HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

11th Annual Evaluation Report

December 2014

An executive agency of the Department for Transport

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Contents

Glossary

Term	Definition
ASC/MAC	Asset Support Contract/Managing Agent Contract: Terms denoting the Highways Agency'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
HA	Highways Agency: An Executive Agency of the Department for Transport; responsible for operating, maintaining and improving the strategic road network in England
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
Sat-Nav	Satellite Navigation: During the past three years of POPE, we have begun to use Sat-Nav to enable an assessment of the post-opening impact of schemes on journey times, including looking at journey time reliability
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 we (the Highways Agency) make to the trunk road network which cost less than £10m to implement. These cover a range of improvements, from the addition of new lanes at a major junction to the provision of new planting on a carriageway verge. 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 the Highways Agency (HA). POPE aims to determine both how schemes have performed in their opening year and how accurate their appraisals have been.

Our methodology in POPE is broadly to consider the impact of each scheme against the Government's four WebTAG objectives, namely economy, environment, society and public accounts; which are themselves split into a number of sub-objectives.

Each year, we undertake meta-analysis of the results of all schemes evaluated to that point in time. This Annual Evaluation Report summarises the results of all 11 years of evaluations completed to date.

Schemes & Evaluations

Over the 11 years, we have now processed over 2,000 Project Appraisal Reports (PARs), which contain each scheme's appraisal information. In the first nine years of the commission, we typically had 200 PARs per annum, but in the two recent financial years this has dropped to approximately 70-80; the main reason for which is a reduction in Government funding for schemes, with a focus instead on larger schemes which are outside the LNMS programme. Typically, in any given year, nearly half of all schemes are classified as safety, which means they are focussing on reducing the number of accidents at a given location. Our analysis has also shown us that there has been a trend in more recent years of reduced investment per scheme.

Of the 2,000 schemes, we have been able to evaluate 756 schemes; the majority (689) of which are either safety or economy schemes, whose focus is generally upon improving safety and / or journey times. Of the remainder, some can never be evaluated as they do not have quantifiable impacts but some can be evaluated once sufficient data becomes available in the future.

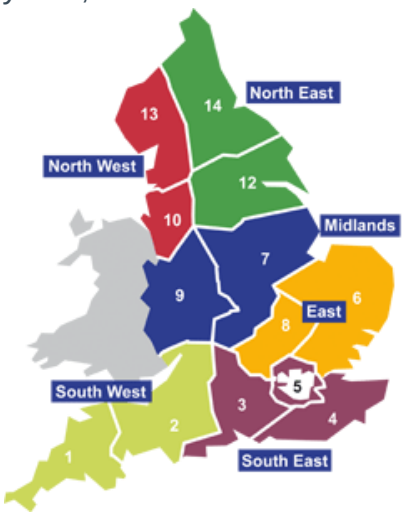
Safety and Economy Scheme Results

The 689 evaluated safety or economy schemes have cost a total of £229m and have delivered the following benefits, demonstrating very strong performance.

1,194	**Accidents** saved in the observed opening year, based on a comparison of accident rates before and after scheme opening. This includes 235 Killed or Seriously Injured (KSI) accidents saved
3.7m	**Vehicle hours** saved in the opening year, based on a comparison of journey times before and after scheme opening
71%	Of scheme costs recouped in the opening year, based on calculating the **First Year Rate of Return**
16.9x	The average scheme will pay for itself nearly 17 times over during its life, based on calculating the **Benefit Cost Ratio**

Our analysis has shown us that:

- Strong performance has been maintained over the 11 years;
- All of the Highways Agency areas, with the exception of Area 1, achieve an accident saving, demonstrating that on the whole, the programme is successful at reducing accidents across the country. Journey time impacts vary considerably by area but this could reflect both the types of schemes implemented (for example, speed limit reduction schemes will typically lead to dis-benefits for journey times), or the performance of the schemes, or sometimes a combination of the two;



- Schemes involving banned turns and new signals are the most effective at saving accidents, reducing the pre-scheme accident rate by an average of 45% and 40% respectively. Speed limit reduction schemes are the strongest performing schemes in regard to KSI accident savings, saving three times that of most measures. Modified signals and widening generate the highest vehicle hour savings. It is notable that modified signals are more effective than new signals at improving journey times; and
- FYRR generally reduces with increased scheme cost and overall benefits increase with scheme cost. Schemes costing more than £2m generate large first year benefits in comparison to other cost categories, but deliver a low FYRR.

All schemes within the programme are assessed against a range of other objectives covering Environment and Society. In general, the majority of sub-objectives considered are beneficial more often than adverse. The objectives which are most commonly scored as non-neutral (i.e. beneficial or adverse) are journey ambience and landscape, with the adverse scores for landscape usually arising because of schemes introducing features like large signs and traffic signals.

Appraisal Accuracy

A key component of our meta-analysis is interrogating the accuracy of our appraisals. This is crucial because it is the appraisal process which governs which schemes are funded and

implemented. We consider the accuracy of forecast accident benefits, journey time benefits and costs at both a programme level and at a scheme-by-scheme level.

At the programme level, costs are the most accurately appraised aspect of the financial forecasts within the PAR, followed by safety benefits and journey time benefits respectively, as outlined in the table. The 16% under-prediction for accident benefits is positive in as much as it demonstrates that the programme is overall surpassing its predicted benefits, but there may have been viable schemes which have not been introduced because the safety benefits were not fully realised during the appraisal. Further investigation of the 71% over-prediction for journey time benefits shows that the monetised over-prediction is much higher for lower cost schemes than higher cost schemes. Our results suggest that there are no measures which are typically implemented for less than £100k which have a notable impact on journey times.

Costs	Outturn costs (£229m) **lower** than predicted (£239m)	**- 4%**
Accident Benefits	Outturn benefits (£109m) **higher** than predicted (£94m)	**+16%**
Journey Time Benefits	Outturn benefits (£55m) **lower** than predicted (£191m)	**-71%**

The results at an individual scheme level show that the forecasting of benefits is poor. Only 12% of schemes evaluated are within 25% of the forecast accident benefit and 23% within the forecast journey time benefit. Cost accuracy for individual schemes is more encouraging than benefit forecasts, with 58% of schemes within 25% of the forecast. We find the majority of the 'other' sub-objectives, relating to environment and society, have been scored the same in the evaluation as they were in the appraisal. Only journey ambience and landscape have required significant changes to date.

Finally, if we look at accuracy of appraisal by scheme cost, it clearly shows us that as scheme cost increases, the accuracy of both journey time and accident benefit forecasts improves.

Environment Schemes

For the seven recent environment scheme evaluations, we see that five have fully met their objectives, one has partially met its objectives and one has failed to meet one of its objectives. This year's environment schemes have therefore largely been a success. The scheme which failed to meet one of its objectives was due to a lack of evidence of tree planting on site, but the PAR and scheme plans were so vague that it is possible that the planting could have taken place elsewhere without our knowledge. This highlights the need for area teams to provide accurate scheme details to enable us to undertake a robust evaluation.

Over the years, but this year particularly, we have seen an improved success rate of schemes fulfilling their objectives. It has been consistently highlighted however that there is a need for a maintenance / aftercare plan to be put into place for every scheme and this year it has been evident that good ongoing maintenance has helped a number of schemes achieve their objectives.

Severance schemes

Four out of the five recently evaluated severance schemes have been assessed as fully achieving their objectives. One scheme did not achieve its objectives, which was a pedestrian crossing scheme that experienced an increase in accidents (including those involving cyclists) after scheme implementation. The recent trends are in line with the historic evaluations, showing that generally severance improvements are successful.

There have been some elements of the schemes which could be improved in order to allow us to undertake more thorough evaluations in future, including pre-scheme pedestrian and cycle counts. There are very few ways to efficiently confirm whether a scheme has increased levels of pedestrian and cycle use, and therefore NMU counts would make our results more quantifiable and robust. Furthermore, it would be beneficial in future evaluations to undertake more user surveys, as with severance schemes the outcomes tend to be a perceived benefit rather than a quantifiable one.

Introduction

Project aims

Local Network Management Schemes (LNMS) are improvements that we (the Highways Agency) make to the trunk road network which cost less than £10m to implement. These cover a range of improvements, from the addition of new lanes at a major junction to the provision of new planting on a carriageway verge.

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 the Highways Agency (HA). For each scheme, POPE aims to determine:

- The performance in the first year and over the longer term
- Whether the scheme has performed better than, worse than, or as expected

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

This evaluation process began in 2003, so we now have a large sample of schemes from which to draw conclusions and learn lessons.

Schemes evaluated

We aim to evaluate all LNMS that cost between £25k and £10m to implement, but only where a meaningful evaluation is possible. There are some schemes we cannot evaluate as they don't have impacts that can be accurately assessed, but most schemes are eligible for evaluation.

Now that we have been undertaking the POPE process for 11 years, the sample of evaluated schemes stands at 756 and this figure typically grows by approximately 60-70 schemes per annum. This covers a wide variety of types and sizes of schemes.

Remainder of the report

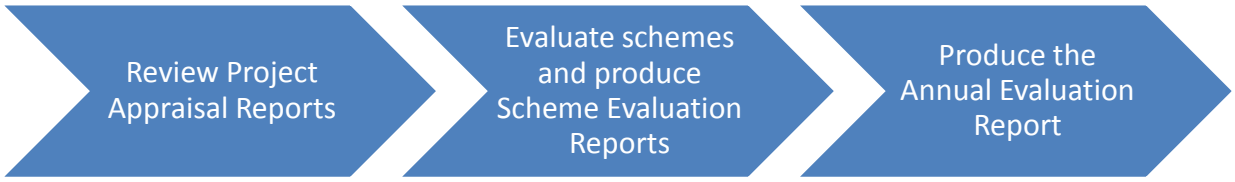
Following this introduction, the next section of the report sets out our evaluation methodology, using case studies to illustrate our latest approach. Thereafter, we give details on our findings from the sample of evaluated schemes. At the end of the report, we pull together the key findings from the POPE process as a whole.

Methodology

Overview

This section sets out the methodology we use to evaluate schemes. Whilst the evaluation methodology has remained consistent over the 11 years that POPE has been undertaken, we have made some subtle improvements to ensure the results continue to be as robust as possible based on the data available.

In broad terms, there are three steps to the POPE process, which are repeated once each year.



Step 1 – Review Project Appraisal Reports

We begin the process by reviewing the project appraisal reports (PARs) from the previous financial year for each scheme. 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 or provision of facilities for otters to safely cross underneath a road) and accessibility (for example, introducing a new length of cycle lane, or a new pedestrian crossing). Note that accessibility schemes are now referred to as ‘severance’ schemes in the latest PAR versions and hence all references hereafter will be to severance schemes.

These documents contain all the ‘predicted’ information on the scheme, including, for example, forecast accident savings and impacts on journey times. This review tells us whether or not it will be possible to evaluate the scheme in question. There are certain types of schemes that it would be virtually impossible to accurately evaluate – for example, a scheme which introduces emergency crossovers on a motorway, as the success or otherwise of this scheme would depend on there being incidents on the motorway, which we cannot predict. We are however able to evaluate most types of schemes.

Step 2 – Evaluate schemes and produce Scheme Evaluation Reports

Having determined that an evaluation will be possible, we request supporting data from our area teams / agents. This typically 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 in any assumptions the PAR has made in regard to reducing 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 Government's four WebTAG objectives:

Each of these objectives is split down into a number of sub-objectives. For example, headings under 'society' include accidents, journey quality and security.

When evaluating a scheme, we look at the PAR predicted and the outturn impacts. A comparison of the two tells us how accurate the predictions were. We also visit each scheme to confirm that it has been implemented as intended. This site visit also enables us to judge some scheme impacts that cannot be identified through desk-top study, for example, when trying to determine the level and nature of pedestrian usage.

For each evaluated scheme, an evaluation report is produced, providing an overview of the methodology used and the key findings. The detail of this report varies according to the size of scheme. For the schemes costing in excess of £1m, we produce a longer and more detailed report, reflecting the greater level of investment that has been made.

Step 3 – Produce the Annual Evaluation Report

To complete each year's process, we compile an Annual Evaluation Report, summarising the results of the entire sample of schemes evaluated up to that point in time. This is our 11th Annual Evaluation Report and hence draws upon the results of 11 years' worth of scheme evaluations – now incorporating 756 schemes. The subsequent sections of this report include many different analyses of results using a range of indicators.

Evaluating a scheme – step by step

To illustrate our approach to evaluating a scheme, we now provide a step by step guide setting out the key processes, using case studies of schemes we have evaluated over the last 12 months. This is set out under the following headings, reflecting the five 'core' components of each scheme evaluation:

- Calculating the costs.
- Calculating the safety impact.
- Calculating the journey time impact.
- Considering the 'other' impacts.
- Calculating the value for money.

Calculating the costs

We compare the predicted and outturn costs for each scheme evaluated. Predicted scheme costs are taken directly from the PAR and are compared with the outturn cost provided by our area teams.

We consider the outturn cost as delivered, but also the 'scheme life' cost which covers the costs of introducing the scheme but also the longer term costs for maintenance and replacement over the entire 'life' of the scheme (typically 60 years). This scheme life cost is used in our subsequent calculation of BCR, which tells us the level of value for money achieved by the scheme.

Case Study: How do we calculate the cost for a scheme?

Scheme name: A1(M) Junction 1 Diverge Improvements.

Location: Potters Bar, Hertfordshire (Area 5).

Description: New signage on the A1(M) southbound off-slip to warn of possible queues and the presence of traffic signals.

Opening Date: March 2012 (predicted – July 2012).

PAR Prediction

- Measures expected to cost a total of £164k
- This includes design, preparation, supervision and implementation costs
- Also includes 'optimism bias' - a percentage to take account of uncertainties in the introduction of the scheme

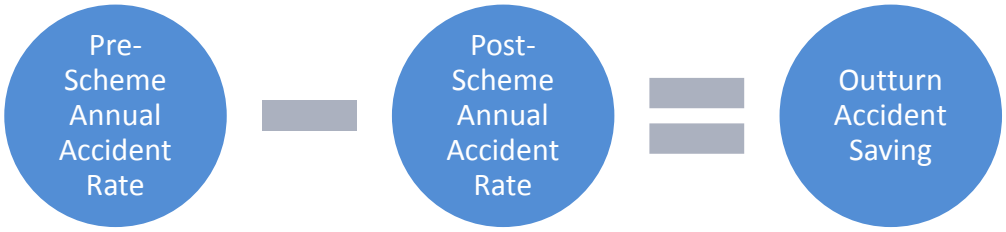
Our 'Outturn' Assessment

- Outturn cost, as provided by the area team, is £142k. A comparison with the prediction of £164k tells us that this scheme has been delivered for a lower than expected cost
- The numbers quoted are directly comparable because our evaluation is based on costs in 2002 prices

Calculating the safety impact

Most safety and economy schemes predict a safety[1] benefit, expressed both as a first year annual accident saving and a scheme life saving.

A comparison of the pre- and post-scheme annual accident rate gives us the scheme's annual accident saving. We require a minimum of three years of pre-scheme data and one year's post-scheme data to make the assessment:



The annual accident saving is monetised using the average value of an accident, taken from PAR guidance. As well as the annual accident saving, we consider information such as accident contributory factors and vehicle movements, allowing us to understand more about a scheme's impact on accidents. The scheme life saving is calculated using 'capitalisation factors', taken from PAR guidance, which allow us to convert an opening year benefit to a benefit which represents the entire scheme life.

Calculating the journey time impact

Whilst most economy schemes predict a benefit to journey times (for example, by reducing queuing on the approach to a junction), some safety schemes predict a dis-benefit, usually through closing a central reserve gap or by reducing the speed limit (both leading to longer journey times for vehicles).

The change in journey times, be it in the form of a benefit or dis-benefit, is measured in vehicle hours across the whole opening year and is monetised using 'Value of Time' figures, taken from PAR guidance, allowing for a direct comparison with accident benefits and scheme costs.

Our current approach to determining a change in journey times is to use satellite navigation (sat-nav) data. This gives us a large sample of journey times (typically thousands) both before and after the scheme from which to understand the impacts.

[1] We use Personal Injury Collision (PIC) data in POPE of LNMS, which refers to accidents where an injury of 'slight', 'serious' or 'fatal' severity was recorded. The accident data referred to in this report has not necessarily been derived from the national validated accident statistics produced by Department for Transport (DfT). As such, the data may subsequently be found to be incomplete or contain inaccuracies. The requirement for up-to date information and site specific data was a consideration in the decision to use non-validated data and, as it is sourced from Local Processing Units through the Managing Agent Contractors or Asset Support Contractors, it is sufficiently robust for use in this context.

Case Study: How do we calculate the safety impact for a scheme?

Scheme name: A595 Scalegill and Linethwaite Junctions Safety Improvements.

Location: Close to Whitehaven, Cumbria (Area 13).

Description: New signing and lining on the approach to a staggered crossroads in order to improve driver awareness.

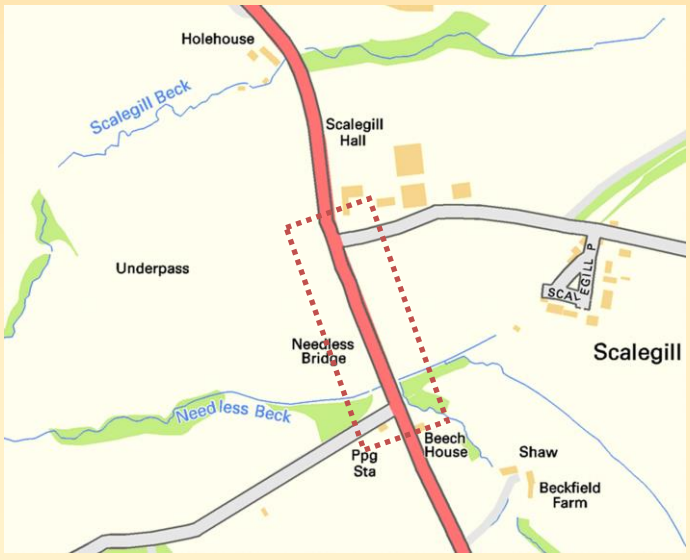
Opening Date: April 2013 (predicted – February 2013).

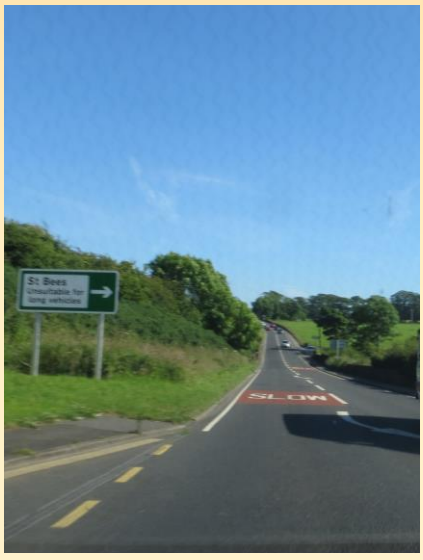
PAR Prediction

- Based on a five year period prior to the scheme (January 2006 - December 2010), annual accident rate was 2.8 (of which 2.4 slight and 0.4 serious)
- Scheme predicted to save 0.96 accidents per annum, delivering benefit of £122k in the opening year

Our 'Outturn' Assessment

- Based on 12 months following completion, annual accident rate has reduced to 2.0 (all slight)
- Scheme has therefore saved 0.8 accidents in the opening year (very slightly lower than forecast), delivering monetary benefit of £102k
- As well as saving accidents, the 'severity index' has been reduced to zero, reflecting the absence of any serious or fatal accidents since scheme completion





Case Study: How do we calculate the journey time impact for a scheme?

Scheme name: A5 / A5195 Ogley Hay Road Signal Improvements.

Location: Burntwood, Staffordshire (Area 9).

Description: Improvements to the traffic signals (including reduced cycle time) following concern that they were functioning sub-optimally, leading to congestion and delays, particularly in the peak periods.

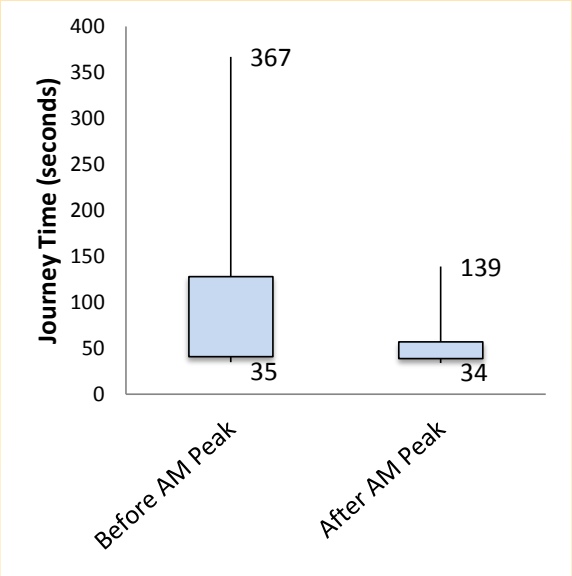
Opening Date: February 2011 (predicted – Q1 2011).

PAR Prediction

- Improvements expected to save 10,600 vehicle hours in the opening year, delivering benefits of £140k or £5.54M over the entire 60 year life of the scheme
- As well as reducing journey times, the PAR predicted a beneficial impact on journey time reliability, both day to day and as a result of there being fewer accidents at the junction

Our 'Outturn' Assessment

- We used sat-nav data covering a variety of time periods pre- and post-scheme. A comparison of the two shows a reduction in congestion, equating to 13,600 vehicle hours in the opening year, giving a monetary benefit of £172k (fairly close to the prediction)
- Reliability was also shown to improve - further details on reliability are provided later in the report



Considering the 'other' impacts

When on site, we make a detailed assessment of the impacts on the remaining economy, environment and society sub-objectives. For example, we need to consider whether the scheme has had an impact on severance, reducing the extent to which the highway forms a barrier in the local community. When on site, we use a detailed checklist (see Appendix A) to guide our assessment and to ensure all individual WebTAG sub-objectives are considered.

Case Study: How do we consider the 'other' impact for a scheme?

Scheme name: A36 Wilton to St Pauls Roundabout Safety Improvements.

Location: Salisbury, Wiltshire (Area 2).

Description: A number of traditional highway improvements, plus better provision for pedestrians, cyclists and users of public transport. This included wider footpaths, safer crossings, use of tactile paving, a larger bus stop and a new advisory cycle lane.

Opening Date: July 2011 (predicted – Q3 2010).

PAR Prediction

- Amongst other impacts, the scheme was forecast to provide a benefit in regard to 'access to the transport system', given improvements to both cycling provision and public transport
- Scheme also expected to have an impact on'severance', given better crossing provision for non-motorised users

Our 'Outturn' Assessment

- The impacts on 'access to the transport system' and 'severance' were assessed in detail during the site visit using the checklist
- This confirmed that the PAR predictions were correct and the benefits to 'access to the transport system' and 'severance' expected have been realised
- The remainder of the evaluation showed the scheme performed very strongly at saving accidents and achieved 'very high' value for money for the HA

Calculating value for money

Finally, our assessment typically culminates with an assessment of value for money. We have two different measures:

First Year Rate of Return (FYRR)	Benefit Cost Ratio (BCR)
• Measures value for money in the scheme's opening year • Calculated by dividing first year benefits by first year costs • Doesn't measure benefits over the whole life of a scheme but is a useful measure of opening year performance	• Measures value for money across the scheme life (typically 60 years) • Calculated by dividing scheme life benefits by scheme life costs • A useful measure of whole life performance, but cannot (practically) be observed so there remains an element of forecasting

In line with wider transport appraisal guidance, we consider any scheme with a BCR exceeding 4.0 as offering 'very high' value for money. Schemes between 2.0 and 4.0 are considered to offer 'high' value for money. Further details are outlined later in the report.

This chapter has provided an overview of the methodology used, but if you require more detail, please request the POPE of LNMS Year 11 Methodology from the HA, using the contact details set out below:

Email: HA_Info@highways.gsi.gov.uk

Telephone: 0300 123 5000

HA Investment in LNMS

Background

We make a considerable investment in improvements across the highway network each year, some of which is through LNMS; the focus of this report.

We previously mentioned that our evaluation process begins each year with obtaining and reviewing PARs from the previous financial year to determine whether an evaluation will be possible. Over the 11 years of POPE, we have processed a total of 2,056 PARs. When reviewing each PAR, we update our own database of information with details of each scheme, including predicted costs and impacts. Interrogation of the database allows us to understand the profile of investment, including change over time and the split by different types of scheme. More detailed information to support this chapter can be found in Appendix C.

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 some of the earlier financial years:

Financial Years - Grouped				
2002-5 (averaged)	2005-8 (averaged)	2008-11 (averaged)	2011/12	2012/13

From this section onwards, we set out the information using a question and answer format.

Investment in LNMS

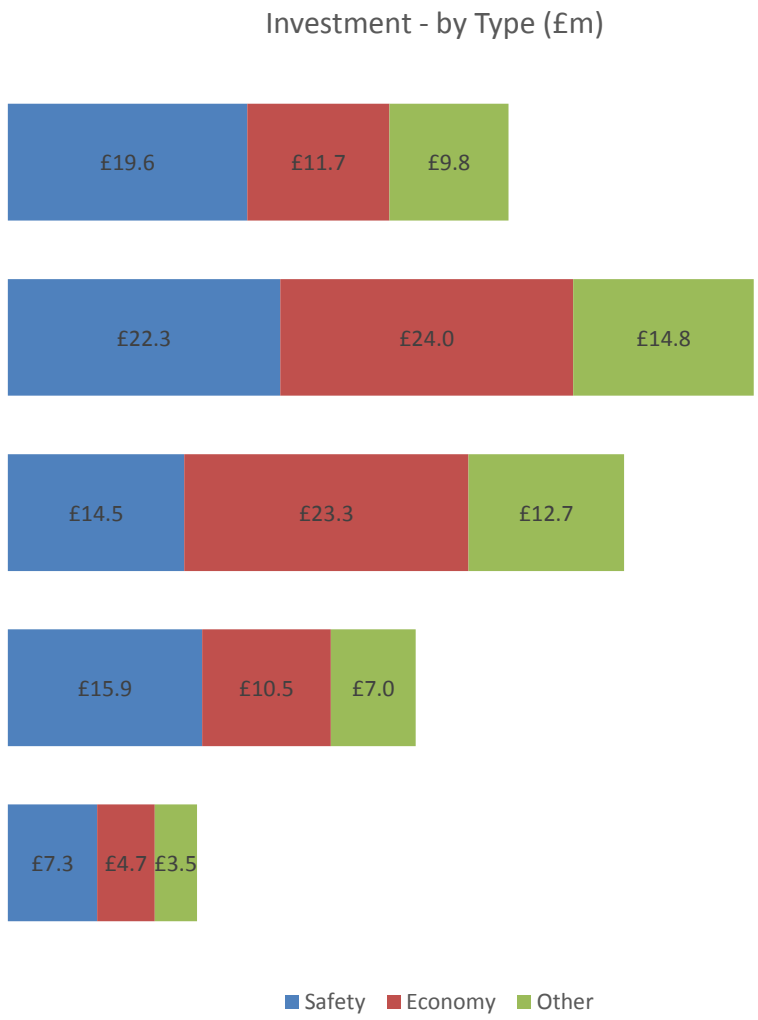
How many LNMS have been implemented and at what cost?

The graphs on the next page show the number of PARs received[2] over the course of the 11 years of the POPE process, and the split into different types of scheme and level of investment (based on total aggregated predicted cost). The sample sizes are shown in brackets on the graph axes. Key points to note are as follows:

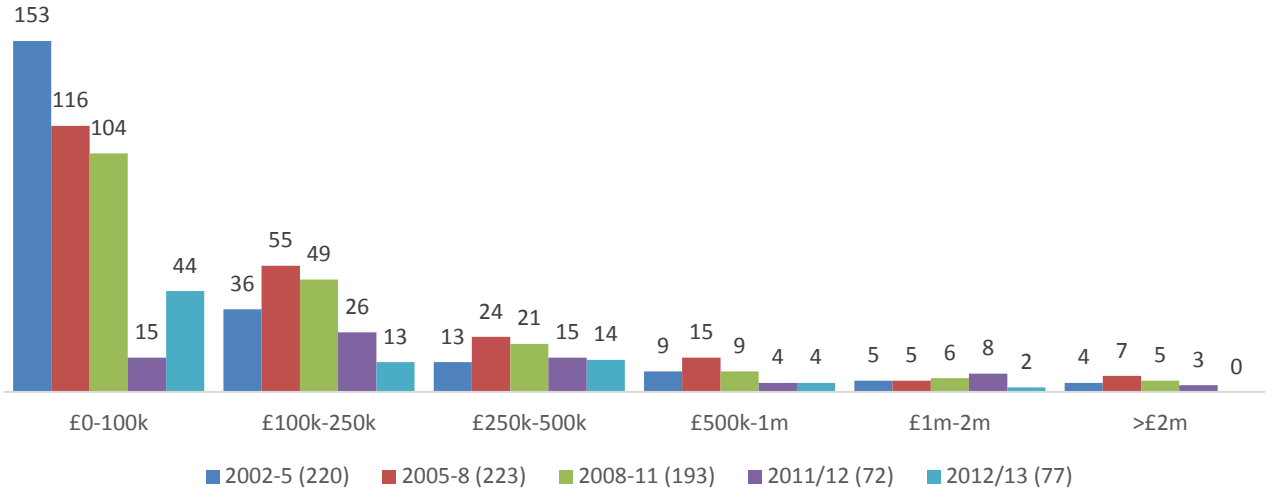
- In terms of total numbers of schemes implemented, it is clear that there was a significant reduction in the last two financial years compared to the previous years. In the first nine years of the commission, we typically had 200 PARs per annum, but in the last two financial years this dropped to approximately 70-80, due mainly to a reduction in Government funding for LNMS with a focus instead on larger schemes which are outside of the LNMS programme.
- 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 congestion. The 'other' category covers a variety of types of scheme, but the more common types are environment and severance.
- The graph to the right shows the proportion of investment for the different types of scheme. It is clear that for economy schemes, the proportion of total investment is larger than the proportion of total number of schemes, which reflects the fact that these schemes generally cost more per scheme than the other types.
- The graph to the right also tells us that the level of investment in the most recent financial year (2012/13) was lower than 2011/12, but the number of schemes has remained similar. This tells us that the most recent batch of schemes cost less on average.

[2] We are aware that although we have processed 2,056 PARs, there are a number which we haven't been provided with by our Area Teams. Hence the figures we quote provide a useful indication of investment but not the complete profile.

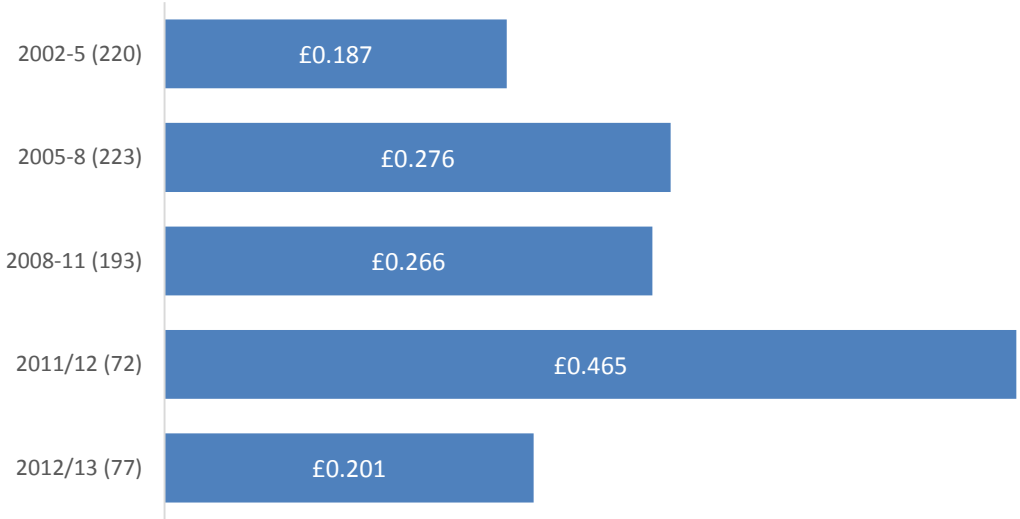

Number of PARs - by Type
2002-5 (220, £41.1)
114
21
84
2005-8 (223, £61.2)
99
45
79
2008-11 (193, £50.5)
75
26
93
2011/12 (72, £33.5)
35
12
25
2012/13 (77, £15.5)
36
10
31
Safety
Economy
Other


Investment - by Type (£m)
£19.6
£11.7
£9.8
£22.3
£24.0
£14.8
£14.5
£23.3
£12.7
£15.9
£10.5
£7.0
£7.3
£4.7
£3.5
Safety
Economy
Other

It is interesting to examine the spread of predicted cost of the 2,056 schemes. In order to understand this profile, we have broken the schemes up into different cost categories (again based on predicted cost), as shown in the graph below. The graph shows 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 the schemes costing up to £250k. There are fewer than 10 schemes in either the £1m-2m or >£2m categories in any given year grouping.



Finally, the graph below shows us how the average investment per scheme (£m) has varied across the 11 years which POPE has been undertaken. This shows us that with the clear exception of 2011/12, there has been a trend in more recent years of declining investment per scheme. The apparent anomaly for 2011/12 can however be partly explained if we look back at the graph above, because that shows us that in 2011/12 there were very few schemes costing less than £100k, hence the average for that year being higher.



How many schemes have been evaluated?

For ease of interpretation, we have grouped the schemes into safety and economy then the other scheme types (most of which are environment and severance schemes).

We can see that of the 2,056 schemes that have been implemented, we have been able to evaluate a total of 756 schemes, the vast majority of which are either safety or economy schemes.

The graphic below shows the common reasons why the remaining schemes have not been evaluated.

Safety & Economy Schemes

689 evaluated

- 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
- For the economy schemes, the availability of observed 'before' journey times was historically a problem, but now we use sat-nav data, this is no longer an issue
- There are various schemes that we can't evaluate as there are no quantifiable impacts - we gave the example earlier of motorway crossover schemes
- 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

Other Schemes

67 evaluated

- Of these 'other' schemes, most are either environment schemes (41) or severance (22)
- Like the safety and economy schemes, there are quite a few that we would never be able to evaluate - for example schemes which treat run-off after there has been a spillage on the carriageway
- Sometimes we have a scheme with measurable impacts, but no 'before' data upon which to base a comparison. This means the POPE evaluation would not be robust ahd hence no evaluation is undertaken

It should be noted that while 689 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 670 schemes.

The results of the 737 schemes (670 safety / economy + 67 other) evaluated across all scheme types are summarised in the next chapters of this report.

Safety & Economy LNMS Results

Introduction

Meta-analysis

One of the fundamental reasons for this Annual Evaluation Report is to identify how the sample of evaluated LNMS has performed and the type and scale of benefits delivered to the public. Each Annual Evaluation Report outlines the achievements of the LNMS programme based on all of the schemes we have evaluated to date.

It is in this section that we consider some of the findings from the 670 safety and economy LNMS evaluated to date and report on what has worked well and less well. These findings include analysis of accident savings, journey time savings, scheme costs and overall value for money. Whilst these benefits are easily quantifiable, we also consider more qualitative impacts such as those on journey quality, severance, and the other WebTAG objectives. This section will be split into:

- Programme Results Summary.
- Findings for this year's evaluated schemes.
- Results by HA area.
- Results by scheme measures.
- Results by scheme cost.
- Other WebTAG results.

We understand that there are many more possible analyses possible using our database 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 monetised).
- First year and scheme life data.
- Cumulative programme level data and average per scheme data.
- All of the above are available disaggregated to scheme year, HA area, scheme measure and scheme cost bands.

Information beyond that included in the appendix is also available by emailing the HA: HA_Info@Highways.gsi.gov.uk

Results without outliers

Whilst we have evaluated 670 LNMS, the aim of some of our analyses is to understand how the typical LNMS is achieving, making our analysis as meaningful as possible. In order to do this, when we disaggregate the results by HA Area, or by scheme measures, we remove outliers from the sample. The process of removing outliers ensures that we are focussing on the performance of schemes normally, rather than being misled by schemes with the most extreme results. The method used for removing outliers is detailed in Appendix B.

LNMS Programme Results Summary

Over the duration of the POPE of LNMS commission, which has been running for 11 years now, 670 LNMS have been evaluated, at a total implementation cost of £229 million. The results of the key metrics show the evaluated LNMS to date have delivered:

1,194

Accidents saved in the observed opening year, with each scheme on average saving 1.8 accidents per annum. These are observed findings which compare the annual accident rate before and after the schemes' opening

3.7m

Vehicle hours saved in the opening year, which equates to an average scheme vehicle hour saving of 5,584 per annum. This has been calculated from our assessment of journey time data from before and after the schemes were implemented

£164m

Is the sum of all first year accident and vehicle hour benefits within the opening year. Each scheme on average has delivered benefits totalling £244,000 in the opening year.

234

Killed or Seriously Injured (KSIs) accidents have been saved in the opening year, with each scheme saving an average of 0.4 KSI accidents.

71%

Of scheme costs recouped in the opening year. The First Year Rate of Return (FYRR) of 71% refers to value for money and means the schemes will on average repay their costs in benefits within 17 months of opening

16.9x

The average scheme will pay for itself nearly 17 times during its life. Clearly the schemes continue to exist beyond the first year after implementation and as such, projections are made for the benefits schemes will bring over their expected lifespan. We call these 'reforecasts' (updated forecasts based on observed opening year results) and the reforecast BCR for the average LNMS is 16.9

Each scheme performs differently and therefore some perform better or worse than the FYRR and BCR reported here, however, the overall findings indicate that the LNMS programme delivers excellent value for money.

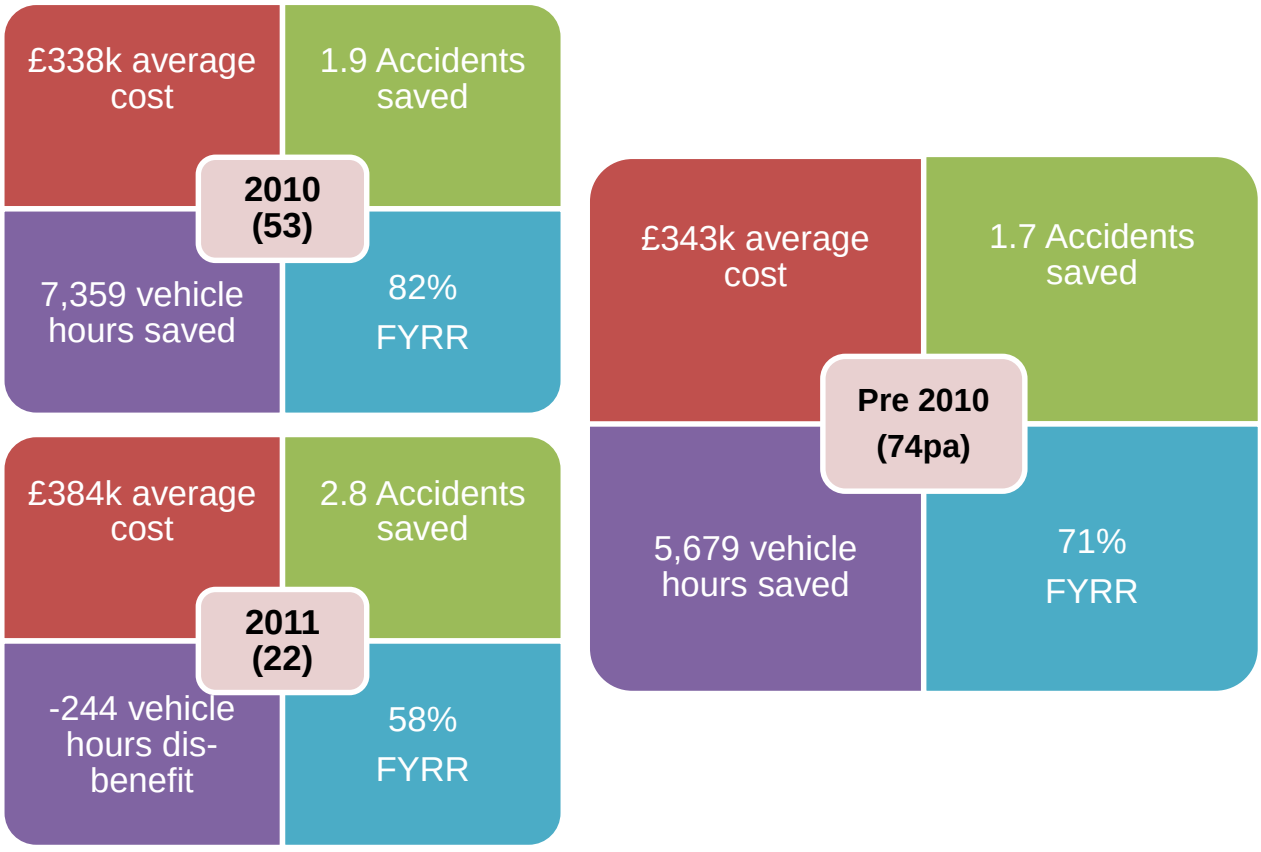
For the remainder of this section, we present the findings in a question and answer format and concentrate on specific analysis and observations of interest. We provide answers for the following questions within this section:

- What have we learnt about the latest schemes?
- How do the results compare between HA Areas?
- What are the results by scheme measure?
- How does scheme cost and overall benefits compare?
- What are the LNMS results for other WebTAG objectives?

What have we learnt about the latest evaluated schemes?

Due to the requirement for at least one year of accident and journey time data following a scheme opening, we have generally evaluated schemes between one and two years after opening. This year we have mainly evaluated LNMS (22 schemes) that opened in the 2011/12 financial year (known as '2011 schemes'), but we have also bolstered up our sample of 2010/11 financial year schemes (referred to as '2010 schemes') by evaluating a further 16 that opened during this period.

Comparison of performance by year and programme



It is interesting to compare the results for the most recently evaluated schemes to the average of LNMS evaluated prior to 2010 to see whether LNMS performance is sustained over time. The opening year performance of 2010 and 2011 schemes against the 'Pre 2010' schemes (2002 – 2009) on four metrics is illustrated above.

The results suggest that the 2010 evaluated schemes are performing well compared to the overall programme pre 2010, with greater than average accidents saved, vehicle hours saved and First Year Rate of Return. If we compare the First Year Rate of Return to each individual year, the results show that the 2010 schemes have been the fourth most successful year to date (for detail see Appendix B).

Whilst we have evaluated fewer 2011 schemes than the typical year (some schemes from this year are still to be evaluated), the emerging results demonstrate that the 2011 schemes saved far greater than the average accidents compared to the pre 2010 programme, but deliver a vehicle hour dis-benefit and lower than average first year rate of return. Of the 2011 evaluated schemes, 24% were economy, which is a higher proportion than the overall programme at 16%. Economy schemes tend to produce the greatest benefits and as such, the vehicle hour dis-benefit is a disappointing result. Looking into the data further shows that the 2011 economy schemes all underperformed.

The average cost of the 2010, 2011 and pre 2010 schemes is fairly similar at £338k-£384k.

How do the results compare between HA areas?

Background

The strategic road network is divided into areas and each one is managed locally. Each area is identified by a number and can be combined with other areas to form a region (see diagram, colours represent regions). For instance, Areas 12 and 14 combine to form the North East region. It is important to evaluate the LNMS by areas to understand how the schemes are performing in different parts of the country. Each area is managed separately and so performance could vary. In addition, each area has its own characteristics and therefore, examining the results by area is valuable.

Evaluation Sample

The type and number of schemes we evaluate in each area[3] vary and whilst we ideally would evaluate a proportionate number of schemes in each area (i.e. a given percentage of each area's schemes), factors such as whether schemes have measurable impacts and data availability prevent some evaluations. As a result, we evaluate as many schemes as we can and the number of evaluations in each area is a representation of this. A summary of the main headline results (average per scheme) by area can be found overleaf.

[3] For the purpose of this annual report, schemes previously within Area 11 have been assigned to either Area 7 or 9 based on the amended area boundaries.

Costs

The average cost of a scheme in each area ranges from £157k to £556k. This wide range can be explained by how many schemes of different cost groups has made it into our evaluated sample in each area. The areas with high average scheme costs implemented a significant proportion of schemes costing more than £1m compared with the areas with lower average scheme costs. For example, Area 5 implemented schemes which on average cost £556k. Of the schemes they have had evaluated, on average 15% cost more than £1m. On the other hand, the average scheme Area 3 has had evaluated in our sample costs £192k and only 2% of their schemes cost more than £1m.

Average cost and benefits by area

Area	1	2	3	4	5	6	7	8	9	10	12	13	14
Number of schemes	19	46	35	48	35	57	57	36	66	47	57	60	68
Average Cost (000's)	£341	£343	£192	£157	£556	£495	£340	£391	£363	£223	£338	£146	£297
Cost Brackets													
<£100k	8	23	18	25	7	36	23	16	29	28	41	34	27
£100k - £250k	8	11	11	17	10	12	21	11	22	10	7	19	21
£250k - £500k	0	6	3	3	7	2	6	3	7	1	0	4	12
£500k - £1m	1	1	2	2	6	1	2	1	4	6	3	2	3
£1m - £2m	0	3	1	1	2	3	3	3	1	2	5	1	2
£2m +	2	2	0	0	3	3	2	2	3	0	1	0	3
Average Accident Saving	-0.1	1.8	1.4	1.5	2.5	1.8	1.5	1.0	1.4	1.6	1.2	1.2	2.1
Average Vehicle Hour Saving (000's)	2444	-3213	-484	502	9508	4750	3804	17840	3714	717	1650	2473	293

Accidents

All of the areas, with the exception of Area 1, achieve an accident saving, demonstrating that on the whole, the LNMS programme is successful overall at reducing accidents across the country. Putting aside Area 1, the average accident saving in the opening year ranges between 1.0 (Area 8) and 2.5 (Area 5). These results overall suggest the programme is successful at improving safety.

Area 1 is the only area to have not produced an accident saving and the results show that there has been a negligible change to the number of accidents. Area 1 has the lowest sample size and if a more substantial number of schemes were evaluated, it is possible that

an accident saving would be achieved. As it happens, around half (10) of the schemes evaluated in Area 1 demonstrate an opening year accident dis-benefit.

Journey Times

We analyse all of the evaluated schemes for changes in the numbers of accidents but only some of the schemes introduce measures that may also impact journey times. These schemes are typically *economy* schemes, aiming to reduce journey times, but can sometimes be *safety* schemes which happen to have associated journey time impacts. One example is speed limit reduction schemes, which aim to reduce accidents by slowing traffic speeds, thus increasing journey times. As a result of these differing priorities between schemes aiming for journey time savings and those introducing a journey time loss for a gain in safety, the average journey time benefits per area must be treated with caution. The results could reflect the type of schemes implemented or the performance of the schemes, or sometimes a combination of the two.

Having said this, the average journey time saving ranges between an increase in vehicle hours of -3,213 (Area 2) and a decrease of 17,840 (Area 8). Looking into the data shows the main cause of the vehicle hour dis-benefit for Area 2 is two speed limit reduction (SLR) schemes which increase vehicle hours by approximately 81,000 and 89,000, however, a journey time dis-benefit was forecast in the PAR.

Similarly, the vehicle hour increase shown for Area 3 is largely influenced by three schemes; two banned turns, each generating around 12,000 extra vehicle hours and one SLR scheme, increasing vehicle hours by 5,500. These schemes were implemented with the intention of improving safety and were forecast to generate vehicle hour increases as a result. These results demonstrate how the performance of one scheme can strongly influence the overall findings when considering vehicle hour savings by area. Vehicle hour increases must be interpreted carefully, as for some schemes they are the intended outcome of the measures installed. In addition to this, the results by area should be considered with caution, as the limited sample sizes for some areas may skew average scheme results.

Opening year value for money

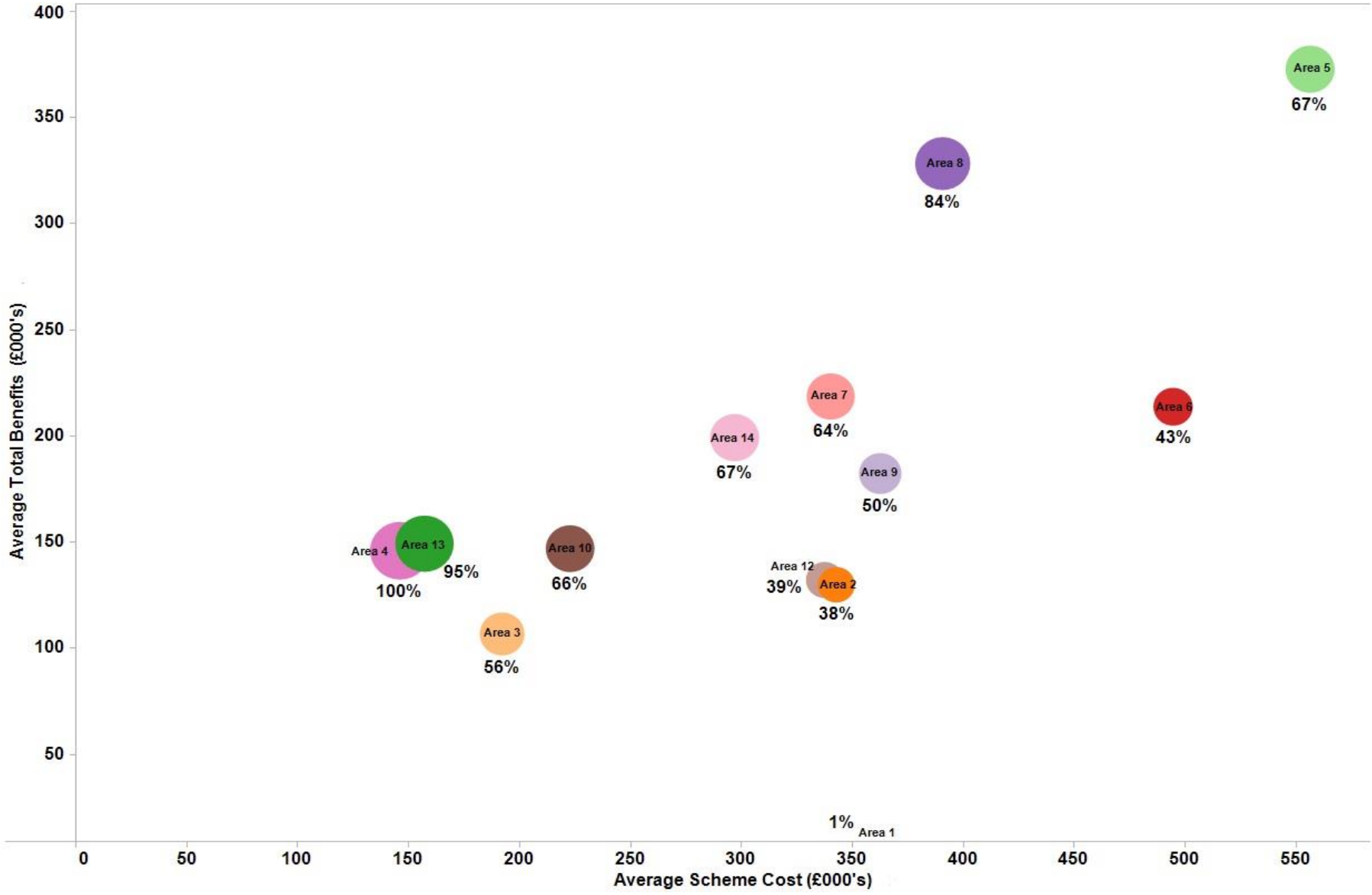
The opening year cost and benefit figures generate the first year rate of return, which identifies the proportion of the scheme's cost returned in benefits in the opening year. It is important to understand whether our approach to investment within the LNMS programme is delivering value for money. To understand how each area is achieving their FYRR, the graph overleaf compares average scheme cost, average benefit achieved and FYRR by area. The size of the circle represents the FYRR and the percentage is also displayed for clarity.

The following can be taken from the graph:

- There is a wide variation in the average cost of a scheme, average benefits of a scheme and FYRR between areas.
- Area 4 and Area 13 achieve the highest FYRR of 100% and 95% respectively, and implementing lower cost schemes (£150k) appears to be key to their success.
- With the exception of Area 1 and Area 5, all other areas achieve a FYRR between 38% and 67%. Individual areas are achieving similar FYRRs, however, the approaches used vary. For example, Area 5 achieves a FYRR of 67% by implementing schemes costing around £550k that deliver £375k of benefits. On the other hand, Area 14 implements schemes that generate £200k of benefits but cost £300k to implement.

- Area 1 is delivering schemes that only just about recoup their costs in benefits.

Value for money by area



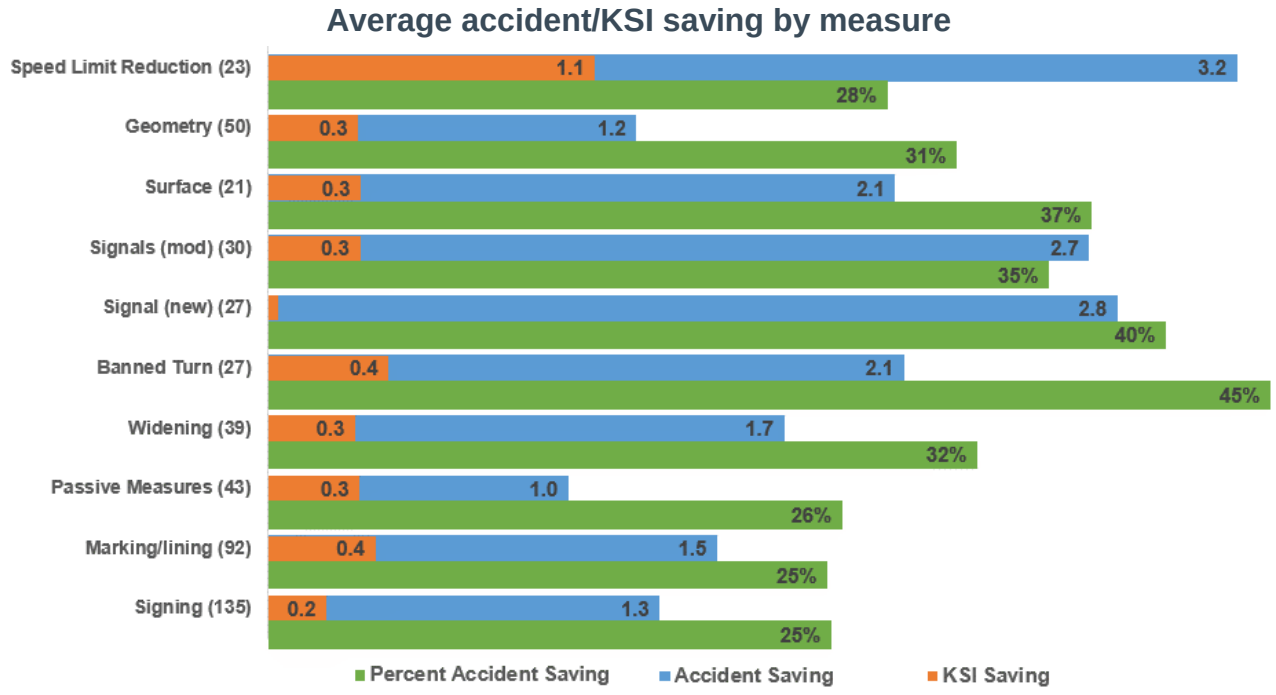
What are the results by scheme measure?

Background

The area teams implement a wide range of different measures to improve journey times and reduce accidents. Measures is the POPE term for the works undertaken in a LNMS, such as lining, signing and marking. Whilst every LNMS is unique, each scheme can be classified based on a small group of commonly implemented measures (see Table C.9 in Appendix C for measure details). In doing this, we can learn something about the cost and effectiveness of the measures.

Accident Savings

The chart below shows the average accident saving, average KSI (killed or seriously injured) saving and percentage accident savings for the most commonly evaluated LNMS measures (those with a sample over 15 LNMS). The accident and KSI figures are absolute numbers, whereas the percentage accident reduction is a proportion of the pre-scheme accident rate. To be clear, the same LNMS may be included within multiple measures as for example, a LNMS may have comprised of two measures.



When we consider the proportion of accidents saved, banned turns and new signals are the most effective, reducing the pre-scheme accident rate by an average of 45% and 40% respectively. Passive measures, marking/lining and signing are the measures which reduce the pre-scheme accident rate by the lowest proportion (25% and 26%).

In terms of KSI savings, the majority of measures deliver a saving of between 0.2 and 0.5, however, SLRs are the most effective at reducing KSIs. On average SLRs are delivering a saving of 1.1 KSIs, three times that of most other measures. SLRs significantly reduce the chance of an accident occurring at a higher speed and this result is therefore expected.

New signals save a higher proportion (40%) of accidents than modified signals (35%). These results are expected as new signals are implemented to address conflicting vehicle movements at a junction and compared to modified signals, they make significant changes to the operation of junctions. On the other hand, modified signals aim to increase the

efficiency of the junction through, for example the installation of MOVA (Microprocessor Optimised Vehicle Actuation), which allocate more green time to traffic movements with the greatest flows.

Aside from the most extreme performing measures, most measures reduce accidents between 1.3 and 1.9 in the opening year, suggesting the majority of measures are successful at reducing accidents.

Journey Times

Some of the evaluated schemes aim to improve journey times for the users, or will have a journey time impact as a result of measures implemented to improve safety. We calculate the journey time savings and annualise them to create a comparable measure of journey time impacts between schemes. We will focus our analysis on just those measures that are likely to drive a change in vehicle hours, whether beneficial or not, providing they have a sample size 15 or above. The table below shows the average vehicle hour saving achieved by these measures.

Average Vehicle Hour Saving by measure

Scheme Measure	Average Vehicle Hour Saving
Signals (mod) (30)	32, 577
Widening (59)	32,358
Signals (new) (27)	3,866
Geometry (50)	4,112
Banned Turns (27)	-2,145
Speed Limit Reduction (SLR) (23)	-19,641

The table shows that widening and modified signals generate the highest vehicle hour saving, with 32,358 and 32,577 vehicle hours saved respectively. Modified signals are more effective than new signals (which save 3,866 vehicle hours) at improving journey times, which possibly indicates how pivotal it is to optimise signal usage or how signals have improved since the LNMS programme started, such as the introduction of MOVA.

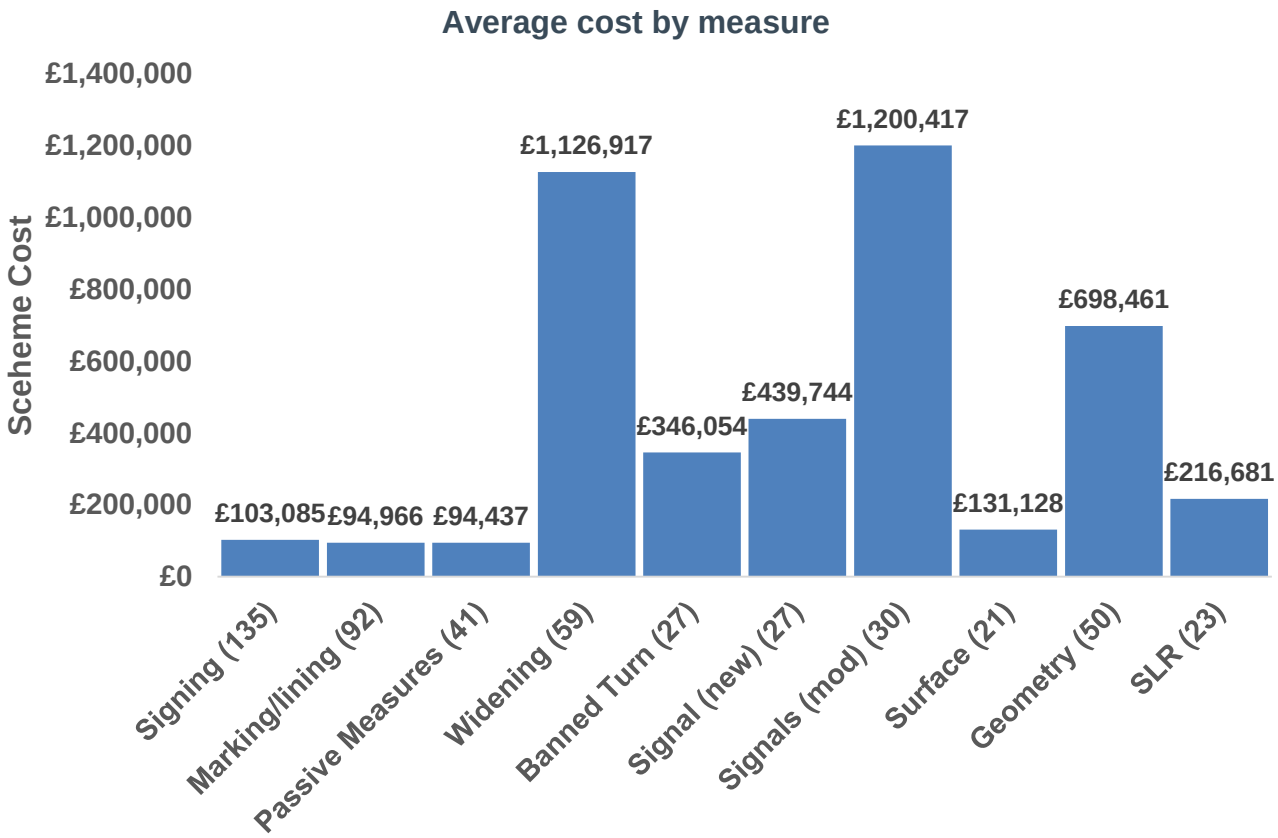
Another possible explanation is that a common conclusion from a new signalisation scheme is that the scheme has been very successful in the peak periods but produced dis-benefits in the non-peak periods. This tends to mean that signal schemes often produce muted results, where the big benefits in some periods are masked by the inefficiencies in others. This contrasts significantly with modified signal schemes. At these schemes, the signals are already in place, so any inefficiencies are included in the before period. The modifications look to balance green time more effectively, and so these schemes tend to lead to benefits in all time periods. This theory is perhaps supported by the fact that 4 of the 30 (13%) modified signal schemes generated a vehicle hour increase, averaging 10,624 per scheme, whereas 9 of the 27 (33%) new signal schemes delivered a vehicle hour increase, averaging 24,412 per scheme. Schemes are more likely to be negative when introducing rather than modifying signals.

Widening schemes produce strong vehicle hour savings as they aim to increase capacity to relieve congestion, thus improving the efficiency of junctions. These results follow expectations and demonstrate widening and signalling measures are successful in achieving their aims.

SLRs and banned turns increase journey times. SLRs on average introduce an additional 19,641 vehicle hours as a result of lower speed limits, however, as previously demonstrated, they produce the second highest accident saving (3.1 annual accident saving) and highest KSI saving (1.0 KSIs). Banned turns also increase journey times (additional 2,145 vehicle hours on average) as motorists are required to reroute, but the measure produces large accident savings compared to other measures. We therefore need to decide whether we accept the journey time dis-benefits associated with these schemes when considering whether to implement these schemes in the future. The key question is whether the accident savings achieved provide sufficient reason to introduce such journey time dis-benefits.

Cost of Measures

The chart below presents the average cost of a LNMS that include the most commonly evaluated measures.



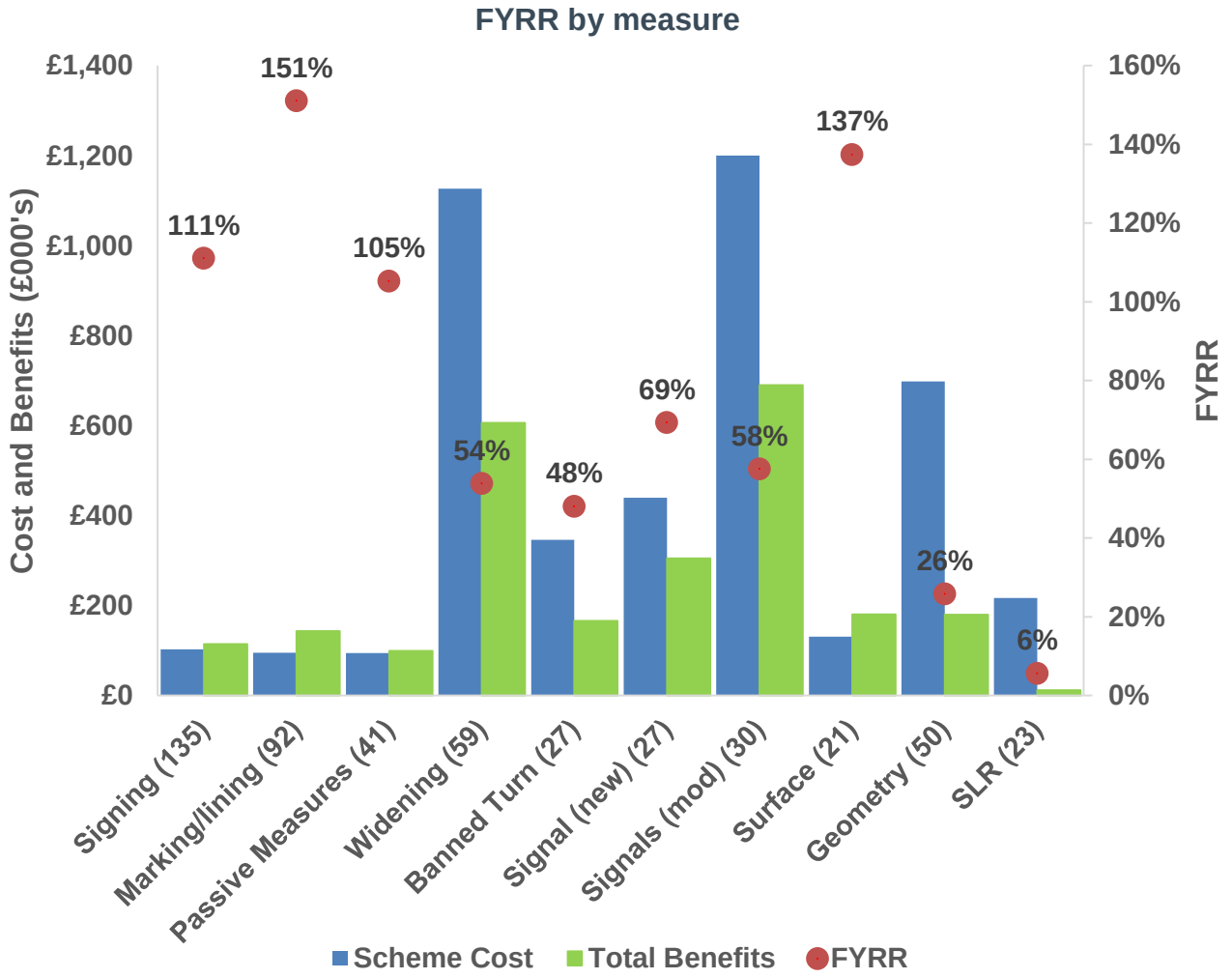
The chart shows that there is a wide difference between the average costs of measures. At the high end, modified signals and widening measures are the most expensive costing on average £1.2m and £1.1m respectively. The modification of signals is a measure which is likely to be implemented alongside other expensive measures such as widening in response to current signalised junctions that are straining due to running over capacity. On the other hand, new signals require expensive technology but this measure is likely to be implemented in isolation as the intervention to assist a junction with capacity issues. Widening and geometric measures are likely to be one of the most expensive as they require physical

change to the road layout and involve potential costs of purchasing land outside of the highway boundary to allow construction.

At the low end, four of the measures listed are all delivered for similar costs. Signing, passive measures, marking/lining and surfacing all cost between £90k and £120k. These measures are typically implemented within the existing highway boundary and involve upgrading existing standards rather than the implementation of a completely new scheme.

Opening year value for money

The chart below shows the average total benefits, average cost of each measure and the FYRR generated. The main finding from the results is that measures costing less than £170k are the only to deliver the FYRRs of over 100%; benefits outweighing their scheme cost.



In terms of individual measures; signing, marking and lining, passive measures and surfacing have low average costs and deliver a FYRR between 105% and 151%.

Widening and modified signals deliver similar FYRR (54% and 58% respectively) and these measures deliver the most vehicle hour savings and one of the highest accident saving (modified signals), but their opening year benefits are not enough to outweigh the large costs of the measures.

Banned turns and geometric measures have average costs of £346k and £698 respectively. They both generate reasonable accident savings (1.2 and 2.1) but banned turns generate a journey time dis-benefit of -2,145 vehicle hours and geometric measures produce a very

small vehicle hour saving of 4,112. These journey time results are not enough to boost the accident benefits and offset the cost of implementing the measures.

SLRs produce the lowest FYRR (6%) which is caused by the journey time dis-benefit counteracting the accident saving, creating a very small monetised benefit overall. Although, if we consider banned turns and SLRs, a journey time dis-benefit is also a measure that the scheme is having its desired effect as they aim to reduce speeds or force an alternate route in order to improve safety.

How does scheme cost affect the benefits delivered?

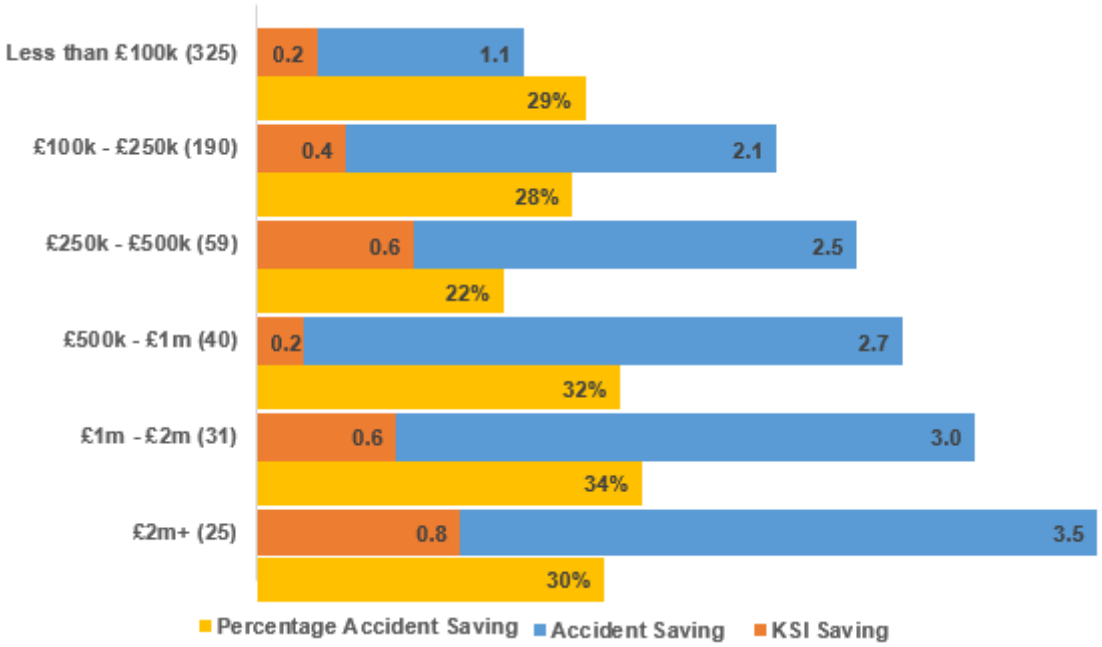
Background

This year we have categorised schemes based on cost to produce six cost bands, each containing a representative number of schemes. By doing this, we can compare the cost of a scheme to its benefits produced to see if there is a relationship between scheme cost and scheme performance.

Accident Saving

The chart below shows the average accident saving, average KSI (killed or seriously injured) saving and percentage accident savings by scheme cost.

Average accident/KSI saving by scheme cost



The results show that at least one accident is saved on average for all cost bands and the saving increases with scheme cost. This increases from 1.1 for schemes costing less than £100k to 3.5 for schemes costing more than £2m. By considering the percentage accident reduction (based on the pre-scheme accident rate), we can see that overall percentage accident reduction is within a narrow range (between 22% and 34%). It appears percentage

reduction remains relatively static between cost bands whereas absolute reduction increases with cost. This may be due to higher cost schemes influencing a larger accident area and thus having a greater impact, albeit the same percentage. Whilst the relationship between scheme cost and KSI saving is less clear, the results show that KSI saving decreases with scheme cost. SLRs have been shown to deliver the highest KSI saving and by looking at the data in further detail, half of the LNMS implementing SLRs cost less than £100k.

Journey Time Saving

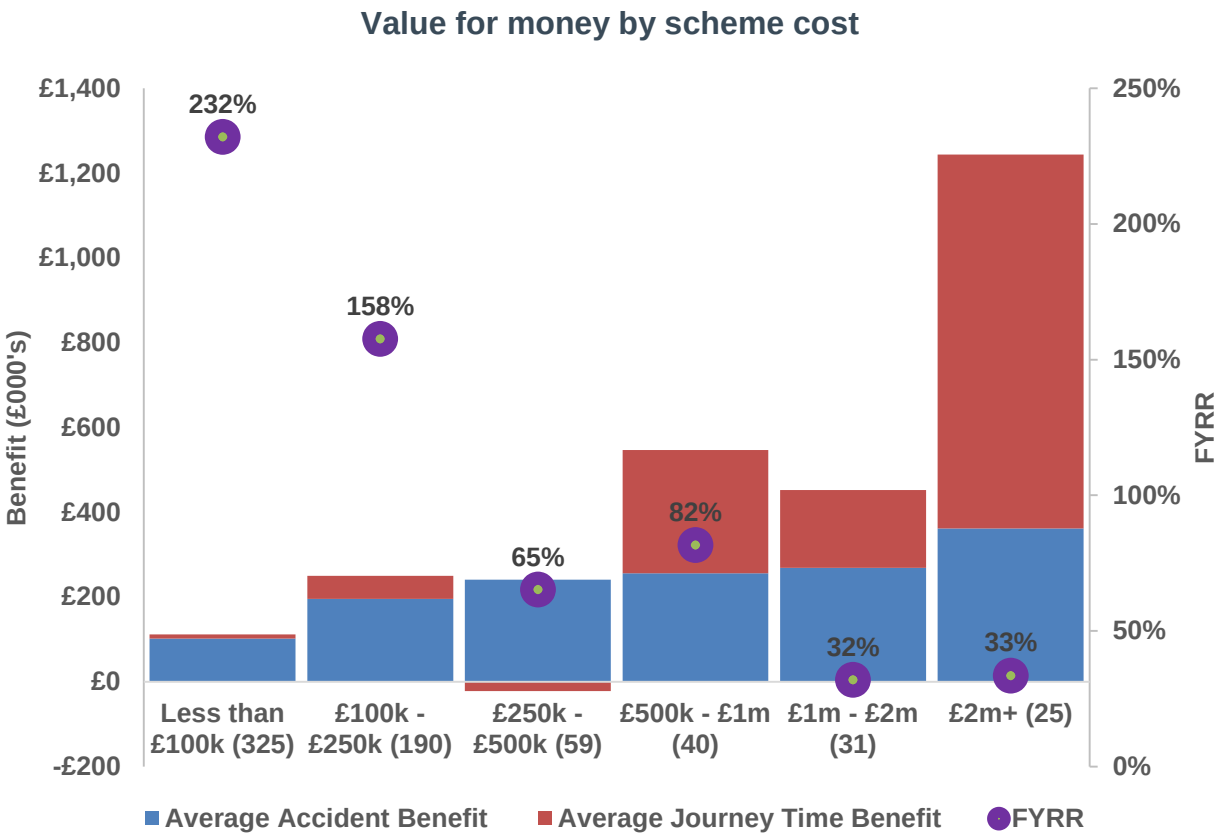
We have also evaluated the change in vehicle hour savings by scheme cost bands, which is shown in the table below. The results suggest that large journey time benefits are only achieved by schemes costing more than £500k. These results correspond with our previous evaluation of average measure costs, which demonstrated that measures with a vehicle hour impact cost the most, between £334k (banned turns) and £1.16M (modified signals). The vehicle hour saving results by scheme cost are therefore in line with expectations, with the most expensive schemes delivering the highest average vehicle saving. Finally, it appears that there are very few journey time hours to be saved with low cost schemes, most likely due to the measures tending to not have an impact on journey times.

Average vehicle hour saving by scheme cost

Scheme Cost	Average Vehicle Hour Saving
Less than £100k	846
£100k - £250k	4,330
£250k - £500k	-1,246
£500k - £1m	22,696
£1m - £2m	13,362
£2m +	56,015

Value for money

The chart overleaf shows the average accident and journey time benefits for each cost band, along with the corresponding FYRR.



The results suggest that FYRR generally reduces with increased scheme cost and overall benefits increase with scheme cost. Schemes costing below £100k or £100k - £250k generate the overall lowest average benefits out of the cost categories, but produce the highest FYRR. Schemes costing more than £2m generate large first year benefits in comparison to other cost categories, but deliver a low FYRR (33%). These results are not surprising as it is unlikely that such high costs could be recouped in benefits within the opening year, however, the table below demonstrates that over their scheme life, schemes costing more than £1m generate benefits that outweigh their cost and achieve an average BCR of 12.2 and 13.5.

Average Benefit Cost Ratio (BCR) by scheme cost

Scheme Cost	BCR over scheme life
Less than £100k	34.0
£100k - £250k	21.3
£250k - £500k	9.9
£500k - £1m	10.1
£1m - £2m	12.2
£2m +	13.5

What are the LNMS results for the other WebTAG objectives?

Background

In addition to journey time (TEE) and accident benefits, all schemes within the LNMS programme are assessed against a wide range of other objectives covering Environment, Society and Economy, known as WebTAG objectives. Each objective consists of a number of sub-objectives that are scored as either adverse, neutral[4] or beneficial within the PAR Appraisal Summary Table (AST). During the one year after evaluation, we produce an Evaluation Summary Table (EST) which assesses the sub-objectives again based on first year results and observations. We have found that the AST tends to be accurate for the majority of objectives. This section considers the impacts found at one year after against Environment, Society and Economy sub-objectives.

The majority of sub-objectives included within the latest PAR version (PAR 6) are the same or similar to those in the previous version (PAR 5), however, some new sub-objectives have been introduced to PAR 6. To allow assessment, the PAR 6 sub-objectives that are similar to PAR 5 sub-objectives have been merged. The PAR 6 sub-objectives that could not be appropriately matched with PAR 5 sub-objectives have remained separate.

Adverse objectives

In general, the majority of sub-objectives considered in the table overleaf are beneficial more often than adverse. However, there are 206 adverse scores and some of these will have arisen from balancing objectives against one another. For example, a scheme may knowingly create an adverse impact for one sub-objective if the perceived benefits to the other sub-objectives outweigh this adverse impact.

A good example of this is gantry signing, which evidently has an adverse impact on landscape by introducing a significant new structure to the skyline. Despite this, the benefits of installing gantry signs is that drivers can read the road ahead, which may save accidents or journey times. In such cases, these benefits may outweigh the adverse impact on the landscape, because the beneficial impacts are considered more desirable than preventing the adverse impact on landscape.

On the other hand, some of these adverse impacts are the results of a scheme having unexpected or undesirable effects that were not forecast or considered during appraisal. The two objectives most likely to be scored adverse are journey ambience and landscape. The remaining objectives are rarely scored as adverse.

Landscape is scored adverse 64 times, over 4 times more often than it is scored beneficial. The vast majority of these scores are due to the balancing of impacts discussed above. Landscape has the second highest number of changes for impact scores, with 24 schemes having a landscape impact worse than expected, and 19, better than expected.

Journey ambience is scored adverse on 99 occasions, although it is much more often scored beneficial. These adverse scores tend to be a result of unforeseen circumstances where the

[4] There has also been the option to not assess a sub-objective in recent PAR versions where it is considered unlikely that the scheme would have any impact or where data has been unavailable to assess sub-objectives. For the purpose of this report and to allow meta-analysis across multiple years, these instances are grouped with neutral scores.

scheme has either had a worse post-scheme accident rate or has added to driver stress through confusion, or less reliable or longer journey times.

Beneficial objectives

Journey ambience is the objective most often scored beneficial, occurring 407 times. There is a close relationship between journey ambience, safety, reliability and journey times. For example, if the scheme makes a route more reliable or quicker to navigate, this will reduce driver stress, and hence benefit journey ambience.

Other successful objectives are severance (57), other government policies (25) and physical fitness (25). These results demonstrate that whilst schemes have a focus on delivering safety or journey time benefits, they also deliver neutral or beneficial impacts on wider objectives.

LNMS have tried to encourage sustainable travel modes (i.e. non-car travel) by incorporating footpaths, cycle paths, crossings and improving access to the public transport network. It appears that from the 25 beneficial scores, achieving this ambition is in progress.

Outturn WebTAG Objective Scores

Objective	Criteria	Predicted Score			Outturn Score			Accuracy Proportion
		Adverse	Neutral/ Not Assessed	Benefit	Impact Worse than Expected	Impact as expected	Impact Better than Expected	
Economy	Regeneration	0	8	0	0	8	0	100%
	Journey Quality	1	3	11	0	14	1	93%
	Wider Impacts	0	8	0	0	8	0	100%
Environment	Noise	2	577	13	9	576	7	97%
	Local Air Quality	3	585	10	8	584	6	98%
	Greenhouse gases	5	560	3	2	562	4	99%
	Landscape	64	519	16	24	556	19	93%
	Townscape	4	559	5	3	562	3	99%
	Heritage	11	582	4	3	585	9	98%
	Biodiversity	7	588	3	8	582	8	97%
	Water	1	555	4	1	557	2	99%
Society	Security	0	42	3	1	44	0	98%
	Physical Fitness	0	550	25	2	562	11	98%
	Access to transport system	2	254	10	2	262	2	98%
	Affordability	1	7	0	0	8	0	100%
	Severance	2	540	57	7	583	9	97%
	Option Values	0	567	1	0	567	1	100%
Previous PARs	Wider Economic Impacts	1	26	3	0	30	0	100%
	Journey Ambience	99	54	407	126	326	108	58%
	Transport Interchange	0	553	7	4	556	0	99%
	Land Use Policy	1	546	13	1	555	4	99%
	Other Government Policies	2	533	25	4	544	12	97%
	Pedestrians and Others	0	55	8	0	62	1	98%

WebTAG sub-objective accuracy

The majority of sub-objectives have required very few changes from the AST to the EST, with accuracy on the whole between 97% and 100%, in that we agree with the AST score. Only journey ambience and landscape have required significant changes over the 670 LNMS evaluated to date, with scorings accurate in 56% and 93% of schemes respectively.

Journey ambience has been rescored 234 times, 108 times to make the score worse and 126 times to make the score better. Historical guidance reported that a close link exists between journey ambience, accidents, journey times and reliability, and on this basis in the past it has been inevitable that journey ambience will require adjusting frequently. In more recent PARs, this relationship has changed due to the introduction of the sub-objective journey quality. The sub-objective comprises of 7 sub-factors[5] and each sub-factor is scored separately and then aggregated to form an overall score for journey quality. As a result, in future years the link between journey ambience and other sub-objectives will be much weaker.

The landscape sub-objective has been amended to beneficial (24) more times than adverse (19). As landscape has been more often scored negative than beneficial shows that overall there is an honest approach to highlighting the downsides of schemes where appropriate.

Summary

This section has considered the performance of LNMS by area, scheme measure and scheme cost as well, as looking at the results for other WebTAG objectives. Some key trends have emerged from these analyses.

- Overall the LNMS programme is delivering good value for money and on average each scheme is paid for in benefits within 17 months.
- Areas achieving the highest FYRR implement schemes costing £100k - £200k.
- The majority of measures achieve an accident saving between 1.2 and 1.9, but speed limit reduction schemes are the most successful at reducing accidents and KSIs. They also deliver the greatest increase in vehicle hour savings, and this also demonstrates the measure is successful.
- Measures costing less than £170k are the only measures to deliver benefits in the first opening year which outweigh their scheme cost.
- Accident savings and vehicle hour savings increase with scheme cost, whilst FYRR decreases with scheme cost.
- The majority of the other WebTAG sub-objectives required very few changes from the AST to the EST suggesting they have been accurately appraised, however, journey ambience and landscape require significant changes.

[5] Journey quality consists of the following seven sub-factors: Traveller Care (Cleanliness, Facilities, Information and Environment), Traveller's views and Traveller Stress (Frustration, Fear of potential accidents and Route Uncertainty).

Appraisal Accuracy

Introduction

This section examines the accuracy of scheme forecasts to see whether they are delivering anticipated results either at a scheme or programme level. This is done by comparing our results to those forecast in the PAR. PARs are completed for all schemes to outline their cost and benefit forecasts and this can be used to calculate metrics of value for money. This evidence is used to determine whether a scheme is introduced or not.

It is therefore important that we assess how accurate the forecasts were as this could have changed the investment decision. All comparisons within this section are between the PAR forecast and outturn result.

We consider how accurate the forecast of accident benefits, journey time benefits and costs are at both a programme level and at a scheme-by-scheme level. The analysis at programme level will allow us to consider whether there is a systematic bias within the appraisal and whether LNMS are generally delivering expected results. By analysing on a scheme basis, we can understand whether each individual scheme is accurately appraised and explore the reasons why accuracy may be different between schemes. In addition, this year we include a new approach to analysis and consider how the accuracy of forecasts changes with scheme cost by using the same cost bands introduced in the previous section.

This section of the report follows a question and answer format, exploring the answers to the following questions:

- How accurate are the forecasts for the LNMS programme?
- How did the schemes without a forecast impact perform?
- How accurate are the forecasts for individual schemes?

How accurate are the forecasts for the LNMS programme?

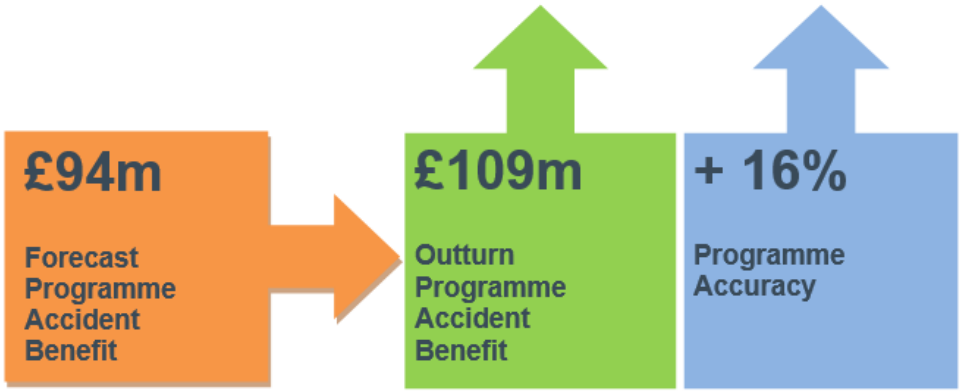
Evaluation

In this section, we consider the accuracy of predicted and outturn costs, accident and journey time impacts in the first year of opening for the LNMS evaluated. For instance, if the PAR for a scheme forecast an accident benefit of £80,000, but delivered only £60,000 of accident benefits, then we document this as -25%, meaning that the outturn result is 25% lower than forecast. The results will suggest whether investment decisions are being made based on accurately predicted impacts.

First, we will consider the accuracy of only the schemes that have forecast a cost, accident or journey time impact in the PAR against the outturn calculated values. Note that for schemes that did not forecast an impact but were found during evaluation to have had an impact, it is not informative to consider their accuracy. In these cases, the decision to not assess the impact in the first place was the error, rather than a forecasting miscalculation.

Accident accuracy

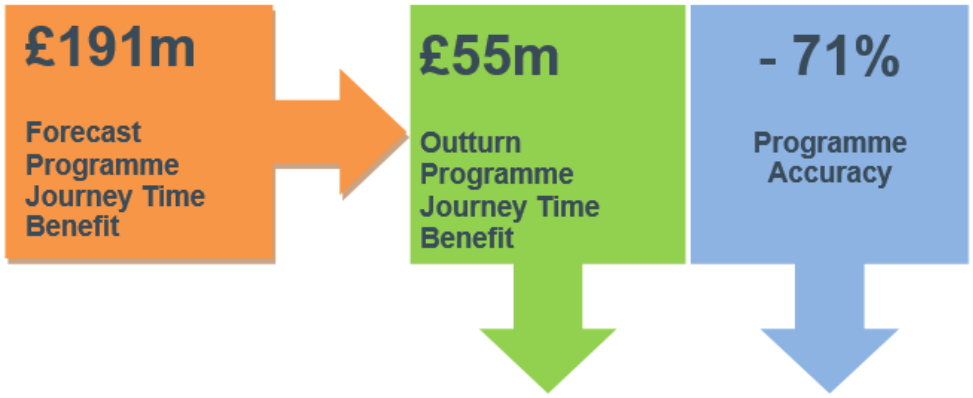
Of the 670 LNMS evaluated, 658 had forecast accident impacts and we have been able to consider the accuracy of these forecasts. The results show that across the LNMS programme, the outturn accident impacts have been under predicted by 16% (£15m), meaning outturn accident benefits are higher than forecast in the PARs.



The result is positive in as much as it demonstrates that the LNMS programme is overall surpassing its predicted accident benefits. On the other hand, based on predicted accident savings, it is possible that viable schemes which would benefit the public are not being approved for implementation, as benefits are not being fully realised during appraisal.

Journey time accuracy

161 of the LNMS evaluated have forecast journey time impacts and so we have assessed the accuracy of only these forecasts. This is demonstrated in the graphic overleaf. It shows that, across the LNMS programme, the outturn journey time benefits have been over predicted by 71%, meaning the outturn journey time benefits are £136m lower than predicted in the PARs.



Of the 161 LNMS considered in this analysis, 58 schemes achieved journey time savings greater than predicted, totalling an additional £27m worth of benefits. The remaining schemes delivered journey times savings worse than predicted, equating to £163m of unrealised journey time benefits. This means that two-thirds of schemes with forecast journey time benefits are set too high, and points towards a potential issue with the process of forecasting journey time benefits. It must be noted that one scheme delivers a journey time benefit £84m lower than forecast. The PAR for this scheme predicted journey time savings in the wrong units (in seconds rather minutes), leading to a large over prediction.

What happened to the missing forecast benefits? Are they related to scheme cost?

Focusing in on these two thirds of schemes that delivered worse than forecast journey time impacts, it is worth looking for patterns within this sample.

If we consider journey time predictions by scheme cost bands (see table below), the *number* of schemes delivering lower than forecast journey time benefits in each cost band is roughly the same (12-22 schemes in each band). The *monetised* under prediction however, is much higher for lower cost schemes than higher cost schemes. £94.4m of the £163m of forecast benefits that do not materialise are from those 19 schemes that cost less than £100k to implement (average of £5.0m per scheme). Improving the accuracy of predictions for these schemes alone would reduce the scale of the over prediction by 70%. As shown earlier in the report, it is rare for less than £100k schemes to impact journey times, and so this needs to be reflected in forecasts in future PARs.

Average under prediction by scheme cost

Scheme Cost	No. schemes predicted a JT impact	No. schemes where outturn JT was less than forecast	Total under prediction from these schemes	Average per scheme
Less than £100k	35	19	£94.4m	£5.0m
£100k - £250k	37	22	£11.4m	£0.5m
£250k - £500k	19	13	£5.1m	£0.4m
£500k - £1m	23	17	£6.3m	£0.3m
£1m - £2m	25	19	£35.4m	£1.9m
£2m +	21	12	£10.5m	£0.9m

Cost accuracy

Forecasting the scheme cost is an essential part of the business case for a scheme. This section considers the accuracy of scheme costs across the LNMS programme for the 670 schemes evaluated. The PARs predicted a total cost of £239m and the actual spend was £229m. This means that the cost of the evaluated LNMS programme is just 4% lower than expected. While there are individual scheme inaccuracies, overall the LNMS programme is close to delivering the expected results. One of the reasons for this overestimation of costs could be the use of optimism bias when forecasting the scheme's value for money.

Summary

The results demonstrate that costs are the most accurately appraised aspect of the financial forecasts within PAR, followed by safety benefits. Finally, journey time benefits are showing to be the most difficult to appraise accurately. These results are generally in line with expectations. Costs are to a degree, controllable as they can be reviewed or stopped if spending diverges from predictions. Whereas, benefits are generated once the scheme is in place and are the outcome of users interfacing with the scheme, and they cannot be intercepted or controlled if they are not in line with forecasts.

Journey time forecasts are significantly over predicted suggesting that the approach for appraising journey time impacts needs amending to deliver forecasts with a higher level of accuracy. This is particularly an issue with the schemes that cost <£100k, which we have shown to be responsible for the majority of the programme inaccuracy. This may occur because schemes that cost <£100k are not subject to the same level of technical scrutiny that higher value schemes are. In the future, low cost schemes should have a forecast made, be it either no or only very small vehicle hour impacts, which falls in line with the findings presented earlier in the results section of this report. Lastly, while accident outturn benefits are higher than forecasts, there is scope to also improve the approach for assessing accident benefits.

How did the schemes without forecast impacts perform?

Evaluation

Having examined the accuracy of the schemes with forecast impacts, this section considers whether forecasts for journey times and accidents should have been made for the schemes with no forecast. There are 3 potential outcomes here, outlined as:

- No impact predicted and no impact found in evaluation
- No impact predicted and dis-benefit found in evaluation
- No impact predicted and benefit found in evaluation

The first option is what we would hope to observe, as the decision not to assess is proven correct. The other two options demonstrate inaccuracy in the appraisal, and this is what we want to analyse in this question. The key issue is whether there is a bias as to whether the incorrectly appraised impacts tend to result in benefits or dis-benefits.

The table below shows a summary of the results, demonstrating that a total of 38 schemes had no accident impact forecast and 509 schemes had no journey time impact forecast. 16 of the accident zero forecasts were correct, and 488 of the journey time zero forecasts were correct. The remainder of this analysis concentrates on the 22 occasions that accidents were incorrectly forecast as no impact and the 21 occasions that journey times were incorrectly forecast as no impact.

Results of schemes without forecast impacts

	Accidents	Journey Times
No impact predicted	38	509
Of which:		
No impacts observed	16	488
Benefits observed	16	5
Dis-benefits observed	6	16

Accuracy

Of the 22 schemes where no accident impact was forecast but the evaluation proved there was an impact, 73% have an accident benefit and the remaining 27% have an accident dis-benefit. The trend is the opposite regarding journey time impacts, with the majority of schemes which had no forecast impact actually showing an observed dis-benefit in the evaluation. This implies there is pessimism around accident forecasts and optimism around journey time forecasts.

By considering the data in more detail, of the 16 schemes delivering an outturn journey time dis-benefit, 14 are safety schemes which all include a speed limit reduction. It is therefore

strongly recommended that PAR authors are encouraged to document the dis-benefits to journey times associated with speed limit reduction schemes during appraisal.

The 22 schemes without accident impact forecasts comprise mainly of economy schemes. These results suggest that the primary aim of a scheme (safety or economy) can lead to some impacts being overlooked. For example safety schemes (for example speed limit reductions) have a tendency to ignore the potential journey time impacts, and economy schemes (such as junction capacity improvements) have a tendency to ignore their potential safety impacts.

It is therefore recommended that forecasts should be provided for both accident and journey time impacts where the scheme measures implemented have the potential to cause impacts, as these results have implications for the LNMS programme outturn benefits and overall value for money.

How accurate are the forecasts for individual schemes?

Scheme accuracy

While the previous section considered the accuracy of the total costs and impacts across the programme as a whole, it is also important to consider the accuracy at a scheme level to understand whether each individual scheme is accurately appraised and why accuracy might be different between schemes. The cost accuracy of all schemes is considered in this section but for the journey time and accident accuracy assessment, only schemes with forecast impacts in their PARs have been included.

The table below presents the proportion of schemes within 25% and 50% of their forecasts. The results displayed are a proportion of the total number of schemes that forecast an impact on accidents and journey times.

Individual Scheme Impact Accuracy

	Accidents	Journey Times	Cost
Within +/-25% of forecast	13%	23%	58%
Within +/-50% of forecast	26%	32%	86%

In terms of individual scheme accuracy, the results show that at an individual scheme level benefit accuracy is poor. Only 13% of LNMS evaluated are within 25% of the forecast accident benefit and 23% within the forecast journey time benefit. If we consider outturn results within 50% of forecasts, only 26% of schemes are within 50% of the forecast accident benefit. This increase is higher than the journey time benefits, with 32% of forecast journey time benefits within 50% of the forecast, although this is still better than the accident benefit accuracy.

The use of accident data for the first year after opening only could be one possible cause for the lower accuracy of accident forecasts compared to journey time forecasts. If accident numbers are considered over a number of years, any skewing in the data caused by the random nature of accidents are less likely to be reflected in the average number of accidents

per annum. On the other hand, journey times are unlikely to vary from the first year after opening as they are more uniform that accidents. Another possible reason for the accident inaccuracy could be due to PARs forecasting an opening year accident saving of less than one, which is explained further in the case study overleaf.

Case Study - *Why does undertaking OYA evaluation mean some forecasts are inaccurate?*

- Some PARs predict an opening year decimal accident saving (e.g. 0.5) rather than a whole number (e.g. 1.0).
- For schemes with decimal forecast accident savings, it is impossible for them to achieve their forecast in the opening year. For example, if a PAR forecasts a scheme will save 0.5 accidents in its opening year, the scheme cannot save a fraction of an accident (e.g. 0.5) within one year, it can only save at least 1 accident or no accidents. Due to this, the difference between the outturn accident saving and forecast will always be at least 100%.
- An annual accident saving of 0.5 could only be achieved by saving 1 accident during the first two years after opening.

Cost accuracy for individual schemes is more encouraging than benefit forecasts, with 58% of schemes within 25% of the forecast, and 86% within 50% of the forecast. Overall, the combined results are representative of the factors discussed previously, with costs easier to control and manage compared to benefits. The forecast for journey time and accident benefits are not accurate, but it seems that journey times are slightly easier to forecast than accidents.

Summary

This section has examined the accuracy of scheme forecasts to see whether they are delivering anticipated results either at a scheme or programme level. There are a number of key findings from our analysis.

- The LNMS programme is on the whole accurately predicting scheme costs, with outturn costs only 4% lower than forecast.
- The programme is delivering 16% higher accident benefits than forecast. The same cannot be said for journey times, which are 71% lower than forecast, although £94.4m of the £163m underestimation can be attributed to over predictions for schemes costing less than £100k.
- Whilst the programme accuracy is generally good, individual scheme accuracy is poor. Forecast journey time impacts are more accurate than accident forecasts.
- The primary aim of a scheme (safety or economy) can lead to some impacts being overlooked. Of the 16 schemes without forecast journey time impacts but outturn journey time increases, 14 were speed limit reduction safety schemes. On the other hand, the majority of schemes without accident impact forecasts were economy schemes which had ignored their potential safety impacts. Where a scheme could

have a potential impact on accidents and/or journey times, forecast impacts should be calculated.

- On an individual scheme basis, forecast journey time accuracy increases with scheme cost and is always lower than forecast accident accuracy.

Environment, Severance and Integration LNMS

Introduction

This section provides an overview of the evaluation process and outcomes for the environment and severance (formerly accessibility) LNMS. These schemes are evaluated using a different approach from the safety and economy LNMS and hence the outcomes are reported separately.

It is not possible to monetise many of these impacts. We evaluate them using a simple qualitative approach whereby we make verbal judgements on how successful the scheme has been in meeting its objectives. We seek to identify whether schemes have performed, better than expected, as expected, or, worse than expected. In addition we assess the schemes performance against the WebTAG objectives used in the PAR AST and assess each sub-objective as 'adverse', 'neutral' or 'beneficial'.

The focus of this section is to initially look at the most recently evaluated schemes (those schemes that have been evaluated this year and hence results not included in last year's Annual Evaluation Report), namely seven environment schemes and five severance schemes. We also re-visit and examine the historic sample, which now stands at 65 schemes, before exploring examples of good and bad practice within the 12 most recent schemes. Specifically, we seek to answer the following questions:

- Have the anticipated outcomes and objectives (stated in the PAR) of the recent schemes been achieved?
- Are there any examples of best practice that we can learn from?
- Are there any elements of schemes we feel should have been approached differently?
- How do the recent scheme evaluations compare to the historic sample?
- How have we put into practice what we have learnt from previous evaluations?
- What would we recommend for the future evaluation of schemes?

Once we have answered the above questions, we look at how our POPE process can be refined in the future to ensure the evaluated sample continues to provide a robust indication of scheme performance.

Environment schemes

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

Evaluating environment schemes

Environmental scheme evaluation begins with a desktop review of scheme location plans, drawings and other detailed specification documents. Then our environmental specialists undertake site visits 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 types of survey undertaken is dependent on each individual scheme and in most cases the Environmental Steward from the MAC/ASC will accompany our staff on site, helping to explain each scheme's local context and circumstances.

Summary of environment results

A summary of the seven recently evaluated environment schemes is provided in the table below. As shown, all bar one scheme have impacted the environment WebTAG sub-objectives. The six schemes with environment impacts have all resulted in a biodiversity benefit, four demonstrated an additional landscape improvement and one also improved journey ambience for the public frequenting the site. Please note that the seventh scheme which did not perform as well, achieved only neutral impacts against each sub objective.

Furthermore, all of the schemes' objectives were achieved except two, namely; returning encroached land back to the highways estate along the A66, which was partially achieved; and, improving tree quality along the M54 which was not achieved. None of the seven schemes did not achieve any of their objectives.

Have the anticipated outcomes and objectives of the recent schemes been achieved?

The table shows that of the seven schemes, five have fully met their objectives. For these five, the scheme measures have been implemented to correct design standards as stated in the PARs, and for those schemes where usage can be observed i.e. otter schemes, evidence has been found to suggest the schemes are also being used as intended and hence have been a success. It should be noted that within the table the WebTAG sub-objectives listed are those that were impacted as a result of the schemes' implementation. However, not all the sub-objectives were influenced by the schemes.

An example of one of the five successful environment schemes, M5 J11a-12 Otter Works can be found in the following Case Study A.

Environment WebTAG Sub-Factors (EST)

Scheme Name	Area	Opening Year	Environment WebTAG Sub-Objectives (EST)			Scheme Objectives	Objective/s Achieved
			Landscape	Biodiversity	Journey Ambience		
A46 Landscape Improvements	9	2011	✓	✓		Integrate highway tree plots with wider landscape and reduce plot monoculture	Yes
M54 Landscape Improvements	9	2011				Cut back vegetation in order to reduce road safety risk Improve tree quality and integration of species	Yes No
Landscape Improvements A66 Cockermouth	13	2010	✓	✓		Return encroached Highways estate land	Partial
						Thinning and felling trees to enhance biodiversity	Yes
						Improve access gates and fencing	Yes
A14 Ipswich Acid Grassland Condition Assessment	6	2011	✓	✓		To support grassland habitats through protecting, maintaining and enhancing nature conservation of road verges	Yes
M5 J11a-12 Otter Works	2	2011		✓		Installation of mitigation measures across the HA network for the protection of otters	Yes
A30 Okehampton Bypass Otter Mitigation	1	2012		✓		Reduce otter mortality rates through mitigation measures	Yes
						Installation of 20 new remedial measures for the protection of otters	Yes
Rest Areas Enhancement Great Dunmow A120	2	2011		✓	✓	Landscaping and environmental improvements to increase public use	Yes
						Landscape integration through the use of sustainable materials and ensuring HGV parking id utilised as intended	Yes

Case Study A: *An environment scheme which has* ***fully*** *met its objectives.*

M5 J11a-12 Otter Works – Area 2

The scheme created new remedial measures for the protection of otters. The scheme is located on the M5 in Upton St. Leonards, Gloucestershire, where the carriageway crosses the River Twyver.

Overall, our evaluation confirmed that the scheme had met its objectives of contributing to the HA Biodiversity Action Plan (BAP) target of installing mitigation measures across the HA network for the protection of otters. The mitigation measures successfully installed an otter ledge along the length of the M5 culvert, and otter-proof fencing to prevent otters from gaining access to the main carriageway. Site surveys showed evidence of use by otters of the ledge further confirming the schemes success.

One scheme partially met its objectives. It should however be noted that the partial assessment relates to one of three specific sub-objectives only, the remaining two had been achieved.

On the whole, we assess a scheme as being partially successful when it still has the potential to fulfil its full objectives, through the rectification of issues identified in the evaluation. The partial assessment presented in this report has been given for partially achieving the objectives of returning encroached upon land to the Highways estate. The scheme was implemented at three locations as per PAR specification, however, at two of the three sites failure has occurred due to residents removing all planting and appropriating the land for themselves.

This specific example of a scheme receiving a ‘partial’ assessment is the Landscape Improvements A66 Cockermouth scheme set out below in Case Study B.

Case Study B: *An environment scheme which has* ***partially*** *met its objectives.*

Landscape Improvements A66 Cockermouth – Area 13

The scheme set out to improve biodiversity within the plots of tree planting by thinning out trees and felling any dangerous trees. Specifically, the scheme aimed to return encroached upon land to the Highways estate, improve the condition of the tree planting and biodiversity and improve access gates and fencing. There has been a history of local residents who live in the adjacent properties of encroaching on the Highways estate for their own means. These areas were to be returned to the Highways estate and replanted.

The evaluation showed that although the condition of tree planting and biodiversity was improved by thinning out trees and felling dangerous trees, and also access was improved to access gates and fencing. However, in two out of three locations, residents had removed the new planting and had replanted the area as their own gardens. Consequently not all of the encroached Highways estate land was returned.

Case Study C: *An example of good ongoing maintenance and after-care.*

Rest Areas Enhancement Great Dunmow A120 – Area 2

This scheme comprised of enhancing two rest areas on the A120, which included environmental improvements through additional landscaping to ensure ongoing public usage throughout the year. Additionally the scheme was implemented to ensure non HGV parking is utilised as intended through the installation of height barriers, and that landscape integration was achieved through the use of sustainable materials.

The evaluation of the scheme identified that the tree planting had been well maintained, grass and shrubs had been kept tidy and weeds kept under control. Furthermore, it was confirmed that the new hard landscaping including new steps, kerbs, bollards and picnic benches had all been installed to the required standard.

Planting at this scheme has enhanced the local landscape and the improved public facilities have generated a journey ambience benefit.

Are there any examples of best practice that we can learn from this year's scheme evaluations?

Previous meta-analysis has confirmed that a common weak point is the lack of sustained maintenance and appropriate aftercare once a scheme has been introduced. During this year there have been schemes that have shown improvement on this aspect, please see Case Study box C which demonstrates that the good aftercare has enabled this particular scheme to reach its full potential.

Another example of good practice was found at the A46 Landscape improvements scheme. This scheme comprised of visually improving the area, through integrating highway tree plots with the wider landscape thus reducing plot monoculture. The work undertaken included crown lifting to reduce the road safety risk, crown reduction at a number of locations and the removal of some dead trees, which vastly improved the aesthetics of the roadside vegetation. The site survey confirmed that the plots were well integrated within the wider landscape context and that the landscape management operations carried out supported this.

Furthermore, good practice was also demonstrated at the A30 Okehampton Bypass Otter Mitigation scheme. Like the M5 Otter scheme presented above, as one which has fully met its objectives, the A30 scheme included the implementation of fencing in order to decrease the likelihood of otter road casualties. It was confirmed that the fences and other measures were of a good enough quality to achieve this objective which was further confirmed by the lack of otter road casualties post implementation.

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

Every year, the evaluation process draws our attention to elements of schemes that we feel should have been approached differently. This evaluation year is no exception and there are scheme specific examples of this, even for those schemes that have proven to be successful.

Although five of the seven schemes evaluated this year achieved their objectives, site observations have also identified the importance of continued site surveys being undertaken in order to sustain this success.

Examples of this are once again shown in the two otter schemes, which although have both fully met their objectives, concerns have been raised about the importance of undertaking regular checks on the infrastructure so any future defeats can be mitigated quickly as well as undertaking future otter activity surveys in order to maintain their success. This would ensure that potential maintenance work takes into consideration the presence/level of otter habitat to minimise the threat of disturbances or damage to the otter population. Our evaluation of these two schemes recommended that the results from these otter surveys should be transferred to a database to be maintained by the MAC/ASC.

Our evaluation of the A14 Ipswich Acid Grassland Condition Assessment scheme recommended that a more frequent mowing regime would control the undesirable encroachment of scrub, in particular bramble, which was evident at one of the sites.

Finally, we do have one scheme which did not achieve one of its objectives. The M54 Landscape Improvements J2 to J4 scheme was implemented in order to enhance biodiversity at the site, specifically by improving tree quality, tree planting, integration of species and cutting back vegetation in order to reduce road safety risk. No evidence of tree planting was found on site and even though tree felling was evident from Google imagery and photos provided by the area team, the PAR and scheme drawings supplied were so vague that it was difficult to ascertain exactly where the felling had taken place when out on site. This highlights the importance of the provision of good scheme drawings and location plans from the MAC/ASC, to aid our site visits.

Historic Sample of Environment Schemes

How do the recent scheme evaluations compare to the historic sample?

Our evaluation of seven schemes in this most recent evaluation year brings the total sample of evaluated environment schemes to 35.

Last year's meta-analysis, based on 10 environmental schemes, confirmed that most of the schemes had only partially met their objectives because of a lack of regular monitoring and checks that can help to ensure that a scheme is establishing itself, particularly at the early stages. Furthermore, last year's meta-analysis concluded that a long term maintenance plan should be developed and followed through for all schemes

Consequently, specific scheme actions highlighted in the previous meta-analysis such as ensuring the location for planting vegetation is appropriate, developing a long term maintenance and management plan and following PAR specification when implementing the scheme, have been used to ensure that future schemes will fully meet their objectives. This has been demonstrated within the most recent environment scheme results, the majority of which have fully met their objectives.

The most consistent and significant finding of previous meta-analyses when looking at the environment programme as a whole, until this report, has been evidence of poor maintenance and after-care. It has been noted that with recent environmental schemes there has been an improvement in maintenance and after-care, which has contributed to more schemes successfully meeting their objectives. For continued improvement, long term

maintenance of schemes is imperative, not only to enable more environmental schemes to fulfil their objectives but to ensure that the scheme is establishing itself.

Overall, our evaluation programme continues to highlight the importance of:

- Ensuring a thorough and long term maintenance/ aftercare plan is developed and undertaken.
- Ensuring regular checks are undertaken on erected structures, such as gates, ledges and fences as well as future habitat surveys undertaken such as otters surveys as infrastructure defeats/sudden changes in population need to mitigated quickly and effectively.
- Ensuring PARs and/or accompanying documents depict an accurate representation of the works that have been undertaken on site.
- Promptly demonstrating ownership of land, when HA land has been appropriated by residents. In order to avoid repeated land re-appropriation from residents, adverse possession of the land and unnecessary costs.

How have we put into practice what we have learnt from previous scheme evaluations?

This year has been very successful with regards to environmental schemes fulfilling their objectives. This has been partially due to looking at previous recommendations and identifying appropriate ways to respond to them.

Previously it had been found that site visits which were not accompanied by the MAC/ASC can lead to limited observation and difficulty in site access/unclear scheme locations. Therefore, this year our ecology specialists and landscape architects have been accompanied by relevant agents for many of their visits. This meant thorough site observations were completed and strong decisions were made on the level of scheme success.

Furthermore, previous scheme evaluations have suggested that the timing of site visits is crucial and they should be undertaken at the most appropriate time of year. Where possible environmental scheme evaluations this year were carried out during times where there were little or no seasonal constraints to site access or observations. This helped to ensure a robust assessment of the schemes can be made.

What would we recommend for the future evaluation of environment schemes?

Although this year's environmental schemes have been very successful overall, it remains vital that we continue to improve the evaluation of these types of schemes in future years and hence we strive to identify recommendations to enable this.

The A46 Landscape Improvements scheme identified that the PAR OS grid references referred to a different section of the A46. Fortunately other scheme works plans and drawings were supplied, which related to the scheme and could be used to identify the locations of the plots , in addition, the M54 scheme locations were also ambiguous. However, this does highlight the importance of clarification within the PAR description, and we therefore recommend a close working relationship with the MAC in order for them to provide assistance on uncertainties.

Severance Schemes

There are many types of severance schemes which include, but are not limited to cycle, pedestrian and public transport infrastructure improvements. The schemes may aim to make better provision for existing users, or attract new users, or a combination of both.

Evaluating severance schemes

The approach is very much scheme specific and needs to be tailored as such. Using information obtained from the MAC/ASC, the nature of the scheme is identified, and from this an appropriate method of evaluation can be adopted.

Due to their irregular characteristics, severance schemes often have no quantifiable observed changes, including no major changes in the level of pedestrian or cycle usage (but the level of comfort and safety for existing users may have been improved). Consequently, in order to establish the most accurate evaluation possible, in addition to undertaking non-motorised user counts, our evaluations generally endeavour to include all of the following:

Consultation with stakeholders and other parties;

- Face-to-face surveys with the public/local residents/users of the scheme.
- Site visits and user observations.

Summary of severance results

This year we have evaluated five severance schemes, with details provided in the table below. This brings the total sample of evaluated severance schemes to 23.

All five of the schemes achieved the severance sub-objective, four achieved improving journey ambience/journey quality and three achieved improving physical activity. Access to the transport system was also improved by one scheme as was improving the accident rate. One scheme however, the A12 Lowestoft, Hollingsworth Road, Signalised Crossing (Puffin) scheme, had an adverse impact on the accident rate. This meant that this scheme did not achieve its overall objective of enhancing safety for NMUs.

The sub-objective results can be seen in the table overleaf, though it should be noted that within the table the sub-objectives listed are those that were impacted as a result of the schemes' implementation. However, not all the sub-objectives were influenced by the schemes.

Severance WebTAG Sub-Objectives (EST)

Scheme Name	Scheme Type	Area	Opening Year	WebTAG Sub-Objectives (EST)					Scheme Objectives	Objective/s Achieved
				Physical Fitness	Accidents	Severance	Access to Transport System	Journey Ambience/ Quality		
A12 Lowestoft, Hollingsworth Road, Signalised Crossing (Puffin)	Pedestrian Crossing	6	2011	✓	×	✓			Enhance safety for NMUs	No
A36 Petersfinger Crossing	Pedestrian Crossing	2	2012	✓		✓	✓	✓	Improve accessibility for NMUs	Yes
A12 Links Road Roundabout, Gorleston	Pedestrian Crossing	6	2011	✓		✓		✓	Reduce severance by improving accessibility to Beacon Business Park and residential properties	Yes
A64 Headley Bar	Footpath Improvements	12	2012			✓		✓	Reduce severance between NMU facilities	Yes
									Reduce risk of pedestrian collisions	Yes
A45 Blacky More Accessibility Review	Anti-pedestrian Fencing and NMU Signing Improvements	7	2011		✓	✓		✓	Reduce risk of accidents through deterring pedestrians crossing at-grade between two junctions	Yes

Have the anticipated outcomes and objectives of the schemes been achieved?

Of the five schemes, four have been evaluated as successfully meeting their objectives. An example of one of these schemes is the A36 Petersfinger Crossing. This scheme included the provision of a signalised toucan crossing, in order to provide safer access to the adjacent bus stops.

This scheme fully achieved its objectives and also received very positive feedback from users and a local cycle group. See the following Case Study D for full details.

In contrast, the A12 Lowestoft, Hollingsworth Road, Signalised Crossing (Puffin) scheme did not achieve its objective of enhancing safety for NMUs crossing the A12. See Case Study E for full details.

Case Study D: *A scheme which has* ***achieved*** *its objectives.*

A36 Petersfinger Crossing – Area 2

The scheme was implemented as a response to pressure from the Salisbury Joint Transport Team and cycling organisations in Salisbury, who highlighted that there was a missing link in the National Cycle Network (NCN) and a Conect2 Sustrans route on the A36 at Petersfinger. Prior to scheme implementation, NMUs travelling to and from Salisbury had to cross the busy A36 without the help of a crossing facility.

Consequently, a signalised toucan crossing was implemented at the location to enable both the essential crossing movement and to provide a safer means of gaining access to the adjacent bus stops. This crossing is also suitable for people with mobility impairments or travelling with pushchairs, as it has incorporated dropped kerbs. Furthermore the scheme has reduced severance for bus users, hence it has benefitted the transport system.

Feedback from a local cycle group suggested:

"I could see the crossing would be very useful for commuters along Southampton Road and students at the College"

Our assessment showed that this scheme had been implemented to a high standard is being well used and hence has fully achieved its overall objective of improving accessibility for NMUs.

Case Study E: *A severance scheme which has* ***not achieved*** *its objectives.*

A12 Lowestoft, Hollingsworth Road, Signalised Crossing (Puffin) – Area 6

Prior to this scheme, there was a central pedestrian refuge protected by guard railing, but no traffic signals. This was improved during 2009 and 2010, through the introduction of a zonal treatment scheme to highlight the crossing location to drivers. However, after a local campaign mounted by the community after a child cyclist fatality, a puffin (signalised) crossing was introduced. This was accompanied by improved road markings, high friction surfacing and pedestrian guard railing.

The site visit concluded that the scheme was implemented as specified and it was being used regularly. However, the accident rate at the scheme location has risen by 0.7 accidents per annum since scheme opening. This equated to four accidents since opening, three of which involved cyclists. Although there were no fatal accidents, it would suggest that the scheme has not enhanced safety.

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

The A12 Links Road Roundabout, Gorleston scheme in Norfolk, demonstrated an example of best practice through ensuring the scheme was implemented in the correct location for the maximum number of NMUs to benefit. The scheme, which was implemented to reduce the safety risk for NMUs crossing the northern arm of the A12, included a toucan crossing, with associated road layout and signing improvements. The location of the crossing on the northern arm was thoughtfully located for NMUs travelling between Beacon Business Park and the neighbouring residential properties, predominantly located to the north and north east of the roundabout.

This location of the crossing was considered appropriately positioned and as a consequence is well used by residents of the village, see case study F for full details.

Additionally, another scheme demonstrating best practice is the A45 Blacky More Accessibility Review, which was successful in preventing pedestrians crossing the A45 at-grade though gaps in the central reserve. It achieved this through installing a 1km stretch of ‘anti-pedestrian’ fencing, to encourage pedestrians to use the existing footway network over Wooton Fields Bridge, rather than dangerously crossing the busy A45 dual carriageway. Although, it will take pedestrians longer to walk between Wooton Fields to the east of the dual carriageway, and Blacky Moore to the west, the risk of accidents has been reduced.

A similar result was achieved in the A64 Headley Bar scheme, which implemented a new stretch of footway (between the existing footway and bus stop), to prevent the need for pedestrians to cross the A64 at-grade, or walk in the carriageway to access the bus stop. Consequently, there have been no pedestrian accidents in the vicinity of the scheme, and severance caused by the busy A64 has been reduced, therefore this scheme has achieved its objectives.

Case Study F: *An example of a scheme that has been appropriately positioned and hence* ***achieved*** *its objectives.*

A12 Links Road Roundabout, Gorelestone – Area 6

The A12 links Gorleston-on-Sea to Great Yarmouth to the north. Previously, there were poor pedestrian facilities on the northern arm of the roundabout, which made it difficult and potentially unsafe to cross the road. To make this arm of the roundabout more accessible to pedestrians and cyclists, a signalised toucan crossing was implemented, including associated road markings, high friction surfacing, kerb realignment of the central reserve and improvements to traffic signing.

During the site visit it was confirmed that the crossing was well used, mostly by cyclists travelling from Links Road (east arm of the roundabout) and the A12 from (south arm of the roundabout), in a northerly direction towards Great Yarmouth. There was a small number who travelled from Beacon Business Park, but it is expected this would increase during the peak traffic hours as people who work on the business park commute home.

Furthermore, it was noted that the majority of NMUs using the roundabout crossed the northern arm of the A12, and all of those seen used the crossing. This confirms that locating the new signalised toucan crossing on the northern arm of the roundabout was the most appropriate location, and has resulted in reducing severance previously experienced by NMUs.

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

There are no obvious examples of bad practice, but the feedback on this year's schemes has suggested some elements of schemes that could be improved or expanded upon:

- The A12 Lowestoft, Hollingsworth, Signalised Crossing (Puffin) was the only severance scheme this year not to fulfil its objectives. It is evident that this location has had several modifications and additions prior to the scheme implementation, and a lot of local attention. However, the accident rate at the crossing has increased since the addition of a signalised crossing. Due to a lack of detailed accident descriptions, we cannot be certain whether the crossing was a causation factor in the accidents.
- For the A12 Links Road Roundabout, Gorleston, the NMU count predominantly showed more people using the northern and north easterly arms of the roundabout, which was undertaken during late morning. As the westerly arm provided access to a business park, it would have enhanced the evaluation to see if the NMU levels were different during peak commuter time. This highlights the importance of identifying local facilities before undertaking site visits, in order to capture the scheme at its full potential.

How do the recent scheme evaluations compare to previous years?

In general terms, the sample of schemes from this most recent evaluation year are similar/representative of the historic sample, with most schemes achieving their objectives.

The evaluation process tends to highlight examples of scheme specific issues. For previous years, these have included stakeholders suggesting changes or additions that could be made to schemes. However, this year's evaluations have received less stakeholder feedback. This feedback is important, as it is not always feasible to identify all of the potential issues with a scheme in a single site visit.

Past meta-analysis has identified that cycle schemes can be very effective, particularly where they plug gaps in the network or link into existing facilities. This pattern has been identified particularly well in the A36 Petersfinger crossing scheme, which has filled a missing link in the National Cycle Network and a Connect2 Sustrans route.

Previous findings have identified that some pedestrian crossing schemes have been implemented away from desire lines, which has resulted in pedestrians continuing to cross a road not at a designated crossing point. Satisfyingly, this was mitigated successfully through the use of 'anti-pedestrian' fencing in the A45 Blacky More Accessibility Review, which acted as a barrier to pedestrians trying to unsafely cross the A45 at-grade.

What would we recommend for the future evaluation of severance schemes?

Three of the five schemes were predicted to and consequently achieved a beneficial impact on the 'journey ambience' sub-objective (subsequently re-named 'journey quality'). However, this beneficial impact can be difficult to assess as it is based on perceptions, meaning it is difficult to fully appreciate what the change in journey ambience would be for someone using the scheme every day. It is important that during future scheme user surveys, the time of day at which they are undertaken is planned accordingly to when footfall may be at its highest (i.e. during the am and pm peaks).

Furthermore, for all five schemes there was an absence of pedestrian and cyclist counts before scheme implementation, which makes it difficult to assess whether the severance schemes have achieved their aims of encouraging walking and cycling. Where appropriate walking and cycling counts were undertaken on site, however without a historical count, quantitative results cannot be drawn. It would therefore be beneficial for future schemes to consider undertaking NMU counts before schemes are implemented.

As all severance schemes are significantly based on qualitative findings, it is always beneficial to obtain user and resident perceptions of a scheme. For these schemes, it is imperative that where possible user surveys are undertaken on site and local interest groups and councils are consulted at the earliest opportunity.
Finally, site visits for the severance schemes are undertaken during late spring and early summer months. This should continue in order to take advantage of an increased abundance of non-motorised users that are likely to be more abundant during warmer months of the year.

Summary and Key Findings

Background

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

To re-cap, our methodology in POPE is broadly to consider the impact of each scheme against the Government's four WebTAG objectives, namely economy, environment, society and public accounts; which are themselves split into a number of sub-objectives. We are interested in how each scheme has performed in its opening year and whether the actual outturn impacts differed from the forecast impacts set out in the PAR.

This POPE process is now in its 11th year and has a well-established evaluation methodology. With that said, we try to continually refine the process to increase the robustness of the results. A relatively recent change we have made is to use sat-nav data to determine the impact of schemes on journey times. This has enabled us to evaluate a higher proportion of economy schemes than ever before. As well as being able to assess the average change in journey times, the sat-nav data allows us to look in detail at journey time reliability. We haven't included this analysis in this meta-analysis, but we hope to do so in the future.

Supporting this report is a full pull-out appendix (see Appendix C), giving tabulated data for the 11 years of scheme evaluations. We also have an analysis tool for our database of results (termed PoLAR) available for use by our area teams to inform their future scheme appraisals.

Schemes & Evaluations

Over the 11 years of POPE, we have now processed a total of 2,056 PARs. When looking at the distribution of those schemes over the 11 year period, it is clear that there have been recent changes. In the first nine years of the commission, we typically had 200 PARs per annum, but in the two recent financial years this has dropped to approximately 70-80. The main reason for this is a reduction in Government funding for schemes, with a focus instead on larger schemes which are outside of the LNMS programme. Other notable trends from the 2,056 PARs include the following:

- Typically, in any given year, nearly half of all schemes are classified as safety, which means they are focussing on reducing the number of accidents at a given location.
- There are fewer high-cost schemes, with a greater focus on the schemes costing up to £250k.
- Finally, when looking at the average size of each scheme over time, with the clear exception of 2011/12, there has been a trend in more recent years of reduced investment per scheme.

Of the 2,056 schemes, we have been able to evaluate 756 schemes; the majority (689) of which are either safety or economy schemes, whose focus is generally upon improving safety and / or journey times. There are a number of reasons for not evaluating the remainder of the safety and economy schemes. In any given year, we 'carry over' a large number of schemes because the required minimum of 12 months of accident data is not yet available, but these are then evaluated the following year upon receipt of the necessary data. There are also a number of schemes where an evaluation would never be possible, because the impacts aren't quantifiable. There are however a number of schemes, including a large number of the earlier economy schemes, where supporting data was not made available and hence no evaluation could be undertaken. Now that we use sat-nav data for the evaluation of journey time impacts, this is no longer an issue and hence our sample of evaluated economy schemes has now grown significantly.

The reasons for not evaluating the remainder of the other scheme types (for example, environment and severance) are broadly similar, largely attributable either to schemes not having quantifiable impacts or to instances where there is not sufficient observed pre-scheme data upon which to base an evaluation.

Safety and Economy Scheme Results

Programme results

It is crucial that we know how well our schemes have performed and the type and scale of benefits delivered to the public. The 670 evaluated safety or economy schemes have cost a total of £229m and have delivered the following benefits, demonstrating very strong performance.

1,194	**Accidents** saved in the observed opening year, based on a comparison of accident rates before and after scheme opening
3.7m	**Vehicle hours** saved in the opening year, based on a comparison of journey times before and after scheme opening
£164m	Is the **sum of all first year** accident and vehicle hour benefits within the opening year
234	**Killed or Seriously Injured** (KSIs) accidents have been saved in the opening year, with each scheme saving an average of 0.4 KSI accidents.
71%	Of scheme costs recouped in the opening year, based on calculating the **First Year Rate of Return**
16.9x	The average scheme will pay for itself nearly 17 times over during its life, based on calculating the **Benefit Cost Ratio**

Recent results

Whilst the programme results demonstrate strong performance, it is useful to look in detail at the most recent financial years to confirm that this level of performance is being sustained. This analysis does confirm continuing strong performance, vindicating our continued investment in the programme, albeit at lower total levels due to recent Government cuts in funding:

- The 2010 evaluated schemes are performing well compared to the overall programme pre-2010, with greater than average accidents saved, vehicle hours saved and First Year Rate of Return.
- Whilst we have evaluated fewer 2011 schemes than the typical year (some schemes from this year are still to be evaluated, having been 'carried over' given that a year's accident data may not have been available), the emerging results demonstrate that the 2011 evaluated schemes saved far greater than the average accidents compared to the pre-2010 programme, but deliver a vehicle hour dis-benefit and a lower than average First Year Rate of Return.

Results by area

We consider the results by area, allowing us to understand whether some areas are delivering higher value for money than others. We should note at the outset that whilst we would ideally evaluate a proportionate number of each area's schemes, factors such as whether schemes have measurable impacts and data availability prevent some evaluations and hence the sample for each area is a reflection of this. Also note that this analysis excludes outliers and hence allows us to learn about the 'typical' scheme in each area. Our key findings from this area analysis are that:

- The average cost of a scheme in each area ranges from £157k to £700k and as we would expect, this is heavily influenced by the number of large schemes implemented.
- All of the areas, with the exception of Area 1, achieve an accident saving, demonstrating that on the whole, the programme is successful at reducing accidents across the country.
- The average journey time saving ranges from an increase in vehicle hours of 3,213 (Area 2) to a decrease of 17,840 (Area 8). We do note however that the results could reflect the type of schemes implemented or the performance of the schemes, or sometimes a combination of the two. For example, if an area introduces a higher number of schemes which reduce the speed limit or ban turns (intentionally increasing journey times), then it could be expected that their overall journey time impacts will be lower.

Results by measure

The area teams implement a wide range of different measures to improve journey times and reduce accidents. Whilst every scheme is unique, each scheme can be classified based on a small group of commonly implemented measures. In doing this, we can learn something about the cost and effectiveness of the measures. These results by measure also exclude outliers. Looking first at accidents, we find that banned turns and new signals are most

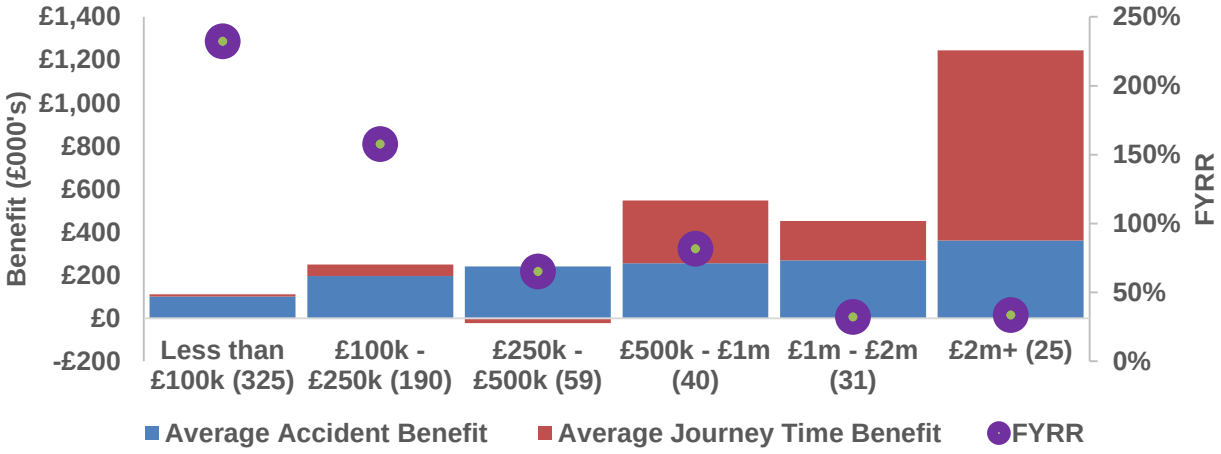
effective, reducing the pre-scheme accident rate by an average of 45% and 40% respectively. These measures both aim to either eliminate or separate conflicting vehicle movements and hence these high percentage accident savings should not surprise us. If we look specifically at the KSI accident savings, then the speed limit reduction schemes are the strongest performing schemes, saving 1.0 KSIs per average scheme, which is three times that of most measures.

Modified signals and widening generate the highest vehicle hour savings. The latter produce strong vehicle hour savings as they aim to increase capacity to relieve congestion, thus improving the efficiency of junctions. Modified signals are more effective than new signals at improving journey times, which possibly indicates how pivotal it is to optimise signal usage or how signals have improved since the LNMS programme started.

Our analysis has shown us that most of the commonly implemented measures deliver FYRRs in excess of 50%.

Results by scheme cost

This year we have introduced analysis of scheme results by size of scheme (based on implementation cost), looking at six different cost bands. This has replaced the former analysis split by 'Small' and 'Large' LNMS. The results show us some interesting trends, as set out in the chart below, showing the average accident and journey time benefits for each cost band, along with the corresponding FYRR. The results suggest that FYRR generally reduces with increased scheme cost and overall benefits increase with scheme cost. Schemes costing more than £2m generate large first year benefits in comparison to other cost categories, but deliver a low FYRR. This should not surprise us however as the higher costs mean it is difficult to re-coup the costs so quickly.



Other impacts

In addition to journey time and accident benefits, all schemes within the programme are assessed against a wide range of other objectives covering Environment and Society. In general, the majority of sub-objectives considered are beneficial more often than adverse. The objective which is most commonly scored as non-neutral (i.e. beneficial or adverse) is journey ambience, with 407 positive scores and 97 adverse scores. Journey ambience has traditionally been closely linked to annual accident rate and journey time change, but with the more recent PAR6 and a new focus on 'journey quality', the link is not so obvious. The other commonly scored non-neutral sub-objective is landscape, which has been scored adverse for 64 schemes, more than four times more than it has been scored beneficial. The

adverse scores usually arise because of schemes introducing features like large signs and traffic signals which have a clear impact on the landscape.

Appraisal Accuracy

Programme level accuracy

A key component of our meta-analysis is interrogating the accuracy of our appraisals. This is crucial because it is the appraisal process which governs which schemes are funded and implemented. We consider the accuracy of forecast accident benefits, journey time benefits and costs at both a programme level and at a scheme-by-scheme level. The analysis at programme level allows us to consider whether there is a systematic bias within the appraisal and whether schemes are generally delivering expected results. By analysing on a scheme basis, we can understand whether each individual scheme is accurately appraised.

Costs	Outturn costs (£229m) **lower** than predicted (£239m)	**- 4%**
Accident Benefits	Outturn benefits (£109m) **higher** than predicted (£94m)	**+16%**
Journey Time Benefits	Outturn benefits (£55m) **lower** than predicted (£191m)	**-71%**

We have summarised the programme level accuracy in the table above (the accident benefits just relate to those schemes which forecast an accident benefit, with the journey time benefits just relating to those which forecast a journey time impact). In broad terms, the results demonstrate that costs are the most accurately appraised aspect of the financial forecasts within the PAR, followed by safety benefits and journey time benefits respectively:

- The over-prediction for costs of 4% confirms that the evaluated programme is close to its expected cost.
- The 16% under-prediction for accident benefits is positive in as much as it demonstrates that the LNMS programme is overall surpassing its predicted benefits, but on the other hand, there may have been viable schemes which have not been introduced because the safety benefits were not fully realised during the appraisal.
- Finally, the 71% over-prediction of journey time benefits is clearly a concern. Further investigation of this issue confirms that two-thirds of schemes with forecast journey time benefits are set too high, pointing towards a potential issue with the process of forecasting journey time benefits. The monetised over-prediction is much higher for lower cost schemes than higher cost schemes. £94.4m of the £163m of forecast benefits that do not materialise are from 19 schemes that cost less than £100k to implement (average of £5.0m per scheme). A key message here is that there is an issue with appraising journey time impacts, particularly for schemes costing less than £100k. Our results suggest that there are no measures which are typically implemented for less than £100k which have a notable impact on journey times. As such, we must consider this issue further and determine whether a greater level of scrutiny should be applied for schemes costing less than £100k which are predicting journey time benefits.

Scheme accuracy

The results at an individual scheme level show that the forecasting of benefits is poor. Only 13% of schemes evaluated are within 25% of the forecast accident benefit and 23% within the forecast journey time benefit. Cost accuracy for individual schemes is more encouraging than benefit forecasts, with 58% of schemes within 25% of the forecast, and 86% within 50% of the forecast.

	Accident Benefits	Journey Time Benefits	Costs
Within +/-25% of forecast	**13%**	**23%**	**58%**
Within +/-50% of forecast	**26%**	**32%**	**86%**

The use of accident data for approximately one to two years after opening only could be one possible cause for the lower accuracy of accident forecasts compared to journey time forecasts. If accident numbers are considered over a number of years, any skewing in the data caused by the random nature of accidents are less likely to be reflected in the average number of accidents per annum. On the other hand, journey times are unlikely to vary from the first year after opening as they are more uniform than accidents. In addition, we should note the difficulty in being accurate in accident forecasting particularly when we are dealing with low numbers. For example, if predicting a change in annual accident rate of 0.5, but the actual impact is 0.75, this represents an under-prediction of 50%.

Looking at the other impacts on the environment and society, we find the majority of the 'other' sub-objectives have been scored the same in the evaluation as they were in the appraisal, showing that there is a good level of accuracy of these impacts. Only journey ambience and landscape have required significant changes over the schemes evaluated to date.

Accuracy by scheme cost

Our analysis of accuracy by scheme cost clearly shows us that as scheme cost increases, the accuracy of both journey time and accident benefit forecasts improves. Journey time accuracy does remain below that of accident saving accuracy for all scheme cost categories, mirroring the programme level finding.

Environment and Severance Scheme Results

Our sample of evaluated schemes has grown by 12 this year, with seven environment schemes and five severance schemes added to the sample. The total sample now stands at 65.

Environment schemes

For the seven recent environment scheme evaluations, we see that five have fully met their objectives, one has partially met its objectives and one has failed to meet one of its objectives. Overall therefore, this year's environment schemes have largely been a success. The scheme that has partially met its objectives, whose aim was to return encroached land to the Highways Agency, occurred because in two out of three locations,

residents had removed the new planting and had replanted the area as their own garden. The Highways estate therefore needs to demonstrate ownership of land, and put in a place a rigorous monitoring regime. The scheme which failed to meet one of its objectives was due to lack of evidence of tree planting on site, however the PAR and scheme plans were so vague that it is possible that the planting could have taken place elsewhere without our knowledge. This therefore highlights the need for area teams to provide accurate scheme details to enable us to undertake a robust evaluation.

Over the years, this year particularly, we have seen an improved success rate of schemes fulfilling their objectives than in previous years.

It has been highlighted year upon year about the need for a maintenance / aftercare plan to be put into place for every scheme and this year it has been evident that good ongoing maintenance has helped a number of schemes achieve their objectives. One example of this is a scheme which was implemented to enhance rest areas and integrate them into the existing landscape. The evaluation showed that tree planting was maintained, grass and shrubs had been kept tidy and weeds kept under control hence enabling its success.

Although we have seen an improvement in this area, we still continue to recommend that these plans are put in place and followed through for all schemes. An example of which includes an otter protection scheme, where we recommend that inspections are undertaken every six months, in line with DMRB guidance to ensure any future infrastructure defeats are rectified early.

The outcome of our environment evaluations this year has led us to make some POPE specific recommendations:

- It is beneficial to undertake site visits accompanied by a MAC/ASC specialist in that particular area (wherever possible the area team's environmental steward would be the preferred option), to ensure the location of the measures are accurate and appropriate thus enabling detailed and relevant surveys to be undertaken.
- As stated above, we need to continue advocating ongoing maintenance and detailed after care plans as these are what enable schemes to reach their full potential.

Severance schemes

Four out of the five severance schemes have been assessed as fully achieving their objectives. One scheme did not achieve its objectives, which was a pedestrian crossing scheme that experienced an increase in accidents (including those involving cyclists) after scheme implementation. For the four successful schemes the response from users and the public have been positive, which is imperative as this feedback from users forms a central part of our POPE assessment. These recent trends are in line with the historic evaluations, showing that generally severance improvements are successful.

The greatest achievements of the recent schemes has been improving NMU safety, reducing NMU severance and filling in missing links in the cycle network.

There have also been some elements of the schemes which could be improved in order to allow us to undertake more thorough evaluations in future, including pre-scheme pedestrian and cycle counts. There are very few ways to efficiently confirm whether a scheme has increased levels of pedestrian and cycle use, and therefore NMU counts would be very valuable and would certainly make our results more quantifiable and robust.

Furthermore, it would be beneficial in future evaluations to undertake more user surveys, as with severance schemes the outcomes tend to be a perceived benefit rather than a quantifiable one.

Following our evaluations this year, we have made a number of recommendations to refine the evaluation process in the future:

- As stated above, to recommend NMU counts are undertaken before scheme implementation, to make the post scheme counts comparable.
- To take into account the facilities in the local area, and identify times in the day when schemes use will be at its highest, in order to gain the highest number of user surveys possible.

Appendix A. Site Visit Checklist

POPE OF LNMS SITE OBSERVATIONS FORM

SITE ID & NAME:					
ASSESSOR:					
DATE:		START TIME:		END TIME:	
PHOTOS:		to			
HAS THIS SCHEME BEEN COMPLETED AS STATED IN THE PAR?					
ARE THERE ANY OTHER SCHEMES BEING BUILT NEAR THIS SCHEME?					

IS THERE ANY REASON THIS SITE COULD NOT BE EVALUATED?

CONDITIONS ON DAY OF SITE VISIT

Weather, special events, accidents etc

CONDITION OF ROAD NETWORK

Are lines and marking faded, is signing poor, is vegetations obscuring visibility etc

GENERAL OBSERVATIONS

use of lanes observed, patterns of movement, sharp braking etc? Is this scheme the cause of congestion, or are there other causes further downsteam?

NMU ACTIVITY OBSERVED

Quantity, type and how did they use the site (e.g. used crossing facilities, jaywalked etc)?

REMEMBER

- To take photos of all the key features and layout
- Take note of any impediments to data collection (road works, traffic management, failed lights etc)

THINK ABOUT THE FOLLOWING

Noise	Are there any obvious areas nearby that are affected by noise?
Air quality	Are there any nearby residents that are likely to be affected by air quality?
Landscape	Is the scheme located in a town or not? Will the scheme measures considerably worsen the view when compared to the existing measures? Photograph evidence
Townscape	
Biodiversity	Take suitable photos to evidence vegetation around site
Physical Activity/ Accessibility	What footpaths, cycleways or other NMU options are there prior to the scheme?
Security	Is the area lit? Are walkways or cyclways lit?
Access to services	Are there any nearby bus stops or train stations?

Appendix B. Outliers

Introduction

Depending on the analysis we are conducting, it may be better for us to remove outliers from the results, to focus on the general result rather than the result of all schemes evaluated, which may contain some unusual schemes or usual results.

For example, when we want to know about how the LNMS programme has performed, we would want to include all schemes evaluated, regardless of how good or bad they were.

However, when conducting other analyses, like when we look at how the HA areas are performing or what the performance of certain measures is, it is preferable to know what happens on average. This is because the information may be useful to future scheme evaluations, but would not be useful if the results were skewed by unusual, unique schemes. For example, if one was building a speed limit reduction scheme, it would be better to know how they perform in general, rather than know how a speed limit reduction scheme which has unusual results performed. To make this possible, we would like to remove outliers, to understand what happens in the case of most schemes, unbiased by extreme events.

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
- LNMS results by Highways Agency areas

Defining an outlier - method

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 3 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 benefits. Whenever outliers have been removed from a result, a footnote is attached to the table or chart, to indicate this.

Appendix C. Facts & Figures

Summarised figures

Throughout this report there has been discussion on both the investment in LNMS and the evaluated LNMS scheme performance. These have been measured against a number of different criteria and disaggregated into a number of groups (e.g. area, scheme type, etc).

There are also analyses that have not specifically been looked at in this report, but that we have collected the data for and may be of interest.

As such, this appendix shows a breakdown of all the investment figures and scheme results already discussed in this report, in addition to further information for interest. The appendix acts as a useful pull out reference to the POPE findings.

With the exception of the two investment tables, each table either focuses on Cumulative or Averages; One Year After, Scheme Life or detailed Accident Analyses. Please note that for analysis by area or by measure outliers have been removed to ensure the results are based on the general case. The number of outliers removed has been included in the tables where relevant so that the impact on samples can be appreciated.

To understand what measures are included in each group please see Table B.9 at the end of this Appendix.

The tables presented in this appendix are listed below:

HA investment in LNMS

- Table C.1: Number of Schemes
- Table C.2: Investment in Schemes

Small LNMS

- Table C.3: Cumulative Opening Year Cost and Benefit Summary
- Table C.4: Average Opening Year Cost and Benefit Summary
- Table C.5: Cumulative Scheme Life Cost and Benefit Summary
- Table C.6: Average Scheme Life Cost and Benefit Summary
- Table C.7: Cumulative Opening Year Accident Data
- Table C.8: Average Opening Year Accident Data

Measures

- Table C.9: List of Measure Groups

Table C.1 – Number of Schemes by Year and Area					
	Safety	**Economy**	**Environment**	**Other**	**Total**
Scheme Year					
2002/3	107	14	42	37	200
2003/4	110	23	45	39	217
2004/5	126	27	44	45	242
2005/6	121	28	51	40	240
2006/7	94	85	27	38	244
2007/8	81	22	49	32	184
2008/9	68	26	29	36	159
2009/10	91	27	45	72	235
2010/11	65	24	43	54	186
2011/12	35	12	9	16	72
2012/13	36	10	25	6	77
Area					
Area 1	33	9	38	25	105
Area 2	54	13	19	18	104
Area 3	58	12	9	8	87
Area 4	67	20	19	18	124
Area 5	47	14	20	27	108
Area 6	92	14	21	11	138
Area 7	70	9	26	55	160
Area 8	85	27	28	48	188
Area 9	59	23	26	10	118
Area 10	62	29	34	44	169
Area 11*	39	30	10	14	93
Area 12	71	27	20	30	148
Area 13	97	28	59	64	248
Area 14	87	38	75	33	233
Other	13	5	5	10	33

*Note that Area 11 was subsequently split into Areas 7 & 9. In the main body of the report, and subsequent appendices, the evaluated schemes have been re-distributed into those areas.

Table C.2 – Investment by Year and Area (£m)					
	Safety	**Economy**	**Environment**	**Other**	**Total**
Scheme Year					
2002/3	£22.8	£2.7	£4.9	£3.4	£33.8
2003/4	£17.8	£12.9	£10.5	£3.5	£44.7
2004/5	£18.3	£19.4	£3.0	£4.0	£44.7
2005/6	£29.6	£19.3	£11.9	£8.3	£69.2
2006/7	£19.3	£31.3	£4.7	£5.7	£60.9
2007/8	£18.1	£21.4	£7.9	£6.0	£53.4
2008/9	£16.3	£22.3	£2.8	£4.2	£45.7
2009/10	£16.4	£12.8	£10.7	£12.1	£52.1
2010/11	£10.7	£34.7	£3.4	£4.9	£53.8
2011/12	£15.9	£10.5	£3.2	£3.8	£33.5
2012/13	£7.3	£4.7	£2.4	£1.1	£15.5
Area					
Area 1	£4.9	£5.0	£2.9	£5.9	£18.7
Area 2	£8.2	£11.4	£2.6	£2.0	£24.2
Area 3	£6.8	£17.4	£9.5	£0.4	£34.0
Area 4	£9.3	£10.0	£3.3	£9.4	£31.9
Area 5	£18.4	£11.8	£4.1	£6.0	£40.4
Area 6	£15.6	£7.0	£2.1	£1.8	£26.6
Area 7	£17.8	£14.3	£5.9	£7.4	£45.3
Area 8	£19.2	£5.4	£8.3	£3.7	£36.7
Area 9	£13.1	£10.2	£3.9	£2.3	£29.5
Area 10	£11.6	£28.1	£7.5	£2.7	£50.0
Area 11*	£22.8	£21.9	£1.2	£1.6	£47.5
Area 12	£9.5	£19.7	£2.7	£2.4	£34.3
Area 13	£9.1	£9.8	£3.5	£6.4	£28.8
Area 14	£18.3	£16.0	£5.5	£3.7	£43.4
Other	£7.9	£4.2	£2.3	£1.3	£15.8

*Note that Area 11 was subsequently split into Areas 7 & 9. In the main body of the report, and subsequent appendices, the evaluated schemes have been re-distributed into those areas.

Table C.3 - Cumulative Opening Year Costs and Benefits Summary

	Number of schemes	Number of Outliers	Accidents Saved		Monetised Safety (£million)		Vehicle Hours Saved (000's)		Monetised JT 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	£6.8	£5.8	481	696	£8.3	£10.6	£14.9	£16.2	101%	101%
2003/4	86		109	132	£10.3	£12.7	1,333	726	£36.7	£11.9	£39.1	£34.0	120%	72%
2004/5	89		98	109	£9.6	£11.2	863	561	£14.8	£7.9	£35.5	£41.6	69%	46%
2005/6	99		121	185	£11.6	£16.8	406	638	£7.3	£7.6	£36.4	£36.2	52%	67%
2006/7	66		126	102	£11	£8.5	7,154	429	£88.4	£5.1	£14.2	£13.2	703%	104%
2007/8	59		101	168	£10.3	£14.9	291	128	£3.6	£1.4	£14.8	£13.7	94%	119%
2008/9	54		85	138	£8.2	£13.5	296	114	£4.0	£1.1	£17.3	£18.5	71%	79%
2009/10	85		125	134	£12.2	£13.2	143	65	£1.4	£0.9	£35.1	£29.2	39%	48%
2010/11	53		93	102	£9.7	£9.5	1,420	390	£21.4	£5.1	£22.4	£17.9	139%	82%
2011/12	22		46	61	£4.2	£4.9	40	-5	£5.6	-£0.1	£8.9	£8.5	110%	58%
HA AREA (outliers removed)														
Area 1	19	1	15	-1	£1.6	-£0.2	228	46	£2.6	£0.3	£6.5	£6.5	64%	1%
Area 2	46	3	63	83	£5.9	£7.8	985	-148	£13.8	-£1.8	£18.1	£15.8	109%	38%
Area 3	35	2	35	47	£3.3	£3.9	49	-17	£0.6	-£0.2	£6.5	£6.7	61%	56%
Area 4	48	0	60	72	£6.1	£7.0	51	24	£0.7	£0.2	£8.9	£7.5	76%	95%
Area 5	35	3	70	88	£5.7	£7.4	168	333	£4.5	£5.7	£17.0	£19.5	60%	67%
Area 6	58	0	77	104	£8.1	£9.9	300	270	£7.3	£2.3	£22.1	£28.4	70%	43%
Area 7	57	1	110	84	£10.9	£8.8	1,466	217	£19.4	£3.7	£21.7	£19.4	140%	64%
Area 8	36	2	37	34	£3.4	£3.1	591	642	£7.6	£8.7	£14.2	£14.1	77%	84%
Area 9	66	4	78	94	£7.5	£9.1	7,074	245	£87.4	£2.9	£22.8	£23.9	417%	50%
Area 10	47	3	51	77	£4.4	£6.5	225	34	£3.5	£0.4	£12.1	£10.5	65%	66%
Area 12	57	6	90	70	£8.2	£6.2	126	94	£6.4	£1.4	£26.6	£19.2	55%	39%
Area 13	60	3	42	73	£4.3	£7.1	72	148	£1.2	£1.7	£10.0	£8.8	55%	100%
Area 14	68	3	128	140	£12.4	£13.4	162	20	£9.9	£0.1	£19.4	£20.2	115%	67%
PRIMARY MEASURES (outliers removed)														
Signing	135	6	157	174	£15.3	£15.1	52	29	£1.1	£0.3	£15.3	£13.9	107%	111%
Marking/lining	92	5	154	139	£14.6	£12.3	6,849	76	£85.0	£0.9	£10.2	£8.7	974%	151%
Passive Measures	41	2	34	41	£3.1	£3.6	76	39	£1.0	£0.5	£4.4	£3.9	92%	105%
NMU Facilities	9	1	6	3	£0.5	£0.4	0	0	£0.0	£0.0	£1.5	£1.3	35%	29%
Widening	59	4	85	100	£7.8	£9.4	2,737	1,909	£44.6	£26.4	£76.6	£66.5	69%	54%
Layby	13	3	16	9	£1.4	£0.9	0	0	£0.0	£0.0	£3.7	£3.1	39%	28%
Banned Turn	27	1	56	57	£5.7	£5.4	-54	-58	-£1.0	-£0.9	£10.2	£9.3	47%	48%
Lighting	7	0	6	11	£0.7	£1.1	-11	-12	-£0.1	-£0.2	£5.2	£4.1	11%	23%
Signal (new)	27	0	50	75	£4.3	£6.3	354	104	£9.7	£1.9	£12.8	£11.9	109%	69%
Signals (mod)	30	1	59	81	£5.2	£7.7	1,770	977	£26.9	£13.0	£44.1	£36.0	73%	58%
Camera	5	1	7	13	£1.5	£1.7	-2	-5	£0.0	-£0.1	£2.6	£2.0	56%	84%
Surface	21	2	35	43	£3.4	£3.9	4	-11	£0.1	-£0.1	£2.9	£2.8	117%	137%
Geometry	50	4	65	61	£7.3	£6.6	289	206	£3.5	£2.4	£37.1	£34.9	29%	26%
Crossing	15	1	12	16	£1.0	£1.6	0	0	£0.3	£0.2	£3.9	£3.9	35%	43%
Narrowing/Lane Drop	11	0	6	5	£0.6	£0.5	80	-7	£1.1	-£0.1	£0.8	£0.7	201%	58%
SLR	23	2	51	73	£5.0	£6.3	-129	-452	-£1.4	-£6.0	£5.4	£5.0	67%	6%
Vegetation Clearance	3	2	2	2	£0.2	£0.2	0	0	£0.0	£0.0	£0.2	£0.1	103%	119%
Other	9	2	17	14	£1.4	£1.9	734	53	£9.2	£0.7	£8.8	£10.3	120%	25%
Scheme Cost														
£0 - £100,000	325		286	360	£28	£33	7,088	275	£95	£3	£21	£16	591%	232%
£100,000 - £250,000	190		323	405	£31	£37	923	817	£13	£10	£34	£30	126%	158%
£250,000 - £500,000	59		127	145	£13	£14	301	-73	£4	-£1	£21	£20	81%	65%
£500,000 - £1 million	40		101	106	£10	£10	1,161	908	£16	£12	£29	£27	88%	82%
£1 million - £2 million	31		80	92	£8	£8	1,708	414	£40	£6	£46	£44	104%	32%
£2 million +	25		57	86	£5	£9	1,246	1,400	£24	£22	£88	£93	33%	33%
Total	670		975	1,195	£94	£112	12,426	3,741	£191	£52	£239	£229	120%	71%

Table C.4 - Average Opening Year Costs and Benefit Summary

	Number of schemes	Number of Outliers	Accidents Saved		Monetised Safety (£000's)		Vehicle Hours Saved		Monetised JT 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	9,079	13,134	£157	£199	£281	£306	101%	101%
2003/4	86		1.3	1.5	£120	£147	15,501	8,441	£426	£139	£455	£395	120%	72%
2004/5	89		1.1	1.2	£108	£126	9,702	6,300	£166	£89	£399	£467	69%	46%
2005/6	99		1.2	1.9	£118	£169	4,097	6,446	£74	£77	£368	£365	52%	67%
2006/7	66		1.9	1.5	£167	£129	108,390	6,497	£1,340	£78	£214	£199	703%	104%
2007/8	59		1.7	2.8	£175	£253	4,927	2,170	£61	£24	£251	£232	94%	119%
2008/9	54		1.6	2.6	£153	£251	5,483	2,104	£75	£20	£320	£343	71%	79%
2009/10	85		1.5	1.6	£143	£155	1,680	768	£16	£10	£412	£343	39%	48%
2010/11	53		1.8	1.9	£183	£180	26,795	7,359	£404	£96	£422	£338	139%	82%
2011/12	22		2.1	2.8	£192	£225	1,799	-244	£254	-£3	£405	£384	110%	58%
HA AREA (outliers removed)														
Area 1	19	1	0.8	-0.1	£85	-£11	12,008	2,444	£135	£15	£341	£341	64%	1%
Area 2	46	3	1.4	1.8	£129	£170	21,418	-3,213	£300	-£40	£394	£343	109%	38%
Area 3	35	2	1.0	1.4	£95	£113	1,410	-484	£19	-£6	£187	£192	61%	56%
Area 4	48	0	1.3	1.5	£128	£145	1,064	502	£14	£4	£186	£157	76%	95%
Area 5	35	3	2.0	2.5	£163	£211	4,788	9,508	£128	£162	£486	£556	60%	67%
Area 6	58	0	1.3	1.8	£140	£171	5,170	4,650	£126	£40	£380	£490	70%	43%
Area 7	57	1	1.9	1.5	£192	£154	25,711	3,804	£340	£64	£380	£340	140%	64%
Area 8	36	2	1.0	1.0	£95	£86	16,420	17,840	£211	£242	£395	£391	77%	84%
Area 9	66	4	1.2	1.4	£114	£138	107,182	3,714	£1,325	£44	£345	£363	417%	50%
Area 10	47	3	1.1	1.6	£94	£138	4,790	717	£74	£9	£258	£223	65%	66%
Area 12	57	6	1.6	1.2	£145	£108	2,216	1,650	£112	£24	£467	£338	55%	39%
Area 13	60	3	0.7	1.2	£71	£118	1,195	2,473	£20	£28	£166	£146	55%	100%
Area 14	68	3	1.9	2.1	£183	£197	2,383	293	£146	£2	£286	£297	115%	67%
PRIMARY MEASURES (outliers removed)														
Signing	135	6	1.2	1.3	£113	£112	384	215	£8	£2	£114	£103	107%	111%
Marking/lining	92	5	1.7	1.5	£158	£134	74,441	822	£924	£9	£111	£95	974%	151%
Passive Measures	41	2	0.8	1.0	£76	£88	1,842	951	£23	£12	£108	£94	92%	105%
NMU Facilities	9	1	0.7	0.4	£60	£42	0	0	£0	£0	£172	£146	35%	29%
Widening	59	4	1.4	1.7	£133	£159	46,395	32,358	£756	£447	£1,298	£1,127	69%	54%
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	-1,982	-2,145	-£37	-£33	£378	£346	47%	48%
Lighting	7	0	0.9	1.5	£103	£153	-1,612	-1,674	-£19	-£21	£745	£581	11%	23%
Signal (new)	27	0	1.8	2.8	£160	£235	13,108	3,866	£358	£70	£475	£440	109%	69%
Signals (mod)	30	1	2.0	2.7	£172	£256	58,984	32,577	£896	£434	£1,470	£1,200	73%	58%
Camera	5	1	1.5	2.5	£295	£343	-451	-1,094	-£6	-£14	£512	£392	56%	84%
Surface	21	2	1.7	2.1	£161	£187	204	-521	£3	-£7	£140	£131	117%	137%
Geometry	50	4	1.3	1.2	£147	£133	5,782	4,112	£69	£47	£743	£698	29%	26%
Crossing	15	1	0.8	1.1	£69	£104	0	0	£22	£10	£261	£263	35%	43%
Narrowing/Lane Drop	11	0	0.6	0.4	£57	£45	7,256	-651	£97	-£9	£77	£63	201%	58%
SLR	23	2	2.2	3.2	£219	£272	-5,591	-19,641	-£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	9	2	1.9	1.6	£154	£214	81,538	5,934	£1,025	£75	£983	£1,147	120%	25%
Scheme Cost														
£0 - £100,000	325		0.9	1.1	£86	£102	21,808	846	£294	£10	£64	£48	591%	232%
£100,000 - £250,000	190		1.7	2.1	£162	£196	4,860	4,301	£66	£54	£182	£159	126%	158%
£250,000 - £500,000	59		2.2	2.5	£221	£241	5,093	-1,246	£64	-£22	£353	£336	81%	65%
£500,000 - £1 million	40		2.5	2.7	£244	£256	29,020	22,696	£394	£291	£728	£670	88%	82%
£1 million - £2 million	31		2.6	3.0	£257	£269	55,084	13,362	£1,287	£184	£1,484	£1,416	104%	32%
£2 million +	25		2.3	3.5	£201	£362	49,857	56,015	£958	£882	£3,507	£3,716	33%	33%
Total	670		1.5	1.8	£141	£167	18,547	5,584	£286	£77	£357	£342	120%	71%

Table C.5 - 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 Cost (£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		£619	£666	£197	£85	£92	£83	8.9	9.0
2010/11	53		£448	£415	£990	£230	£49	£41	29.5	15.6
2011/12	22		£188	£224	£218	-£1	£20	£20	20.1	11.2
HA AREA (outliers removed)										
Area 1	19	1	£78	£29	£85	£2	£11	£12	14.5	2.6
Area 2	46	3	£359	£447	£659	-£103	£37	£32	27.6	10.6
Area 3	35	2	£178	£184	-£3	-£17	£15	£15	11.8	11.0
Area 4	48	0	£324	£379	£30	£8	£28	£25	12.5	15.7
Area 5	35	3	£342	£441	£233	£310	£38	£43	15.2	17.4
Area 6	58	0	£395	£505	£426	£157	£41	£46	20.1	14.3
Area 7	57	1	£441	£228	£648	£55	£37	£34	29.4	8.4
Area 8	36	2	£139	£198	£257	£220	£21	£20	19.2	21.1
Area 9	66	4	£368	£472	£3,400	£140	£59	£55	64.4	11.2
Area 10	47	3	£258	£383	£156	£23	£37	£33	11.1	12.2
Area 12	57	6	£411	£328	£396	£90	£41	£30	19.7	13.8
Area 13	60	3	£237	£415	£58	£82	£34	£27	8.7	18.1
Area 14	68	3	£490	£582	£442	-£26	£40	£39	23.5	14.1
PRIMARY MEASURES (outliers removed)										
Signing	135	6	£758	£849	£53	£15	£55	£50	14.7	17.1
Marking/lining	92	5	£820	£700	£3,368	£43	£39	£33	106.4	22.2
Passive Measures	41	2	£175	£214	£12	£21	£12	£10	16.2	23.6
NMU Facilities	9	1	£29	£22	£0	£0	£4	£4	7.1	6.1
Widening	59	4	£303	£375	£1,841	£1,090	£94	£81	22.7	18.1
Layby	13	3	£68	£38	£0	£0	£4	£3	18.4	12.3
Banned Turn	27	1	£286	£289	-£47	-£41	£16	£14	15.2	17.8
Lighting	7	0	£30	£32	-£3	-£4	£6	£5	4.1	5.5
Signal (new)	27	0	£225	£370	£391	£69	£27	£26	22.7	17.0
Signals (mod)	30	1	£155	£283	£1,190	£415	£55	£47	24.5	14.8
Camera	5	1	£41	£66	-£1	-£4	£4	£3	9.4	18.1
Surface	21	2	£186	£201	£3	-£7	£15	£14	12.2	14.0
Geometry	50	4	£293	£347	£107	£132	£88	£78	4.5	6.2
Crossing	15	1	£51	£75	£19	£9	£7	£7	10.6	12.8
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	9	2	£45	£95	£500	£32	£10	£11	53.8	11.2
Scheme Cost										
£0 - £100,000	325		£1,652	£1,952	£3,908	£134	£79	£61	70.6	34.0
£100,000 - £250,000	190		£1,583	£1,905	£622	£410	£123	£109	17.9	21.3
£250,000 - £500,000	59		£509	£632	£123	-£45	£61	£59	10.4	9.9
£500,000 - £1 million	40		£430	£444	£461	£341	£78	£77	11.4	10.1
£1 million - £2 million	31		£271	£415	£1,855	£292	£59	£58	36.3	12.2
£2 million +	25		£76	£317	£1,066	£941	£88	£93	13.0	13.5
Total	670		£4,522	£5,664	£8,035	£2,073	£487	£457	25.8	16.9

Table C.6 - Average Scheme Life Cost and Benefit Summary

Scheme Year	Number of schemes	Number of Outliers	Scheme Life Safety Benefits (£million)		Scheme Life Journey Time Benefits (£million)		Scheme Life Cost (£million)		BCR	
			Predicted	Outturn	Predicted	Outturn	Predicted	Outturn	Predicted	Outturn
2002/3	53		£7.7	£7.6	£6.2	£6.6	£0.6	£0.6	21.4	22.6
2003/4	86		£5.3	£7.8	£20.2	£6.5	£0.8	£0.6	33.8	22.4
2004/5	89		£4.4	£6.9	£7.8	£4.2	£0.6	£0.7	19.6	16.7
2005/6	99		£4.8	£7.4	£1.6	£2.8	£0.6	£0.6	10.0	16.9
2006/7	66		£10.4	£8.9	£51.1	£0.9	£0.5	£0.5	117.8	21.1
2007/8	59		£7.4	£10.6	£2.6	£1.4	£0.6	£0.6	17.7	21.6
2008/9	54		£7.4	£13.0	£3.4	£1.0	£0.7	£0.7	15.1	18.7
2009/10	85		£7.3	£7.8	£2.3	£1.0	£1.1	£1.0	8.9	9.0
2010/11	53		£8.5	£7.8	£18.7	£4.3	£0.9	£0.8	29.5	15.6
2011/12	22		£8.5	£10.2	£9.9	£0.0	£0.9	£0.9	20.1	11.2
HA AREA (outliers removed)										
Area 1	19	1	£4.1	£1.5	£4.5	£0.1	£0.6	£0.6	14.5	2.6
Area 2	46	3	£7.8	£9.7	£14.3	-£2.2	£0.8	£0.7	27.6	10.6
Area 3	35	2	£5.1	£5.2	-£0.1	-£0.5	£0.4	£0.4	11.8	11.0
Area 4	48	0	£6.7	£7.9	£0.6	£0.2	£0.6	£0.5	12.5	15.7
Area 5	35	3	£9.8	£12.6	£6.6	£8.9	£1.1	£1.2	15.2	17.4
Area 6	58	0	£6.8	£8.7	£7.3	£2.7	£0.7	£0.8	20.1	14.3
Area 7	57	1	£7.7	£4.0	£11.4	£1.0	£0.6	£0.6	29.4	8.4
Area 8	36	2	£3.9	£5.5	£7.2	£6.1	£0.6	£0.6	19.2	21.1
Area 9	66	4	£5.6	£7.1	£51.5	£2.1	£0.9	£0.8	64.4	11.2
Area 10	47	3	£5.5	£8.1	£3.3	£0.5	£0.8	£0.7	11.1	12.2
Area 12	57	6	£7.2	£5.8	£7.0	£1.6	£0.7	£0.5	19.7	13.8
Area 13	60	3	£3.9	£6.9	£1.0	£1.4	£0.6	£0.5	8.7	18.1
Area 14	68	3	£7.2	£8.6	£6.5	-£0.4	£0.6	£0.6	23.5	14.1
PRIMARY MEASURES (outliers removed)										
Signing	135	6	£5.6	£6.3	£0.4	£0.1	£0.4	£0.4	14.7	17.1
Marking/lining	92	5	£8.9	£7.6	£36.6	£0.5	£0.4	£0.4	106.4	22.2
Passive Measures	41	2	£4.3	£5.2	£0.3	£0.5	£0.3	£0.2	16.2	23.6
NMU Facilities	9	1	£3.3	£2.4	£0.0	£0.0	£0.5	£0.4	7.1	6.1
Widening	59	4	£5.1	£6.3	£31.2	£18.5	£1.6	£1.4	22.7	18.1
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	£10.7	-£1.7	-£1.5	£0.6	£0.5	15.2	17.8
Lighting	7	0	£4.3	£4.6	-£0.5	-£0.6	£0.9	£0.7	4.1	5.5
Signal (new)	27	0	£8.3	£13.7	£14.5	£2.6	£1.0	£1.0	22.7	17.0
Signals (mod)	30	1	£5.2	£9.4	£39.7	£13.8	£1.8	£1.6	24.5	14.8
Camera	5	1	£8.2	£13.3	-£0.3	-£0.7	£0.8	£0.7	9.4	18.1
Surface	21	2	£8.8	£9.6	£0.1	-£0.3	£0.7	£0.7	12.2	14.0
Geometry	50	4	£5.9	£6.9	£2.1	£2.6	£1.8	£1.6	4.5	6.2
Crossing	15	1	£3.4	£5.0	£1.3	£0.6	£0.4	£0.4	10.6	12.8
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	9	2	£5.0	£10.5	£55.6	£3.5	£1.1	£1.3	53.8	11.2
Scheme Cost										
£0 - £100,000	325		£5.1	£6.0	£12.0	£0.4	£0.2	£0.2	70.6	34.0
£100,000 - £250,000	190		£8.3	£10.0	£3.3	£2.2	£0.6	£0.6	17.9	21.3
£250,000 - £500,000	59		£8.6	£10.7	£2.1	-£0.8	£1.0	£1.0	10.4	9.9
£500,000 - £1 million	40		£10.7	£11.1	£11.5	£8.5	£2.0	£1.9	11.4	10.1
£1 million - £2 million	31		£8.8	£13.4	£59.9	£9.4	£1.9	£1.9	36.3	12.2
£2 million +	25		£3.0	£12.7	£42.6	£37.7	£3.5	£3.7	13.0	13.5
Total	670		£6.7	£8.5	£12.0	£3.1	£0.7	£0.7	25.8	16.9

Table C.7 - Cumulative Opening Year Accident Data

	Number of schemes	Number of Outliers	Pre Scheme Accident Rate				Post Scheme Accident Rate				Accidents Saved	KSI Saved	%age Accident 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	10	20%	£5.8
2003/4	86		416	74	16	18%	321	44	9	14%	132	37	26%	£12.7
2004/5	89		414	59	13	15%	333	40	5	12%	109	28	22%	£11.2
2005/6	99		574	91	23	17%	425	58	20	15%	185	36	27%	£16.8
2006/7	66		391	56	13	15%	306	45	8	15%	102	16	22%	£8.5
2007/8	59		429	83	17	19%	306	51	7	16%	165	42	31%	£14.9
2008/9	54		345	50	10	15%	240	22	5	10%	138	33	34%	£13.5
2009/10	85		371	50	12	14%	252	39	9	16%	134	15	31%	£13.2
2010/11	53		290	29	7	11%	198	21	5	12%	102	10	31%	£9.5
2011/12	22		115	17	2	14%	61	10	1	16%	61	8	46%	£4.9
HA AREA (outliers removed)														
Area 1	19	1	72	13	3	18%	82	5	2	8%	-1	9	-1%	-£0.2
Area 2	46	3	203	26	8	14%	140	9	6	9%	83	20	35%	£7.8
Area 3	35	2	154	17	4	12%	109	17	2	15%	47	2	27%	£3.9
Area 4	48	0	182	38	9	21%	127	24	6	20%	72	17	31%	£7.0
Area 5	35	3	279	34	4	12%	205	20	5	11%	88	14	28%	£7.4
Area 6	58	0	277	63	13	21%	195	47	7	21%	104	22	30%	£9.9
Area 7	57	1	259	52	11	19%	208	27	2	12%	84	34	26%	£8.8
Area 8	36	2	230	37	8	17%	203	34	5	16%	34	7	12%	£3.1
Area 9	66	1	238	40	6	16%	171	17	3	11%	94	26	33%	£9.1
Area 10	47	3	210	18	5	10%	134	19	3	14%	77	1	33%	£6.5
Area 12	57	6	163	29	8	18%	108	19	3	16%	70	15	35%	£6.2
Area 13	60	3	157	30	7	19%	106	13	5	15%	70	19	36%	£7.1
Area 14	68	3	511	75	18	15%	387	62	16	17%	140	15	23%	£13.4
PRIMARY MEASURES (outliers removed)														
Signing	135	6	588	87	17	15%	440	66	12	15%	174	26	25%	£15.1
Marking/lining	92	5	449	79	17	18%	345	51	12	15%	136	33	25%	£12.3
Passive Measures	41	2	134	19	5	15%	106	9	3	10%	41	12	26%	£3.6
NMU Facilities	9	1	7	1	1	26%	3	2	0	39%	3	0	39%	£0.4
Widening	59	4	279	31	6	12%	196	17	4	9%	100	17	32%	£9.4
Layby	13	3	61	12	4	21%	61	5	3	12%	9	8	12%	£0.9
Banned Turn	27	1	97	21	9	23%	51	17	2	27%	57	11	45%	£5.4
Lighting	7	0	19	5	1	24%	13	1	0	7%	11	5	43%	£1.1
Signal (new)	27	0	171	15	2	9%	96	15	1	14%	75	1	40%	£6.3
Signals (mod)	30	1	211	18	3	9%	139	11	1	8%	81	9	35%	£7.7
Camera	5	1	26	4	1	17%	13	4	1	27%	13	0	41%	£1.7
Surface	21	2	103	13	2	13%	66	8	1	11%	43	6	37%	£3.9
Geometry	50	4	168	25	5	15%	122	13	1	11%	61	15	31%	£6.6
Crossing	15	1	38	5	1	14%	24	4	0	15%	16	2	36%	£1.6
Narrowing/Lane Drop	11	0	30	5	1	15%	28	3	0	10%	5	2	13%	£0.5
SLR	23	2	216	41	8	19%	167	19	5	13%	73	25	28%	£6.3
Vegetation Clearance	3	2	5	1	0	18%	3	1	0	20%	2	0	29%	£0.2
Other	9	2	25	5	0	19%	15	1	1	10%	14	4	47%	£1.9
Scheme Cost														
£0 - £100,000	325		1,036	169	40	17%	759	107	21	14%	357	80	29%	£33.0
£100,000 - £250,000	190		1,238	184	42	15%	903	131	25	15%	405	70	28%	£37.2
£250,000 - £500,000	59		566	90	20	16%	459	56	16	14%	145	38	22%	£14.2
£500,000 - £1 million	40		286	39	8	14%	188	33	6	18%	106	8	32%	£10.2
£1 million - £2 million	31		232	34	5	15%	158	18	4	12%	92	18	34%	£8.3
£2 million +	25		247	33	4	13%	182	15	1	8%	86	21	30%	£9.0
Total	670		3,605	550	120	16%	2,648	361	74	14%	1,192	235	28%	£112.0

Table C.8 - Average Opening Year Accident Data

Scheme Year	Number of schemes	Number of Outliers	Pre Scheme Accident Rate				Post Scheme Accident Rate				Accidents Saved	KSI Saved	%age Accident 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	0.2	20%	£110
2003/4	86		7.9	1.4	0.3	18%	6.1	0.8	0.2	14%	2.5	0.7	26%	£147
2004/5	89		7.8	1.1	0.2	15%	6.3	0.8	0.1	12%	2.0	0.5	22%	£126
2005/6	99		10.8	1.7	0.4	17%	8.0	1.1	0.4	15%	3.5	0.7	27%	£169
2006/7	66		7.4	1.1	0.2	15%	5.8	0.8	0.1	15%	1.9	0.3	22%	£129
2007/8	59		8.1	1.6	0.3	19%	5.8	1.0	0.1	16%	3.1	0.8	31%	£253
2008/9	54		6.5	0.9	0.2	15%	4.5	0.4	0.1	10%	2.6	0.6	34%	£251
2009/10	85		7.0	1.0	0.2	14%	4.8	0.7	0.2	16%	2.5	0.3	31%	£155
2010/11	53		5.5	0.5	0.1	11%	3.7	0.4	0.1	12%	1.9	0.2	31%	£180
2011/12	22		2.2	0.3	0.0	14%	1.2	0.2	0.0	16%	1.2	0.1	46%	£225
HA AREA (outliers removed)														
Area 1	19	1	3.8	0.7	0.2	18%	4.3	0.3	0.1	8%	-0.1	0.5	-1%	-£11
Area 2	46	3	4.4	0.6	0.2	14%	3.0	0.2	0.1	9%	1.8	0.4	35%	£170
Area 3	35	2	4.4	0.5	0.1	12%	3.1	0.5	0.0	15%	1.4	0.1	27%	£113
Area 4	48	0	3.8	0.8	0.2	21%	2.6	0.5	0.1	20%	1.5	0.4	31%	£145
Area 5	35	3	8.0	1.0	0.1	12%	5.9	0.6	0.1	11%	2.5	0.4	28%	£211
Area 6	58	0	4.8	1.1	0.2	21%	3.4	0.8	0.1	21%	1.8	0.4	30%	£171
Area 7	57	1	4.5	0.9	0.2	19%	3.7	0.5	0.0	12%	1.5	0.6	26%	£154
Area 8	36	2	6.4	1.0	0.2	17%	5.6	0.9	0.1	16%	1.0	0.2	12%	£86
Area 9	66	1	3.6	0.6	0.1	16%	2.6	0.3	0.1	11%	1.4	0.4	33%	£138
Area 10	47	3	4.5	0.4	0.1	10%	2.9	0.4	0.1	14%	1.6	0.0	33%	£138
Area 12	57	6	2.9	0.5	0.1	18%	1.9	0.3	0.0	16%	1.2	0.3	35%	£108
Area 13	60	3	2.6	0.5	0.1	19%	1.8	0.2	0.1	15%	1.2	0.3	36%	£118
Area 14	68	3	7.5	1.1	0.3	15%	5.7	0.9	0.2	17%	2.1	0.2	23%	£197
PRIMARY MEASURES (outliers removed)														
Signing	135	6	4.4	0.6	0.1	15%	3.3	0.5	0.1	15%	1.3	0.2	25%	£112
Marking/lining	92	5	4.9	0.9	0.2	18%	3.8	0.6	0.1	15%	1.5	0.4	25%	£134
Passive Measures	41	2	3.3	0.5	0.1	15%	2.6	0.2	0.1	10%	1.0	0.3	26%	£88
NMU Facilities	9	1	0.7	0.2	0.1	26%	0.4	0.2	0.0	39%	0.4	0.0	39%	£42
Widening	59	4	4.7	0.5	0.1	12%	3.3	0.3	0.1	9%	1.7	0.3	32%	£159
Layby	13	3	4.7	1.0	0.3	21%	4.7	0.4	0.3	12%	0.7	0.6	12%	£67
Banned Turn	27	1	3.6	0.8	0.3	23%	1.9	0.6	0.1	27%	2.1	0.4	45%	£200
Lighting	7	0	2.7	0.7	0.1	24%	1.9	0.1	0.0	7%	1.5	0.7	43%	£153
Signal (new)	27	0	6.3	0.6	0.1	9%	3.6	0.6	0.0	14%	2.8	0.0	40%	£235
Signals (mod)	30	1	7.0	0.6	0.1	9%	4.6	0.4	0.0	8%	2.7	0.3	35%	£256
Camera	5	1	5.1	0.9	0.2	17%	2.7	0.9	0.1	27%	2.5	0.1	41%	£343
Surface	21	2	4.9	0.6	0.1	13%	3.1	0.4	0.0	11%	2.1	0.3	37%	£187
Geometry	50	4	3.4	0.5	0.1	15%	2.4	0.3	0.0	11%	1.2	0.3	31%	£133
Crossing	15	1	2.6	0.3	0.1	14%	1.6	0.3	0.0	15%	1.1	0.1	36%	£104
Narrowing/Lane Drop	11	0	2.7	0.4	0.1	15%	2.5	0.3	0.0	10%	0.4	0.2	13%	£45
SLR	23	2	9.4	1.8	0.4	19%	7.3	0.8	0.2	13%	3.2	1.1	28%	£272
Vegetation Clearance	3	2	1.5	0.3	0.1	18%	1.1	0.3	0.0	20%	0.5	0.1	29%	£51
Other	9	2	2.7	0.6	0.0	19%	1.6	0.1	0.1	10%	1.6	0.4	47%	£214
Scheme Cost														
£0 - £100,000	325		3.2	0.5	0.1	17%	2.3	0.3	0.1	14%	1.1	0.2	29%	£102
£100,000 - £250,000	190		6.5	1.0	0.2	15%	4.8	0.7	0.1	15%	2.1	0.4	28%	£196
£250,000 - £500,000	59		9.6	1.5	0.3	16%	7.8	1.0	0.3	14%	2.5	0.6	22%	£241
£500,000 - £1 million	40		7.2	1.0	0.2	14%	4.7	0.8	0.2	18%	2.7	0.2	32%	£256
£1 million - £2 million	31		7.5	1.1	0.2	15%	5.1	0.6	0.1	12%	3.0	0.6	34%	£269
£2 million +	25		9.9	1.3	0.2	13%	7.3	0.6	0.0	8%	3.5	0.8	30%	£362
Total	670		5.4	0.8	0.2	16%	4.0	0.5	0.1	14%	1.8	0.4	28%	£167

Table C.9 – List of Measure Groups

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