highways england

Post Opening Project Evaluation of Local Network Management Schemes POPE of LNMS

12th Annual Evaluation Report

January 2016

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Glossary

Term	Definition
ASC / MAC	Asset Support Contract / Managing Agent Contract: Terms denoting Highways England's area teams (ASCs are gradually replacing the MACs for each area)
AST	Appraisal Summary Table: A summary of the predicted impacts of a given scheme, prior to opening
BCR	Benefit Cost Ratio: A ratio of benefit to cost over the whole life of the scheme
EST	Evaluation Summary Table: A summary of the outturn impacts of a given scheme, after opening
FYRR	First Year Rate of Return: A ratio of first year benefit to scheme cost
KSI	Killed or Seriously Injured Accident: Refers to an accident in which a person is either seriously injured or killed
LNMS	Local Network Management Scheme: Improvement scheme costing up to £10m
PAR	Project Appraisal Report: A report produced for all schemes, summarising predicted costs and impacts
PIC	Personal Injury Collision: An accident involving at least one road vehicle resulting in human injury or death which becomes known to the police within 30 days of its occurrence. This excludes damage-only accidents
POPE	Post-Opening Project Evaluation: The process by which the outturn impacts of a scheme are compared to those predicted
Scheme Life	The expected life of a scheme, as stated in the PAR. For most schemes, the default scheme life is 60 years
WebTAG	The Government's latest transport appraisal guidance, which forms the basis of the PAR appraisal

Executive Summary

Local Network Management Schemes (LNMS) are improvements that Highways England makes to the trunk road network which cost less than £10m to implement. These can cover a range of improvements from the provision of new badger fencing to the construction of new lanes on the approach to a major junction. After a minimum of one year following completion of each scheme, we undertake an evaluation to ascertain how the scheme has performed. This process is called Post-Opening Project Evaluation (POPE) and is currently undertaken by Atkins on behalf of Highways England. For each scheme, POPE aims to determine the performance in the first year and over the longer term, and also identify whether the performance has been better than, worse than, or as expected.

Investment in LNMS

Each LNMS is appraised using a Project Appraisal Report (PAR). These documents are compiled as part of the scheme planning process and contain all the predicted information on the scheme. The PARs can include forecast impacts on accident rate and journey times. Each PAR is denoted a scheme type according to the nature of its intended impact. For example, safety schemes focus primarily on reducing accidents.

Across the 12 years of POPE, we have now processed a total of 2,119 PARs. Analysing this sample of PARs has shown us that there has been a clear reduction in the number of schemes implemented across the 12 years, with significantly fewer PARs in the recent three financial years. This is mainly due to a reduction in Government funding for LNMS with a focus instead on larger schemes which are outside of the LNMS programme (including Pinch Point Schemes and Major Schemes).

Of the 2,119 schemes, we have been able to evaluate 820 schemes, which is approximately 40% of the total number. Of the remaining 60%, sometimes we temporarily cannot evaluate a scheme because supporting data is not yet available. However a large number of schemes will never be evaluated, either because they do not have quantifiable impacts or supporting data has not been made available or stored properly by our area teams.

Safety & Economy LNMS – programme results

The table shows that the performance of the programme is exceptional based on the sample of 717 evaluated schemes. A First Year Rate of Return (FYRR) of 64% means that the average scheme will recoup its cost within 20 months of opening, with a Benefit Cost Ratio (BCR) of 15.6 suggesting that the average scheme will pay for itself nearly 16 times over its life. All monetary values are in 2002 prices and all numbers in the table refer to the opening year only, with the exception of the BCR which provides a forecast for the entire scheme life.

Total Cost	Total Accident Benefit	Total Journey Time Benefit	Value for Money
£259m	£118m	£48m	FYRR: 64%, BCR: 15.6

LNMS can include a wide range of different improvements (termed 'measures' for the purpose of this report) aimed at reducing journey times and accident rates. Whilst each scheme is unique, the works undertaken can be categorised based on a small group of commonly implemented measures. The highest accident savings are achieved by speed limit reductions, with 3.3 accidents saved per scheme, representing a 29% reduction from the pre-scheme annual accident rate. Speed limit reductions also save the highest number of Killed or Serious Injured accidents (KSIs), at 1.1 per annum. However, all the common measures are on average shown to reduce both accidents and KSIs. In regard to journey times, it is important to note that while most schemes aim to reduce journey times through tackling congestion, some intentionally increase journey times to tackle safety concerns, for example through reducing the speed limit or banning a turn.

Safety & Economy LNMS – recent results

Our analysis has looked at how the schemes completed in the recent four years (termed recent schemes) compare to those in the first eight years of the commission (termed older schemes) with a summary provided in the table below. Despite the recent schemes costing more, the vehicle hour saving delivered is substantially lower than the older schemes at 851 hours compared to 5,679 hours respectively. It is possible that some of the variation is due to the journey time data used to assess the recent schemes. Most of the recent schemes were assessed using Satellite Navigation data, which means we have been able to easily consider the impact of the scheme across all time periods during the year before and after the scheme opened. The older schemes were predominately evaluated using other data sources and our analysis shows that the average benefit is lower for schemes evaluated using Satellite Navigation data. The average accident saving is very similar for the two periods.

Metric	Recent	Older
Average Scheme Cost	£445k	£343k
Average Accident Saving	1.8	1.7
Average Vehicle Hours Saved	851	5,679
FYRR	41%	71%

In addition, our analysis of recent schemes has shown us that:

- Generally there is an increase in the annual accident saving as scheme cost increases, but the trend is much less clear for journey times, largely due to large new signal schemes sometimes delivering dis-benefits in the opening year;
- There is substantial variation in both the cost and performance of schemes implemented by area (the strategic road network is divided into areas and each one is managed by a private sector organisation on behalf of Highways England). We should be careful however when interpreting these results as schemes are implemented with different primary objectives – for example with some areas introducing more speed limit reduction schemes than others which could lead to higher accident savings but more vehicle hour dis-benefits; and

- Finally, each scheme is also assessed against its impact on all WebTAG sub-objectives, which includes the environment and society objectives. Our analysis has shown that of the other impacts, the landscape sub-objective is scored adverse the most, however this is likely due to the primary aim of schemes being to deliver accident or journey time savings, whilst having an adverse impact on the landscape (for example through introducing larger signs).

Safety & Economy LNMS – accuracy of appraisal

As well as looking at the results themselves, POPE is also interested in looking at the accuracy of appraisals, allowing us to understand whether our forecasts have materialised.

Accuracy - programme level

At the programme level (which is the cumulative impacts of all schemes that have opened in the last four years), as shown in the table below, we find that cost and accident benefit appraisal is relatively accurate. There is however a high level of inaccuracy for journey time impacts, which are substantially over-predicted, with outturn results 98% lower than forecast. We have found that 61% of schemes over-predict their journey time benefits by between £100k and £2m.

Metric	Predicted Total	Outturn Total	Difference
Scheme Cost	£57m	£56m	**-1%**
Average Accident Benefit	£24m	£21m	**-11%**
Average Vehicle Hour benefit	£52m	£1.3m	**-98%**

Accuracy - scheme by scheme

The table shows the proportion of the recent schemes with outturn impacts within 25% and 50% of their forecast impact on cost, accidents and journey times.

Metric	Proportion of Recent Schemes within 25% of Forecast	Proportion of Recent Schemes within 50% of Forecast	How do these results compare to the historic sample?
Scheme Cost	60%	95%	**Better**
Average Accident Benefit	19%	33%	**Better**
Average Vehicle Hour Benefit	11%	22%	**Worse**

The analysis shows that the accuracy of cost appraisal has improved for the recent schemes, with 95% of the recent schemes' costs within 50% of their forecast cost.

The accuracy of forecast accident impacts has improved for the recent schemes, however the overall accuracy remains poor. For the recent schemes, 33% are within 50% of the forecast which could in part be a function of the methodology used in POPE and the use of relatively limited periods of post-opening accident data. Accidents are random in nature and using only one year of accident data means any skewing in accident numbers cannot be averaged across several years. In addition, some PARs forecast a saving less than one (for example, an expected annual accident saving of 0.5), meaning it is impossible for schemes to achieve their expected saving based on only one year of post-scheme observed data.

The overall accuracy of journey time forecasts is poor for recent and older schemes, with a trend towards worsening forecasts. This is in part linked to a number of new signals schemes which have delivered considerable inter-peak and overnight dis-benefits, which means that despite some good peak time benefits, the schemes are often delivering overall dis-benefits.

Environment and Severance LNMS – results and accuracy of appraisal

Environment schemes

Of the 10 environment schemes evaluated this year (bringing the total sample up to 45), we show that four have fully met their objectives, five have partially met their objectives and one has not met its objectives. Eight of the 10 schemes have beneficially impacted the environment WebTAG sub-objectives with four resulting in a biodiversity benefit, one resulting in a landscape benefit and three resulting in both a biodiversity and landscape benefit. Overall, the performance of this year's schemes was similar to that of the historic sample and the evaluation process has highlighted the importance of:

- Developing thorough and long-term maintenance / aftercare plans;
- Complying with DMRB specifications for structures such as mammal-proof fences and culvert ledges;
- Regularly checking structures (gates, ledges and fences) and surveys of habitats and species surveys as structure defects / sudden changes in population need to be mitigated quickly and effectively; and
- Ensuring PARs and / or accompanying documents depict an accurate representation of the works that have been undertaken on site.

In addition, we have made some recommendations to improve the POPE process, with actions identified for both the area teams and the POPE team. For the area teams, we rely on timely and accurate receipt of supporting data, with an ongoing action on the POPE team to ensure that examples of best practice are circulated as and when they arise. There is also an action on both the area teams and the POPE team to continue working closely together to ensure that local knowledge and context for each scheme is used to inform the evaluation.

Severance schemes

This year six severance schemes have been evaluated, bringing the total sample of evaluated severance schemes to 29. All six were judged to have a beneficial impact on the severance sub-objective, with five of these schemes also having a beneficial impact on the journey quality sub-objective. Four schemes successfully reduced the annual accident rate and two schemes provided a security benefit. In addition to the aforementioned sub-objectives, one lay-by improvement scheme also had a beneficial impact on the landscape and water environment sub-objectives. In general terms, the success of this year's schemes is consistent with that of the historic sample, with most schemes achieving their objectives.

It should be noted that five of the six schemes evaluated this year were predicted to have a beneficial impact on the physical activity sub-objective. However, in all five cases, a neutral score was awarded for the evaluation as, despite evidence of usage for some schemes, there was insufficient evidence that the schemes would significantly increase the number of people who undertake exercise of any kind for over 30 minutes a day. This trend will continue to be monitored in future meta-analysis.

A number of suggestions are made regarding the future evaluation of severance schemes, aimed at both the area teams and the POPE team:

- Although severance schemes are largely evaluated qualitatively, the absence of pedestrian and cyclist counts makes it very difficult to robustly assess the impact of the scheme on encouraging NMU use and hence evaluate the scheme's success or otherwise in regard to the physical activity objective. The action is therefore on the area teams to ensure that adequate pre-scheme data is collected to support downstream evaluations;
- Feedback from scheme users and local residents is a valuable source of information in severance scheme evaluations as it is difficult to identify all the potential issues of a scheme in one site visit. Responses from people who use the scheme regularly are more likely to show how the scheme performs on an everyday basis. The action is on the POPE team to ensure that consultation is launched as soon as possible to maximise the uptake and usefulness of the feedback; and
- Whilst none of the schemes evaluated this year included measures put in place to eliminate peak time problems, every effort should be made in the evaluation to ensure that site visits are timed to coincide with potential peaks in demand, also helping to maximise the opportunity for face to face consultation with users of the scheme.

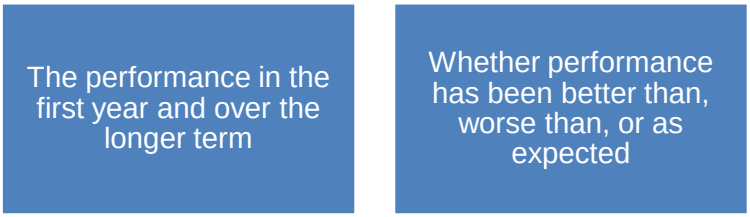
Introduction

What are Local Network Management Schemes?

Local Network Management Schemes (LNMS) are improvements that we (Highways England) make to the trunk road network which cost less than £10m to implement. These can cover a range of improvements from the provision of new badger fencing to the construction of new lanes on the approach to a major junction. Improvements which cost more than £10m are termed Major Schemes and these are evaluated under a separate commission.

What is Post-Opening Project Evaluation?

After a minimum of one year following completion of each scheme, we undertake an evaluation to ascertain how it has performed. This process is called Post-Opening Project Evaluation (POPE) and is currently undertaken by Atkins on behalf of Highways England. For each scheme, POPE aims to determine:



Observed 'before' and 'after' data is collected to enable an evaluation of each scheme. Having considered the impact of the scheme on aspects of the Department for Transport's WebTAG objectives, namely society (including safety and security), economy (including journey times and reliability), environment and public accounts, the evaluation typically culminates in an assessment of value for money, based on both First Year Rate of Return (FYRR) and Benefit Cost Ratio (BCR).

How many schemes have been evaluated?

We aim to evaluate all LNMS but only where a robust evaluation is possible. There are a limited number of schemes we cannot evaluate as they don't have impacts that can be accurately assessed; for example schemes which introduce marker posts on the highway verge, as the success or otherwise of such a scheme would depend upon there being incidents in a certain location.

The POPE process began in 2003 and has now been running for 12 years. The sample of evaluated schemes typically grows by approximately 50-60 each year and there are now 820 evaluated schemes. This covers a wide variety of types and sizes of scheme.

What do we cover in this report?

The next chapter of the report outlines our methodology for evaluating schemes, with subsequent chapters looking in detail at the results of the scheme evaluations and the accuracy of our appraisals. At the end of the report we compile the key findings.

Methodology

This section outlines the methodology we use to evaluate each scheme.

What are the main steps in the POPE process?

The evaluation methodology has remained consistent over the 12 years that POPE has been undertaken, but there have been some subtle improvements where possible to ensure the process continues to use the best available data.

There are three steps in the POPE process, which are repeated once each year:

Step 1 – Review Project Appraisal Reports

Each scheme is appraised using a Project Appraisal Report (PAR). These documents, compilied as part of the planning process, contain all the predicted information on the scheme, such as forecast impacts on annual accident rate and journey times.

Each PAR is denoted a scheme type according to the nature of its intended impact. Safety schemes focus primarily on reducing accidents, whilst economy schemes focus on reducing journey times and congestion. Other common scheme types are environment (for example, new planting on a highway verge) and severance (for example, introducing a new pedestrian crossing).

Having first received PARs for all schemes completed in the previous financial year, we review each PAR to determine whether a robust evaluation will be possible.

Step 2 – Evaluate schemes and produce Scheme Evaluation Reports

We request supporting data from the area team which has implemented the scheme. This request includes the actual, or 'outturn', cost plus accident data for the scheme's location both before and after the scheme was completed. We are also interested to know how a scheme may seek to reduce journey times. We seek supporting drawings and photographs to aid our evaluation and understanding of the scheme's impact.

In broad terms, our evaluation considers the impact of each scheme on the Department for Transport's four WebTAG objectives: Economy, Environment, Society and Public Accounts.

When evaluating a scheme, we compare the PAR predicted and outturn impacts to tell us how accurate the predictions were. We also visit each scheme to confirm that it has been implemented as intended. This site visit enables us to assess some scheme impacts that cannot be identified through desk-top study, for example, when we are trying to understand whether people are using a new pedestrian crossing.

We produce an evaluation report for each scheme, which provides an overview of the methodology used and the key findings. More detailed reports for those schemes costing in excess of £1m are produced to reflect the greater level of investment that has been made. In our scheme evaluation reports (and this meta-analysis), we present all costs and benefits in 2002 prices.

Step 3 – Produce the Annual Evaluation Report

We produce an Annual Evaluation Report summarising the results of the entire sample of schemes evaluated up to that point in time. This 12th Annual Evaluation Report contains the results from 819 scheme evaluations, spanning 12 years of evaluations. The later chapters of this report provide details on the key findings, with further details also provided in the appendices.

In addition to this report, we have an Excel based tool, named the POPE of LNMS Analysis Reporter (PoLAR), which allows for the area teams to interrogate the database of results to help inform future appraisals. This tool is not available for the public, but note that many different breakdowns of scheme results are provided in the appendices of this report, which should be of use.

Evaluating a scheme – a simple guide

Our approach to evaluating a typical scheme is outlined in the tables that follow, including two case studies to show how the theory is converted into practice. In summary, there are five elements that we need to consider:

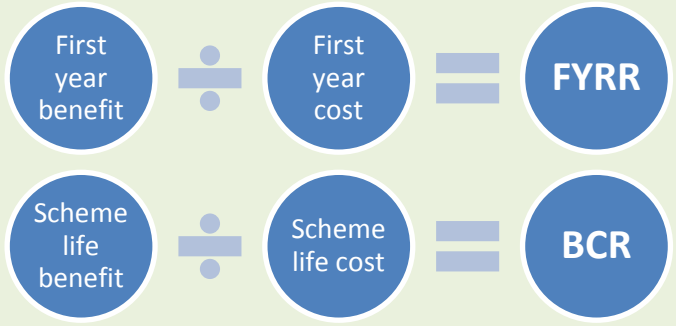
We consider:				
Costs	**Accidents**	**Journey Times**	**Other Impacts**	**Value for Money**
				

If you require further details on the methodology we use, please contact Highways England using the contact details set out below:

Email: info@highwaysengland.co.uk

Telephone: 0300 123 5000

A simple guide: *Part 1*	What does the PAR contain?	What do we request to enable our evaluation?	What do we consider in our evaluation?
Costs 	The predicted cost, including design, preparation, supervision and implementation elements. Also includes optimism bias – a percentage to take account of uncertainties in the implementation of the scheme	The comparable outturn cost, if possible split into the same components as the PAR cost	As well as considering the outturn cost as delivered, we are interested in the forecast costs over the entire scheme life, which is typically 60 years. Scheme life costs must include any future maintenance costs, but also costs to cover replacement of different elements of the scheme (for example, signs and surfacing)
Accidents 	The predicted accident saving (for most schemes), expressed both as a first year annual accident saving and a scheme life saving. These savings are given a monetary value in the PAR	Accident data for the scheme extent, which may range from one arm of a junction only to an entire corridor covering multiple junctions. We request accident data in STATS19 format, as this provides significant detail on each accident. We need at least three years' pre-scheme and one year's post-scheme data (see caveat to right)	We compare the pre-scheme and post-scheme annual accident rate. The difference between these two rates gives us the scheme's annual accident saving. We use personal injury collision (PIC) data. We monetise the saving using the average value of an accident taken from the Department for Transport's WebTAG guidance. We calculate both the first year (observed) saving and the scheme life (re-forecast) saving. *Due to the short timeframe over which the accident analysis is typically carried out, no single scheme's safety results should be taken as **statistically robust**, but our aim is to combine the results from many different evaluations to provide robust results at a broader level (for example, across the programme, or over a year)*
Journey Times 	The predicted journey time impact (for some schemes), which is typically a saving (i.e. a measure to reduce journey times) but can sometimes be a dis-benefit (for example, through reducing the speed limit)	Clarification on why the scheme has forecast a saving, including any available split into different time periods (for example, a scheme may forecast a benefit at certain times of the day only)	Using Satellite Navigation data, we are now able to make a robust comparison of pre-scheme versus post-scheme journey times. We monetise the change in journey times using the Value of Time (VOT) figures taken from WebTAG guidance. In addition to the change in journey time per vehicle, we are interested in how journey reliability has changed. To do this, we interrogate the percentile Satellite Navigation journey time data, using measures such as inter-quartile range to assess whether there has been a change in journey time reliability

A simple guide: *Part 2*	What does the PAR contain?	What do we request to enable our evaluation?	What do we consider in our evaluation?
Other Impacts	Details on the impact of the scheme on the environment and on society, for example considering noise and community severance	Further details on the expected impacts, including any surveys or supporting information gathered as part of the appraisal	Our assessment is tailored according to the impacts that are forecast and hence there is no 'one size fits all' approach. Wherever possible and proportionate, we will commission a post-scheme survey and compare this to any available pre-scheme survey. For severance schemes (for example, new pedestrian crossings), we will also seek to consult with users of the scheme and local stakeholders to understand how the scheme has changed their journey
Value for Money	The predicted First Year Rate of Return (FYRR) and Benefit Cost Ratio (BCR). The FYRR is based on the impacts in each scheme's opening year only, whereas the BCR considers the longer-term value for money over the scheme life	As long as we have been given the information outlined above regarding costs, accidents, journey times and other impacts, then that will typically suffice, so no further data is usually required	Using the monetised costs and benefits, we calculate both FYRR and BCR. In line with Department for Transport wider transport appraisal guidance, we consider any scheme with a BCR exceeding 4.0 as offering 'very high' value for money, with a BCR between 2.0 and 4.0 offering 'high' value for money. A FYRR of 100% or more means that scheme costs will be recouped within the first year of a scheme opening.  Appendix A contains further details regarding our calculation of scheme life benefits, which informs the BCR of each scheme

Case Study 1	M62 Junction 12 Diverge (near Manchester)	The Numbers:
Introduction	Measures were introduced to address extensive queuing on the M62 eastbound approach to J12. The scheme re-configured the eastbound diverge to provide separate lanes for M60 northbound and southbound traffic   Images: @ 2015 Google	Opening Date: Sep 2011
Costs	The PAR predicted that the scheme would be open to the public at a cost £3.462m (including 3% optimism bias and approximately £142k of risk allowance). The scheme's actual outturn cost was considerably higher than forecast at £5.104m. No explanation was given by the area team	Outturn Cost: £5.104m
Accidents	The PAR predicted that the scheme would reduce the annual accident rate by 2.0, resulting in a predicted monetary benefit of £168k in the opening year. Analysis demonstrated that the annual accident rate has been reduced by 3.7, giving higher than forecast accident benefits of £312k. In addition to reducing the accident rate, the severity index has been reduced to zero, as all accidents post-scheme have been classified as 'slight'. See Appendix A for further details on the scheme life	Outturn Accident Saving: 3.7 (per annum) £312k (monetised impact)
Journey Times	The measures generated a journey time saving of 50,000 vehicle hours in the opening year, equating to a monetary saving of £661k. Over 50% of journey time benefits were experienced during the weekday PM peak and shoulder peak, which together make up the period 14:00 to 19:00. As well as improving journey times, the evaluation has demonstrated that journey time reliability has been improved in all periods for all routes through the diverge, with the greatest improvements in the PM peak. See Appendix A for further details on the scheme life	Outturn Vehicle Hour Saving: 50,000 (per annum) £661k (monetised impact)
Other Impacts	The evaluation team considered that the scheme has also had a beneficial impact on journey quality, as a result of reductions in: • Driver frustration • Fear of potential accidents • Route uncertainty This impact is qualitative rather than quantitative	Not quantified but the qualitative assessment suggests a beneficial impact on journey quality
Value for Money	The scheme reaped monetary benefits of £974k in the first year of opening, equating to a FYRR of 19% and a BCR of 8.8. This suggests that the scheme has delivered very high value for money and that the scheme costs will be recouped within six years of opening	FYRR: 19% BCR: 8.8

Case Study 2	A38 Tideford to Kilna House Footway (Cornwall)	The Numbers:
Introduction	Prior to this improvement, there was no footway provision along this stretch of the A38. In order to address the need to increase accessibility and safety for pedestrians at this location, a section of new footway was constructed within the existing verge on the north side of the A38  Image: @ 2015 Google	Opening Date: Apr 2012
Costs	It was anticipated that the scheme would be open to the public at a cost of £137k. This scheme was completed for a slightly higher than predicted cost of £141k, showing that the PAR prediction was more accurate than that for the previous case study	Outturn Cost: £141k
Accidents	The scheme was assessed using five years of pre-scheme accident data and 31 months of post-scheme accident data. The analysis demonstrated that the annual accident rate has decreased from 1.60 to 0.77, equating to a decrease of 0.83 accidents per annum. In addition to the reduced accident rate, there have been no accidents involving pedestrians post-scheme	Outturn Accident Saving: 0.8 (per annum) (no impact forecast in PAR)
Journey Times	The scheme was not expected to have an impact on journey times or journey reliability. Based on the scheme as observed on site, the evaluation team agreed with the PAR assessment and hence no assessment was made of a change in journey times for vehicles	Not assessed
Other Impacts	The scheme measures were considered to have an impact on severance by removing the need to cross the busy road in a dangerous location. Through the provision of an additional safer route for pedestrians, it was apparent that the scheme measures had a beneficial impact on severance. Based on the site visit and feedback from the local community, whilst there is some evidence of usage, a neutral impact was awarded for physical activity as there was insufficient evidence to suggest that the scheme has attracted a sufficient number of new users to warrant a beneficial score	Not quantified, but the assessment confirmed a beneficial impact on severance and a neutral impact for physical activity
Value for Money	Value for money is not quantified, but based on a qualitative assessment the scheme was judged to have met its main objectives and hence can be considered to be offering value for money	Not quantified – but scheme shown to meet its main objectives

Investment in LNMS

What do we outline in this chapter?

Highways England makes a considerable investment in improvements on the trunk road network each year, some of which is through LNMS (the focus of this report). Other investment streams include Pinch Point schemes and Major Schemes, but the performance of these schemes is evaluated in separate commissions.

Earlier in the report, we showed that our LNMS evaluation process begins each year by reviewing PARs for schemes which were completed in the previous financial year. We store details of all these schemes on our central database and by interrogating this information in this section of the report, we set the scene regarding Highways England's investment across England up to and including the 2013/14 financial year (there is a slight lag time necessary for the project). We have now processed a total of 2,119 PARs.

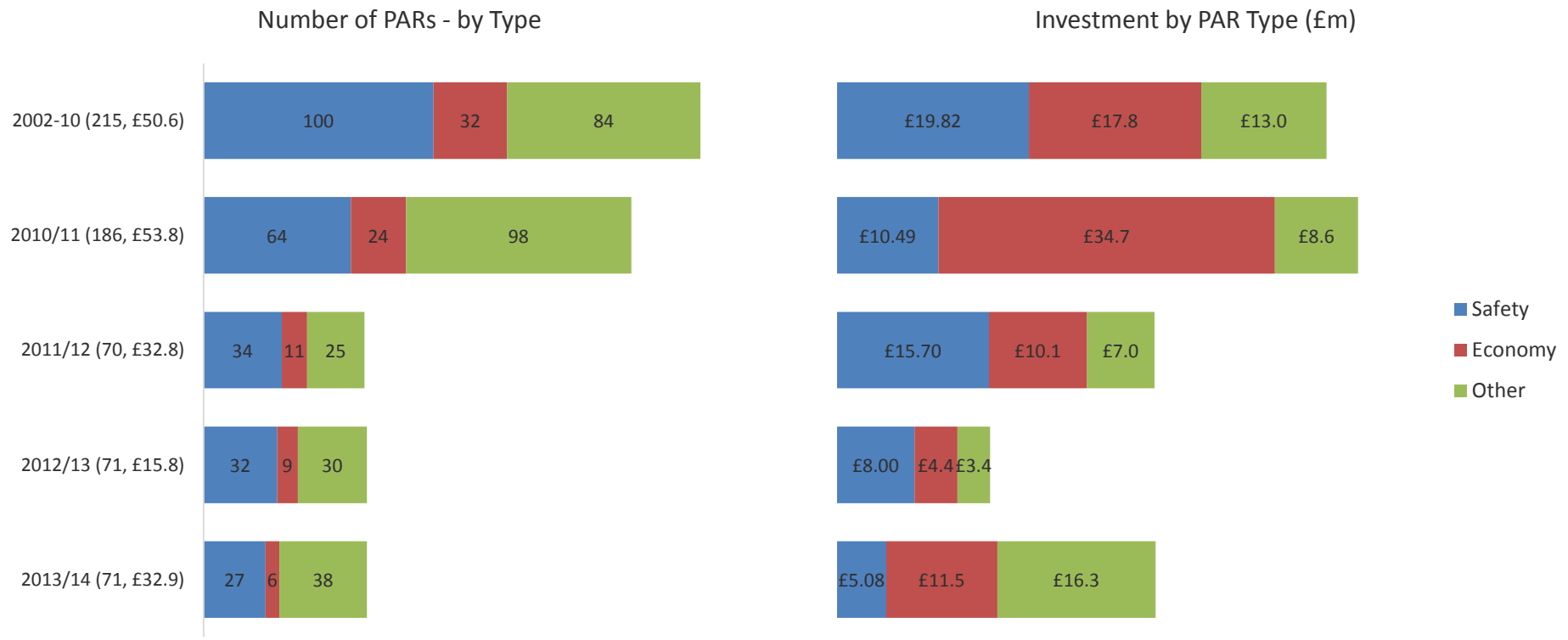
More detailed information to support this chapter can be found in Appendix B, including breakdowns of investment by area and scheme type. Before looking in more detail at the numbers, please note that for ease of interpretation and to allow us to focus on the more recent trends, we have grouped the earlier financial years as follows:

Financial Years - Grouped

2002-10 (averaged)	2010/11	2011/12	2012/13	2013/14

How many schemes have been implemented and at what cost?

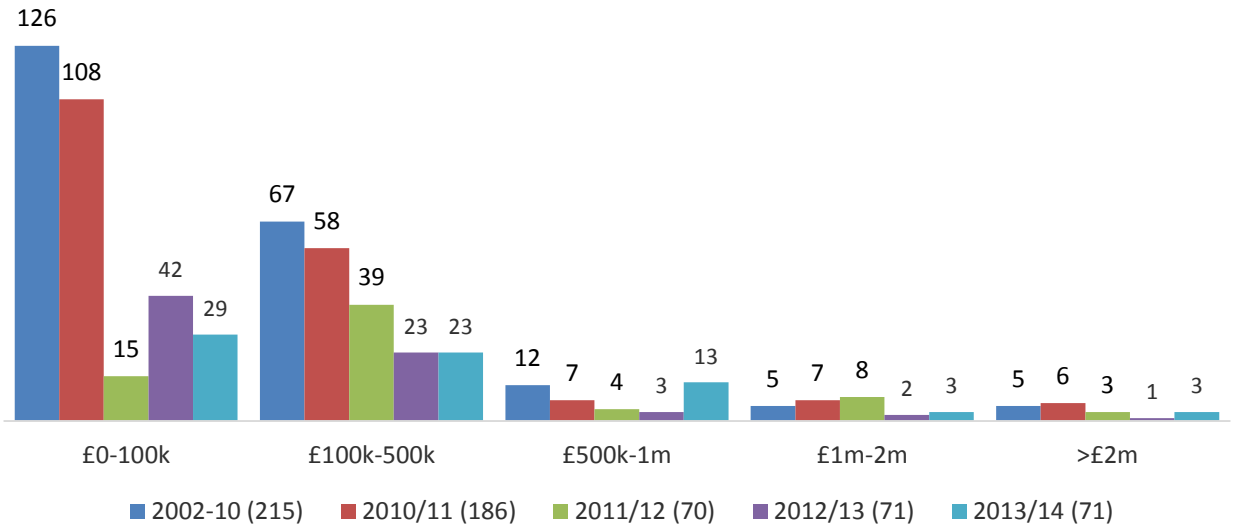
The graphs on the next page provide a summary of the PARs received over the 12 years of the POPE process. The sample sizes are shown in brackets on the graph axis and the numbers in brackets are the averages for the year(s). The 'other' category of scheme type comprises mainly environment and severance schemes.



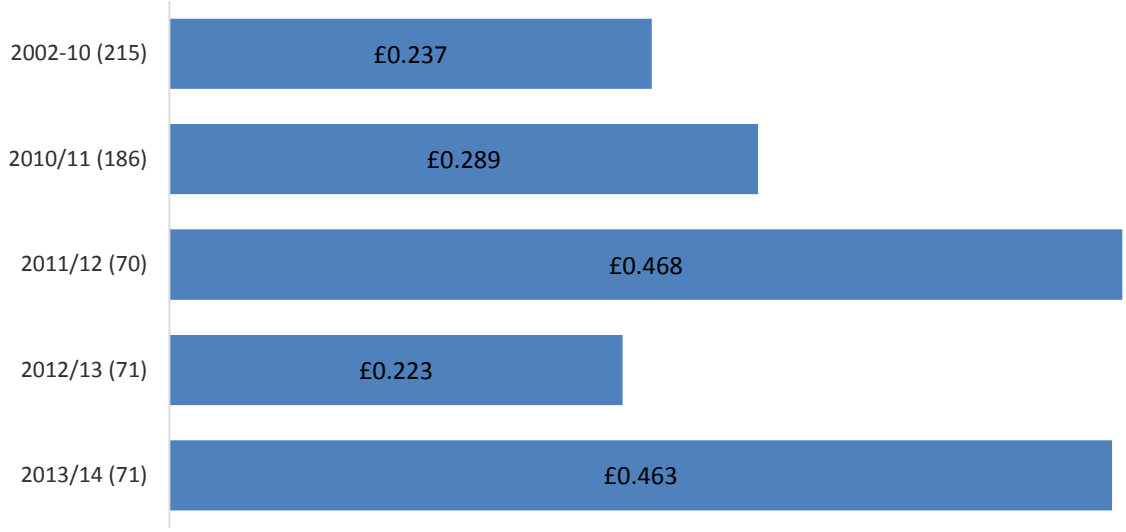
Key points to note are as follows:

- The left graph shows that there has been a clear reduction in the number of schemes implemented across the 12 years, with significantly fewer PARs in the recent three financial years. This is mainly due to a reduction in Government funding for LNMS with a focus instead on larger schemes which are outside of the LNMS programme (including Pinch Point Schemes and Major Schemes);
- The left graph also shows that within each year, typically nearly half of all schemes are classified as 'safety'. This means their primary focus is on reducing the number of accidents at a given location. The economy schemes make up a much smaller proportion each year (typically 10-20% each year) and focus on reducing journey times and improving journey reliability. The 'other' category covers a variety of types of scheme, but the more common types are environment and severance; and
- The graph to the right shows the proportion of investment for the different types of scheme. For economy schemes, the proportion of total investment is larger than the proportion of the total number of schemes, which reflects the fact that these schemes generally cost more per scheme than the other types.

While LNMS are those improvements costing up to £10m, the vast majority cost less than £1m. The graph below shows us the distribution of the 2,119 PARs collected to date, showing us that there is a general decline in the number of schemes as the cost increases, with a greater focus (in terms of numbers of schemes) on schemes costing up to £500k.



Finally, the graph below shows us how the average investment per scheme (£m) has varied across the 12 years. The general trend is for increasing investment per scheme in the more recent years, with the clear exception of 2012/13. Looking back at the graph above, we can see that this low average scheme cost in 2012/13 is partly attributable to very few schemes costing greater than £1m in that year and a relatively high number of schemes costing less than £100k. A full breakdown for all 12 financial years is provided in Appendix B.



How many schemes have been evaluated?

Of the 2,119 schemes that have been implemented, we have been able to evaluate a total of 820 schemes, which is approximately 40% of the total number.

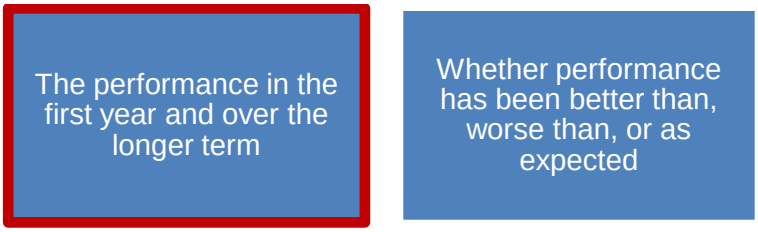
The table below provides some details on what we have been able to evaluate and why it hasn't been possible to evaluate the remainder.

PAR Type	How many have we evaluated?	Why haven't we been able to evaluate the remainder?
Safety & Economy	736 schemes	Many schemes are 'carried over' because 12 months of accident data is not yet available. These schemes will be evaluated next year once the data is available. Hence this is a temporary issue only and not something that should concern us. There are also many schemes which don't have quantifiable impacts, so an evaluation would never be possible. Finally, unfortunately there are some schemes which should have been evaluated but data hasn't been stored properly by our area teams and hence an evaluation has not been possible. For the economy schemes, our sample of evaluated schemes has however grown significantly following our use of Satellite Navigation data, as we are less reliant on pre-scheme observed information being held by our area teams
Other (mostly Severance & Environment)	84 schemes	Like the safety and economy schemes, there are many 'other' schemes that we would never be able to evaluate - for example schemes which treat run-off after there has been a spillage on the carriageway. The success or otherwise of this scheme would clearly be dependent on there being a spillage, which means an evaluation is not appropriate. There are many schemes however where an evaluation should have been possible but has not been undertaken, because data used to inform the appraisal is not available for our usage. We are working with our area teams to try to avoid future instances of this
All	820	-

The remaining chapters of this report outline the performance of the 820 schemes that have been evaluated (736 safety / economy and 84 others). It should be noted that while 736 safety / economy LNMS have been evaluated, 19 scheme evaluations have involved merging two or more phases of the same scheme (or merging schemes that were introduced adjacent to one another) into one evaluation. As a result, all subsequent calculations for safety / economy LNMS are based on 717 schemes.

Safety & Economy LNMS – Programme Results

In this section, we consider the findings from the 717 evaluated safety and economy LNMS and report on what has worked well and what has worked less well. This analysis therefore relates to the first of the two POPE aims that we set out earlier:



Note that this chapter looks at the programme as a whole (12 years) and the next chapter examines the results for the recent schemes only.

We present only key findings in this report but understand the evaluation results could be analysed in various other ways and we have therefore provided a full pull-out of our results in Appendix C. The data provided in the appendix includes:

- Accident data by severity (slight, serious and fatal accidents);
- Journey time data (vehicle hours and monetary savings);
- First year and scheme life data; and
- Cumulative programme level data and average per scheme data.

All of the above are available disaggregated to scheme year, by area team, scheme measure and scheme cost bands.

A reminder also that our area teams are able to use the PoLAR Excel based tool to interrogate the database of results, allowing the observed data to be used to inform future appraisals.

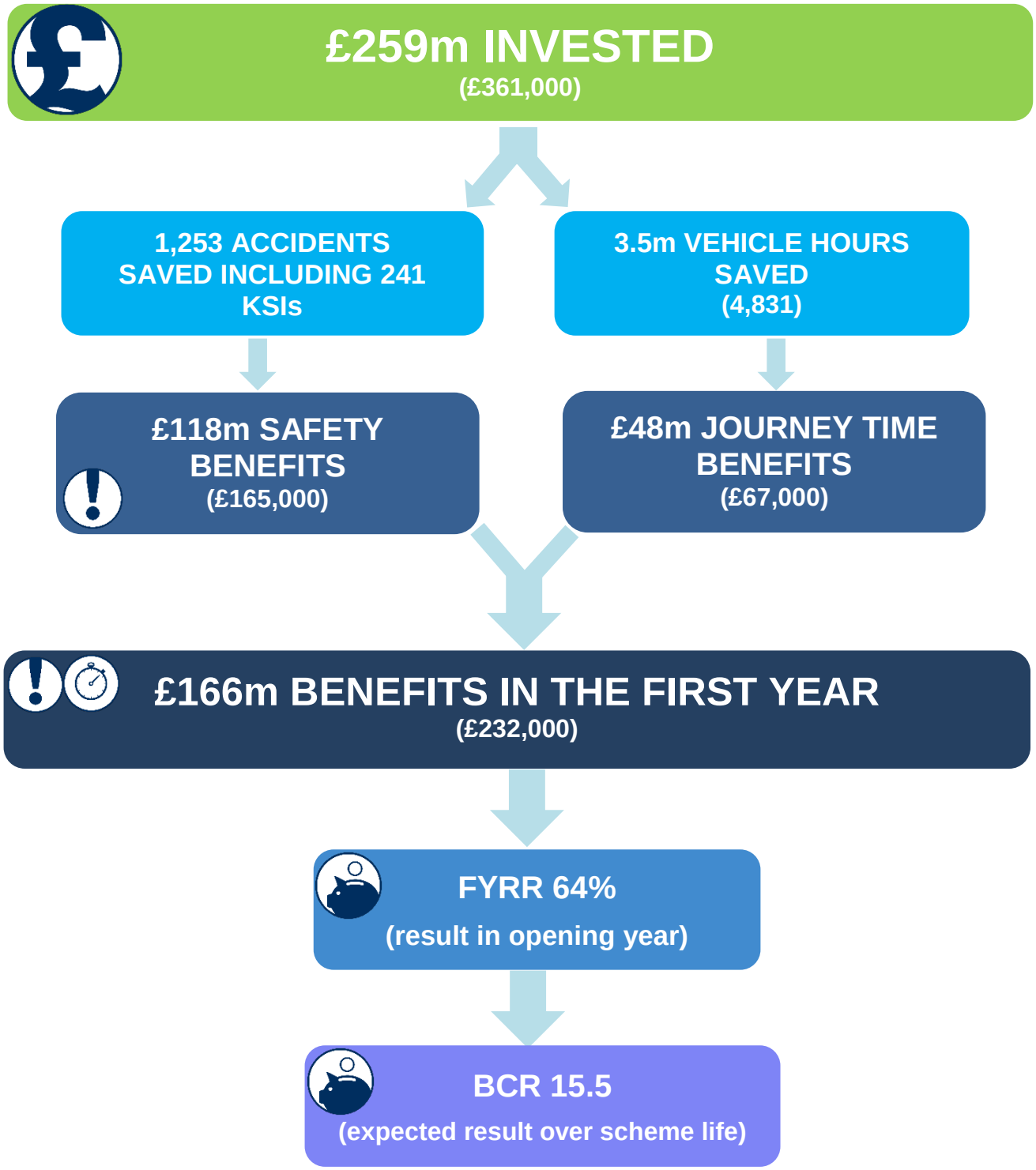
What are the headline results?

Before looking in detail at the results, it is important to explain how we have dealt with 'outliers', which are schemes with either extremely good or extremely bad performance relative to the average scheme. For some of the analysis, we want to focus on how the typical LNMS is performing and **therefore when we analyse the results by area team or scheme measure, we remove outliers from the sample**. The process of removing outliers ensures we are considering the performance of typical schemes and are not being misled by schemes with the most extreme results. The method used to remove outliers is detailed in Appendix D. All other analysis is based on the results of the 717 LNMS evaluated to date.

The headline findings of the programme are shown in the graphic overleaf (the figures in brackets are the averages per scheme).

Over the duration of the POPE commission, 717 LNMS have been evaluated, with a combined total investment cost of £259m. These schemes have delivered a total of £166m of benefits in the opening year, consisting of £118m of safety benefits and £48m of journey

time benefits. These benefits are the result of the evaluated schemes saving 3.5m opening year vehicle hours and 1,253 opening year accidents, of which 19% are KSIs. The results show that approximately 70% of total benefits are derived from safety benefits with the remaining 30% being derived from journey time benefits.



The scheme costs and benefits are used to calculate the First Year Rate of Return (FYRR). The graphic shows that the average scheme achieves a FYRR of 64%, which means schemes recoup their cost in benefits within 20 months of opening assuming the first year performance continues. This demonstrates exceptional performance at the programme level.

We are also interested in the performance over the longer term, based on scheme life. As a typical scheme life is 60 years, it is not feasible to observe the performance over that

period, so we calculate a 'reforecast BCR', which takes the first year performance and provides an updated forecast on how the scheme is expected to perform based on its entire scheme life. The reforecast BCR is shown to be 15.6, which means each scheme will pay for itself nearly 16 times during its life on average. Based on the Department for Transport criteria outlined earlier, the LNMS programme is delivering very high value for money.

It is interesting to look at the spread of the FYRR and BCR for individual schemes, to provide more information on how our investment in highway improvement schemes is being recouped in benefits. Based on FYRR, the table below shows how many schemes are expected to recoup their cost in benefits (if the first year performance continues) for five categories ranging from within 12 months to 'never'[1]. The results show that 70% are expected to recoup their costs in benefits within five years of completion, with 48% expected to recoup their costs within 12 months.

Spread of FYRR Results

Expected period to recoup cost	Number of Schemes	%
12 months	344	48%
1 – 5 years	157	22%
5 – 10 years	30	4%
10 years +	24	3%
Does not recoup any cost in benefits (-ve FYRR)	*162*	*23%*

The table below shows the spread of BCRs for the LNMS programme. The results indicate that over half of schemes (55%) will recoup their costs ten times (or more) over the course of their life, which is typically 60 years, again demonstrating exceptional value for money. There are however 23 (3%) schemes that deliver total benefits lower than the scheme cost and 158 (22%) schemes deliver a dis-benefit.

Spread of BCR Results

Number of times a scheme pays for itself in its lifetime	Number of Schemes	%
10+	398	56%
5 – 10	69	10%
1 – 5	69	10%
Partially recoups cost in benefits	23	3%
Does not recoup any cost in benefits (-ve BCR)	*158*	*22%*

[1] When a scheme increases the accident rate and / or journey times, it scores a negative FYRR and BCR, which means that the investment is not expected to be recouped.

What are the results by scheme measure?

By their very nature, LNMS can include a wide range of different improvements (termed 'measures' for the purpose of this report) aimed at reducing journey times and accident rates. Every location has its own set of circumstances and hence no two schemes are identical.

Whilst each scheme is unique, the works undertaken can be categorised based on a small group of commonly implemented measures (as shown in Appendix C). Schemes can have primary and secondary measures, as for example, a scheme may consist of the installation of new signals (primary measure) and some improvements to signing (secondary measure). Note that each scheme can include more than one measure but can only have a maximum of two primary measures. For schemes with more than two measures that are considered main measures, all measures are referred to as secondary measures.

By looking at the performance of different primary measures that have a sample size over 15, we can learn more about the cost and effectiveness of each at addressing safety and journey time concerns. Note that for this sub-section**, outliers have been removed from all analysis**, as we are trying to learn about the typical scheme without being biased by schemes with extreme performance.

Cost by measure

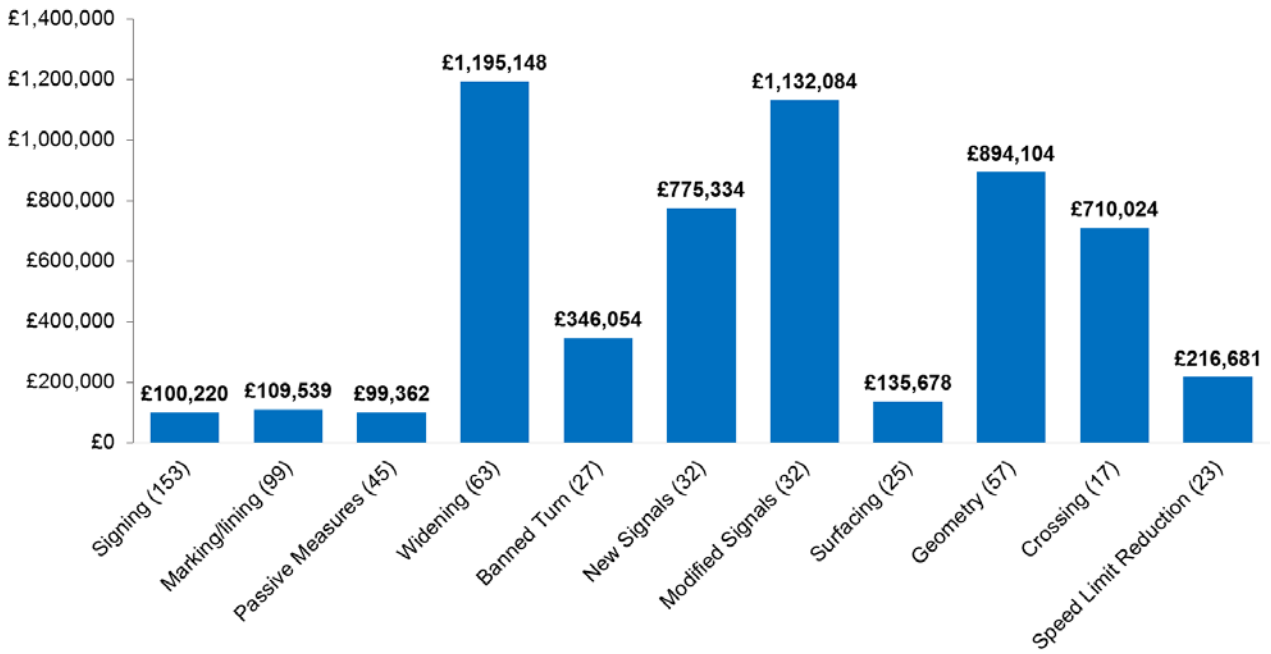
The graph shows the average cost of a LNMS where the measure in question was a 'major' component of the scheme. Note that one scheme can have multiple measures, so there is a limited element of double counting in this analysis. The sample size included in the analysis is shown in brackets. Examples of the types of schemes which have been put into the measures categories are provided in Appendix C. For example, 'signing' includes traditional signs, vehicle activated signs or variable message (electronic) signs.

The graph shows that the average cost of measures varies. The most costly measures are widening and the modification of existing signals (referred to hereon in as 'modified signals'), which cost on average £1.2m and £1.1m respectively. Geometry, new signals and crossings are the next most expensive measures to implement, with geometry change schemes costing approximately £900k and the two latter measures ranging between approximately £710k and £775k.

The high cost of the average widening scheme is to be expected, given that the scheme is making a significant change to the highway layout which may require land to be purchased outside of the highway boundary. The high cost associated with the modification of signals can be partly explained by the measure typically being implemented alongside other more expensive measures such as widening, which tend to be implemented in response to congestion at junctions.

Four of the measures have similar implementation costs of between approximately £100k and £200k. These measures are signing, passive measures, marking / lining and surfacing which tend to be smaller alterations implemented within the existing highway boundary. The low costs are therefore to be expected.

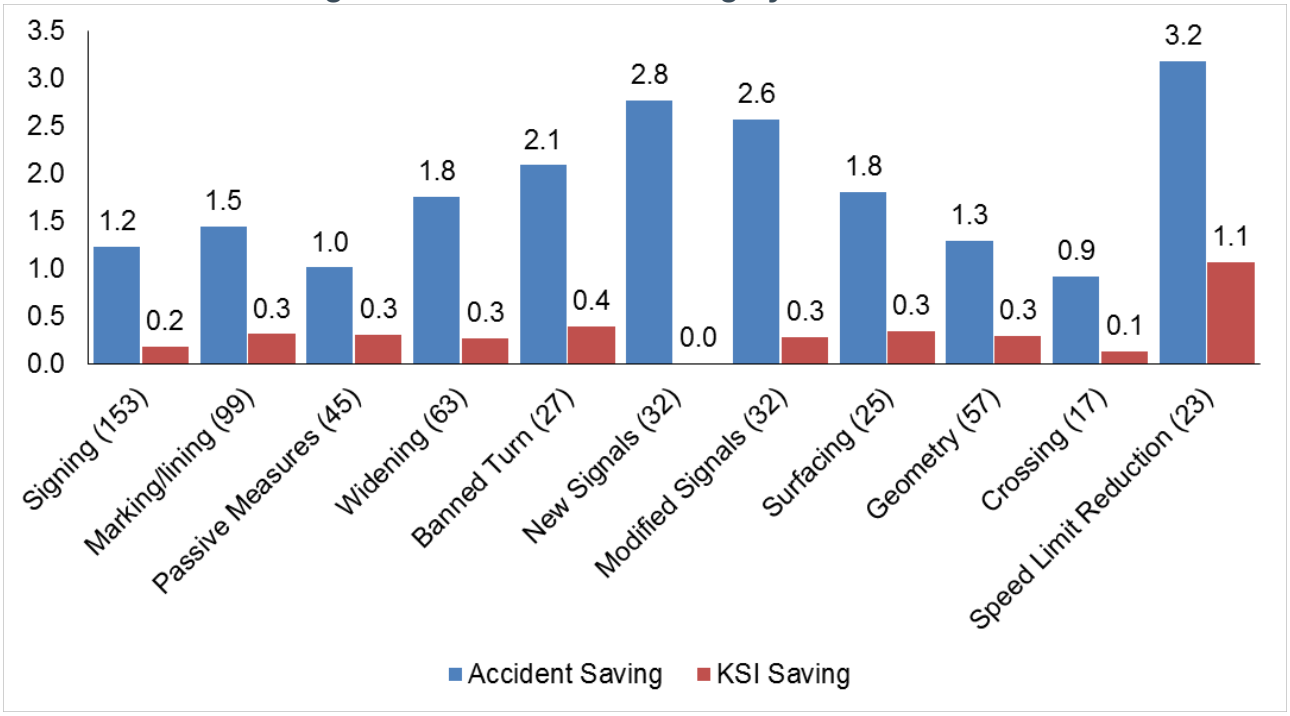
Average cost by scheme measure



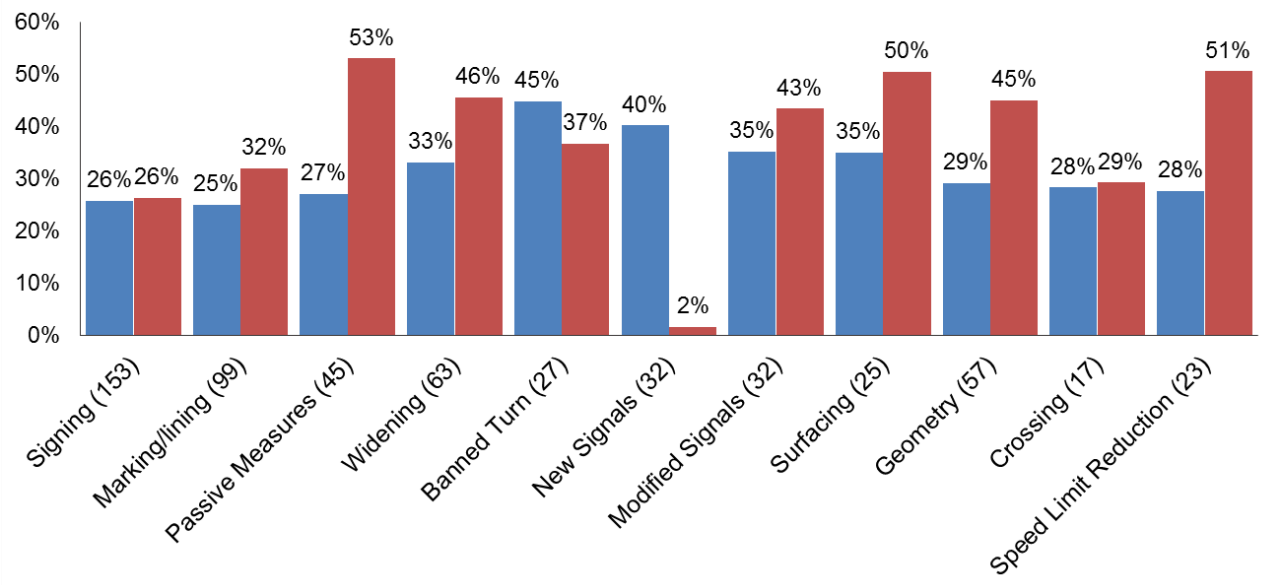
Accident savings by measure

The graphs overleaf show the average accident saving and KSI (Killed or Seriously Injured) saving for the most commonly evaluated LNMS measures. The change in the annual accident rate and KSIs is shown both as an absolute number and as a percentage change (the latter is the percentage accident reduction as a proportion of the pre-scheme accident rate).

Average accident and KSI saving by scheme measure



Percentage accident and KSI saving by scheme measure



In terms of absolute accident and KSI savings, speed limit reduction schemes are the most effective, saving on average 3.2 accidents, including 1.1 KSIs. The majority of the remaining measures save between 0.2 and 0.3 KSIs. The higher KSI saving for speed limit reductions is one of the major success stories of LNMS and the result is likely to be because the measure reduces the chance of an accident occurring at a higher speed.

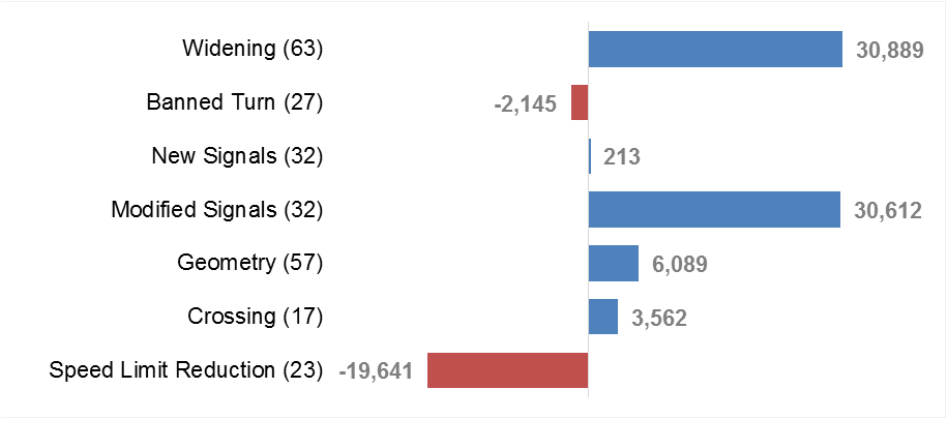
The next most effective measures at reducing accidents are new signals (2.8 accidents saved per scheme) and modified signals (2.6 accidents per scheme). Banned turn schemes are notable for their impact on KSIs, saving 0.4 KSIs per average scheme (which equates to a 45% reduction). A number of the banned turned schemes are gap closures, which through banning a right turn in the central reservation, remove a potential cause of high speed accidents and hence may be expected to have this positive impact in regard to KSIs.

It is clear that on average, each measure is successful at saving accidents and KSIs in the opening year.

Journey time savings by measure

Some of the LNMS implemented have an impact on journey times for users. This could be in the form of a journey time improvement or a worsening of journey times as a result of measures implemented to improve safety (for example, a speed limit reduction). The impact on journey times is annualised to allow comparison of journey time impacts between schemes. The graph shows the average vehicle hour saving achieved by each measure.

Average vehicle hour saving by scheme measure



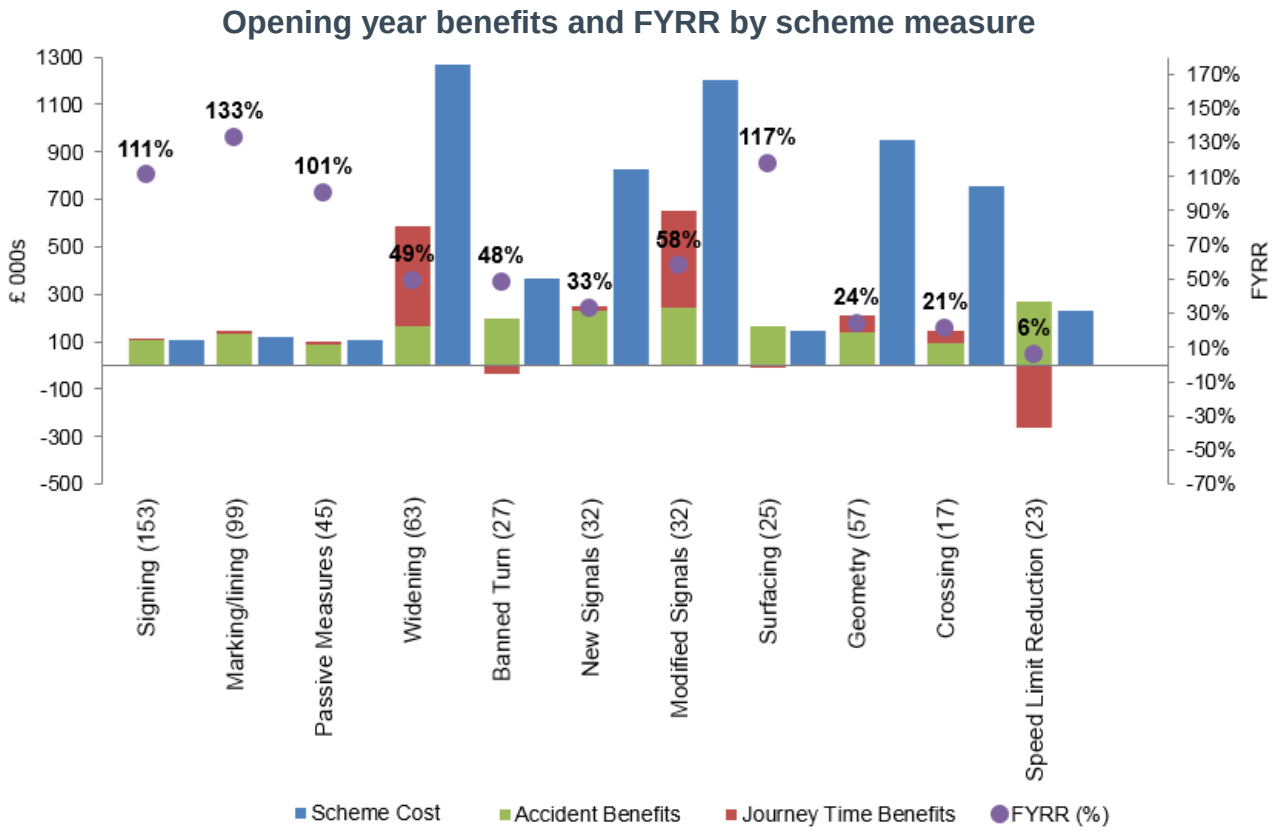
The graph shows that widening and modified signals are the two most effective measures at saving vehicle hours, with 31k vehicle hours saved by each measure. Modified signals on average are more effective at improving journey times than new signals, which highlights the importance of optimising signals.

Our current methodology is to obtain journey time data for all periods of the day for the duration of one year before and after a scheme opens. The small vehicle hour saving (213) for new signals could therefore be a result of schemes improving journey times in peak periods but worsening them in the non-peak periods. Furthermore it is often the case that new signal schemes improve journey times for particular movements through a junction but at the same time worsen journey times for another movement. The benefits therefore can be offset by dis-benefits meaning on average new signal schemes deliver only a small vehicle hour saving in the opening year.

The opposite is often the case for modified signals due to the inefficiencies of new signals being included in the pre-scheme period. This effectively means that the dis-benefit of the signals would have been incurred at the time the signals were first introduced rather than as part of the modification. This theory is supported by 21 of the 32 (66%) modified signal schemes delivering journey time benefits in the opening year compared to only 11 of the 32 (34%) new signal schemes delivering journey time benefits.

Value for money by measure

Having considered the average vehicle hour and accident saving each measure delivers, we now look at the average monetary value of these benefits and the FYRR. The graph shows the average costs and benefits (including the breakdown into accident and journey time benefits), showing the level of value for money as demonstrated by FYRR.



The four measures which have similar costs between £100k and £200k (signing, marking / lining, passive measures and surfacing) on average deliver a FYRR in excess of 100% meaning they recoup their costs within the opening year. On the other hand, more expensive schemes such as widening, new signals, modified signals and changes to geometry deliver lower FYRRs between 24% and 58%, as their opening year benefits are not large enough to outweigh the substantial costs associated with these schemes.

As we showed earlier, speed limit reduction schemes deliver high accident and KSI savings. These schemes on average produce accident benefits to the value of £272k, which is higher than the average scheme implementation cost of £217k (which means their first FYRR would be in excess of 100% if only accident benefits were considered). The accident benefits are however largely offset by a journey time dis-benefit of £260k meaning these schemes deliver the lowest FYRR of 6%.

Another measure which has some of its accident benefits offset by journey time dis-benefits (£33k) is banned turns, however the accident benefits alone are not enough to cover the scheme cost in the opening year like speed limit reduction schemes.

A journey time dis-benefit in the opening year for speed limit reduction and banned turn schemes can be considered a success as the primary aim of these schemes tends to be improved safety by reducing the speed of vehicles or making vehicles use a different route to make their journey, thereby improving safety.

Summary

What are the headline results of the programme?

- *Against total investment of £259m on the LNMS programme, the schemes have returned total benefits of £166m in their first year of opening. Of those benefits, £118m (approximately 70% of the total) is from safety impacts and the remaining £48m is from journey time impacts.*
- *The average FYRR for the programme is 64%, which means schemes will repay their cost within 20 months of opening.*

What are the results by scheme measure?

- *As we would expect, the average costs of measures vary substantially. The most expensive measures are widening and modified signals, costing £1.2m and £1.1m respectively.*
- *The highest accident savings are achieved by speed limit reductions, with 3.3 accidents saved per scheme, representing 29% of the pre-scheme annual accident rate. Speed limit reductions also save the highest number of KSIs, at 1.1. All the common measures are on average shown to reduce both accidents and KSIs.*
- *Many scheme measures reduce journey times through tackling congestion, but some intentionally increase journey times to tackle safety concerns, for example through reducing the speed limit or banning a turn.*

Safety & Economy LNMS – Recent Scheme Results

Having looked in the last chapter of the report at the programme results, this chapter provides more details on the results for the recent schemes only, namely those which were completed in the last four financial years (2010/11, 2011/12, 2012/13 and 2013/14). The reason for narrowing the sample in this way is because scheme appraisal methods and guidance have changed and therefore the key findings from these schemes are likely to be more relevant to current approaches. For the remainder of this chapter, all findings are based only on the results of schemes that were completed in the last four financial years. This chapter continues to relate to the first of the POPE aims shown below:

The performance in the first year and over the longer term

Whether performance has been better than, worse than, or as expected

Again, we present only key findings in this section but understand that the evaluation results could be analysed in various other ways depending on the interest of the reader. Appendix C provides a full pull-out of our results for schemes that opened in the last four financial years, which hereafter we refer to as 'recent schemes'. Schemes prior to those financial years are referred to as 'older schemes'. The total sample of recent economy and safety schemes, prior to outlier removal, is 126 schemes.

As we stated earlier in the methodology section, at least 12 months of accident data following a LNMS opening is required for us to proceed with an evaluation, hence most evaluations are undertaken one to two years after a scheme has opened. As a result, the majority of schemes we evaluated in this calendar year are those which opened in the 2012/13 and 2013/14 financial years and these are referred to as 2012 and 2013 schemes respectively. This year we have evaluated 18 schemes that opened in 2012 and 20 schemes that opened in 2013. In addition, we have also increased our sample of schemes that opened in 2011/12 ('2011 schemes') by evaluating a further 10 schemes, bringing the total number of 2011 schemes to 55.

What are the results for the recent schemes and how do they compare to the older schemes?

Whilst we are focussing our analysis in this chapter on the recent schemes, in this chapter we also make a comparison of the average results for the recent schemes and the average results for the older schemes (which opened in the first eight financial years covered by the POPE process).

The average scheme results for the recent schemes and older schemes are shown side by side in the table overleaf. The results indicate that schemes in both these periods are on average successful at delivering benefits in their opening year, with the older schemes performing better; delivering a FYRR of 71% compared to 41% for the recent schemes. The average accident saving is similar for the two periods at 1.8 per annum for the recent schemes compared to 1.7 per annum for the older schemes. The difference in FYRR is

therefore attributable to the variations in the average scheme cost and the vehicle hour savings for the two periods and we now consider these factors in more detail.

Comparison of performance for recent and older schemes

Metric	Recent	Older
Schemes evaluated per annum	32	74
Average Scheme Cost	£445k	£343k
Average Accident Saving	1.8	1.7
Average Vehicle Hours Saved	851	5,679
FYRR	41%	71%

Cost

The recent schemes on average cost £445k, which is higher than the average costs of the older schemes of £343k. There are a few potential explanations for this result which are as follows:

- Schemes costing less than £500k accounted for a higher proportion of the older schemes (87%) compared to the recent schemes (79%);
- One scheme, the A31 Canford Bottom (creation of a 'hamburger' layout in place of a conventional roundabout), cost £9m and is included in the recent scheme sample. Excluding this scheme from the analysis reduces the average recent scheme cost to £386k, which is much closer to the average for the older schemes; and
- The findings in the earlier 'Investment in LNMS' section show a trend of increasing average scheme costs over time across all scheme types. It also demonstrates that fewer larger schemes have been implemented in recent years but the average cost of these schemes is higher.

Journey time savings

Despite the recent schemes costing more, the vehicle hour saving delivered is much lower than the older schemes at 851 hours compared to 5,679 hours respectively. The partial reasoning for this could be that advances in technology mean we are more in control of the journey time data collected for use in evaluations. The recent schemes were all evaluated using Satellite Navigation data, whereas the older schemes were predominately evaluated using other data sources, which typically included sample journey time surveys. Analysis shows that the average benefit is lower for schemes evaluated using Satellite Navigation data and this could therefore have a bearing on the variation in vehicle hour saving shown for the two periods.

Other factors

As well as the results themselves, it is noteworthy that on average we have evaluated 32 schemes per annum in the last four years, which is less than half the number of schemes we evaluated in the previous eight years. This reflects the reduced the number of LNMS which have been implemented on the network, with more investment in other programmes

such as the Pinch Point Schemes. The lower sample size can also mean that extreme results have more of an impact on the average result than that for a larger sample.

In summary, the older and recent schemes are on average successful at reducing accident numbers and improving journey times in their opening year. The variation in FYRR is largely attributable to scheme costs and vehicle hour savings, as the accident saving for the two periods has been very consistent.

How does scheme cost affect the benefits delivered?

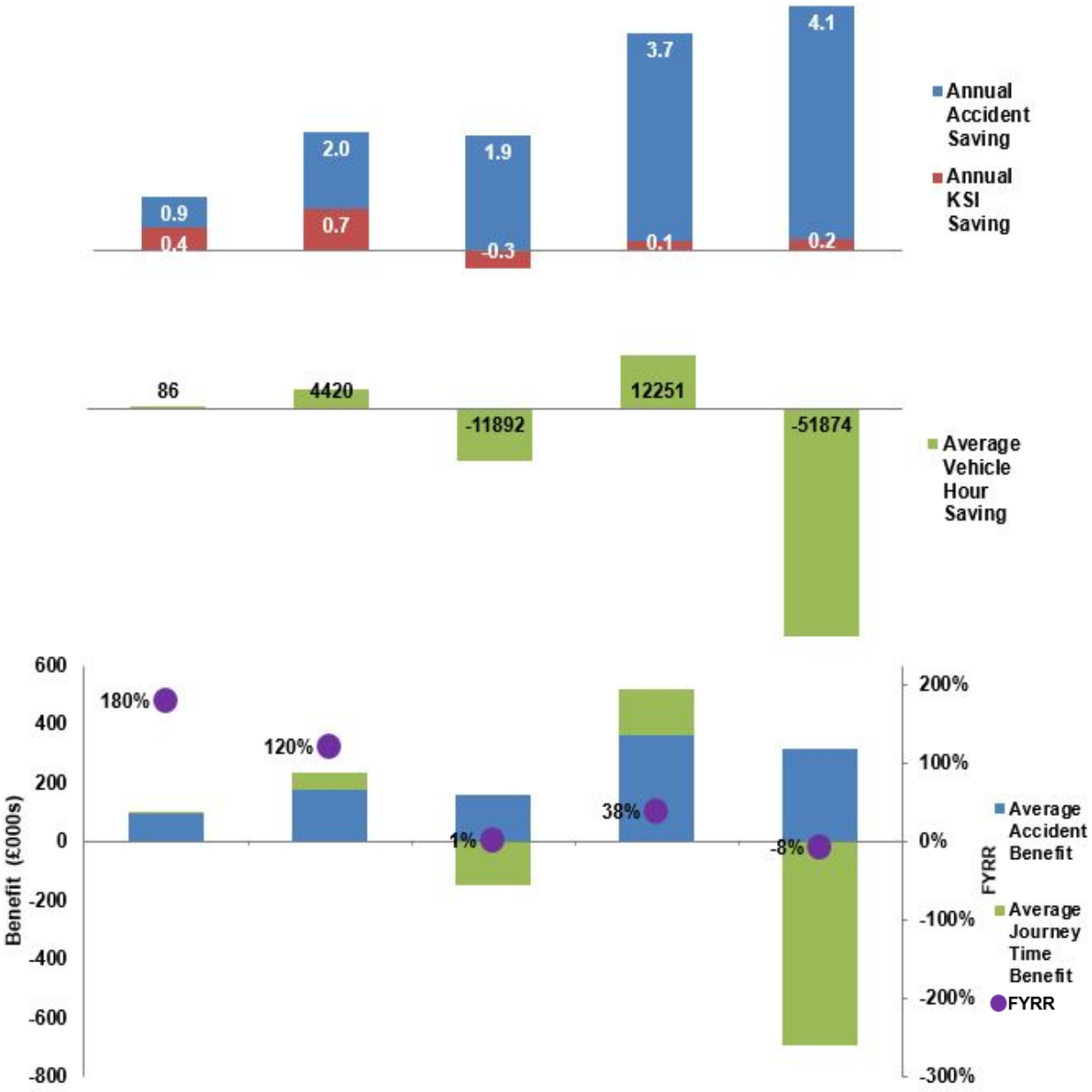
In our Annual Evaluation Report last year, we considered how the type and scale of benefits varies according to scheme cost. This section continues this analysis but this year focuses on the recent schemes only. **Note that outliers have not been removed for the purpose of this analysis.**

We have categorised the recent schemes into five cost categories and the average performance of schemes within each cost category is shown overleaf.

How does scheme cost affect the benefits delivered?

(Sample sizes in brackets)

<£100k (47)	£100k - £500k (53)	£500k - £1m (8)	£1m - £2m (14)	>£2m (4)



Accident savings

The results show that generally there is an increase in annual accident saving as scheme cost increases; ranging from 0.9 for schemes costing less than £100k to 4.1 for schemes costing over £2m. This is likely to be a function of the more impactful measures which are introduced for the larger schemes, which have a greater potential to influence annual accident rates than the more minor measures associated with schemes costing less than £100k.

The results show that there is virtually no difference in accident saving for the £100k - £500k and £500k - £1m cost brackets, saving 2.0 and 1.9 accidents per annum respectively.

There is no clear trend in the KSI savings by scheme cost, however, on average with the exception of schemes costing between £500k and £1m, schemes within each of the other cost brackets reduce KSIs.

Journey time savings

Whilst there is a clear trend in regard to accident savings, the graph shows that the pattern is much less clear in regard to journey time savings.

Of the five cost categories, only three deliver a journey time benefit on average. It is notable that schemes costing between £500k and £1m, and those costing over £2m, deliver on average a journey time dis-benefit, which means that journey times have been worsened as a result of the schemes implemented.

It is useful to interrogate the sample of schemes costing between £500k and £1m to determine why there may have been a dis-benefit. This interrogation shows that of the eight schemes:

- Two new signals schemes delivered a large increase in vehicle hours of 52,717 and 59,685;
- A further two new signals schemes delivered a small vehicle hour increase of 4,361 and 11,042;
- Two schemes had zero impacts on vehicle hours; and
- Only two schemes delivered a vehicle hour saving, of 14,768 and 17,990, both of which were widening schemes. These benefits were not enough to offset the dis-benefits from the four new signal schemes.

The average vehicle hour increase for schemes costing £2m or more is the result of two new signal schemes, which deliver substantial vehicle hour increases of 282,092 and 35,964 hours. These large dis-benefits are only partially offset by some benefits from a widening and new signal scheme that delivered benefits of 50,006 and 60,555 vehicle hours respectively.

Value for money

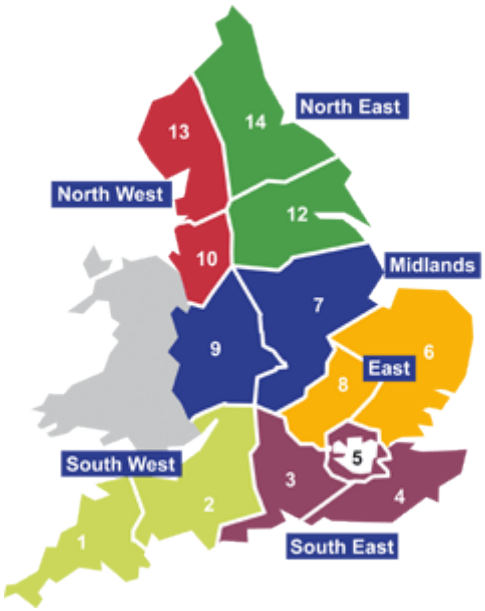
The results show, as we might expect, that FYRR generally reduces as scheme cost increases, from 180% for schemes costing less than £100k to -8% for schemes costing over £2m. As noted above, the reason for the notably poor performance in the £2m+ category relates to two new signal schemes which delivered large increases in vehicle hours.

Schemes costing less than £500k on average deliver benefits in the opening year that outweigh the scheme cost (as shown by FYRRs in excess of 100%). Those costing in excess of £500k achieve much lower FYRRs and hence will take longer to recoup their costs. Unfortunately based on the analysis undertaken it does not appear that the costs will be recouped for the schemes costing more than £2m, as shown by the negative

FYRR. As noted earlier, schemes typically have a forecast life of 60 years and hence it is possible that the performance of these schemes could improve over their scheme life.

How are the areas performing based on the recent schemes?

The strategic road network is divided into areas and each one is managed by a private sector organisation on behalf of Highways England. Each area is identifiable by a number and typically two areas form a region. The diagram shows the regional divisions of the network and identifies which areas form each region. For example, Areas 6 and 8 are shown in yellow and form the East region. It is useful to evaluate the results by area to understand whether the LNMS programme is successful at delivering improvements across the country.



Sample sizes and caveats

The type and number of schemes we evaluate in each area vary considerably. We would ideally evaluate a proportionate number of schemes in each area (i.e. a given percentage of each area's schemes), however factors such as whether schemes have measurable impacts and limited data availability prevent some evaluations. We therefore evaluate as many schemes as possible in each area and this is reflected in the number of evaluations completed by area. Due to the focus on schemes which have opened in the last four years, interpretation of the results by area must be approached with caution given the relatively limited sample sizes.

Average results in this section are based on the results for all schemes regardless of whether a journey time or accident saving was expected in the scheme appraisal. Whilst all schemes may have an impact on accident numbers, only some schemes have an impact on journey times. These tend to be economy schemes which are implemented with the primary aim of reducing journey times. As we noted earlier however, some schemes with the primary aim of improving safety can also have journey time impacts as a secondary impact, with banned turns and speed limit reduction measures being good examples of these. Due to these varying objectives, we must also be cautious when interpreting journey time impacts by area, hence we give further consideration to individual scheme results in circumstances where a journey time impact in an area is noticeably different from other areas. **Outliers have been removed from the analysis by area.**

The table provides a summary of performance by area for the recent schemes, including average scheme cost, accident saving and journey time saving. The number of schemes within each area is also shown. Some areas have only implemented a handful of schemes hence the results should be treated with caution.

Average cost and benefits by area

Area Team	Number of Schemes	Average Cost (£000s)	Average Accident Saving	Average Vehicle Hour Saving	FYRR	Cost Brackets				
						£0 - £100k	£100k - £500k	£500k - £1m	£1m - £2m	£2m +
Area 1	10	£83	1.0	0	124%	7	3	0	0	0
Area 2	8	£504	3.6	4,209	73%	1	5	0	2	0
Area 3	4	£2,153	0.5	15,139	11%	0	3	0	0	1
Area 4	7	£112	0.5	0	57%	5	2	0	0	0
Area 5	9	£131	0.9	545	64%	2	7	0	0	0
Area 6	10	£97	0.9	-106	89%	6	4	0	0	0
Area 7	8	£750	3.8	-33,868	-8%	3	2	0	2	1
Area 8	2	£727	1.9	0	55%	1	0	0	1	0
Area 9	14	£455	0.7	-1,155	4%	1	12	0	0	1
Area 10	8	£1,075	1.8	10,612	27%	3	0	3	1	1
Area 12	19	£424	2.7	-1,968	45%	7	4	4	4	0
Area 13	7	£69	1.9	0	303%	5	2	0	0	0
Area 14	13	£218	2.6	-1,813	94%	5	7	0	1	0

The results show there is a wide variation in the average cost of a scheme between the areas, ranging from £69k (Area 13) to £2.2m (Area 3). Categorisation of the schemes by cost bracket (as displayed in the right-most columns in the table) shows that most of the schemes implemented by the area teams cost less than £500k. The very high average cost in Area 3 is due to one scheme costing £9m (the A31 Canford Bottom). This same scheme also saved 61,000 vehicle hours, hence the high average vehicle hour saving of 15,139 for Area 3.

On average each area is implementing schemes that deliver an accident saving, ranging from 0.5 (Areas 3 and 4) to 3.8 (Area 7) per annum. The large average accident saving in Area 7 is attributable to three of the eight schemes achieving high accident savings (between 4.6 and 7.7 accidents saved per annum).

The average vehicle hours saving varies across the areas, ranging from a dis-benefit of 33,868 hours (Area 7) to a saving of 15,139 hours (Area 3). Area 6, Area 7, Area 9, Area 12 and Area 14 on average deliver a dis-benefit. The substantial dis-benefit in Area 7 is due to one new signal scheme which delivered a journey time dis-benefit of 282,092 vehicle hours. This is slightly offset by a vehicle hour saving of 11,147 from a widening scheme.

Four areas (Area 1, Area 4, Area 8 and Area 13) deliver no change in vehicle hours and this is due to all schemes in these areas not delivering a journey time impact. Further consideration of the individual scheme results shows:

- The dis-benefit in Area 9 is due to three new signal schemes which increased vehicle hours by 9,800, 11,000 and 36,000;
- In Area 14, three schemes are responsible for the dis-benefit; one new signal scheme (4,696 hours), one signal improvement scheme (22,969 hours) and one widening scheme (8,641 hours); and
- Only one (a gap closure scheme) of the ten schemes in Area 6 had an impact on journey times. The scheme delivered a dis-benefit of 1,059 vehicle hours, which is expected for a gap closure scheme as vehicles are required to travel further to improve safety at a junction. This dis-benefit averages to 106 vehicle hours per scheme in Area 6. This demonstrates the need to be cautious when interpreting area results.

In terms of value for money, only Area 7 delivers a negative FYRR due to the high vehicle hour dis-benefit, whilst the highest FYRR across the areas is for Area 13. The high FYRR in Area 14 is a function of the relatively high accident saving per scheme (1.9 accidents saved per scheme) and the relatively low average scheme costs (£69k, which is the lowest of all the areas), giving a high FYRR of 303%. This suggests a recouping of scheme costs within four months of scheme completion, demonstrating exceptional performance.

What is journey time reliability and why is it important?

A scheme is also appraised against its impact on journey time reliability, which is the variation in journey times that road users cannot predict. There are two elements to journey time reliability:

- Day to day variability (termed DDV) – this refers to the variation in journey times caused by congestion at the same period each day. For example, a driver may expect there to be congestion on a certain route on a Friday evening but they would not be able to predict the exact time of day the delays will occur or the duration of delays; and

- Incident related variability (termed IRV) – this refers to a variation in journey times due to non-predictable events such as accidents, spillages from HGVs or objects in the carriageway.

Journey time reliability impacts can be monetised using economic appraisal software, however based on current WebTAG guidance the monetised impact of reliability is not included in the calculation of a forecast FYRR and BCR. In line with guidance, we do not monetise the journey time reliability impacts or include it as part of the outturn FYRR or reforecast BCR.

In POPE, whenever we have used Satellite Navigation data to assess a change in journey time, we also use the data to assess the change in journey reliability. Rather than disaggregating between the impact of the scheme on DDV and IRV, we use journey time data to make one overall assessment of the change in journey reliability, which is likely to include an element of both IRV and DDV. A case study is provided overleaf to show how we have assessed journey time reliability.

The approach currently consists of examining the change in journey times on routes relevant to each scheme to inform an overall assessment of the impact on journey reliability. The evaluation of non-junction schemes tends to be simpler as evaluations often include only one or two journey time routes, however the assessment of junction schemes is often more complicated including several routes. As noted earlier, schemes can often improve journey times for some movements through a junction whilst worsening journey times for other movements. The same applies to reliability in that the impact of a scheme may vary according to each individual movement (with differing traffic flows for each movement) and time period at a junction.

In the future, we expect to move towards ‘flow weighted reliability’ which would weight the level of reliability impact according to the volume of traffic making each movement. The advantage of this approach will be to provide a single quantitative measure of journey reliability, allowing for direct comparisons between different schemes. For the time being however, as the case study overleaf demonstrates, we rely on the qualitative interpretation of the quantitative journey time results only.

Case Study 3: M5 J5 Economy Scheme (Worcestershire)

Introduction

The M5 Junction 5 economy scheme was designed and implemented by Area 9. The junction is a grade separated dumbbell roundabout (see adjacent map), with four main approaches. In order to reduce delays on two of the approach arms, the link between the two roundabouts was widened and new signing installed to inform drivers of the new layout. In addition to reducing journey times for users of the junction, the PAR also forecast that the scheme would reduce the annual accident rate.

Opening Date:

April 2012

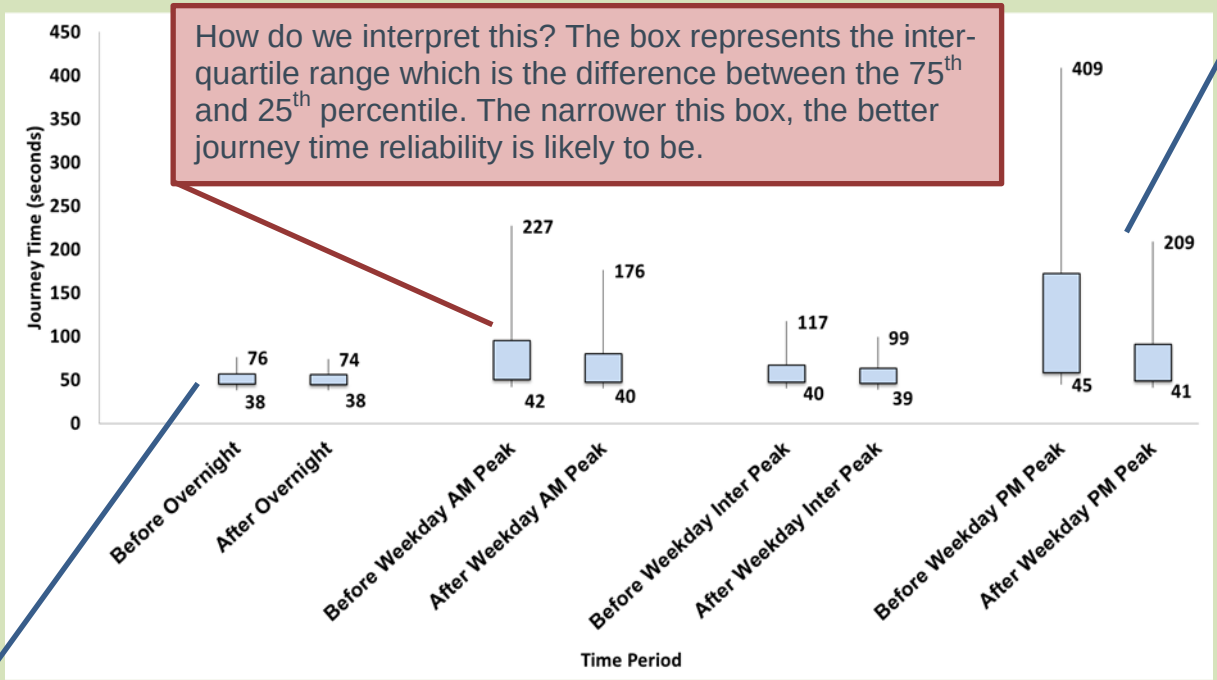
Outturn Cost:

£306k

Journey Times

The evaluation showed that the scheme saved just under 18,000 vehicle hours, which was close to the PAR prediction. We then used the data to determine the impact on journey reliability, with a snapshot of our analysis below. This shows clearly that the impact on reliability depends on the time period, with benefits in the AM and PM peak but less notable impacts at other times.

How do we interpret this? The box represents the inter-quartile range which is the difference between the 75th and 25th percentile. The narrower this box, the better journey time reliability is likely to be.



The results show the interquartile range in the before and after periods is almost the same, indicating journey time reliability has not improved overnight or during the inter-peak period.

This shows that journey time reliability has improved in the PM peak as the interquartile range is smaller in the after period than the before period.

What are the results for the other WebTAG objectives?

Up until now we have focused our analysis on the impact of schemes on journey times and accidents, however each LNMS is also assessed against its impact on a range of other objectives, including the Environment and Society WebTAG objectives. Our evaluation includes an assessment of the outturn impact of each scheme on these objectives.

The analysis in this section includes only recent schemes and outliers have not been excluded. In the last four years, the majority of PARs have been either PAR5 or PAR6. The main differences between these PARs are the sub-objectives included within the objectives. The majority of the sub-objectives are the same, however some new sub-objectives have been introduced into the latest PAR version. In order to allow for consistent and informative analysis of schemes' impacts across multiple PAR versions, the PAR6 sub-objectives have been matched with the PAR5 sub-objectives and any outstanding sub-objectives (those which can't be matched) are reported separately. The table overleaf shows the predicted and actual impacts on each sub-objective, allowing for an assessment of how accurate the appraisals have been.[2]

Results (Focussing on Forecast Impacts)

Whilst a neutral impact was forecast in the PARs for the majority of the sub-objectives, beneficial impacts were forecast more often than adverse impacts, as we might expect. An example of a scheme which may however forecast some adverse impacts is a large signing scheme. Whilst the scheme would typically be expected to reduce the number of accidents, through providing improved warning of upcoming hazards or the presence of a junction, the impact of the landscape of these new signs may be considered adverse.

The table also shows that:

- Landscape is the sub-objective that receives the most forecast adverse scores, with six schemes forecasting this outcome. However the vast majority of schemes forecast either a neutral impact (64 schemes) or a beneficial impact (four schemes); and
- Journey ambience receives the most forecast beneficial scores, with 50 schemes expected to deliver this outcome. Journey ambience (now replaced by Journey Quality in newer PARs) was primarily linked to accidents and journey times and therefore if a scheme was expected to deliver a beneficial impact on these, then driver stress was considered to be reduced and the scheme subsequently received a beneficial score in the PAR. Of the remainder, 13 schemes were forecast to have a neutral impact and no schemes were forecast to have an adverse impact.

Accuracy

The majority of the sub-objectives received an evaluation score that was the same as that forecast in the PAR, with overall accuracy between approximately 90% and 100%, indicating largely accurate forecasts. Journey ambience and journey quality are however the two sub-objectives where there have been numerous instances of the actual impact differing from that which was forecast, with accuracy of forecast impacts of 63% and 32%

[2] PARs often include a 'Not Applicable' score for some sub-objectives. If a PAR score of 'Not Applicable' is shown in the PAR and we find in the evaluation that there has been an impact, then we score the outcome as either 'Better than expected' or 'Worse than expected', depending on the nature of the outcome.

respectively (as highlighted with red bold text in the table). Further analysis is now provided on these two sub-objectives:

- Journey quality is scored based on seven factors ranging from public transport facilities to driver frustration. Each scheme receives a score for each of the seven factors which are then totalled to calculate the overall impact. Aside from the 52 schemes where this sub-objective was marked as not applicable, there were only seven schemes where an impact on journey quality was forecast. Looking at the outturn impacts, 19 (30%) delivered the type of impact expected and 39 (61%) delivered an impact better than expected. These results indicate that scheme appraisals are not always recognising that schemes could have an impact on journey quality; and
- Journey ambience has a higher level of accuracy and of the 64 schemes, 24 (37%) were rescored for journey ambience in the EST. This consisted of 16 schemes having an impact worse than expected and eight schemes an impact better than expected. Whilst journey quality is based on seven independent factors, journey ambience is closely associated with the impact of a scheme on accidents and journey times and hence an increase in journey times and / or accidents could give rise to an adverse score for journey ambience in the EST.

Aside from the journey ambience and journey quality sub-objectives, on the whole the scores in the EST are very rarely changed from the AST scores, which indicates a high level of accuracy in forecasting the impacts of schemes on other WebTAG objectives, which is a positive message.

Predicted WebTAG objectives and accuracy levels

Objective	Sub-objective	Forecast Impact				Comparison of Forecast and Outturn Impact			
		Adverse	Neutral	Beneficial	Not Applicable /Not Assessed	Impact Better than Expected	Impact as Expected	Impact Worse than expected	Proportion Correct
Economy	Regeneration	0	6	3	50	3	56	0	95%
	Journey Quality	0	2	5	52	39	19	1	**32%**
	Wider Impacts	0	1	0	58	0	59	0	100%
Environment	Noise	0	55	4	64	2	118	3	96%
	Local Air Quality	0	60	2	61	1	120	2	98%
	Greenhouse gases	0	56	2	65	3	120	0	98%
	Landscape	6	64	4	49	0	116	7	94%
	Townscape	1	60	1	61	2	119	2	97%
	Heritage	1	68	0	54	0	123	0	100%
	Biodiversity	1	66	1	55	1	121	1	98%
	Water	0	67	1	55	0	123	0	100%
Society	Security	1	31	2	52	4	81	1	94%
	Physical Fitness	0	64	4	55	2	119	2	97%
	Access to Transport System	0	1	0	58	0	59	0	100%
	Affordability	1	3	1	54	2	57	0	97%
	Severance	0	68	7	48	6	115	2	93%
	Option Values	0	53	1	69	2	120	1	98%
Previous PARs	Wider Economic Impacts	0	14	2	11	0	26	1	96%
	Journey Ambience	0	13	50	1	8	40	16	**63%**
	Transport Interchange	0	52	0	12	0	64	0	100%
	Land Use Policy	0	49	4	11	0	62	2	97%
	Other Government Policies	0	44	10	10	0	59	5	92%

Summary

What are the results for the recent schemes and how do they compare to the older schemes?

- *The recent schemes on average cost £447k, which is higher than the older schemes which on average cost £343k.*
- *The average accident saving for the recent schemes and older schemes is similar at 1.8 and 1.7 respectively.*
- *The recent schemes deliver on average low vehicle hour savings (851) compared to the older schemes (5,679).*

How does scheme cost affect the benefits delivered?

- *Generally there is an increase in annual accident saving as scheme cost increases, with a range in annual accident saving from 0.9 for schemes costing less than £100k to 4.1 for schemes costing over £2m.*
- *The trend is much less clear for journey times, largely due to new signal schemes that cost between £500k and £1m and over £2m delivering dis-benefits in the opening year.*

How are the areas performing based on the recent schemes?

- *There is a wide variation in the average cost of a scheme between the areas, ranging from £69k to £2.2m.*
- *LNMS are successful at reducing accidents across the country with all areas delivering a benefit in the opening year between 0.5 and 3.8.*
- *Area 13 achieves the highest FYRR of 303%, whilst Area 7 delivers a negative FYRR due to a substantial vehicle hour dis-benefit from a new signal scheme.*

What is journey time reliability and why is it important?

- *In POPE, whenever we have used Satellite Navigation data to assess a change in journey time, we also use the data to assess the change in journey reliability. Currently this is a qualitative assessment but we are moving towards a quantifiable measure using flow weighted reliability.*
- *The case study showed how journey reliability can vary considerably across different movements and time periods.*

What are the results for the other WebTAG objectives?

- *The landscape sub-objective receives the most adverse predicted scores, however schemes often aim to reduce accidents and improve journey times but have a negative impact on landscape at the same time. For example, a new signing scheme may aim to reduce the accident rate, but in doing so could have a negative impact on the landscape.*
- *The overall accuracy of predicted impacts on the other WebTAG objectives is high, however journey ambience and journey quality forecast impacts have a high level of inaccuracy.*

Safety & Economy LNMS – Accuracy of Appraisal

Having focussed up to now on the results of the schemes, in this chapter we consider whether the predicted impacts have materialised, which is the second of the POPE aims:

The performance in the first year and over the longer term	**Whether performance has been better than, worse than, or as expected**

We look at how accurate the forecast costs, accidents impacts and journey time impacts are at both a programme level and individual scheme level for the recent schemes. To do this, we compare our results with the forecasts in the PAR. To recap, PARs are documents which are completed for all schemes and outline the forecast costs and benefits, culminating in a prediction of value for money. This information is used by Highways England to determine whether a scheme is implemented and hence the accuracy of this information is crucial.

Our two measures of accuracy are as follows:

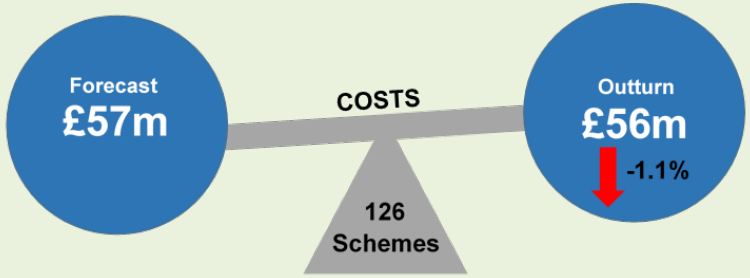
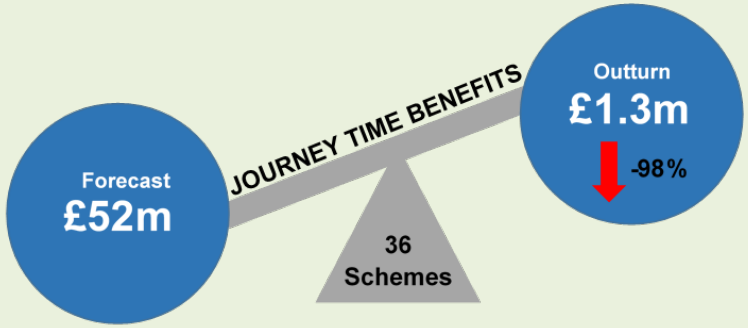
- Accuracy at the programme level: If we sum the predicted costs for all schemes, how do these compare to the actual outturn cost of all schemes? We also make the same comparison for benefits; and
- Accuracy on a scheme by scheme basis: What proportion of schemes have outturn costs that are within a certain threshold of what was predicted? Again, we make the same calculation for benefits.

This section first looks at the programme level results before considering the accuracy on a scheme by scheme basis. **Outliers are not removed from the samples included in this chapter.**

How accurate are the forecasts for the LNMS programme?

Last year's Annual Evaluation Report highlighted that there were substantial inaccuracies with journey time forecasts and consequently recommended that consideration was given to journey time appraisal techniques. In this chapter, we look at the accuracy of forecast costs, safety impacts and journey time impacts in the first year of opening for the recent schemes, which are those completed in the last four years. The results will indicate whether investment decisions have been based on accurate forecasts and suggest if advances in scheme appraisal methods and guidance in the last four years have improved the accuracy of forecast impacts.

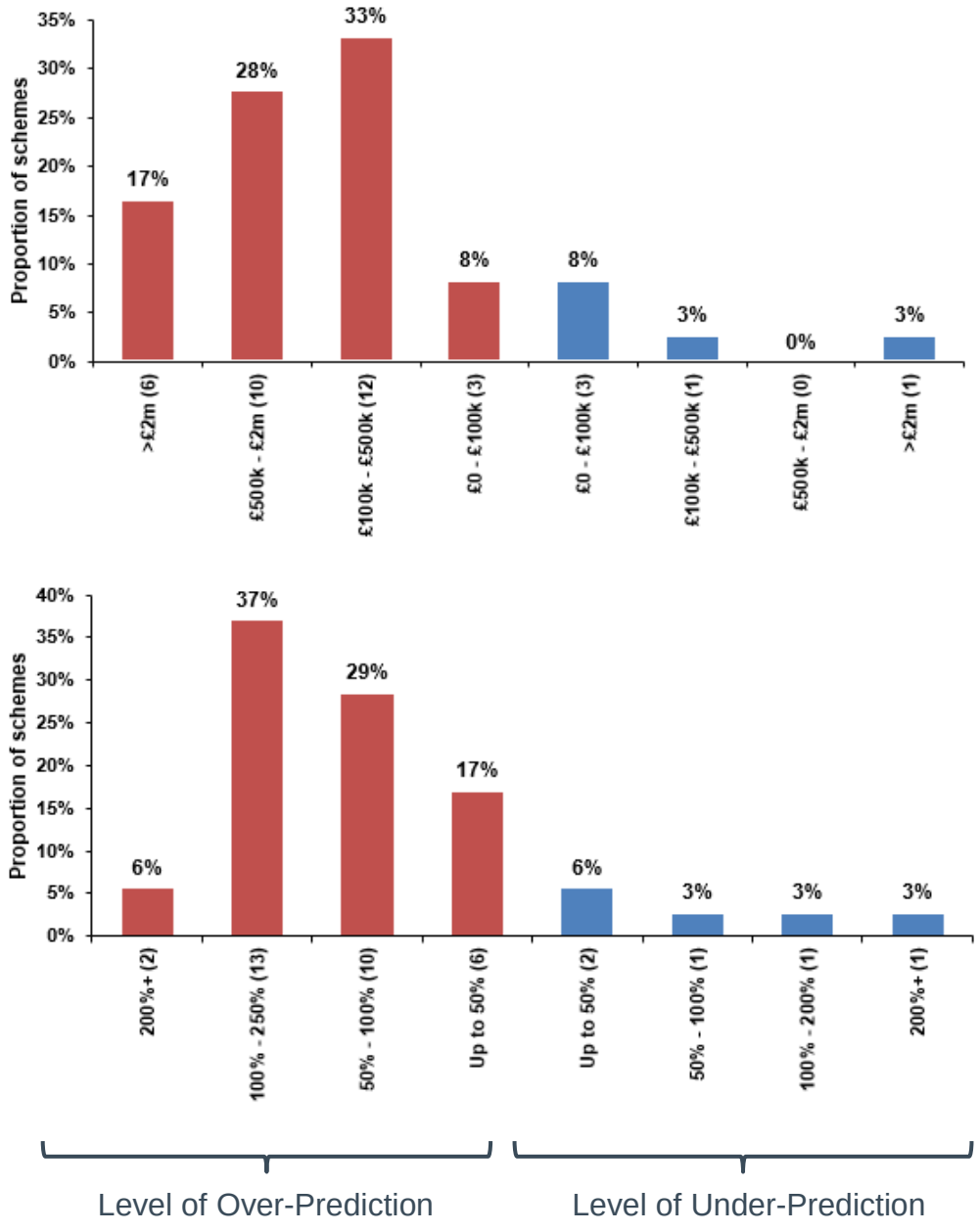
We compare only schemes that have a forecast cost, accident or journey time impact in the PAR with the results of our evaluations and the graphic overleaf details the number of schemes that we have considered. We have used this approach as the inclusion of schemes that were found to have an impact when the PAR did not predict any impact does not help in understanding the accuracy of forecasts. We consider the performance of schemes without forecast impacts later in this chapter.

Metric	What has happened?	What does this tell us?
Scheme Cost		The total outturn cost of the recent schemes is £56m, which is only slightly lower than the expected cost of £57m based on costs in the PARs. It goes without saying that accurately predicting the cost of a scheme is a key determinant of accurately predicting value for money. Whilst we show later that there are individual inaccuracies with scheme costs, at a programme level the evidence shows that costs have been accurately appraised
Average Accident Saving		The accident forecasts at a programme level are highly accurate. Overall the accident impacts are being slightly over-predicted, with the actual observed impacts being 11% lower than forecast in the PARs
Average Vehicle Hour Saving		Unfortunately the results are not as positive in regard to journey time impacts. Overall the journey time benefits delivered are **substantially** lower than the PARs predicted. The actual outturn benefit of £1.3m is 98% lower than the forecast. Further interrogation of the differences between the forecast and outturn impacts shows the majority (65%) of schemes delivered lower than expected journey time impacts, with 12% delivering an impact between £500k and £2m less than expected and 8% delivering an impact over £2m less than forecast. Further analysis is provided overleaf

As the table shows, there is a clear tendency towards over-predicting journey time impacts, with 65% of the sample of recent schemes having outturn impacts that are lower than forecast.

The graphs below shows the profile of accuracy of appraisal for journey time impacts of the 36 schemes with forecast impacts. The left four columns on the first graph show the absolute over-prediction (i.e. outturn impacts lower than forecast) and the right four columns show under-prediction. The results demonstrate a clear bias towards over-prediction. The data shows that the majority of the over-predictions (61% of schemes), which are perhaps of greatest concern, are between £100k and £2m. It is concerning that a further 17% of schemes have over-forecast their journey time benefits by in excess of £2m. That 17% comprises six schemes and of those, four forecast a benefit but delivered a dis-benefit (three of these were new signals schemes) and two forecast a benefit and delivered a lower than forecast benefit. The second graph shows the proportion of inaccuracies. 23 (66%) of the 36 schemes delivered journey time benefits between 50% and 250% lower than forecast.

Profile of appraisal accuracy for journey time impacts



Finally, the table overleaf shows how the level of over-prediction varies according to size of scheme. Albeit based on low sample sizes, the table shows the proportion of schemes where benefits have been over-predicted. For those schemes where there has been an over-prediction, the last two columns then shows the total over-prediction originating from the schemes and the average level of over-prediction. This data shows us that the over-prediction of benefits is occurring across all sizes of scheme, with between 75% and 100% of schemes having their benefits over-predicted. The right-most column shows very clearly that the level of over-prediction increases with size of scheme.

Scheme cost bracket	Number of schemes with forecast impact	Number and proportion of schemes where JT benefit was less than forecast	Total difference between forecast and outturn for schemes with over-predictions	Average difference between forecast and outturn for schemes with over-predictions
<£100k	4	3 (75%)	-£0.03m	-£0.01m
£100k - £500k	12	9 (75%)	-£2.6m	£0.3m
£500k - £1m	6	6 (100%)	-£7.2m	-£1.2m
£1m - £2m	10	9 (90%)	-£23.8m	-£2.6m
£2m +	4	4 (100%)	-£20.7m	-£5.2m

Are the types of outturn impacts similar to the forecast impacts?

In this section, we consider whether the appraisals are getting the type of journey time and accident impacts right. For example, does a scheme that forecasts a benefit for journey times generally deliver a benefit?

Key findings – accidents

The table below shows the outcomes for the 121 schemes which forecast an accident saving, breaking the sample down into those which delivered either a benefit, dis-benefit or no impact.

Comparison of type of forecast and outturn accident impacts[3]

	Forecast	Outturn	Number of Schemes	Forecast Total	Outturn Total	Average Difference per scheme
Accident Impacts	+	+	94 (78%)	£19.3m	£25.1m	£62,000
	+	-	26 (21%)	£4.4m	-£4.0m	-£323,000
	+	0	1 (1%)	£0.6 m	£0m	-£615,000

Figures may not total due to rounding

The table shows that the appraisals for the majority of the recent schemes are successful at forecasting accident savings, with 78% of schemes that forecast a saving actually delivering a saving. On average, these schemes deliver a higher level of benefit than forecast, equating to an additional £62k per scheme. The proportion of schemes that deliver a dis-benefit (despite forecasting a benefit) is 21% (26 schemes) and these schemes on average deliver a dis-benefit that is £323k lower than forecast.

[3] Note the percentages are based on the total number of schemes expected to have that type of impact.

Key findings – journey times

The same analysis has also been undertaken for journey times, but this time there are six potential combinations of forecast and outturn impact, as two of the 36 schemes forecast a dis-benefit to journey times. Of the two schemes which forecast a dis-benefit, one was a speed limit reduction and the other was a banned turn, hence the expected increase in journey times appears logical in both cases.

Comparison of type of forecast and outturn journey time impacts[4]

	Forecast	Outturn	Number of Schemes	Forecast Total	Outturn Total	Average Difference per Scheme
Journey Time Impacts	+	+	17 (50%)	£30.0m	£5.2m	-£1.4m
	+	-	15 (44%)	£22.5m	-£6.8m	-£2.0m
	+	0	2 (6%)	£0.5m	£0m	£0.3m
	-	-	1 (50%)	-£4.3m	-£4.3m	£0m
	-	+	1 (50%)	-£2.8m	£3.6m	£6.4m
	-	0	0	£0m	£0m	£0m

The results show that 50% of schemes that were expected to deliver a benefit actually delivered a benefit. However, these schemes did not achieve the level of benefits expected and on average delivered £1.4m lower journey time benefits than expected. Two of the schemes (one consisting of widening and the modification of signals, and the other a new signal scheme) delivered extremely low benefits compared to their forecasts. These schemes delivered benefits which were £6m and £13m less than expected respectively.

A further 44% of schemes were also expected to deliver a journey time benefit but delivered a dis-benefit, equating to on average £2m less than the benefit expected. One of the schemes in this category is a new signal scheme which delivered an outturn journey time dis-benefit that was £10m lower than the forecast benefit.

Overall these results indicate that the type of journey time impacts (i.e. whether a benefit or dis-benefit) are forecast accurately approximately half of the time, however, when the forecast type of impact is correct, the impacts are substantially over-predicted. These results provide further reasoning for the large over-prediction of journey time benefits at a programme level.

How did the schemes without forecast impacts perform?

Up until this point, we have focussed on the accuracy of appraisal only for those schemes with forecast impacts. In this section, we

[4] Note the percentages are based on the total number of schemes expected to have that type of impact. Figures may also not total due to rounding.

now consider the results for the schemes without forecast impacts to establish whether forecasts for accident and journey time impacts should have been made as part of the appraisal. There are three possible outcomes as shown in the table below. We are really interested in understanding whether the decision to not forecast an impact was correct. The focus of this section is therefore on the outcomes where the PAR did not predict a scheme would have an impact (either on journey times and / or accidents) and our evaluation found there has been an impact (benefit or dis-benefit).

Potential outcomes for schemes without forecast impact

Predicted impact	Outturn impact	Interpretation	Was the appraisal decision correct?
No impact	No impact	The decision not to forecast an impact is correct	✔
No impact	Dis-benefit	The decision not to forecast an impact is incorrect as our results show the scheme has had an impact on journey times and / or accidents	✘
No impact	Benefit		✘

Of the 126 schemes that have been evaluated in the last four years, 36 schemes had journey time impacts predicted and 121 schemes had accident impacts predicted. Subtracting these from the total sample shows that 90 schemes did not have a journey time impact forecast and five schemes did not have an accident impact forecast.

Key findings – accidents

All five schemes without forecast accident impacts had an impact on accidents, which is to be expected as it is rare for an annual accident rate to be completely static. Four schemes (80%) delivered a positive impact, with an average benefit of £114k per scheme. The remaining scheme delivered a dis-benefit of £3k. All of these schemes are *economy* schemes involving widening or signals (new or modified), where the main focus is on addressing capacity issues at junctions, which might explain why the potential safety impact of these measures had not been considered in the appraisals.

Whilst these results indicate accident impacts should have been predicted, only five (4%) of the 126 schemes evaluated in the last four years have not predicted an impact on safety, confirming that in most cases the appraisal has taken account of the potential impact of the scheme on annual accident rate.

Key findings – journey times

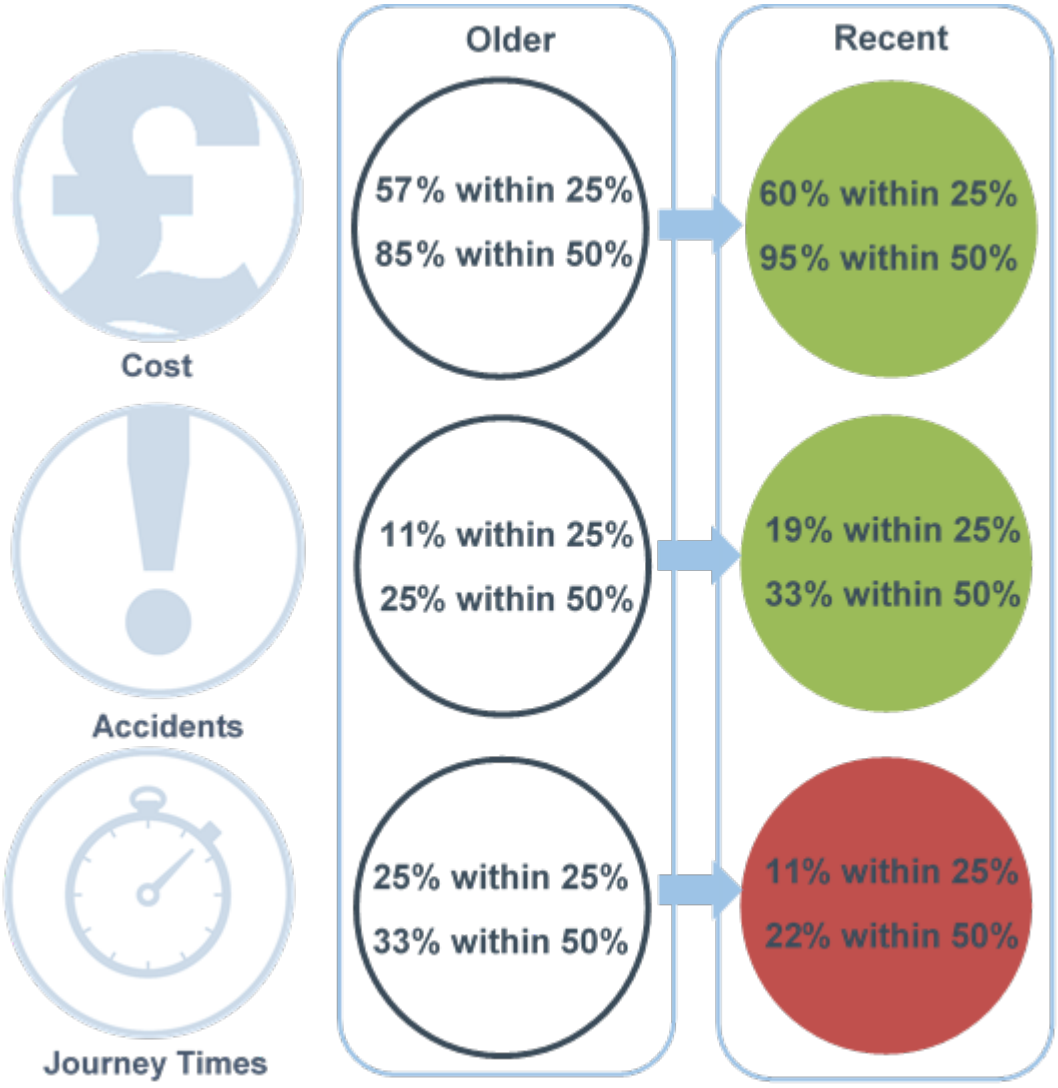
Of the 90 schemes without forecast journey time impacts, 89 (99%) delivered no impact, meaning the decision to not forecast an impact was appropriate. Only one of the 90 schemes delivered an impact on journey times, which was a benefit of £115k. This confirms that in most cases, impacts are being forecast where they should be.

How accurate are the forecasts and how do they compare to previous years?

The previous section focussed on the accuracy of the forecast total costs, journey time and accident impacts for the recent schemes at a programme level, however, this section considers the accuracy of individual scheme forecasts to understand if there is a difference in accuracy between schemes. In line with our other analysis, we have considered the accuracy of scheme costs, journey time and accident impacts for the recent schemes (2010 – 2013) but we have also considered accuracy for the older schemes (2002 – 2010) to understand if there has been an improvement in accuracy over time.

The cost accuracy assessment includes all schemes (126), as every scheme had a forecast cost in the PAR, whereas the analysis of journey time (36) and accident accuracy (121) includes only schemes with forecasts. The headline results are shown in the graphic below. Green shading for the recent schemes indicates an improvement in appraisal accuracy over the older schemes whereas red shading highlights a deterioration.

Accuracy of individual scheme forecasts



Key findings – costs

The accuracy of forecast costs has improved for the recent schemes. The proportion of schemes with outturn costs within 50% of their forecasts has increased by 10 percentage points between the two periods. As a result, 95% of schemes evaluated in the recent years are within 50% of their forecast cost. Costs are more accurately appraised than accident and journey time impacts, which we might expect as project managers are able to review and control their costs as the project develops, making changes where needed to ensure that the project is delivered to the agreed budget.

Key findings – accidents

The accuracy of forecast accident impacts has improved for the recent schemes, with the proportion of schemes within 25% more than doubling between the two periods, however the overall accuracy remains poor. The results show that the accuracy of accident forecasts for recent schemes is poor, with 19% of outturn accident impacts within 25% of the forecast, increasing only to 33% within 50% of the forecast.

These poor levels of accuracy could in part be a function of the methodology used in POPE and the use of relatively limited periods of post-scheme accident data.

Accidents are random in nature and using only one year of accident data means any skewing in accident numbers cannot be averaged across several years. In addition, some PARs forecast a saving less than one (for example, an expected annual accident saving of 0.5), meaning it is impossible for schemes to achieve their expected saving based on only one year of post-scheme observed data (as a scheme can only save at least one accident or no accidents within 12 months).

By their very nature, accidents are random events and are virtually impossible to accurately predict. The accuracy of the impact is also likely to vary according to measure, as some schemes such as banned turns are making far more impactful changes than others, such as simple signing schemes.

Regardless of the individual scheme accuracy, comparison of the cumulative forecast and outturn accident impacts for the recent schemes (as shown at the start of this section) reveals accident impacts are being accurately appraised at the programme level.

As noted earlier in the report, it is important to note that given the short timeframe over which the accident analysis is undertaken (with the post-scheme accident period required to be at least 12 months), no single scheme's safety results should be taken as statistically robust, but the aim of the commission is to combine the results from many different evaluations to provide more robust results.

Key findings – journey times

The overall accuracy of journey time forecasts is poor for both sets of schemes, however the proportion of schemes within 25% and 50% of their forecasts has reduced for the recent schemes. As we noted earlier, this is in part linked to a number of new signals schemes which have delivered considerable inter-peak and overnight dis-benefits, which means that despite some good peak time benefits, the schemes are often delivering overall dis-benefits.

Last year's Annual Evaluation Report revealed substantial inaccuracies in journey time forecasting, based on all schemes evaluated to that point in time. This year, having looked at the performance of the older schemes versus the recent schemes, we can see that unfortunately the level of appraisal accuracy has decreased for the recent schemes, with just 11% of recent schemes delivering an outturn journey time impact within 25% of their forecast impact. This suggests an action plan is needed to ensure the accuracy of journey time appraisal improves in the future and that schemes implemented can deliver the improvements required at a particular location.

Summary

How accurate are the forecasts for recent schemes at a programme level?

- *Costs are the most accurately appraised element, with outturn costs approximately 1% lower than forecast.*
- *Outturn accident benefits are 11% lower than forecast and the LNMS have delivered £21m of benefits compared to a forecast benefit of £24m.*
- *The accuracy of journey time benefit appraisal is poor, with outturn benefits of only £1.3m compared to the forecast total of £52m, which means the LNMS programme is delivering benefits 98% lower than expected.*

Are the types of outturn impacts similar to the forecast impacts?

- *Of the schemes which forecast a benefit for accidents, 78% achieved a benefit, which on average was £62k higher than forecast.*
- *Half of the schemes that were forecast to deliver a journey time benefit have delivered a benefit, however on average they deliver a benefit that is £1.4m lower than predicted.*

How did the schemes without forecast impacts perform?

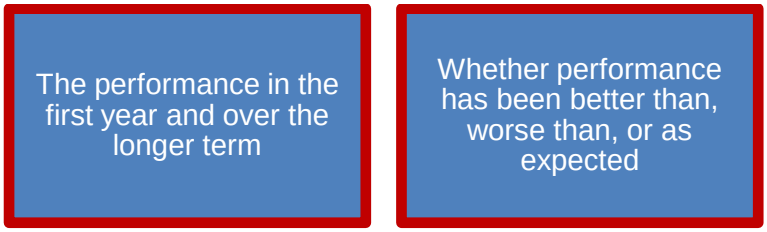
- *90 of the 126 schemes in our sample did not have journey time impacts predicted. Only one of these schemes delivered a journey time impact indicating the decision not to appraise an impact was correct for the vast majority of schemes.*
- *Five of the 126 schemes were not expected to have an impact on safety. Four of these schemes delivered a benefit and one delivered a dis-benefit, indicating these schemes should have had an impact predicted in their appraisal.*

How accurate are the forecasts and how do they compare to previous years?

- *On an individual scheme basis, cost is the most accurately forecast element of appraisal for recent schemes.*
- *The accuracy of forecast accident and journey time impacts is poor on a scheme by scheme level, with very low percentages of schemes having outturn impacts within 25% or 50% of what was forecast.*
- *The accuracy of scheme appraisals for scheme cost and accident impacts is better for recent schemes than older schemes, however, the accuracy of journey times for recent schemes is worse than older schemes.*

Environment and Severance LNMS – Results and Accuracy of Appraisal

The focus in the last chapter was on the safety and economy schemes only, but in this chapter we look in detail at both the results and appraisal accuracy for the other scheme types, namely the environment and severance schemes. These schemes are evaluated using a different approach from the safety and economy schemes and hence the outcomes are reported separately in this Annual Evaluation Report. This chapter covers both of the POPE aims:



It is not possible to monetise the majority of the impacts for these schemes. We instead evaluate them using a qualitative approach, culminating in an assessment of whether we consider that the scheme has met its key objectives. We seek to identify whether schemes have performed better than expected, as expected, or worse than expected.

The focus of this section is to initially look at this year's scheme results, namely 10 environment schemes and six severance schemes, exploring examples of good and bad practice using case studies. We then re-visit and examine the historic sample of schemes, before exploring the POPE process and suggesting improvements for future evaluations.

Given the differing approach to evaluation, in this chapter we consider the environment schemes and severance schemes separately.

Environment schemes

Environment schemes focus on reducing the direct and indirect impacts of transport facilities on the environment of both users and non-users.

Before looking at the outcomes from this year's scheme evaluations, it is useful to recap on the broad approach to evaluation, to understand what the limitations in our approach are. Evaluation starts with a detailed desktop review of all of the scheme location plans, drawings and other detailed specification documents we receive. Our environmental specialists then prepare the necessary pro-formas to capture the information needed for a robust evaluation and standardise the survey methodology. Site visits are then undertaken where visual inspections of the scheme and specialist surveys are completed in order to collect detailed information and observe the

outturn impacts of the scheme. The type of survey undertaken is dependent on each individual scheme and in some cases the Environmental Steward from the area team will accompany our staff on site, helping to explain each scheme's local context and circumstances.

Summary of results

A summary of the 10 evaluated environment schemes from this year is provided in the table overleaf. In the right-most column, we show that of the 10 schemes evaluated, four have fully met their objectives, five have partially met their objectives and one has not met its objectives. This is generally a positive message but does highlight that there is considerable room for improvement.

Eight of the 10 schemes have beneficially impacted the environment WebTAG sub-objectives with four resulting in a biodiversity benefit, one resulting in a landscape benefit and three resulting in both a biodiversity and landscape benefit. Of the two schemes without beneficial impacts, one was found to be neutral for all of the environment WebTAG sub-objectives and the final scheme evaluated was found to be adverse for biodiversity, landscape and townscape. There were no forecast or actual impacts on the remaining environment sub-objectives.

Scheme Name	Area	Sub-Objectives (✓= beneficial impact, ×= adverse impact)			Scheme Objectives	Objectives Achieved?
		Landscape	Biodiversity	Townscape		
A66 Smallways (Nor Beck) - Provision of Otter Ledges and Fencing	14		✓		To reduce the likelihood of otter road traffic accidents and contribute towards the target of installing mitigation measures across the network for the protection of otters	Partial
Butterfly Habitat Enhancement	7		✓		To enhance the habitats for a range of butterfly species	Partial
Network wide Safe Crossings for Deer	1		✓		To reduce the number of deer vehicle collisions through the installation of deer proof fencing and adaptation / enhancement of existing highway features	Yes
A66 Temple Sowerby Bypass Barn Owl Mitigation	13	✓	✓		To reduce barn owl fatalities by creating a hedgerow / woodland screen to prevent barn owls flying low over the carriageways	Partial
A590 Bat Mitigation	13		✓		To install bat roosting opportunities to contribute to biodiversity targets	Yes
M69 Hedgerow Improvements	7	✓	✓		To enhance the habitat condition of hedgerows to improve biodiversity, visual screening and the aesthetics of the road corridor	Yes
A38 Ivybridge Soft Estate Improvements	1	✓			To improve the woodland structure and integrity, contribute to wider landscape connectivity and enhance the biodiversity	Partial
A38 Manadon Retaining Wall Planting Improvement 2012-13	1	×	×	×	To secure the safety of the road user, protect and enhance the landscape, support and enhance biodiversity, improve journey ambience and protect and enhance the townscape	No
A38 Saltram Soft Estate Improvements	1				To repair the ‘native’ woodland by supplementing existing native species with extra planting and removing the ‘non-native’ species	Partial
A38 Gylnn Valley Woodland Improvements	1	✓	✓		To re-establish the integrity of this ancient woodland and improve biodiversity through control of an invasive species and reducing the threat of Phytophthora	Yes

Have the outcomes and objectives of this year's evaluated schemes been met?

The previous table shows that of the 10 schemes evaluated this year, four have fully met their objectives. The four schemes which have met their objectives have been implemented to correct design standards as stated in the PARs, and for those schemes where usage can be observed (for example, bat boxes), evidence has been found to suggest the schemes are also being used as intended and hence have been a success. An example of one of the four fully successful environment schemes, A590 Bat Mitigation, can be found below.

Case Study 4	A590 Bat Mitigation (Cumbria)
Introduction	The scheme was implemented to enhance Area 13 for a number of bat species by improving opportunities for roosting, foraging and hibernating habitats in Cumbria. The scheme opened in February 2013 at a cost of £21k. 
Other Impacts	Our environment evaluation confirmed that this scheme met its objective of working towards the Highways Agency's (at the time of scheme implementation) Biodiversity Action Plan to enhance bat habitats. The evaluation confirmed that the number of roosting opportunities for bats has been increased by the installation of bat boxes along the A590. On the whole, the boxes were installed correctly and bats were found to be present in several locations.

Five of the schemes partially met their objectives, having some beneficial impacts on the environment WebTAG sub-objectives but not fully achieving the objectives set out in the PAR. An example of one of these partially successful environmental schemes, Butterfly Habitat Enhancement, can be found below.

Case Study 5	Butterfly Habitat Enhancement Environmental Improvement Scheme (Area 7)
Introduction	The scheme aimed to encourage butterfly diversification and population growth by grass cutting, seeding and plug planting. The scheme was completed in April 2013 at a cost of £414k. That cost includes maintenance throughout the 60 year scheme life. 
Other Impacts	The scheme **partially** met its objectives. Our environment evaluation confirmed that all sites visited showed evidence that the proposed habitat enhancements had been undertaken but only two had been successful. There was a lack of management across the scheme, including at the two successful sites and, if not rectified, all sites will become unsuitable for the target butterfly species. Management of scrub and trees is required to maintain grassland and wildflower verges and a wildflower grass cut is needed annually at the end of the season (September onwards).

Of the 10 schemes, only one, the A38 Manadon Retaining Wall Planting Improvement, did not meet its objectives and was found to have an adverse effect on the biodiversity, landscape and townscape WebTAG sub-objectives. Details of this scheme can be found below.

Case Study 6	A38 Manadon Retaining Wall Planting Improvement (Area 1)
Introduction	 The scheme comprised plot thinning and vegetation clearance, removal of all woody vegetation, treatment for weeds on site, removal of Virginia creeper, planting of native shrubs and installation of tree protection guards at the Manadon Road retaining wall in Plymouth. The scheme has **not** met its objectives. The scheme opened in January 2013 at a cost of £7k.
Other Impacts	Our environment evaluation found that the scheme had an adverse effect on the biodiversity, landscape and townscape sub-objectives. In regard to biodiversity, the value of the plot was considered to have been reduced, as the young hedge plants provide less habitat value than a mature belt of trees. It was envisaged however that over the years, shrub planting will develop further to provide a greater biodiversity value, but this will still not be sufficient to make up for the loss of the former belt of trees. When compared to the previous woodland belt it was seen as a deterioration of diversity and therefore the scheme was not judged to have achieved its objectives. The evaluation does acknowledge however that the area team had a difficult task in balancing the conflicting safety and environment objectives at this location.

Are there any examples of success / best practice that we can learn from?

With four fully successful schemes and five partially successful schemes this year there are numerous examples of success and best practice. An example of an overall scheme demonstrating best practice is the Network wide Safe Crossings for Deer Project. The deer-proof fencing was fully compliant with the PAR and DMRB specifications and would effectively prevent deer from crossing the road, reducing the likelihood of deer-vehicle collisions. The details of this scheme can be found overleaf.

Case Study 7	Network wide Safe Crossings for Deer Project
Introduction	The scheme aimed to reduce the number of deer-vehicle accidents in Area 1 by encouraging deer to use existing highway structures through the installation of small sections of deer proof fencing and adaptation / enhancement of existing highway features. The scheme was completed in March 2013 for a cost of £26k. This scheme is an example of **best** practice.  
Other Impacts	Our environment evaluation found that the deer fencing was installed to fully comply with the DMRB specifications and would effectively prevent any deer present in this location from accessing the main carriageway, thus reducing the likelihood of deer-vehicle collisions.

Good practice was also demonstrated on the M69 Hedgerow Improvements Scheme in which hedge planting was undertaken to improve connectivity, provide visual screening and improve aesthetics. The scheme was found to be successful but will rely on effective on-going management if this is to be maintained.

Additionally, there were many schemes evaluated this year which showed elements of success or best practice, even if the overall objectives weren't fully met. An example of this would be the A66 Smallways (Nor Beck) - Provision of Otter Ledges and Fencing Project in which the installation of the otter ledges under the A66 culvert were fully compliant with DMRB specifications.

Are there any elements of schemes we feel should have been approached differently?

The Annual Evaluation Report aims to highlight the areas of the environment schemes that could be approached differently to improve the process for future years. There are many examples of elements which could be tackled differently, even for the schemes evaluated as successful overall.

Each year the environment schemes we evaluate highlight the need for on-going management and aftercare and this year is no different. A lack of management and aftercare was found in the majority of the environment schemes evaluated this year ranging from a lack of vegetation clearance at the access / egress to the otter ledges to a lack of weed removal and on-going management of planted areas on the landscape based schemes. Although many of these schemes met their objectives (fully or partially), recommendations for regular monitoring and management have been made to ensure the schemes continue to be effective in the future.

Environment schemes involving planting often require a large amount of management during the first few years to ensure successful establishment of the plants and to remove weeds. Future planting schemes could be approached differently with use of biodegradable mulch mats. These would provide weed control in the newly planted areas but reduce the future management requirements as they do not need to be removed at a later date.

The Network-wide Safe Deer Crossings Project described previously was an example of best practice as the site that was implemented was done so successfully and complied with the DMRB specifications. There was, however, a lack of information regarding a second proposed site, described in the PAR, which highlights the importance of the provision of accurate and updated scheme information to aid in site visits.

Parts of the A66 Smallways (Nor Beck) - Provision of Otter Ledges and Fencing Project showed good practice, as described in the previous section, but the otter-proof fencing installed at this site did not meet the standards set out in the DMRB specification. The fencing installed was not high enough and had no overhang and thus would not prevent otter from accessing the carriageway. This example highlights the importance of following the standards set out in the DMRB.

Does the performance of this year's schemes differ from the historic sample?

Our evaluation of 10 schemes in this recent evaluation year brings the total sample of evaluated environment schemes to 45.

The meta-analysis from previous years found that the lack of maintenance and aftercare once a scheme has been introduced is a common issue encountered. Last year's schemes showed improvement in this area but this year's schemes have shown a lack of post-scheme management to be a recurring issue, as described in the previous section.

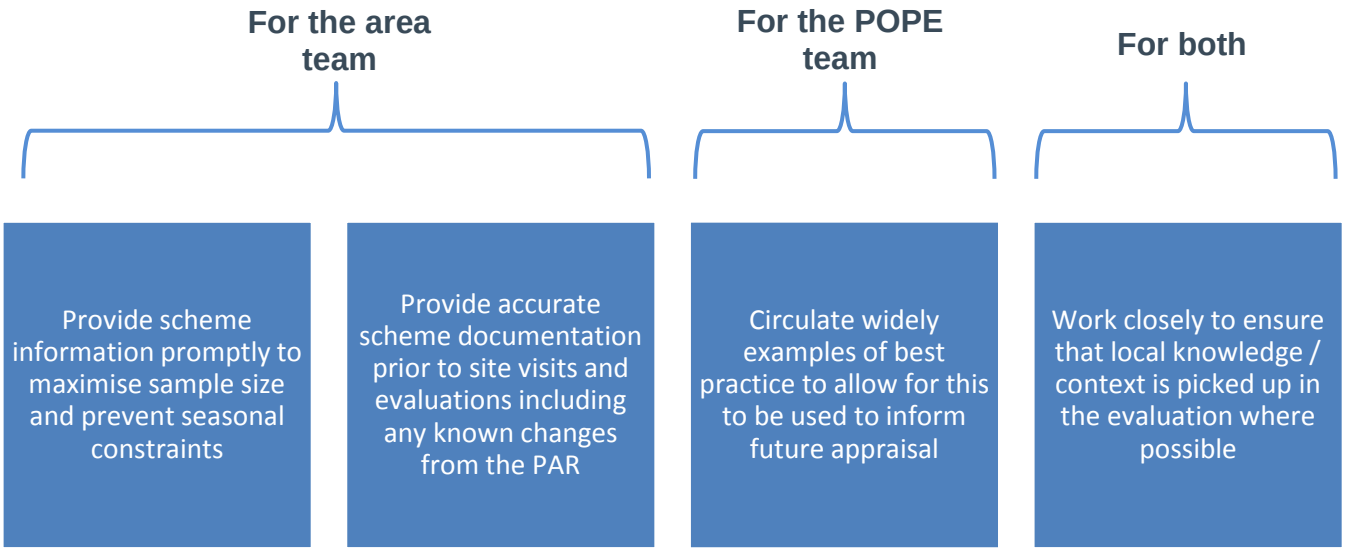
Overall, the performance of this year's schemes was similar to that of the historic sample and the evaluation process has highlighted the importance of:

- Developing thorough and long-term maintenance / aftercare plans;
- Complying with DMRB specifications for structures such as mammal-proof fences and culvert ledges;
- Regularly checking structures (gates, ledges and fences) and surveys of habitats and species surveys as structure defects / sudden changes in population need to be mitigated quickly and effectively; and
- Ensuring PARs and / or accompanying documents depict an accurate representation of the works that have been undertaken on site.

How can we improve the evaluation of future schemes?

Whilst the analysis in this section has focussed so far on the schemes themselves, it is also important that as part of this Annual Evaluation Report we take stock of our evaluation approach and consider where we can strengthen the POPE process in the future.

Overall this year's environment evaluations have been successful but there are still several areas which require improvement. It is essential that we continue to improve and develop our evaluations of these types of schemes to enable complete success in future years. The following factors are considered vital for robust evaluations of environment schemes in POPE. We have split these according to whether the suggestion is for the area team, the POPE team or a combination of the two:



Severance schemes

There are many types of severance schemes, but the most common ones are improvements to pedestrian and / or cycle facilities, for example in providing new lengths of footway or cycle lane. These schemes may sometimes aim to improve the environment for existing users and may sometimes aim to attract new users, with some schemes aiming for a combination of the two.

A 'one size fits all' approach is not possible for the evaluation of severance schemes, given the diverse range of measures and objectives. This means that in each case a tailored methodology must be adopted. The first step for all severance scheme evaluations involves a desktop review of available information from the area team, including the PAR, which contains the objectives of the scheme and its expected performance. Whilst no two scheme evaluations are identical, common elements of the evaluation then include:

- Consulting with stakeholders and other interested parties;
- Undertaking face-to-face surveys with local residents and users of the scheme;
- Undertaking site visits, where visual inspections are undertaken in order to ensure all of the proposed measures have been completed and are well-maintained; and
- Observing the scheme being used and user behaviour, in order to ensure that people are using the scheme as intended.

Summary of results

This year six severance schemes have been evaluated, with details provided in the table. This brings the total sample of evaluated severance schemes to 29.

All six of the schemes were judged to have a beneficial impact on the severance sub-objective, with five of the six schemes having a beneficial impact on the journey quality sub-objective. Four schemes successfully reduced the annual accident rate and two schemes made an improvement for the security sub-objective. In addition to the sub-objectives shown in the table, the A63 Pool Bank Lay-by Closure had a beneficial impact on the landscape and water environment sub-objectives.

It should be noted that five of the six schemes were predicted to have a beneficial impact on the physical activity sub-objective. However, in all five cases, a neutral score was awarded for the evaluation as, despite evidence of usage for some schemes, there was insufficient evidence that the schemes would significantly increase the number of people

who undertake exercise of any kind for over 30 minutes a day. This trend will continue to be monitored in future meta-analysis.

Scheme Name	Area	Sub-Objectives (✓= beneficial impact)				Scheme Objectives	Objectives Achieved?
		Severance	Journey Quality	Accidents	Security		
A66 Crosthwaite Roundabout – Cycleway Improvements	13	✓	✓	✓		To encourage more pedestrians and cyclists To improve safety for pedestrians and cyclists	Yes (with some caveats)
A66 Lamplugh Roundabout – Footway Improvements	13	✓	✓	✓		To reduce severance To encourage walking and cycling	Yes (with some caveats)
A1(M) J59 Coatham Mundeville Interchange – NMU Route	14	✓	✓			To increase NMU traffic, particularly cyclists and pedestrians To encourage cyclists to dismount from their bicycles when crossing the junction	Partial
A38 Tideford to Kilna House Footway Link	1	✓	✓	✓		To improve facilities and networking of safe walking routes	Yes
A63 Poolbank Lay-by Closure	12	✓		✓	✓	To improve community severance To improve the economy and safety To improve the environment	Yes (with some caveats)
A590 Witherslack Underpass Improvements	13	✓	✓		✓	To encourage greater use of the underpass by disabled people and other NMUs	Yes (with some caveats)

Have the outcomes and objectives of this year's evaluated schemes been met?

Of the six severance schemes evaluated, five have successfully met their objectives (albeit with some caveats) and one has partially met its objectives. An example of a successful scheme is the A38 Tideford to Kilna House Footway Link, which comprised the construction of a new footway linking two un-connected sections of footpath. This scheme

received positive feedback from a local resident and was judged to have fully met its objectives. Further details on this scheme are provided overleaf.

Case Study 8	A38 Tideford to Kilna House Footway (Cornwall)
Introduction	Prior to this improvement, there was no footway provision along this stretch of the A38. In order to address the need to increase accessibility and safety for pedestrians at this location, a section of new footway was constructed within the existing verge on the north side of the A38.  The extent of new footway covers the A38 from the eastern end of the village of Tideford to a public right of way (PROW) near Kilna House to the east of the village. The new footway also connects to the existing footway at the bus stop on the east side of Tideford, providing pedestrians with safe access to the bus stop and other services in the village. The scheme was completed in April 2012 for a cost of £141k
Other Impacts	Our assessment showed that this scheme has been implemented to a high standard and is well maintained. The scheme measures were considered to have an impact on severance by removing the need to cross the busy road in a dangerous location. Through the provision of an additional safer route for pedestrians, it was apparent that the scheme measures had a beneficial impact on severance. Based on the site visit and feedback from the local community, whilst there is some evidence of usage, a neutral impact was awarded for physical activity as there was insufficient evidence to award a beneficial score Quote from the parish council: *"As a result of the scheme the area is now much easier and safer to navigate and we consider it to be a real success."*

Another example of a scheme that has successfully met its objectives is shown overleaf.

Case Study 9	A63 Pool Bank Lay-by Closure
Introduction	This scheme is located on the A63 in Welton nearby Hull. Pre-scheme, Pool Bank Lay-by was used for vehicles to pull in and stop, and for access to Pool Bank Cottage. Previously in 2007, the lay-by had been temporarily closed due to complaints of inappropriate use by HGV drivers. At the time the adjacent footway was narrow, incomplete and had full height kerbs, which made use difficult for disabled people. After observing the success of the temporary closure, this scheme, completed in November 2013, saw the lay-by permanently close, leaving access for Pool Bank Cottage only. Additionally, a shared-use cycle / footway was implemented, a new 1m hardstrip on the A63 was introduced and redundant paved areas were landscaped 
Other Impacts	This scheme contributed towards reducing community severance through implementing a continuous and well maintained shared-use cycle / footway and addressed nuisance and security issues through closing the lay-by. A neutral score was awarded for physical activity as despite the new infrastructure being provided to facilitate walking and cycling, there was insufficient evidence of usage to warrant a beneficial score. A neutral score was also awarded for journey quality, as whilst the scheme was judged to have reduced the fear of accidents, it scored adversely in regard to facilities, as users of the A63 are no longer able to use the lay-by. The combination of these two elements (one beneficial and one adverse) leads to the neutral score. The site visit confirmed that the expected works have been delivered and that the facilities are well maintained Quote from the parish council: *"The alterations to Pool Bank Lay-by have led to improved quality of life for residents of adjacent properties."*

The following case study outlines the evaluation of the A1(M) Coatham Mundeville Interchange. Whilst there was clear evidence of usage of the new routes, the reason for the partial assessment was that users were observed to disobey the 'cyclists dismount' signage. It is important to note however that this was based on a limited timeframe for observations and hence it may be that the majority of users do obey the warning signage.

Case Study 10	A1(M) Junction 59 Coatham Mundeville Interchange NMU Route
Introduction	 This scheme is located north of Darlington and was implemented in order to improve the existing NMU facilities at the Coatham Mundeville Interchange to help develop transport links between Darlington and Durham. The scheme intended to encourage the use of NMU routes through the interchange, as a result of widening and realigning some of the existing facilities and providing appropriate dropped kerbs, tactile paving, signing and road markings. The scheme also aimed to encourage cyclists to dismount when crossing the junction. The scheme was completed in January 2014
Other Impacts	Site observations showed that the scheme was implemented as the PAR stated. However, on one section of the junction the on-road NMU markings were worn and difficult to read. There were no pre-scheme NMU counts undertaken to allow for a comparison of whether the scheme has been successful in encouraging more NMUs to use the junction. However, over a 30 minute observation period, four NMUs (two cyclists and two equestrians) were observed crossing the junction using the NMU facilities. Although the NMUs were using the shared-use cycle / footway and not the road, neither cyclist dismounted their bicycles as the signs instruct, on the overbridge footway. It is recognised that this outcome is based on a small sample size, and further observations would help to determine whether the majority of cyclists do obey signage at this location

Does the performance of this year's schemes differ from the historic sample?

Including the six severance schemes evaluated this year, the total sample of evaluated severance schemes is 29. In general terms, the success of this year's schemes is consistent with that of the historic sample, with most schemes achieving their objectives.

Historically, severance scheme evaluations have shown that some pedestrian crossing schemes have been implemented away from desire lines, causing NMUs to cross a road away from a designated crossing point and hence not effectively addressing the problem which existed prior to the scheme. Although none of the severance schemes this year included pedestrian crossing implementation, there had been pre-scheme evidence of NMUs creating their own desire lines at the A66 Lamplugh Roundabout, Cockermouth. Pre-scheme, there was evidence of pedestrian and cyclist desire lines along the north and west arms of the roundabout (where there were no existing NMU facilities). The scheme filled the gaps in provision for NMUs which appears to have eliminated the unsuitable and unsafe desire lines.

Historic meta-analysis has also shown that cycle schemes can be very effective in instances where they infill missing links in the network. This trend was apparent in a number of severance schemes this year, with four of the six schemes evaluated all having cycleway / footway improvements as objectives. All four achieved their objectives of filling in the gaps in the network which is a clear good news story for the programme.

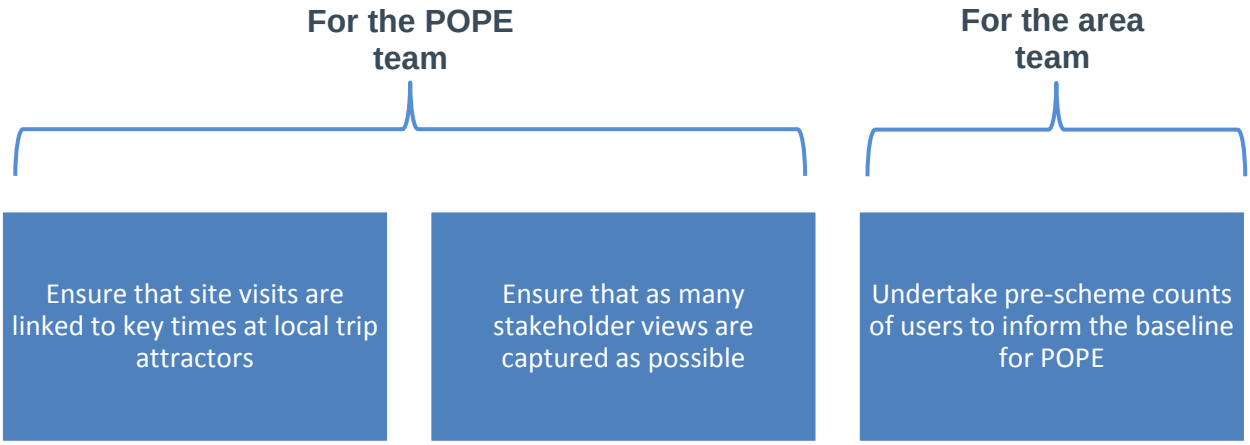
How can we improve the evaluation of future schemes?

All six of the schemes evaluated this year lacked pre-scheme pedestrian and cycle counts, which represents a continuation of the trend in historic meta-analysis which has identified limited availability of this data. Although severance schemes are evaluated qualitatively, with the exception of considering (albeit not monetising) the change in annual accident rate, the absence of pedestrian and cyclist counts makes it very difficult to robustly assess the impact of the scheme on encouraging NMU use and hence the scheme's success or otherwise in regard to the physical activity sub-objective.

Whilst the point above refers to the need for the area team to provide robust pre-scheme data, the following two suggestions are made regarding the POPE process itself:

- In previous years it has been reported that there has been a lack of stakeholder feedback on some of the schemes which has acted as a constraint on the ability of the evaluation team to understand how the scheme has performed. This year has seen mixed success regarding stakeholder feedback, with responses received only for some schemes. Feedback from scheme users and local residents is a valuable source of information in severance scheme evaluations, as it is difficult to identify all the potential issues of a scheme in one site visit. Responses from people who use the scheme regularly are more likely to show how the scheme performs on an everyday basis; and
- Furthermore, it has been previously stated that the site visits should be undertaken at optimum times of the day in order to ensure we see the scheme working as it should be (i.e. in daylight, and if appropriate during the AM / PM peaks). None of the schemes evaluated this year included measures put in place to eliminate peak time problems, though we ensured the site visits were undertaken in the daytime when people would be using the scheme. If the PAR / supporting documentation makes us aware of local sites which may impact NMU usage at particular times of the day, then every effort is made to coincide the evaluation with those periods.

The graphic below summarises the suggestions to maintain and improve the POPE process, showing where the suggestion is aimed at the area team or the POPE team.

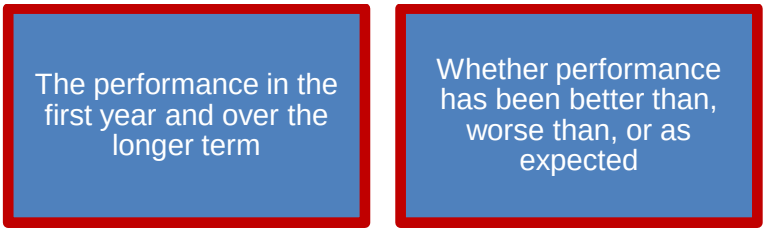


Summary & Key Findings

In this final chapter of the report, we compile and summarise the key findings and consider how we can use this information to inform both appraisal and evaluation in the future.

The Post-Opening Project Evaluation process

LNMS are improvements that Highways England makes to the trunk road network which cost less than £10m to implement. These can cover a range of improvements from the provision of new badger fencing to the construction of new lanes on the approach to a major junction. After a minimum of one year following completion of each scheme, we undertake an evaluation to ascertain how the scheme has performed. This process is called POPE and is currently undertaken by Atkins on behalf of Highways England. For each scheme, POPE aims to determine:



Investment in LNMS

Each LNMS is appraised using a PAR. These documents, compilied as part of the planning process, contain all the predicted information on the scheme, including, for example, forecast impacts on accident rate and journey times. Each PAR is denoted a scheme type according to the nature of its intended impact. For example, safety schemes focus primarily on reducing accidents.

Across the 12 years of POPE, we have now processed a total of 2,119 PARs, across all scheme types. Through interrogating this information, we have been able to understand more about the profile of investment in England. Key points arising from this analysis are as follows:

- There has been a clear reduction in the number of schemes implemented across the 12 years, with significantly fewer PARs in the recent three financial years. This is mainly due to a reduction in Government funding for LNMS with a focus instead on larger schemes which are outside of the LNMS programme (including Pinch Point Schemes and Major Schemes);
- Within each year, typically nearly half of all schemes are classified as ‘safety’. These schemes focus on reducing the annual accident rate;
- There is a general decrease in the number of schemes as the cost increases, with a greater focus (in terms of numbers of schemes) on the schemes costing up to £500k; and
- Of the 2,119 schemes that have been implemented, we have been able to evaluate a total of 820 schemes, which is approximately 40% of the total number. Of the remaining 60%, sometimes we temporarily cannot evaluate a scheme because supporting data is not yet available. This means the evaluation has to be postponed until the next evaluation year. However a large number of schemes will never be evaluated, either because they do not have quantifiable impacts or supporting data has not been made available or stored properly by our area teams.

Safety & Economy LNMS – programme results

Focussing now on the results of the safety and economy schemes only (a sample of 717 schemes), the table below shows that the performance of the LNMS programme is exceptional. Based on the schemes we have evaluated, the LNMS programme delivers a FYRR of 64%, which means that the average scheme will recoup its cost within 20 months of opening. The BCR is used to measure performance over the scheme life, with the figure of 15.6 suggesting that the average scheme will pay for itself nearly 16 times over its life. All monetary values are in 2002 prices and all numbers in the table refer to the opening year only, with the exception of the BCR which provides a forecast for the entire scheme life.

Total Cost	Total Accident Benefit	Total Journey Time Benefit	Value for Money
£259m	£118m	£48m	FYRR: 64% BCR: 15.6

It is useful to consider the spread of both FYRR and BCR to learn more about the results of individual schemes. The key findings from this analysis are as follows:

- Just under three quarters of schemes (70%) are expected to recoup their costs in benefits within five years of completion. This comprises of 48% of schemes that are expected to recoup their costs within 12 months and 22% that are expected to recoup their costs within one to five years; and
- Based on the BCR, over half of schemes (55%) will recoup their costs ten times (or more) over the course of their life, which again demonstrates exceptional value for money.

By their very nature, LNMS can include a wide range of different improvements (termed 'measures' for the purpose of this report) aimed at reducing journey times and accident rates. Whilst each scheme is unique, the works undertaken can be categorised based on a small group of commonly implemented measures. By looking at the performance of different measures, we can learn more about the cost and effectiveness of each at addressing safety and journey time issues. As well as highlighting the large variation in cost according to the measure implemented, our analysis of results by scheme measure shows us that:

- The highest accident savings are achieved by speed limit reductions, with 3.3 accidents saved per scheme, representing 29% of the pre-scheme annual accident rate. Speed limit reductions also save the highest number of KSIs, at 1.1 per annum. All the common measures are on average shown to reduce both accidents and KSIs; and
- Many scheme measures reduce journey times through tackling congestion, but some intentionally increase journey times to tackle safety concerns, for example through reducing the speed limit or banning a turn.

Safety & Economy LNMS – recent results

Our analysis has looked at how the schemes completed in the recent four years (termed recent schemes) compare to those in the first eight years of the commission (termed older schemes). This comparison is useful in telling us about how performance has changed

over time. It also holds relevance as, during this period, appraisal methods and guidance have developed and as such results for the recent schemes are likely to have the most relevance to current appraisal methods.

The average results for the recent schemes and older schemes are shown side by side in the table below. In summary, we find that average costs have increased, although there are several potential reasons for this, which include:

- The recent schemes include a lower proportion (79%) of schemes costing in excess of £500k, compared to 87% for the older schemes;
- One scheme included in the recent scheme sample cost £9m, which inevitably has a large influence on the average cost; and
- There is a general trend of increasing average scheme cost over time for all scheme types and large schemes tend to be implemented less frequently but have higher average costs when they are implemented.

Despite the recent schemes costing more, the vehicle hour saving delivered is substantially lower than the older schemes at 851 hours compared to 5,679 hours respectively. It is possible that some of the variation is due to the journey time data used to assess the recent schemes. Most of the recent schemes were assessed using Satellite Navigation data, which means we have been able to easily consider the impact of the scheme across all time periods during the year before and after the scheme opened. The older schemes were predominately evaluated using other data sources and our analysis shows that the average benefit is lower for schemes evaluated using Satellite Navigation data. The average accident saving is very similar for the two periods.

Metric	Recent	Older
Average Scheme Cost	£445k	£343k
Average Accident Saving	1.8	1.7
Average Vehicle Hours Saved	851	5,679
FYRR	41%	71%

How does scheme cost affect the benefits delivered?

We have looked in detail at how the size of scheme, in terms of monetary value, influences the level of accident and journey time benefits. In order to do this, we have split schemes into five categories based on actual outturn cost, starting with schemes costing <£100k and culminating with schemes costing >£2m. Generally there is an increase in annual accident saving as scheme cost increases, with the range in annual accident saving from 0.9 for schemes costing less than £100k to 4.1 for schemes costing over £2m. The trend is much less clear for journey times, largely due to new signal schemes that cost between £500k and £1m and over £2m delivering dis-benefits in the opening year.

How do the results compare between areas?

The strategic road network is divided into areas and each one is managed by a private sector organisation on behalf of Highways England. It is useful to evaluate the results by area to understand whether the LNMS programme is successful at delivering improvements across the country.

Before we explain the results, it is important that we understand the limitations of the comparison by area. The results are based on low samples of schemes in some areas and we also should take care to acknowledge that some schemes are implemented with different primary objectives. For example, one area may have more speed limit reduction schemes than others which could lead to higher accident savings but more vehicle hour dis-benefits rather than benefits. For these reasons the analysis is indicative only.

The analysis shows us that there is a wide variation in the average cost of a scheme between the areas, ranging from £69k to £2.2m. On the whole, the majority of schemes in each area cost less than £500k. With the exception of Area 7, all areas deliver positive FYRRs, indicating that costs will be recouped in benefits. The highest FYRR is for Area 13 (303%).

Other WebTAG objectives

Each scheme is also assessed against its impact on all WebTAG sub-objectives. The one year after evaluations include an Evaluation Summary Table (EST) which shows the outturn impact of the scheme on each sub-objective based on findings and observations.

A key finding is that the landscape sub-objective is scored adverse the most, however this is likely due to the primary aim of schemes being to deliver accident or journey time savings, whilst having an adverse impact on the landscape. For example, a new signal scheme would be expected to improve journey times but at the same time may have a negative impact on the landscape due to the physical structures or lighting.

We have also considered the accuracy of forecast impacts for the sub-objectives. We found that aside from the journey ambience and journey quality sub-objectives, on the whole the scores in the EST are very rarely changed from the AST scores, which indicates a high level of accuracy in forecasting the impacts of schemes on other WebTAG objectives.

Safety & Economy LNMS – accuracy of appraisal

As well as looking at the results themselves, POPE is also about looking at the accuracy of appraisals, allowing us to understand whether our forecasts have materialised. In order to do this, we interrogate:

- Accuracy at the programme level: If we sum the predicted costs for all schemes, how do these compare to the actual opening cost of all schemes? We also make the same comparison for benefits; and
- Accuracy on a scheme by scheme basis: What proportion of schemes have outturn costs that are within a certain threshold of what was predicted? Again, we make the same calculation for benefits.

How accurate are results at the programme level?

At the programme level (which is the cumulative impacts of all schemes that have opened in the last four years), as shown in the table below, we find that cost and accident benefit appraisal is relatively accurate. There is however a high level of inaccuracy for journey time impacts, which are substantially over-predicted, with outturn results 98% lower than forecast.

Metric	Predicted Total	Outturn Total	Difference
Scheme Cost	£57m	£56m	**-1%**
Average Accident Benefit	£24m	£21m	**-11%**
Average Vehicle Hour benefit	£52m	£1.3m	**-98%**

When looking in more detail at the over-prediction of journey time impacts, we find that the majority of the over-predictions are between £100k and £2m, with 61% of schemes over-predicting their benefits by that range. It is concerning that a further 17% of schemes have over-forecast their journey time benefits by in excess of £2m. That 17% comprises six schemes and of those, four forecast a benefit but delivered a dis-benefit (three of these were new signals schemes) and two forecast a benefit and delivered a lower than forecast benefit.

How accurate are results at the scheme-by-scheme level?

Whilst we have considered the accuracy of the LNMS programme, we also investigate the accuracy of individual scheme forecasts. The table below shows the proportion of the recent schemes with outturn impacts within 25% and 50% of their forecast impact on cost, accidents and journey times.

Metric	Proportion of Recent Schemes within 25% of Forecast	Proportion of Recent Schemes within 50% of Forecast	How do these results compare to the historic sample?
Scheme Cost	60%	95%	**Better**
Average Accident Benefit	19%	33%	**Better**
Average Vehicle Hour Benefit	11%	22%	**Worse**

Costs

The analysis shows that the accuracy of cost appraisal has improved for the recent schemes, with 95% of the recent schemes' costs within 50% of their forecast cost. Costs are more accurately forecast than accident and journey time impacts, which we might expect as project managers are able to review and control their costs as the project

develops, making changes where needed to ensure that the project is delivered to the agreed budget.

Accidents

The accuracy of forecast accident impacts has improved for the recent schemes, however the overall accuracy remains poor. For the recent schemes, 33% are within 50% of the forecast. These poor levels of accuracy could in part be a function of the methodology used in POPE, and the use of relatively limited periods of post-opening accident data. Accidents are random in nature and using only one year of accident data means any skewing in accident numbers cannot be averaged across several years. In addition, some PARs forecast a saving less than one (for example, an expected annual accident saving of 0.5), meaning it is impossible for schemes to achieve their expected saving based on only one year of post-scheme observed data.

Journey times

The overall accuracy of journey time forecasts is poor for recent and older schemes, with a trend towards worsening forecasts. This is in part linked to a number of new signals schemes which have delivered considerable inter-peak and overnight dis-benefits, which means that despite some good peak time benefits, the schemes are often delivering overall dis-benefits. Last year's meta-analysis highlighted that journey time accuracy was one of the areas that required the most attention to improve the investment of LNMS. This additional analysis this year shows that the accuracy appears to have worsened rather than improved for the recent schemes relative to the older schemes, which furthers the case for an action plan to ensure more accurate journey time appraisal and more careful selection of schemes based on the findings to date.

Environment and Severance LNMS – results and accuracy of appraisal

Environment schemes

Of the 10 environment schemes evaluated this year (bringing the total sample up to 45), we show that four have fully met their objectives, five have partially met their objectives and one has not met its objectives. This is generally a positive message but does highlight that there is considerable room for improvement:

Objectives Achieved?	Number of Schemes
Yes, fully	4
Yes, partially	5
No	1

Eight of the 10 schemes have beneficially impacted the environment WebTAG sub-objectives with four resulting in a biodiversity benefit, one resulting in a landscape benefit and three resulting in both a biodiversity and landscape benefit. Of the two schemes without beneficial impacts, one was found to be neutral for all of the environment WebTAG sub-objectives and the final scheme evaluated was found to be adverse for biodiversity, landscape and townscape.

We have previously highlighted in the meta-analysis for environment schemes that there is a clear need for on-going management and aftercare and this year is no different. A lack of management and aftercare was found in the majority of the environment schemes evaluated ranging from a lack of vegetation clearance at the access / egress to the otter ledges to a lack of weed removal and on-going management of planted areas on the landscape based schemes. The environment schemes involving planting often require a

large amount of management during the first few years to ensure successful establishment of the plants and to remove weeds. The suggestion is made that future planting schemes could be approached differently with use of biodegradable mulch mats to provide weed control in the newly planted areas.

Overall, the performance of this year's schemes was similar to that of the historic sample and the evaluation process has highlighted the importance of:

- Developing thorough and long-term maintenance / aftercare plans;
- Complying with DMRB specifications for structures such as mammal-proof fences and culvert ledges;
- Regularly checking structures (gates, ledges and fences) and surveys of habitats and species surveys as structure defects / sudden changes in population need to be mitigated quickly and effectively; and
- Ensuring PARs and / or accompanying documents depict an accurate representation of the works that have been undertaken on site.

As well as making suggestions for the schemes themselves, we have also outlined some POPE specific recommendations to improve the future robustness of evaluations, with actions identified for both the area teams and the POPE team. For the former, we rely on timely and accurate receipt of supporting data, with an ongoing action on the POPE team to ensure that examples of best practice are circulated as and when they arise. There is also an action on both the area teams and the POPE team to continue working closely together to ensure that local knowledge and context for each scheme is used to inform the evaluation.

Severance schemes

This year six severance schemes have been evaluated, bringing the total sample of evaluated severance schemes to 29. All six were judged to have a beneficial impact on the severance sub-objective, with five of these schemes also having a beneficial impact on the journey quality sub-objective. Four schemes successfully reduced the annual accident rate and two schemes provided a security benefit. In addition to the aforementioned sub-objectives, one lay-by improvement scheme also had a beneficial impact on the landscape and water environment sub-objectives. In general terms, the success of this year's schemes is consistent with that of the historic sample, with most schemes achieving their objectives.

It should be noted that five of the six schemes evaluated this year were predicted to have a beneficial impact on the physical activity sub-objective. However, in all five cases, a neutral score was awarded for the evaluation as, despite evidence of usage for some schemes, there was insufficient evidence that the schemes would significantly increase the number of people who undertake exercise of any kind for over 30 minutes a day. This trend will continue to be monitored in future meta-analysis.

A number of suggestions are made regarding the future evaluation of severance schemes, aimed at both the area teams and the POPE team:

- Although severance schemes are evaluated qualitatively, with the exception of considering (albeit not monetising) the change in annual accident rate, the absence of pedestrian and cyclist counts makes it very difficult to robustly assess the impact of the scheme on encouraging NMU use and hence the scheme's success or otherwise in regard to the physical activity objective. The action is therefore on the area teams to ensure that adequate pre-scheme data is collected to support downstream evaluations;
- Feedback from scheme users and local residents is a valuable source of information in severance scheme evaluations, as it is difficult to identify all the potential issues of a scheme in one site visit. Responses from people who use the

scheme regularly are more likely to show how the scheme performs on an everyday basis. The action is on the POPE team to ensure that consultation is launched as soon as possible to maximise the uptake and usefulness of the feedback; and

- Whilst none of the schemes evaluated this year included measures put in place to eliminate peak time problems, every effort should be made in the evaluation to ensure that site visits are timed to coincide with potential peaks in demand, also helping to maximise the opportunity for face to face consultation with users of the scheme.

Appendix A – Calculation of Scheme Life Benefits

Earlier in the report, we provided a case study to show how we calculate accident and journey time impacts for each scheme. In this appendix, we provide more detail on how we calculate scheme life impacts based on our observed findings in the opening year. These numbers relate to the M62 Junction 12 Diverge (near Manchester), which formed Case Study 1 earlier in the report.

Case Study 1 (More Detail)		Saving	Monetary Saving
Accidents 	Opening Year	3.7 accidents saved, as a result of the annual accident rate being reduced from 7.0 to 3.3	£312k, derived from multiplying the annual accident saving (3.7) by the average value of an accident (£83.8k)
	Scheme Life	234.9 accidents saved, as a result of multiplying the opening year saving (3.7 accidents per annum) by the capitalisation factor of 63.0. The capitalisation factor takes account of discounting and the expected level of traffic growth over the scheme life	£18.1m, as a result of multiplying the opening year saving (£312k) by the capitalisation factor of 58.0. Note the capitalisation factor differs from that used for the change in annual accident rate
Journey Times 	Opening Year	50,000 vehicle hours saved, as a result of Atkins' assessment of the change in journey times at the diverge	£661k, as a result of multiplying the number of vehicle hours saved (50,000) by the average value of time (£13.22 per hour)
	Scheme Life	We do not calculate a scheme life saving in regard to vehicle hours (in line with the PAR approach) and we rely instead on calculating a scheme life monetary impact, as shown in the column to the right	£26.9m, as a result of multiplying the opening year saving (£661k) by the capitalisation factor of 40.7. The capitalisation factor takes account of discounting and expected level of traffic growth over the scheme life. Note this capitalisation factor differs from those used to derive the safety scheme life impacts

Appendix B – Further Information on Investment in LNMS

Throughout this report there has been discussion on both the investment in LNMS and the evaluated LNMS performance. These have been measured against a number of different criteria and disaggregated into a number of groups (for example, by area and by measure) and the results are shown in Appendix C.

This appendix however shows a breakdown of all the investment figures, which were discussed earlier in this report. The appendix acts as a useful pull out reference to the POPE findings. In addition to this report, we have an Excel based tool, named the POPE of LNMS Analysis Reporter (PoLAR), which allows for the area teams to interrogate the database of results to help inform future appraisals. This tool is not available for the public.

Investment in LNMS – Further Information

		Number of Schemes					Investment in Schemes (£m)				
		Safety	Economy	Environment	Other	Total	Safety	Economy	Environment	Other	Total
Investment by Financial Year	**2002/3**	107	14	42	37	**200**	£22.8	£2.7	£4.9	£3.4	**£33.8**
	2003/4	110	23	45	39	**217**	£17.8	£12.9	£10.5	£3.5	**£44.7**
	2004/5	126	27	44	45	**242**	£18.3	£19.4	£3.0	£4.0	**£44.7**
	2005/6	121	28	51	40	**240**	£29.6	£19.3	£11.9	£8.3	**£69.2**
	2006/7	94	85	27	38	**244**	£19.3	£31.3	£4.7	£5.7	**£60.9**
	2007/8	81	22	49	32	**184**	£18.1	£21.4	£7.9	£6.0	**£53.4**
	2008/9	68	26	29	36	**159**	£16.3	£22.3	£2.8	£4.2	**£45.7**
	2009/10	91	27	45	72	**235**	£16.4	£12.8	£10.7	£12.1	**£52.1**
	2010/11	64	24	43	55	**186**	£10.5	£34.7	£3.4	£5.2	**£53.8**
	2011/12	34	11	9	16	**70**	£15.7	£10.1	£3.2	£3.8	**£32.8**
	2012/13	32	9	24	6	**71**	£8.0	£4.4	£2.3	£1.1	**£15.8**
	2013/14	27	6	14	24	**71**	£5.1	£11.5	£5.0	£11.3	**£32.9**
Investment by Area	**Area 1**	38	8	38	25	**109**	£5.2	£4.9	£2.9	£5.9	**£19.0**
	Area 2	56	13	19	19	**107**	£8.4	£11.4	£2.6	£2.1	**£24.5**
	Area 3	59	13	9	8	**89**	£7.2	£23.3	£9.5	£0.4	**£40.3**
	Area 4	69	20	19	18	**126**	£11.5	£10.0	£3.3	£9.4	**£34.1**
	Area 5	51	13	28	36	**128**	£21.0	£11.4	£8.6	£15.8	**£56.8**
	Area 6	95	14	21	11	**141**	£15.7	£7.0	£2.1	£1.8	**£26.8**
	Area 7	74	9	30	57	**170**	£18.4	£14.3	£6.2	£7.6	**£46.5**
	Area 8	85	27	28	52	**192**	£19.2	£5.4	£8.3	£3.8	**£36.7**
	Area 9	58	23	26	11	**118**	£12.9	£10.2	£3.9	£2.5	**£29.5**
	Area 10	62	29	34	44	**169**	£11.6	£28.1	£7.5	£2.7	**£50.0**
	Area 11	39	30	10	14	**93**	£22.8	£21.9	£1.2	£1.6	**£47.5**
	Area 12	72	29	20	31	**152**	£9.7	£21.1	£2.7	£2.8	**£36.3**
	Area 13	99	29	59	69	**256**	£9.2	£12.2	£3.5	£6.8	**£31.6**
	Area 14	85	40	76	35	**236**	£17.2	£17.6	£5.6	£3.9	**£44.3**
	Other	13	5	5	10	**33**	£7.9	£4.2	£2.3	£1.3	**£15.8**

Appendix C – LNMS Results

Throughout this report, we have presented only the key findings from different analyses. This appendix provides a pull out of all the results for all schemes evaluated to date and also for recent schemes (last four financial years) only. The results are aggregated by:

- Financial year;
- Area team;
- Measure; and
- Cost category.

Please note that for analysis by area or by measure outliers have been removed to ensure the results are based on the typical scheme. The following appendix (Appendix C) contains details of this process of removing outliers. The number of outliers removed has been included in the tables where relevant so that the impact on samples can be appreciated. The number of schemes column therefore excludes any outliers.

To understand what measures are included in each group please see the table at the end of this appendix.

For the purpose of this Annual Evaluation Report, schemes previously within Area 11 have been assigned to either Area 7 or 9 based on the amended area boundaries. This applies only to our analysis of all schemes evaluated as all recent schemes are subject to the new area boundaries.

Results for all Schemes Evaluated

CUMULATIVE OPENING YEAR COSTS AND BENEFITS SUMMARY														
		Number of Schemes	Number of Outliers	Accidents Saved		Monetised Safety Benefits (£million)		Vehicle Hours Saved (000's)		Monetised Journey Time Benefits (£million)		Scheme Cost (£million)		FYRR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Year	2002/3	53		65	57	£7	£6	481	696	£8	£11	£15	£16	101%	101%
	2003/4	86		109	132	£10	£13	1,333	726	£37	£12	£39	£34	120%	72%
	2004/5	89		98	109	£10	£11	863	561	£15	£8	£36	£42	69%	46%
	2005/6	99		121	185	£12	£17	406	638	£7	£8	£36	£36	52%	67%
	2006/7	66		126	102	£11	£9	7,154	429	£88	£5	£14	£13	703%	104%
	2007/8	59		101	168	£10	£15	291	128	£4	£1	£15	£14	94%	119%
	2008/9	54		85	138	£8	£14	296	114	£4	£1	£17	£19	71%	79%
	2009/10	85		125	134	£12	£13	143	65	£1	£1	£35	£29	39%	48%
	2010/11	55		102	112	£10	£10	1,723	404	£26	£5	£27	£26	136%	59%
	2011/12	33		72	84	£7	£7	65	-229	£14	-£3	£17	£16	126%	27%
	2012/13	18		48	11	£4	£1	0	-71	£3	-£1	£4	£4	171%	9%
	2013/14	20		20	25	£2	£3	500	3	£8	£0	£8	£10	117%	27%
Area Team *(outliers removed)*	Area 1	26	1	21	2	£2	£0	228	46	£2.6	£0.3	£7.1	£7.0	66%	5%
	Area 2	48	3	64	86	£6	£8	985	-148	£13.8	-£1.8	£18.3	£15.9	109%	39%
	Area 3	37	2	41	47	£4	£4	550	44	£7.4	£0.6	£12.7	£15.0	88%	30%
	Area 4	54	1	83	70	£8	£7	51	24	£0.7	£0.2	£10.2	£8.7	89%	82%
	Area 5	40	3	75	82	£6	£7	170	338	£4.5	£5.7	£17.6	£20.0	61%	63%
	Area 6	61	0	78	106	£8	£10	300	270	£7.3	£2.3	£22.2	£28.5	70%	44%
	Area 7	61	3	114	95	£11	£10	1,466	217	£19.4	£3.7	£22.2	£19.7	139%	70%
	Area 8	36	2	37	34	£3	£3	591	642	£7.6	£8.7	£14.2	£14.1	77%	84%
	Area 9	70	4	102	111	£10	£11	7,401	217	£91.7	£2.5	£27.3	£30.0	373%	45%
	Area 10	51	1	57	86	£5	£7	296	399	£16.6	£5.0	£19.0	£18.9	113%	64%
	Area 12	63	6	103	85	£9	£7	126	-20	£10.3	-£0.1	£28.8	£20.9	68%	35%
	Area 13	62	3	42	75	£4	£7	72	148	£1.2	£1.7	£10.0	£8.8	55%	101%
	Area 14	69	3	129	140	£13	£13	162	15	£10.1	£0.1	£19.6	£20.3	115%	67%
Primary Measures *(outliers removed)*	Signing	153	7	174	189	£17	£17	52	29	£1.1	£0.3	£17.1	£15.3	106%	111%
	Marking/lining	99	7	162	147	£15	£13	6,849	107	£87.4	£1.2	£12.5	£10.8	821%	133%
	Passive Measures	45	3	38	46	£3	£4	76	39	£1.0	£0.5	£5.1	£4.5	86%	101%
	NMU Facilities	9	1	6	3	£1	£0	0	0	£0.0	£0.0	£1.5	£1.3	35%	29%
	Widening	63	4	94	111	£9	£10	3,066	1,946	£49.9	£26.8	£81.7	£75.3	71%	49%
	Layby	13	3	16	9	£1	£1	0	0	£0.0	£0.0	£3.7	£3.1	39%	28%
	Banned Turn	27	1	56	57	£6	£5	-54	-58	-£1.0	-£0.9	£10.2	£9.3	47%	48%
	Lighting	7	0	6	11	£1	£1	-11	-12	-£0.1	-£0.2	£5.2	£4.1	11%	23%
	Signal (new)	32	1	71	89	£6	£7	1,157	7	£23.9	£0.7	£21.7	£24.8	138%	33%
	Signals (mod)	32	1	60	82	£5	£8	1,770	980	£27.3	£13.1	£44.4	£36.2	73%	58%
	Camera	5	1	7	13	£1	£2	-2	-5	£0.0	-£0.1	£2.6	£2.0	56%	84%
	Surfacing	25	4	41	45	£4	£4	4	-11	£0.1	-£0.1	£3.8	£3.4	107%	117%
	Geometry	57	2	78	74	£8	£8	789	347	£13.6	£4.2	£49.3	£51.0	45%	24%
	Crossing	17	1	18	16	£2	£2	500	61	£7.0	£1.0	£9.9	£12.1	87%	21%
	Narrowing/Lane Drop	11	0	6	5	£1	£0	80	-7	£1.1	-£0.1	£0.8	£0.7	201%	58%
	SLR	23	2	51	73	£5	£6	-129	-452	-£1.4	-£6.0	£5.4	£5.0	67%	6%
	Vegetation Clearance	3	2	2	2	£0	£0	0	0	£0.0	£0.0	£0.2	£0.1	103%	119%
	Other	11	2	19	22	£2	£3	734	53	£9.2	£0.7	£9.0	£10.5	119%	32%
Scheme Cost	£0 - £100,000	346		302	377	£29	£35	7,090	275	£95.6	£3.3	£22.4	£16.7	557%	229%
	£100,000 - £500,000	266		486	567	£47	£53	1,248	750	£17.1	£9.0	£59.4	£53.5	108%	116%
	£500,000 - £1 million	43		116	105	£11	£10	1,161	795	£19.3	£10.2	£31.1	£28.5	97%	71%
	£1 million - £2 million	33		96	104	£10	£10	1,708	450	£42.2	£6.1	£49.9	£47.4	104%	33%
	£2 million +	29		73	103	£6	£10	2,050	1,193	£41.9	£19.3	£101.1	£112.5	48%	26%
Total		**717**		**1,073**	**1,256**	**£104**	**£118**	**13,256**	**3,464**	**£216**	**£48**	**£264**	**£259**	**121%**	**64%**

AVERAGE OPENING YEAR COSTS AND BENEFITS SUMMARY

		Number of Schemes	Number of Outliers	Accidents Saved		Monetised Safety Benefits (£000's)		Vehicle Hours Saved		Monetised Journey Time Benefits (£000's)		Scheme Cost (£000's)		FYRR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Year	2002/3	53		1.2	1.1	£128	£110	9079	13134	£157	£199	£281	£306	101%	101%
	2003/4	86		1.3	1.5	£120	£147	15501	8441	£426	£139	£455	£395	120%	72%
	2004/5	89		1.1	1.2	£108	£126	9702	6300	£166	£89	£399	£467	69%	46%
	2005/6	99		1.2	1.9	£118	£169	4097	6446	£74	£77	£368	£365	52%	67%
	2006/7	66		1.9	1.5	£167	£129	108390	6497	£1,340	£78	£214	£199	703%	104%
	2007/8	59		1.7	2.8	£175	£253	4927	2170	£61	£24	£251	£232	94%	119%
	2008/9	54		1.6	2.6	£153	£251	5483	2104	£75	£20	£320	£343	71%	79%
	2009/10	85		1.5	1.6	£143	£155	1680	768	£16	£10	£412	£343	39%	48%
	2010/11	55		1.9	2.0	£188	£187	31334	7346	£479	£96	£491	£480	136%	59%
	2011/12	33		2.2	2.5	£214	£226	1979	-6939	£439	-£95	£516	£488	126%	27%
	2012/13	18		2.7	0.6	£244	£67	0	-3944	£154	-£49	£233	£200	171%	9%
	2013/14	20		1.0	1.2	£97	£130	25014	157	£401	£4	£424	£499	117%	27%
Area Team *(outliers removed)*	Area 1	26	1	0.8	0.1	£82	£3	8775	1786	£98	£11	£272	£268	66%	5%
	Area 2	48	3	1.3	1.8	£127	£169	20525	-3079	£287	-£38	£381	£332	109%	39%
	Area 3	37	2	1.1	1.3	£103	£107	14854	1179	£199	£16	£344	£407	88%	30%
	Area 4	54	1	1.5	1.3	£155	£128	945	446	£12	£4	£189	£161	89%	82%
	Area 5	40	3	1.9	2.1	£154	£173	4242	8442	£112	£143	£440	£499	61%	63%
	Area 6	61	0	1.3	1.7	£135	£166	4916	4422	£120	£38	£364	£468	70%	44%
	Area 7	61	3	1.9	1.6	£186	£166	24025	3554	£318	£60	£363	£323	139%	70%
	Area 8	36	2	1.0	1.0	£95	£86	16420	17840	£211	£242	£395	£391	77%	84%
	Area 9	70	4	1.5	1.6	£144	£155	105726	3105	£1,310	£36	£389	£428	373%	45%
	Area 10	51	1	1.1	1.7	£95	£141	5812	7815	£325	£97	£372	£370	113%	64%
	Area 12	63	6	1.6	1.4	£148	£118	2005	-316	£163	-£1	£458	£332	68%	35%
	Area 13	62	3	0.7	1.2	£70	£117	1156	2393	£19	£27	£162	£142	55%	101%
	Area 14	69	3	1.9	2.0	£181	£195	2348	221	£146	£1	£284	£294	115%	67%
Primary Measures *(outliers removed)*	Signing	153	7	1.1	1.2	£112	£109	339	190	£7	£2	£112	£100	106%	111%
	Marking/lining	99	7	1.6	1.5	£155	£133	69178	1076	£883	£13	£126	£110	821%	133%
	Passive Measures	45	3	0.9	1.0	£77	£89	1679	866	£21	£11	£114	£99	86%	101%
	NMU Facilities	9	1	0.7	0.4	£60	£42	0	0	£0	£0	£172	£146	35%	29%
	Widening	63	4	1.5	1.8	£136	£162	48671	30889	£792	£426	£1,297	£1,195	71%	49%
	Layby	13	3	1.2	0.7	£111	£67	0	0	£0	£0	£284	£237	39%	28%
	Banned Turn	27	1	2.1	2.1	£213	£200	-1982	-2145	-£37	-£33	£378	£346	47%	48%
	Lighting	7	0	0.9	1.5	£103	£153	-1612	-1674	-£19	-£21	£745	£581	11%	23%
	Signal (new)	32	1	2.2	2.8	£188	£231	36169	213	£748	£22	£679	£775	138%	33%
	Signals (mod)	32	1	1.9	2.6	£163	£243	55297	30612	£852	£408	£1,387	£1,132	73%	58%
	Camera	5	1	1.5	2.5	£295	£343	-451	-1094	-£6	-£14	£512	£392	56%	84%
	Surfacing	25	4	1.6	1.8	£159	£165	172	-437	£2	-£6	£150	£136	107%	117%
	Geometry	57	2	1.4	1.3	£147	£138	13849	6089	£239	£74	£865	£894	45%	24%
	Crossing	17	1	1.0	0.9	£89	£92	29428	3562	£415	£57	£580	£710	87%	21%
	Narrowing/Lane Drop	11	0	0.6	0.4	£57	£45	7256	-651	£97	-£9	£77	£63	201%	58%
	SLR	23	2	2.2	3.2	£219	£272	-5591	-19641	-£59	-£260	£236	£217	67%	6%
	Vegetation Clearance	3	2	0.7	0.5	£70	£51	0	0	£0	£0	£69	£43	103%	119%
	Other	11	2	1.7	2.0	£141	£245	66713	4855	£839	£61	£821	£951	119%	32%
Scheme Cost	£0 - £100,000	346		0.9	1.1	£85	£101	20491	795	£276	£10	£65	£48	557%	229%
	£100,000 - £250,000	266		1.8	2.1	£177	£200	4690	2821	£64	£34	£223	£201	108%	116%
	£500,000 - £1 million	43		2.7	2.4	£256	£235	26995	18499	£449	£238	£723	£662	97%	71%
	£1 million - £2 million	33		2.9	3.2	£299	£294	51746	13631	£1,278	£186	£1,512	£1,435	104%	33%
	£2 million +	29		2.5	3.5	£215	£355	70687	41134	£1,445	£665	£3,486	£3,879	48%	26%
Total		**717**		**1.5**	**1.8**	**£145**	**£165**	**18,488**	**4,831**	**£301**	**£67**	**£368**	**£361**	**121%**	**64%**

CUMULATIVE SCHEME LIFE COST AND BENEFIT SUMMARY

		Number of Schemes	Number of Outliers	Scheme Life Safety Benefits (£million)		Scheme Life Journey Time Benefits (£million)		Scheme Life Costs (£million)		BCR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Year	2002/3	53		£408	£401	£329	£352	£34	£33	21.4	22.6
	2003/4	86		£456	£670	£1,738	£560	£65	£55	33.8	22.4
	2004/5	89		£394	£611	£696	£372	£56	£59	19.6	16.7
	2005/6	99		£470	£729	£155	£278	£63	£60	10.0	16.9
	2006/7	66		£685	£589	£3,373	£60	£34	£31	117.8	21.1
	2007/8	59		£438	£626	£153	£82	£33	£33	17.7	21.6
	2008/9	54		£397	£703	£185	£53	£39	£40	15.1	18.7
	2009/10	85		£626	£666	£196	£86	£92	£83	8.9	9.0
	2010/11	55		£481	£456	£1,187	£238	£53	£50	31.2	13.9
	2011/12	33		£294	£341	£567	-£123	£32	£31	26.9	7.0
	2012/13	18		£192	£36	£105	-£34	£18	£15	16.5	0.2
	2013/14	20		£73	£119	£117	-£20	£16	£15	12.1	6.5
Area Team *(outliers removed)*	Area 1	26	1	£101	£42	£85	£2	£14	£14	13.8	3.2
	Area 2	48	3	£366	£460	£659	-£103	£38	£33	27.3	10.8
	Area 3	37	2	£188	£189	£64	-£8	£21	£24	12.0	7.7
	Area 4	54	1	£431	£371	£30	£8	£33	£29	13.8	13.0
	Area 5	40	3	£359	£431	£234	£313	£39	£44	15.1	16.8
	Area 6	61	0	£407	£518	£425	£156	£42	£47	19.9	14.2
	Area 7	61	3	£460	£284	£648	£55	£39	£35	28.3	9.6
	Area 8	36	2	£139	£198	£257	£220	£21	£20	19.2	21.1
	Area 9	70	4	£463	£538	£3,571	£127	£67	£64	60.6	10.5
	Area 10	51	1	£283	£418	£775	£235	£44	£42	23.8	15.6
	Area 12	63	6	£453	£381	£544	£35	£50	£37	19.9	11.2
	Area 13	62	3	£238	£420	£58	£82	£34	£28	8.7	18.1
	Area 14	69	3	£493	£583	£448	-£29	£41	£40	23.2	13.9
Primary Measures *(outliers removed)*	Signing	153	7	£834	£914	£53	£15	£63	£56	14.1	16.6
	Marking/lining	99	7	£856	£736	£3,461	£57	£44	£37	97.4	21.3
	Passive Measures	45	3	£192	£234	£12	£21	£13	£11	15.2	22.2
	NMU Facilities	9	1	£29	£22	£0	£0	£4	£4	7.1	6.1
	Widening	63	4	£338	£418	£2,052	£1,111	£101	£91	23.6	16.8
	Layby	13	3	£68	£38	£0	£0	£4	£3	18.4	12.3
	Banned Turn	27	1	£286	£294	-£47	-£42	£16	£15	15.2	17.3
	Lighting	7	0	£30	£32	-£3	-£4	£6	£5	4.1	5.5
	Signal (new)	32	1	£282	£416	£751	£0	£42	£44	24.7	9.5
	Signals (mod)	32	1	£158	£287	£1,205	£417	£56	£48	24.4	14.6
	Camera	5	1	£41	£66	-£1	-£4	£4	£3	9.4	18.1
	Surfacing	25	4	£214	£212	£3	-£7	£18	£16	12.0	13.1
	Geometry	57	2	£344	£423	£307	£181	£105	£98	6.2	6.2
	Crossing	17	1	£59	£79	£86	£17	£13	£15	11.2	6.3
	Narrowing/Lane Drop	11	0	£38	£31	£54	-£7	£4	£3	23.8	7.3
	SLR	23	2	£190	£311	-£66	-£284	£11	£9	11.5	3.0
	Vegetation Clearance	3	2	£14	£11	£0	£0	£1	£1	13.4	16.2
	Other	11	2	£51	£125	£500	£32	£11	£12	50.9	13.2
Scheme Cost	£0 - £100,000	346		£1,727	£2,053	£3,915	£134	£87	£66	65.2	32.9
	£100,000 - £500,000	266		£2,243	£2,608	£772	£368	£199	£181	15.1	16.4
	£500,000 - £1 million	43		£478	£434	£596	£287	£86	£84	12.5	8.6
	£1 million - £2 million	33		£346	£464	£1,941	£309	£63	£61	36.6	12.6
	£2 million +	29		£121	£385	£1,579	£808	£101	£112	16.8	10.6
Total		**717**		**£4,915**	**£5,945**	**£8,803**	**£1,906**	**£535**	**£505**	**25.6**	**15.5**

AVERAGE SCHEME LIFE COST AND BENEFIT SUMMARY

		Number of Schemes	Number of Outliers	Scheme Life Safety Benefits (£million)		Scheme Life Journey Time Benefits (£million)		Scheme Life Costs (£million)		BCR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Year	2002/3	53		£7.7	£7.6	£6.2	£6.6	£34.4	£33.4	0.4	0.4
	2003/4	86		£5.3	£7.8	£20.2	£6.5	£64.9	£55.0	0.4	0.3
	2004/5	89		£4.4	£6.9	£7.8	£4.2	£55.6	£58.9	0.2	0.2
	2005/6	99		£4.8	£7.4	£1.6	£2.8	£62.6	£59.7	0.1	0.2
	2006/7	66		£10.4	£8.9	£51.1	£0.9	£34.5	£30.7	1.8	0.3
	2007/8	59		£7.4	£10.6	£2.6	£1.4	£33.4	£32.8	0.3	0.4
	2008/9	54		£7.4	£13.0	£3.4	£1.0	£38.7	£40.5	0.3	0.3
	2009/10	85		£7.4	£7.8	£2.3	£1.0	£91.9	£83.0	0.1	0.1
	2010/11	55		£8.7	£8.3	£21.6	£4.3	£53.5	£50.0	0.6	0.3
	2011/12	33		£8.9	£10.3	£17.2	-£3.7	£32.0	£31.0	0.8	0.2
	2012/13	18		£10.7	£2.0	£5.9	-£1.9	£18.0	£15.1	0.9	0.0
	2013/14	20		£3.7	£5.9	£5.9	-£1.0	£15.8	£15.1	0.6	0.3
Area Team *(outliers removed)*	Area 1	26	1	£3.9	£1.6	£3.3	£0.1	£0.5	£0.5	13.8	3.2
	Area 2	48	3	£7.6	£9.6	£13.7	-£2.1	£0.8	£0.7	27.3	10.8
	Area 3	37	2	£5.1	£5.1	£1.7	-£0.2	£0.6	£0.6	12.0	7.7
	Area 4	54	1	£8.0	£6.9	£0.6	£0.2	£0.6	£0.5	13.8	13.0
	Area 5	40	3	£9.0	£10.8	£5.8	£7.8	£1.0	£1.1	15.1	16.8
	Area 6	61	0	£6.7	£8.5	£7.0	£2.6	£0.7	£0.8	19.9	14.2
	Area 7	61	3	£7.5	£4.7	£10.6	£0.9	£0.6	£0.6	28.3	9.6
	Area 8	36	2	£3.9	£5.5	£7.2	£6.1	£0.6	£0.6	19.2	21.1
	Area 9	70	4	£6.6	£7.7	£51.0	£1.8	£1.0	£0.9	60.6	10.5
	Area 10	51	1	£5.5	£8.2	£15.2	£4.6	£0.9	£0.8	23.8	15.6
	Area 12	63	6	£7.2	£6.0	£8.6	£0.6	£0.8	£0.6	19.9	11.2
	Area 13	62	3	£3.8	£6.8	£0.9	£1.3	£0.5	£0.4	8.7	18.1
	Area 14	69	3	£7.1	£8.5	£6.5	-£0.4	£0.6	£0.6	23.2	13.9
Primary Measures *(outliers removed)*	Signing	153	7	£5.5	£6.0	£0.3	£0.1	£0.4	£0.4	14.1	16.6
	Marking/lining	99	7	£8.6	£7.4	£35.0	£0.6	£0.4	£0.4	97.4	21.3
	Passive Measures	45	3	£4.3	£5.2	£0.3	£0.5	£0.3	£0.3	15.2	22.2
	NMU Facilities	9	1	£3.3	£2.4	£0.0	£0.0	£0.5	£0.4	7.1	6.1
	Widening	63	4	£5.4	£6.6	£32.6	£17.6	£1.6	£1.4	23.6	16.8
	Layby	13	3	£5.2	£2.9	£0.0	£0.0	£0.3	£0.2	18.4	12.3
	Banned Turn	27	1	£10.6	£10.9	-£1.7	-£1.6	£0.6	£0.5	15.2	17.3
	Lighting	7	0	£4.3	£4.6	-£0.5	-£0.6	£0.9	£0.7	4.1	5.5
	Signal (new)	32	1	£8.8	£13.0	£23.5	£0.0	£1.3	£1.4	24.7	9.5
	Signals (mod)	32	1	£4.9	£9.0	£37.7	£13.0	£1.7	£1.5	24.4	14.6
	Camera	5	1	£8.2	£13.3	-£0.3	-£0.7	£0.8	£0.7	9.4	18.1
	Surfacing	25	4	£8.5	£8.5	£0.1	-£0.3	£0.7	£0.6	12.0	13.1
	Geometry	57	2	£6.0	£7.4	£5.4	£3.2	£1.8	£1.7	6.2	6.2
	Crossing	17	1	£3.5	£4.6	£5.1	£1.0	£0.8	£0.9	11.2	6.3
	Narrowing/Lane Drop	11	0	£3.5	£2.8	£4.9	-£0.6	£0.4	£0.3	23.8	7.3
	SLR	23	2	£8.3	£13.5	-£2.9	-£12.3	£0.5	£0.4	11.5	3.0
	Vegetation Clearance	3	2	£4.6	£3.5	£0.0	£0.0	£0.3	£0.2	13.4	16.2
	Other	11	2	£4.7	£11.3	£45.5	£2.9	£1.0	£1.1	50.9	13.2
Scheme Cost	£0 - £100,000	346		£5.0	£5.9	£11.3	£0.4	£0.3	£0.2	65.2	32.9
	£100,000 - £250,000	266		£6.5	£7.5	£2.2	£1.1	£0.6	£0.5	15.1	16.4
	£500,000 - £1 million	43		£1.4	£1.3	£1.7	£0.8	£0.2	£0.2	12.5	8.6
	£1 million - £2 million	33		£1.0	£1.3	£5.6	£0.9	£0.2	£0.2	36.6	12.6
	£2 million +	29		£0.4	£1.1	£4.6	£2.3	£0.3	£0.3	16.8	10.6
Total		**717**		**£6.9**	**£8.3**	**£12.3**	**£2.7**	**£0.7**	**£0.7**	**25.6**	**15.5**

CUMULATIVE OPENING YEAR ACCIDENT DATA SUMMARY

		Number of Schemes	Number of Outliers	Pre Scheme Annual Accident Rate				Post Scheme Annual Accident Rate				Accidents Saved	% Accident Saved	KSI Saved	% KSI Saved	Safety Benefits (£million)
				Slight	Serious	Fatal	SI %	Slight	Serious	Fatal	SI %					
Scheme Year	2002/3	53		245	39	7	16%	198	30	6	15%	57	20%	10	22%	£6
	2003/4	86		416	74	16	18%	321	44	9	14%	132	26%	37	41%	£13
	2004/5	89		414	59	13	15%	333	40	5	12%	109	22%	28	38%	£11
	2005/6	99		574	91	23	17%	425	58	20	15%	185	27%	36	32%	£17
	2006/7	66		391	56	13	15%	306	45	8	15%	102	22%	16	24%	£9
	2007/8	59		429	83	17	19%	306	51	7	16%	165	31%	42	42%	£15
	2008/9	54		345	50	10	15%	240	22	5	10%	138	34%	33	55%	£14
	2009/10	85		371	50	12	14%	252	39	9	16%	134	31%	15	24%	£13
	2010/11	55		305	30	7	11%	204	21	5	11%	112	33%	10	29%	£10
	2011/12	33		209	29	4	14%	135	22	1	15%	84	34%	10	29%	£7
	2012/13	18		108	13	4	13%	97	15	1	14%	11	9%	0	3%	£1
	2013/14	20		52	6	2	12%	31	4	0	11%	25	42%	3	46%	£3
Area Team (outliers removed)	Area 1	26	1	84	14	4	18%	91	7	2	9%	2	2%	9	51%	£0
	Area 2	48	3	207	26	8	14%	141	9	6	9%	86	35%	20	58%	£8
	Area 3	37	2	164	18	4	12%	119	18	2	14%	47	25%	2	11%	£4
	Area 4	54	1	239	44	11	19%	185	32	7	17%	70	24%	17	30%	£7
	Area 5	40	3	290	35	4	12%	220	22	5	11%	82	25%	12	30%	£7
	Area 6	61	0	280	64	13	21%	197	47	7	21%	106	30%	23	30%	£10
	Area 7	61	3	271	54	12	19%	211	27	2	12%	95	28%	36	55%	£10
	Area 8	36	2	230	37	8	17%	203	34	5	16%	34	12%	7	15%	£3
	Area 9	70	4	270	44	8	16%	187	21	3	11%	111	34%	28	53%	£11
	Area 10	51	1	239	22	5	10%	154	22	3	14%	86	32%	1	4%	£7
	Area 12	63	6	184	31	9	18%	117	19	3	15%	85	38%	18	46%	£7
	Area 13	62	3	159	30	7	19%	107	13	5	14%	72	37%	19	52%	£7
	Area 14	69	3	512	75	18	15%	388	62	16	17%	140	23%	15	16%	£13
Primary Measures (outliers removed)	Signing	153	7	624	92	19	15%	464	70	12	15%	189	26%	29	26%	£17
	Marking/lining	99	7	478	81	18	17%	365	55	13	16%	144	25%	32	32%	£13
	Passive Measures	45	3	142	20	6	16%	111	10	3	10%	46	27%	14	53%	£4
	NMU Facilities	9	1	7	1	1	26%	3	2	0	39%	3	39%	0	6%	£0
	Widening	63	4	297	32	6	11%	204	17	4	9%	111	33%	17	46%	£10
	Layby	13	3	61	12	4	21%	61	5	3	12%	9	12%	8	51%	£1
	Banned Turn	27	1	97	21	9	23%	51	17	2	27%	57	45%	11	37%	£5
	Lighting	7	0	19	5	1	24%	13	1	0	7%	11	43%	5	83%	£1
	Signal (new)	32	1	202	17	2	9%	114	18	1	14%	89	40%	0	2%	£7
	Signals (mod)	32	1	213	18	3	9%	140	11	1	8%	82	35%	9	43%	£8
	Camera	5	1	26	4	1	17%	13	4	1	27%	13	41%	0	5%	£2
	Surfacing	25	4	113	15	2	13%	76	8	1	10%	45	35%	9	50%	£4
	Geometry	57	2	216	32	6	15%	159	19	2	12%	74	29%	17	45%	£8
	Crossing	17	1	48	6	2	14%	34	6	0	14%	16	28%	2	29%	£2
	Narrowing/Lane Drop	11	0	30	5	1	15%	28	3	0	10%	5	13%	2	45%	£0
	SLR	23	2	216	41	8	19%	167	19	5	13%	73	28%	25	51%	£6
	Vegetation Clearance	3	2	5	1	0	18%	3	1	0	20%	2	29%	0	20%	£0
	Other	11	2	34	6	0	16%	16	1	1	9%	22	55%	5	75%	£3
Scheme Cost	£0 - £100,000	346		1082	174	41	17%	790	112	21	14%	374	29%	82	38%	£35
	£100,000 - £500,000	266		1889	284	65	16%	1432	198	41	14%	567	25%	110	32%	£53
	£500,000 - £1 million	43		316	42	9	14%	218	39	7	17%	105	28%	6	11%	£10
	£1 million - £2 million	33		261	39	7	15%	177	22	4	13%	104	34%	20	44%	£10
	£2 million +	29		312	41	4	13%	231	21	1	9%	103	29%	22	50%	£10
Total		**717**		**3860**	**580**	**126**	**15%**	**2848**	**391**	**75**	**14%**	**1253**	**27%**	**241**	**34%**	**£118**

AVERAGE OPENING YEAR ACCIDENT DATA SUMMARY

		Number of Schemes	Number of Outliers	Pre Scheme Annual Accident Rate				Post Scheme Annual Accident Rate				Accidents Saved	% Accident Saved	KSI Saved	% KSI Saved	Safety Benefits (£000's)
				Slight	Serious	Fatal	SI %	Slight	Serious	Fatal	SI %					
Scheme Year	2002/3	53		4.6	0.7	0.1	16%	3.7	0.6	0.1	15%	1.1	20%	0.2	22%	£110
	2003/4	86		4.8	0.9	0.2	18%	3.7	0.5	0.1	14%	1.5	26%	0.4	41%	£147
	2004/5	89		4.7	0.7	0.1	15%	3.7	0.5	0.1	12%	1.2	22%	0.3	38%	£126
	2005/6	99		5.8	0.9	0.2	17%	4.3	0.6	0.2	15%	1.9	27%	0.4	32%	£169
	2006/7	66		5.9	0.9	0.2	15%	4.6	0.7	0.1	15%	1.5	22%	0.2	24%	£129
	2007/8	59		7.3	1.4	0.3	19%	5.2	0.9	0.1	16%	2.8	31%	0.7	42%	£253
	2008/9	54		6.4	0.9	0.2	15%	4.5	0.4	0.1	10%	2.6	34%	0.6	55%	£251
	2009/10	85		4.4	0.6	0.1	14%	3.0	0.5	0.1	16%	1.6	31%	0.2	24%	£155
	2010/11	55		5.6	0.5	0.1	11%	3.7	0.4	0.1	11%	2.0	33%	0.2	29%	£187
	2011/12	33		6.3	0.9	0.1	14%	4.1	0.7	0.0	15%	2.5	34%	0.3	29%	£226
	2012/13	18		6.0	0.7	0.2	13%	5.4	0.8	0.1	14%	0.6	9%	0.0	3%	£67
	2013/14	20		2.6	0.3	0.1	12%	1.5	0.2	0.0	11%	1.2	42%	0.2	46%	£130
Area Team (outliers removed)	Area 1	26	1	3.2	0.5	0.2	18%	3.5	0.3	0.1	9%	0.1	2%	0.4	51%	£3
	Area 2	48	3	4.3	0.6	0.2	14%	2.9	0.2	0.1	9%	1.8	35%	0.4	58%	£169
	Area 3	37	2	4.4	0.5	0.1	12%	3.2	0.5	0.0	14%	1.3	25%	0.1	11%	£107
	Area 4	54	1	4.4	0.8	0.2	19%	3.4	0.6	0.1	17%	1.3	24%	0.3	30%	£128
	Area 5	40	3	7.3	0.9	0.1	12%	5.5	0.6	0.1	11%	2.1	25%	0.3	30%	£173
	Area 6	61	0	4.6	1.0	0.2	21%	3.2	0.8	0.1	21%	1.7	30%	0.4	30%	£166
	Area 7	61	3	4.4	0.9	0.2	19%	3.5	0.5	0.0	12%	1.6	28%	0.6	55%	£166
	Area 8	36	2	6.4	1.0	0.2	17%	5.6	0.9	0.1	16%	1.0	12%	0.2	15%	£86
	Area 9	70	4	3.9	0.6	0.1	16%	2.7	0.3	0.0	11%	1.6	34%	0.4	53%	£155
	Area 10	51	1	4.7	0.4	0.1	10%	3.0	0.4	0.1	14%	1.7	32%	0.0	4%	£141
	Area 12	63	6	2.9	0.5	0.1	18%	1.9	0.3	0.0	15%	1.4	38%	0.3	46%	£118
	Area 13	62	3	2.6	0.5	0.1	19%	1.7	0.2	0.1	14%	1.2	37%	0.3	52%	£117
	Area 14	69	3	7.4	1.1	0.3	15%	5.6	0.9	0.2	17%	2.0	23%	0.2	16%	£195
Primary Measures (outliers removed)	Signing	153	7	4.1	0.6	0.1	15%	3.0	0.5	0.1	15%	1.2	26%	0.2	26%	£109
	Marking/lining	99	7	4.8	0.8	0.2	17%	3.7	0.6	0.1	16%	1.5	25%	0.3	32%	£133
	Passive Measures	45	3	3.2	0.5	0.1	16%	2.5	0.2	0.1	10%	1.0	27%	0.3	53%	£89
	NMU Facilities	9	1	0.7	0.2	0.1	26%	0.4	0.2	0.0	39%	0.4	39%	0.0	6%	£42
	Widening	63	4	4.7	0.5	0.1	11%	3.2	0.3	0.1	9%	1.8	33%	0.3	46%	£162
	Layby	13	3	4.7	1.0	0.3	21%	4.7	0.4	0.3	12%	0.7	12%	0.6	51%	£67
	Banned Turn	27	1	3.6	0.8	0.3	23%	1.9	0.6	0.1	27%	2.1	45%	0.4	37%	£200
	Lighting	7	0	2.7	0.7	0.1	24%	1.9	0.1	0.0	7%	1.5	43%	0.7	83%	£153
	Signal (new)	32	1	6.3	0.5	0.1	9%	3.5	0.6	0.0	14%	2.8	40%	0.0	2%	£231
	Signals (mod)	32	1	6.7	0.6	0.1	9%	4.4	0.4	0.0	8%	2.6	35%	0.3	43%	£243
	Camera	5	1	5.1	0.9	0.2	17%	2.7	0.9	0.1	27%	2.5	41%	0.1	5%	£343
	Surfacing	25	4	4.5	0.6	0.1	13%	3.0	0.3	0.0	10%	1.8	35%	0.3	50%	£165
	Geometry	57	2	3.8	0.6	0.1	15%	2.8	0.3	0.0	12%	1.3	29%	0.3	45%	£138
	Crossing	17	1	2.8	0.4	0.1	14%	2.0	0.3	0.0	14%	0.9	28%	0.1	29%	£92
	Narrowing/Lane Drop	11	0	2.7	0.4	0.1	15%	2.5	0.3	0.0	10%	0.4	13%	0.2	45%	£45
	SLR	23	2	9.4	1.8	0.4	19%	7.3	0.8	0.2	13%	3.2	28%	1.1	51%	£272
	Vegetation Clearance	3	2	1.5	0.3	0.1	18%	1.1	0.3	0.0	20%	0.5	29%	0.1	20%	£51
	Other	11	2	3.1	0.6	0.0	16%	1.5	0.1	0.1	9%	2.0	55%	0.5	75%	£245
Scheme Cost	£0 - £100,000	346		3.1	0.5	0.1	17%	2.3	0.3	0.1	14%	1.1	29%	0.2	38%	£101
	£100,000 - £250,000	266		5.5	0.8	0.2	16%	5.4	0.7	0.2	14%	2.1	33%	0.1	11%	£200
	£500,000 - £1 million	43		0.9	0.1	0.0	14%	5.1	0.9	0.2	17%	2.4	229%	-0.9	-612%	£235
	£1 million - £2 million	33		0.8	0.1	0.0	15%	5.4	0.7	0.1	13%	3.2	355%	-0.7	-488%	£294
	£2 million +	29		0.9	0.1	0.0	13%	8.0	0.7	0.0	9%	3.5	344%	-0.6	-499%	£355
Total		**717**		**5.4**	**0.8**	**0.2**	**15%**	**4.0**	**0.5**	**0.1**	**14%**	**1.7**	**27%**	**0.3**	**34%**	**£165**

Results for Recent Schemes Evaluated (last four financial years)

CUMULATIVE OPENING YEAR COSTS AND BENEFITS SUMMARY

		Number of Schemes	Number of Outliers	Accidents Saved		Monetised Safety Benefits (£000'S)		Vehicle Hours Saved (000's)		Monetised Journey Time Benefits (£000's)		Scheme Cost (£000's)		FYRR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Year	2010/11	55		102	112	£10	£10	1723	404	£26	£5	£27	£26	136%	59%
	2011/12	33		72	84	£7	£7	65	-229	£14	-£3	£17	£16	126%	27%
	2012/13	18		48	11	£4	£1	0	-71	£3	-£1	£4	£4	171%	9%
	2013/14	20		20	25	£2	£3	500	3	£8	£0	£8	£10	117%	27%
Area Team *(outliers removed)*	Area 1	10	0	9	10	£1	£1	0	0	£0	£0	£1	£1	91%	124%
	Area 2	8	0	16	28	£1	£2	992	34	£14	£0	£5	£4	281%	73%
	Area 3	4	0	9	2	£1	£0	500	61	£7	£1	£7	£9	114%	11%
	Area 4	7	2	17	4	£2	£0	0	0	£0	£0	£1	£1	176%	57%
	Area 5	9	1	13	8	£1	£1	2	5	£0	£0	£1	£1	87%	64%
	Area 6	10	0	9	9	£1	£1	-1	-1	£0	£0	£1	£1	116%	89%
	Area 7	8	0	15	30	£1	£3	80	-271	£7	-£4	£6	£6	157%	-8%
	Area 8	2	0	3	4	£1	£1	0	0	£0	£0	£2	£1	51%	55%
	Area 9	14	1	25	9	£2	£0	390	-16	£5	£0	£5	£6	162%	4%
	Area 10	8	0	10	15	£1	£1	120	85	£5	£1	£7	£9	93%	27%
	Area 12	19	0	36	51	£3	£4	106	-37	£12	£0	£10	£8	143%	45%
	Area 13	7	0	5	14	£1	£1	0	0	£0	£0	£1	£0	108%	303%
	Area 14	13	1	24	34	£2	£3	129	-24	£2	£0	£3	£3	129%	94%
Primary Measures *(outliers removed)*	Signing	47	6	74	58	£7	£6	0	0	£0	£0	£9	£7	90%	76%
	Marking/lining	26	6	33	31	£3	£3	0	31	£2	£0	£5	£4	121%	90%
	Passive Measures	11	3	11	10	£1	£1	0	0	£0	£0	£1	£1	69%	63%
	NMU Facilities	1	0	2	7	£0	£1	0	0	£0	£0	£0	£0	49%	129%
	Widening	14	1	29	31	£3	£3	1,558	215	£27	£3	£18	£19	159%	28%
	Layby	1	3	1	1	£0	£0	0	0	£0	£0	£0	£0	88%	63%
	Banned Turn	1	1	0	1	£0	£0	-1	-1	£0	£0	£0	£0	120%	30%
	Lighting	0	0	0	0	£0	£0	0	0	£0	£0	£0	£0	NA	NA
	Signal (new)	11	1	35	33	£3	£3	927	-120	£20	-£1	£14	£18	161%	6%
	Signals (mod)	9	1	16	30	£1	£3	1,210	80	£18	£1	£8	£6	244%	61%
	Camera	1	1	3	4	£1	£1	0	0	£0	£0	£2	£1	51%	55%
	Surfacing	12	1	30	24	£3	£3	4	-11	£0	£0	£4	£4	77%	74%
	Geometry	11	0	19	15	£2	£2	552	197	£11	£3	£15	£18	84%	23%
	Crossing	2	1	6	0	£0	£0	500	61	£7	£1	£6	£8	121%	10%
	Narrowing/Lane Drop	2	0	2	3	£0	£0	0	0	£0	£0	£0	£0	62%	160%
	SLR	4	1	13	13	£1	£1	0	9	£0	£0	£2	£2	52%	58%
	Vegetation Clearance	0	1	0	0	£0	£0	0	0	£0	£0	£0	£0	NA	NA
	Other	4	2	7	11	£1	£1	0	0	£0	£0	£0	£0	145%	235%
Scheme Cost	£0 - £100,000	47		39	42	£4	£5	2	4	£0.3	£0.1	£3.3	£2.5	127%	180%
	£100,000 - £500,000	53		110	107	£11	£9	47	234	£1.7	£3.0	£12.0	£10.4	102%	120%
	£500,000 - £1 million	8		23	15	£2	£1	146	-95	£6.0	-£1.2	£4.8	£4.6	164%	2%
	£1 million - £2 million	14		54	51	£6	£5	1,291	172	£25.6	£2.2	£23.1	£18.9	137%	38%
	£2 million +	4		16	17	£1	£1	803	-207	£18.0	-£2.8	£13.4	£19.6	143%	-8%
Total		**126**		**242**	**232**	**£24**	**£22**	**2289**	**107**	**£52**	**£1**	**£57**	**£56**	**133%**	**41%**

AVERAGE OPENING YEAR COSTS AND BENEFITS SUMMARY

		Number of Schemes	Number of Outliers	Accidents Saved		Monetised Safety Benefits (£000's)		Vehicle Hours Saved		Monetised Journey Time Benefits (£000's)		Scheme Cost (£000's)		FYRR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Year	2010/11	55		1.9	2.0	£188	£187	31334	7346	£479	£96	£491	£480	136%	59%
	2011/12	33		2.2	2.5	£214	£226	1979	-6939	£439	-£95	£516	£488	126%	27%
	2012/13	18		2.7	0.6	£244	£67	0	-3944	£154	-£49	£233	£200	171%	9%
	2013/14	20		1.0	1.2	£97	£130	25014	157	£401	£4	£424	£499	117%	27%
Area Team *(outliers removed)*	Area 1	10	0	0.9	1.0	£82	£103	0	0	£0	£0	90	83	91%	124%
	Area 2	8	0	2.0	3.6	£176	£312	123943	4209	£1,692	£56	665	504	281%	73%
	Area 3	4	0	2.2	0.5	£181	£39	125068	15139	£1,678	£203	1629	2153	114%	11%
	Area 4	7	2	2.4	0.5	£242	£63	0	0	£0	£0	137	112	176%	57%
	Area 5	9	1	1.4	0.9	£122	£76	232	545	£3	£7	144	131	87%	64%
	Area 6	10	0	0.9	0.9	£117	£88	-143	-106	-£2	-£1	99	97	116%	89%
	Area 7	8	0	1.9	3.8	£176	£393	10025	-33868	£917	-£455	695	750	157%	-8%
	Area 8	2	0	1.6	1.9	£522	£398	0	0	£0	£0	1021	727	51%	55%
	Area 9	14	1	1.8	0.7	£167	£33	27877	-1155	£365	-£15	328	455	162%	4%
	Area 10	8	0	1.3	1.8	£110	£155	14948	10612	£671	£136	843	1075	93%	27%
	Area 12	19	0	1.9	2.7	£153	£213	5558	-1968	£615	-£22	535	424	143%	45%
	Area 13	7	0	0.8	1.9	£86	£209	0	0	£0	£0	80	69	108%	303%
	Area 14	13	1	1.9	2.6	£170	£230	9894	-1813	£168	-£24	264	218	129%	94%
Primary Measures *(outliers removed)*	Signing	47	6	1.6	1.2	£158	£121	0	0	£9	£0	£187	£159	90%	76%
	Marking/lining	26	6	1.3	1.2	£126	£128	0	1189	£93	£14	£181	£159	121%	90%
	Passive Measures	11	3	1.0	0.9	£91	£76	0	0	£0	£0	£132	£120	69%	63%
	NMU Facilities	1	0	2.1	7.0	£156	£519	0	0	£0	£0	£316	£402	49%	129%
	Widening	14	1	2.1	2.2	£194	£179	111285	15322	£1,905	£202	£1,316	£1,384	159%	28%
	Layby	1	3	0.8	0.6	£109	£85	0	0	£0	£0	£124	£134	88%	63%
	Banned Turn	1	1	0.2	0.9	£247	£76	-1428	-1059	-£17	-£13	£192	£210	120%	30%
	Lighting	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Signal (new)	11	1	3.2	3.0	£254	£240	84307	-10869	£1,853	-£134	£1,308	£1,642	161%	6%
	Signals (mod)	9	1	1.8	3.3	£158	£287	134472	8877	£2,036	£117	£900	£666	244%	61%
	Camera	1	1	3.0	3.6	£1,026	£776	0	0	£0	£0	£1,998	£1,414	51%	55%
	Surfacing	12	1	2.5	2.0	£281	£233	358	-911	£5	-£12	£369	£300	77%	74%
	Geometry	11	0	1.7	1.3	£183	£139	50180	17908	£983	£235	£1,396	£1,626	84%	23%
	Crossing	2	1	2.8	-0.2	£236	£3	250136	30278	£3,357	£406	£2,970	£4,063	121%	10%
	Narrowing/Lane Drop	2	0	0.9	1.7	£90	£202	0	0	£0	£0	£144	£126	62%	160%
	SLR	4	1	3.3	3.3	£284	£270	0	2179	£0	£29	£546	£512	52%	58%
	Vegetation Clearance	0	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Other	4	2	1.7	2.6	£178	£268	0	0	£0	£0	£123	£114	145%	235%
Scheme Cost	£0 - £100,000	47		0.8	0.9	£83	£96	44	86	£7	£1	£71	£54	127%	180%
	£100,000 - £500,000	53		2.1	2.0	£199	£179	889	4420	£33	£58	£226	£197	102%	120%
	£500,000 - £1 million	8		2.9	1.9	£238	£157	18213	-11892	£748	-£149	£601	£573	164%	2%
	£1 million - £2 million	14		3.9	3.7	£442	£361	92181	12251	£1,828	£160	£1,653	£1,352	137%	38%
	£2 million +	4		3.9	4.1	£299	£315	200872	-51874	£4,489	-£695	£3,359	£4,899	143%	-8%
Total		**126**		**1.9**	**1.8**	**£188**	**£171**	**18,166**	**851**	**£410**	**£11**	**£450**	**£445**	**133%**	**41%**

CUMULATIVE SCHEME LIFE COST AND BENEFIT SUMMARY

		Number of Schemes	Number of Outliers	Scheme Life Safety Benefits (£million)		Scheme Life Journey Time Benefits (£million)		Scheme Life Costs (£million)		BCR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
	2010/11	55		£481	£456	£1,187	£238	£53	£50	31.2	13.9
	2011/12	33		£294	£341	£567	-£123	£32	£31	26.9	7.0
	2012/13	18		£192	£36	£105	-£34	£18	£15	16.5	0.2
	2013/14	20		£73	£119	£117	-£20	£16	£15	12.1	6.5
Area Team *(outliers removed)*											
	Area 1	10	0	£36	£46	£0	£0	£4	£3	10.0	13.5
	Area 2	8	0	£74	£138	£645	£21	£9	£8	77.2	21.3
	Area 3	4	0	£27	£16	£67	£8	£8	£10	12.1	2.5
	Area 4	7	2	£77	£19	£0	£0	£4	£3	19.9	6.6
	Area 5	9	1	£48	£32	£1	£3	£3	£3	15.0	12.4
	Area 6	10	0	£53	£42	-£1	-£1	£5	£5	10.4	8.3
	Area 7	8	0	£62	£138	£301	-£142	£9	£9	40.9	-0.5
	Area 8	2	0	£16	£12	£0	£0	£2	£2	7.5	8.1
	Area 9	14	1	£99	-£2	£204	-£9	£18	£18	16.7	-0.6
	Area 10	8	0	£45	£61	£215	£43	£11	£13	24.6	8.0
	Area 12	19	0	£131	£185	£456	-£10	£24	£19	24.9	9.3
	Area 13	7	0	£26	£59	£0	£0	£2	£1	15.4	45.1
	Area 14	13	1	£99	£132	£93	-£14	£10	£8	19.2	14.6
Primary Measures *(outliers removed)*											
	Signing	47	6	£315	£234	£20	£0	£27	£23	12.6	10.3
	Marking/lining	26	6	£141	£136	£93	£14	£15	£12	15.7	12.7
	Passive Measures	11	3	£50	£41	£0	£0	£4	£4	11.6	10.7
	NMU Facilities	1	0	£10	£33	£0	£0	£1	£2	7.8	20.3
	Widening	14	1	£148	£130	£1,191	£137	£23	£24	57.5	11.3
	Layby	1	3	£6	£5	£0	£0	£0	£0	48.4	34.7
	Banned Turn	1	1	£11	£3	-£1	-£1	£1	£1	18.2	4.5
	Lighting	0	0	£0	£0	£0	£0	£0	£0	NA	NA
	Signal (new)	11	1	£112	£122	£599	-£81	£25	£28	28.6	1.5
	Signals (mod)	9	1	£71	£128	£837	£43	£11	£9	84.8	19.7
	Camera	1	1	£15	£11	£0	£0	£2	£1	7.6	8.1
	Surfacing	12	1	£139	£109	£3	-£7	£11	£9	13.2	11.8
	Geometry	11	0	£97	£78	£240	£92	£18	£20	18.6	8.4
	Crossing	2	1	£8	£4	£67	£8	£6	£9	11.9	1.4
	Narrowing/Lane Drop	2	0	£9	£19	£0	£0	£2	£1	5.5	13.9
	SLR	4	1	£50	£48	£0	£6	£4	£4	12.2	14.2
	Vegetation Clearance	0	1	£0	£0	£0	£0	£0	£0	NA	NA
	Other	4	2	£29	£43	£0	£0	£2	£2	17.0	26.7
Scheme Cost											
	£0 - £100,000	47		£177	£206	£14	£2	£15	£12	12.4	17.9
	£100,000 - £500,000	53		£485	£419	£70	£128	£48	£42	11.6	13.1
	£500,000 - £1 million	8		£82	£57	£242	-£40	£18	£17	17.9	1.0
	£1 million - £2 million	14		£251	£201	£1,138	£105	£24	£21	57.1	14.7
	£2 million +	4		£46	£68	£513	-£133	£13	£20	41.6	-3.3
Total		**126**		**£1,040**	**£952**	**£1,977**	**£62**	**£119**	**£111**	**25.3**	**9.1**

AVERAGE SCHEME LIFE COST AND BENEFIT SUMMARY

		Number of Schemes	Number of Outliers	Scheme Life Safety Benefits (£million)		Scheme Life Journey Time Benefits (£million)		Scheme Life Costs (£million)		BCR	
				Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
Scheme Cost	2010/11	55		£8.7	£8.3	£21.6	£4.3	£1.0	£0.9	31.2	13.9
	2011/12	33		£8.9	£10.3	£17.2	-£3.7	£1.0	£0.9	26.9	7.0
	2012/13	18		£10.7	£2.0	£5.9	-£1.9	£1.0	£0.8	16.5	0.2
	2013/14	20		£3.7	£5.9	£5.9	-£1.0	£0.8	£0.8	12.1	6.5
Area Team *(outliers removed)*	Area 1	10	0	£3.6	£4.6	£0.0	£0.0	£0.4	£0.3	10.0	13.5
	Area 2	8	0	£9.3	£17.3	£80.7	£2.7	£1.2	£0.9	77.2	21.3
	Area 3	4	0	£6.7	£4.0	£16.8	£2.0	£1.9	£2.4	12.1	2.5
	Area 4	7	2	£11.0	£2.8	£0.0	£0.0	£0.6	£0.4	19.9	6.6
	Area 5	9	1	£5.4	£3.6	£0.1	£0.3	£0.4	£0.3	15.0	12.4
	Area 6	10	0	£5.3	£4.2	-£0.1	-£0.1	£0.5	£0.5	10.4	8.3
	Area 7	8	0	£7.8	£17.2	£37.6	-£17.8	£1.1	£1.2	40.9	-0.5
	Area 8	2	0	£8.0	£6.2	£0.0	£0.0	£1.1	£0.8	7.5	8.1
	Area 9	14	1	£7.1	-£0.1	£14.6	-£0.6	£1.3	£1.3	16.7	-0.6
	Area 10	8	0	£5.6	£7.6	£26.8	£5.4	£1.3	£1.6	24.6	8.0
	Area 12	19	0	£6.9	£9.8	£24.0	-£0.5	£1.2	£1.0	24.9	9.3
	Area 13	7	0	£3.7	£8.5	£0.0	£0.0	£0.2	£0.2	15.4	45.1
	Area 14	13	1	£7.6	£10.1	£7.1	-£1.1	£0.8	£0.6	19.2	14.6
Primary Measures *(outliers removed)*	Signing	47	6	£6.7	£5.0	£0.4	£0.0	£0.6	£0.5	12.6	10.3
	Marking/lining	26	6	£5.4	£5.2	£3.6	£0.5	£0.6	£0.5	15.7	12.7
	Passive Measures	11	3	£4.5	£3.8	£0.0	£0.0	£0.4	£0.4	11.6	10.7
	NMU Facilities	1	0	£9.8	£32.6	£0.0	£0.0	£1.3	£1.6	7.8	20.3
	Widening	14	1	£10.6	£9.3	£85.1	£9.8	£1.7	£1.7	57.5	11.3
	Layby	1	3	£6.0	£4.7	£0.0	£0.0	£0.1	£0.1	48.4	34.7
	Banned Turn	1	1	£11.4	£3.5	-£0.9	-£0.7	£0.6	£0.6	18.2	4.5
	Lighting	0	0	NA	NA	NA	NA	NA	NA	NA	NA
	Signal (new)	11	1	£10.2	£11.1	£54.5	-£7.3	£2.3	£2.6	28.6	1.5
	Signals (mod)	9	1	£7.8	£14.2	£93.0	£4.8	£1.2	£1.0	84.8	19.7
	Camera	1	1	£15.1	£11.4	£0.0	£0.0	£2.0	£1.4	7.6	8.1
	Surfacing	12	1	£11.6	£9.1	£0.2	-£0.6	£0.9	£0.7	13.2	11.8
	Geometry	11	0	£8.8	£7.1	£21.8	£8.3	£1.6	£1.8	18.6	8.4
	Crossing	2	1	£4.1	£1.9	£33.6	£4.1	£3.2	£4.4	11.9	1.4
	Narrowing/Lane Drop	2	0	£4.3	£9.3	£0.0	£0.0	£0.8	£0.7	5.5	13.9
	SLR	4	1	£12.5	£11.9	£0.0	£1.4	£1.0	£0.9	12.2	14.2
	Vegetation Clearance	0	1	NA	NA	NA	NA	NA	NA	NA	NA
	Other	4	2	£7.2	£10.7	£0.0	£0.0	£0.4	£0.4	17.0	26.7
Scheme Cost	£0 - £100,000	47		£3.8	£4.4	£0.3	£0.0	£0.3	£0.2	12.4	17.9
	£100,000 - £500,000	53		£9.1	£7.9	£1.3	£2.4	£0.9	£0.8	11.6	13.1
	£500,000 - £1 million	8		£10.2	£7.2	£30.3	-£5.1	£2.3	£2.2	17.9	1.0
	£1 million - £2 million	14		£17.9	£14.4	£81.3	£7.5	£1.7	£1.5	57.1	14.7
	£2 million +	4		£11.4	£17.1	£128.2	-£33.3	£3.4	£4.9	41.6	-3.3
Total		**126**		**£8.3**	**£7.6**	**£15.7**	**£0.5**	**£0.9**	**£0.9**	**25.3**	**9.1**

CUMULATIVE OPENING YEAR ACCIDENT DATA SUMMARY

		Number of Schemes	Number of Outliers	Pre Scheme Annual Accident Rate				Post Scheme Annual Accident Rate				Accidents Saved	% Accident Saved	KSI Saved	% KSI Saved	Safety Benefits (£million)
				Slight	Serious	Fatal	SI %	Slight	Serious	Fatal	SI %					
Scheme Year	2010/11	55		305	30	7	11%	204	21	5	11%	112	33%	10	29%	£10.3
	2011/12	33		209	29	4	14%	135	22	1	15%	84	34%	10	29%	£7.5
	2012/13	18		108	13	4	13%	97	15	1	14%	11	9%	0	3%	£1.2
	2013/14	20		52	6	2	12%	31	4	0	11%	25	42%	3	46%	£2.6
Area Team (outliers removed)	Area 1	10	0	22	2	2	16%	14	2	0	11%	10	38%	2	57%	£1.0
	Area 2	8	0	44	5	0	11%	18	3	0	14%	28	58%	2	45%	£2.5
	Area 3	4	0	13	2	1	18%	12	2	0	17%	2	11%	1	19%	£0.2
	Area 4	7	2	41	4	1	10%	33	8	0	20%	4	8%	-4	-86%	£0.4
	Area 5	9	1	21	3	0	12%	14	1	1	10%	8	34%	1	50%	£0.7
	Area 6	10	0	24	5	1	20%	17	4	1	20%	9	30%	2	31%	£0.9
	Area 7	8	0	76	11	1	13%	50	7	0	12%	30	35%	5	40%	£3.1
	Area 8	2	0	13	2	1	16%	10	2	1	17%	4	25%	0	18%	£0.8
	Area 9	14	1	54	4	1	8%	44	4	1	12%	9	15%	-1	-20%	£0.5
	Area 10	8	0	48	5	0	10%	32	6	1	16%	15	28%	-1	-21%	£1.2
	Area 12	19	0	81	8	3	13%	40	2	0	5%	51	55%	9	81%	£4.1
	Area 13	7	0	20	3	0	12%	9	1	0	6%	14	60%	2	80%	£1.5
	Area 14	13	1	84	10	2	12%	53	7	2	15%	34	35%	2	18%	£3.0
Primary Measures (outliers removed)	Signing	47	6	170	26	7	16%	122	19	3	15%	58	29%	10.9	34%	£5.7
	Marking/lining	26	6	108	15	2	14%	77	13	4	18%	31	25%	0.5	3%	£3.3
	Passive Measures	11	3	23	4	2	20%	17	2	1	14%	10	34%	3.2	54%	£0.8
	NMU Facilities	1	0	9	2	0	16%	4	1	0	17%	7	62%	1.1	61%	£0.5
	Widening	14	1	71	4	1	7%	41	4	0	9%	31	41%	1.2	23%	£2.5
	Layby	1	3	0	0	0	67%	0	0	0	NA	1	100%	0.4	100%	£0.1
	Banned Turn	1	1	1	0	0	29%	1	0	0	0%	1	60%	0.4	100%	£0.1
	Lighting	0	0	0	0	0	NA	0	0	0	NA	0	NA	0.0	NA	£0.0
	Signal (new)	11	1	60	6	1	10%	30	4	0	11%	33	49%	2.9	44%	£2.6
	Signals (mod)	9	1	54	3	1	7%	27	1	1	4%	30	51%	3.1	75%	£2.6
	Camera	1	1	12	2	1	15%	9	2	1	18%	4	25%	0.2	9%	£0.8
	Surfacing	12	1	56	8	2	15%	39	4	0	9%	24	36%	6.5	64%	£2.8
	Geometry	11	0	45	7	1	14%	32	4	1	13%	15	28%	2.5	35%	£1.5
	Crossing	2	1	9	1	0	16%	10	1	0	13%	0	-4%	0.3	19%	£0.0
	Narrowing/Lane Drop	2	0	4	0	0	14%	1	0	0	0%	3	81%	0.6	100%	£0.4
	SLR	4	1	22	4	1	17%	13	1	0	5%	13	49%	3.9	85%	£1.1
	Vegetation Clearance	0	1	0	0	0	NA	0	0	0	NA	0	NA	0.0	NA	£0.0
	Other	4	2	18	3	0	17%	10	1	1	11%	11	50%	2.3	66%	£1.1
Scheme Cost	£0 - £100,000	47		1,082	174	41	17%	790	112	21	14%	374	29%	82	38%	£35.1
	£100,000 - £500,000	53		1,889	284	65	16%	1,432	198	41	14%	567	25%	110	32%	£53.1
	£500,000 - £1 million	8		316	42	9	14%	218	39	7	17%	105	28%	6	11%	£10.1
	£1 million - £2 million	14		261	39	7	15%	177	22	4	13%	104	34%	20	44%	£9.7
	£2 million +	4		312	41	4	13%	231	21	1	9%	103	29%	22	50%	£10.3
Total		**126**		**3860**	**580**	**126**	**15%**	**2848**	**391**	**75**	**14%**	**1253**	**27%**	**241**	**34%**	**£118.3**

AVERAGE OPENING YEAR ACCIDENT DATA SUMMARY

		Number of Schemes	Number of Outliers	Pre Scheme Annual Accident Rate				Post Scheme Annual Accident Rate				Accidents Saved	% Accident Saved	KSI Saved		Safety Benefits (£000's)
				Slight	Serious	Fatal	SI %	Slight	Serious	Fatal	SI %					
Scheme Year	2010/11	55		5.6	0.5	0.1	11%	3.7	0.4	0.1	11%	2.0	33%	0.2	29%	£187
	2011/12	33		6.3	0.9	0.1	14%	4.1	0.7	0.0	15%	2.5	34%	0.3	29%	£226
	2012/13	18		6.0	0.7	0.2	13%	5.4	0.8	0.1	14%	0.6	9%	0.0	3%	£67
	2013/14	20		2.6	0.3	0.1	12%	1.5	0.2	0.0	11%	1.2	42%	0.2	46%	£130
Area Team (outliers removed)	Area 1	10	0	2.2	0.2	0.2	16%	1.4	0.2	0.0	11%	1.0	38%	0.2	57%	£103
	Area 2	8	0	5.5	0.7	0.0	11%	2.2	0.4	0.0	14%	3.6	58%	0.3	45%	£312
	Area 3	4	0	3.3	0.6	0.2	18%	3.0	0.6	0.0	17%	0.5	11%	0.1	19%	£39
	Area 4	7	2	5.8	0.5	0.1	10%	4.7	1.2	0.0	20%	0.5	8%	-0.5	-86%	£63
	Area 5	9	1	2.4	0.3	0.0	12%	1.6	0.1	0.1	10%	0.9	34%	0.2	50%	£76
	Area 6	10	0	2.4	0.5	0.1	20%	1.7	0.4	0.1	20%	0.9	30%	0.2	31%	£88
	Area 7	8	0	9.4	1.3	0.1	13%	6.2	0.8	0.0	12%	3.8	35%	0.6	40%	£393
	Area 8	2	0	6.5	0.9	0.3	16%	4.8	0.8	0.3	17%	1.9	25%	0.2	18%	£398
	Area 9	14	1	3.9	0.3	0.0	8%	3.2	0.3	0.1	12%	0.7	15%	-0.1	-20%	£33
	Area 10	8	0	6.0	0.6	0.0	10%	4.0	0.7	0.1	16%	1.8	28%	-0.1	-21%	£155
	Area 12	19	0	4.3	0.4	0.2	13%	2.1	0.1	0.0	5%	2.7	55%	0.5	81%	£213
	Area 13	7	0	2.8	0.4	0.0	12%	1.2	0.1	0.0	6%	1.9	60%	0.3	80%	£209
	Area 14	13	1	6.5	0.7	0.1	12%	4.1	0.5	0.2	15%	2.6	35%	0.2	18%	£230
Primary Measures (outliers removed)	Signing	47	6	3.6	0.6	0.1	16%	2.6	0.4	0.1	15%	1.2	29%	0.2	34%	£121
	Marking/lining	26	6	4.2	0.6	0.1	14%	3.0	0.5	0.1	18%	1.2	25%	0.0	3%	£128
	Passive Measures	11	3	2.1	0.4	0.2	20%	1.5	0.2	0.1	14%	0.9	34%	0.3	54%	£76
	NMU Facilities	1	0	9.4	1.6	0.2	16%	3.5	0.7	0.0	17%	7.0	62%	1.1	61%	£519
	Widening	14	1	5.1	0.3	0.1	7%	2.9	0.3	0.0	9%	2.2	41%	0.1	23%	£179
	Layby	1	3	0.2	0.4	0.0	67%	0.0	0.0	0.0	NA	0.6	100%	0.4	100%	£85
	Banned Turn	1	1	1.1	0.2	0.2	29%	0.6	0.0	0.0	0%	0.9	60%	0.4	100%	£76
	Lighting	0	0	NA	NA	NA	NA	NA	NA	NA	NA	0.0	NA	0.0	NA	NA
	Signal (new)	11	1	5.5	0.5	0.1	10%	2.7	0.3	0.0	11%	3.0	49%	0.3	44%	£240
	Signals (mod)	9	1	6.0	0.4	0.1	7%	3.0	0.1	0.1	4%	3.3	51%	0.3	75%	£287
	Camera	1	1	12.4	1.6	0.6	15%	9.0	1.5	0.5	18%	3.6	25%	0.2	9%	£776
	Surfacing	12	1	4.7	0.7	0.2	15%	3.2	0.3	0.0	9%	2.0	36%	0.5	64%	£233
	Geometry	11	0	4.1	0.6	0.1	14%	2.9	0.4	0.1	13%	1.3	28%	0.2	35%	£139
	Crossing	2	1	4.6	0.7	0.2	16%	5.0	0.7	0.0	13%	-0.2	-4%	0.2	19%	£3
	Narrowing/Lane Drop	2	0	1.8	0.1	0.2	14%	0.4	0.0	0.0	0%	1.7	81%	0.3	100%	£202
	SLR	4	1	5.6	0.9	0.2	17%	3.2	0.2	0.0	5%	3.3	49%	1.0	85%	£270
	Vegetation Clearance	0	1	NA	NA	NA	NA	NA	NA	NA	NA	0.0	NA	0.0	NA	NA
	Other	4	2	4.5	0.8	0.1	17%	2.4	0.2	0.2	11%	2.6	50%	0.6	66%	£268
Scheme Cost	£0 - £100,000	47		23.0	3.7	0.9	17%	16.8	2.4	0.5	14%	8.0	29%	1.7	38%	£746
	£100,000 - £500,000	53		35.6	5.4	1.2	16%	27.0	3.7	0.8	14%	10.7	25%	2.1	32%	£1,002
	£500,000 - £1 million	8		39.5	5.3	1.2	14%	27.2	4.8	0.9	17%	13.1	28%	0.7	11%	£1,264
	£1 million - £2 million	14		18.7	2.8	0.5	15%	12.7	1.5	0.3	13%	7.4	34%	1.5	44%	£693
	£2 million +	4		77.9	10.2	1.0	13%	57.8	5.4	0.3	9%	25.7	29%	5.6	50%	£2,575
Total		**126**		**30.6**	**4.6**	**1.0**	**15%**	**22.6**	**3.1**	**0.6**	**14%**	**9.9**	**27%**	**1.9**	**34%**	**£939**

List of Measure Groups

SIGNING	LIGHTING	SURFACE	WIDENING
Signs	Lighting	Anti-Skid Surface	Widening - no additional lanes
Chevron Signs	Lighting (passively safe)	Coloured Surfacing	Widening - Additional Lane/Lane Gain
Vehicle Actuated Sign		Re-Texturing	Climbing Lane/HGV overtaking ban
VMS	**SIGNAL**	Re-Surfacing	
	Traffic Signals (new)		**LAYBY**
MARKING/LINING	Traffic Signal - improvement	**GEOMETRY**	Layby Improvement
Road Markings	Traffic Signals (new ped phase)	Slip road merge/diverge improvements	Layby Closure
Chevron Markings	Traffic Signals (Vehicle Conflict Separation)	Right Turn Lane/ghost island at Priority Junction	
Lining - general		Roundabout (geometry)	**BANNED TURN**
Lining - Ladder Markings	**CAMERA**	Roundabout (new)	Prohibited Turn - Sign
Lining - Lane (destination) Markings	Red Light Camera	Mini-Roundabout	Prohibited Turn - Layout
Lining - Slow Markings	Speed Camera		
Roundabout (lateral bar markings)		**CROSSING**	**NARROWING/LANE DROP**
	PASSIVE MEASURES	New/Improved Splitter Island/Separation	Narrowing
NMU FACILITIES	Hardstanding	Islands/Refuges	Lane Drop
Footway (new)	Carriageway Drainage	Crossings (inc improvements)	
Footway (improvement)	Safety Barrier	Zebra Crossing	**SPEED LIMIT REDUCTION**
Pedestrian Guardrail/fencing	Road Studs		
Cycle Facilities/lanes (inc off-c'way)	Marker Posts	**VEGETATION CLEARANCE**	**OTHER**
	Illuminated Bollards/Other Bollards		

Appendix D – Outliers

Depending on the analysis we are performing, sometimes we want to look at how the typical scheme is performing, rather than considering the results based on all schemes which would include schemes with atypical performance.

For example, when we want to consider how the LNMS programme is performing, we are interested in all schemes that have been evaluated, hence all schemes are included in the sample regardless of their performance. When we undertake other analyses such as looking at the performance of schemes by area team or the performance of certain measures, we are interested in what happens on average. This because the information presented could be useful for future scheme appraisals, whereas a result which could be skewed by unusual performances would not be useful. For example, it is more useful to know the typical performance of a speed limit scheme, rather the performance of a speed limit scheme that has unusual results. To focus on the typical performance of a scheme, we would like to remove outliers (those schemes with atypical performances).

As such, in this report, all results are based on the whole sample of evaluated schemes with just two exceptions:

- LNMS results by scheme measures; and
- LNMS results by Highways England's area teams.

The method we have used to identify outliers is the Devore's Fourth Spread method. This method considers how many inter-quartile ranges from the median values are, and identifies outliers based on whether they are suitably close to the median.

In order to only remove the extreme outliers, we remove schemes only when the scheme result is three inter-quartile ranges from the median. By definition of Devore's Fourth Spread, this will only identify extreme outliers.

One additional complication is that we have had to apply this method separately for schemes with only safety impacts and ones with both safety and journey time impacts. This is because schemes that impact on both safety and journey times are more likely to have high outturn benefits than schemes that only influence safety. Therefore, it is necessary to treat these two types of schemes separately, to ensure that we are not biasing the sample when removing outliers.

The outliers are removed based on total outturn benefits. Whenever outliers have been removed from a result, a footnote is attached to the table or chart or a note is included in the text, to indicate this.

This report includes analyses for all schemes from the LNMS programme by area team, and in this case the outliers have been calculated based on all schemes. Whereas, when we undertake our analysis of the recent schemes (last four financial years), the outliers have been recalculated based only schemes included in this sample.

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