 environmental appraisal stated that 14 properties were expected to be demolished. The project was not predicted to create or remove exceedances of the air quality strategy objectives and would not affect air quality within any air quality management areas. All predicted concentrations for PM_{10}[44] and NO_2[45] were predicted to be below 40 µg m³ thresholds. No significant effects were predicted, and no specific mitigation was proposed.

Our evaluation confirmed that there were no air quality management areas (AQMA[46]) along the project and no monitoring data to suggest that there were any air quality issues. Traffic data was analysed which showed that observed flows were between 24% and 27% lower than forecasts This equated to annual average daily flows (AADT) of between 18,000 and 23,000 vehicles lower. This was greater than the 1,000 AADT flow change that would suggest that impacts are better than expected. As the flows were lower than expected, the impacts were considered to be better than expected.

A1 Leeming to Barton

The 2014 environmental appraisal reported that a net improvement in air quality would be experienced at a local level. More properties were predicted to experience an improvement than a deterioration in air quality. However, at a regional level, a deterioration in air quality was predicted with an overall increase in NO_x[47] and PM_{10} emissions. The reason reported for this was due to the increase in speeds on the A1. The Environmental statement reported that air quality within the vicinity of the project met national air quality objectives and no AQMA had been declared. No significant environmental effects were predicted.

Our evaluation confirmed that there were no AQMAs along the project. There was no monitoring data to suggest that that there was an air quality issue along the project. Traffic data was analysed for those sections of the project where forecast and observed data was available. This showed some sections where observed total flows were more than 1,000 (1,116) higher than forecast and others where they were more than 1,000 (9,328) lower. The data also showed that observed HGV flows were between 1,100 and 1,500 higher than forecast. This was above the 200 flow change which would indicate emissions would be worse than expected.

Predicted changes in air quality reported in the Environmental Statement were reviewed to examine what these changes in flows might mean and to help overcome some of the limitations caused by not having traffic data for all sections of the project. The highest predicted concentration at a sensitive receptor with the

[44] Small particles in the air with diameters less than 10 microns.
[45] Nitrogen dioxide – an important pollutant associated with traffic emissions.
[46] Locations where a local authority believes the air quality objectives may not be met. https://uk-air.defra.gov.uk/aqma/
[47] The different oxides of nitrogen found in traffic emissions.

project was 29µg m³ which is below the UK air quality standard of 40µg m³. Although emissions based on traffic flow changes may be higher along some sections of the project than predicted, they were lower along others. Overall, we considered that there was a low risk that the changes in emissions due to the project would lead to a new exceedance of the air quality standards or change the outcome of the environmental assessment. Overall, the outcome was still considered to be not significant and so was as expected.

6.4. Greenhouse gases

The Environmental Statement for the A1 Dishforth to Leeming forecast a net increase of 18,359 tonnes of carbon dioxide (CO_2). This forecast was for the original project extent from Dishforth to Barton, its study area, and only for the opening year. No figure specifically for the A1 Dishforth to Leeming is available. The 2006 environmental appraisal forecast stated that "the change in emissions is primarily as a result of the predicted increase in average vehicle speed due to the road improvement". No quantitative forecasts were presented in the appraisal.

The 2014 environmental appraisal for the A1 Leeming to Barton project reported that the project would result in an increase in carbon (CO_{2e}[48]) emissions across the study area of 122,955 tonnes over the 60 year appraisal period. The reason for this increase was due to the anticipated changes in vehicle speeds on the A1(M).

The POPE methodology manual sets out an approach for evaluating the carbon emissions along the projects. It recognises that it is not possible to make a direct comparison between predicted and observed carbon emission. This is because the appraisal is based on the entire modelled area over 60 years whereas, at evaluation, traffic information for the whole study area is not usually available. Instead we used the 2019 forecast and observed traffic data to estimate a reforecast and an observed 2019 carbon emission just for the project extent with the projects in place (do something – DS). These are shown in Table 4 below. For Dishforth to Leeming, this was the emission in year seven after opening, and for Leeming to Barton, at year one but only for part of the project as we had insufficient traffic data between Catterick and Scotch Corner to calculate and compare emissions. The Defra emission factor toolkit v9 was used. [49]

Table 4 Re-forecast and observed carbon emission

Project	Reforecast Do Something (CO_2 tonnes)	Observed (CO_2 tonnes)
Dishforth to Leeming	155,000	104,000
Leeming to Barton	57,000	60,000

Note: The figure for Leeming to Barton is only the Leeming to Catterick and Scotch Corner to Barton sections as there was insufficient data for the Catterick to Scotch Corner section for forecast and observed emissions to be calculated.

This approach has limitations as it doesn't consider traffic changes and the emission changes that would result along the wider network and so can be affected by issues such as reassignment. Whilst it generates a CO_2 figure, this figure

[48] This is a consistent measure of assessing the contribution of greenhouse gases to global warming.
[49] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

cannot be compared against the appraisal but can give some indication of the accuracy of the forecast along the particular section of the appraised project.

From the available traffic data and the calculated emissions, we concluded that observed emissions along the A1 Dishforth to Leeming were lower than forecast due to the lower than forecast numbers of road users. For the A1 Leeming to Barton observed emissions along those sections for which we had data are higher than forecast due to the higher than forecast HGV flows. However, overall, when you compare the combined emissions where we have data for the two projects, the emissions were lower than forecast.

6.5. Landscape

A1 Dishforth to Leeming

The 2006 environmental appraisal stated that the widened road corridor and introduction of vertical elements into the landscape would alter the locally valued landscape character. This would have a negative impact. There would be an overall beneficial effect on visual amenity due to a net increase in vegetation cover. The impact overall was assessed as Slight Adverse.

Our evaluation confirmed that the predicted impacts of the project had arisen and the widened road had become a more prominent feature within the landscape. Earth bunds and mitigation planting had been created to help integrate the road into the landscape and to help screen views of the new infrastructure from nearby properties. Planting across the project appeared to be developing well, although there were some areas where growth was stunted and there was little sign of recent maintenance. The problems reported during the one-year after evaluation at Gatenby bridge appeared to be improving with planting beginning to develop more effectively. At one year after, the earth bund created at Oak Tree underpass was reported to present an unsympathetic shape in the landscape although it was considered that by the design year the planting would have helped soften the unnatural shape. At seven years after, the planting had begun to establish and whilst the bund was still prominent, its shape was beginning to soften.

Figure 16 Landscape bund at Oak Tree underpass OYA

Source: Site visit 2014.

Figure 17 Landscape bund at Oak Tree underpass 7YA

Source: Site visit 2019.

Overall, we considered that provided an effective maintenance regime was maintained, the impacts at design year would be as expected.

A1 Leeming to Barton

The 2014 environmental appraisal reported that the project would adversely affect the local landscape character. This was because the new A1 and local access road would widen the road corridor, add new vertical elements such as signs and gantries, remove mature vegetation and trees and change local field patterns. After mitigation was provided, this would lead to a slight adverse impact.

Our evaluation found that the impacts were broadly as expected. The widening of the A1 and construction of the new local access road had created new vertical elements in the landscape and had added to the urbanisation of the existing route corridor. There had been loss of agricultural land and impacts to field boundaries especially in areas where the A1 and the local access route had diverted from the alignment of the original A1. Properties close to the project had experienced adverse visual impacts, especially through Brompton-on-Swale where significant vegetation clearance had taken place. Mitigation had been incorporated into the project and examples of false cuttings/earth mounds, screen fencing and planting was observed. One gantry at Brompton-on-Swale had been moved and we considered that it may provide a better than expected outcome at this location. Limited evidence of recent maintenance was seen, which was a concern, as it could affect the establishment of the mitigation planting. For this reason, we considered it was too early to say whether the design year outcome would be met. This should be reconsidered at five years after when the mitigation will have had an opportunity to establish.

6.6. Townscape

A1 Dishforth to Leeming

The 2006 environmental appraisal reported that the scattered rural villages, which were set back from the A1, and towns close to A1 were typical of the area. New junctions and a loss of mature trees would redefine the limits of towns and their sense of scale and would have an adverse impact upon views. Rural villages would not be affected. The impact overall was assessed as slight adverse.

Our evaluation found that the impacts were broadly as expected with the new junctions and loss of mature vegetation adding to the sense of scale of the A1. The additional lighting at Gatenby bridge did bring an urban element to the location through increased exposure to nighttime light. The one-year after report concluded that the increased lighting did not affect the impact for townscape. At seven years after, this remained the case and, as mitigation planting develops, the impact will continue to reduce. Overall, we consider the impacts were as expected.

A1 Leeming to Barton

The 2014 environmental appraisal reported that in the year of opening, there would be moderate adverse effects on a small number of residential properties. This was due to the land take associated with the Catterick junction and the impact on appearance due to the loss of mature trees adjacent to Brompton-on-Swale. By the design year, it was predicted that only slight adverse visual impacts would remain.

Our evaluation found that the impacts were broadly as expected and, as predicted, limited principally to the urban areas around Brompton-on-Swale. The loss of mature vegetation had opened up views from residential areas and had altered the sense of place, but mitigation planting was in place. As mentioned in the landscape section, there was limited evidence of recent maintenance. This was a concern as it could affect the establishment of the mitigation planting. For this reason, we considered it is too early to say whether the design year outcome would be met. This should be reconsidered at five years after when the mitigation will have had an opportunity to establish.

6.7. Heritage of historic resources

A1 Dishforth to Leeming

The 2006 environmental appraisal predicted that there would be slight adverse visual impacts on several listed buildings and direct adverse impacts on the schedule ancient monument at Healam Bridge. There would be direct adverse impacts on several other sites and buildings of local and regional importance. The appraisal reported that the project would be damaging to nationally significant heritage assets, but that adequate mitigation would be implemented. The impact overall was assessed as moderate adverse.

Our evaluation confirmed that the issues with the encroachment of brambles on Healam bridge, which were identified at one year after, had been removed. This should help improve the condition of the structure and its future viability. The impacts to the Roman settlement at Healam bridge had occurred as predicted, but archaeological studies were undertaken as expected and the proposed booklet and academic papers had been produced. These provide context to what was discovered during the archaeological studies. Traffic on the local access road continued to have an impact on the setting of a few listed buildings along the route but some had improved because of the A1 moving heavy traffic further away. Overall, the outcome of the evaluation was that the impacts were broadly as expected.

A1 Leeming to Barton

The 2014 environmental appraisal reported that there would be moderate adverse impacts on Bainesse and Cataractonium scheduled monuments. There would also

be minor positive effects on the setting of one listed building and a range of minor and moderate adverse impacts on cultural heritage assets of mostly local importance. Mitigation would be implemented including optimising the route alignment, archaeological investigations and new screen planting. Overall, the impacts after mitigation were predicted to be moderate adverse.

Our evaluation found that field studies, which formed the archaeological mitigation, were undertaken at both Bainesse and Cataractonium scheduled monuments. The finds are to be deposited with the Yorkshire Museum in York and the findings of the investigations are to be published. A report on Death, Burial and Identity[50] was available from York University and a popular booklet on the discoveries (A1 Leeming to Barton archaeological discoveries 2018[51]) had been published. Further publications were expected. The realignment of the A1 and new planting had moved heavy traffic away from the Grade II listed Oak Grange which had helped reduce the impacts of the road on its setting. Overall, we considered that the impacts were as expected, but this will need to be confirmed at five years after, when all the proposed archaeological publications are expected to have been published.

6.8. Biodiversity

A1 Dishforth to Leeming

The 2006 environmental appraisal reported that there would be adverse impacts on a site of interest to nature conservation, locally important habitats and protected wildlife species. This would include badger, otter and great crested newt (GCN). The impacts would be due to the loss of terrestrial habitat along the highway verge and in adjacent land, and to the disturbance of wildlife species. Mitigation would be implemented including a new mammal tunnel, new habitats including new terrestrial habitats for GCN, the creation of ponds and species rich grasslands. The impact overall was assessed as slight adverse.

Our evaluation confirmed that the impacts were broadly as expected with loss of habitats along the project apparent. New planting and habitat creation had taken place including new ponds at Gatenby and mitigation provided including wildlife fencing and a new otter ledge. However, there was little evidence that areas of species-rich grasslands had been maintained, with many overgrown and containing weeds. The proposed mammal tunnel at Hergill balancing pond was not found and the GCN habitat at Scot Lane was overgrown with brambles and nettles suggesting additional maintenance was required. Whilst the impacts were broadly as expected, the absence of some of the proposed mitigation and limited maintenance led us to conclude that the outcome for biodiversity was worse than expected.

[50] https://www.york.ac.uk/archaeology/news-and-events/news/external/news-2019/death-and-burial-book/
[51] https://assets.highwaysengland.co.uk/roads/road-projects/a1-leeming-to-barton/A1+Leeming+to+Barton+archaeology+brochure.pdf

Figure 18 Scot Lane GCN pond and habitat July 2019

Source: Site visit 2019.

A1 Leeming to Barton

The 2014 environmental appraisal reported that no nationally important sites would be affected during construction or operation of the project. Slight adverse impacts on a site of interest to nature conservation, locally important habitats and notable species (brown hare/deer) due to permanent habitat loss would occur. With mitigation in place including new planting and habitats, neutral impacts on protected species were predicted. The appraisal also reported slight beneficial effects on ponds, as these will be managed/enhanced. Overall the impacts to biodiversity by the design year were anticipated to be slight adverse.

Our evaluation confirmed that the predicted impacts had occurred, and the proposed mitigation was in place. Great crested newt monitoring suggests the mitigation had been successful and new habitats including hedgerows were beginning to establish. Further monitoring is required before conclusions can be drawn on the success of the bat mitigation and the establishment of the new species-rich grassland. During the 2019 site visit, there was little evidence of recent habitat management. An effective maintenance regime will be essential for ensuring that mitigation establishes. For this reason, we concluded that it was too early to say with confidence whether the outcome for biodiversity would be met. This issue will be reconsidered at five years after when we should see the outcome of on-going maintenance and additional species monitoring.

6.9. Water environment

A1 Dishforth to Leeming

The 2006 environmental appraisal reported that, with mitigation, the project would have a neutral impact on flood risk and beneficial impacts on water quality. This was due to the introduction of positive drainage features along the project and the introduction of new treatment facilities for road runoff where previously there had been none. Overall, the impact was considered to be neutral.

Our evaluation confirmed the findings reported at one year after. The mitigation proposed including the new drainage network and new balancing ponds were in place and appeared to be functioning correctly. The balancing ponds were heavily vegetated with reeds but this was a design requirement of the RAF in order to limit bird use and potential impacts on passing aircraft. Overall, we considered the impacts were as expected.

A1 Leeming to Barton

The 2014 environmental appraisal reported that the project would provide slight beneficial impacts on the water environment. This was due to the introduction of new treatment and containment facilities resulting in greater protection of surface and groundwater. The appraisal reported that the design of the drainage network would ensure no significant impact on flood risk. Overall, a slight beneficial impact was predicted.

Our evaluation confirmed that the predicted impacts had occurred broadly as expected. New balancing ponds had been provided to manage drainage from the additional impermeable road surface and to provide improved treatment of the road runoff. Detailed design drawings were not available at the time but the drainage network appeared to be in place and functioning as expected. Emergent planting at Angleham balancing pond had failed and the replacement planting had yet to establish. The RAF requested that Standing Stone balancing pond be vegetated to minimise bird use. Planting was in place but Typha Latifolia was noted and it is unclear whether this species was in the approved planting mix. This species can spread rapidly reducing species diversity so should be removed if its use was not specified. Overall, we considered the impacts were as expected.

6.10. Physical activity

A1 Dishforth to Leeming

Physical activity is only evaluated at one year after and not usually updated unless significant issues were identified. No significant outstanding issues remained following the one year after and so an updated evaluation for A1 Dishforth to Leeming was not considered necessary.

A1 Leeming to Barton

The 2014 environmental appraisal reported that 11 public rights of way (PRoWs) would be stopped-up due to the project, reducing opportunities to cross the existing dual carriageway. It reported that the project would instead provide three new safe crossing locations and new non-motorised user (NMU[52]) facilities along the local access route. These would provide a new north-south route, linking up PRoWs and providing new circular leisure routes. This would encourage NMU use on routes not currently used on safety grounds. The appraisal however reported that overall there would be slight adverse impacts. The worksheets supporting the appraisal indicated the new facilities would provide beneficial impacts to NMU, so there is some uncertainty with the adverse appraisal score reported.

Our evaluation confirmed that new NMU facilities had been provided. This included new pavements, signage, equestrian parapet at Catterick road overbridge and a new bridleway near Scurragh house. The local access road that runs parallel to the

[52] NMU – non-motorised users such as pedestrians, cyclists and equestrians.

A1 had wide grass verges and, as strategic traffic now uses the new improved A1, it provided a safer environment for NMUs than previously existed. NMU surveys were not undertaken but the new facilities and local access road should provide a better environment and so more opportunities for physical activity. We considered these impacts were beneficial and overall better than expected.

6.11. Severance

A1 Dishforth to Leeming

Severance is only evaluated at one year after and not updated unless significant issues were identified. No significant outstanding issues remained following the one-year after evaluation and so an updated evaluation for A1 Dishforth to Leeming was not considered necessary.

A1 Leeming to Barton

The 2014 environmental appraisal reported that the existing A1 already caused significant severance especially for NMUs. The project would sever 11 public rights of way (PRoWs) but these would be mitigated with either safe crossings at bridges or diversions to safer crossing locations. The impacts would be both positive and negative as some diversions would be longer increasing severance whereas some would be safer and so reducing severance. The segregated NMU facility on the local access route would also provide a north-south route, improving PRoW connections and support access to circular leisure routes. Overall, the appraisal reported that the outcome would be slight adverse.

Our evaluation confirmed that new severance had occurred where PROWs have been diverted and journeys increased. New facilities such as bridleways, new pavements and higher parapets on bridges had been provided making journeys safer and reducing severance in other areas. The new local access route had lower numbers of road users than the A1 and wide verges which were likely to make the environment for NMUs feel safer, trips more attractive and help alleviate severance further. Based on the qualitative information available, we considered that, on balance, the impacts were as expected.

6.12. Journey quality

A1 Dishforth to Leeming

Journey quality is only evaluated at one year after and not updated unless significant issues are identified. No significant outstanding issues remained following the one-year after evaluation and so an updated evaluation for A1 Dishforth to Leeming was not considered necessary.

A1 Leeming to Barton

The 2014 environmental appraisal reported that the project would enhance vehicle travellers' journeys by providing better information, reducing route uncertainty and driver frustration and reducing the fear of accidents. The impact on drivers' views would be neutral but the removal of laybys and some services would have an adverse effect on traveller facilities. Overall, the project would provide large beneficial effects for road users.

Our evaluation confirmed that new signage had been provided which would improve driver information and reduce route uncertainty. The additional lane on the A1, improved road alignment and the new local access road had added capacity and removed conflicts between strategic and local traffic. It had also reduced interactions between faster and slower moving traffic which should reduce overall driver frustration. Roadside facilities such as laybys had been removed but some facilities were still accessible at junctions. Driver views overall had remained unchanged, however the variety of materials and design elements at the reconstructed Fort Bridge on Catterick Road had created an increased sense of urbanisation and had affected views for road users.

Cultural heritage in the area created significant constraints but it is unclear how these were balanced with good environmental design. National Highways principles on good environmental design, which were published[53] after this project was constructed, should help ensure similar constraints are managed more sympathetically in the future. Although the design of Fort Bridge detracts from drivers' views and roadside facilities have been lost, we considered the large beneficial effects predicted were likely to still be as expected.

Figure 19 Fort Bridge Catterick Road July 2019 – north side

Source: Site visit 2019.

[53] The Road to good design:Highways England's design vision and principles. March 2018

Figure 20 Fort Bridge Catterick Road July 2019 – south side

Source: Site visit 2019.

6.13. Overview

The results of the evaluation are summarised against each of the Transport Appraisal Guidance (TAG)[54] environmental sub-objectives and presented in Table 5 for A1 Dishforth to Leeming and Table 6 for A1 Leeming to Barton.

Table 5 Environmental Impacts – A1 Dishforth to Leeming

Sub-objective	Appraisal Score	7YA Evaluation	Summary
Noise	Not available	Better than expected	The route has now been upgraded to motorway standard. Observed numbers of road users along the route were between 24% and 27% lower than forecast. As a result of these lower than forecast flows, impacts were likely to be better than expected.
Air Quality	Not available	Better than expected	The route has now been upgraded to motorway standard. Observed numbers of road users along the route were between 24% and 27% lower than forecast. As a result of these lower than forecast flows, impacts were likely to be better than expected.
Greenhouse gases	Slight adverse.	-	Greenhouse gas emissions are lower than forecast along the A1 Dishforth to

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

	No quantitative figure given		Leeming project. This was likely to be due to lower than forecast overall numbers of road users and %HGVs. In the absence of data for the entire traffic model area, it was not possible to comment on the total emissions of the project itself.
Landscape	Slight adverse	As expected	The evaluation confirms that the planted areas continue to develop and will continue to provide improved screening of the A1 and help integrate it into the surrounding landscape. However, whilst the design year outcome should still be met, appropriate maintenance did not appear to have taken place. This could delay the delivery of the design year outcome beyond year 15.
Townscape	Slight adverse	As expected	The mitigation planting continues to grow which should help screen the A1, minimising impacts to local townscape features. Lighting including at Gatenby, was likely to remain visible but its impact should reduce over time.
Biodiversity	Slight adverse	Worse than expected	The impacts were largely as predicted but the absence of the Hergill mammal tunnel indicates that not all of the proposed mitigation was delivered. The GCN pond at Scot Lane had not been maintained as set out in the HEMP[55] so was unclear if this mitigation had been delivered successfully.
Heritage of historic resource	Moderate Adverse	As expected	Impacts were broadly as expected and maintenance had improved at Healam Bridge SAM. The archaeological finds had been deposited at York Museum and the findings of the studies had been published in a popular booklet and an academic report.
Water Environment	Flood risk neutral water quality	As expected	The one-year after evaluation confirmed that the drainage mitigation was provided as expected. At seven years after this remained the case and, based on the site visit, it appeared to be functioning correctly. Maintenance,

[55] HEMP – Handover Environmental Management Plan. Sets out the expected long-term maintenance programme and designed to support the achievement of design year outcomes.

	significant beneficial		especially for the vegetated ponds, will be essential to ensure this remains the case.

Table 6 Environmental Impacts – Leeming to Barton

Sub-objective	Appraisal Score	One-year Evaluation	Summary
Noise	Number annoyed: Without project: 392 With project: 315	As expected	Noise barriers had been installed as expected. It was understood that a low noise surface was laid but the pavement asset data had not yet been updated so this could not be confirmed. A comparison of observed flows against forecast suggested overall impact would be as expected.
Air quality	NO_2 - Improvement at 731 properties; No change at 15 properties; a deterioration at 21 properties	As expected	Numbers of road users were higher than predicted along some sections of the road but lower along others. However, whilst emissions may be greater than predicted in places, the risk this change in traffic flow would contribute to a new exceedance or changes the outcome of the environmental assessment was low.
Greenhouse gases	An increase in CO_2 emissions of 122,955 tonnes over 60-year period	-	There was insufficient traffic data to evaluate the appraised greenhouse gas emissions of the whole project.
Landscape	Slight adverse	Too early to say	The predicted impacts were observed with evidence of the loss of hedgerows, woodland plots, field boundaries and agricultural land seen. The urbanisation of the route, along with new gantries and overbridges, had led to visual impacts to nearby properties. The landscape mitigation was broadly as expected although no evidence of management that year was seen. Provided the mitigation is maintained, then it is likely that the design year outcome will be met but

			this should be reconsidered at five years after.
Townscape	Slight adverse	Too early to say	Vegetation clearance had occurred along the project that had opened up views, especially through Brompton-on-Swale. Planting and visual screens were in place which should, over time, reduce the impacts. The moving of the gantry by the playing fields off Honeypot Road may have led to outcomes being better than expected but this will depend on how well the mitigation establishes. This should be considered again at five years after.
Heritage of historic resource	Moderate adverse	As expected	Documentary evidence contained in the handover environmental management plan and the site visit confirmed that the predicted adverse impacts to the scheduled monuments and beneficial impacts to the listed building had arisen. The proposed mitigation had been implemented as expected and further publications documenting the discoveries are planned over the coming years. These further publications should be confirmed at five years after.
Biodiversity	Slight adverse	Too early to say	The site visit confirmed that the predicted impacts and proposed mitigation had occurred broadly as expected. However, there did not appear to have been any maintenance during 2019 and monitoring data will be required before the design year outcomes can be confirmed with confidence. This should be reconsidered at five years after.
Water environment	Slight beneficial	As expected	Project impacts and planned mitigation were broadly as expected. There were some issues with planting and establishment at Angleham and Standing Stone balancing ponds that need to be reconsidered at five years after.

Physical activity	Slight adverse	Better than expected	There is some uncertainty with the original appraisal as its reported adverse impacts contradict beneficial statements in the ES[56]. A new section of bridleway and NMU provision had been provided. The new local access road provided a safer option for NMUs which may encourage new trips.
Severance	Slight adverse	As expected	Based on qualitative observations during the site visit, the predicted impacts had arisen and the mitigation had been provided broadly as expected.
Journey quality	Large beneficial	As expected	The additional lane, improved signage and the removal of slower moving local traffic had delivered the expected improvements to traveller journeys. The loss of roadside facilities was expected.

[56] ES – Environmental Statement.

7. Value for money

When a project is appraised, an economic assessment is used to determine the project's value for money. The assessment is based on an estimation of costs and benefits (related to travel times, vehicle operating costs and user charges), accident costs (related to numbers and severity level of accidents) and costs to road users due to delays during construction and future maintenance periods.

The economic impacts of the Dishforth to Leeming project were forecast when the route was to be upgraded as part of the wider A1 Dishforth to Barton Improvement. When the A1 Dishforth to Barton Improvement was split into two separate projects, an update to the traffic and safety forecast and associated Economic Assessment Report was not prepared for the smaller project. A new appraisal summary table was produced for the A1 Dishforth to Leeming project, however we do not have the underlying data to determine how the updated figures in the appraisal summary table were calculated.

7.1. Benefits

To evaluate the monetised benefits of a project, information is needed on both the forecast and observed traffic and safety benefits. At seven years after, it was not possible to measure journey time benefits because we were not able to measure both before and after journey times.

To measure the safety benefits as part of our evaluation methodology, we compare the forecast accident numbers against those observed after the project opens. We did not have the forecast accident numbers for the A1 Dishforth to Leeming project and so we were unable to make the comparison or monetise the benefits. As it was not possible to monetise either the journey time or safety benefits, it was not possible to reforecast an outturn benefits cost ratio (BCR) for the project.

Whilst we were unable to monetise the project benefits, our analysis showed that the project had delivered a number of the expected benefits. This included adding capacity with the addition of extra lanes, reducing congestion evidenced through the route stress metric and improving road user safety by reducing the number and severity of personal injury collisions.

An evaluation of the value for money is not within the scope for one-year after evaluations as it is considered too soon to undertake the analysis. A reforecast outturn BCR for the A1 Leeming to Barton project will be made at five years after if sufficient data is available.

7.2. Costs

The Present Value Cost (PVC) is calculated to allow for a valid comparison with benefits. Values in differing years are converted to a standard base year through the process of discounting, as defined by the Treasury Green Book.

We considered the outturn costs of the A1 Dishforth to Leeming project, Table 7, and found that they were lower than forecast. This was because of savings made in the procurement and demolition of structures and ability to reuse some road restraint systems (crash barriers).

Table 7 A1 Dishforth to Leeming Present Value Costs

A1 Dishforth to Leeming – PVC	
Forecast Cost (2010 prices) excluding indirect tax	Outturn costs (2010 prices up to 2018/19)
£354 million	£319 million

7.3. Conclusion

As part of project appraisal, an economic assessment is used to determine the project's value for money. The assessment is based on an estimation of costs and benefits (including savings related to travel times, vehicle operating costs and user charges), accident costs (savings related to numbers and severity level of accidents) and costs to users due to delays during construction and future maintenance periods.

A1 Dishforth to Leeming

At seven years after, it was not possible to measure journey time benefits nor monetise the safety benefits. This meant that we were unable to reforecast an outturn benefit cost ratio (BCR). Whilst we were unable to monetise project benefits, our analysis did show that the project did deliver benefits. These included adding capacity, reducing congestion and improving road user safety. The outturn costs of the project were lower than forecast. This was due to savings made in the procurement and demolition of structures and ability to reuse some road restraint systems (crash barriers).

A1 Leeming to Barton

An evaluation of the value for money is not within the scope for one-year after evaluations as it is considered too soon to assess all the benefits that will be realised. A reforecast of outturn BCR for the A1 Leeming to Barton project will be made at five years after.

Annex 1

A.1. A1 Leeming to Barton local traffic forecast v observed changes

Table 8 Forecast versus observed average weekly traffic volumes on local roads in the Leeming to Barton project study area.

			Forecast		Observed		Change	
Route	Direction	Time period	Do Minimum (2017)	Do Something (2017)	Pre-construction (2013)	Post-opening (2019)	Forecast change	Observed change
Catterick Road (west of A6055 junction)	EB	Morning peak	920	920	480	650	0%	36%
		Evening peak	900	900	480	740	0%	54%
	WB	Morning peak	830	830	460	680	0%	48%
		Evening peak	1060	1060	550	790	0%	44%
Gatherley Road (A6136) (north of junction with Catterick Road and Leeming Lane)	NB	Morning peak	740	450	630	500	-39%	-20%
		Evening peak	780	350	590	550	-55%	-7%
	SB	Morning peak	770	240	580	460	-69%	-20%
		Evening peak	790	280	670	510	-65%	-24%
Gatherley Road (A6136) (south of junciton with Station Road)	NB	Morning peak	740	290	460	230	-61%	-50%
		Evening peak	780	240	490	230	-70%	-53%
	SB	Morning peak	770	120	480	230	-85%	-52%
		Evening peak	790	170	540	250	-78%	-53%
Leeming Lane (southeast of junction with Gatherley Road and Catterick Road)	NWB	Morning peak	350	20	360	240	-95%	-33%
		Evening peak	260	40	380	260	-86%	-33%
	SEB	Morning peak	280	20	320	210	-94%	-34%
		Evening peak	420	30	390	260	-93%	-33%
Silver Street / A6055 Kneeton Lane / A6055	EB	Morning peak	140	60	110	120	-55%	9%
		Evening peak	190	80	110	100	-57%	-3%
	WB	Morning peak	160	120	120	130	-29%	11%
		Evening peak	190	150	140	120	-24%	-15%

Source: Automatic and link counts on local roads: commissioned by Atkins in May 2013 and July 2019.

Annex 2

A.2. Safety counterfactual methodology

Personal injury collisions (hereafter referred to as '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 have established a test we call the Counterfactual. The Counterfactual answers the question: What would have likely occurred without the project being implemented? To answer this question, we estimate the range of collisions that could have occurred without the project in place. Previous Post-Opening Project Evaluations answered this question by looking at national trends in collisions. Adjustments have been made to the methodology for estimating the Counterfactual. These have been made to address the following areas:

Amended Data Collection Method

- Revised method for identifying collisions that occurred on the network.
- Only validated STATS19 information is used for reporting purposes.

Adjusting for numbers of road users

- Baseline traffic flows are an important factor when determining the counterfactual. We now assume that without the changes made to the network, the trends would follow regional background traffic growth patterns.
- We can now calculate the collision rate for the busiest stretches of conventional motorways.

Assessing Regional Trends

- The new method uses regional rather than national trends for collision rates and background traffic growth, which provides greater granularity and makes the hypotheses more realistic.

We have found that the adjustments have resulted in a slight change from the previous methodology. We still have confidence in the accuracy of the previous methodology but believe we have made suitable changes that will ensure a methodology fit for purpose for the future.

Annex 3

A.3. Incident Reporting

Police forces choose how they collect STATS19 data. Some police forces do this electronically, for example, using mobile devices, while others complete paper forms which are later digitised. In addition, some collisions are reported by members of the public after the event. Since 2016, new data collection systems (called CRaSH and COPA) have been introduced by some police forces.

Before these new systems, reporting police officers categorised the severity of non-killed casualties as either serious or slight according to their own judgment of the injuries sustained. This was based on information available within a short time of the collision, and often did not reflect the results of medical examination. This sometimes led to casualties being incorrectly classified as slight injuries when they were serious, or vice versa.

In CRaSH reporting, police officers record the types of injuries suffered by the casualty rather than the severity. In previous systems, the determination of severity was at the discretion of the reporting police officer. CRaSH automatically converted the injury type to a severity classification. This led to implications for reporting on collision severity as there had been an increase in the number of serious collisions recorded[57]. North Yorkshire Police have not transferred to CraSH reporting during this period of evaluation.

These changes make it difficult to monitor trends in the number of KSI casualties over time or between different police forces. To help with this, the Office for National Statistics (ONS) has undertaken research to identify methods of estimating and adjusting for the increased recording of serious injuries in the new systems. Based on this work, DfT have published an adjusted time series of KSIs at the national level and statistical adjustments at the record level. These adjustments are based on estimates of how casualty severities may have been recorded had injury-based severity reporting systems always been used.

The adjustments will be reviewed by the Office for National Statistics (ONS) and DfT as more data becomes available, and it is possible that further refinements will be made to the adjustment methodology in the future. Currently it is not possible to reliably adjust collision severity information at the granular level required for this project.

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

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